#1751

CITY OF LINCOLN NEBRASKA

DEPARTMENT OF LICENSES AND PERMITS

INDIVIDUAL SEWAGE SYSTEM CONSTRUCTION — TYPE OF LICENSE OR PERMIT

AUGUST 24, 1981 — THIS LICENSE OR PERMIT EXPIRES

LINCOLN CHRISTIAN SCHOOL — LICENSEE OR PERMITTEE

3308 NORTH COTNER 68507 — ADDRESS

T9N, R7E, Section 15 NE¼, LOT51T — NAME OF ESTABLISHMENT, IF ANY

84 & Old Cheney Road — ADDRESS

REMARKS: NON-TRANSFERABLE

PERMIT	INSPECTION FEE	OCCUPATION TAX	LICENSE	TOTAL
$ 60.00	$	$	$	$ 60.00

ACCOUNTING NO.	ACCOUNTING NO.	ACCOUNTING NO.	CODE
018754	110.16	148.14	6-2

SERIAL NO. — DATE — AMOUNT

56737 0244 60.0 -

VALID RECEIPT ONLY IF MACHINE RECEIPTED IN THIS SPACE

APPLICATION
HEALTH

THIS LICENSE OR PERMIT IS ISSUED SUBJECT TO REVOCATION AS PROVIDED BY LAW

M 20103-0477
QUEST FOR SITE CLEARANCE AND PERMIT
R INDIVIDUAL SEWAGE DISPOSAL SYSTEM
ity Ordinance No. 9150 ☒
County Resolution No. 2832 ☐

LINCOLN-LANCASTER COUNTY HEALTH DEPARTMENT
Division of Environmental Health
2200 St. Marys Avenue
Lincoln, Nebraska 68502
Phone: 474-1541

A

FILING FEE: $ 60.00

FILE NO. 1751

DATE: 2/23/81

The undersigned hereby requests SITE CLEARANCE and PERMIT to construct an Individual Sewage Disposal System in conformance with appropriate resolution or ordinance, as described herein:

1. Legal description of property: Twp. 7N ; Range 7E; Section 15 NE¼
   Block ____: Lot 51T : Addition ____
   Street Address 84th & Old Cheney Road

2. Property Use: Residential ☐ ; Commercial ☒ Other Use ☐
   No. of Bedrooms ____. Describe School On basis of 200 students

3. Type of Individual Sewage Disposal System: Septic Tank ☒ ; Other ☐

4. Distance to public sewer: ____ ft.

c/o Lincoln Christian School
c/o Paul von Gillern
Signature of Applicant (Owner or Lessee)
→ Bond Permit 3308 N Cotner 68507
5240 Normal
Address

(Do not write below this double line)

1. Health Department: Date Rec'd. 2/24/81. Date Frwd. 2/24/81. ACTION: Approved ☒ Disapproved ☐ Signature: Jerrold C. Hood

2. Supt. Bldg. Insp.: or Village Clerk Date Rec'd. 2-24-81. Date Frwd. 2-24-81. ACTION: Approved ☐ Disapproved ☐ Signature: Paul Boesen

3. City ~~or County~~ Engineer: Date Rec'd. 2-24-81. Date Frwd. 2-24-81. ACTION: Approved ☒ Disapproved ☐ Signature: [illegible]

REMARKS OR REASONS FOR DISAPPROVAL See attached letter.

Site Visits:
Date: 10-1-81 by: nm sewer line
Date: 10-2-81 by: nm laterals
Date: 10-6-81 by: nm laterals
10-7-81 nm.
10-8-81
10-9-81
10-13-81
10-14-81

PROVISIONAL
INSTALLATION ~~FINAL~~ WRITTEN APPROVAL
Date: ____ By: ____

White: Health Dept. Copy
Yellow: Engineers Copy
Pink: Bldg. Inspector's Copy

* Lower most lateral had ground water seepage probably from a perched water table which is characteristic of Pawnee clay soil.

FORM 20105-0477
SOIL ABSORPTION TEST DATA REPORT
(Annex to Application)
(Reference: City Ordinance No. 9150 and County Resolution No. 2832)

LINCOLN-LANCASTER COUNTY HEALTH DEPARTMENT
Division of Environmental Health
2200 St. Marys Avenue
Lincoln, Nebraska 68502
Phone: 474-1541

B

FILE NO. _____

PROPERTY WHERE SOIL TESTED:

Location: Township 19N ; Range 7E ; Section & ¼ Section 15 . NE¼
Property Dimensions: 930 ft. x 1332 ft. Area: 29.85 acres. (Attach Sheet C with sketch of property).
Soil Type: Silty Clay ☐ ; Silty Clay Loam ☐ ; Sandy Loam ☐ ; Silt Loam ☒ ; Clay Loam ☐ .
Dates of Tests: 2-18-81 to 2-19-81 . Weather: Precip. 0 Temp. 65°.

OWNER: Lincoln Christian School
c/o Paul von Gillern
Address: 5240 Normal

PERCOLATION TEST DATA TABLE

a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.
		Pre-Saturation Period				Percolation Readings						Results	
		Start		End		Start			End				
Hold No.	Hole Depth (in.)	Date (Mo./ Day)	Time (Hr./ Min.)	Date (Mo./ Day)	Time (Hr./ Min.)	Date (Mo./ Day)	Time (Hr./ Min.)	Water Level (in.)	Time (Hr./ Day)	Water Level (in.)	Elapsed Time (Min.)	Water Level Drop (in.)	Percolation Rates (Min./in.)
1	24"	2/18	8:50	2/19	8:50	2/19	8:50	8"	1:50	7½	60	½	60 ½
2			AM		AM		AM		PM	7		1	1
3									2/19	6		2	2
4										3		5	5
5										4⅛		3⅛	3⅛
6										5⅛		2⅞	2⅞
7										7¼		¾	¾
8										6¼		1¾	1¾
9										6¾		1¼	1¼
10										6¼		1¾	1¾

Paul von Gillern
Signature of Person Conducting Test

Sum of Percolation Rates: _____
Average of Rates: _____
Mean of Rates: _____

Address 3308-N Colonial Phone 467-4792

(Do not write below this line)

REVIEWING ACTION

Remarks: _____
Soil Type (SCS): Pawnee Clay Loam
Date: February 23, 1981
appears to be some inclusion

Approved Percolation Rate (a)
A. 30 min./inch
B. _____ min./inch
C. _____ min./inch

Jerrold C. Wood
Signature of Reviewing Official

FORM 20102-0477
PRELIMINARY PLANS & SPECIFICATIONS FOR SEWAGE DISPOSAL SYSTEM (Annex to Application)
City Ordinance No. 9150 ☐
County Resolution No. 2832 ☐

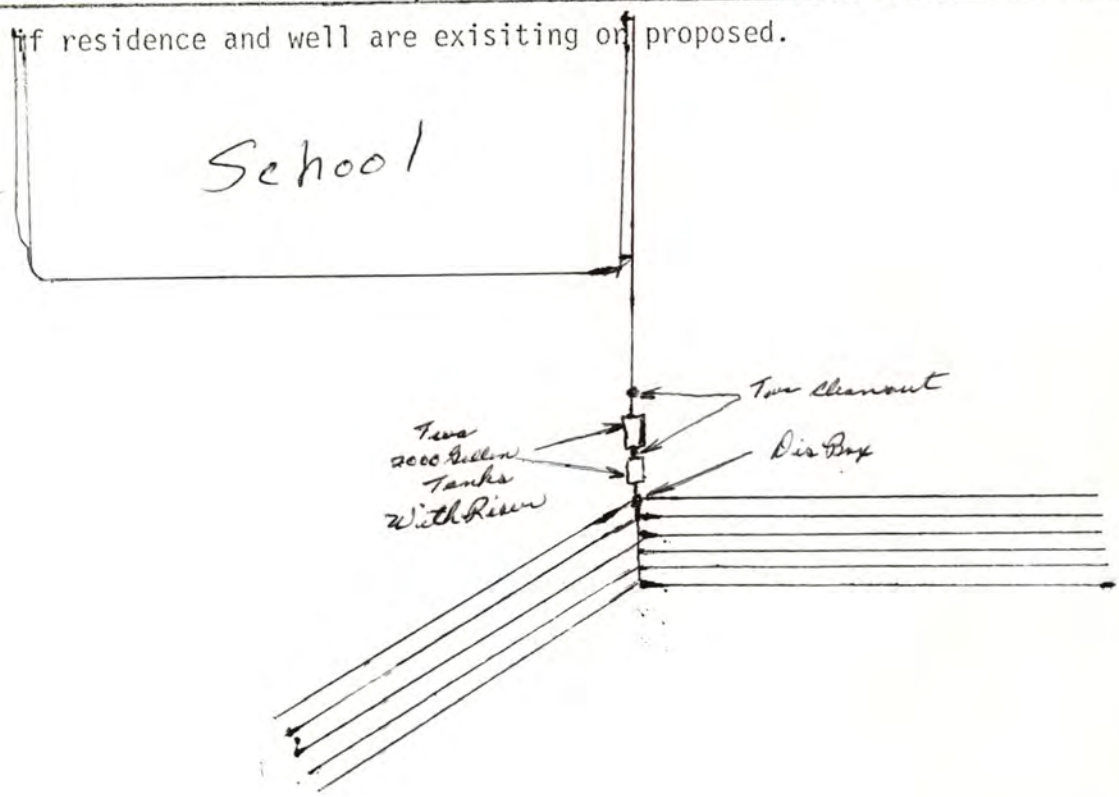
LINCOLN-LANCASTER COUNTY HEALTH DEPARTMENT
Division of Environmental Health
2200 St. Marys Avenue
Lincoln, Nebraska 68502
Phone: 474-1541

C

Sketch of property showing Percolation Test hole locations, well, residence, direction and property line.

