

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 corner 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, Sedgewick 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 system.

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
Drainage Length: 1400 feet
Drainage Area: 15.7 Acres
Precipitation Data:
100 year - 24 hour storm, SCS Type II
Rainfall Distribution (7.8" total rainfall)

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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 Acres-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.

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Pearson Farms

4/26/88 CB 1/5

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

From SCS "Soil Survey of Sedgewick County"
Half the site is type "S" soil, the other half is Type "B" 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 plot.

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 "Irrigation Engineering, Second Ed, June 1968"

For Developed Site:
10% Impervious: $CN = 96 = 0.10(16) + 0.66$
30% Grassland Area $CN = 74 = 0.30(74) + 0.22$
Composite $CN = 76.6 \rightarrow$ use 77

Other Site Parameters:

Time of Concentration: Use Kirtley-Hathaway Equation: $T_c = 0.6262 L^{0.47} A^{0.07} S^{-0.235}$

For n factor, use 70% of flow on pavement 30% of flow on grassed areas

$n = (0.17(0.02) + 0.3(0.4)) = 0.13$

$L = 1400'$ (Longest path)

Average slope = 0.005 ft/ft

$T_c = 0.6262 (1400)^{0.47} (0.13)^{0.07} (0.005)^{-0.235}$

$T_c = 33.1$ min

$T_c = 0.55$ hrs

For SCS Lag time, $Lag = 0.16 T_c$

$Lag = 0.6 (0.55) = 0.33$ (19.8 minutes)

HEC-1 Input

Basin Area = 15.7 Ac = 0.0245 sq. mi

Curve Number = 77

$Lag = 0.33$ hrs

Rampfall = 7.6" (100yr - 24hr storm) using SCS

Type II Distribution, See HEC-1 Input Form

Volume

Results of Basin Runoff

Peak flow = 32 cfs

Runoff Volume = 9 Acres-ft

Required Pumping Rate: Pond must be pumped dry in 4 days

4/26/88 CB 3/5
Pump Rate: $(900 \text{ ft}^3) \left(\frac{1.48 \text{ cfs}}{1.48 \text{ cfs}} \right) \left(\frac{1.48 \text{ cfs}}{1.48 \text{ cfs}} \right) = 6.49 \text{ gpm/sec}(60) = 509 \text{ gpm/minute}$

Use Pump Rate of 510 gpm/minute

Pumping Parameters

Pond Bottom = 153

Outlet Elevation = 162

8" A.V.C. Pipe Length = 1010 LF

Try 6" Pipe, 1010 LF

$H_f = (3.3' / 100) (1010) = 33.3'$

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

Try 8" Discharge Pipe

$H_f = (2.82' / 100) (1010) = 28.3'$

Total Head = $162 - 153 + 28.3 = 37.3'$

From Figure 2 "Engineering Data for Vacuum"

Proved Pump Performance Curves

C 510 gpm, Total Head = 37.3'

Need 55hp pump

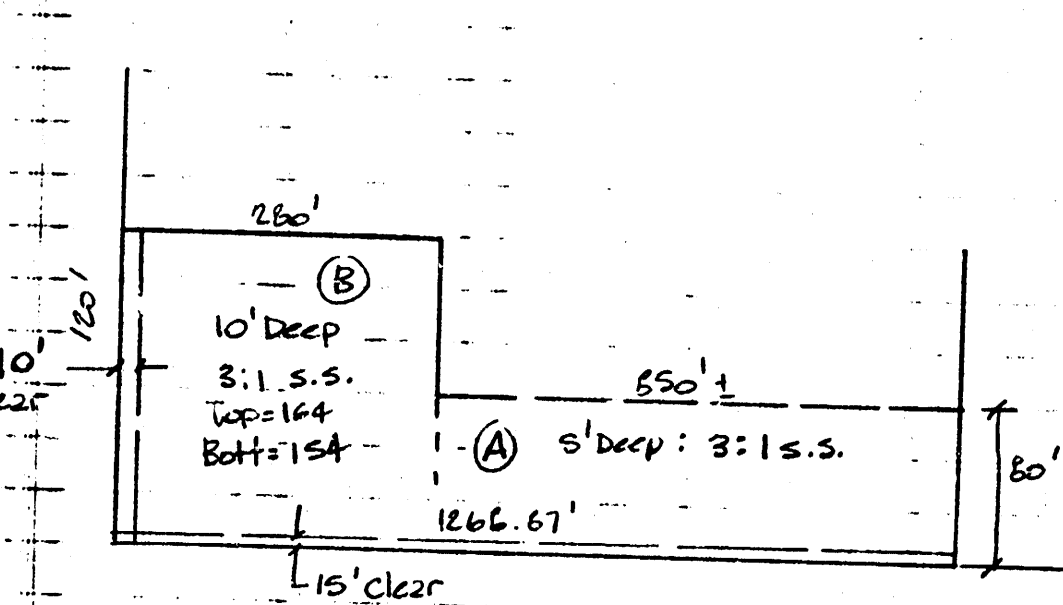
8" outlet pipe

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.

4/26/88 CB 4/5
Required storage = 9.0 Ac. Ft.

Try the following Parameters



Volume: $150' \times 150' \times (5' / 3.1) = 50' \text{ Avg. S.A.}$

$(A) = (50' \times 150') (5') = 3,750 \text{ ft}^3$

$(B) = 150' \times 150' \times 10' = 2,250 \text{ ft}^3$

$\times 150' \times 150' \times 10' = 2,250 \text{ ft}^3$

$\text{Vol} = (2,250 + 2,250) = 4,500 \text{ ft}^3$

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Results:

Runoff Volume = 9.0 Ac. Ft.

