O'FALLON LAKES L.P.

STORM WATER MANAGEMENT AND DETENTION REPORT

Prepared for:

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Stock Project No. 202-2927

George M. Stock, P.E. E-25116

STATE OF MISSOURI
GEORGE MICHAEL STOCK
NUMBER E-25116
REGISTERED PROFESSIONAL ENGINEER

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1. EXECUTIVE SUMMARY

Stock & Associates Consulting Engineers prepared this report at the request of Gundaker Commercial Group, for the project titled "O'Fallon Lakes L.P.".

The proposed multi-family residential development is located on the Southeastern corner of the intersection of O'Fallon Road and Veterans Memorial Parkway in the City of O'Fallon, Missouri. The site is currently comprised of approximately 20.19 acres of heavily wooded area.

Storm water management for this development will provide two detention basins for the two watersheds on the property. Proposed basins #1 and #2 have been designed to detain the differential run-off for the 2, 15, 25, and 100-yr, 20 minute storms per the City of O'Fallon requirements.

Using the Rational method, the pre and post developed discharge rates for each watershed were calculated for the 2, 15, 25 and 100-year storm. The basins will detain the differential runoff with high water elevations of 568.86 and 578.41 in basins #1 & #2, respectively for the 100yr event assuming the low flow orifice is blocked. Each basin will maintain greater than one (1) foot of free board in this event.

The Allowable Release Rate (A.R.R) was calculated by adding the pre-developed release rate to the pre-developed off-site within the system and subtracting the post-developed by-pass and the release from the basin. The outfall structures to the basins were designed to release less than the A.R.R. for the 2, 15, 25, and 100-yr storm.

2. SUMMARY OF ALLOWABLE RELEASE RATES
(2yr, 15yr, 25yr and 100yr)

Basin 1

Pre-developed	Onsite (cfs)	Offsite (cfs)	Offsite within system (cfs)	Total (cfs)
2yr	25.26	78.64	9.77	113.67
15yr	37.42	116.50	14.49	168.41
25yr	46.22	143.86	17.90	207.98
100yr	59.03	184.02	22.89	265.94

Post-developed	Onsite (cfs)	Offsite (cfs)	Bypass (cfs)
2yr	13.27	78.64	18.02
15yr	19.66	116.50	26.70
25yr	24.26	143.86	32.97
100yr	31.03	184.02	42.13

Therefore:
A.R.R. (2yr) = 113.67 - 78.64 - 18.02 - Basin #1 Outfall (2yr)= 17.01 cfs
A.R.R. (15yr) = 168.41 – 116.50 – 26.70 - Basin #1 Outfall (15yr)= 25.21 cfs
A.R.R. (25yr) = 207.98 – 143.86 – 32.97 - Basin #1 Outfall (25yr)= 31.15 cfs
A.R.R. (100yr) = 265.94 - 184.02 – 42.13 - Basin #1 Outfall (100yr)= 39.79 cfs

Basin 2

Pre-developed	Onsite (cfs)	Offsite (cfs)	Offsite within system (cfs)	Total (cfs)
2yr	7.80	0.00	3.03	10.83
15yr	11.56	0.00	4.49	16.05
25yr	14.28	0.00	5.54	19.82
100yr	18.23	0.00	7.09	25.32

Post-developed	Onsite (cfs)	Offsite (cfs)	Bypass (cfs)
2yr	12.27	0.00	3.58
15yr	18.18	0.00	5.30
25yr	22.44	0.00	6.55
100yr	28.71	0.00	8.36

Therefore:
A.R.R. (2yr) = 10.83 – 3.58 - Basin #2 Outfall (2yr)= 7.25 cfs
A.R.R. (15yr) = 16.05 – 5.30 - Basin #2 Outfall (15yr)= 10.75 cfs
A.R.R. (25yr) = 19.82 – 6.55 - Basin #2 Outfall (25yr)= 13.27 cfs
A.R.R. (100yr) = 25.32 –8.36 - Basin #2 Outfall (100yr)= 16.96 cfs

3. OUTFALL STRUCTURE ANALYSIS

A. Basin #1

Name.... PR 10

File.... F:\DRAW2900\2022927\DETENTION\BASIN1.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 564.00 ft
Increment = .10 ft
Max. Elev.= 570.00 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
Culvert-Box		--->	TW	564.000	570.000
Weir-Rectangular		--->	TW	567.750	570.000

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID	=	
Structure Type	=	Culvert-Box
No. Barrels	=	2
Barrel Height	=	.50 ft
Barrel Width	=	3.00 ft
Upstream Invert	=	564.00 ft
Dnstream Invert	=	563.99 ft
Horiz. Length	=	1.00 ft
Barrel Length	=	1.00 ft
Barrel Slope	=	.01001 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130
Ke	=	.5000 (forward entrance loss)
Kb	=	.038410 (per ft of full flow)
Kr	=	.5000 (reverse entrance loss)
HW Convergence	=	.001 +/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0610
Inlet Control M	=	.7500
Inlet Control c	=	.04230
Inlet Control Y	=	.8200
T1 ratio (HW/D)	=	1.238
T2 ratio (HW/D)	=	1.492
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 = 564.62 ft ---> Flow = 3.71 cfs
At T2 Elev = 564.75 ft ---> Flow = 4.24 cfs

OUTLET STRUCTURE INPUT DATA

Structure ID =
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 567.75 ft
Weir Length = 12.00 ft
Weir Coeff. = 3.330000

Weir TW effects (Use adjustment equation)

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

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

3. OUTFALL STRUCTURE ANALYSIS

A. Basin #2

File.... F:\DRAW2900\2022927\DETENTION\BASIN2.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 574.00 ft
Increment = .10 ft
Max. Elev.= 580.00 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
Culvert-Box		--->	TW	574.000	580.000
Weir-Rectangular		--->	TW	577.750	580.000

