APPENDIX I

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August 25, 1981

Piedmont Engineers, Architects and Planners
Post Office Box 1717
Greenville, South Carolina 29602

Attention: Mr. David Holland

Subject: Report of Geotechnical Exploration
and Monitoring Well Installation
Proposed Sludge Disposal Site
J. P. Stevens Louisville Plant
Louisville, Georgia
LETCo. Job Number GV-633

Gentlemen:

As authorized, Law Engineering Testing Company has completed a subsurface exploration including the installation of groundwater monitoring wells at the subject project. This work was done in general accordance with our Proposal Number GV81-118, dated July 14, 1981, and a revised scope of services outlined in our letter of July 28, 1981. The purpose of this exploration was to explore the general subsurface conditions across the site with widely spaced borings, evaluate surface soil permeability, install groundwater monitoring wells, and evaluate foundation conditions for the holding tank facilities.

PROJECT INFORMATION

It is our understanding, based upon conversations with Mr. David Holland of Piedmont Engineers, that a 75-acre tract north of the J. P. Stevens Plant in Louisville, Georgia (see Site Location Map, Drawing Number 1) has been proposed for use as a sludge disposal site using shallow sludge injection methods. A holding tank facility, including two 50-foot diameter by 22-foot high concrete tanks with a 24 by 24 slab-on-grade single-story building between, will be located near the center of the site. It is anticipated that the tanks will be approximately 4 to 6 feet below existing grade.

FIELD EXPLORATION

In order to explore the general subsurface conditions across the site, 16 soil test borings were drilled to depths of 25 to 60 feet below the ground surface. Boring locations were chosen and laid out in the field by Piedmont Engineers, utilizing survey methods. Boring elevations were also evaluated by survey, and are presented on the individual Test Boring Records and Observation Well Records in the Appendix.

Borings were drilled with a truck-mounted drill-rig utilizing wash boring techniques to advance the borings. At routine intervals in the soil test borings, the soil was tested and sampled by means of the standard penetration test in general accordance with ASTM D-1586. Relatively undisturbed samples were obtained by the Shelby tube method in general accordance with ASTM D-1587. The samples were sealed against moisture loss and transported to the laboratory for classification and laboratory test assignment by a geotechnical engineer. Test Boring Records showing the classification of soil sampled and penetration resistances are attached in the appendix.

PVC monitoring wells were installed in seven of the borings (MW-1 through MW-7). The purpose of the monitoring wel 1s was to observe present groundwater conditions at the site and to facilitate future sampling of groundwater during the monitoring program. Each well consists of a well screen connected to a 2-inch inside diameter Schedul e 40 PVC riser that extends above the ground surface. All connections are made by threaded couplings. The well screen is a 5-foot length of 2-inch inside diameter PVC pipe slotted with 0.020-inch sized slots. ASTM C-33 concrete sand was placed around the length of the well screen and the riser pipe to a point approximately 10 feet below the ground surface. A bentonite pellet seal approximately 12 inches thick was then placed to seal off surface water infiltration. Concrete grout was then placed above the bentonite seal to the ground surface. Diagrams of individual monitoring wells are presented on the Observation Well Record in the Appendix.

To estimate the permeability and infiltration capacity of the surface soils of the site, two infiltration tests were performed adjacent to Borings TB-3 and TB-4. In the infiltration tests, an 18-inch deep steel ring, 22 inches in diameter was pushed approximately 2 inches into the soil. An inner ring 3 inches in diameter was pushed concentrically into the center of the large ring. Water was then added to both the inner ring and the outer ring, and was allowed to percolate into the soil. After saturation of the soil, the rate of drop of the water level in the inner ring was measured. By this method, an infiltration rate in inches per minute was obtained. Results of the infiltration tests are presented on Drawing 4 in the Appendix.

