Clarity Pointe Memory Care
Assisted Living Facility & Improvements
Stormwater Detention Report

Project #: 150275.000

Liberty Township
Butler County, Ohio
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Introduction

The proposed Clarity Pointe Memory Care site is located along the north side of Liberty Way in Liberty Township. The proposed site is part of a PUD development that was originally approved in 2005 (Parcel No. D2010-009.000-019)as the HeritageSpring Cottage development. In lieu of the cottages that were proposed on the northeastern section of the site, an assisted living facility is proposed to be constructed.

The proposed modifications will replace five 2-family buildings that were originally planned for this section of the site. The proposed assisted living facility will consist of a 41,400 sq-ft one-story building.

Strategy

A stormwater detention system was previously designed for the site in 2005 for the developed proposed on the site. A detention basin was proposed at the northeast corner of the site. Per our review of Baumann Engineering's stormwater detention report (dated 5/31/05), this stormwater detention basin was intended to regulate stormwater runoff from the proposed HeritageSpring cottages site as well as the future assisted living facility (Barrington of West Chester) along Liberty Way. The existing HeritageSpring nursing facility along Liberty Way has its own detention basins to manage the stormwater detention from its site.

The original basin at the northeast corner of the site was designed in 2005, and at that time, Butler County stormwater regulations stated that the post-developed peak runoff rate from a 50-year storm were required to be held back to the pre-developed peak runoff rate from a 10-year storm.

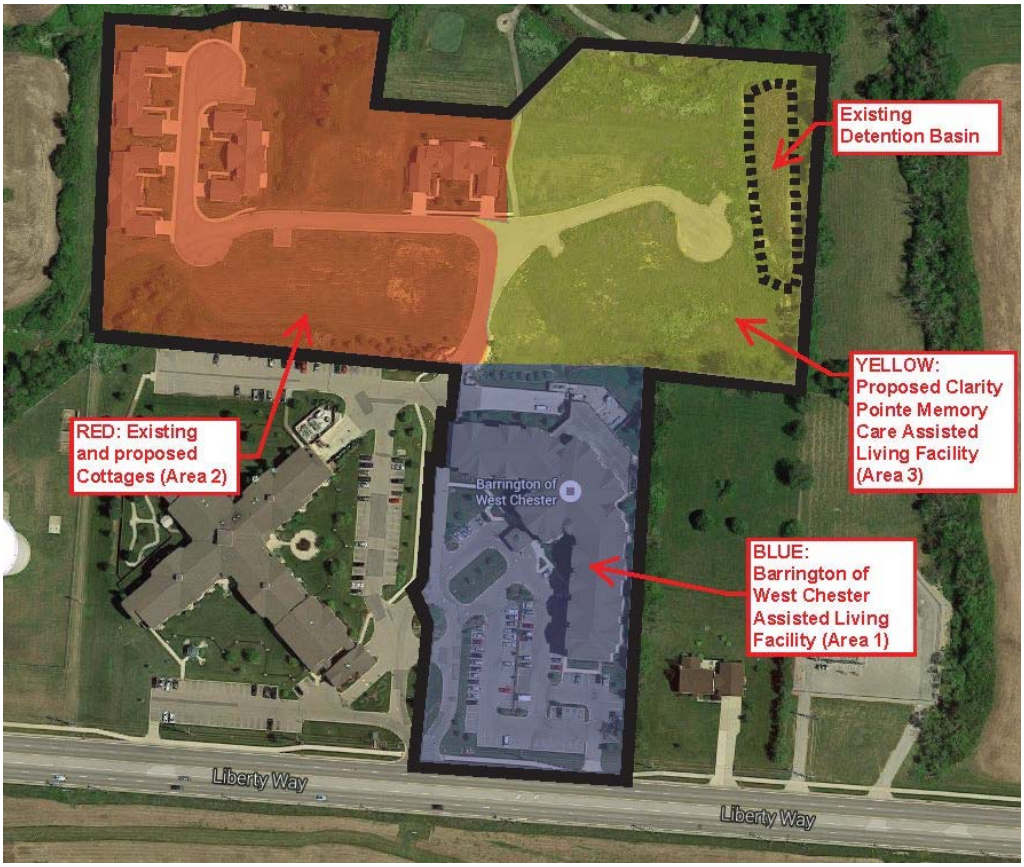
Butler County's current stormwater detention requirements follow the Critical Year Method. According to these regulations, the post-developed runoff rates from all storm events up to the critical year storm must be held back to the one-year pre-developed runoff rate, and all storms greater than the critical year storm (up to the 100-year storm) shall be held back by one storm event (i.e. Post-100 to Pre-50 or Post-50 to Pre-25) under pre-developed conditions.

The existing basin was designed back in 2005 to account for cottages to be built on the site of the proposed Memory Care Assisted Living facility. In comparing the amount of impervious area that was proposed for the cottages versus the amount of impervious area proposed for the Memory Care Assisted Living facility, there is a slight increase of approximately 0.5 Acres of added impervious area. A breakout of this increase in impervious area is as follows:

- Previous Design: 0.38 Acres of Roadway, 0.96 Acres for the cottages; **1.34 Acres Total Impervious Area**
- Proposed Design: **1.84 Acres Total Impervious Area**

Because the south portion of the site (Barrington of West Chester assisted living facility) has been already been developed, and in the case of the northwest corner of the site where cottages have either already been constructed or are still intended to be constructed per the 2005 approved plans, we are proposing to analyze the stormwater detention as follows:

- Break out the site into three separate areas (per the image shown on the following page):
    - Area 1: Barrington of West Chester assisted living facility
    - Area 2: Cottages at the northwest corner of the site
    - Area 3: Proposed Clarity Pointe Memory Care Assisted Living facility



- For Areas 1 and 2, detention requirements for these two areas shall remain as designed per the 2005 detention calculations (50-year post-developed rates shall be held back 10-year pre-developed rates).
- For Area 3, a critical year storm analysis will be performed to determine the allowable release rates from this area.
- The total allowable release rates from the site for each storm event will be the sum of the allowable flows from Areas 1 and 2 along with the allowable flows from Area 3.
- Water quality storage will also be designed to be incorporated within the existing basin to bring the basin into compliance with current Butler County and OEPA regulations.

Drainage Overview

Pre-developed Conditions

Existing conditions used in these calculations reflect the site conditions prior any development taking place on the site. A summary of these existing conditions are as follows:

- **Northwest and South Areas (Areas 1 and 2):**
  - Drainage Area = 9.38 Acres
  - CN = 70 (weighted average)
    - 2.82 Acres of Open Space (Good), Soil Type B (CN=61)
    - 6.56 Acres of Open Space (Good), Soil Type C (CN=74)
  - Tc = 20 minutes
- **Northeast Area (Area 3):**
  - Drainage Area = 4.17 Acres
  - CN = 74
    - 4.17 Acres of Open Space (Good), Soil Type C (CN=74)

- Tc = 16 minutes

Post-developed Conditions

Some of the storm water runoff from the proposed site improvements will be detained within the existing detention basin on the site within Area 3. The existing basin will be expanded to accommodate the increased runoff from the site and also to incorporate post-construction water quality.

The post-developed conditions for the on-site area on the site is as follows:

- **Northwest and South Areas (Areas 1 and 2):**
  - Drainage Area = 9.38 Acres
    - Captured Area within the detention basin in Area 3 = 5.37 Acres
      - CN = 88 (weighted average)
        - 0.66 Acres of Open Space (Good), Soil Type B (CN=61)
        - 1.15 Acres of Open Space (Good), Soil Type C (CN=74)
        - 3.56 Acres of Impervious Area (CN=98)
      - Tc = 10 minutes
    - Uncaptured Area = 4.01 Acres
      - CN = 80 (weighted average)
        - 0.43 Acres of Open Space (Good), Soil Type B (CN=61)
        - 2.38 Acres of Open Space (Good), Soil Type C (CN=74)
        - 1.20 Acres of Impervious Area (CN=98)
      - Tc = 15 minutes
- **Northeast Area (Area 3):**
  - Drainage Area = 4.17 Acres
    - Captured Area within the detention basin in Area 3 = 3.40 Acres
      - CN = 87 (weighted average)
        - 1.56 Acres of Open Space (Good), Soil Type C (CN=74)
        - 1.84 Acres of Impervious Area (CN=98)
      - Tc = 10 minutes
    - Uncaptured Area = 0.77 Acres
      - CN = 74 (weighted average)
        - 0.77 Acres of Open Space (Good), Soil Type C (CN=74)
      - Tc = 10 minutes

Results

The critical year storm for Area 3 was calculated per Table 1 on the following page:

Percent Increase in Runoff Volume From a 1-Year Frequency 24 Hour Storm		
Equal to or greater than	and less than	The critical storm for peak rate control will be
N/A	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	N/A	100 year

Table 1

The on-site hydrologic volume of runoff from a 1-year storm under pre-developed conditions is 0.211 Ac-Ft.
The on-site hydrologic volume of runoff from a 1-year storm under post-developed conditions is 0.409 Ac-Ft.

The percent increase was calculated as follows:

- $Percent\ Increase = \frac{(0.409)-(0.211)}{0.211}$
- $Percent\ Increase = 93.8\%\ Increase$

Per the above table, a 93.8% increase equates to a **10-year Critical Year Storm.**

The allowable release rates from the site were determined to be per the following table:

Column A	Column B	Column C	Column D	Column E	Column F
	$Q_{pre\text{-}dev\ (Areas\ 1+2)}$	**$Q_{allowable\ (Areas\ 1+2)}$**	**$Q_{pre\text{-}dev\ (Area\ 3)}$**	**$Q_{allowable\ (Area\ 3)}$**	**Total $Q_{allowable}$** (Column C + Column E)
1-yr	3.52 cfs	3.52 cfs	2.63 cfs	2.63 cfs	**6.15 cfs**
2-yr	5.61 cfs	5.61 cfs	3.85 cfs	2.63 cfs	**8.24 cfs**
5-yr	9.90 cfs	9.90 cfs	6.23 cfs	2.63 cfs	**12.53 cfs**
10-yr	13.29 cfs	13.29 cfs	8.07 cfs	2.63 cfs	**15.92 cfs**
25-yr	17.61 cfs	13.29 cfs	10.37 cfs	8.07 cfs	**21.36 cfs**
50-yr	21.38 cfs	13.29 cfs	12.36 cfs	10.37 cfs	**23.66 cfs**
100-yr	24.49 cfs	24.49 cfs	13.98 cfs	12.36 cfs	**36.85 cfs**

Table 2

Since part of the site bypasses the detention basin within Area 3, the runoff from this un-detained flow as calculated to determine the allowable outflow rate from the detention basin. The following table shows show the allowable outflow rate from the basin was calculated:

Column A	Column B	Column C	Column D	Column D	Column E
	$Q_{allowable}$	$Q_{Un\text{-}detained}$ (Areas 1+2)	$Q_{Un\text{-}detained\ (Area\ 3)}$	$Q_{Basin\ Allowable}$ (Col B – Col C – Col D)	**Total Designed** $Q_{Basin\ Outflow}$
1-yr	6.15 cfs	4.21 cfs	0.59 cfs	1.35 cfs	1.25 cfs
2-yr	8.24 cfs	5.65 cfs	0.85 cfs	1.74 cfs	1.60 cfs
5-yr	12.53 cfs	8.32 cfs	1.36 cfs	2.85 cfs	2.07 cfs
10-yr	15.92 cfs	10.31 cfs	1.75 cfs	3.86 cfs	2.34 cfs
25-yr	21.36 cfs	12.76 cfs	2.24 cfs	6.36 cfs	4.18 cfs
50-yr	23.66 cfs	14.83 cfs	2.66 cfs	6.17 cfs	5.93 cfs
100-yr	36.85 cfs	16.50 cfs	3.00 cfs	17.35 cfs	7.58 cfs

Table 3

Since the flows in Column E are less than the flows in Column D, it appears the proposed outflows from the site are within the allowable range.