TW SETUP, DS Channel

File.... F:\DRAW2900\2022927\DETENTION\BASIN2.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID	=	
Structure Type	=	Culvert-Box
No. Barrels	=	1
Barrel Height	=	.50 ft
Barrel Width	=	2.50 ft
Upstream Invert	=	574.00 ft
Dnstream Invert	=	573.99 ft
Horiz. Length	=	1.00 ft
Barrel Length	=	1.00 ft
Barrel Slope	=	.01001 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130
Ke	=	.5000 (forward entrance loss)
Kb	=	.039880 (per ft of full flow)
Kr	=	.5000 (reverse entrance loss)
HW Convergence	=	.001 +/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0610
Inlet Control M	=	.7500
Inlet Control c	=	.04230
Inlet Control Y	=	.8200
T1 ratio (HW/D)	=	1.238
T2 ratio (HW/D)	=	1.492
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 = 574.62 ft ---> Flow = 3.09 cfs
At T2 Elev = 574.75 ft ---> Flow = 3.54 cfs

File.... F:\DRAW2900\2022927\DETENTION\BASIN2.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID =
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 577.75 ft
Weir Length = 12.00 ft
Weir Coeff. = 3.330000

Weir TW effects (Use adjustment equation)

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

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

4. DETENTION BASIN VOLUMES

A. Basin #1

Type.... Vol: Elev-Area
Name.... P 10

File.... F:\DRAW2900\2022927\DETENTION\BASIN1.PPW
Title... Basin 1

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
564.00	-----	6163	0	.000	.000
565.00	-----	7328	20211	.155	.155
566.00	-----	8631	23912	.183	.338
567.00	-----	9946	27842	.213	.551
568.00	-----	11491	32128	.246	.797
569.00	-----	12976	36678	.281	1.077
570.00	-----	14517	41218	.315	1.393

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

4. DETENTION BASIN VOLUMES

B. Basin #2

Type.... Vol: Elev-Area
Name.... P 10

File.... F:\DRAW2900\2022927\DETENTION\BASIN2.PPW
Title... Basin 2

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
574.00	-----	6217	0	.000	.000
575.00	-----	6952	19743	.151	.151
576.00	-----	7943	22326	.171	.322
577.00	-----	8810	25118	.192	.514
578.00	-----	9774	27863	.213	.727
579.00	-----	10714	30721	.235	.962
580.00	-----	11734	33660	.258	1.220

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

S/N: 721201d06a87 Stock & Associates
PondPack Ver: 7.0 (325) Compute Time: 13:52:13 Date: 09-10-2003

5. DETENTION BASIN #1 ROUTING

A. 2 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 10	READ HYG 10		HYG 10	2 yr

WARNING: Adding in hydrograph that is truncated on left...
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WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
HYG	10	2 yr	.628	.0100	23.04

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
P	10 IN	2 Yr.	.619	.0500	23.04

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 2 Yr.

Peak Discharge =	23.04 cfs
Time to Peak =	.0500 hrs
HYG Volume =	.619 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	23.04	23.04	23.04	23.04	23.04
.2500	23.04	23.04	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 2 Yr.
Outflow HYG file = NONE STORED - P 10 OUT 2 Yr.

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	564.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	23.04 cfs	at	.0500 hrs
Peak Outflow	=	16.84 cfs	at	.3000 hrs
Peak Elevation	=	565.74 ft		
Peak Storage	=	.287 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.619
- Infiltration	=	.000
- HYG Vol OUT	=	.619
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

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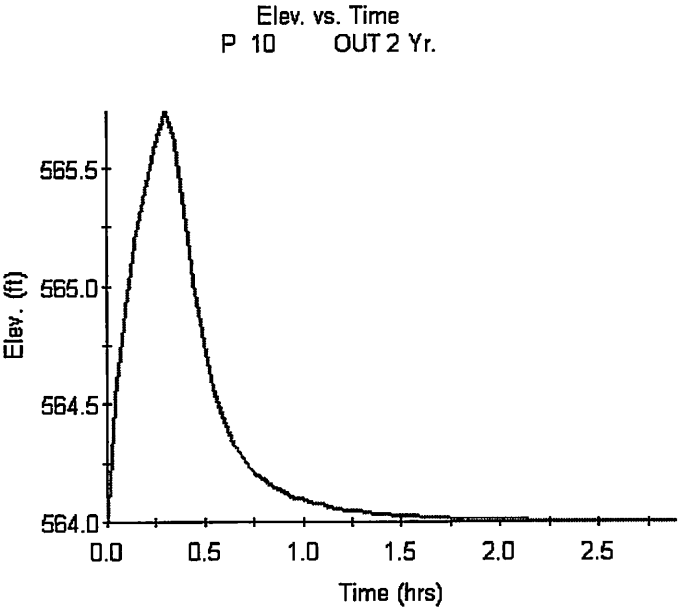

Currently Plotted Curves

P 10 OUT 2 Yr.

5. DETENTION BASIN #1 ROUTING

B. 15 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 10	READ HYG 10		HYG 10	15 yr

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INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
HYG	10	15 yr	.931	.0100	34.15

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
P	10 IN	15 Yr.	.917	.0500	34.15

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 15 Yr.

Peak Discharge =	34.15 cfs
Time to Peak =	.0500 hrs
HYG Volume =	.917 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	34.15	34.15	34.15	34.15	34.15
.2500	34.15	34.15	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 15 Yr.
Outflow HYG file = NONE STORED - P 10 OUT 15 Yr.