FILE NO. _____

Indicate on sketch if residence and well are exisiting or proposed.



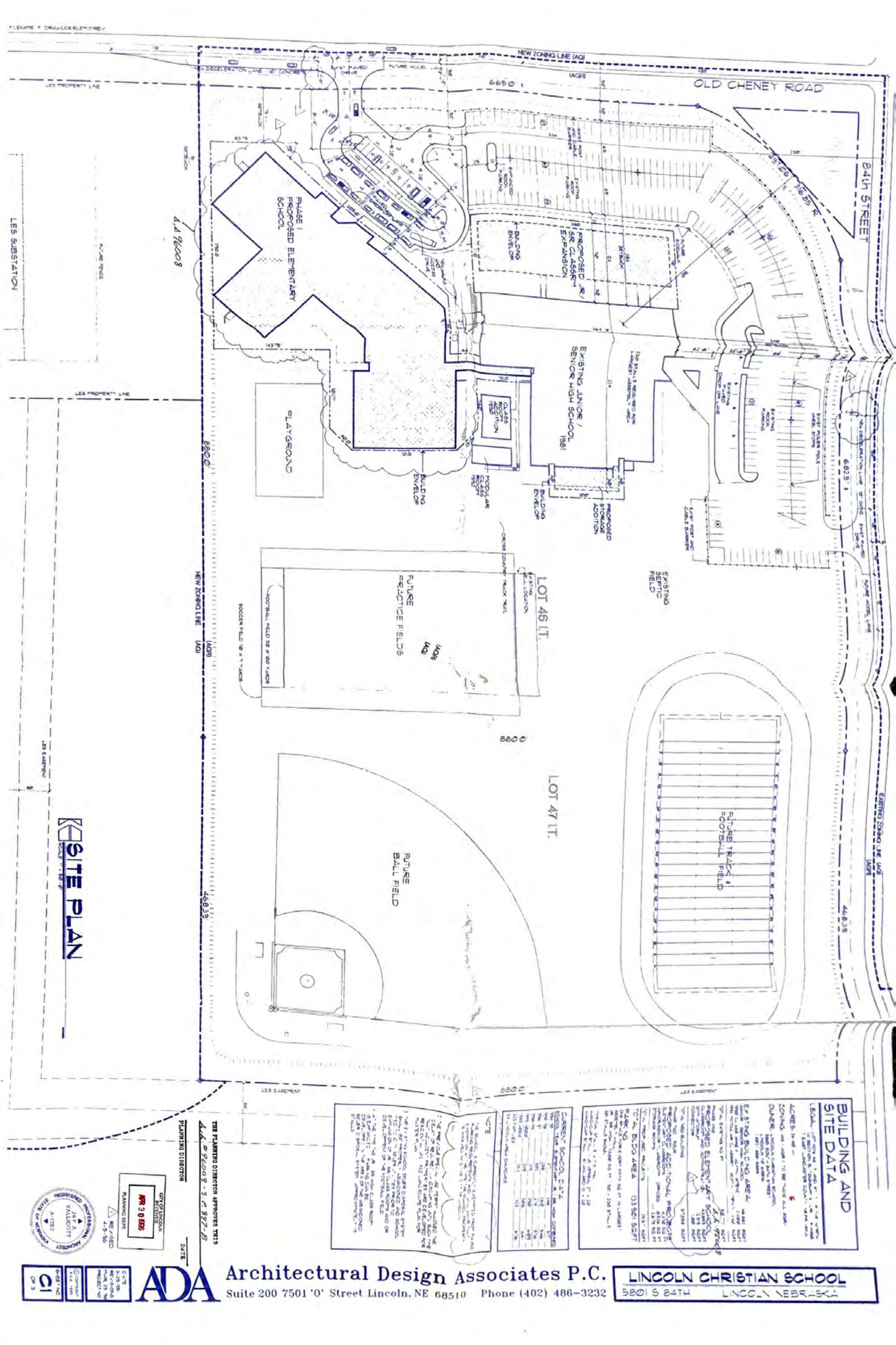
REVIEWING ACTION

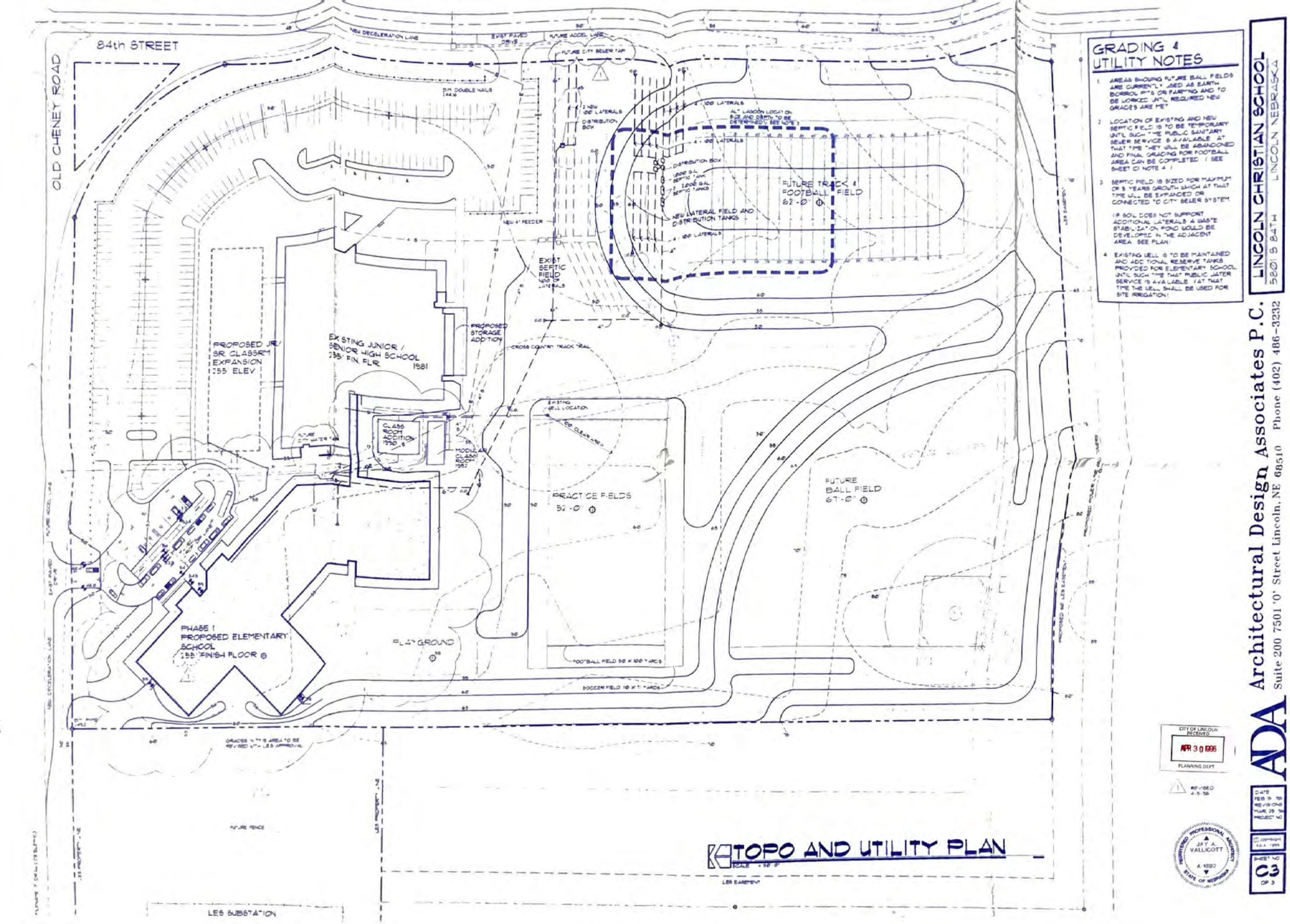
Remarks: _____

Date: February 23, 1981

Minimum Design Requirement
1. Capacity of Septic Tank 4000 gals.
2. Total Length of Laterals 1111 ft.
3. With a Trench Width of 48 in.
4. Total Area of Lateral needed 4444 sq.ft.