Modifications are proposed to the basin berm and spillway elevations as well as the basin outlet structure. The current basin spillway elevation is 861.66. To get additional storage volume within the basin, the basin spillway is proposed to be raised from 861.66 to 863.40. The basin berm will also be raised to provide the required 1 foot of freeboard above the 100-year water surface elevation within the pond. The basin outlet structure will be replaced to account for the required water quality volume storage within the basin as well as to account for the basin outflow adjustments. No work is proposed within the bottom of the existing basin (elevation 857.55).

The enlarged detention basin will provide 1.679 Ac-Ft of storage at the spillway elevation of 863.40. The proposed water surface elevations for each design year storm are as follows:

Proposed Detention Basin Conditions	
Design Storm	**Proposed Water Surface Elevation (ft)**
1-yr	860.39
2-yr	860.83
5-yr	861.61
10-yr	862.15
25-yr	862.64
50-yr	863.00
100-yr	863.29

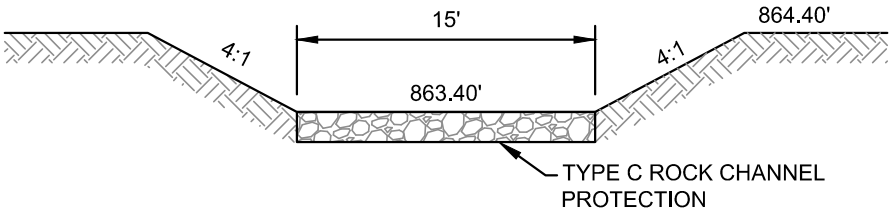
Table 4

The basin outlet structure is proposed to be modified. A 2" orifice (invert = 857.55) will be located at the bottom of the basin for water quality purposes. A 7.25" diameter office (invert = 859.48), a 6"T x 24"W window (invert = 862.30) as well as the catch basin grate (elev = 863.21) will also be part of the outlet structure to help regulate the flow from the basin. The existing 24" pipe will remain in use as the basin outlet pipe.

The basin spillway will be located at 863.40 and will be 15' wide. The basin berm will be raised to 864.40.

The Ohio Environmental Protection Agency (OEPA) requires projects to capture and treat stormwater for a storm event of 0.75" or less. These requirements are proposed to be met by utilizing the extended draw down time for the water quality volume held in the detention basin. Water quality calculations are included in Appendix E of this report. Per these

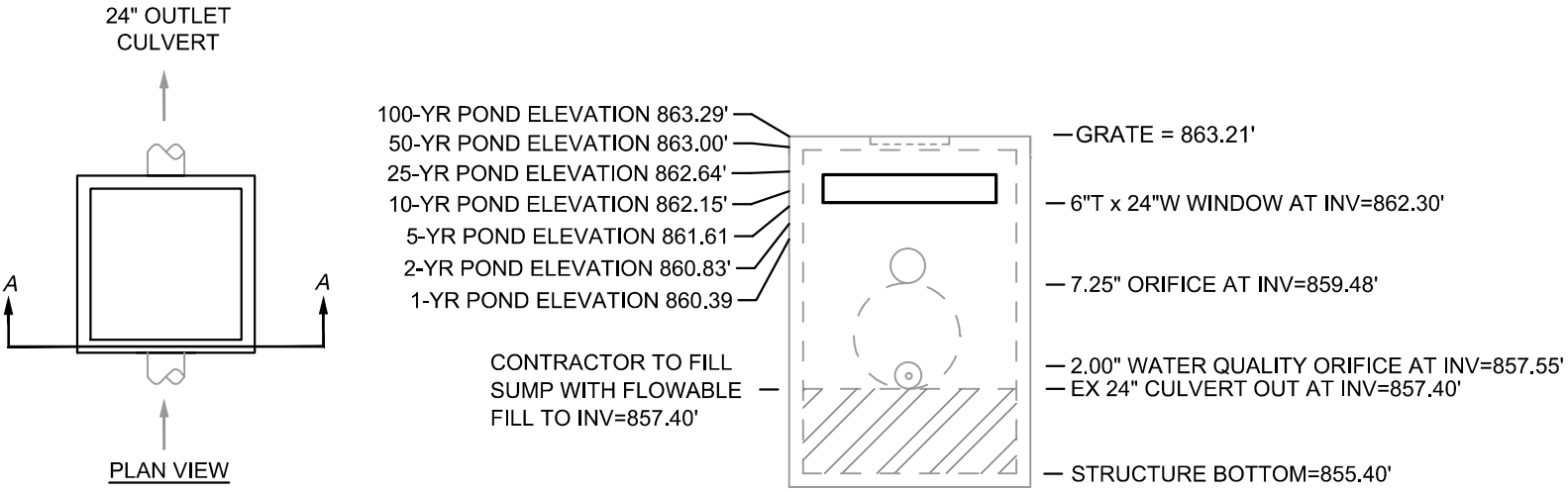
calculations, 0.26 Ac-Ft of water quality volume storage is required to be provided, and this will take place in the basin up to an elevation of 859.40.



1
C150

SPILLWAY DETAIL

N.T.S.



* MODIFIED ODOT TYPE CB 2-3

2
C150

DETENTION CONTROL STRUCTURE (CB-601)

N.T.S.

Conclusion

Per current Butler County stormwater regulations, the Critical Year Storm Method shall be used to determine the allowable release rates for each storm event. The basin on this site was previously designed in 2005 under the old Butler County stormwater regulations to handle the runoff from the site based on the 2005 site plan. Design revisions are proposed to take place in the northeast portion of the site, and an assisted living facility is proposed to be constructed in lieu of the cottages that were planned for this part of the site. Because the south portion of the site (Barrington of West Chester assisted living facility) has been already been developed, and in the case of the northwest corner of the site where cottages have either already been constructed or are still intended to be constructed per the 2005 approved plans, the allowable release rates from those portions of the site are proposed to remain per the allowable release rates under the previous Butler County detention regulations. The proposed redeveloped area at the northeast part of the site will be designed under the current Butler County detention regulations, and the allowable flows from each portion of the site will be added to determine the overall release rate from the site for each storm intensity.

Table 3 on Page 7 outlines the allowable and proposed design flows from the site.

Since the flows shown in Column E are less than the flows shown in Column D, we believe the proposed flows from the site are within the allowable range per the regulations. The basin has been retrofitted to incorporate water quality storage within the basin. The basin berm and spillway elevations have been raised to provide additional stormwater storage, and one foot of freeboard has been provided within the basin above the 100-year water surface elevation.

Therefore, it is our opinion that this proposed detention design is in compliance with Butler County requirements.

Appendix A

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********** TC CALCULATIONS **********

01 PRE DEV..... Tc Calcs 2.01

03 POST DEV..... Tc Calcs 2.03

********** CN CALCULATIONS **********

01 PRE DEV..... Runoff CN-Area 3.01

03 POST DEV..... Runoff CN-Area 3.02

MASTER DESIGN STORM SUMMARY

Network Storm Collection: BUTLER

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.5000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
01 PRE DEV	AREA	1	.211		12.1000	2.63		
*02 PRE OUT	JCT	1	.211		12.1000	2.63		
03 POST DEV	AREA	1	.409		12.0000	6.73		
*04 POST OUT	JCT	1	.409		12.0000	6.73		

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2690 hrs

==========
Total Tc: .2690 hrs
==========

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .1670 hrs

==========
Total Tc: .1670 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .1670 hrs
==========

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Open space (Type C) - Good conditio	74	4.170			74.00
COMPOSITE AREA & WEIGHTED CN --->		4.170			74.00 (74)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Open space (Type C)	74	2.330			74.00
Impervious Areas	98	1.840			98.00
COMPOSITE AREA & WEIGHTED CN --->		4.170			84.59 (85)

Index of Starting Page Numbers for ID Names

----- 0 -----
01 PRE DEV... 2.01, 3.01
03 POST DEV... 2.03, 3.02

----- W -----
Watershed... 1.01

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Watershed..... Master Network Summary 1.01

********** TC CALCULATIONS **********

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02 PRE NE..... Runoff CN-Area 3.02

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05 CAP POST NE.. Runoff CN-Area 3.04

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Composite Rating Curve 5.05

MASTER DESIGN STORM SUMMARY

Network Storm Collection: BUTLER

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.5000	Synthetic Curve	TypeII 24hr
2	2.9000	Synthetic Curve	TypeII 24hr
5	3.6000	Synthetic Curve	TypeII 24hr
10	4.1000	Synthetic Curve	TypeII 24hr
25	4.7000	Synthetic Curve	TypeII 24hr
50	5.2000	Synthetic Curve	TypeII 24hr
100	5.6000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
01 PRE NW+S	AREA	1	.355		12.1500	3.52		
01 PRE NW+S	AREA	2	.515		12.1000	5.61		
01 PRE NW+S	AREA	5	.835		12.1000	9.90		
01 PRE NW+S	AREA	10	1.090		12.1000	13.29		
01 PRE NW+S	AREA	25	1.418		12.1000	17.61		
01 PRE NW+S	AREA	50	1.706		12.1000	21.38		
01 PRE NW+S	AREA	100	1.944		12.1000	24.49		
02 PRE NE	AREA	1	.211		12.1000	2.63		
02 PRE NE	AREA	2	.294		12.0500	3.85		
02 PRE NE	AREA	5	.455		12.0500	6.23		
02 PRE NE	AREA	10	.580		12.0500	8.07		
02 PRE NE	AREA	25	.739		12.0500	10.37		
02 PRE NE	AREA	50	.877		12.0500	12.36		
02 PRE NE	AREA	100	.990		12.0500	13.98		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*03 PRE OUT	JCT	1	.566		12.1000	6.11		
*03 PRE OUT	JCT	2	.808		12.1000	9.40		
*03 PRE OUT	JCT	5	1.290		12.1000	15.93		
*03 PRE OUT	JCT	10	1.670		12.1000	21.03		
*03 PRE OUT	JCT	25	2.156		12.1000	27.49		
*03 PRE OUT	JCT	50	2.582		12.1000	33.10		
*03 PRE OUT	JCT	100	2.934		12.1000	37.71		
04 CAP POST NW+S	AREA	1	.618		12.0000	10.12		
04 CAP POST NW+S	AREA	2	.773		12.0000	12.60		
04 CAP POST NW+S	AREA	5	1.055		12.0000	17.01		
04 CAP POST NW+S	AREA	10	1.262		12.0000	20.17		
04 CAP POST NW+S	AREA	25	1.513		12.0000	23.97		
04 CAP POST NW+S	AREA	50	1.726		12.0000	27.14		
04 CAP POST NW+S	AREA	100	1.897		12.0000	29.66		
05 CAP POST NE	AREA	1	.371		12.0000	6.09		
05 CAP POST NE	AREA	2	.468		12.0000	7.65		
05 CAP POST NE	AREA	5	.643		12.0000	10.42		
05 CAP POST NE	AREA	10	.772		12.0000	12.42		
05 CAP POST NE	AREA	25	.930		12.0000	14.83		
05 CAP POST NE	AREA	50	1.063		12.0000	16.83		
05 CAP POST NE	AREA	100	1.171		12.0000	18.43		
06 UNC POST NW+S	AREA	1	.297		12.0500	4.21		
06 UNC POST NW+S	AREA	2	.393		12.0500	5.65		
06 UNC POST NW+S	AREA	5	.573		12.0500	8.32		
06 UNC POST NW+S	AREA	10	.709		12.0500	10.31		
06 UNC POST NW+S	AREA	25	.879		12.0500	12.76		
06 UNC POST NW+S	AREA	50	1.024		12.0500	14.83		
06 UNC POST NW+S	AREA	100	1.143		12.0500	16.50		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
07 UNCAP POST NE	AREA	1	.039		12.0000	.59		
07 UNCAP POST NE	AREA	2	.054		12.0000	.85		
07 UNCAP POST NE	AREA	5	.084		12.0000	1.36		
07 UNCAP POST NE	AREA	10	.107		12.0000	1.75		
07 UNCAP POST NE	AREA	25	.136		12.0000	2.24		
07 UNCAP POST NE	AREA	50	.162		12.0000	2.66		
07 UNCAP POST NE	AREA	100	.183		12.0000	3.00		
08 POND IN	POND	1	.989		12.0000	16.22		
08 POND IN	POND	2	1.241		12.0000	20.25		
08 POND IN	POND	5	1.699		12.0000	27.43		
08 POND IN	POND	10	2.034		12.0000	32.59		
08 POND IN	POND	25	2.444		12.0000	38.80		
08 POND IN	POND	50	2.789		12.0000	43.97		
08 POND IN	POND	100	3.067		12.0000	48.10		
08 POND OUT	POND	1	.989		12.8000	1.25	860.39	.524
08 POND OUT	POND	2	1.241		12.7500	1.60	860.83	.665
08 POND OUT	POND	5	1.699		12.7500	2.07	861.61	.939
08 POND OUT	POND	10	2.034		12.7500	2.34	862.15	1.147
08 POND OUT	POND	25	2.444		12.5000	4.18	862.64	1.346
08 POND OUT	POND	50	2.789		12.4000	5.93	863.00	1.503
08 POND OUT	POND	100	3.067		12.3500	7.58	863.29	1.631
*09 POST OUT	JCT	1	1.325		12.0500	5.26		
*09 POST OUT	JCT	2	1.688		12.0500	7.57		
*09 POST OUT	JCT	5	2.356		12.0500	11.25		
*09 POST OUT	JCT	10	2.851		12.0500	13.88		
*09 POST OUT	JCT	25	3.459		12.0500	17.05		
*09 POST OUT	JCT	50	3.975		12.0500	19.73		
*09 POST OUT	JCT	100	4.393		12.0500	23.35		