To evaluate the compressibility characteristics of one of the soil layers encountered, a consolidation test was performed on a portion of a relatively undisturbed soil sample obtained in the field. The results of this consolidation test are presented in the Appendix.

Several grain size and Atterberg Limits tests were conducted on selected soil samples to aid in classification. The results of these tests are presented on the appropriate data sheets in the Appendix.

SITE AND SUBSURFACE CONDITIONS

Geology

The plant lies in the northeastern part of the state within the Coastal Plain Physiographic-Geologic Province. This area consists mainly of marine deposits in which sediments were laid out during successive periods of sea levels that were much higher than at the present time. Most of the deposits in the coastal plain are typical of those laid down in a shallow sloping sea bottom; sands, silts and clays with irregular deposits of shells. Most formations were laid down in nearly level strata tilting somewhat seaward. Well away from the shore, the deposition is relatively uniform. Closer to the shore, the formations consisted of layers of sands deposited during periods of high river in-flow and strong current movements alternating with silt and clay deposited during periods of relatively quiet water.

The soils encountered within the depths of our borings primarily belong to the Barnwell formation of the Eocean Age. The Barnwell Formation is primarily composed of sands, sandy silts, and clayey sands, with occasional thin beds of limestone and marl. In much of the Barnwell deposit, most of the underlying limestone has been carried away by intrastratal solution. This has resulted in areal subsidence and an associated deformation of the overlying strata beds. The remaining limestone is generally very thin.

Site Conditions

The site of the proposed sludge disposal area lies to the north of the existing J. P. Stevens Plant in Louisville, Georgia. At the present time, approximately one-half of the site is cultivated in corn. The remaining areas are either wooded or thickly overgrown with weeds, young trees and bushes.

Topographically, the site slopes gently downward from the northeast to the south and west to a small creek approximately 400 feet beyond the western limits of the proposed sludge injection area. No other drainage features were noted within the area under consideration.

Subsurface Stratigraphy and Hydrology

The soil conditions encountered by the 16 soil test borings are generally consistent with published literature regarding the Barnwell Formation. Within the site under consideration, four major soil strata (Strata I through IV) were defined in our borings. The following paragraphs present descriptions of conditions encountered in each soil stratum.

Stratum I

The first stratum encountered by most of the borings was generally confined to the upper 10 to 15 feet below the ground surface. This stratum was composed of marine deposited sandy silts, silty sands, and some clayey silts. Standard penetration test values (N-values) ranged from 3 to 46 blows per foot (bpf) but were generally greater than 20. Two infiltration tests performed within this first stratum indicate infiltration rates on the order of one-half to 1 inch per minute. Based upon the classification of the soils, the permeability probably ranges from approximately 10^{-3}cm/sec in the silty sands to 10^{-5}cm/sec in the clayey sandy silt layers.

Stratum II

Stratum II generally comprises a zone between the depths of 10 to 30 feet below the ground surface in the boring locations. This stratum was somewhat similar in composition to Stratum 1, but was generally of a looser consistency. The N-values in this material ranged from 5 to greater than 20 bpf. Most N-values were in the 10 to 20 bpf range.

Stratum III

The third stratum encountered by the deeper borings was composed of a firm to hard clayey silt. The N-values in this material varied from 5 to 32 bpf. It is anticipated that the permeability of this layer is quite low, probably on the order of magnitude of 10^{-5} to 10^{-7}cm/sec, based upon visual classification.

Stratum IV

The fourth stratum encountered generally began at a depth of 37 to 40 feet below the ground surface. The deeper borings were all terminated in this stratum. The predominant materials consisted of hard dark gray sandy silt and highly weathered limestone. In two of the borings, TB-1 and TB-6, voids approximately 1 to 2 feet in height were encountered in the weathered limestone. Based upon the nature and frequency of occurrence of the voids found, it is probable that this thin limestone bed contains numerous small voids of limited lateral extent. The soil surrounding the weathered limestone was generally stiff to very hard with N-values ranging from 15 to greater than 100 bpf.