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	564.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	34.15 cfs	at	.0500 hrs
Peak Outflow	=	21.82 cfs	at	.3000 hrs
Peak Elevation	=	566.64 ft		
Peak Storage	=	.472 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.917
- Infiltration	=	.000
- HYG Vol OUT	=	.917
- Retained Vol	=	.000
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

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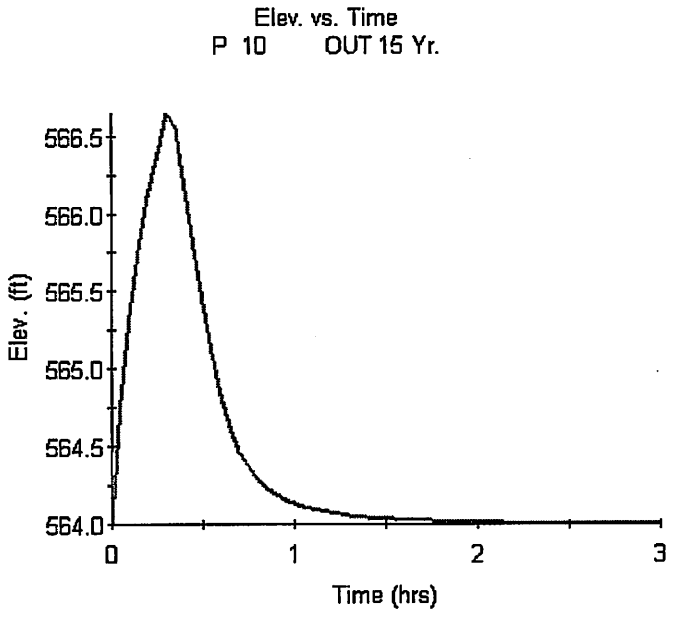

Currently Plotted Curves

P 10 OUT 15 Yr.

5. DETENTION BASIN #1 ROUTING

C. 25 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10   IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 10	READ HYG 10		HYG 10	25 yr

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INFLOWS TO: P 10   IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	HYG 10	25 yr	1.150	.0100	42.16

TOTAL FLOW INTO: P 10   IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	P 10 IN	25 Yr.	1.132	.0500	42.16

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 25 Yr.

Peak Discharge =	42.16 cfs
Time to Peak =	.0500 hrs
HYG Volume =	1.132 ac-ft

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HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	42.16	42.16	42.16	42.16	42.16
.2500	42.16	42.16	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir   = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10   IN 25 Yr.
Outflow HYG file = NONE STORED - P 10   OUT 25 Yr.

Pond Node   Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	564.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	42.16 cfs	at	.0500 hrs
Peak Outflow	=	24.73 cfs	at	.3000 hrs
Peak Elevation	=	567.28 ft		
Peak Storage	=	.616 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	1.132
- Infiltration	=	.000
- HYG Vol OUT	=	1.132
- Retained Vol	=	.000
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

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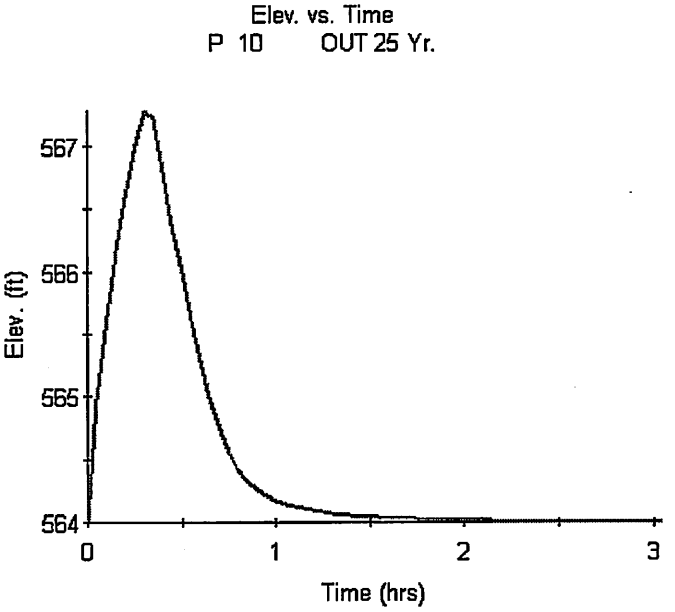

Currently Plotted Curves

P 10 OUT 25 Yr.

5. DETENTION BASIN #1 ROUTING

D. 100 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 10	READ HYG 10		HYG 10	100 yr

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WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	HYG 10	100 yr	1.471	.0100	53.92

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	P 10 IN	100 Yr	1.448	.0500	53.92

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 100 Yr

Peak Discharge =	53.92 cfs
Time to Peak =	.0500 hrs
HYG Volume =	1.448 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	53.92	53.92	53.92	53.92	53.92
.2500	53.92	53.92	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 100 Yr
Outflow HYG file = NONE STORED - P 10 OUT 100 Yr

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	564.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	53.92 cfs	at	.0500 hrs
Peak Outflow	=	36.52 cfs	at	.3000 hrs
Peak Elevation	=	568.11 ft		
Peak Storage	=	.824 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	1.448
- Infiltration	=	.000
- HYG Vol OUT	=	1.448
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

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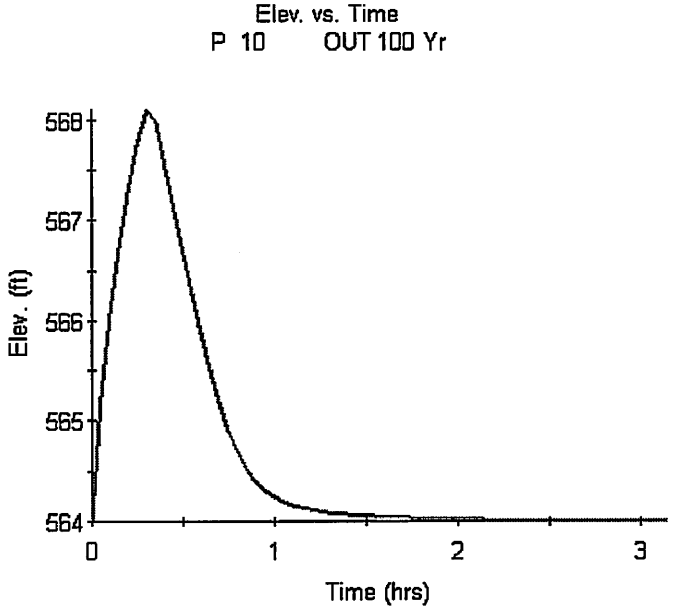