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .3330 hrs

==========
Total Tc: .3330 hrs
==========

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	2.9000 in
Slope	.024000 ft/ft
Avg.Velocity	.12 ft/sec

Segment #1 Time: .2323 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	113.00 ft
Slope	.106000 ft/ft
Unpaved	
Avg.Velocity	5.25 ft/sec

Segment #2 Time: .0060 hrs

Segment #3: Tc: TR-55 Shallow

Hydraulic Length	204.00 ft
Slope	.013000 ft/ft
Unpaved	
Avg.Velocity	1.84 ft/sec

Segment #3 Time: .0308 hrs

==========
Total Tc: .2690 hrs
==========

```
 ------------------------------------------------------------------------
 Tc Equations used...
 ------------------------------------------------------------------------


 ==== SCS TR-55 Sheet Flow ================================================

      Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

      Where:  Tc = Time of concentration, hrs
              n  = Mannings n
              Lf = Flow length, ft
              P  = 2yr, 24hr Rain depth, inches
              Sf = Slope, %


 ==== SCS TR-55 Shallow Concentrated Flow ================================

      Unpaved surface:
      V  = 16.1345 * (Sf**0.5)

      Paved surface:
      V  = 20.3282 * (Sf**0.5)

      Tc = (Lf / V) / (3600sec/hr)

      Where:  V  = Velocity, ft/sec
              Sf = Slope, ft/ft
              Tc = Time of concentration, hrs
              Lf = Flow length, ft
```

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .1670 hrs

Total Tc: .1670 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .1670 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .1670 hrs

Total Tc: .1670 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .1670 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

==========
Total Tc: .2500 hrs
==========

Tc Equations used...

==== User Defined ==========

Tc = Value entered by user

Where: Tc = Time of concentration

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .1670 hrs

Total Tc: .1670 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .1670 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Open space (Type B)	61	2.820			61.00
Open space (Type C) - Good conditio	74	6.560			74.00
COMPOSITE AREA & WEIGHTED CN --->		9.380			70.09 (70)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Open Space, Good (C)	74	4.170			74.00
COMPOSITE AREA & WEIGHTED CN --->		4.170			74.00 (74)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Open space (Type B)	61	.660			61.00
Open space (Type C)	74	1.150			74.00
Impervious Areas	98	3.560			98.00
COMPOSITE AREA & WEIGHTED CN --->		5.370			88.31 (88)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Open Space, Good (C)	74	1.560			74.00
Impervious Areas	98	1.840			98.00
COMPOSITE AREA & WEIGHTED CN --->		3.400			86.99 (87)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Open space (Type B)	61	.430			61.00
Open space (Type C)	74	2.380			74.00
Impervious Areas	98	1.200			98.00
COMPOSITE AREA & WEIGHTED CN --->		4.010			79.79 (80)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Open Space, Good (C)	74	.770			74.00
COMPOSITE AREA & WEIGHTED CN --->		.770			74.00 (74)

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
857.55	-----	1	0	.000	.000
858.00	-----	3623	3684	.013	.013
859.00	-----	9305	18734	.143	.156
860.00	-----	12592	32722	.250	.406
861.00	-----	14945	41256	.316	.722
861.50	-----	15921	46292	.177	.899
862.00	-----	16897	49220	.188	1.088
862.50	-----	18066	52435	.201	1.288
863.00	-----	19235	55942	.214	1.502
863.40	-----	19235	57705	.177	1.679

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 857.55 ft
Increment = .10 ft
Max. Elev.= 863.40 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Orifice-Circular	O1	--->	C1	857.550	863.400
Orifice-Area	O3	--->	C1	862.300	863.400
Orifice-Circular	O2	--->	TW	859.480	863.400
Inlet Box	GR	--->	TW	863.210	863.400
Culvert-Circular	C1	--->	TW	857.400	863.400

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID = O1
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 857.55 ft
Diameter = .1670 ft
Orifice Coeff. = .600

Structure ID = O3
Structure Type = Orifice-Area

# of Openings = 1
Invert Elev. = 862.30 ft
Area = 1.0000 sq.ft
Top of Orifice = 862.80 ft
Datum Elev. = 862.55 ft
Orifice Coeff. = .600

Structure ID = O2
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 859.48 ft
Diameter = .6040 ft
Orifice Coeff. = .600

OUTLET STRUCTURE INPUT DATA

Structure ID = GR
Structure Type = Inlet Box

# of Openings	=	1
Invert Elev.	=	863.21 ft
Orifice Area	=	2.0000 sq.ft
Orifice Coeff.	=	.600
Weir Length	=	8.00 ft
Weir Coeff.	=	3.000
K, Reverse	=	1.000
Mannings n	=	.0000
Kev,Charged Riser	=	.000
Weir Submergence	=	No
Orifice H to crest	=	Yes

OUTLET STRUCTURE INPUT DATA

Structure ID = C1
Structure Type = Culvert-Circular

No. Barrels = 1
Barrel Diameter = 2.0000 ft
Upstream Invert = 857.40 ft
Dnstream Invert = 857.15 ft
Horiz. Length = 37.00 ft
Barrel Length = 37.00 ft
Barrel Slope = .00676 ft/ft

OUTLET CONTROL DATA...
Mannings n = .0130
Ke = .5000 (forward entrance loss)
Kb = .012411 (per ft of full flow)
Kr = .5000 (reverse entrance loss)
HW Convergence = .001 +/- ft

INLET CONTROL DATA...
Equation form = 1
Inlet Control K = .0098
Inlet Control M = 2.0000
Inlet Control c = .03980
Inlet Control Y = .6700
T1 ratio (HW/D) = 1.157
T2 ratio (HW/D) = 1.303
Slope Factor = -.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 859.71 ft ---> Flow = 15.55 cfs
At T2 Elev = 860.01 ft ---> Flow = 17.77 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 40
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .00 cfs
Max. Q tolerance = .00 cfs

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
857.55	.00	Free Outfall		(no Q: O1,O3,O2,GR,C1)
857.65	.01	Free Outfall		O1,C1 (no Q: O3,O2,GR)
857.75	.04	Free Outfall		O1,C1 (no Q: O3,O2,GR)
857.85	.05	Free Outfall		O1,C1 (no Q: O3,O2,GR)
857.95	.06	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.05	.07	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.15	.07	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.25	.08	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.35	.09	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.45	.09	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.55	.10	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.65	.11	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.75	.11	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.85	.12	Free Outfall		O1,C1 (no Q: O3,O2,GR)
858.95	.12	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.05	.13	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.15	.13	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.25	.13	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.35	.14	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.45	.14	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.48	.14	Free Outfall		O1,C1 (no Q: O3,O2,GR)
859.55	.16	Free Outfall		O1,O2,C1 (no Q: O3,GR)
859.65	.22	Free Outfall		O1,O2,C1 (no Q: O3,GR)
859.75	.33	Free Outfall		O1,O2,C1 (no Q: O3,GR)
859.85	.47	Free Outfall		O1,O2,C1 (no Q: O3,GR)
859.95	.64	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.05	.83	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.15	1.00	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.25	1.11	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.35	1.21	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.45	1.30	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.55	1.39	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.65	1.47	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.75	1.54	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.85	1.61	Free Outfall		O1,O2,C1 (no Q: O3,GR)
860.95	1.68	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.05	1.75	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.15	1.81	Free Outfall		O1,O2,C1 (no Q: O3,GR)

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
861.25	1.87	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.35	1.93	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.45	1.99	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.55	2.04	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.65	2.10	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.75	2.15	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.85	2.20	Free Outfall		O1,O2,C1 (no Q: O3,GR)
861.95	2.25	Free Outfall		O1,O2,C1 (no Q: O3,GR)
862.05	2.30	Free Outfall		O1,O2,C1 (no Q: O3,GR)
862.15	2.35	Free Outfall		O1,O2,C1 (no Q: O3,GR)
862.25	2.39	Free Outfall		O1,O2,C1 (no Q: O3,GR)
862.30	2.42	Free Outfall		O1,O2,C1 (no Q: O3,GR)
862.35	2.68	Free Outfall		O1,O3,O2,C1 (no Q: GR)
862.45	3.20	Free Outfall		O1,O3,O2,C1 (no Q: GR)
862.55	3.72	Free Outfall		O1,O3,O2,C1 (no Q: GR)
862.65	4.24	Free Outfall		O1,O3,O2,C1 (no Q: GR)
862.75	4.77	Free Outfall		O1,O3,O2,C1 (no Q: GR)
862.85	5.27	Free Outfall		O1,O3,O2,C1 (no Q: GR)
862.95	5.72	Free Outfall		O1,O3,O2,C1 (no Q: GR)
863.05	6.13	Free Outfall		O1,O3,O2,C1 (no Q: GR)
863.15	6.49	Free Outfall		O1,O3,O2,C1 (no Q: GR)
863.21	6.69	Free Outfall		O1,O3,O2,C1 (no Q: GR)
863.25	7.01	Free Outfall		O1,O3,O2,GR,C1
863.35	8.40	Free Outfall		O1,O3,O2,GR,C1
863.40	9.28	Free Outfall		O1,O3,O2,GR,C1