The foregoing descriptions provide a general summary of the subsurface conditions encountered. The attached Test Boring Records contain detailed information recorded at each boring location. These Test Boring Records represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual.

Groundwater Levels

The groundwater levels at the monitoring well installations and other boreholes were measured at the time of boring and after a stabilization period. Data for the individual monitoring well installations are given on the individual Observation Well Records in the Appendix.

Groundwater levels taken in the monitoring wells were used to construct a piezometric surface contour map which represents approximate interpreted elevations of the groundwater surface across the site. (see Figure 3.) The lateral direction of groundwater flow can be estimated from the piezometric map since flow will occur perpendicular to the piezometric contours with water moving from higher to lower levels. The map developed for the site indicates a general direction of flow toward the south and west. It should be noted that groundwater levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest groundwater levels occur in late winter and spring, and the lowest levels occur in late summer and fall.

FOUNDATION RECOMMENDATIONS

Based upon the results of the soil test borings and laboratory consolidation tests performed on a relatively undisturbed sample of foundation soil, the location at Borings TB-6 through TB-3 appears suitable for construction of the proposed storage tanks. The holding tank location was originally planned at TB-1, but was shifted 240 feet south when a 2-foot void was encountered in this boring. Shallow foundations should be designed for an allowable bearing pressure of 3,000 psf. Utilizing the laboratory data, previous experience with similar soils, and anticipated tank loads, we estimate a potential total settlement of the tanks of approximately 1 inch with differential settlements of approximately one-half inch or less. A relatively thin (about a foot thick) void was encountered in one of the four deep borings (TB-6, TB-7, TB-8, and TB-9) at the holding tank location. For a void this thin, it is our experience and opinion that the void will probably not be sizeable enough or sufficiently large in an areal extent to create subsidence problems at the surface. It should be noted, however, that in limestone regions, some element of risk with regard to solution activity and associated subsidence must be accepted.

It is recommended that all foundation excavations be inspected prior to installation of reinforcing steel or concrete to compare the soils upon which the foundation will bear to the materials encountered by the soil test borings. In some areas soft or loose soils may need to be undercut to firm material and back filled with compacted soil fill or crushed stone. The need for such undercutting can best be evaluated at the time of construction after proper inspection.

Site and Preparation Grading

In order to provide proper support for the foundations, floor slabs, and any structural fill, the site should be properly prepared. This preparation includes first the removal of all topsoil, organic materials, and other unsuitable materials, such as excessively loose, soft, or wet soil. Then, prior to placing fill in the fill areas and after rough grade has been established in the cut areas, all areas which will support structural elements such as foundations, floor slabs, or structural fill should be proof rolled. Proof rolling should be done with a medium to heavy weight roller (to be selected by the geotechnical engineer in the field) and should consist of making at least two passes over all areas with the roller. Any areas which pump, rut, deflect, or wave under the roller and do not tighten up with successive passes should be undercut (removed) and replaced with compacted, suitable fill. If the depth of loose material is less than 2 to 3 feet, it is possible that the existing soil can be compacted in place through the use of a vibratory compactor. After such compaction the site should again be proof rolled to evaluate the effectiveness of this technique.

Soils encountered by the borings generally appear suitable for compacted fill, although some adjustments in moisture content may be required to properly compact the fill. All fill material to support floor slabs, foundations, or other structural fill should be placed in maximum 8-to 10-inch loose lifts and thoroughly compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698). This specification should be increased to 98 percent for the top 18 inches beneath the floor slabs. Field density tests should be conducted during the compaction operations by an experienced technician under the direction of a registered engineer in order to monitor the contractor's compaction performance.

Based upon preliminary structural information and water level readings, foundation elements should generally be above the site groundwater elevation. However, should groundwater levels rise due to precipitation, some site dewatering may be necessary. The soil types encountered by the borings are generally relatively pervious and probably can be dewatered through the use of ditches and cased sumps.