Currently Plotted Curves

P 10 OUT 100 Yr

5. DETENTION BASIN #1 ROUTING

E. 100 year event (low flow orifice blocked)

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 10	READ HYG 10		HYG 10	100 yr

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WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
HYG	10	100 yr	1.471	.0100	53.92

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
P	10 IN	100 Yr	1.448	.0500	53.92

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 100 Yr

Peak Discharge =	53.92 cfs
Time to Peak =	.0500 hrs
HYG Volume =	1.448 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	53.92	53.92	53.92	53.92	53.92
.2500	53.92	53.92	.00		

File.... F:\DRAW2900\2022927\DETENTION\BASIN1-LFB.PPW
Storm... 100 Yr. Tag: 100 Yr

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 100 Yr
Outflow HYG file = NONE STORED - P 10 OUT 100 Yr

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	564.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	53.92 cfs	at	.0500 hrs
Peak Outflow	=	46.65 cfs	at	.3000 hrs
Peak Elevation	=	568.86 ft		
Peak Storage	=	1.035 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	1.448
- Infiltration	=	.000
- HYG Vol OUT	=	.716
- Retained Vol	=	.732
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

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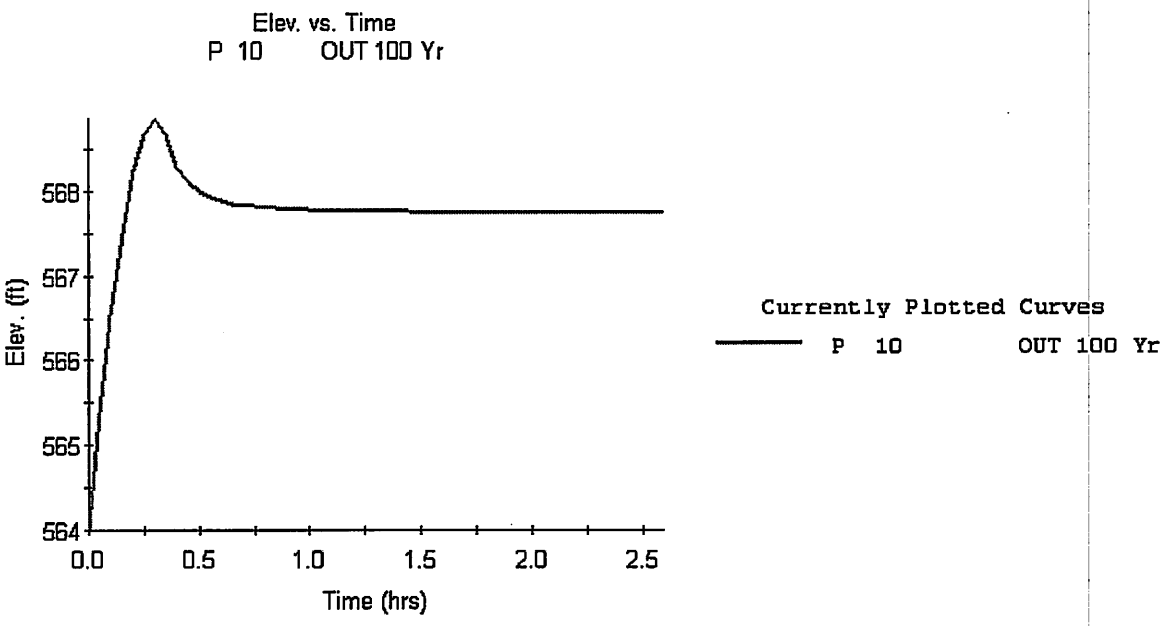

Elev. vs. Time
P 10 OUT 100 Yr
Elev. (ft)
568
567
566
565
564
0.0
0.5
1.0
1.5
2.0
2.5
Time (hrs)
Currently Plotted Curves
P 10 OUT 100 Yr

5. DETENTION BASIN #2 ROUTING

A. 2 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	READ HYG 20		HYG 20	2 yr 2

WARNING: Adding in hydrograph that is truncated on left...
WARNING: Missed peak when adding hydrograph...
WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	HYG 20	2 yr 2	.417	.0100	15.30

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	P 10 IN	2 yr	.411	.0500	15.30

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 2 yr

Peak Discharge =	15.30 cfs
Time to Peak =	.0500 hrs
HYG Volume =	.411 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	15.30	15.30	15.30	15.30	15.30
.2500	15.30	15.30	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 2 yr
Outflow HYG file = NONE STORED - P 10 OUT 2 yr

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	574.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

