FINAL DRAINAGE PLAN FOR

PEARSON FARMS ADDITION

APRIL 30, 1988

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FINAL DRAINAGE REPORT FOR
PEARSON FARMS ADDITION
April 30, 1988

EXISTING CONDITIONS

Pearson Farms Addition is located at the southwest cornrer of the intersection of Maize Road and 21st Street North, and is more fully described as the North 1/2 of the NE 1/4 of the NE 1/4, Section 7, Twp. 27-S, R-1-W, Sedgwick County Kansas.

Drainage from the site is largely to the south from a high point near the north central portion of the addition (See Map 1). The north portion of the addition drains into the 21st Street ditch where it is intercepted by an existing storm water system. The site is currently being farmed.

METHOD OF ANALYSIS

Because of the lack of any clearly defined drainage outlet for the site, and due to the limited capacity of the 21st Street storm water sewer to accept large runoff volumes from the site, a detention pond will be sized to accept the improved condition runoff. A runoff volume for the site will be calculated using the Army Corps of Engineers HEC-1 Program. From this data, a detention pond will be sized, as well as a pump station outlet stystem.

An alternate method of providing a pond outlet would require a culvert pipe to discharge via a drainage channel to the west. At the time of this report, no drainage easements had been acquired across the unplatted property to the west. In the event that a drainage channel from the west became available, the pond discharge would be limited to the existing condition 5 year - 24 hour storm discharge from the site. Design of this outlet pipe and drainage channel would be required at such time that drainage easements became available.

SITE DRAINAGE PARAMETERS

Composite Soil Type: Hydrological Group "C"
Composite Curve Number : 91
Lag Time of Area: 0.33 hours
Draiange Length: 1400 feet
Drainage Area: 15.7 Acres
Precipitation Data:
100 year - 24 hour storm, SCS Type II
Rainfall Distribution (7.8" total rainfall)

From this input data, the following results were found from the HEC-1 Model:

Peak Runoff: 32 cfs
Time to Peak: 13 hours
Runoff Volume: 9 Acre-feet

For complete input data listing and calculated results, see the HEC-1 input and output data found at the end of this report.

RESULTS

A drainage basin capable of holding 9 acre-feet of runoff volume is needed for the site. Discharge from the pond will be provided by a pump station capable of draining the pond dry in a four day period. A layout of the proposed detention pond can be found on Map 1.

The pump station would have to provide a pumping rate of 510 gallons per minute to meet the four day drainage period. From preliminary estimates, the motor would need to be 3.5 horsepower, with an eight inch discharge line as shown on Map 1. Note that exact pumping station details as well as final detention pond details would be necessary at the time of final design of the detention pond.

SUMMARY

Because of the lack of any suitable drainage outlet from Pearson Farms Addition, a pump drained detention pond will be used to drain the site. The pond will be capable of accepting the 100 year - 24 hour runoff from the site in the fully developed condition. Final design of both the pump station and detention facility would be required before construction at the site. The detention pond layout and site drainage pattern may be found on Map 1, located at the end of this report.

An alternate outlet for storm water discharge from the detention pond could be provided by means of a drainage channel across unplatted property to the west. At the time of this report, no drainage easements had been acquired across this property, however, in the event that access was provided, a pipe could be used for pond discharge. Any discharge from the pond to a drainage channel would be limited to the existing condition 5 year - 24 hour storm discharge from the site.

For complete drainage input data, as well as assumptions and supporting calculations, see the enclosed worksheets and HEC-1 input and output data included at the end of this report.

PEARSON FARMS ADDITION
(DRAINAGE)

4/28/88 CB 1/5

Pearson Farms

Drainage Area: Use Site Area less building setback on the north; DA = 15.7 Acres
(Assume Average 60' strip along the north side to drain north)

From SCS "Soil Survey of Sedgwick County"
Half the site is type "B" soil, the other half = Type "D" soil; Use type "C" soil properties for analysis.

For fully developed site:

1. 15.7 Acres of developed area will drain into detention facility along the south side of the plat.
2. For the detention pond design, the 100yr-24 hr storm will be routed over the site into the detention pond.
3. Outlet from the pond will be provided by a pump station that will discharge to the North into an existing County storm water sewer.