SLUDGE INJECTION

Based on our evaluation of the surface and subsurface soil conditions and the overall site hydrology, the use of the proposed areas for the disposal of sludge waste disposal appears feasible from a geotechnical standpoint. The near surface soils sampled are generally pervious and thus appear compatible with the injection method of sludge waste disposal. As the groundwater table is generally quite shallow, careful attention should be paid to a program of groundwater quality monitoring. The number and location of the wells chosen for this study should be adequate to evaluate the extent to which any waste materials percolate into the shallow aquifer system.

SCOPE

A sludge disposal system has been designed for the new waste treatment plant at the J. P. Stevens & Co., Inc., Louisville, Georgia, Finishing Plant. The disposal system will utilize subsurface injection or surface spray application of the waste activated sludge on an 80 acre portion of an adjacent site near the new waste treatment plant.

The site is also designed for use as a land treatment area for wastewater during the construction period of the new waste treatment plant. It may be necessary to apply a portion of the treated wastewater to the site to avoid violating the existing discharge permit limitations, due to the new increase in production capacity. The wastewater would be applied on an interim basis, until the new treatment plant is operational in February 1983. This report will describe the disposal site system, operation, the site loading and the sludge characteristics.

DISPOSAL SITE LOCATION AND DESCRIPTION

The disposal site is located in Jefferson County, adjacent to State Highway 171, one-half mile north of the new waste treatment plant designed for the J. P. Stevens & Co., Inc., Louisville, Georgia, Wool Finishing Plant. Drawing SP-10 shows the relationship of the site and the surrounding properties. The site topography is shown on Drawing SP-11 in two foot intervals. The site is partially wooded but will be cleared, grubbed and grassed prior to operating the disposal area. Slopes on the injection site will be graded to a maximum of 15:1 to prevent soil erosion and allow access for the injection tractor.

The site is divided into five (5) injection areas each containing a hose hydrant and (10) spray areas. The site is surrounded with a buffer zone to provide room for the tractor turnaround, provide area to eliminate wind drift, prevent any disturbance on the surrounding properties and provide a visual barrier. The digester, pump and blower building and equipment storage shed are located in the center of the site and are shown in detail on Drawings SD-1, 2 and S-3, 4.

SITE GEOLOGY

A geotechnical environmental soils testing and consulting engineering service was retained to define the site geology and assure that the site is suitable for sludge land application. The company, Law Engineering and Testing Company, was directed to perform a surface and subsurface exploration and install groundwater monitoring wells on the site. The site subsurface exploration is highlighted in this section and is appended to this report.

Subsurface Classification
A series of sixteen soil test borings were made to provide information on the soil characteristics and groundwater profile. The site strata generally indicate that the upper 10-15 feet is sandy silts, silty sands and small amounts of clayey silts. Permeability of the upper soil layers was in the range of 1/2 to 1 inch per minute. Below the upper layer a zone 10 to 30 feet below was similar to the upper portion but more loose. Below this layer, a firm to hard clayey silt was encountered and some sandstone found below that.

Groundwater Level
The groundwater level was measured in the monitor wells and bore holes after a 24 hour stabilization period. The appended report has a groundwater map constructed from the levels encountered in the wells and the site generally flows south and west, away from the highway. The groundwater level was typically 10 to 25 feet below the surface, depending on the elevation of the site at the boring location.

SLUDGE CHARACTERISTICS

The new treatment plant is a biological activated sludge process which will generate an estimated 4,000 pounds of biological solids a day at maximum design loads. The design loading is 18,000 pounds of COD/Day for 5 days a week. The pilot tests indicated that 80% of the COD was removed by biological treatment and 27.5% of it was converted to biological solids. The 4,000 pounds per day of sludge is a conservative estimate due to the high sludge age of the treatment plant and the sludge digestion before injection, but will be used as the basis for the site loadings in this report.