Index of Starting Page Numbers for ID Names

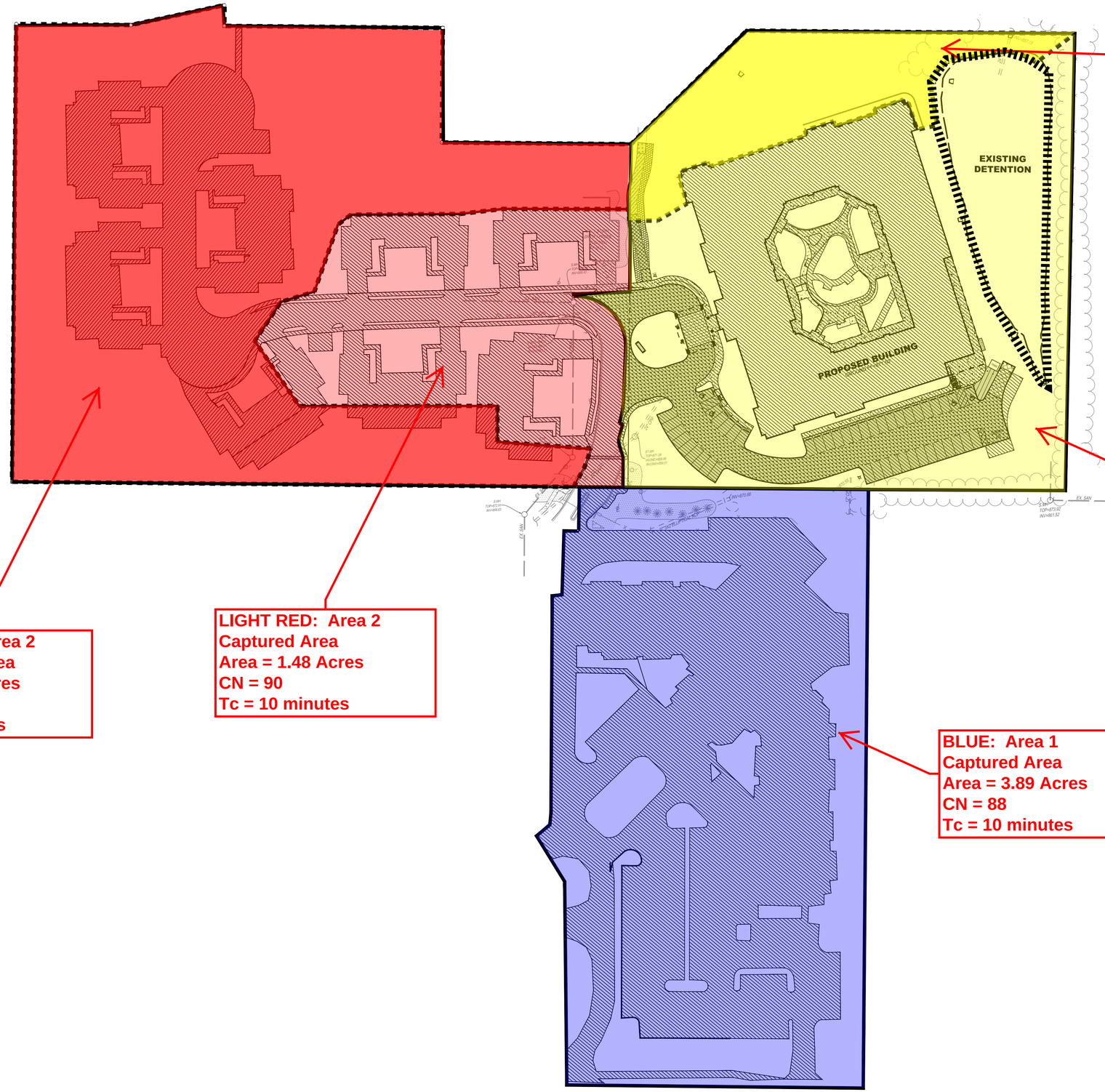
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02 PRE NE... 2.03, 3.02
04 CAP POST NW+S... 2.05, 3.03
05 CAP POST NE... 2.07, 3.04
06 UNC POST NW+S... 2.09, 3.05
07 UNCAP POST NE... 2.11, 3.06
08 POND... 4.01

----- O -----
O1... 5.01, 5.05

----- W -----
Watershed... 1.01

Appendix C

INSPIRED PEOPLE ▲ CREATIVE DESIGN ▲ TRANSFORMING COMMUNITIES



DARK YELLOW: Area 3
Uncaptured Area
Area = 0.77 Acres
CN = 74
Tc = 10 minutes

LIGHT YELLOW: Area 3
Captured Area
Area = 3.40 Acres
CN = 87
Tc = 10 minutes

DARK RED: Area 2
Uncaptured Area
Area = 4.01 Acres
CN = 80
Tc = 15 minutes

LIGHT RED: Area 2
Captured Area
Area = 1.48 Acres
CN = 90
Tc = 10 minutes

BLUE: Area 1
Captured Area
Area = 3.89 Acres
CN = 88
Tc = 10 minutes

THE KLEINGERS GROUP
CIVIL ENGINEERING
SURVEYING
LANDSCAPE ARCHITECTURE
www.kleingers.com
6305 Centre Park Dr.
West Chester, OH 45069
513.779.7851

SEAL:

NO. DATE DESCRIPTION

FINAL P.U.D.
CLARITY POINTE MEMORY CARE
SECTION 7, TOWN 3, RANGE 3
LIBERTY TOWNSHIP
BUTLER COUNTY, OHIO
FOR: HERITAGE DEVELOPMENT PARTNERS, LLC

PROJECT NO: 150275.000
DATE: 8/14/15
SCALE: 1" = 50'
0 25 50 100

SHEET NAME:
POST-DEVELOPED CONDITIONS

SHEET NO.
APPENDIX C

Appendix D

PROJECT	**Clarity Pointe Memory Care**
JOB #	**150275.000**
DATE	**9/8/2015**

DESIGN	**ACB**
CHECK	**ACB**

WATER QUALITY VOLUME = INPUT FIELDS

Method 2

WQv= C * P * A / 12

C = 0.421152576
P = 0.75 IN
A = 8.77 ACRES *

WQv = 0.23 AC FT

RUNOFF COEFFICIENT

$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

WHERE: i = IMPERVIOUS RATIO

IMPERVIOUS RATIO, i = IMPERVIOUS AREA / TOTAL AREA

IMPERVIOUS AREA =	5.4
TOTAL AREA =	8.77
i =	0.615735

P = Precipitation Depth of 0.75 - inches

***AREA TO INCLUDE OFFSITE DRAINAGE**

THEREFORE, WQv =		**0.23**	**AC FT**
	OR,	10056	CF

EXTENDED DETENTION VOLUME - DRY BASINS

EDv = 1.20 * WQv

Dry EDv =	**0.28**	**AC FT**
OR,	12067	CF

EDv REQUIRED STORAGE AVAILABLE AT: **859.48**

* INTERPOLATE WATER QUALITY VOLUME WATER SURFACE ELEVATION

SIZE ORIFICE FOR EXTENDED DETENTION VOLUME DRAIN

***** DOUBLE CHECK UNITS *****

Q(avg) = EDv / Td Q(max) = 2 * Q(avg) Td = 48 HOURS FOR DRY

Q(avg) = 0.0698 CFS

Q(max) = 0.1397 CFS

A = Q(max) / C * (2 * g * H(max))^0.5

H(max) = 1.93 FT

A = 0.0209 SQ FT AREA OF REQUIRED ORIFICE

D = 1.96 IN **Use 2" orifice.**

WHERE:

EDv = EXTENDED DETENTION VOLUME
*EDv = 0.75 * WQv FOR WET PONDS AND WETLANDS*
*EDv = 1.2 * WQv FOR DRY DETENTION BASINS*
Q_{avg} = *AVERAGE FLOW RATE THROUGH THE ORIFICE*
Q_{max} = *MAXIMUM FLOW RATE THROUGH THE ORIFICE*
T_d = *EDv DRAIN TIME (24 TO 48 HOURS)*
C = 0.6 ORIFICE COEFF.
g = 32.2 ft/ sec²
H_{max} = *MAXIMUM HYDRAULIC HEAD*
A = ORIFICE AREA (ft²)
D = ORIFICE DIAMETER (ft)

Appendix E

May 31, 2005
Project 030.36-21666

DRAINAGE REPORT
HeritageSpring Cottages

This report and the attached calculations are for the storm water management plan associated with the HeritageSpring Cottages development, located off Hamilton-Mason Road in Liberty Township, Butler County, Ohio. The proposed development is the second part of three phases covering two parcels.

The first phase consisted of a nursing facility on the majority of the 10.1 acre southern lot directly off Hamilton–Mason Road. The remainder of this lot (east portion) is identified as a future assisted living facility which will be the third and final phase.

The current development consists of attached cottage residences on a 9.7 acre parcel to the north of the identified parcel in phase, with the access being through the southern parcel on a common drive.

Detention has been provided for the existing nursing facility in two detention basins, one of which is located on the southwest corner of the current site. The design and calculations for the phase one detention basins were done by McGill Smith Punshon, Inc. in 2003.

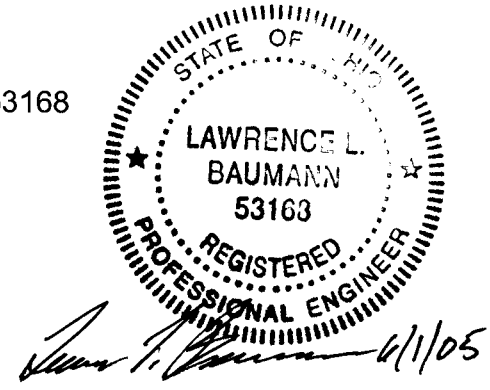
The proposed detention for the current development takes into account the remainder of the southern parcel (future phase) and the entire north parcel, for a total drainage area of 12.97 acres. Runoff hydrographs used for the proposed conditions include the future development of the assisted living facility. The existing drainage pattern is to a creek which flows from the southwest corner of the site to the north property line and then east along the north property line adjacent to the existing golf course. An existing farm pond located in the southeast corner will be filled and the proposed detention basin will be located in the northwest corner of the site and will outlet into the existing creek to the north.

The calculations for the storm sewer system and culverts are attached to the end of the report.

Baumann Engineering Inc.
10170 International Blvd.
Cincinnati, Ohio 45246
Phone: 513-860-3999
Fax: 513-860-0287
www.BaumannEng.com

Prepared by: Lawrence L. Baumann, OHPE #53168

RECEIVED
JUN 01 2005
BY:



6/1/05

Calculation Summary:

Total Area= 12.97 acres C=0.40 Tc = 20 min. I(10) = 3.95 in/hr
Rational Method Q(10yr)=12.97x3.95x.40= 20.49 cfs Pre-Dev.

Undetained Area= 4.41 acres C=0.52 Tc=15 min. I(50)=5.95 in/hr
Q(50yr)=4.41x5.95x.52= 13.64 cfs Post-Dev.