Curve Numbers for developed site:
Source "210-VI-TR-55; Second Ed, June 1986"

For Developed Site:
70% Impervious: @ CN 98 = 0.70(98) = 68.6
30% Grassed Area CN 74 = 0.30(74) = 22.2
Composite CN = 90.6 → use 91

4/28/88 CB 2/5

Other Site Parameters:
Time of Concentration: Use Kerby-Hathaway Equation: $T_c = 0.6262\,L^{0.47} n^{0.47} S^{-0.235}$

for n factor; use 70% of flo on pavement
30% of flo on grassed areas

$n = (0.7)(0.02) + 0.3(0.4) = 0.13$
$L = 1400'$ (Longest path)
Average slope = 0.005 ft/ft

$T_c = 0.6262(1400)^{0.47}(0.13)^{0.47}(0.005)^{-0.235}$
$T_c = 33.1$ min
$T_c = 0.55$ hrs

For SCS Lag time; $T_{lag} = 0.6 T_c$
$T_{lag} = 0.6(0.55) = 0.33$ (19.8 minutes)

HEC-1 Input

Basin Area = 15.7 Ac = 0.0245 Sq. Miles
Curve Number = 91
$T_{lag} = 0.33$ hrs.

Rainfall = 7.8" (100yr - 24 hr storm) using SCS Type II Distribution. See HEC-1 Input for Values.

Results of Basin Runoff

Peak flow = 32 cfs
Runoff Volume = 9 Acre-ft.

Required Pumping Rate: Pond Must be pumped dry in 4 days.

4/28/88 CB 3/5

Pump Rate = $(9\,ac\text{-}ft)\left(\frac{43560\,ft^2}{Acre}\right)\frac{1}{(4\,days)(24\,hr)(3600\,sec/hr)}$

Pump Rate = (1.13 cfs)(7.48) = 8.49 gal/sec(60)
= 509 gal/minute

Use Pump Rate of 510 gal/minute

Pumping Parameters
Pond Bottom = 153
Outlet Elevation = 162
6" P.V.C. Pipe; Length = 1010 L.F.

Try Hf; 6" Pipe; 1010'
Hf = (3.3'/100')(10.1) = 33.3

Total Head = 162-153 + 33.3 = 42.3 Too Much

Try 8" Discharge Pipe
Hf = (0.82'/100')(1010) = 8.3'
Total Head = 162-153 + 8.3 = 17.3'

From Figure 2 "Engineering Data for Vacuum Primed Pump Performance Curves"
@ 510 gpm; Total Head = 17.3'
Need 3.5hp pump
8" outlet pipe.

Further Pump Details will not be addressed until final design of Pump station.

Storage Requirements: Assume that the pump station will not benefit storage routing during the course of the rainfall.

4/28/88 CB 4/5

Required storage = 9.0 Ac. ft.

Try the following Parameters

280'
(B) 10' Deep
3:1 S.S.
Top = 164
Bott = 154
120'
10' clear
(A) 5' Deep: 3:1 S.S.
550' ±
1266.67'
80'
15' clear

Volume: 80' - 15' - (5')(3:1) = 50' Avg S.A
(A) = (50')(550')(5') = 212,500 ft³

(B) = 280 - 10' - 10(3) = 240
× 120 - 15' - 10(3) = 75
Vol = (240)(75)(10) = 180,000.0 ft³

Vol = $\frac{212{,}500 + 180{,}000}{43560}$ = 9.01 Ac-ft O.K.

Use Area as described above for detention storage. Can be pumped dry in 4 days.

Note: Pond Can be configured in any shape to provide 9 acre-ft of on site storage.

4/28/88 CB 5/5

Results:

Runoff Volume = 9.0 Acre ft.
Required on-site storage = 9.0 Acre ft.
Pond Outlet = Pump Station; 3.5 HP
8" Discharge Pipe; 1010 L.F.
(Note: Pump station to be designed @ time of Pond Design)

Discharge Rate = 1.2 cfs to south R/W Ditch, 21st St. North.