The actual waste activated sludge characteristics are not available since the facility is not in operation, but the raw and treated wastewater characteristics and pilot study tests allow the sludge characteristics to be estimated. These values will be confirmed after the system is operating by the routine monitoring program defined in this report. The sludge chemical and physical composition is summarized in Table I along with the daily and yearly quantity of sludge based on the 4000 pounds/day of sludge generated at maximum plant loading.

TABLE I

SLUDGE COMPOSITION AND QUANTITY

(Calculated from Raw Waste and Pilot Study Tests)

Parameter	Waste Activated Sludge Mg/gm	Sludge Produced (Design) lbs/day	Annual Sludge Quantity lbs/year (lbs/day x 365 x 0.6)
Sludge @ 2% Solids		200,000	43.8×10^6
Total Sol ids	1,000	4,000	876,000
Total Dissolved Sol ids	25	100	21,900
Total Suspended Solids	975	3,900	854,100
Volatile S.S.	760	3,040	665,760
TOC	350	1,400	306,600
Nitrate-NO_3-N	< 1	Neg.	-
Ammonia-NH_3-N	5	20	4,380
Organic Nitrogen	45	180	39,400
Total Nitrogen	50	200	43,800
Phosphorus	6	24	5,260
Chromium	0.66	2.64	580
Zinc	1.66	6.64	1,450
Copper	0.33	1.3	290
Aluminum	Neg.	0	-
Calcium	Neg.	0	-

Neg. -Negligible amount

Estimated based on typical raw waste analyses
*Annual sludge = maximum sludge x 0.6 (based on 5 day week waste flow of 3.0 MGD projected production capacity flow vs. 3.6 MGD design capacity)

DISPOSAL SITE LOADING

The previous table of sludge composition and quantity is used to project the quantity of sludge that can have a significant effect on the disposal area. The following list of characteristics are reviewed in detail:

1. Volume -hydraulic loading
2. Organic material
3. Nitrogen compounds
4. Phosphorous
5. Metals

The parameters and the quantities are summarized in Table II. The waste loading is based on the disposal site area consisting of 80 acres. The loads are compared with the typical design criteria currently being used for land application of sludges in the referenced literature listed in the bibliography.

TABLE II

DISPOSAL SITE SLUDGE LOADING

(4000 #/Day Activated Sludge -80 Acre Disposal Site)

Parameters	Annual Quantity	Loading/Acre/Year
Sludge Volume (Gallons) @ 2% Solids	5,252,000	65,650
Hydraulic Load @ 2% Solids	702,045 ft.^{3}	.201 ft/yr (2-3/8)
Organic Load (76% VSS) tons	333	4.16
Nutrient Load -Pounds		
Nitrogen Total (T K N-N)	43,800	548
Ammonia Nitrogen (NH_3 -N)	4,380	55
Organic Nitrogen (OrgKN-N)	39,400	493
Phosphorous (Total P) -Pounds	5,260	66
Metal Load -Pounds		
Chromium	580	7.25
Zinc	1,450	18.1
Copper	290	3.6

Hydraulic Load

The volume of sludge applied at the maximum quantity at 2% solids will be equivalent 2.42 inches/acre/year. The application rate will be almost insignificant compared to the rainfall in this area and the high soil permeability (0.5-1 inch/minute) will prevent any significant surface ponding or runoff.

Organic Load

The waste activated sludge generated at the waste treatment plant is estimated to be approximately 76% volatile material. For the purpose of simplifying this report we will assume that all this is organic material. The quantity of volatile solids from Table I is 3,040 pounds/day. This volume of material (Table II) equals 333 tons/year or a load of 4.16 tons/acre/year. The typical organic load for soil systems is 20-50 tons/acre/year, therefore no significant effect due to the organic material is foreseen in applying the proposed quantity of sludge.

