NORTHWEST KANSAS PLANNING AND DEVELOPMENT COMMISSION
ENVIRONMENTAL ASSESSMENT REVIEW

REQUEST FOR ACTION ON GRANT REVIEW — DATE: December 26, 2002

Agency Name:
Kansas Geological Survey
University of Kansas
1930 Constant Avenue
Lawrence, KS 66047

Impact Categories:
Geological and other applicable

Applicant's Name and Address:
City of Palco
509 Main
Palco, KS 67657

Project Title:
Non-Discharging Evaporative Sewer Lagoon Waste Water Treatment Facility

Project Number:
KDH&E (Palco, KS Revolving Loan Application NPDES Permit)

Return No Later Than:
January 30, 2003

Return To: Steve Hanson
Northwest Kansas Planning & Development Commission
P.O. Box 248
Hill City, KS 67642

The enclosed proposal has been submitted by the Northwest Kansas Planning and Development Commission for an Environmental Assessment Review. Your review of this proposal as it affects regional or local interest will be appreciated. Your appropriate comments concerning the proposal should be submitted to the Northwest Kansas Planning and Development Commission no later than the date specified above.

Comments filed on a proposal may include: (1) The extent to which the project is consistent with or contributes to th fulfillment of your agency planning within the state, region or locality; (2) How the proposal relates to state, regional local objectives; and (3) The effect of the proposal on your agency's activities.

_____ No Impact Anticipated

_✓_ Potentially Beneficial

_____ Potentially Adverse - Requires Documentation Only

_____ Potentially Adverse - Requires More Study

_____ Needs Mitigation

_____ Requires Project Modification

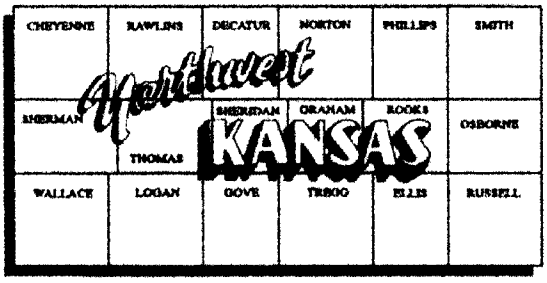
COMMENTS:

The short-term impacts of construction should be offset by the long-term benefits of the improvements to the wastewater treatment system. There should be a determination of whether there are any water-supply wells within ½ mile that could potentially be affected by the allowed leakage of water through the lagoon.

Reviewer's Signature and Title

Donald C. Whittemore Senior Scientist

1/27/03



NORTHWEST KANSAS PLANNING and DEVELOPMENT COMMISSION
319 N. Pomeroy
Box 248
Hill City, Kansas 67642-0248
(785) 421-2151 Fax (785) 421-3496

December 30, 2002

Kansas Geological Survey
University of Kansas
1930 Constant Avenue
Lawrence, KS 66047

Re: Environmental Assessment

Dear Sir,

The City of Palco is applying for Revolving Loan Funds through the Kansas Department of Health & Environment, Division of Environment, Bureau of Water. We ask that you review the attached information and provide any comments concerning this project.

The loan will be used to assist in the financing of the construction of a Non-discharging evaporative sewer lagoon wastewater treatment facility on land commonly known as a tract of land in Section 21, Township 9 South, Range 20 West of the 6th P.M., Rooks County Kansas. The preferred alternative is located directly East of the present trickle filtration wastewater treatment facility on land currently grass pasture, approximately 300 feet from the Spring Creek drainage system which drains into the South Solomon River.

Attached is the engineers report and project layout map, USGS site map, township map with sited location and legal description and KDH&E Water Pollution Control Facility Ste Appraisal.

All comments need to be returned to Steve Hanson, Northwest Kansas Planning & Development Commission, P.O. Box 248, Hill City, KS 67642.

Sincerely,

Steve Hanson
Business Finance Officer

Enclosures

I. INTRODUCTION AND SCOPE

The City of Palco currently operates a 1940's mechanical wastewater treatment plant consisting of a pump station, Imhoff tank, trickling filter, final settling basin, and sludge drying beds. The original plant was designed to serve a population of approximately 600 people.

