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July 10, 2008

Mr. Scott Lindebak, P.E.
Storm Water Mgmt

City Bldg.
455 N. Main – 8th Floor
Wichita, KS 67202

Re: Drainage Report
Equestrian Estates 2nd Addition

Dear Scott:

This addition is a re-plat of part of the original subdivision. This area drains to an existing pond on the east side and to an existing storm sewer at the northwest corner of this addition. No changes of the pond outflow structure or the existing storm sewer will be required because of this development. Since there are no changes to the existing drainage facilities, this report will only summarize the change in flows to each of these discharge points.

Proposed Ponds Adjacent to 127th

Storm water detention in this area is not proposed since the 100 year design flows have been reduced from 54 cfs to 44.6 cfs after completion of this addition and the development to the south. Our calculations for the peak runoff of the developed condition of this addition are as follows:

The soil type is Ce and La both of which are in the Hydrologic Soil Group C. The rational formula C factor for this soil group and ¼ acre lots for the 100 year storm is 0.68. The original drainage calculations were for 17.2 acres draining to this area, which has been reduced to 11.78 acres by the lot grading within Sierra Hills and this addition. 400 feet of the rear lots in this development will drain through dense grass before entering the proposed ponds. This translates to a 28.9 min. time of concentration with an i = 5.57 using the sheet flow formula. The additional time of the runoff has been ignored since it will only further reduce the peak flow.

11.78 x .68 x 5.57 = 44.6 cfs

Existing Pond on the East Side

This pond discharge was originally computed for an inflow of 146 cfs with an outflow rate of 99.3 cfs. The design of the ponds in Sierra Hills account for 85 cfs of the original 146 cfs flow leaving 61 cfs of the runoff coming from this addition. After development of the proposed 2nd addition this will change from 61 cfs to 79.1 cfs or a 18.1 cfs increase. The total flow to the pond will increase to164.1 cfs. When routed through the exiting pond structure this revised flow will increase the design water surface

from 1331.91 to 1332.01 and the flow rate from 99.3 cfs to 103.9 cfs. The calculations for these conditions are as follows:

The soil type, time of concentration for sheet flow and rational formula C factor are the same as above. In this case 350 feet of shallow flow is added to the 400 feet of sheet flow before it reaches the pond.

The flow is through a grassed waterway, back yards, at a coefficient of 0.457.

V= 3.28 x 0.457 x 1.0**.5 = 1.5 fps

350/1.5 = 233 sec = 3.9 min

Total Tc = 3.9 + 28.9 = 32.8 min. i = 5.22

Q100 = 22.29 ac x .68 x 5.22 = 79.1 cfs

79.1 + 85 = 164.1 cfs into pond

The hydrograph and summary which show the design calculations for this flow is included in this report. Also included is the original hydrograph plot and the design information for the Sierra Hills drainage report.

Please let me know if you need any additional information.

Sincerely,

Poe and Associates, Inc.