Jerrold C. Hood
Signature of Reviewing Official


NEW ZONING LINE (AG)
OLD CHENEY ROAD
84th STREET
LES PROPERTY LINE
LES SUBSTATION
LES EASEMENT
PHASE I PROPOSED ELEMENTARY SCHOOL
PROPOSED JR / SR CLASSRM EXPANSION
BUILDING ENVELOP
EXISTING JUNIOR / SENIOR HIGH SCHOOL 1981
PLAYGROUND
BUILDING ENVELOP
CLASS ROOM ADDITION
MODULAR CLASS ROOM
PROPOSED STORAGE ADDITION
EXISTING SEPTIC FIELD
FUTURE PRACTICE FIELDS
LOT 46 I.T.
LOT 47 I.T.
FUTURE BALL FIELD
FUTURE TRACK / FOOTBALL FIELD
6650'
6825'
8800'
4683'
SITE PLAN
BUILDING AND SITE DATA
A.A. #96008 & #96018 & #88-18
THE PLANNING DIRECTOR APPROVES THIS
PLANNING DIRECTOR
DATE
CITY OF LINCOLN RECEIVED
APR 30 1996
PLANNING DEPT.
REVISED 4-15-96
Architectural Design Associates P.C.
Suite 200 7501 'O' Street Lincoln, NE 68510 Phone (402) 486-3232
LINCOLN CHRISTIAN SCHOOL
5801 S 84TH LINCOLN NEBRASKA



GRADING & UTILITY NOTES

1. AREAS SHOWING FUTURE BALL FIELDS ARE CURRENTLY USED AS EARTH BORROW PITS OR FARMING AND TO BE LEVELED UNTIL REQUIRED NEW GRADES ARE MET
2. LOCATION OF EXISTING AND NEW SEPTIC FIELD IS TO BE TEMPORARY UNTIL SUCH TIME PUBLIC SANITARY SEWER SERVICE IS AVAILABLE AT THAT TIME THEY WILL BE ABANDONED AND FINAL GRADING FOR FOOTBALL AREA CAN BE COMPLETED (SEE SHEET C1 NOTE 4)
3. SEPTIC FIELD IS SIZED FOR MAXIMUM OF 5 YEARS GROWTH WHICH AT THAT TIME WILL BE EXPANDED OR CONNECTED TO CITY SEWER SYSTEM

   IF SOIL DOES NOT SUPPORT ADDITIONAL LATERALS A WASTE STABILIZATION POND WOULD BE DEVELOPED IN THE ADJACENT AREA. SEE PLAN!
4. EXISTING WELL IS TO BE MAINTAINED AND ADDITIONAL RESERVE TANKS PROVIDED FOR ELEMENTARY SCHOOL UNTIL SUCH TIME THAT PUBLIC WATER SERVICE IS AVAILABLE (AT THAT TIME THE WELL SHALL BE USED FOR SITE IRRIGATION!

TOPO AND UTILITY PLAN

SCALE: 1" = 50'-0"

LINCOLN CHRISTIAN SCHOOL
5801 S 84TH LINCOLN NEBRASKA

ADA Architectural Design Associates P.C.
Suite 200 7501 'O' Street Lincoln, NE 68510 Phone (402) 486-3232

CITY OF LINCOLN RECEIVED APR 30 1996 PLANNING DEPT

1 REVISED 4-5-96

DATE FEB 19 96
REVISIONS MAR 29 96
PROJECT 6 of 6

JAY A. VALLICOTT A-1892 REGISTERED PROFESSIONAL ARCHITECT STATE OF NEBRASKA

C1 OF 3
SHEET 6 OF 6

Engineering Study
November 1995

WASTEWATER TREATMENT ALTERNATIVE ANALYSIS

LINCOLN CHRISTIAN SCHOOL LINCOLN, NEBRASKA



Completed by

OLSSON ASSOCIATES
OA Project No. 95-0449

OLSSON ASSOCIATES

CONSULTING ENGINEERS

1111 Lincoln Mall
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Holdrege, NE
Kearney, NE
Sioux City, IA

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CONSULTING
ENGINEERS

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Grand Island, NE
Holdrege, NE
Kearney, NE
Sioux City, IA

27 November, 1995

Lincoln Christian School, Board of Education
c/o Mr. Robert Wekesser Jr.
5801 South 84th Street
Lincoln, Nebraska 68516

Re: Wastewater Treatment Alternative Analysis
Lincoln Christian School
Lincoln, Nebraska
OA Project No. 95-0449.1

Dear Board Member:

We are pleased to present this evaluation of the wastewater treatment system in accordance with our agreement with Lincoln Christian School. We trust that it will provide the information necessary for you to make sound decisions for implementing an improvement program.

We would like to thank Bob Wekesser for his time, consultation, and data used in the report preparation.

Sincerely,

John S. Olsson

John S. Olsson

Encl.

cc: Jay Vallicott, ADA (w/encl.)
Brad Southwick (w/encl.)

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❑ Executive Summary

The existing wastewater treatment system for the Lincoln Christian School (LCS) is no longer functioning as intended. The lateral field is not able to absorb the quantity of wastewater that is being generated by LCS. The current wastewater generation rate for LCS is approximately 3,500 gallons per day. This amount is expected to increase to 7,500 gallons per day by the year 1999. The increase is due primarily to a steady increase in student enrollment as well as the proposed addition of an elementary school.

Expanding or replacing the existing lateral field is not considered a viable solution as the soils are not suitable for an absorption field. The most cost effective solution is to construct two controlled discharge lagoons, each with a surface area of approximately .45 acres. Another alternative would be to pump LCS wastewater to the nearest point of collection on the City of Lincoln Wastewater System. Historically, the City has not allowed entities to tie-in to their system if they were not annexed. If this option is pursued, LCS should discuss the matter with City officials to determine if it would be acceptable. Pumping the wastewater to the City, or treating it on-site, should both be considered temporary since City sewer may be extended to LCS property by 1999.

The controlled discharge lagoons could be constructed on a parcel of land near the southeast corner of LCS property. The lagoons would be supplied by a pumping station that would lift the wastewater from the existing lateral field site to the new lagoon cells. A discharge permit would be required, and operation and maintenance costs would be realized with controlled discharge lagoons. The anticipated capital improvement cost is projected to be approximately $112,000.

❑ Existing Wastewater Treatment System

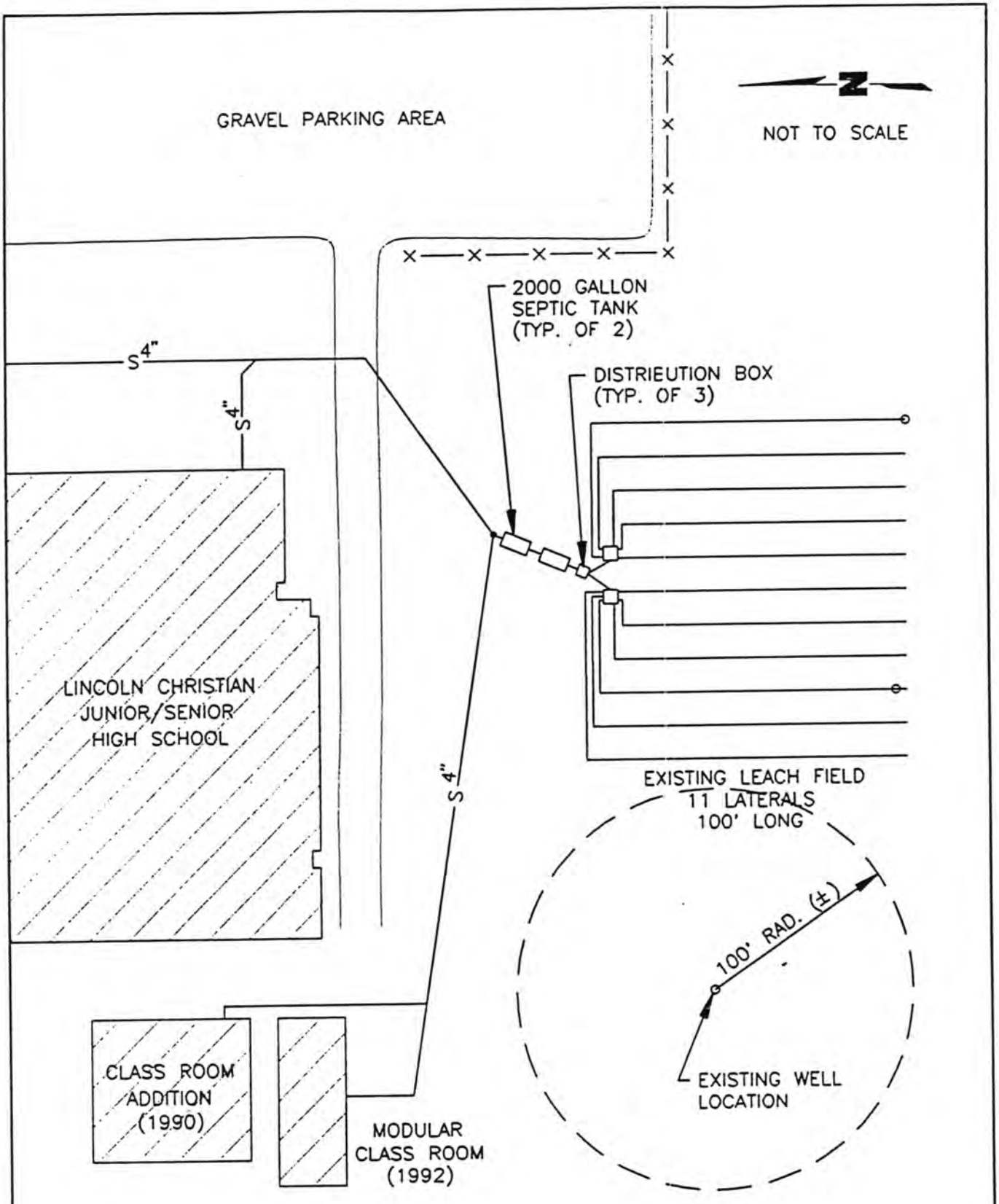
Summary of Findings

- ✓ Existing System is not functional.
- ✓ Short term (<9 mo.) and long term (4 yrs) solutions are needed.
- ✓ Concern for water supply well set-back distance.
- ✓ 155 feet of clay overlies water bearing formation.
- ✓ Pumping station required for future improvements

The existing wastewater treatment system that serves Lincoln Christian School (LCS) consists of septic tanks in combination with a soil absorption field (leach field). Wastewater that leaves the school is conveyed to the septic tanks via a four inch diameter sewer from the main school as well as a separate feed from two detached classrooms that were constructed in the early 1990s. Two septic tanks, each with a capacity of 2,000 gallons, retain the solids while allowing liquid and dissolved solids to pass to the leach field. Liquid that leaves the septic tanks is split by a series of distribution boxes. The distribution boxes allow liquid to flow to any one of the eleven laterals. Each lateral consists of the half-moon distribution conduit that is placed in a four foot wide trench and backfilled with gravel. Each lateral extends to the south a distance of approximately 100 feet. Figure 1 graphically shows the layout of the existing system based on the best available information.