In February of 2000 the Kansas Department of Health and Environment issued the City a new Kansas Water Pollution Control Permit covering the existing treatment facility (See Attachment). In addition to the limitations for BOD_5, TSS and PH, which were covered in previous permits, the new permit also included limitations for ammonia, fecal coliform and total residual chlorine if chlorine is used as a disinfectant. These additional compliance requirements cannot be met by the existing treatment facility without costly upgrades and modifications to the plant. Realizing that the existing plant is over 50 years old, upgrading the existing facility is not a cost feasible option. In addition, history has shown that the EPA has frequently made significant modifications to the effluent limits on mechanical treatment facilities which inevitably results in costly plant upgrades.

Waste stabilization lagoons are a viable long-term option to the current mechanical treatment process. To date, KDHE and EPA have made very few changes to the design and operational requirements for lagoons and the permit effluent limits have remained consistent for many years as well. This long term consistency as well as the elimination of nearly all of the operation/maintenance problems currently associated with mechanical treatment plants has resulted in many communities opting for waste stabilization lagoons in leu of mechanical treatment.

Based on this fact, the intent of this report is to provide the City of Palco with an evaluation of waste stabilization lagoons as a primary long-term means of wastewater treatment.

The purpose of this report is to:

- Evaluate waste stabilization lagoons (both discharging and nondischarging-evaporative) as a primary means of wastewater treatment.
- Establish a cost estimate(s) for the alternatives reviewed.
- Make a recommendation regarding the appropriate improvement alternative.

II. FINDINGS AND RECOMMENDATIONS

A. FINDINGS

The major findings resulting from this study are briefly stated in the following and discussed in further detail in subsequent sections of this report.

1. Recent changes to the city's Water Pollution Control Permit effluent limitations have resulted in the need either to upgrade the existing mechanical treatment plant or develop an alternate method of wastewater treatment, i.e., waste stabilization lagoons.
2. The City of Palco has experienced a steady decline in population over the past 40 years. The U.S. Federal Census Data showed a population in 1960 of 575 and a population in 2000 of 248. This reduction in population essentially equates to a 2%/year reduction. For the purpose of this report, an assumed 20 year growth rate of 1%/year will be used with the existing population being estimated at 248. This results in a future population for design purposes of 302 in the year 2020.
3. Currently the collection system flows via gravity to the pump station at the existing plant. According to City officials there are no flow measuring devices at the pump station. Due to the lack of available flow information, the daily domestic per capita wastewater flows were approximated by utilizing a 2-year average of (per capita) cold weather potable water usage. This method resulted in a wastewater flow of approximately 107 gallons per capita day (gpcd).

   Additionally the lack of metering equipment makes it impossible to determine actual inflow and infiltration into the system. Due to our inability to accurately measure the flow related to inflow and infiltration, an assumed value of 38 gpcd was used resulting in a total average wastewater flow of 145 gpcd.
4. The lagoon cell acreage requirements necessary to develop either a discharging lagoon system or a nonoverflowing evaporative system are as follows:
   a. Discharging Lagoon System
      (1) current population = 248
      (2) future population = 302 (in 2022)
      (3) • surface area required for adequate organic treatment and 120 day detention = 3.03 acres (based on 5' depth)

b. Nonoverflowing System
   (1) current population = 248
   (2) future population = 302 (in 2022)
   (3) annual precipitation = 23.05 inches
   (4) annual evaporation = 58.98 inches
   • surface area required = 7.22 Acres

5. Cost estimates for the two alternatives are as follows:
   a. Discharging System based on future population of 302 people.
      Estimated Total Project Cost = $431,581.25
   b. Nonoverflowing Evaporative System based on future population of 302 people.
      Estimated Total Project Cost = $618,741.50

B. RECOMMENDATIONS

The primary recommendations resulting from this study are as follows:

1. Based on the historical fact that the effluent discharge standards applicable to mechanical treatment plants have been ever-changing, we would recommend the abandonment of the existing treatment plant and the construction of a nondischarging waste stabilization lagoon system capable of handling a future population of 302.
2. If the city chooses to pursue the development of a waste stabilization treatment system, we would recommend that the city immediately conduct a soils investigation of the proposed site. This investigation would determine the elevation any groundwater under the site and would establish the soil conditions relevant to lagoon construction.