Nitrogen Load

The nitrogen balance in a soil system is an important factor in minimizing the amount of groundwater contamination potential. It is proposed the site operate with a cover crop of perennial and annual grass that will be used for nutrient uptake and control. The actual management of the site is discussed in more detail later in this report. Since the site nutrient control is a cover crop, the quantity of material applied should be less than the crop uptake of the material.

Table II shows that 55 pounds of ammonia and 493 pounds of organic nitrogen will be applied per acre per year. Literature currently indicates that available nitrogen for crop uptake is equal to $NH_4 + NO_3$ + 20% organic nitrogen and each year, an additional 2 lbs N/ton of sludge will be released from the residual 80% of the organic portion applied in previous applications.

Table 111 summarizes the levels of available nitrogen over the first 5 years.

TABLE 111

ANNUAL NITROGEN BALANCE

Year	Tons Organic Material/Acre	Ammonia Nitrogen	+Organic Nitrogen	+Residual Organic N	+Total M Pounds Available/Acre
1	4.16	55	493 x 2 = 98.6	0	98.6
2	4.16	55	493 x 2 = 98.6	2 x 4.16	106.9
3	4.16	55	493 x 2 = 98.6	2 x 8.32	115.2
4	4.16	55	493 x 2 = 98.6	2 x 12.48	123.6
5	4.16	55	493 x 2 = 98.6	2 x 16.64	131.9

Phosphorous Load

Table II indicates a total of 66 pounds/acre/year of total phosphorous applied. The phosphorous is not as readily released from the sludge nor soluble as the nitrogen compounds but should be considered in designing a well managed soil system.

Nutrient Balance and Crop Uptake

It is proposed that cover crops be used to recover the majority of these nutrients, to recycle them and reduce the effect they would have on the groundwater quality. The cover crops that will be grown are:

Summer -Bermuda Grass
Winter -Winter Rye

These grasses would be harvested and removed from the site. The crop uptake vs. applied loads for the nitrogen and phosphorous rates are summarized in Table IV. The crop uptake exceeds the nutrient application rates, which indicates that nutrient removal should be effectively controlled by the cover crop.

TABLE IV

ANNUAL NUTRIENT BALANCE SUMMARY

(lbs/acre/year)	Nitrogen	Phosphorous
Crop Uptake		
Bermuda (8 months)	570	145
Winter Rye (4 months)	205	75
Weighted Total (12 months)		
Nutrient Available		
Applied Loads (See Table III)	100-150	66
Nutrient Deficiency	314-264	56

Metal Loads

Wastewater analysis indicates minor quantities of chromium, zinc and copper. These materials are expected to be found in the sludge to some degree but the actual quantity is not known. For the purpose of this report, we assumed 100% of the metals will accumulate in the sludge solids and the quantity is shown on Table 11. Of the three significant metals, zinc is the limiting metal with acceptable limits for soils of this type around 500 lbs/acre. At an annual rate of 18.1 lbs/acre/year of zinc the site life may be limited to 27.6 years if sludge is applied at the aximum application rate and if all the zinc is in the sludge. The actual quantity of sludge applied and the presence of other significant metals will be closely monitored during the operation of the site and a more accurate analysis made during the first year of operation.

DISPOSAL SITE OPERATION AND APPLICATION METHODS

The system operational summary is as follows:

1. The activated sludge produced during the treatment of the wastewater is wasted to the thickener to maintain the desired level of mixed liquor solids in the aeration basin. The volume to be wasted is control led by the operator.
2. The thickener concentrates and stores the solids in preparation for transferring to the sludge site. The storage capacity of the thicker is approximately 16 days, assuming 2% solids concentration.
3. The sludge transfer pumps (P-501, P-502) located in the chemical storage building; pump the sludge to the digester via the 6" PVC force main pipe. These pumps are timer activated and operate at 250-350 GPM @ 150' TDH.
4. The digester stores the sludge and provides aeration to aerobically digest the organic solids prior to disposal on the land. The storage capacity is approximately 20 days.
5. Injection pumps (P-503, P-504) pump the solids from the digester, via the distribution piping system, to the hose hydrants located in the center of the injection areas. The pump capacity is 700 GPM @ 210' TDH.
6. The sludge can be distributed via two methods, one using an injection tractor, the other using spray equipment. The injection tractor is attached to the hydrant shown on Drawing SD-3 via a rubber hose and injects approximately 700 GPM of liquid sludge over a 16 acre area. The tractor