During a site review of the area conducted on October 26, 1995, a representative from the Lincoln-Lancaster County Health Department (LLCHD) observed septic effluent discharging from an observation port near the southeast corner of the field. LCS was advised of the problem, and the septic tanks were pumped out to relieve the immediate problem. The tanks are now being inspected on a weekly basis to ensure the leach field is not discharging.

During the week of October 30, 1995, Mr. Brad Southwick of Southwick Septic and Drainage exposed one of the laterals for the purposes of evaluating the condition of the leach field. The laterals were reported to be in fair condition. However, the soil surrounding the laterals was extremely tight. A soil probe was inserted at various



EXISTING LATERAL FIELD
LINCOLN CHRISTIAN SCHOOL

OLSSON ASSOCIATES
CONSULTING ENGINEERS
1111 Lincoln Mall, P.O. Box 84608
Lincoln, NE 68501-4608

FIGURE 1

locations around the leach field. The probe could only penetrate the ground in the southeast corner of the leach field. This indicates that the majority of the field is no longer passing water.

It should be noted that the water supply well that serves the school is located approximately 100 feet west of the west edge of the leach field. According to Nebraska Department of Health, Title 179, Regulations Governing Public Water Supply Systems, a minimum of 500 feet of separation should be provided between a public water supply and a leach field. The current location of the wastewater system does not comply with this recommendation. The Department of Health has some flexibility to allow for variances for setback distance, however documentation may need to be provided to demonstrate the design is protective of human health. The boring log given on page A-1 of the Appendix shows that approximately 155 feet of clay overlies the water bearing formation. This is a significant amount of low permeability material, and contamination of the supply from overlaying wastewater percolation would be minimal.

The existing leach field is located near the lowest elevation on property owned by LCS. Any new facilities will likely require the use of a pumping station to lift the wastewater to the required elevation.

❑ Wastewater Flows

Summary of Findings

- ✓ Existing flow is 3,500 gal/day.
- ✓ City sewer may be available by 1999.
- ✓ 1999 design flow is 7,500 gal/day.

Existing Flows

The analysis of existing wastewater flows for LCS began by applying typical theoretical (textbook) wastewater generation rates for schools to the number of students that attend LCS. In addition to school population, Sunday church services, and Summer sports camps were also considered in evaluation of flow. The evening

meetings that are held at the school are considered to be incidental in regard to wastewater flow.

Actual water (wastewater) use in the school was monitored by installing a two inch water meter in the supply line. The meter was installed November 6, 1995, and data recording began on November 8, 1995. Daily readings were taken from the meter and compared to the theoretical values to verify that the wastewater generation rates were appropriate. Actual water use data was not used by itself because of the short duration of time for the monitoring period. A two week monitoring period may not be representative of water use throughout the school year. Such things as school activities and climatological conditions can effect water use on a short term basis.

As shown in Table 1 below, a good correlation exists between the theoretical values and actual metered water use. A more detailed flow breakdown is found on page A-2 of the Appendix.

TABLE 1
EXISTING WASTEWATER FLOWS

Theoretical Values

Student Contribution 275 stud. @ 20 gal/day-stud.[1]
+84 stud. @ 10 gal/day-stud. = 6340 gal/day = 1,299,700 gal/yr.[2]

Church Contribution 650 par. @ 3 gal/day-par.[1] = 1,950 gal/day = 101,400 gal/yr.[3]

Summer Contribution 40 ath. @ 10 gal/day-ath. = 390 gal/day = 18,000 gal/yr. [4]

Total Flow = 1,419,100 gal/year = 3,888 gal/day

Metered Water Use (11/13/95 to 11/17/95)

Beginning Reading 1,450 cubic feet

Ending Reading 3,340 cubic feet

Water Use = 14,137 gal/4 days = 3,534 gal/day

[1] From Metcalf and Eddy, 3rd edition

[2] Based on 205 school days per year

[3] Based on 52 church service days per year

[4] Based on a total of nine - five day summer camps

Future Flows

Correspondence from LLCHD has indicated that City of Lincoln sewer service may be extended to LCS by the year 1999 (see page A-3 of Appendix). The year 1999 becomes the basis for design since any improvements which are made now will likely be abandoned when City sewer is provided.

Assuming a five percent annual increase in school and church population, and the addition of a new elementary school between now

and the year 1999, the design flow is projected to be 7,500 gallons per day. A summary of future growth projections and wastewater flows is given below. A more detailed breakdown is located on page A-2 of the Appendix.

TABLE 2[1]

FUTURE WASTEWATER FLOWS - 1999

School	637 students/school day			2,610,444 gal/yr.
Church	753 parishioners/Sunday			117,383 gal/yr.
Summer Camps	40 athletes/day			18,000 gal./yr.
Total Flow	=	2,745,827 gal./yr.	=	7,522 gal/day

USE 7,500 gal./day

[1] See Table 1 for assumptions

❑ Wastewater Treatment Alternatives

Several alternative treatment methods are available for the treatment of LCS wastewater. The options that are given below provide for a variety of methods, some of which are viable alternatives for the types and quantities of wastewater that is expected for LCS. Alternatives which are followed by an asterisk are considered to be potentially viable alternatives, and are discussed in more detail in the following section.

- Water Saving Strategies and Devices*
- Constructed Wetlands

- Land Application Systems
- Stabilization Ponds (Lagoons)*
- Soil Absorption Systems*
- Mechanical Treatment Plants
- Connect to City of Lincoln Sanitary Sewer System*

Water Saving Strategies and Devices

There are two major considerations in this area. First, water savings strategies include such things as correcting leaking fixtures or a campaign to make students aware of the problem, and recommend they limit water use. This may be a difficult task to accomplish given the type of facility that is involved. The second option would be to utilize water saving devices such as low water use shower heads in the locker rooms, or low gallon toilets, and lavatories in the public restrooms. As stated in the next section, this option may help to reduce total wastewater flow, but it will not allow the school to eliminate the need to take corrective action.

Constructed Wetlands

A constructed wetland is system that is constructed for the purpose of saturating the soil. Vegetation is grown to consume the nutrients in the wastewater. There are two types of wetlands systems; a free water surface (FWS) or a subsurface flow (SF) wetland. Both systems discharge to surface water.

Wetland systems generally consist of basins with a barrier material to prevent wastewater infiltration into groundwater. A series of inlet and outlet structures divert flow to the basins and control the water depth. The vegetation grown is usually a combination of cattails, bulrush and reeds; however, other vegetation can be used.

There are two types of problems with these systems. One, there is no established design criteria and, therefore, requirements by NDEQ could be excessive. Secondly, the usual method of pretreatment in this area is lagoons. During the winter it is sometimes necessary to store wastewater due to the lack of vegetation. This creates the need for a rather large lagoon. Firethorn Development has recently completed a wetlands system, however this is the first of its kind in the State of Nebraska to the best of our knowledge.

A constructed wetlands is not considered a viable alternative at this time. A more reliable and long term alternative is desired.

Land Application Systems

Land application systems provide for the irrigation of a land area by wastewater that has had some form of pretreatment. Generally, these systems are considered to not have a surface water discharge. There are four recognized land application systems. These include; slow rate, rapid infiltration, subsurface infiltration and overland flow. Both the rapid infiltration and subsurface infiltration system require highly porous soils and deep groundwater tables, neither of which we have at LCS. This leaves slow rate and overland flow systems. Slow rate is basically a farm irrigation system. Water is applied during the crop growing season at a rate of one to two inches per week.

Crops that are grown typically have a high nitrogen uptake such as reed canary grass, corn, etc. The overland flow method uses large areas utilizing flood or sprinkler irrigation. While slow rate is typically associated with row crops, overland flow is associated

with grasses.

The major problem with these systems is that they only work during the growing season and not during the winter. For that reason, lagoons are used for treatment and winter storage. Typically the size of the lagoon is so large that a conventional lagoon treatment system is of similar size.

Due to the potential large land requirements and high operational costs for maintaining the irrigation system, land application is not considered a viable option.

Stabilization Ponds (Lagoons)

Three types of lagoon systems are commonly used in this area.

1. Complete Retention Facultative Lagoons
2. Controlled Discharge Facultative Lagoons
3. Aerated Lagoons

There are two main sizing criteria for lagoon systems. First is hydraulic flow. The larger the volume of water to be treated, the bigger the land area. The second criteria is organic loading. The State has a limit of 20 lbs. of BOD/acre/day on lagoon organic loading. Complete retention lagoons are not discharged, so a discharge permit is not required. Annual maintenance costs are generally minimal. As shown on page A-5 of the Appendix, the complete retention lagoon will reach maximum capacity in five years. An additional cell may be required if the lagoons are used past the year 1999.

A controlled discharge lagoon is similar to a complete retention lagoon, however the size is reduced because the lagoon is typically discharge twice a year. Some operational costs will be realized with a controlled discharge lagoon since testing of the water is required before discharge.