Allowable Discharge= 20.45cfs – 13.64cfs= 6.85 cfs

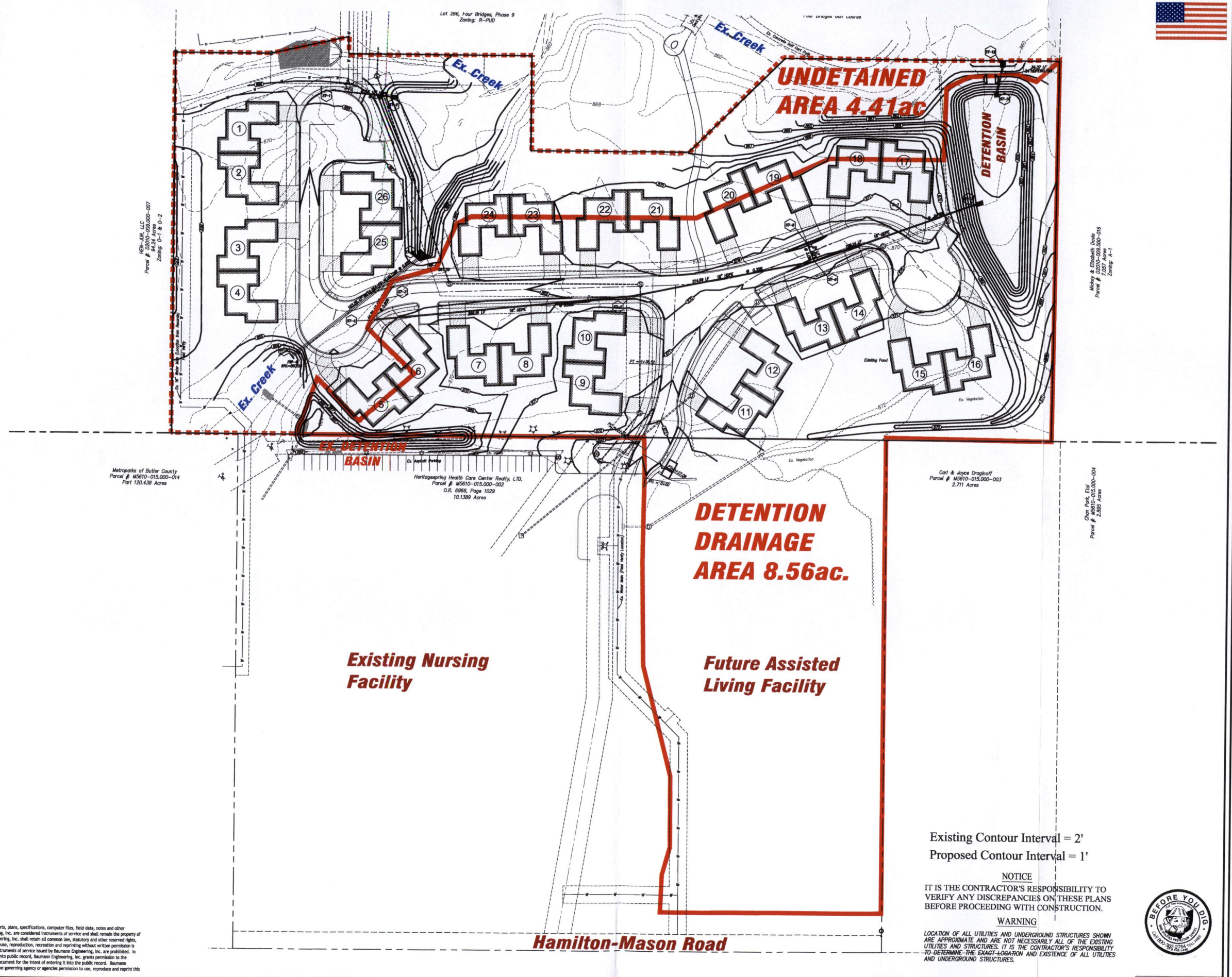
Maximum Discharge (50-yr) from basin= 6.35 cfs Post-Dev.
Maximum Pond Elevation (50-yr)= 861.78

Maximum Discharge (100-yr) from basin= 6.73 cfs Post-Dev.
Maximum Pond Elevation (100-yr)= 862.11

**See Pond Pack computer program reports for detailed runoff hydrographs and detention basin routings.

umann Engineering Inc.
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ncinnati, Ohio 45246
one: 513-860-3999
x: 513-860-0287
w.BaumannEng.com

NORTH



Existing Contour Interval = 2'

Proposed Contour Interval = 1'

NOTICE

IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ANY DISCREPANCIES ON THESE PLANS BEFORE PROCEEDING WITH CONSTRUCTION.

WARNING

LOCATION OF ALL UTILITIES AND UNDERGROUND STRUCTURES SHOWN ARE APPROXIMATE AND ARE NOT NECESSARILY ALL OF THE EXISTING UTILITIES AND STRUCTURES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT LOCATION AND EXISTENCE OF ALL UTILITIES AND UNDERGROUND STRUCTURES.

BEFORE YOU DIG
OHIO UTILITIES PROTECTION SERVICE
Call 800-362-2764 Toll Free

Drawing #:

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LAND SURVEYING

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513.860.0287 fax
BAUMANNENG.COM

DETENTION STORMWATER MAP

HeritageSpring Cottages
9.6717 Acre Parcel
Parcel # D2010-009.000-019
Hamilton-Mason Road
Section 7, Town 3, Range 3,
Liberty Township
Butler County, Ohio

SURVEYOR'S SEAL

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REVISIONS

SCALE: None

Detention Area Map

SHEET #:

DET

PROJECT #: 21666

DATE: 5.27.2005

H:\JOBS\21666\CAD\21666DP.dwg, Detention Map, 5/27/2005 4:19:36 PM, TT, 24X36, Baumann Engineering, Inc.

Bid Issue - Document Subject to Change.

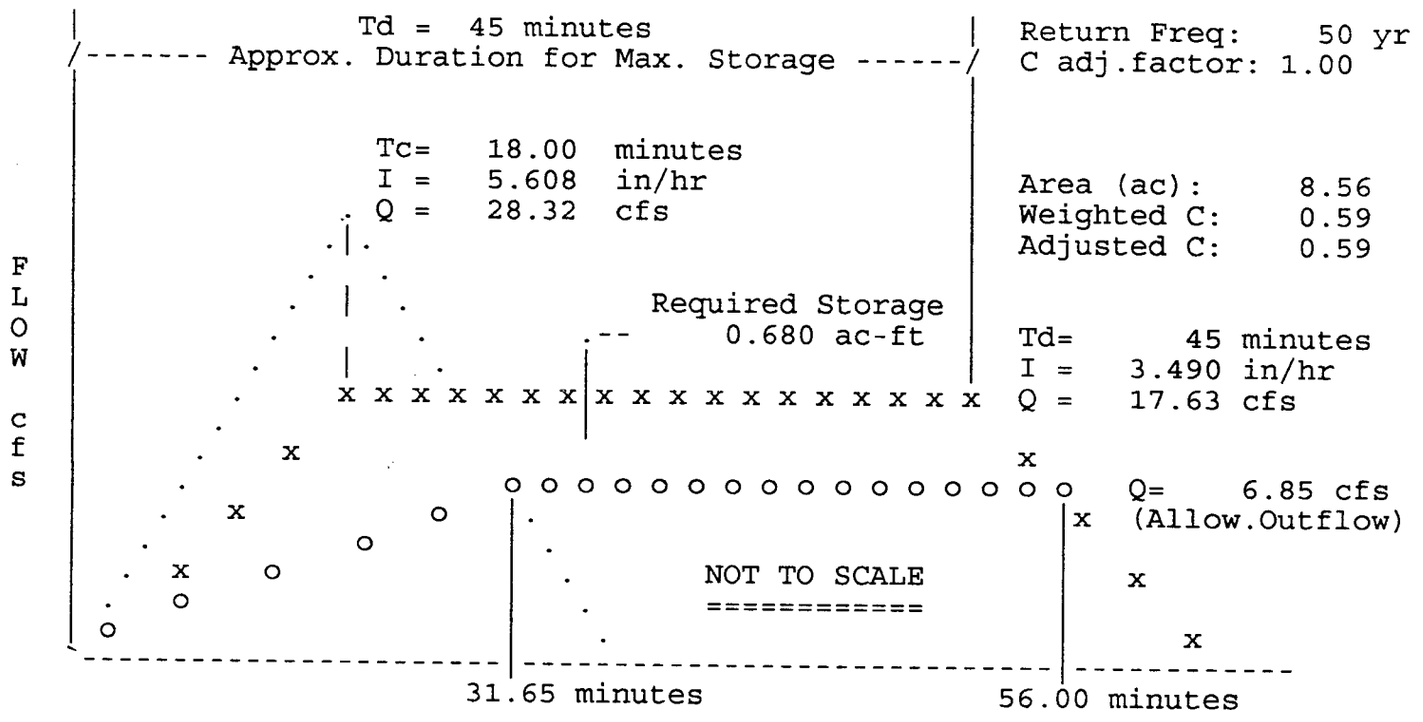
Quick TR-55 Ver.5.46 S/N:
Executed: 16:28:34 04-12-2005

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 50 YEAR STORM

RETURN FREQUENCY: 50 yr	Allowable Outflow: 6.85 cfs
'C' Adjustment: 1.000	Required Storage: 0.680 ac-ft
Peak Inflow: 17.63 cfs	Inflow .HYD stored: 21666D50.HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 16:28:34 04-12-2005

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 50 YEAR STORM

**** Modified Rational Hydrograph *****

Weighted C = 0.590 Area= 8.560 acres Tc = 18.00 minutes

Adjusted C = 0.590 Td= 45.00 min. I= 3.49 in/hr Qp= 17.63 cfs

RETURN FREQUENCY: 50 year storm Adj.factor = 1.00
Output file: 21666D50.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 50 Year Storm

Time Hours	Time increment = 0.083 Hours Time on left represents time for first Q in each row.						
0.050	2.94	7.83	12.73	17.63	17.63	17.63	17.63
0.633	17.63	17.63	14.69	9.79	4.90	0.00	

Quick TR-55 Ver.5.46 S/N:
Executed: 16:28:34 04-12-2005

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 50 YEAR STORM

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 50 years
`C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
DETAINED	0.590	8.56						
			18.00	0.590	0.590	5.608	8.56	28.32

Quick TR-55 Ver.5.46 S/N:
Executed: 16:28:34 04-12-2005

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* *
* MODIFIED RATIONAL METHOD *
* ---- Grand Summary For All Storm Frequencies ---- *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 50 YEAR STORM

Area = 8.56 acres Tc = 18.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
50	0.590	45	3.490	17.63	6.85	1.093	0.680

Quick TR-55 Ver.5.46 S/N:
Executed: 16:28:34 04-12-2005

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 50 YEAR STORM

RETURN FREQUENCY: 50 yr `C' Adjustment = 1.000 Allowable Q = 6.85 cfs

Hydrograph file duration= 45.00 minutes
Hydrograph file: 21666D50.HYD Tc = 18.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.590	0.590	18	5.608	8.56	28.32	0.702	0.532
0.590	0.590	20	5.320	8.56	26.87	0.740	0.553
0.590	0.590	30	4.390	8.56	22.17	0.916	0.639
0.590	0.590	40	3.730	8.56	18.84	1.038	0.671
**********	**********	**********	**********	**********	**********	********** Storage Maximum	
0.590	0.590	45	3.490	8.56	17.63	1.093	0.680
**********	**********	**********	**********	**********	**********	**********	**********
0.590	0.590	50	3.250	8.56	16.41	1.130	0.674
0.590	0.590	60	2.870	8.56	14.49	1.198	0.651
0.590	0.590	120	1.700	8.56	8.59	1.419	0.334
0.590	0.590	180	1.210	8.56	6.11	Qpeak < Qallow	