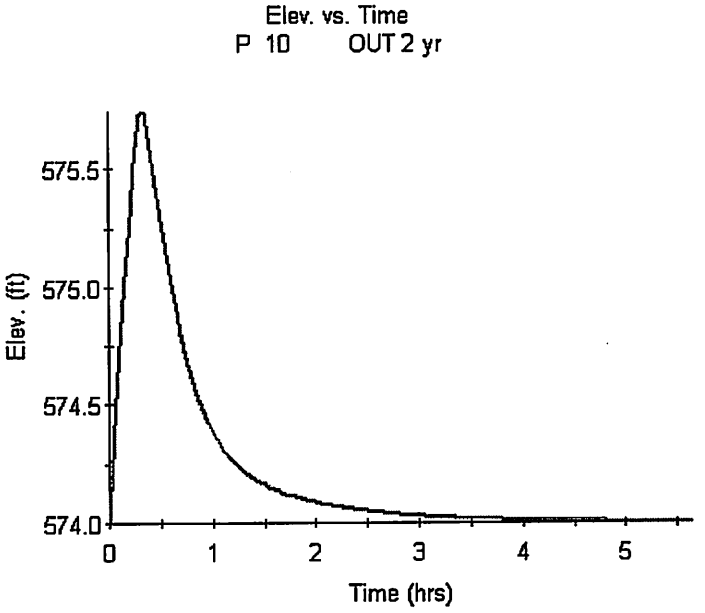
INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	15.30 cfs	at	.0500 hrs
Peak Outflow	=	7.02 cfs	at	.3500 hrs
Peak Elevation	=	575.74 ft		
Peak Storage	=	.276 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.411
- Infiltration	=	.000
- HYG Vol OUT	=	.411
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

WARNING: Inflow hydrograph truncated on left side.



Currently Plotted Curves

P 10 OUT 2 yr

5. DETENTION BASIN #2 ROUTING

B. 15 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	READ HYG 20		HYG 20	15 yr2

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WARNING: Missed peak when adding hydrograph...
WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
HYG	20	15 yr2	.618	.0100	22.67

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
P 10	IN	15 yr	.609	.0500	22.67

TOTAL NODE INFLOW...
HYG file =
HYG ID   = P 10   IN
HYG Tag = 15 yr

Peak Discharge =	22.67 cfs
Time to Peak =	.0500 hrs
HYG Volume =	.609 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	22.67	22.67	22.67	22.67	22.67
.2500	22.67	22.67	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir   = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10   IN 15 yr
Outflow HYG file = NONE STORED - P 10   OUT 15 yr

Pond Node   Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	574.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

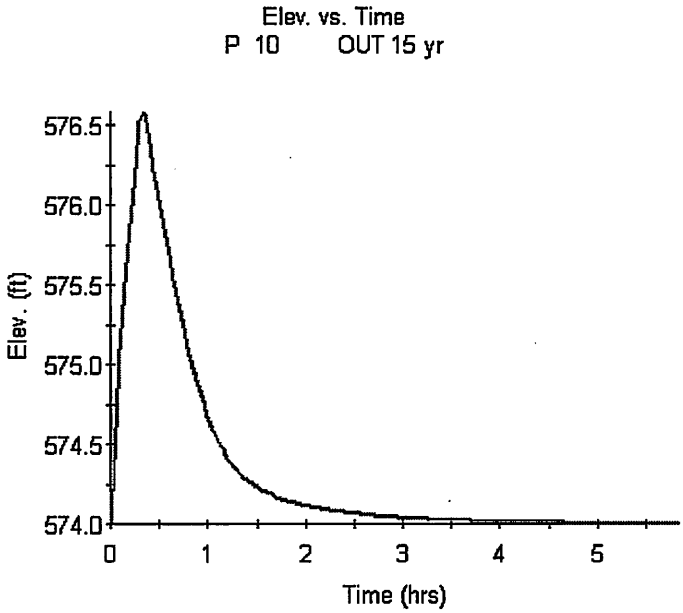
INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	22.67 cfs	at	.0500 hrs
Peak Outflow	=	8.96 cfs	at	.3500 hrs
Peak Elevation	=	576.58 ft		
Peak Storage	=	.431 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.609
- Infiltration	=	.000
- HYG Vol OUT	=	.609
- Retained Vol	=	.000
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

WARNING: Inflow hydrograph truncated on left side.



Currently Plotted Curves

P 10 OUT 15 yr

5. DETENTION BASIN #2 ROUTING

C. 25 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	READ HYG 20		HYG 20	25 yr2

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WARNING: Missed peak when adding hydrograph...
WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
HYG	20	25 yr2	.763	.0100	27.98

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
P 10	IN	25 yr	.752	.0500	27.98

TOTAL NODE INFLOW...
HYG file =
HYG ID = P 10 IN
HYG Tag = 25 yr

Peak Discharge	27.98 cfs
Time to Peak	.0500 hrs
HYG Volume	.752 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	27.98	27.98	27.98	27.98	27.98
.2500	27.98	27.98	.00		

Type.... Pond Routing Summary
Name.... P 10 OUT Tag: 25 yr
File.... F:\DRAW2900\2022927\DETENTION\BASIN2.PPW
Storm... 25 yr Tag: 25 yr

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 25 yr
Outflow HYG file = NONE STORED - P 10 OUT 25 yr

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	574.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