An aerated lagoon can be significantly smaller in size, however, the operation costs are much higher. Typically, 25 Hp per million gallons of lagoon volume is needed for the aeration. A major problem with aerated lagoons is winter operation. They must be monitored to assure nothing freezes and causes the aeration system to fail. An aerated lagoon would not be considered a viable option for LCS.

Odors can be a problem with any lagoon system. When properly sized there are minimal odors, but they cannot be eliminated. The major advantage to a lagoon system is its low operation cost. There is not the need for a highly skilled, trained operator. Both the complete retention and controlled discharge lagoon warrant further consideration as a treatment method for LCS.

Soil Absorption Systems

The following types of soil absorption systems could be considered:

1. Leach Fields
2. Fill Systems
3. Evapo-Transpiration Beds

A leach field is the same type of system that is now used by LCS.

It generally consists of a series of perforated pipes that are placed in a trench and backfilled with a porous material. Wastewater that flows through the pipes seeps out the pipe perforations and percolates into the ground. An evapo-transpiration bed is similar to a leach field except that the trenches are much wider, and trees or other vegetation are planted between the laterals. Wastewater is treated by a combination of percolation and water transpiration by the tree roots.

A fill system is used in areas where a tight soil overlays a sandy or other permeable soil. In this case the tight soil is stripped away and replaced with sand or other granular fill. A detailed hydrogeologic study would need to be made if this option were to be considered.

In general, soil absorption systems can be installed for a reasonable price, and the operational costs are low. The long term viability and success rate of these systems is questionable, and will be scrutinized by the regulators, particularly at this location.

Mechanical Treatment Plants

These systems are what would be normally considered conventional treatment plants. They all have surface water discharge and are required to meet discharge permit limits. Mechanical plants are very effective at treating wastewater, however the initial capital investment is large, and high operational costs would be realized. Daily operator attention would be required.

The water flow rate from LCS is not large enough, and the

economics involved with a mechanical plant render this option not viable for LCS.

Connect to City of Lincoln Sewer System

This alternative is very attractive, unfortunately the City of Lincoln sewer system does not extend to the LCS property. Correspondence form the LLCHD has indicated that sewer service may be available at LCS by the year 1999. There is no guarantee that this will occur. The design of any new treatment facilities will be made in consideration of a 4-year design life. If the installation of sewer is delayed beyond the year 1999, then new facilities may need to be expanded to accommodate school growth.

In the absence of a gravity sewer system, LCS could potentially pump their wastewater to the nearest point of the City's' collection system. This option may require annexation and/or City of Lincoln approval.

Summary of Findings

- ✓ On-site soils are not suitable for a leach field.
- ✓ City sewer may be on-site by 1999.
- ✓ Design for 1999 flows, expand new system if needed.
- ✓ Water savings devices are not cost effective.
- ✓ Construct either 4 acre complete retention lagoon or .9 acre controlled discharge lagoon.
- ✓ School may need to be annexed if wastewater is pumped to city sewer.

❑ Viable Wastewater Treatment Alternative Analysis

Soil Absorption Systems

As stated in the previous section, the City and State have observed the failure of several soil absorption systems in the immediate vicinity of LCS. Firethorn Development, Southfork, Country Meadows, and the LCS site are all examples of systems that have failed in one way or another. The primary problem appears to be the lack of appropriate soils.

Percolation tests completed by Southwick Septic and Drainage in an area to the south of the existing leach field have revealed the soil to be relatively tight, and unsuitable for a soil absorption

system. According the Lancaster County soil survey, the soil type in this area is classified as a Pawnee Clay. Table 3 provides for a summary of the percolation data. It is important to note that NDEQ will not permit a soil absorption system if the percolation rate is slower than 100 minutes per inch. Only four of twelve test locations were acceptable according to NDEQ requirements.

TABLE 3
SOIL PERCOLATION DATA

Hole Number	1	2	3	4	5	6	7	8	9	10	11	12
Perc. Rate (min/inch)	240	60	80	120	np	30	240	240	np	240	240	np

np - no percolation was observed

An alternative would be to bring in the more permeable Sharpsburg soil that has been stockpiled from the Land Construction borrow operation. This type of system would be similar to a fill type system in that a more permeable soil would be brought in to replace the less permeable Pawnee Clay. As shown in the attached boring log of the LCS water well (page A-1 of the Appendix), the material under the Pawnee does not appear to be much more permeable than the Pawnee itself. A detailed hydrogeolgic study would need to be made if this option were to be pursued.

Water Saving Devices

A fixture count of all existing and proposed pluming fixtures for the existing Jr./Sr. High School and proposed Elementary addition indicates that a total of 133 supply fixture units exist in public locations. If each one of these units was equipped with a water efficient fixture, the total wastewater flow could by reduced by approximately 25 percent. This would reduce the total design flow rate to 5,600 gallons per day in-lieu of 7,500 gallons per day.

The estimated cost to install water efficient fixtures in public restrooms throughout the schools is estimated:

TABLE 4
OPINION OF COST - WATER SAVINGS DEVICES

Replace Shower Heads	$ 1,800
Replace Water Closets/Urinals	$ 7,000
Replace Sink Lavatories	$ 8,500
Added incremental cost to construct elementary school with water efficient fixtures	$15,000
TOTAL PROJECT	**$32,300**

Even by utilization of water saving devices, new treatment facilities are still needed, only to a smaller scale. The cost of all water saving fixtures will not be totally recoverable.

Stabilization Ponds

Complete Retention Lagoons

Complete Retention Lagoons are simply lagoons which do not discharge. All the wastewater and precipitation which enters the system is lost through evaporation and percolation.

The low operation and maintenance budget possible with this alternative is an advantage. Large land requirements and high initial cost can be a disadvantage for this alternative. An advantage to a complete retention lagoon system is that there is no discharge permit required for the system so discharge monitoring is not required and effluent limitations do not have to be met. The complete retention lagoon system can also handle a wide variation in hydraulic loadings.

Flow from the collection system would be pumped from a pumping station through a force main to the lagoons. The force main would discharge into a distribution box prior to the lagoons and piping would distribute the wastewater in either parallel or series operation. The pumping station would be sized to handle the peak design flow.

Based on a design flow of 7,500 gallons per day in year 1999 plus average precipitation and evaporation for the study area, and zero seepage, the total lagoon surface area required is 4 acres. As shown on page A-5 of the Appendix, the monthly water balance demonstrates how the water level changes over the year. Geotechnical testing will be required to determine the appropriate seepage amount. This may reduce the final lagoon size.

The most feasible location for the total retention lagoons was found to be in the southeast corner of the property as shown in Figure 2. This layout provides the greatest separation distance from the school well, however it is less than the recommended 1,000 feet.

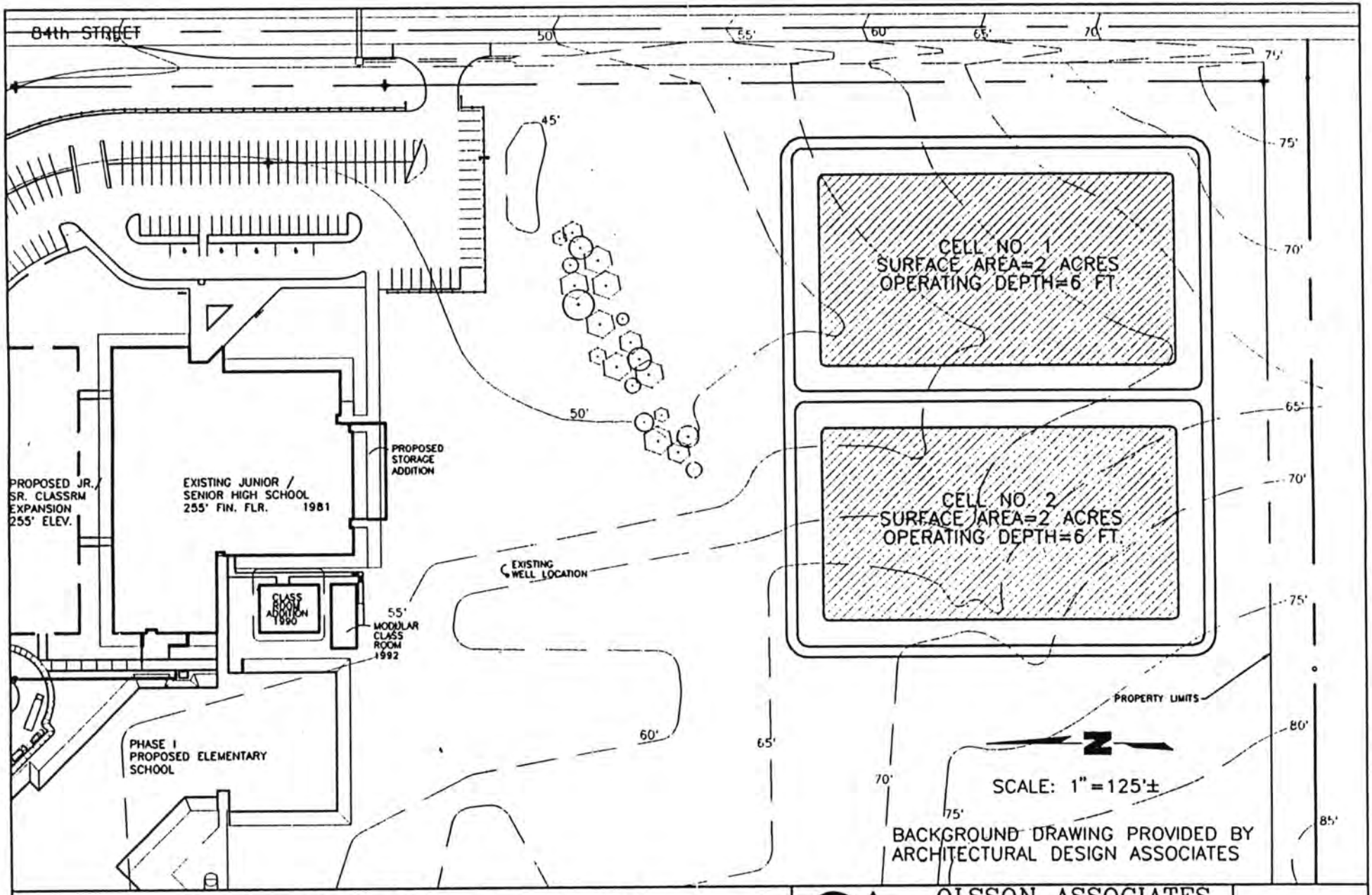
The estimated costs for this alternative is provided in Table 5.