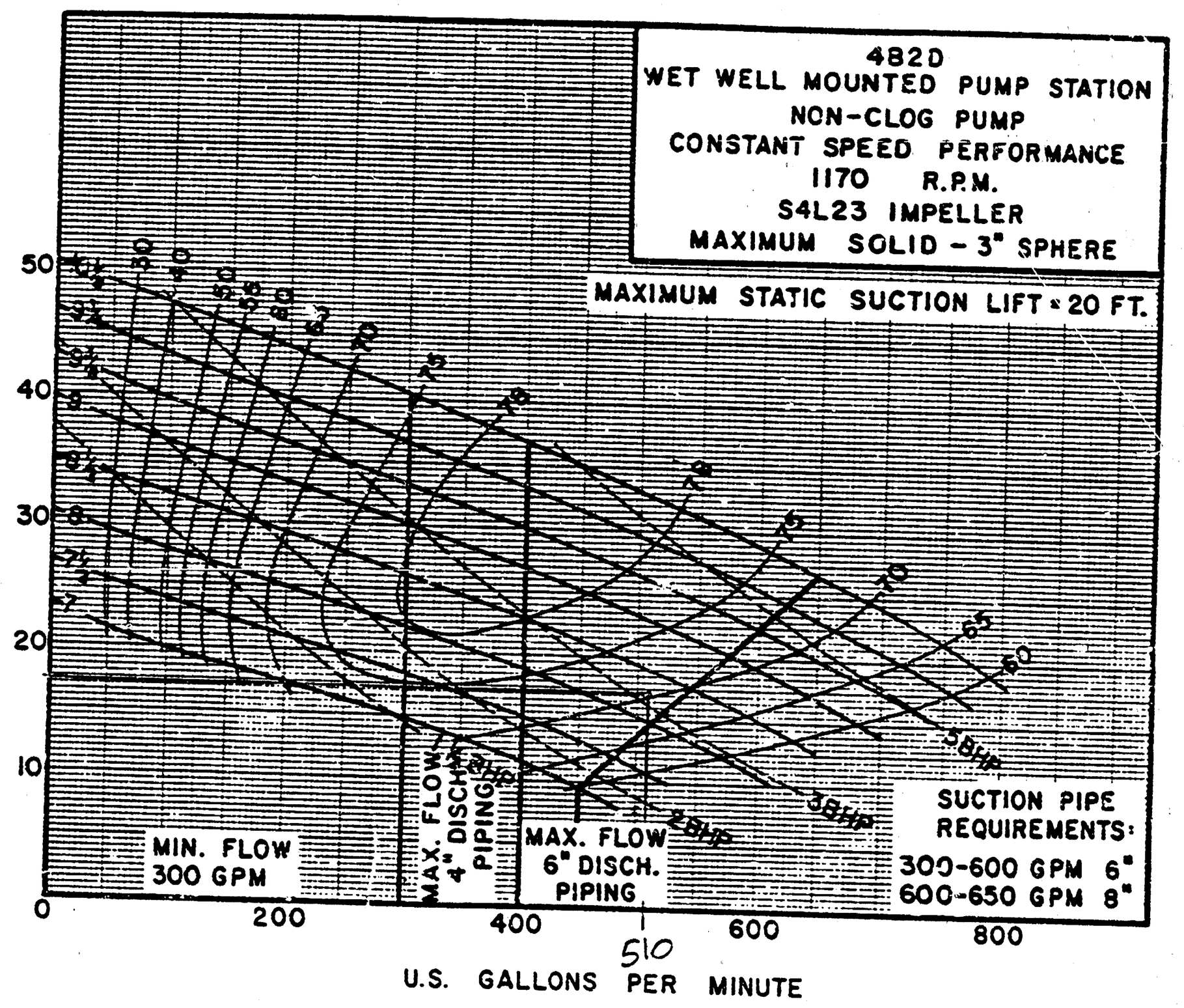

FIGURE 2

ENGINEERING DATA
Smith & Loveless, Inc.
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215
Vacuum Primed Pump Performance Curves
Constant Speed
482D
1170 RPM

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                                   ****
               FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
 U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                   ****

 THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

 1                                   HEC-1 INPUT                                       PAGE 1

          LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
 *** FREE ***
            1      ID   WATERSHED DATA FOR TABULATING INFLOW HYDROGRAPH
            2      ID   FOR PEARSON FARMS DETENTION POND.
            3      ID
            4      IT      5       0       0     289
            5      IO      4       2       0