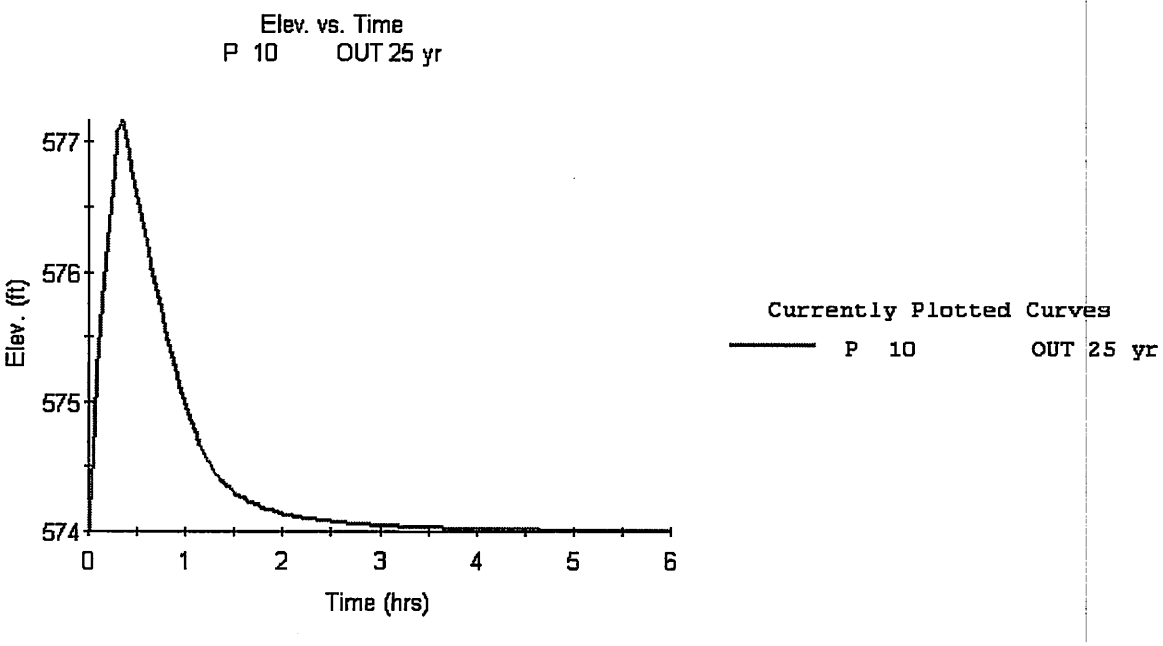
Peak Inflow	=	27.98 cfs	at	.0500 hrs
Peak Outflow	=	10.10 cfs	at	.3500 hrs
Peak Elevation	=	577.17 ft		
Peak Storage	=	.548 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.752
- Infiltration	=	.000
- HYG Vol OUT	=	.751
- Retained Vol	=	.000
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

WARNING: Inflow hydrograph truncated on left side.

S/N: 721201d06a87 Stock & Associates
PondPack Ver: 7.0 (325) Compute Time: 14:00:57 Date: 09-10-2003


Elev. vs. Time
P 10 OUT 25 yr
577
576
575
574
Elev. (ft)
0
1
2
3
4
5
6
Time (hrs)
Currently Plotted Curves
P 10 OUT 25 yr

5. DETENTION BASIN #2 ROUTING

D. 100 year event

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	READ HYG 20		HYG 20	100yr2

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WARNING: Missed peak when adding hydrograph...
WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	HYG 20	100yr2	.976	.0100	35.80

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	P 10 IN	100 yr	.962	.0500	35.80

TOTAL NODE INFLOW...
HYG file =
HYG ID   = P 10   IN
HYG Tag = 100 yr

Peak Discharge =	35.80 cfs
Time to Peak =	.0500 hrs
HYG Volume =	.962 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	35.80	35.80	35.80	35.80	35.80
.2500	35.80	35.80	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 100 yr
Outflow HYG file = NONE STORED - P 10 OUT 100 yr

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	574.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

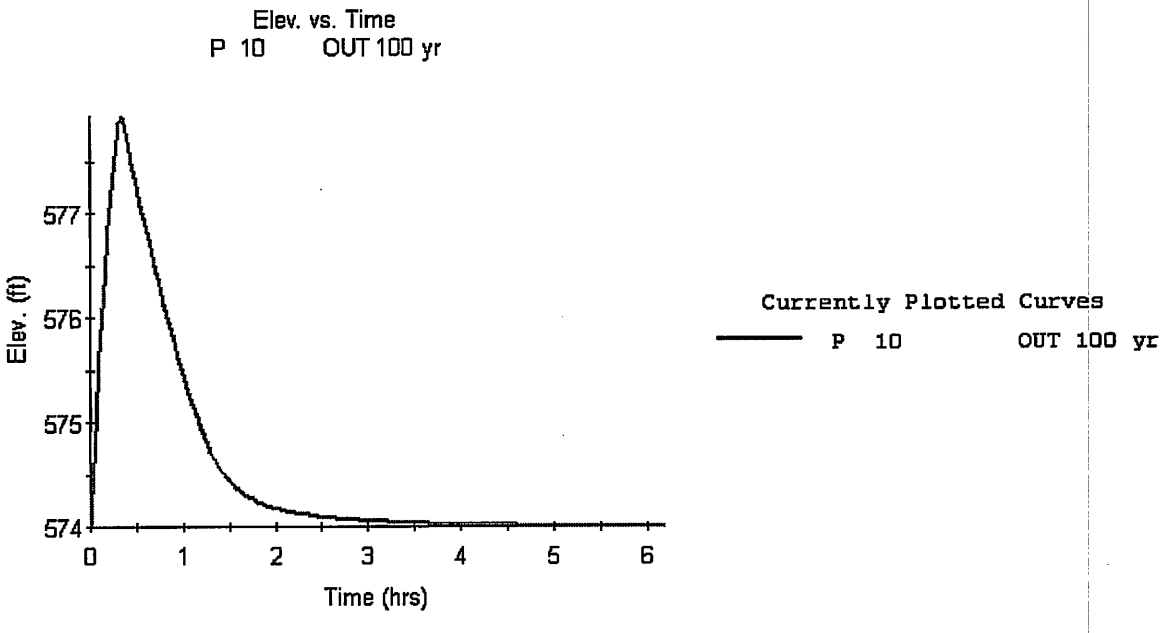
INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	35.80 cfs	at	.0500 hrs
Peak Outflow	=	14.77 cfs	at	.3500 hrs
Peak Elevation	=	577.94 ft		
Peak Storage	=	.714 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.962
- Infiltration	=	.000
- HYG Vol OUT	=	.961
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

WARNING: Inflow hydrograph truncated on left side.