TABLE 5

OPINION OF COST - COMPLETE RETENTION LAGOONS[1]

Mobilization and General Grading	$5,000
Abandon Septic Tanks	$500
Manholes	$1,600
Gravity Sewer	$1,800
Pumping Station/Elec.	$23,000
4 Inch PVC Force Main	$5,000
Lagoon Construction (4 acres)	$140,600
Contingencies (15%)	$26,600
Professional Services (Geotech., Design, Permitting, Const. Serv.)	$16,000
TOTAL PROJECT	**$220,100**

[1] Based on typical competitive bid prices for similar work



COMPLETE RETENTION LAGOON LAYOUT (4 YEAR)
LINCOLN CHRISTIAN SCHOOL

OLSSON ASSOCIATES
CONSULTING ENGINEERS
1111 Lincoln Mall, P.O. Box 84608
Lincoln, NE 68501-4608

FIGURE 2

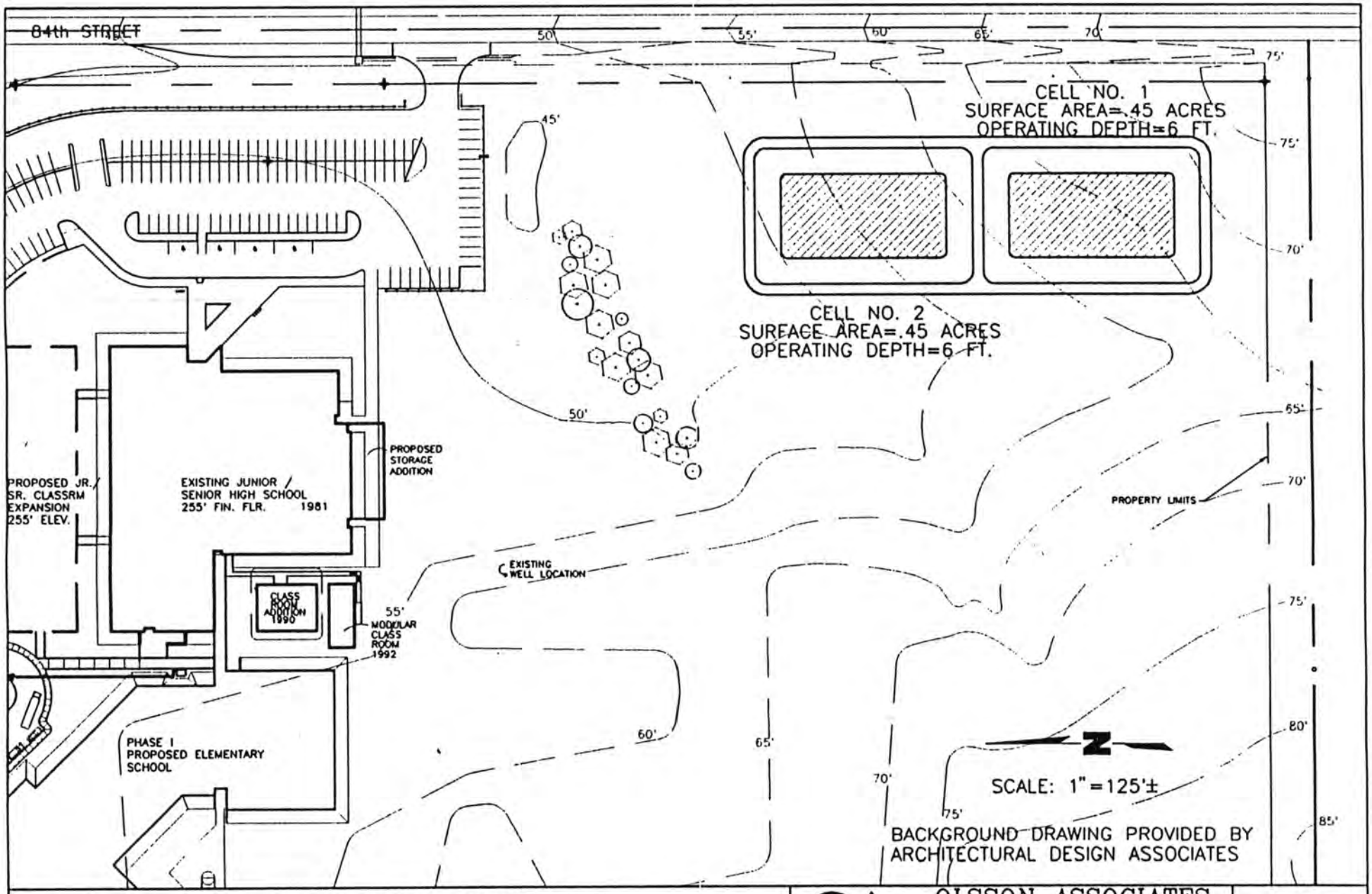
Controlled Discharge Lagoons

A controlled discharge lagoon system is constructed similar to a complete retention lagoon system except there is discharge twice per year, and a discharge permit is required. The design includes consideration of wastewater flow, average annual precipitation, evaporation, and projected seepage. This lagoon system can also handle a wide variation in both hydraulic and organic loading rates.

Storage volume is defined as that volume available form the 2-foot depth to the maximum operating depth. Controlled discharge systems are designed to provide 180 days storage so that normal discharges may be made twice a year, in the fall after the first freeze when algae settles out and in the spring after recovery but before two many algae have developed.

Based on a average flow of 7,500 gallons per day and taking into consideration two discharges per year and zero seepage, the total lagoon surface area required would be .9 acres with a 6 foot operating depth. (Please note that the NDEQ requires that based on soil types native to southeast Nebraska, a value of zero seepage must be assured unless geotechnical testing substantiate that seepage can be considered). Geotechnical testing will be required to determine the appropriate seepage amount. This may reduce the final lagoon size.

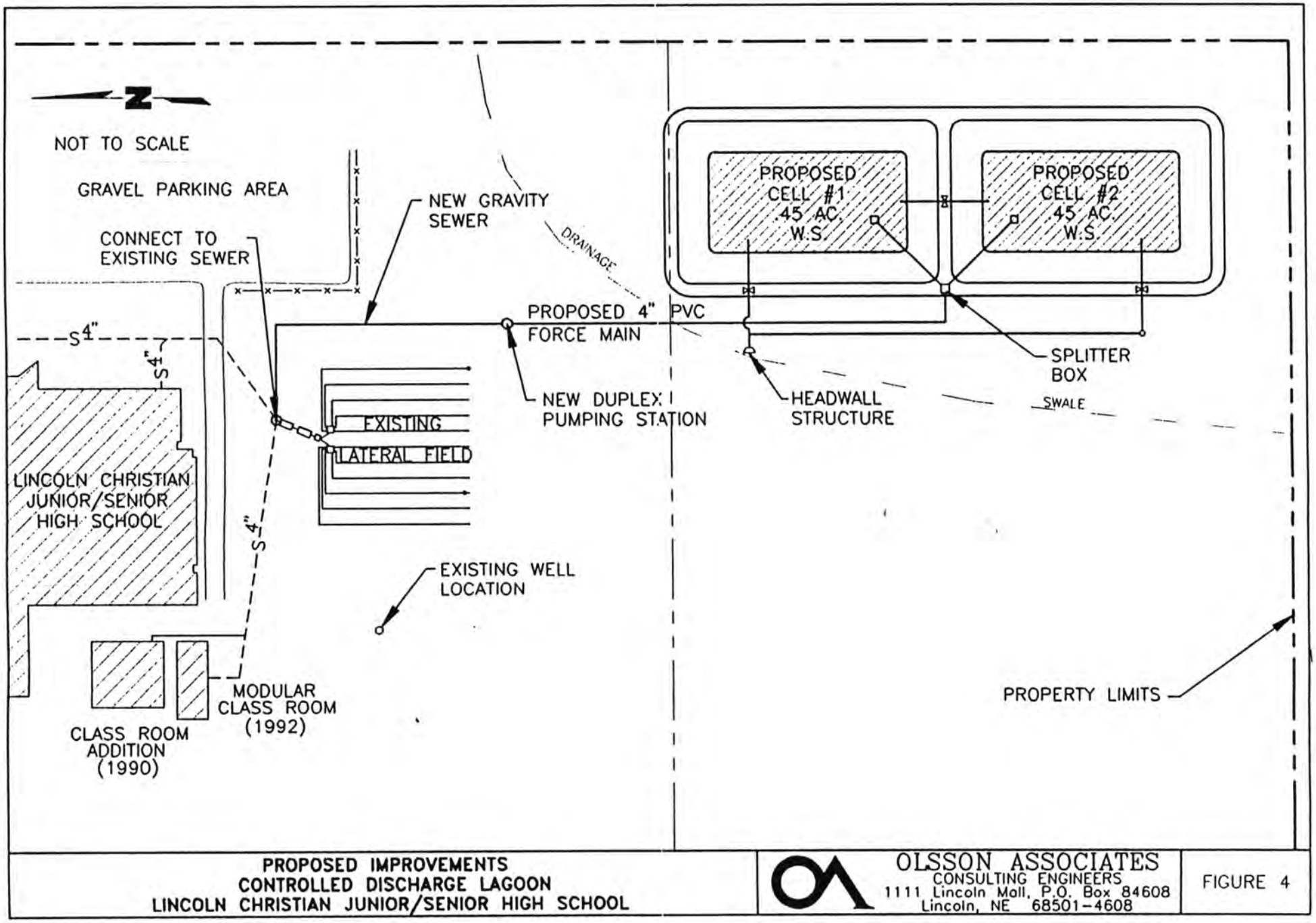
A lift station and force main would be required to lift the sewage up to the new lagoon system. Pump capacity should be near 60 gallons per minute to handle peak flow rates. The most feasible location for controlled discharge lagoons is near the southeast corner of the LCS property as shown in Figure 3. A schematic diagram of a controlled discharge lagoon is shown in Figure 4.