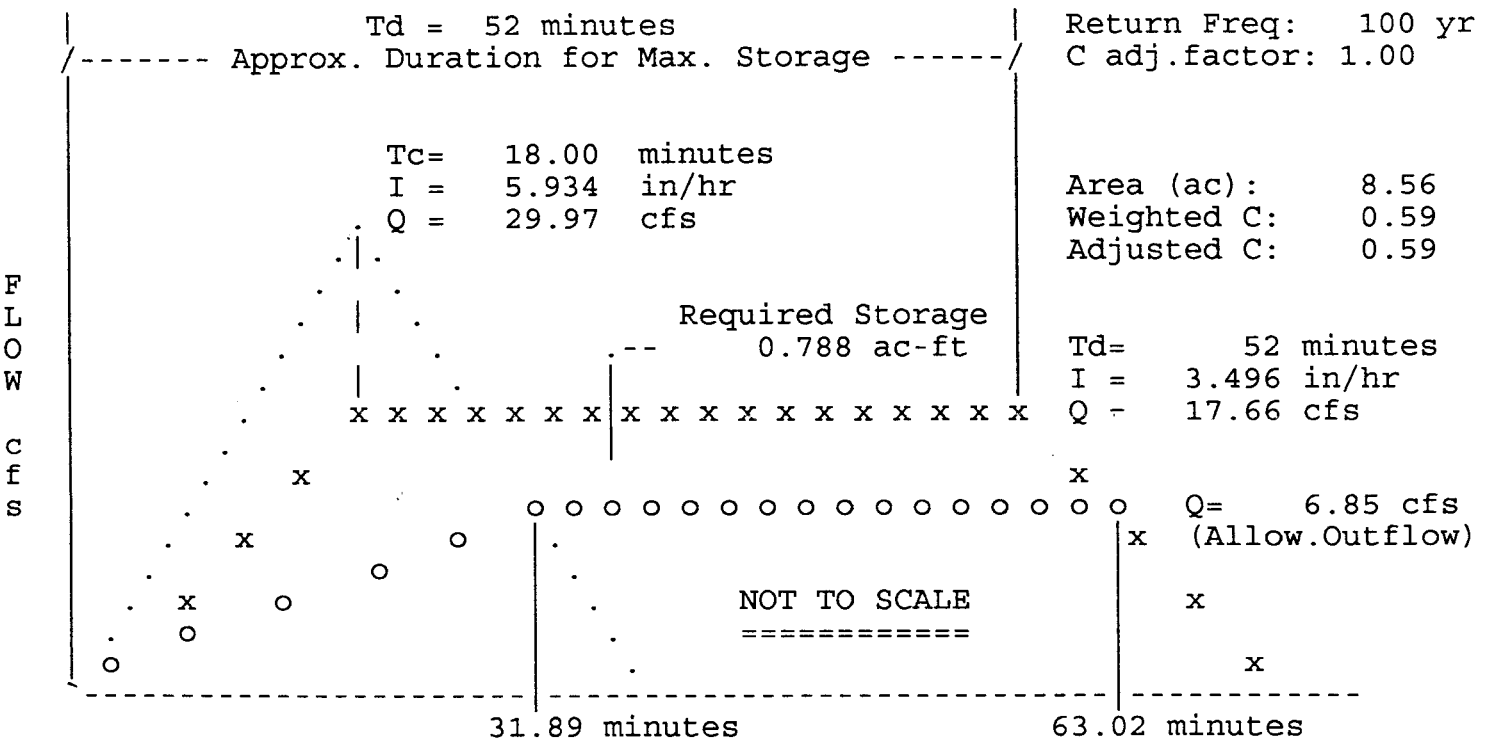
Quick TR-55 Ver.5.46 S/N:
Executed: 16:18:05 04-12-2005

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 100 YEAR STORM

RETURN FREQUENCY: 100 yr	Allowable Outflow: 6.85 cfs
'C' Adjustment: 1.000	Required Storage: 0.788 ac-ft
Peak Inflow: 17.66 cfs	Inflow .HYD stored: 21666-C .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 16:18:05 04-12-2005

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 100 YEAR STORM

**** Modified Rational Hydrograph *****

Weighted C = 0.590 Area= 8.560 acres Tc = 18.00 minutes

Adjusted C = 0.590 Td= 52.00 min. I= 3.50 in/hr Qp= 17.66 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: 21666-C .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.083 Hours Time on left represents time for first Q in each row.						
0.050	2.94	7.85	12.75	17.66	17.66	17.66	17.66
0.633	17.66	17.66	17.66	16.68	11.77	6.87	1.96
1.217	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 16:18:05 04-12-2005

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 100 YEAR STORM

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
DETAINED	0.590	8.56						
			18.00	0.590	0.590	5.934	8.56	29.97

Quick TR-55 Ver.5.46 S/N:
Executed: 16:18:05 04-12-2005

MODIFIED RATIONAL METHOD
---- Grand Summary For All Storm Frequencies ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 100 YEAR STORM

Area = 8.56 acres Tc = 18.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
100	0.590	52	3.496	17.66	6.85	1.265	0.788

Executed: 16:18:05 04-12-2005

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

POST-DEVELOPMENT DETAINED DRAINAGE AREA FOR 100 YEAR STORM

RETURN FREQUENCY: 100 yr `C' Adjustment = 1.000 Allowable Q = 6.85 cfs

Hydrograph file duration= 52.00 minutes
Hydrograph file: 21666-C .HYD Tc = 18.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.590	0.590	18	5.934	8.56	29.97	0.743	0.573
0.590	0.590	20	5.690	8.56	28.74	0.792	0.604
0.590	0.590	30	4.750	8.56	23.99	0.991	0.713
0.590	0.590	40	4.080	8.56	20.61	1.135	0.767
0.590	0.590	50	3.580	8.56	18.08	1.245	0.786
0.590	0.590	52	3.496	8.56	17.66	1.265	0.788
0.590	0.590	60	3.190	8.56	16.11	1.331	0.782
0.590	0.590	120	1.920	8.56	9.70	1.603	0.511

Storage Maximum

POND-2 Version: 5.20
S/N:

NEW DETENTION AREA

CALCULATED 04-12-2005 16:14:58
DISK FILE: H:\JOBS\PONDPACK\DATA2\21666 .VOL

Planimeter scale: 1 inch = 50 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	* Volume (acre-ft)	Volume Sum (acre-ft)
858.50	0.40	0.02	0.00	0.00	0.00
859.00	2.46	0.14	0.22	0.04	0.04
860.00	4.45	0.26	0.59	0.20	0.23
861.00	5.09	0.29	0.82	0.27	0.51
862.00	5.76	0.33	0.93	0.31	0.82
863.00	6.45	0.37	1.05	0.35	1.17
864.00	7.16	0.41	1.17	0.39	1.56

$$IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

$$Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))$$

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: 21666 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

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OUTLET STRUCTURE PROPOSED NEW DETETION AREA

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Outlet Structure File: H:\JOBS\PONDPACK\DATA2\21666 .STR
Planimeter Input File: H:\JOBS\PONDPACK\DATA2\21666 .VOL
Rating Table Output File: H:\JOBS\PONDPACK\DATA2\21666 .PND

Min. Elev.(ft) = 858.5 Max. Elev.(ft) = 864 Incr.(ft) = .2

Additional elevations (ft) to be included in table:
* *

****
SYSTEM CONNECTIVITY
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Structure	No.	Q Table		Q Table
WEIR-VR	2		->	2
CULVERT-CR	1		->	1

Outflow rating table summary was stored in file:
H:\JOBS\PONDPACK\DATA2\21666 .PND

Outlet Structure File: 21666 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

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OUTLET STRUCTURE PROPOSED NEW DETETION AREA

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	858.50
E2 elev.(ft)?	864
Diam. (ft)?	1
Inv. el.(ft)?	858.50
Slope (ft/ft)?	.005
T1 ratio?	
T2 ratio?	
K Coeff.?	.0098
M Coeff.?	2
c Coeff.?	.0398
Y Coeff.?	.67
Form 1 or 2?	1
Slope factor?	-.5

Outlet Structure File: 21666 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

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OUTLET STRUCTURE PROPOSED NEW DETETION AREA

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>>>>>> Structure No. 2 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	862.11
E2 elev.(ft)?	864
Weir coefficient?	3.33
Weir elev.(ft)?	862.11
Length (ft)?	9
Contracted/Suppressed (C/S)?	C

Outlet Structure File: 21666 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

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OUTLET STRUCTURE PROPOSED NEW DETETION AREA

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***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
858.50	0.0	1
858.70	0.1	1
858.90	0.5	1
859.10	1.0	1
859.30	1.6	1
859.50	2.3	1
859.70	2.9	1
859.90	3.4	1
860.10	3.8	1
860.30	4.2	1
860.50	4.5	1
860.70	4.9	1
860.90	5.2	1
861.10	5.5	1
861.30	5.7	1
861.50	6.0	1
861.70	6.3	1
861.90	6.5	1
862.10	6.7	1
862.30	9.4	2 +1
862.50	14.4	2 +1
862.70	20.8	2 +1
862.90	28.3	2 +1
863.10	36.7	2 +1
863.30	45.9	2 +1
863.50	55.8	2 +1
863.70	66.3	2 +1
863.90	77.5	2 +1
864.00	0.0	

Outlet Structure File: 21666 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

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OUTLET STRUCTURE PROPOSED NEW DETETION AREA

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Outflow Rating Table for Structure #2
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
858.50	0.0	E < Inv.El.= 862.11
858.70	0.0	E < Inv.El.= 862.11
858.90	0.0	E < Inv.El.= 862.11
859.10	0.0	E < Inv.El.= 862.11
859.30	0.0	E < Inv.El.= 862.11
859.50	0.0	E < Inv.El.= 862.11
859.70	0.0	E < Inv.El.= 862.11
859.90	0.0	E < Inv.El.= 862.11
860.10	0.0	E < Inv.El.= 862.11
860.30	0.0	E < Inv.El.= 862.11
860.50	0.0	E < Inv.El.= 862.11
860.70	0.0	E < Inv.El.= 862.11
860.90	0.0	E < Inv.El.= 862.11
861.10	0.0	E < Inv.El.= 862.11
861.30	0.0	E < Inv.El.= 862.11
861.50	0.0	E < Inv.El.= 862.11
861.70	0.0	E < Inv.El.= 862.11
861.90	0.0	E < Inv.El.= 862.11
862.10	0.0	E < Inv.El.= 862.11
862.30	2.5	H =.19
862.50	7.2	H =.39
862.70	13.4	H =.59
862.90	20.7	H =.79
863.10	28.9	H =.990
863.30	37.9	H =1.19
863.50	47.6	H =1.39
863.70	58.0	H =1.59
863.90	68.9	H =1.79
864.00	0.0	E = or > E2=864

C = 3.33 L (ft) = 9
H (ft) = Table elev. - Invert elev. (862.11 ft)
Q (cfs) = C * (L-.2H) * (H**1.5) -- Contracted Weir

Outlet Structure File: 21666 .STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

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OUTLET STRUCTURE PROPOSED NEW DETETION AREA

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Outflow Rating Table for Structure #1
CULVERT-CR Circular Culvert (With Inlet Control)

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages		
858.50	0.0	No headwater		
858.70	0.1	Equ.1: HW =.2	dc=.15	Ac=.074
858.90	0.5	Equ.1: HW =.4	dc=.299	Ac=.197
859.10	1.0	Equ.1: HW =.6	dc=.421	Ac=.314
859.30	1.6	Equ.1: HW =.8	dc=.54	Ac=.433
859.50	2.3	Equ.1: HW =1.0	dc=.647	Ac=.538
859.70	2.9	Transition: HW =1.2		
859.90	3.4	Submerged: HW =1.4		
860.10	3.8	Submerged: HW =1.6		
860.30	4.2	Submerged: HW =1.8		
860.50	4.5	Submerged: HW =2.0		
860.70	4.9	Submerged: HW =2.2		
860.90	5.2	Submerged: HW =2.4		
861.10	5.5	Submerged: HW =2.6		
861.30	5.7	Submerged: HW =2.8		
861.50	6.0	Submerged: HW =3.0		
861.70	6.3	Submerged: HW =3.2		
861.90	6.5	Submerged: HW =3.4		
862.10	6.7	Submerged: HW =3.6		
862.30	7.0	Submerged: HW =3.8		
862.50	7.2	Submerged: HW =4.0		
862.70	7.4	Submerged: HW =4.2		
862.90	7.6	Submerged: HW =4.4		
863.10	7.8	Submerged: HW =4.6		
863.30	8.0	Submerged: HW =4.8		
863.50	8.2	Submerged: HW =5.0		
863.70	8.4	Submerged: HW =5.2		
863.90	8.6	Submerged: HW =5.4		
864.00	0.0	E = or > E2=864		