Elev. vs. Time
P 10 OUT 100 yr
577
576
575
574
Elev. (ft)
0
1
2
3
4
5
6
Time (hrs)
Currently Plotted Curves
P 10 OUT 100 yr

5. DETENTION BASIN #2 ROUTING

E. 100 year event (low flow orifice blocked)

SUMMARY FOR HYDROGRAPH ADDITION
at Node: P 10 IN

HYG Directory: F:\DRAW2900\2022927\DETENTION\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
A 20	READ HYG 20		HYG 20	100yr2

WARNING: Adding in hydrograph that is truncated on left...
WARNING: Missed peak when adding hydrograph...
WARNING: Adding in hydrograph that is truncated on right...

INFLOWS TO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	HYG 20	100yr2	.976	.0100	35.80

TOTAL FLOW INTO: P 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	P 10 IN	100 yr	.962	.0500	35.80

TOTAL NODE INFLOW...
HYG file =
HYG ID   = P 10   IN
HYG Tag = 100 yr

Peak Discharge =	35.80 cfs
Time to Peak =	.0500 hrs
HYG Volume =	.962 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	35.80	35.80	35.80	35.80	35.80
.2500	35.80	35.80	.00		

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\DRAW2900\2022927\DETENTION\
Inflow HYG file = NONE STORED - P 10 IN 100 yr
Outflow HYG file = NONE STORED - P 10 OUT 100 yr

Pond Node Data = P 10
Pond Volume Data = P 10
Pond Outlet Data = PR 10

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	574.00 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	35.80 cfs	at	.0500 hrs
Peak Outflow	=	21.53 cfs	at	.3000 hrs
Peak Elevation	=	578.41 ft		
Peak Storage	=	.822 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.962
- Infiltration	=	.000
- HYG Vol OUT	=	.290
- Retained Vol	=	.672
Unrouted Vol	=	-.000 ac-ft (.000% of Inflow Volume)

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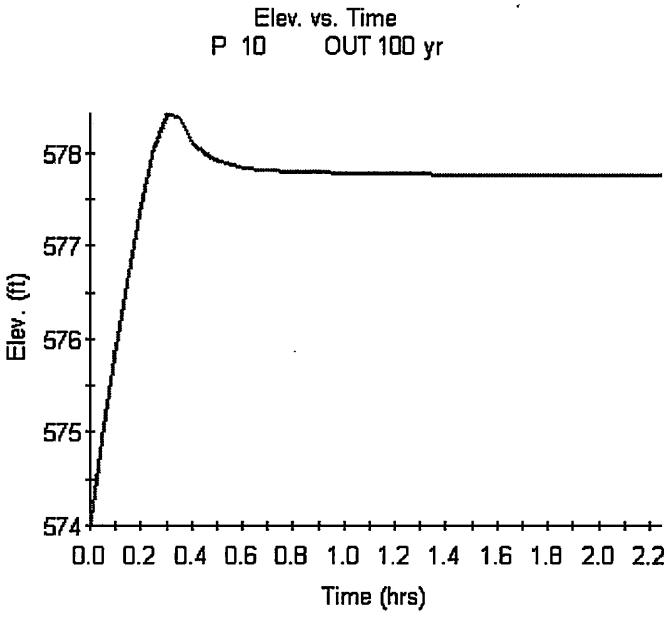
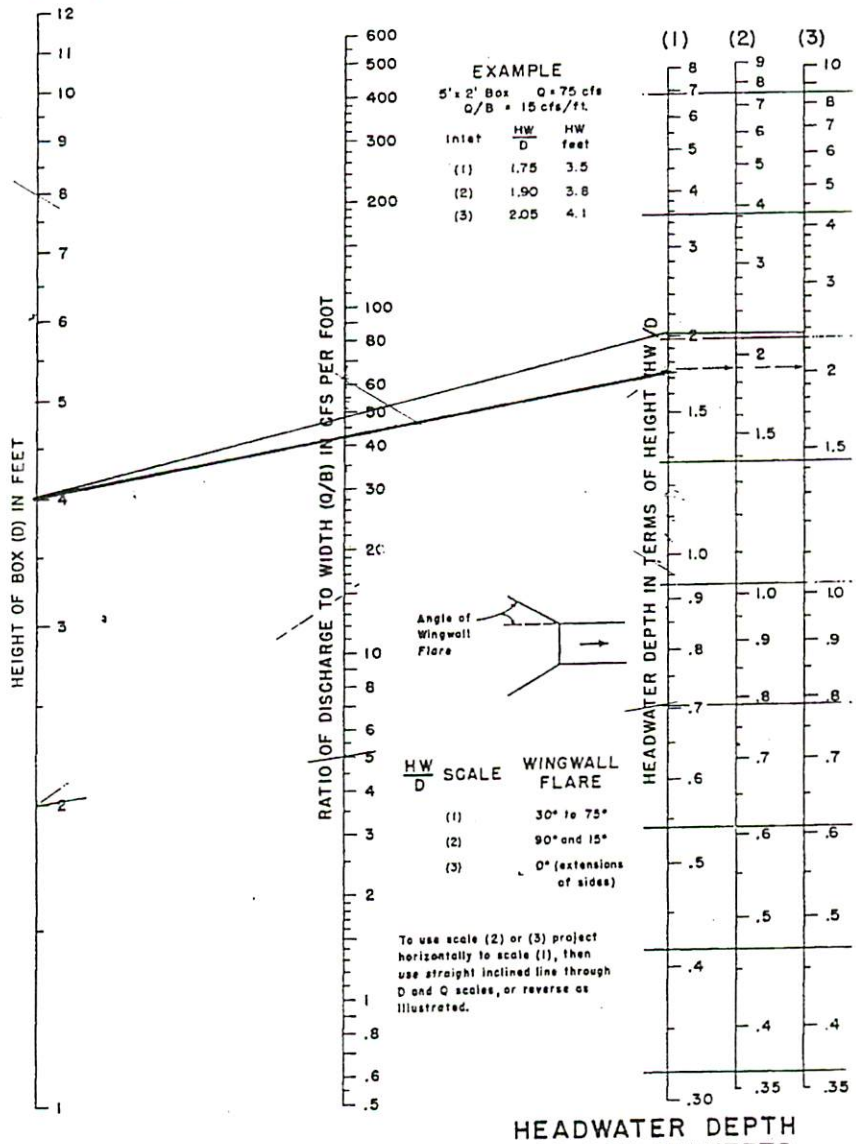