injects as it makes a pass along one side of the area. When reaching the end of the area, the operator activates the radio transmitter, which controls the bypass valve cutting off the sludge flow. He makes a 180 turn, activates the valve again, and makes another pass adjacent to the last. This is done until the entire area has been covered evenly.

Additional information regarding the operation, design and specification of the injection system is appended to this report. The spray application method uses a modified irrigation hose and reel system and spreads the sludge over the surface of the site at a rate of 500 GPM. The system will operate on a weekly routine with the quantity of sludge to be injected or sprayed being determined by the quantity of material generated by the treatment process, degree of digestion, weather conditions and crop management.

Waste Application Rates

The injection or spray rate is variable, dependent largely upon the speed of the tractor or spray gun retraction. Application rates are normally limited to an average of 1"-$1^{1/2}$"for injection. This will allow the area to rest 3 or 4 months between applications. The operating time for the injection tractor should be 7 hrs/day once every 2-3 weeks. For the spray system, a 1/2"-11' application of sludge on a more frequent basis will be used.

SITE RECORD KEEPING & MONITORING

The operator will record the volume of sludge, date and time of application site area and other operational data as outlined on the "Operation Log" located on the form in appendix II. The operator will semiannually review these logs and determine the loadings per site area and equalize the application of sludge so that the site gets an equal quantity of sludge over the entire area. Form V in the appendix will be used for this summary.

Sludge & Soil Monitoring

J. P. Stevens & Co., Inc. will keep weekly logs indicating the volume and type of material applied to the disposal areas and will analyze for major sludge and characteristics every 6 months. Yearly soil samples from the site will be analyzed and reported on a form to monitor changes in the site soil characteristics. Results will be forwarded to the State along with normal operating permit requirements on an as required basis. The frequency of the tests analyzed will be subject to modifications based on background and operational test results. Sludge characteristics to be analyzed are: Total Solids, Total Volatile Solids, TKN, NH_3, NO_3, P, Cr, Cd, Zn, Cu, Pb, As, Ba, Hg, Se, Ag. Soil characteristics monitored are pH, TKN, P, K, Zn, Cu, As, Ba, Cd, Cr, Pb, Hg, Se, Ag. The appendix IV & V are the operator summary report form for these parameters. After background samples are analyzed, the soil and sludge parameter list will be shortened to the more significant components. These are identified in the reporting forms by an asterisk (*).

Ground Monitoring

The site plan SP-10 indicates seven groundwater monitoring wells encircling the site. These wells will be used to determine background water quality and to detect any effect the sludge application may have on the groundwater quality at the site. Details of a typical monitoring well is shown in the appendix. Monitor well #1 and #2 appear to be an upstream (background) sampling point. Monitor wells #3, 4, 5, 6 and 7 are installed surrounding the site, 5 feet into the surface groundwater. It is proposed that a series of 12 sets of background analysis be made prior to the site disposal operation and thereafter a sampling and analysis be made prior to the site disposal operation and thereafter a sampling and analysis be made prior to the site disposal operation and thereafter a sampling and analysis be routinely performed on some indicator parameters that would be specific to the waste that will be disposed of on this site. This routine monitoring would be a quarterly basis. The reporting forms for the site is appendix VII. The parameters to be monitored for the background are pH, C1, Fe, Mn, Phenol, Na, SO_4, TOH, NO_3, Zn, As, Ba, Cd, Cr, Pb, Hg, Se, Ag, Cu, conductivity, TKN, PO4, TOC. The routine indicator parameters would be the pH, conductivity, TOC, NO_3, PO_4, TKN. The frequency of sampling and parameters may change depending on the test results.