Required on-site storage = 9.0 Ac. Ft.

Pond outlet = Pump station, 3.5 HP

8" Discharge Pipe 1010 LF

(Note: Pump station to be designed at time of Pond Design)

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

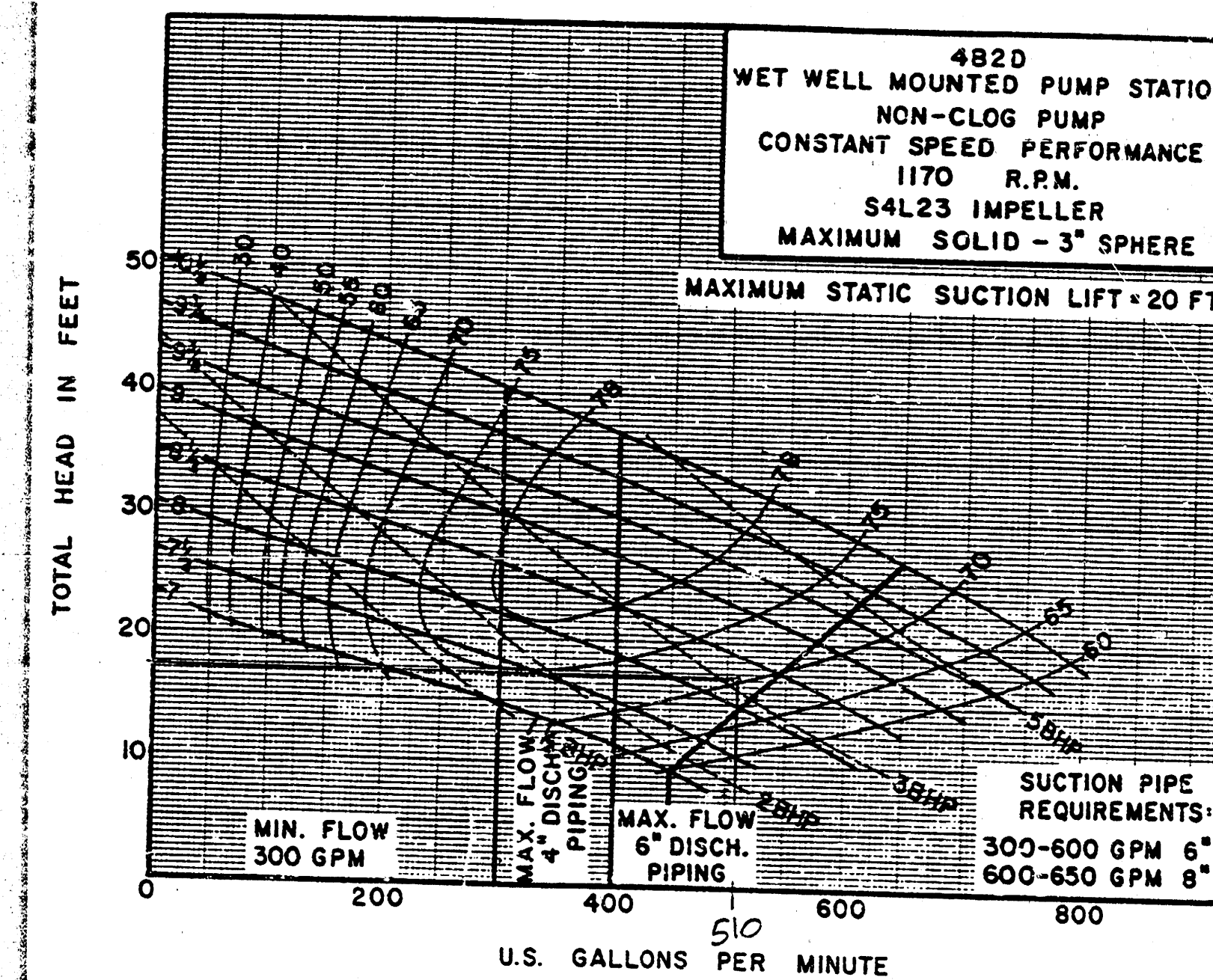


FIGURE 2

FLOOD HYDROGRAPH PACKAGE HEC-1 (1981 XT 512K VERSION) - FEB 1, 1988									
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 401 SECOND STREET, DAVIS, CA. 95616									
THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3									
HEC-1 INPUT									
LINE	ID	1	2	3	4	5	6	7	8
1	10	1	1	1	1	1	1	1	1
2	10	1	1	1	1	1	1	1	1
3	10	1	1	1	1	1	1	1	1
4	10	1	1	1	1	1	1	1	1
5	10	1	1	1	1	1	1	1	1
6	10	1	1	1	1	1	1	1	1
7	10	1	1	1	1	1	1	1	1
8	10	1	1	1	1	1	1	1	1
9	10	1	1	1	1	1	1	1	1
10	10	1	1	1	1	1	1	1	1
11	10	1	1	1	1	1	1	1	1
12	10	1	1	1	1	1	1	1	1
13	10	1	1	1	1	1	1	1	1
14	10	1	1	1	1	1	1	1	1
15	10	1	1	1	1	1	1	1	1
16	10	1	1	1	1	1	1	1	1
17	10	1	1	1	1	1	1	1	1

TOTAL TIME BASE 24.00 HOURS									
ENGLISH UNITS									

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PEARSON FARMS ADDITION
(DRAINAGE)