III. EXISTING CONDITIONS

A. EXISTING TREATMENT SYSTEM

The existing wastewater treatment plant consists of an Imhoff tank, trickling filter, final settling basin, and sludge drying beds. The original plant was constructed in the 1950's and it has served the City consistently since that time. Recent changes in the City's water pollution control permit have resulted in the need to upgrade the existing mechanical treatment plant to meet the new effluent limits or implement an alternative treatment process ie., waste stabilization lagoons.

The existing plant is in excess of fifty years old and would require extensive and cost prohibitive improvements aimed at meeting the new effluent standards. Due to this fact and the ever changing mechanical wastewater treatment plant effluent standards, this report will not further detail the existing conditions or associated improvements to your treatment plant.

B. WASTEWATER FLOW

Due to the lack of continuous flow measuring equipment, records containing actual wastewater flows to the existing facility are not available. Without actual metered flow information, average daily wastewater flows were determined by evaluating a 3-year average of winter months water usage and providing an allowance for inflow and infiltration (I & I).

Unfortunately the actual metered winter water usage records are not available due to the fact that the City does not read the water meters during the winter months. Instead they bill each patron for the monthly minimum and then correct any billing discrepancies in the spring when the meter is first read. Do to this circumstance we utilized actual master meter records for the winter months and then subtracted out the average 5-year historic water loss percentage to establish approximate metered usage to the residences through the winter months.

Utilizing this approach and evaluating a 3-year average of 1999, 2000, and 2001 (Dec., Jan., Feb.,) resulted in an average daily domestic wastewater flow rate of 107.4 gpcd.

Upon completing discussions with KDHE staff regarding estimated inflow and infiltration rates, an estimated value of 38 gpcd was established for your system. It should be pointed out that this is merely a best guess based on actual I & I rates for cities similar in size to Palco. The actual amount of I & I could impact the

overall size requirements of the proposed improvements and therefore substantiating this number through the use of hour meters or flow meters would be beneficial.

Combining the calculated domestic wastewater flow of 107.4 gpcd with the estimated value of 38 gpcd for I & I results in a total average daily wastewater flow equal to 145 gpcd. This figure is relatively representative of actual wastewater flow rates in similar sized communities and therefore was used in the analysis of the various alternative improvements.

IV. BASIS OF DESIGN

A. General

Current Kansas Department of Health and Environment design standards regarding both discharging and nonoverflowing (evaporative) type waste stabilization ponds are as follows:

1. Discharging System

   a. A minimum of 3 cells are required with the two treatment cells sized based on 34 lbs. BOD_5/Acre/Day with a 60%/40% split in surface area between the primary and secondary cells.

   b. Maximum depth of primary/secondary cells is 5 feet. Maximum depth of tertiary cells is 8 - 10 feet.

   c. The total system storage must provide 120-day detention of the average daily wastewater flow.

   d. Multiple drawoff points should be utilized to eliminate algal release in the effluent discharge.

   e. The effluent discharge standards for discharging lagoons are as follows:

	Weekly Limit	Monthly Limit	Test Frequency
• Biological oxygen demand (5-day) - BOD_5.	45 mg/l	30 mg/l	once quarterly
• Total suspended solids TSS.	120 mg/l	80 mg/l	once quarterly
• pH	--	6.0 - 9.0	once quarterly
• Ammonia (N)	Monitor		one monthly
• Fecal Coliform (colonies/100ml)	900	April thru October	
•	2000	November thru March	

2. Nonoverflowing (evaporative) System.

   a. A minimum of 2 cells shall be provided with a 60%/40% split in surface area between the primary and secondary cells.

   b. Maximum water loss through pond bottoms and embankments is 0.25 inches/day.

   c. Irrigation from nonoverflowing ponds is allowed but must be approved by KDHE.

   d. There are no effluent discharge standards for nonoverflowing systems.

B. Population

1. Current Population

The City of Palco is located in the western part of the state and is approximately 38 miles northwest of Hays.

For the past 30 years, Palco has experienced a steady decline in its population. The rate of decline is essentially equal to a rate of 2% /year over the forty year time frame from 1960 to 2000. The actual recorded U.S. Federal Census data for each ten-year interval is shown below.