Kenny E. Hill, P.E.
Vice President

Hydrograph Plot

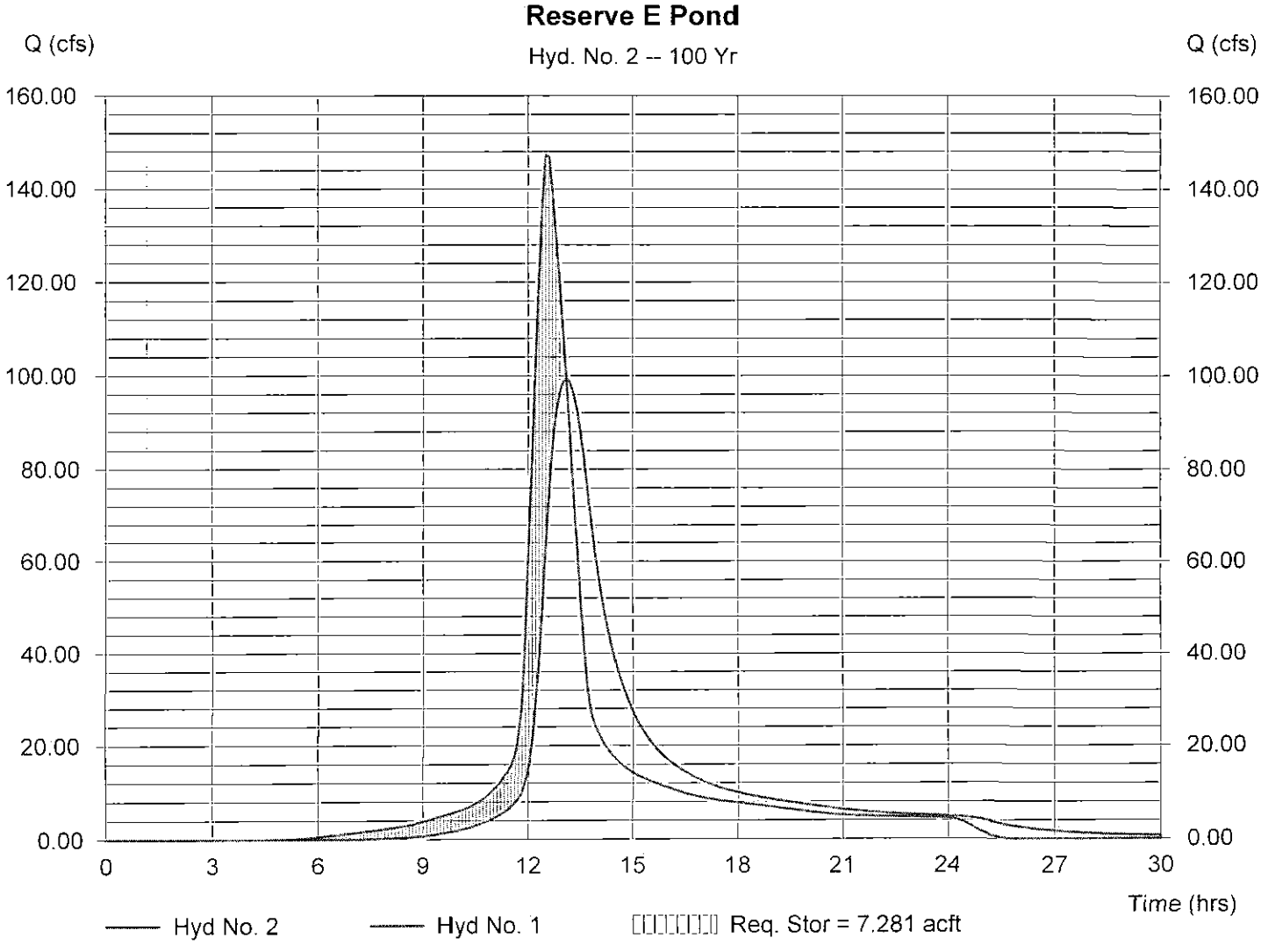
Hydraflow Hydrographs by Intelisolve | Thursday, Dec 8 2005, 10:16 AM

Hyd. No. 2

Reserve E Pond

Hydrograph type	= Reservoir	Peak discharge	= 99.34 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 1	Max. Elevation	= 1331.91 ft
Reservoir name	= Reserve E Pond	Max. Storage	= 7.281 acft

Storage Indication method used. | Hydrograph Volume = 25.047 acft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Jul 10 2008, 10:35 AM