Currently Plotted Curves

P 10 OUT 100 yr

PROPOSED 4'X4' Box Culvert

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Q = 172.71 cfs (50yr)
Q = 195.17 cfs (100yr)

D = 4'

$\frac{Q}{D} = \frac{172.71 cfs}{4'} = 43.2$ cfs/ft

$\frac{HW}{4'} = 2.05$

188 HW = 8.2' 50yr

$\frac{Q}{D} = \frac{195.17}{4} = 48.8$

$\frac{HW}{4} = 2.35$

HW = 9.4' 100yr.

STOCK & ASSOCIATES
CONSULTING ENGINEERS, INC.

PRINCIPALS

GEORGE C. STOCK, P.E.
GEORGE M. STOCK, P.E.

February 24, 2004

City of O'Fallon
100 North Main St.
O'Fallon, MO 63366
(636)240-2000

RE: O'Falllon Lakes
Stock Project: 202-2927
Planning & Zoning number: 2203.01

Ms. Greenlee,

Pursuant to your review dated January 8, 2004, enclosed please find:

- Two (2) revised copies of Site Improvement Plans
- One (1) copy of the Stormwater Management Report
- Two (2) copies of the Hardscape Plans

We offer the following point-by-point reply to the review comments.

1. *Provide safety fence along the top of the retaining wall behind Building 6.*

   Provided for on sheet C5.

2. *Developer shall participate in any funding mechanism adopted by the Board of Alderman for improvements to the west lift station.*

   N/A

3. *Construction plans shall include details of all the amenity area; i.e.:pool, tennis courts, and sport courts.*

   Provided.

4. *Show light fixture locations on site plans.*

   Provided on site plans.

5. *Provide pedestrian connections from the development to the adjacent undeveloped properties to the east and west.*

A pedestrian connection has been provided to the west. Due to the proposed grading along the east property line, access is limited.

6. *Show location of all ground mounted mechanical equipment on site plan.*

   Provided on site plans.

7. *Provide all standard utility and drainage easements.*

   Provided on site plans.

8. *Remove general note 10 and construction notes 4 and 22 and replace with the following note; "All fill placed under proposed storm and sanitary sewer, proposed roads, and/or paved areas shall be compacted to 90% of maximum density as determined by the Modified AASHTO T-180 Compaction Test or 95% of maximum density as determined by the Standard Proctor Test AASHTO T-99. All Fill placed in proposed roads shall be compacted from the bottom of the fill up. All tests shall be verified by a soils engineer concurrent with grading and backfilling operations." Ensure moisture content of the soil in fill areas is to correspond to the compactive effort as defined by the Standard or Modified Proctor Test. Optimum moisture content shall be determined using the same test that was used for compaction. Soil compaction curves shall be submitted to the City of O'Fallon prior to the placement of fill. Proof rolling may be required to verify soil stability at the discretion of the City of O'Fallon.*

   Note 10 has been revised and notes 4 and 22 have been removed.

9. *Obtain approval from all responsible agencies including fire protection district and MoDOT.*

   Approval will be forthcoming.

10. *Provide a copy of all recorded easements (both on and off-site) and right-of-way or warranty deeds required with this development. If a plat was required with P&Z approval then a record plat must be submitted for review and approval.*

    The record plat will be submitted under separate cover.

11. *Ensure box culvert meets City of O'Fallon requirements for freeboard above high water elevation. See City of O'Fallon requirements for freeboard above high water elevation. See City code Section 405.230-2c. Provide calculations to check for inlet and outlet control. Provide calculations for the 100 year and 50 year storm. Demonstrate 2' of freeboard for the 50-year storm. From the submitted sheet at the end of the detention report it appears the culvert will pond water off site for the 100-year event. The culvert must be large enough to not impact adjacent properties with increased water surface elevations and should closely match the existing structure downstream.*

    Calculations for the 100-year storm have been provided in the drainage report. The culvert has been lowered to reduce the ponding elevation.

12. *Label the 50-year P.I. factors and areas on the drainage area map.*

    Provided on sheet C15.

13. *Please provide on the drainage area sheet 15 of 16 the total impervious area on site in table form. (to be used to check detention calculations.*

    Provided on sheet C15.

14. *The out flow pipes from the basins need to be labeled RCP on the profile to match the detail on sheet C-13.*

    The details have been revised to show H.D.P.E.

15. *Provide calculation for the 2-year sediment in each basin to retain depth.*

    Provided on sheet C16.

16. *Show on the hydrographs the time it takes for each basin to get back to normal water level.*

    Provided in the drainage report.

17. *Provide Q in swale west of building 9 and provide cross section of swale to carry flow.*

    Provided on sheet C15.

18. *Ensure all light poles are located within landscape islands.*

    Provided.

19. *Indicate all proposed lake elevations and provide any provisions to drain lakes. All lakes shall be designed to hold 2 years of sediment storage and still achieve desired depth.*

    Provided on sheet C16.

If you have any questions or need any additional information, please do not hesitate to contact our office at your earliest convenience.

Sincerely,

Ryan Schriber, P.E.

Ryan Schriber, P.E. – Project Manager L. H.

cc: Mark Hejna – Gundaker Commercial
George M. Stock, P.E.