Year	Population	
1960	575	(Source: U.S. Federal Census Data)
1970	398	
1980	329	
1990	295	
2000	248	

2. Future Population

Although a number of factors strongly indicate that the current downward trend will end and the city will experience modest growth, predicting the exact timing of such growth is difficult. An estimated rate of growth is necessary in order to schedule improvements. It is possible that actual rates of growth will vary from those predicted; however, it is believed that these predictions do form a reasonable basis for planning future wastewater system requirements. A 20-year time span is used as the design goal for estimating future system needs.

For the purpose of this report and for future planning, a predicted growth rate of 1.0%/yr. over the next 20 years will be used. Applying this growth rate to the 2000 population of 248 results in a population projection for the year 2022 of approximately 302 or an increase of 54 people over the 20-year planning period.

V. PROPOSED IMPROVEMENTS

A. General

The various alternatives covered in this section outline the improvements necessary to eliminate the current mechanical treatment system through the construction of waste stabilization lagoons that are sized to handle the 20 year projected future population growth. Alternates A & B outline the basic design process and overall lagoon sizing requirements for both discharging and nondischarging evaporative lagoon system respectively. Section D outlines the improvements necessary regarding the pumping station and force main needed to get the wastewater to the proposed lagoons.

B. Alternate A - Construct Discharging Waste Stabilization Lagoons

1. Continuously discharging lagoons are designed based on both organic loading (BOD_5) and hydraulic loading (total 120 day detention). KDHE Standards require that the primary and secondary cells of this type of system handle the organic loading and be sized such that the loading does not exceed 34 lbs (BOD_5)/acre. The tertiary cell in this type of system is essentially required to account for the 120-day total detention.
2. Design (based on Future 20 year Population Projection)
   a. Parameters:
      - Population 302
      - Ave.Per Capita Wastewater Flow 145
      - Per Capita Organic Load Rate ..... 0.17lbs. BOD_5 per capita (Established by KDHE)
      - Max. Organic Loading Rate ..... 34 lbs.BOD_5/Acre (Established by KDHE)
      - Actual Organic Loading Rate used in Calculations 25 lbs.BOD_5/Acre
      - Detention Required ..... 120 days

   b. Design Calculations:
      - Organic loading (Acreage Required)

        302 P.E. x 0.17 lbs. BOD_5/P.E. = 51.34 lbs. BOD_5

        51.34 lbs. BOD_5 ÷ 25 lbs. BOD_5/Acre = 2.05 Acres

      - Hydraulic loading (Volume Required)

        302 P.E. x 145 gpcd x 120 days = 5,254,800 gallons

        Volume Required for 120 day total detention = 702,513 ft.^{3}.

        At an average lagoon depth = 5'; <u>total</u> surface area required for hydraulic loading = 3.3 acres.

3. Discharging lagoon system layout.

   Organic loading requires 2.05 acres with 60/40 split primary to secondary.

   Hydraulic loading requires 3.30 acres <u>total</u> (includes 2.05 ac. for organic loading).

   Oversizing the primary and secondary cells will provide for additional organic treatment capacity. Based on this the proposed layout consists of:

   Primary cell = 1.4 acres surface area @ water level, depth = 5'.
   Secondary cell = 1.1acres surface area @ water level depth = 5'.
   Tertiary cell = 0.8 acres surface area @ water level depth = 5'.

C. Alternate B - Construct Nondischarging Evaporative Lagoons.

1. Nondischarging ponds are designed based on hydraulic considerations rather than organic loading. The successful operation of a nondischarging system is highly dependent upon evaporation, precipitation and water loss through the pond floor and embankments. The primary advantage to nondischarging wastewater lagoons is that there is no direct discharge from this type of treatment system and therefore no effluent standards or testing requirements to comply with. Conversely the primary disadvantages involved with this type of treatment system are (a) large land area requirement and, (b) higher construction costs due to larger size of lagoons.
2. Design: (Based on Future 20 year Population Projection)
   a. Parameters:
      - Population 302
      - Ave.Per Capita Wastewater Flow ..... 145 gpcd
      - Annual average precipitation ..... 23.05 inches/year
      - Annual average evaporation ..... 58.98 inches/year
      - Max. allow. soil percolation rate ..... 0.25 inches/day (use ⅛"/day)

   b. Design Calculations

      Total daily flow - 302 P.E. x 145 gpcd = 43790.0 gallons/day.
      Percolation rate - 0.125 inches/day = 3,394.42 gallons/acre/day.
      Evaporation rate - 58.98 inches/year = 4,387.53 gallons/acre/day.
      Precipitation - 23.05 inches/year = 1,714.69 gallons/acre/day.