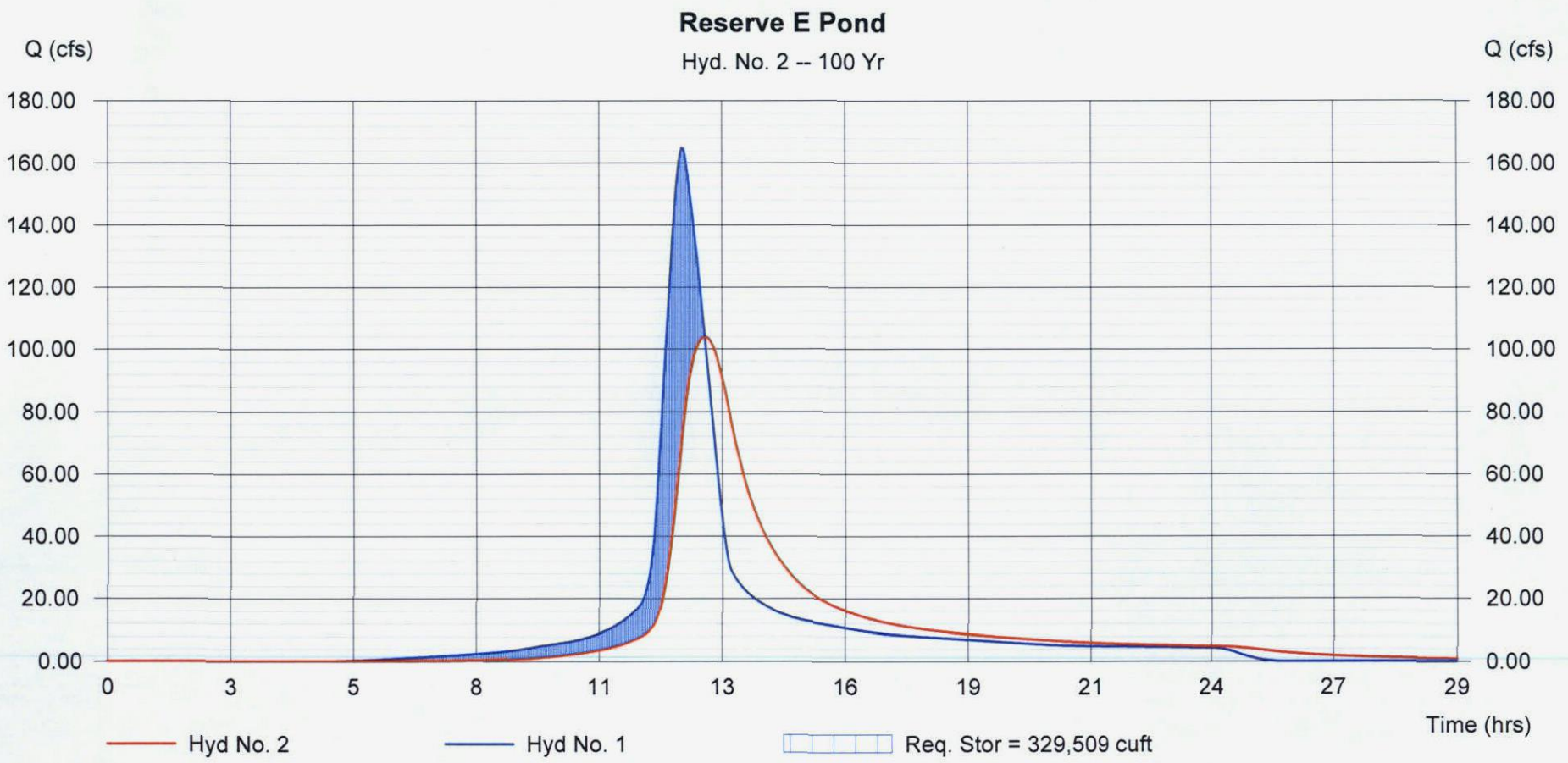
Hyd. No. 2

Reserve E Pond

Hydrograph type	= Reservoir	Peak discharge	= 103.88 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Inflow hyd. No.	= 1	Max. Elevation	= 1332.01 ft
Reservoir name	= Reserve E Pond	Max. Storage	= 329,509 cuft

Storage Indication method used.

Hydrograph Volume = 1,071,105 cuft



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	164.89	2	748	1,071,987	----	------	------	Basin to Reserve E Pond
2	Reservoir	103.88	2	778	1,071,105	1	1332.01	329,509	Reserve E Pond

Sierra Hills Addition
Residential Subdivision
Final Drainage Plan
August 8, 2002

East Detention Pond (situated in Reserve A)

Total Area served by detention pond = 27.6 acres
Off site area (Catholic Diocese of Wichita) = 6.1 Acres
Sierra Hills Area = 21.5 Acres

Time of concentration calculations for detention pond:
SCS velocity method

Total longest path to proposed storm water sewer inlet = 660 feet

First 400 feet, shallow concentrated flow at 1.5 percent grade
V1 = 0.365 f/s (City of Wichita Attachment E, Average overland flow velocity)
T1 = 400' * (1/0.365 f/s) = 1095 seconds = 18.3 minutes

Next portion of overland flow = 260 feet, grassed waterway at 1.5% grade
V2 = 1.33 f/s (Attachment E)
T2 = 260' * (1/1.33 f/s) = 195 seconds = 3.3 minutes

Balance of flow via 500' of storm water sewer pipe
V3 = 4.0 f/s (assumed)
T3 = 500' * (1/4.0 f/s) = 125 seconds = 2.1 minutes

Total time of concentration = T1 + T2 + T3 = 23.7 minutes. This value is less than 0.29 * the Lag Time, so increase the pond time of concentration to 30 minutes for a more accurate model of the system.