CONTROLLED DISCHARGE LAGOON LAYOUT
LINCOLN CHRISTIAN SCHOOL

OLSSON ASSOCIATES
CONSULTING ENGINEERS
1111 Lincoln Mall, P.O. Box 84608
Lincoln, NE 68501-4608

FIGURE 3



PROPOSED IMPROVEMENTS
CONTROLLED DISCHARGE LAGOON
LINCOLN CHRISTIAN JUNIOR/SENIOR HIGH SCHOOL

OLSSON ASSOCIATES
CONSULTING ENGINEERS
1111 Lincoln Mall, P.O. Box 84608
Lincoln, NE 68501-4608

FIGURE 4

The estimated cost for the controlled discharge lagoon are given in Table 6.

TABLE 6

OPINION OF COST - CONTROLLED DISCHARGE LAGOONS[1]

Mobilization and General Grading	$3,000
Abandon Septic Tanks	$500
Manholes	$3,200
Gravity Sewer	$1,800
Pumping Station/Elec.	$23,000
4 Inch PVC Force Main	$6,200
Lagoon Construction (0.9 acre)	$40,900
Effluent Sewer	$6,600
Contingencies (15%)	$12,800
Eng. Design & Const. Services (Geotech., Design, Permitting, Const. Serv.)	$14,000
TOTAL PROJECT	**$112,000**

Estimated Annual Operation and Maintenance[2] = $2,500

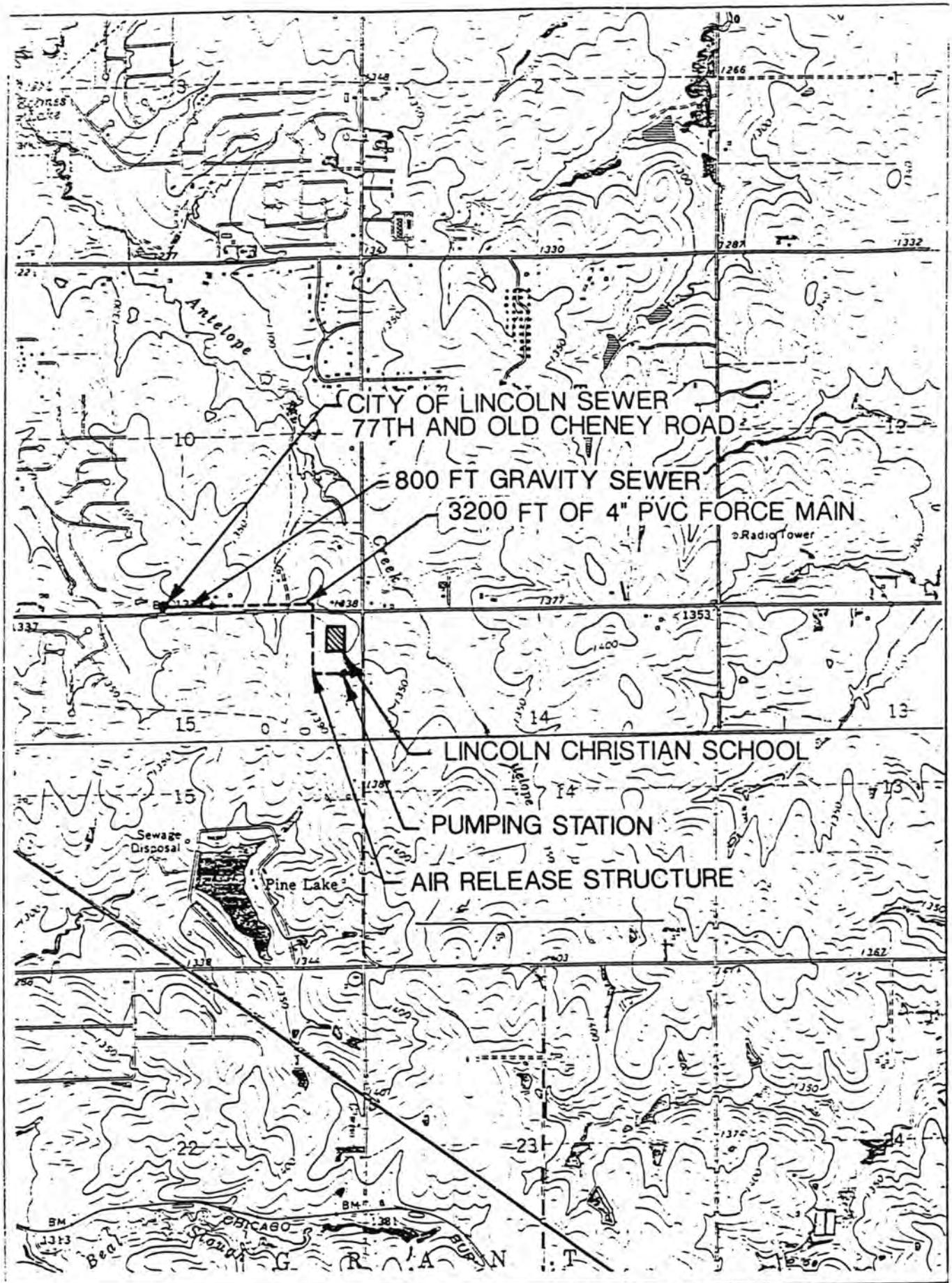
[1] Based on typical competitive bid pricing for similar work

[2] Does not include operation and maintenance costs that are common to all viable alternatives. Based on verbal quote from Peoples Services

Connect to City of Lincoln Sewer System

Until the City of Lincoln extends the wastewater collection system up Antelope Creek, LCS will need evaluate the possibility of pumping their wastewater to the nearest point on the collection system. An existing manhole located on the north side of S. 77th

Street and Old Cheney Road may prove the be the most feasible tie-in point. As shown if Figure 5, this work will require the installation of approximately 3,200 lineal feet of 4-inch force main, 800 feet of gravity sewer, one air release structures, and a pumping station. The total cost for this alternative is estimated below:



PUMP TO CITY SEWER-LAYOUT
LINCOLN CHRISTIAN SCHOOL

OLSSON ASSOCIATES
CONSULTING ENGINEERS
1111 Lincoln Mall, P.O. Box 84608
Lincoln, NE 68501-4608

FIGURE 5

TABLE 7

OPINION OF COST - PUMP TO CITY SEWER[1]

Mobilization	$2,000
Abandon Septic Tank	$500
Manholes	$4,000
Gravity Sewer	$13,500
Pumping Station/Elec.	$23,000
4 Inch PVC Force Main	$42,000
Air Release Structure	$2,500
Road Borings	$2,000
Pavement Removal/Replacement	$2,000
Contingencies (15%)	$13,700
Professional Services (Design, Const. Serv.)	$12,000
TOTAL PROJECT	**$117,200[2]**

Note: City of Lincoln user changes not included

1 Based on typical competitive bid pricing for similar work

2 As stated earlier in the report, this option may require annexation and/or City of Lincoln approval.

APPENDIX

BLUE VALLEY DRILLING

Test Hole Log

Gerald Strader
Blue Rapids, Kansas 66411
Phone 913/292-7353

Roger Strader
Pickrell, Nebraska 68422
Phone 402/673-3465

Name (Century) Drilling Date 5 - 15 , 1981

Address _____ Phone _____

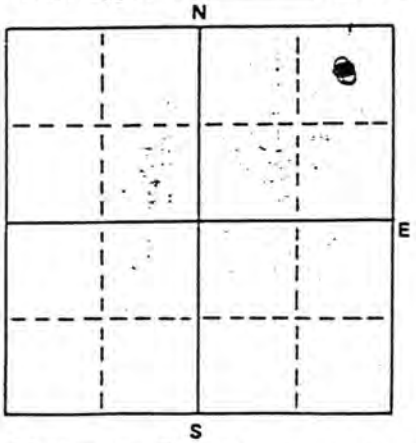
Location Lincoln Ave

Location of Well Church School - 81st + Old Chalk Rd

0	10	Yellow Clay	171	174	Yellow Shale
10	17	Brown Clay	174	176	Yellow Clay
17	19	Gray Clay	176	183	Red + Yellow Clay
19	21	Fine Sand	183	186	Yellow Shale
21	35	Yellow Clay	186	187	Black Shale
35	39	Tan Clay	187	190	Gray Shale
39	54	Yellow Clay	190	199	Blue Shale
54	95	Blue Clay	199	201	Black Shale
95	97	Brown Clay	201	218	Blue Shale
97	130	Blue Clay			
130	134	Red Clay			
134	138	Tan Clay			
138	141	Gray Clay			
141	142	Fine Stone			
142	156	Tan Clay			
156	167	Brown Sandstone	11'		
167	170	Yellow Clay			
170	171	Red Clay			

Water Level _____ Estimate _____ Gal. Per. Min. _____ Water Level _____ Estimate _____ Gal. Per. Min.