$$\text{Total required acreage} = \frac{43{,}790 \text{ gallons/day}}{6{,}067.26 \text{ gallons/day/acre}} = 7.22 \text{ Acres}$$

3. Nondischarging Lagoon System Layout

   Total acreage required 7.22 acres. Utilizing a 2-cell configuration split 60/40 the pond layout would comprise:

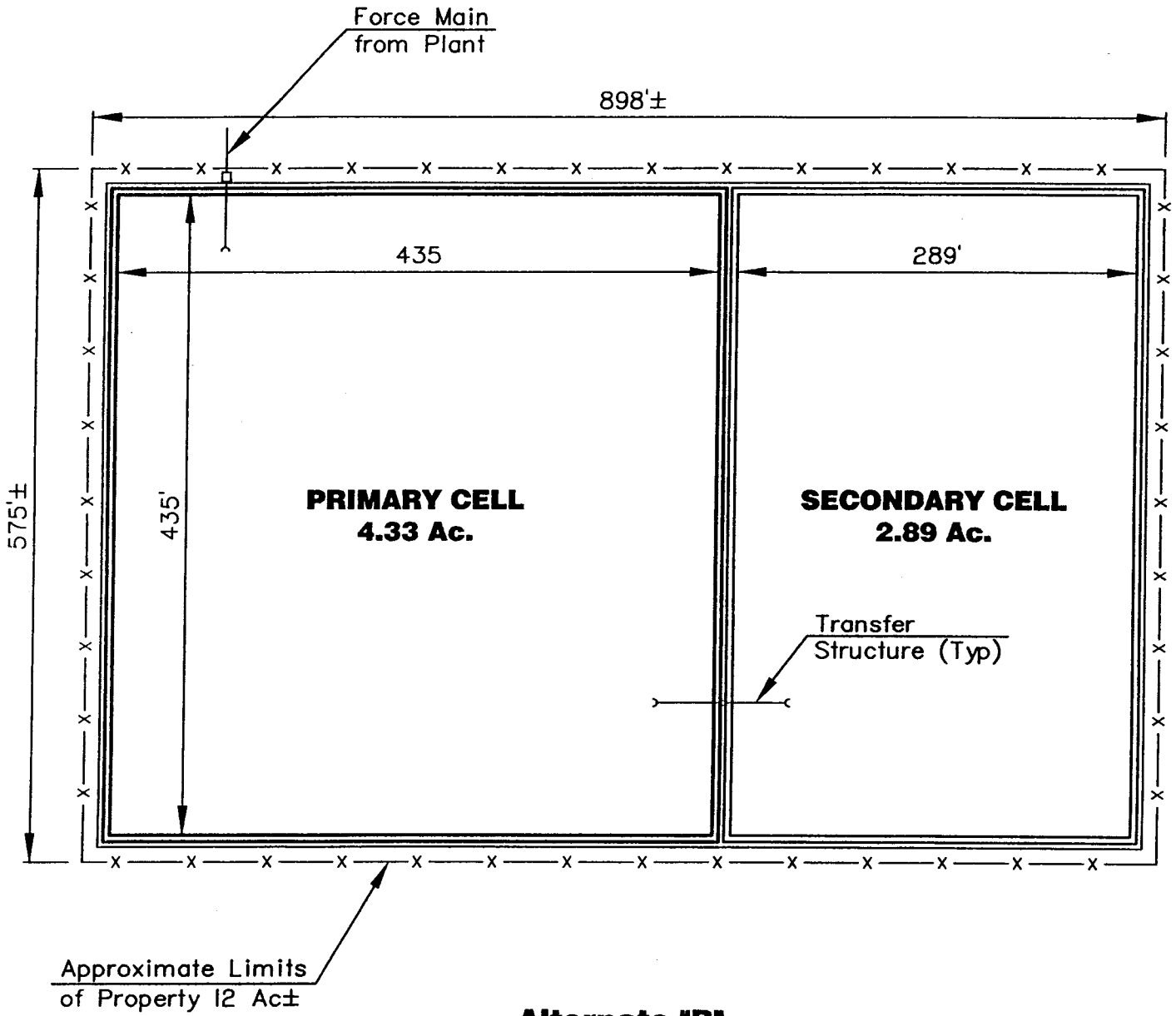
   Primary cell = 4.33 acres surface area at water level.
   Secondary cell = 2.89 acres surface area at water level.