INTERIM PERIOD WASTEWATER LAND APPLICATION

It is proposed that the sludge disposal site be utilized for wastewater land treatment until the new waste treatment facility is on line. The plant currently has trouble meeting the NPDES permit discharge limits and uses land application of treated wastewater to reduce the volume of water discharged Additional production facilities are scheduled for operation in May, 1982 and will aggravate this situation; therefore, an interim method of land application and treatment for the wastewater has been designed into the sludge disposal facilities.

The system will operate much like the spray system designed for the sludge. Two temporary transfer pumps (Dwg. WT-18) will take treated wastewater and pump it to the sludge digester. The pumps that are used for sludge injection will be used for spraying wastewater through two reel type agricultural irrigation devices. The areas to be sprayed, the hydrant location, buffer zones and other site details are shown on Drawing SD-4.

Wastewater Application Rate and Equipment Capacity

Based on current spraying volumes and the anticipated production increases, the spray system is designed to spray up to one million gallons of wastewater/day on a 5 day, 16 hour basis.

The temporary transfer pumps P-501, P-502 are sized to pump 500 GPM @ 190' TDH each. The digester can store 290,000 gallons and the spray pumps (P-503, P-504) will pump 500 GPM @ 220' TDH. Each spray irrigator (See appended brochure) will spray about 500 GPM over 1000' long x 400 ' diameter area at an application rate of 1-2 inches/pass. The spray areas will be rotated continually to prevent site ponding or saturation of the surface soils.

Site Loads

Hydraulic Loading

The hydraulic load of one million gallons/day for 5 days/week on an 80 acre site will be 2.3" water/week. Recommended levels of water for irrigation of agricultural crops range from 1 to 2.5 inches/week. Due to the high permeability of the site soils, the system should be capable of operating at this level on an interim basis.

Organic Loading

The organic load will be calculated based upon the current wastewater effluent COD of 300 and assuming the increased production load will raise the COD to 500 mg/l. Assuming the COD is equal to the organic load, a volume of 5 million gallons/week, the annual load is 542 tons COD/year or 6.8 tons/acre/year. This is a conservative load which should not cause any significant effects on an interim basis.

Nutrient Loading

Wastewater analysis indicates that Total Kjeldhal Nitrogen is less than 10 mg/1 and phosphorous is less than 6 mg/1. The site load for Nitrogen is 21,684 lbs/year or 271 lbs/re/acre. Most of this nitrogen is organic and will not readily be released into the ground water. Phosphorous loading of 13,000 lbs/year equals 162 lbs/acre/yr. This will be slightly higher than the crop uptake rate but should not cause any significant harm on a short term basis.

Metal Loading

The metals analysis of the treated wastewater indicates approximately 250 ppb chromium, 100 ppb zinc, <50 ppb cu. The application rates for these metals are summarized in Table V.

TABLE V

Metal	Concentration ppb	lb/year	lbs/acre/year
Chromium	250	542	6.8
Copper	<50	<108	<1.4
Zinc	100	217	2.7

These levels of metals will not significantly effect useable life of the site .

<u>Wastewater Application Reporting and Monitoring System</u>

The operator will report the volume, date, time of operation, site area, weather conditions, etc. on the appended "Operation Log" shown in the appendix. The total monthly site loading will be calculated for the parameters discussed. A monthly wastewater analysis will be performed to use as a basis for these load calculations. Operator forms for this purpose are appended. (Appendix VI & VIII)

The soil and groundwater monitoring and record keeping will be the same as the sludge site monitoring and reporting system. (Appendix I11 & VII)