            6      KK   SUB-1
            7      KM   COMPUTING RUNOFF HYDROGRAPH  FOR SUBBASIN NO. 1
            8      PB      0
            9      IN     60
           10      PC   0.00  0.0585  0.1287  0.216  0.312  0.419  0.566  0.712  0.858  1.053
           11      PC   1.297  1.641  3.705  5.811  6.201  6.503  6.747  6.937  7.108  7.250
           12      PC   7.371  7.487  7.600  7.703  7.800
           13      BA  0.0245
           14      LS      0      91       0
           15      UD   0.33
           16      KO      3       1
           17      ZZ
 1                                 ****
               FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
 U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                   ****

               WATERSHED DATA FOR TABULATING INFLOW HYDROGRAPH
               FOR PEARSON FARMS DETENTION POND.

   5 IO        OUTPUT CONTROL VARIABLES
                     IPRNT          4  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        289  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     2    0  ENDING DATE
                    NDTIME       0000  ENDING TIME
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               TOTAL TIME BASE   24.00 HOURS
       ENGLISH UNITS

 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
      6 KK    *   SUB-1    *
              *            *
              **************
                    COMPUTING RUNOFF HYDROGRAPH  FOR SUBBASIN NO. 1

      9 IN     TIME DATA FOR INPUT TIME SERIES
                     JXMIN        60  TIME INTERVAL IN MINUTES
                    JXDATE     1   0  STARTING DATE
                    JXTIME         0  STARTING TIME

     16 KO     OUTPUT CONTROL VARIABLES
                     IPRNT         3  PRINT CONTROL
                     IPLOT         1  PLOT CONTROL
                     QSCAL        0.  HYDROGRAPH PLOT SCALE

            SUBBASIN RUNOFF DATA

     13 BA     SUBBASIN CHARACTERISTICS
                     TAREA       .02  SUBBASIN AREA

            PRECIPITATION DATA

      8 PB           STORM      7.80  BASIN TOTAL PRECIPITATION

     10 PI      INCREMENTAL PRECIPITATION PATTERN
                 .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
                 .00    .00    .01    .01    .01    .01    .01    .01    .01    .01
                 .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                 .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                 .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                 .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
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                 .01    .01    .01    .01    .01    .01    .01    .01    .01    .01
                 .01    .01    .01    .01    .01    .01    .01    .01
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     14 LS          SCS LOSS RATE
                         STRTL          .20  INITIAL ABSTRACTION
                        CRVNBR        91.00  CURVE NUMBER
                         RTIMP          .00  PERCENT IMPERVIOUS AREA

     15 UD          SCS DIMENSIONLESS UNITGRAPH
                          TLAG          .33  LAG

                                          ***

                                   UNIT HYDROGRAPH
                              22 END-OF-PERIOD ORDINATES
              4.     12.     25.     31.     31.     26.     19.     13.      9.      6.
              4.      3.      2.      1.      1.      1.      0.      0.      0.      0.
              0.      0.

       ***         ***         ***         ***         ***

                    HYDROGRAPH AT STATION    SUB-1

     TOTAL RAINFALL =    7.80, TOTAL LOSS =    1.07, TOTAL EXCESS =    6.73

   PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     24.00-HR
 +   (CFS)       (HR)
                           (CFS)
 +    32.       13.00                 13.          4.          4.          4.
                        (INCHES)   5.100       6.685       6.685       6.685
                         (AC-FT)      7.          9.          9.          9.

                    CUMULATIVE AREA =     .02 SQ MI
 1
                                   RUNOFF SUMMARY
                            FLOW IN CUBIC FEET PER SECOND
                         TIME IN HOURS,  AREA IN SQUARE MILES

              OPERATION      STATION     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD    BASIN   MAXIMUM    TIME OF
 +                                       FLOW     PEAK                                          AREA    STAGE    MAX STAGE
                                                           6-HOUR     24-HOUR     72-HOUR
              HYDROGRAPH AT
 +                           SUB-1        32.    13.00         13.          4.          4.     .02