D. Pump Station and Force Main

The area immediately surrounding the existing mechanical treatment plant does not contain sufficient area to construct waste stabilization lagoons. Due to this fact, it will be necessary to construct a pump station at the existing treatment facility and pump the wastewater through a force main to the proposed lagoon site located east of the plant.

Due to the lack of available information relative to the impact of inflow and infiltration within the collection system, additional pumping capacity should be considered. It is important to note that oversizing the pump station adds unnecessary costs to the system, however undersizing will lead to sewerage bypasses which present obvious problems as well. For the purpose of sizing the pumping station, a peak day wastewater flow rate of 0.060 MGD will be used. This flow rate will result in the need for a pumping facility capable of handling approximately 175 gpm based on a 4:1 peaking factor. Based on the fact that collection system is in the process of being evaluated, we would strongly suggest that these flow rates be re-evaluated prior to the ultimate construction of the pump station. The force main connecting the pump station with the lagoons would be a 6-inch PVC line which would maintain the needed 2 foot/sec. velocity throughout the previously stated flow range.

LAYOUT OF ALTERNATE B



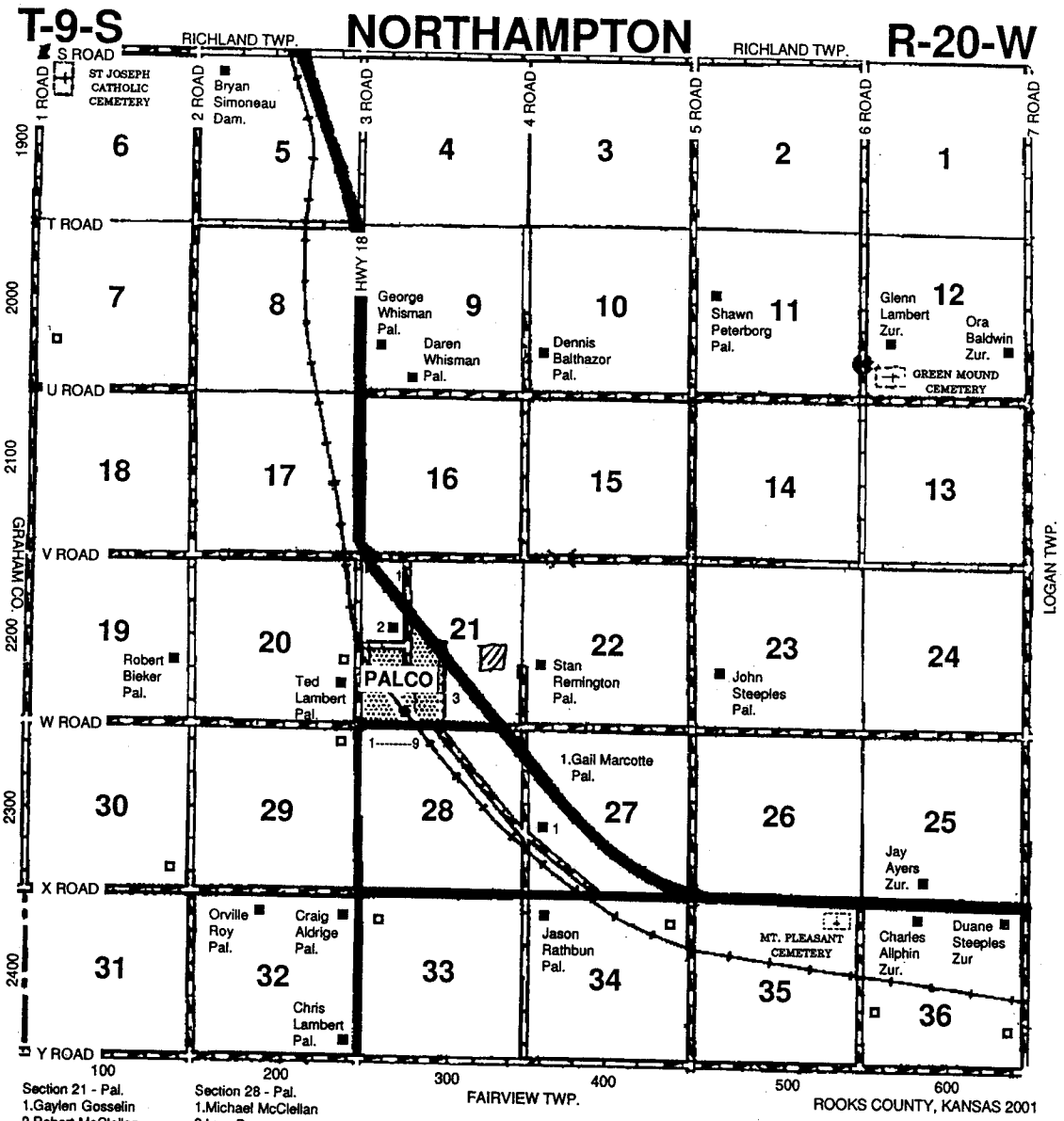
Alternate "B"
Evaporation System

Proposed lagoon wasterwater treatment facility location

Palco, Kansas, United States 25 Aug 1991 USGS

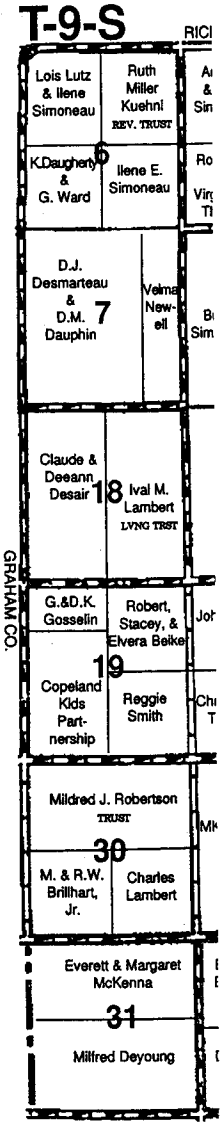
Image courtesy of the U.S. Geological Survey

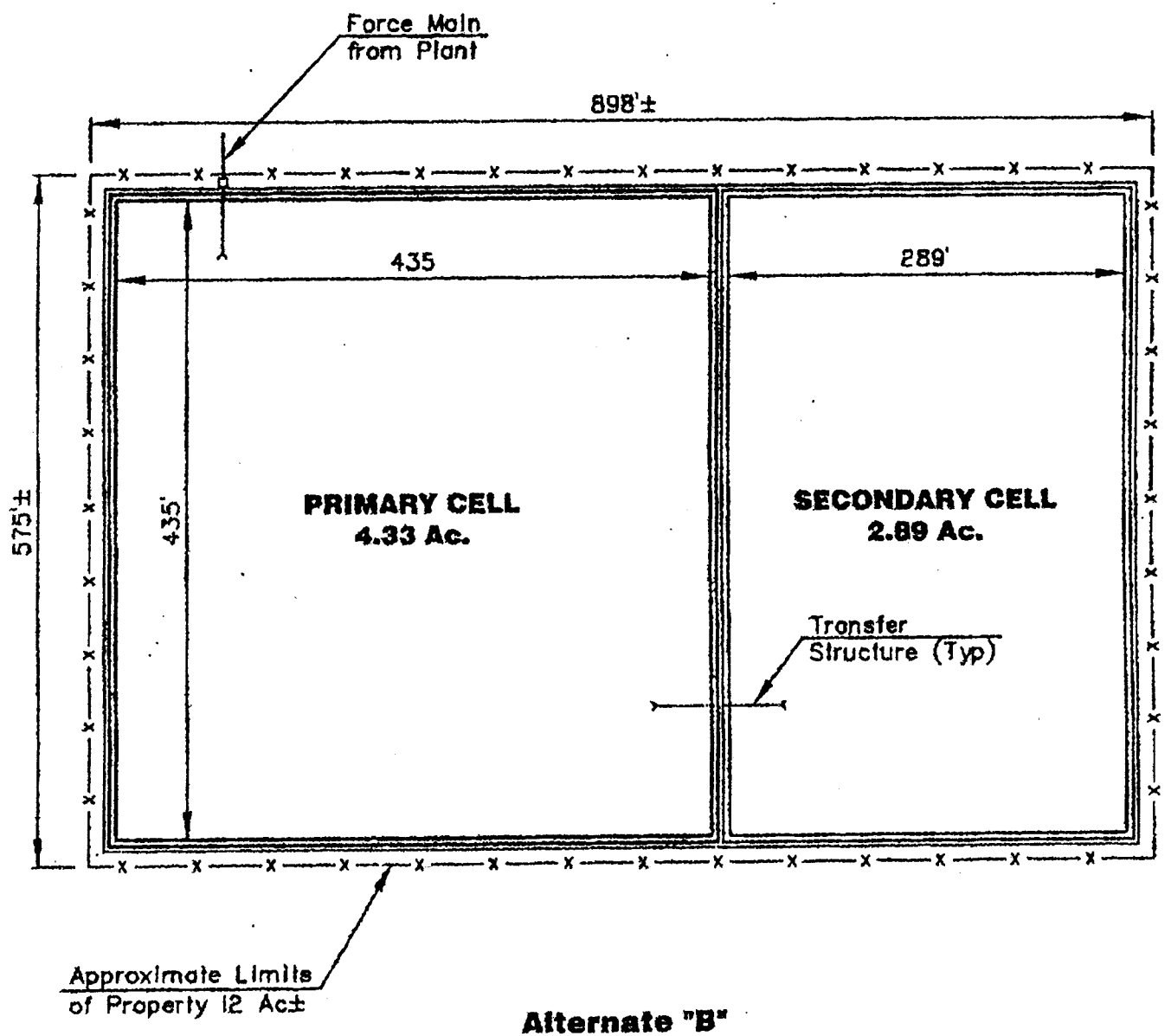
Source=3909952NE Center=(-99.5609,39.2476) 0ms Running Time