Peak Pond Outflow

The allowable flow rate from the proposed pond is governed by the drainage plan for Equestrian Estates (platted by Poe and Associates). The drainage plan prepared for this addition indicates 50.75 acres draining to a proposed pond situated in Reserve E, Equestrian Estates, resulting in an undeveloped runoff amount of 124 cfs. The offsite area indicated by the Poe plan is 34.7 acres. Based on these numbers, the ratio of offsite drainage area divided by the total drainage area = 34.7 ac/50.75 ac = 0.684.

Applying this ratio to the total undeveloped flow into the Equestrian Estates pond yields 0.684 * 124 cfs = **85 cfs**. This is the total allowable runoff that can be handled by the Equestrian Estates pond, and the target outflow for the new, Sierra Hills pond situated in Reserve A.

SCS Curve Numbers for Pond Routing

From the Soil Survey of Sedgwick County, Kansas, the area feeding the Sierra Hills Pond in Reserve A is predominately type Ia soils, hydrological soil group D. Utilizing this information, the following can be used to determined a weighted SCS Curve Number (CN):

Offsite area (terraced, small grain, good condition) = 6.1 acres, CN = 81
Residential Area, hard surface, type D soils = 21.5 acres, CN = 92

Weighted CN = ((6.1 * 81) + (21.5 * 92)) / 27.6 acres = 89.56, use **CN = 90 for design**

Calculate Existing Runoff

Utilizing the Army Corps of Engineers HEC-1 program, input the following data:

BA (basin area) = 27.6 Acres / 640 acres/sq. mile = 0.0431 square miles
SCS Lag = 0.6 * Tc = 0.60 * 20 minutes * 60 min/hour = 0.20 hours
CN (composite) = 90
Rainfall = 100 year – 24 hour storm = 7.8 inches, using SCS Type II rainfall distribution

- File U:\hecpack\sierra\eponds.hc1; Result Q100 = 128 cfs

Design of Detention Pond

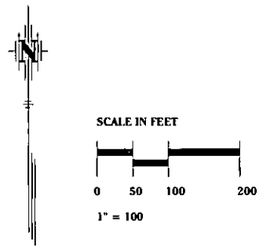
The detention pond will need to limit the outflow to 85 cfs from an existing peak of 128 cfs. Based on the proposed grading of the site, a two-step pond will be designed to provide detention. The model will route the entire storm through the top pond, and then, through a weir, into the second pond. The outlet weir for the lower (second) pond will limit the flow leaving the site. This model will be conservative, for not all of the flow will reach the top pond prior to routing to the second, however, for simplicity of the model, will provide a satisfactory result.

Upper pond configuration:
Static Pool = 1337.0
Outlet weir = concrete, sharp crested, width = 7.0 feet
Qweir = CLH*1.5, where C = 3.0 for the broad crested weir

Lower pond configuration:
Static Pool = 1335.0
Outlet weir = concrete, sharp crested, width = 5.0 feet
Qweir = CLH*1.5, where C = 3.0 for the broad crested weir

Stage-storage and stage-discharge information follow on the next page, as well as a summary table of the routing results, and the output file from the routing procedure.

Refinements to the actual storage volumes and weir configuration will be done at the time of the design of the pond and storm water sewer system.



BENCHMARKS

1. "□"-Cut on South Hub Guard of R.C.B.C. 26' South & 94' West of NW Cor. Sec. 35 Elev. 1311.90

2. Rail Road Spike in Power Pole. Approximately 25' South & 30' East of W. 1/4 Cor. Sec. 35 Elev. 1349.65

Drainage Plan

EQUESTRIAN ESTATES 2ND ADDITION

Date: June 11, 2008

to Wichita - Sedgwick County, Kansas

(Associated Zone Case PUD 2000-0001)

POE & ASSOCIATES OF KANSAS, INC.
CONSULTING ENGINEERS