 *** NORMAL END OF HEC-1 ***
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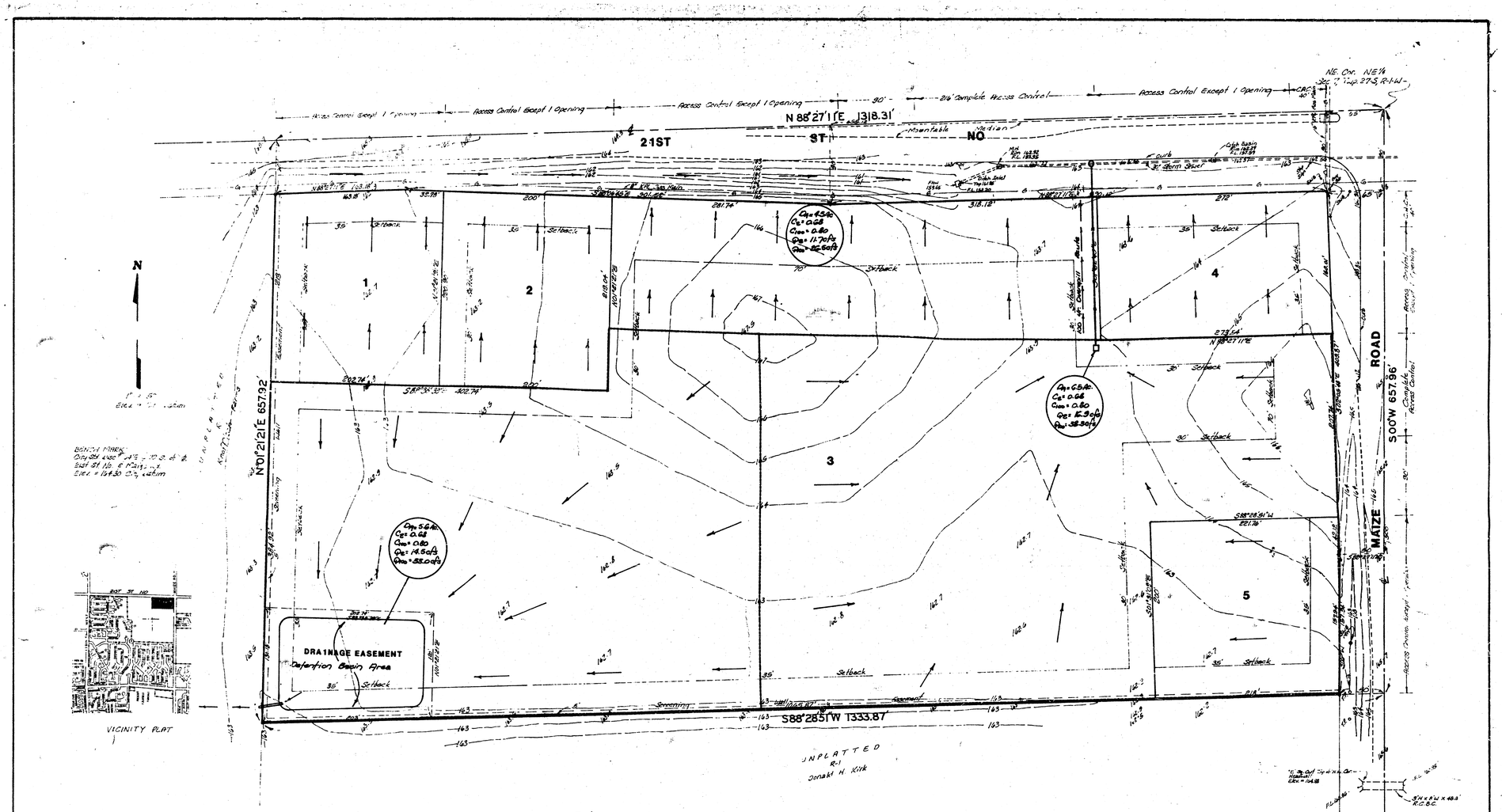
PEARSON FARMS ADDITION
(DRAINAGE)



DRAINAGE CONCEPT
PRELIMINARY PLAT

PEARSON FARMS ADDITION

N1/2, NE1/4, NE1/4, SEC 7, TWP 27-S, R-1-W

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24 Nov 87
3 Nov 87
9 OCT 87