Section 21 - Pal.
1.Gaylen Gosselin
2.Robert McClellan
3.Fred Fisher

Section 28 - Pal.
1.Michael McClellan
2.Ivan Burgess
3.vacant
4.Ron Palmberg
5.Marvin Keller
6.Leonard Marcott
7.Terry Kortan
8.Claude Desair





Alternate "B"
Evaporation System

Rooks

State of Kansas . . . ROBERT F. BENNETT, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

DWIGHT F. METZLER, Secretary

Topeka, Kansas 66620

Palco - 2.0

Date September 17, 2002

WATER POLLUTION CONTROL FACILITY SITE APPRAISAL

Ownership of Proposed Facility City of Palco

Type of Proposed Treatment New two (2) cell wastewater lagoon facility.

Estimation of Proposed Loading —

New Facility X Expansion of Facility ____

Location of Site

21 Section, Township 09 S, Range 21 E, Rooks County, KS

Location with Respect to Community East of the community approximately ½ mile

Separation with Respect to Nearby Existing Habitations and Commercial Structures

½ mile

Separation with Respect to Nearby Proposed Habitations and Commercial Structures

Unknown

(over)

Separation with Respect to Water Supply Wells and Distribution or Service Water Lines Unknown. At least ½ mile if any.

Separation of Exact Treatment Site from Property Lines —

Site Ownership Information —

Present Use of Site Agricultural ground. Pasture

Slope of Site (Direction and Percent) Surface area slopes to the north

Nature of Topsoil

Probability of Encountering Rock During Construction None

Describe Receiving Watercourse S. Fork Solomon River via Spring Creek.

Could Watercourse be Conceivably Farmed? Yes

What is the Nature and Location of the Nearest Downstream Water Supple Use?

None in area

Receiving Watercourse:

Estimated 50% Exceedance Flow _____ gpm
Estimated Minimum Annual Flow _____ gpm

Estimated Maximum Annual Flow _____ gpm

Is this Watercourse Available Upon this Property? Yes ____ No X

If Not, Give Details Water Course is north of the proposed site

Estimate Feasibility of Utilizing Existing Sewerage Systems in Lieu of this New Treatment Facility None

Estimate Feasibility of Cooperating with other Developed Properties, Existing or Proposed, in the Formation of a Public Sewer District None

Location of Nearest Domestic Sewage Treatment Facility ½ mile east

Recommendation of Appraiser as to Site Approval Proposed site would be acceptable for the installation of a new two (2) cell waste stabilization facility.

Signature Melvin D. Windle

Title KDHE - Hays District Office.

Date 9-17-02

Note: Sketch on Reverse Side