Used Unsubmerged Equ. Form (1) for elev. less than 859.66 ft
Used Submerged Equation for elevations greater than 859.8 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft) at dc

Transition flows interpolated from the following values:
E1=859.66 ft; Q1=2.75 cfs; Dc=.71 ft; E2=859.8 ft; Q2=3.14 cfs

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* POND ROUTING FOR POST-DEVELOPEMENT 50 YEAR STORM *
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Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666D50.HYD
Rating Table file: H:\JOBS\PONDPACK\DATA2\21666 .PND

----INITIAL CONDITIONS----
Elevation = 858.50 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
858.50	0.0	0.000	0.0	0.0
858.85	0.4	0.019	5.6	6.0
859.20	1.3	0.067	19.5	20.8
859.55	2.4	0.130	37.8	40.2
859.90	3.4	0.207	60.2	63.6
860.25	4.1	0.297	86.3	90.4
860.60	4.7	0.392	113.8	118.5
860.95	5.2	0.491	142.7	147.9
861.30	5.7	0.595	172.9	178.6
861.65	6.2	0.704	204.4	210.6
862.00	6.6	0.817	237.3	243.9
862.35	7.0	0.935	271.6	278.6
862.70	7.4	1.058	307.3	314.7
863.05	7.7	1.186	344.4	352.1
863.40	8.1	1.319	383.0	391.1
863.75	8.4	1.456	423.0	431.4

Time increment (t) = 0.083 hrs.

Pond File: H:\JOBS\PONDPACK\DATA2\21666 .PND
Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666D50.HYD
Outflow Hydrograph: H:\JOBS\PONDPACK\DATA2\OUT .HYD

INFLOW HYDROGRAPH

TIME (hrs)	INFLOW (cfs)
0.050	2.94
0.133	7.83
0.217	12.73
0.300	17.63
0.383	17.63
0.467	17.63
0.550	17.63
0.633	17.63
0.717	17.63
0.800	14.69
0.883	9.79
0.967	4.90
1.050	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	0.0	0.0	0.00	858.50
10.8	9.4	10.8	0.69	858.96
20.6	26.3	29.9	1.82	859.37
30.4	50.5	56.7	3.10	859.80
35.3	77.8	85.7	3.98	860.19
35.3	103.9	113.0	4.58	860.53
35.3	129.0	139.1	5.05	860.85
35.3	153.3	164.3	5.47	861.14
35.3	176.9	188.6	5.86	861.41
32.3	196.9	209.2	6.18	861.63
24.5	208.7	221.3	6.33	861.76
14.7	210.7	223.4	6.35	861.78
4.9	203.0	215.6	6.26	861.70

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: H:\JOBS\PONDPACK\DATA2\21666 .PND
Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666D50.HYD
Outflow Hydrograph: H:\JOBS\PONDPACK\DATA2\OUT .HYD

Starting Pond W.S. Elevation = 858.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	17.63 cfs
Peak Outflow	=	6.35 cfs
Peak Elevation	=	861.78 ft

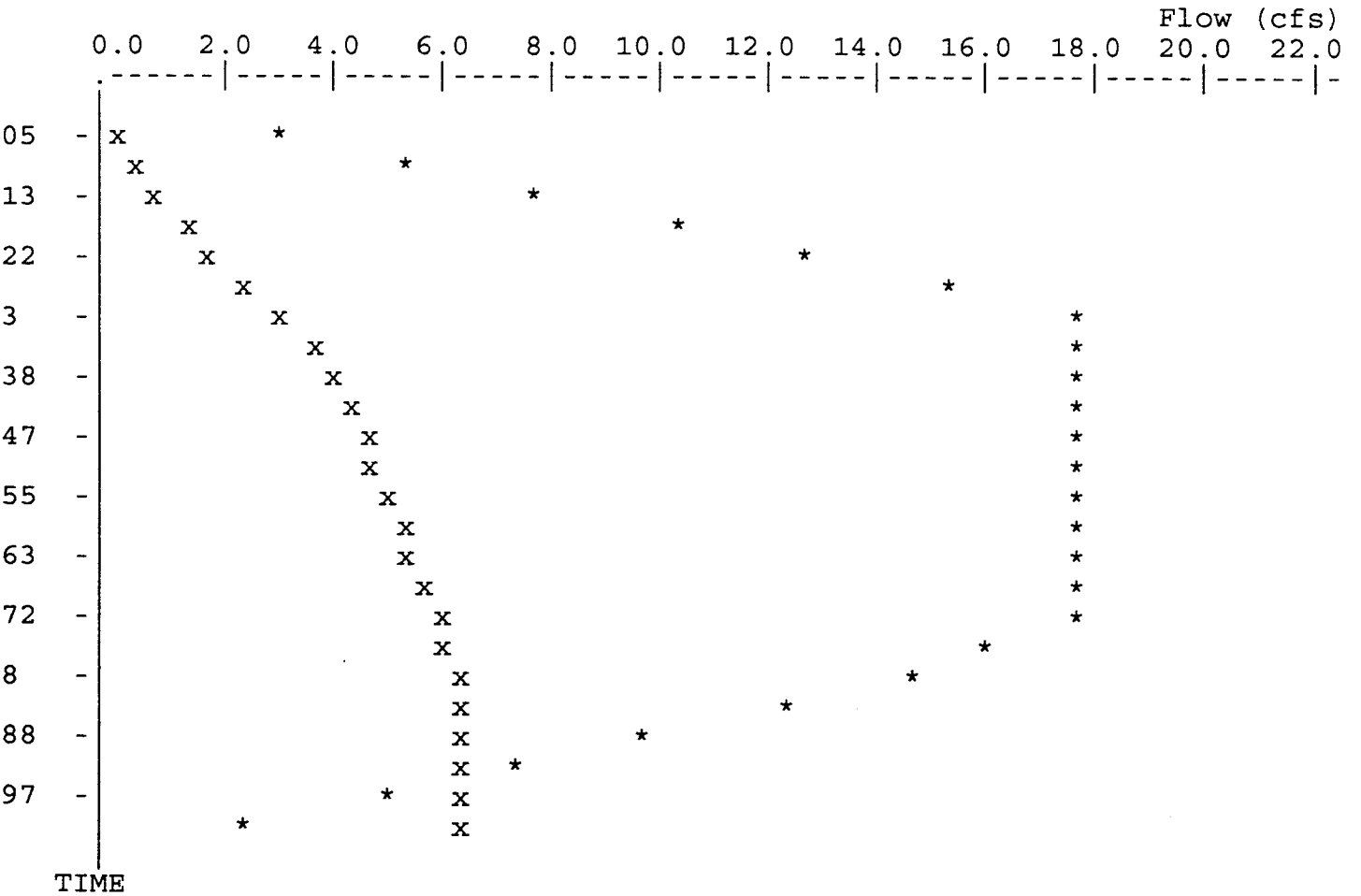
***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	0.75 ac-ft
Total Storage in Pond	=	0.75 ac-ft

Warning: Inflow hydrograph truncated on left side.

Pond File: H:\JOBS\PONDPACK\DATA2\21666 .PND
Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666D50.HYD
Outflow Hydrograph: H:\JOBS\PONDPACK\DATA2\OUT .HYD
EXECUTED: 04-12-2005
13:28:05

Peak Inflow = 17.63 cfs
Peak Outflow = 6.35 cfs
Peak Elevation = 861.78 ft



* File: H:\JOBS\PONDPACK\DATA2\21666D50.HYD Qmax = 17.6 cfs
x File: H:\JOBS\PONDPACK\DATA2\OUT .HYD Qmax = 6.3 cfs

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* PROPOSED POND ROUTING FOR 100 YEAR STORM *
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Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666-C .HYD
Rating Table file: H:\JOBS\PONDPACK\DATA2\21666 .PND

----INITIAL CONDITIONS----
Elevation = 858.50 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
858.50	0.0	0.000	0.0	0.0
858.85	0.4	0.019	5.6	6.0
859.20	1.3	0.067	19.5	20.8
859.55	2.4	0.130	37.8	40.2
859.90	3.4	0.207	60.2	63.6
860.25	4.1	0.297	86.3	90.4
860.60	4.7	0.392	113.8	118.5
860.95	5.2	0.491	142.7	147.9
861.30	5.7	0.595	172.9	178.6
861.65	6.2	0.704	204.4	210.6
862.00	6.6	0.817	237.3	243.9
862.35	7.0	0.935	271.6	278.6
862.70	7.4	1.058	307.3	314.7
863.05	7.7	1.186	344.4	352.1
863.40	8.1	1.319	383.0	391.1
863.75	8.4	1.456	423.0	431.4

Time increment (t) = 0.083 hrs.

Pond File: H:\JOBS\PONDPACK\DATA2\21666 .PND
Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666-C .HYD
Outflow Hydrograph: H:\JOBS\PONDPACK\DATA2\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.050	2.94	-----	0.0	0.0	0.00	858.50
0.133	7.85	10.8	9.4	10.8	0.69	858.96
0.217	12.75	20.6	26.4	30.0	1.82	859.37
0.300	17.66	30.4	50.6	56.8	3.11	859.80
0.383	17.66	35.3	77.9	85.9	3.98	860.19
0.467	17.66	35.3	104.1	113.2	4.59	860.53
0.550	17.66	35.3	129.3	139.4	5.06	860.85
0.633	17.66	35.3	153.6	164.6	5.47	861.14
0.717	17.66	35.3	177.2	189.0	5.86	861.41
0.800	17.66	35.3	200.1	212.6	6.22	861.67
0.883	16.68	34.3	221.5	234.5	6.49	861.90
0.967	11.77	28.5	236.6	249.9	6.67	862.06
1.050	6.87	18.6	241.8	255.2	6.73	862.11
1.133	1.96	8.8	237.2	250.6	6.68	862.07
1.217	0.00	2.0	226.1	239.2	6.54	861.95

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: H:\JOBS\PONDPACK\DATA2\21666 .PND
Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666-C .HYD
Outflow Hydrograph: H:\JOBS\PONDPACK\DATA2\OUT .HYD

Starting Pond W.S. Elevation = 858.50 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	17.66 cfs
Peak Outflow	=	6.73 cfs
Peak Elevation	=	862.11 ft