Hole Plugged _____ How _____ Hole Plugged _____ How _____



¼ ¼ ¼ of Section NE-NE 15

Township 9 N Range 7 E of

County _____

1 _____ @ _____ per ft. $ _____

2 _____ @ _____ per ft. $ _____

State Tax on $ _____ $ _____

TOTAL $ _____

Terms: Cash upon completion unless other arrangements have previously been made.

Any invoice not paid will be subject to a **Service Charge** of 1½% per month from date of invoice which is an **Annual Percentage Rage of 18%.**

Driller _____ Purchaser _____

Lincoln Christian School
OA Project No. 95-0449

Year	# Students/HS	# Students/Elem	# of Students	Flow Rate per day	Flow Rate per year
1995-1996	275	84	359	6340 gal/day	1299700 gal
1996-1997	289	289	578	11550 gal/day	2367750 gal
1997-1998	303	303	606	12128 gal/day	2486138 gal
1998-1999	318	318	637	12734 gal/day	2610444 gal

Assumptions
1. Elementary School is not included in the 1995-1996 school year.
2. Each campus experiences a five percent growth each year.
3. Average flow rate of 20 gallons per day per student is used.
4. Average flow rate of 10 gallons per day per elem. student in existing detached classrooms.

Church Flow Rates

Year	# at Church	Flow Rate on Sunday Mornings	# at Church	Flow Rate on Sunday Evenings	Flow Rate per year
1995-1996	450	1350 gal/day	200	600 gal/day	101400 gal
1996-1997	473	1418 gal/day	210	630 gal/day	106470 gal
1997-1998	496	1488 gal/day	221	662 gal/day	111794 gal
1998-1999	521	1563 gal/day	232	695 gal/day	117383 gal

Assumptions
1. Church growth is assumed to be five percent.
2. Church mets approximately 52 Sundays.
3. Church attendance ranges from 400-450 mornings and 150-200 in evenings.
4. Average flow rate of 3 gallons per day per person is used.

Summer Time Rates

Year	# of Students	Flow Rate per day	Flow Rate per year
1995-1996	40	400 gal/day	18000 gal
1996-1997	40	400 gal/day	18000 gal
1997-1998	40	400 gal/day	18000 gal
1998-1999	40	400 gal/day	18000 gal

Assumptions
1. Approximately a total of 360 students attend 9 summer camps.
2. Summer camps each last 5 days.
3. No growth rate is assumed.
4. Average flow rate of 10 gallons per day per student is used.

Total Rates = Summer + School + Church

Year	Flow Rate per year	Flow Rate per day
1995-1996	1419100 gal/year	3888 gal/day
1996-1997	2492220 gal/year	6828 gal/day
1997-1998	2615931 gal/year	7167 gal/day
1998-1999	2745828 gal/year	7523 gal/day

Summary of Information from the Water Meter

Date	Time	Meter Reading (In Units)	Cumulative Use (Gallons)	Daily Use (Gallons)
11/06/95	Install Date	0	0	0
11/07/95	No Reading			
11/08/95	11:15 a.m.	56	4200	4200
11/09/95	6:45 a.m.	76	5700	1500
11/10/95	9:40 a.m.	110	8250	2550
11/11/95	9:00 p.m.	131	9825	1575
11/12/95	Not Taken			
11/13/95	6:48 a.m.	145	10875	1050
11/14/95	6:50 a.m.	186	13950	3075
11/15/95	9:00 a.m.	228	17100	3150
11/16/95	8:00 a.m.	256	19200	2100
11/17/95	7:30 a.m.	334	25052	5850
11/18/95	No Reading			
11/19/95	No Reading			
11/20/95	6:45 a.m.	396	29700	4650

Lincoln-Lancaster County
HEALTH DEPARTMENT

3140 "N" STREET
LINCOLN, NE 68510-1514
402-441-8000
TDDY 402-441-6248
M. JANE FORD, HEALTH DIRECTOR

CERTIFIED

November 1, 1995

Mr. George Lockyer, Principal
Lincoln Christian School
5801 So. 84th Street
Lincoln, NE 68516

Dear Mr. Lockyer:

On October 26, 1995, Jerrold Hood, REHS, of the Lincoln-Lancaster County Health Department (LLCHD) was at Lincoln Christian School to inspect the soil percolation area for the proposed new sewage system to serve the new elementary school. Upon arrival Mr. Hood became immediately aware of a very strong sewage odor. Mr. Hood inspected the area of LCS's existing septic system, and found septic effluent running onto the surface of the ground near the East end of the lateral field. This is in violation of Lincoln Municipal Code 24.38.120, and State law, and must be corrected immediately.

The following actions must be taken immediately:

1) The two septic tanks should be pumped to provide immediate relief for the laterals. The septic tanks may require regular pumping to provide adequate relief for the system until it is properly upgraded/repaired.
2) Water conservation efforts should be instituted, such as limiting the use of water to the greatest extent possible, including reducing the use of showers and the number of alternate or additional uses of LCS facilities; and inspecting plumbing fixtures and repairing any leaks leading to increased flow into the septic system.

Please submit a written plan of action within 14 days that includes a schedule for pumping the septic tanks until the system can be repaired, and a plan for repair of the system.

Please submit a written plan of action within the next 30 days that identifies what will be done to assure proper long term sewage disposal for the school after the temporary repair is completed. LLCHD recommends that the plan address sewage disposal from both the existing facility, and the proposed new elementary school.

While at the LCS campus, Mr. Hood also inspected the area where soil percolation test holes were drilled to determine the suitability for a septic system for the new elementary school. Upon inspection, six out of eight holes still contained water from the percolation test performed the previous day. If this is an accurate reflection of soil percolation, and was not the result of the holes being refilled with water, or lawn watering,

then this indicates that the soils in the areas tested would not be suitable for a septic system.

Ideally LCS would be connected to the City of Lincoln sanitary sewer system. LLCHD has contacted several City agencies to determine if and when LCS property is proposed to be annexed into the City. The Planning Department reported that LCS is expected to be annexed in the future. The Lincoln Public Works and Utilities' Department indicated that their Capital Improvement Plan includes the extension of City sewer up the Antelope Creek drainage to the East of LCS in Fiscal Year 1998-99. Thus, City sewer will potentially be available to LCS by 1999. Thus, the LCS plan for sewage disposal needs to address the immediate needs of the existing facility, the near future need of the proposed new elementary school, and connection to the City of Lincoln sanitary sewer system.

I have attached additional notes to this letter to assist you.

If there are any questions, please contact me at 441-8024.

Sincerely,

Scott E. Holmes, Chief
Environmental Health Division

SH:dl
SEP2501/6

cc: Steve Goans, Nebraska Department of Environmental Quality
Ray Hill, Planning Department
Jay Vallicott, Architectural Design Assoc.
7501 "O" St., Ste 200, Lincoln, NE
Jerry Hood, LLCHD

11/21/95

PRECIPITATION /EVAPORATION DATA IS BASED ON NOAA CLIMATOLOGICAL DATA FROM 1972-1993, LINCOLN OBSERVATION STAT

INFLOW= *7500 GPD*

Proposed Lagoon Area *4.000 acre*
Proposed Initial Depth *2.00 ft*
Anticipated Seepage Rate *0 in/day*

Lincoln Christian School - Wastewater Treatment Alternative Analysis

MONTH	WASTEFLOW DAYS/MO.	INFLOW (GPD)	INFLOW (ft3)	PRECIP. (IN.)	PRECIP. (COEF.) (ft3)	LAKE EVAP. (IN.)	EVAP. (COEF.) (ft3)	SEEPAGE (COEFF.) (ft3)	VOLUME (ft3)	PROPOSED LAGOON LEVEL (ft)
ber	30	7500	30080.2	2.20	31944.0	4.50	65340.0	0	-3315.8	1.98
November	30	7500	30080.2	1.20	17424.0	0.00	0.0	0	47504.2	2.25
December	30	7500	30080.2	0.40	5808.0	0.00	0.0	0	35888.2	2.46
January	30	7500	30080.2	0.50	7260.0	0.00	0.0	0	37340.2	2.67
February	30	7500	30080.2	0.80	11616.0	0.00	0.0	0	41696.2	2.91
March	30	7500	30080.2	2.10	30492.0	0.00	0.0	0	60572.2	3.26
April	30	7500	30080.2	2.70	39204.0	0.00	0.0	0	69284.2	3.66
May	30	7500	30080.2	4.00	58080.0	6.70	97284.0	0	-9123.8	3.61
June	30	7500	30080.2	4.20	60984.0	8.90	129228.0	0	-38163.8	3.39
July	30	7500	30080.2	3.50	50820.0	9.60	139392.0	0	-58491.8	3.05
August	30	7500	30080.2	3.50	50820.0	7.80	113256.0	0	-32355.8	2.87
September	30	7500	30080.2	3.40	49368.0	6.00	87120.0	0	-7671.8	2.82
				28.5		43.5			143162.6	0.82