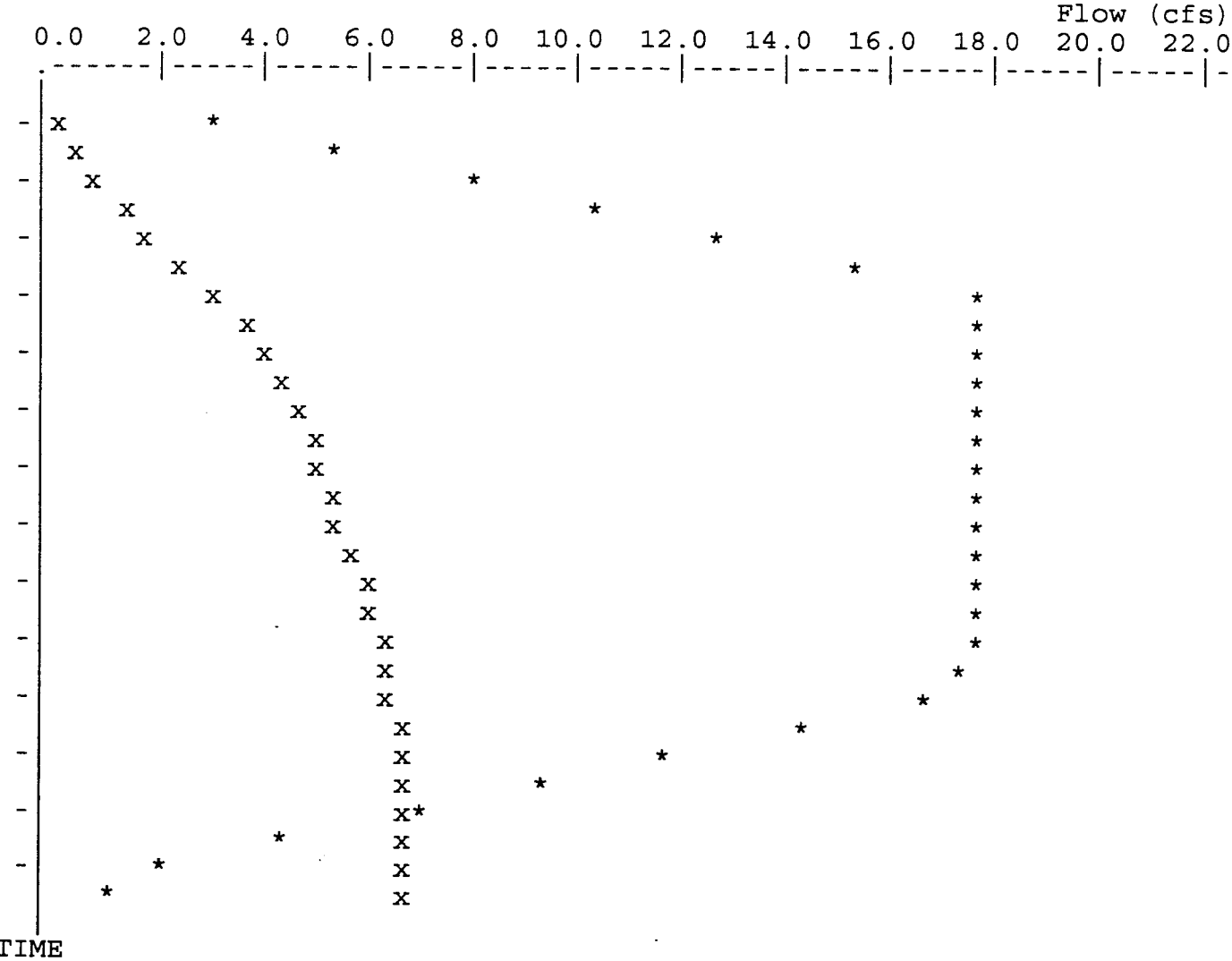
***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	0.86 ac-ft
Total Storage in Pond	=	0.86 ac-ft

Warning: Inflow hydrograph truncated on left side.

Pond File: H:\JOBS\PONDPACK\DATA2\21666 .PND
Inflow Hydrograph: H:\JOBS\PONDPACK\DATA2\21666-C .HYD
Outflow Hydrograph: H:\JOBS\PONDPACK\DATA2\OUT .HYD
EXECUTED: 04-12-2005
15:45:12

Peak Inflow = 17.66 cfs
Peak Outflow = 6.73 cfs
Peak Elevation = 862.11 ft



File: H:\JOBS\PONDPACK\DATA2\21666-C .HYD Qmax = 17.7 cfs
File: H:\JOBS\PONDPACK\DATA2\OUT .HYD Qmax = 6.7 cfs

EMERGENCY OVER FLOW

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	30.0000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0200
Height	1.0000 ft
Bottom width	10.0000 ft
Left slope	0.3300 ft/ft (V/H)
Right slope	0.3300 ft/ft (V/H)

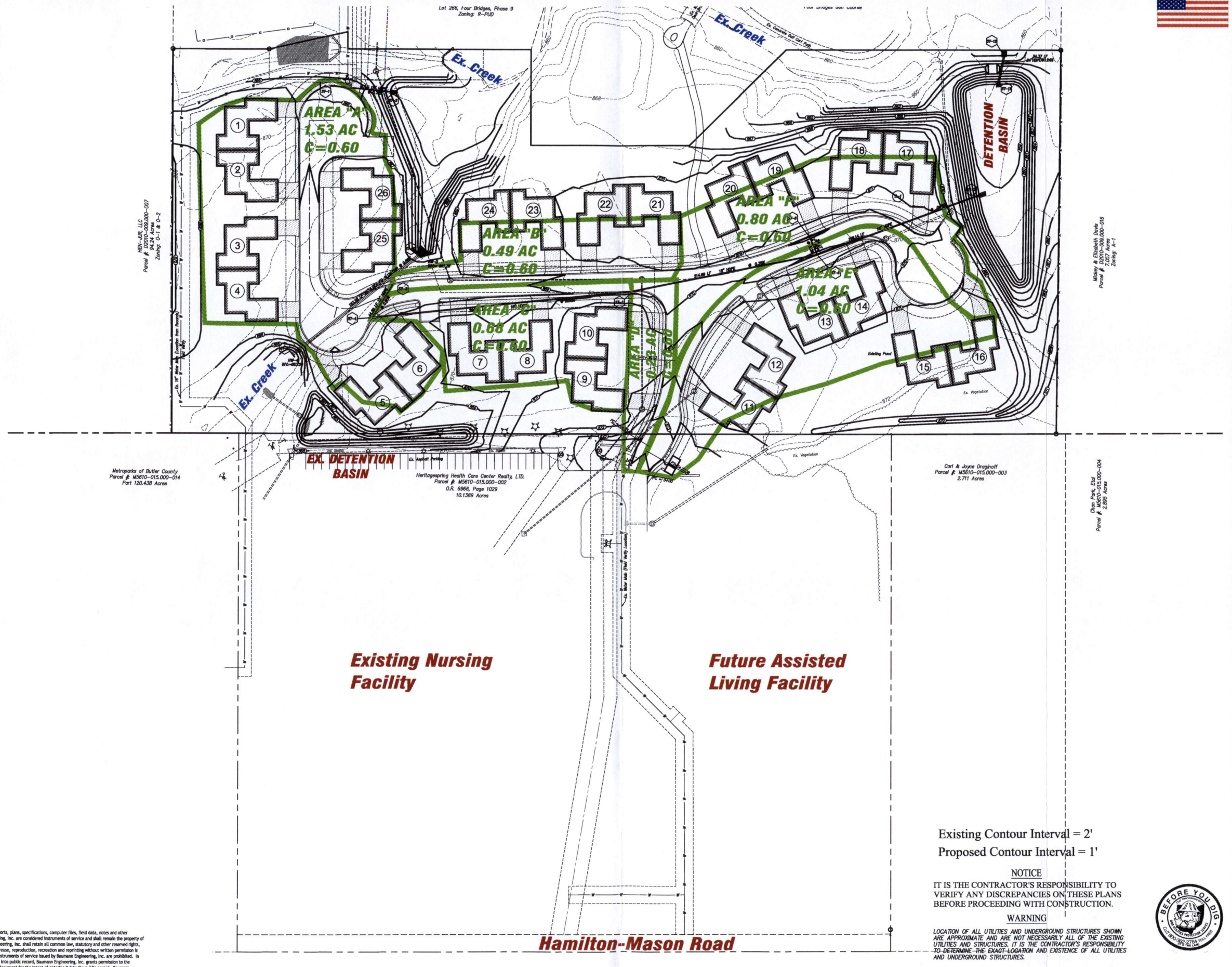
Computed Results:

Depth	0.5606 ft
Velocity	4.5741 fps
Full Flowrate	83.1126 cfs
Flow area	6.5586 ft2
Flow perimeter	13.5779 ft
Hydraulic radius	0.4830 ft
Top width	13.3977 ft
Area	13.0303 ft2
Perimeter	16.3821 ft
Percent full	56.0621 %

Critical Information

Critical depth	0.6128 ft
Critical slope	0.0073 ft/ft
Critical velocity	4.1288 fps
Critical area	7.2661 ft2
Critical perimeter	13.9110 ft
Critical hydraulic radius	0.5223 ft
Critical top width	13.7140 ft
Specific energy	0.8858 ft
Minimum energy	0.9192 ft
Froude number	1.1526
Flow condition	Supercritical

NORTH



Existing Contour Interval = 2'

Proposed Contour Interval = 1'

NOTICE

IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ANY DISCREPANCIES ON THESE PLANS BEFORE PROCEEDING WITH CONSTRUCTION.

WARNING

LOCATION OF ALL UTILITIES AND UNDERGROUND STRUCTURES SHOWN ARE APPROXIMATE AND ARE NOT NECESSARILY ALL OF THE EXISTING UTILITIES AND STRUCTURES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT LOCATION AND EXISTENCE OF ALL UTILITIES AND UNDERGROUND STRUCTURES.

Drawing #:

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STORM SEWER SYSTEM MAP

HeritageSpring Cottages
9.6717 Acre Parcel
Parcel # D2010-009.000-019
Hamilton-Mason Road
Section 7, Town 3, Range 3,
Liberty Township
Butler County, Ohio

SURVEYOR'S SEAL

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ENGINEER'S SEAL

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REVISIONS

SCALE: None

Storm Drainage Map

SHEET #:

STM

PROJECT #: 21666

DATE: 5.27.2005

H:\JOBS\21666\DESIGN\SWPPP\Heritage Storm Sewer Map, 5/31/2005 4:14:01 PM, 1:1.00000, Baumann Engineering, Inc.

Bid Issue - Document Subject to Change.

BAUMANN ENGINEERING, INC.

ORIGINAL

STORM PIPING CALCULATION																							
PROJECT:	HERITAGE COTTAGES																						
PROJ. #:	21666																						
DATE:	4/9/05																						
STRUCT. NUMBER	STRUCT. TYPE	AREA I.D.	INCREM. AREA	TOTAL ACRES	C	INCREM. AC	SUM AC	TIME TO INLET	TIME IN PIPE	TOTAL MINUTES	INTENS.	REQ'D CFS	PIPE SIZE	N	PIPE GRADE	VEL. FPS	CAP. CFS	PIPE LENGTH	UPPER END	LOWER END	RIM ELEV	DEPTH STRUCT.	WINDOW ELEV
ST-1	CB#3	A	1.530	1.530	0.60	0.918	0.918	10.00		10.00	5.15	4.73	15	0.013	0.75	4.56	5.59	67.00	863.00	862.50	866.55	3.55	
ST-3	CB#3	B	0.490	0.490	0.60	0.294	0.294	10.00		10.00	5.15	1.51	12	0.013	0.60	3.51	2.76	44.59	865.49	865.22	868.24	2.75	
ST-4	CB#3	C	0.680	1.170	0.60	0.408	0.702		0.24	10.24	5.11	3.59	18	0.013	0.35	3.52	6.21	299.81	865.00	863.95	868.13	3.13	
ST-5	CB#3	D	0.230	1.400	0.60	0.138	0.840		1.42	11.67	4.90	4.12	18	0.013	0.35	3.52	6.21	214.17	863.95	863.20	869.60	5.65	
ST-6	CB#3	E+F	1.840	3.240	0.60	1.104	1.944		1.02	12.68	4.76	9.26	18	0.013	0.78	5.25	9.28	198.14	863.20	861.66	869.16	5.96	
ST-8	CB#3	F	0.800	0.800	0.60	0.480	0.480	10.00		10.00	5.15	2.47	12	0.013	3.00	7.86	6.17	24.00	866.16	865.44	869.16	3.00	
CUL	HWL		0.800	0.800	0.60	0.480	0.480	10.00		10.00	5.15	2.47	36	0.013	0.68	7.78	55.00	183.56	863.00	861.75			