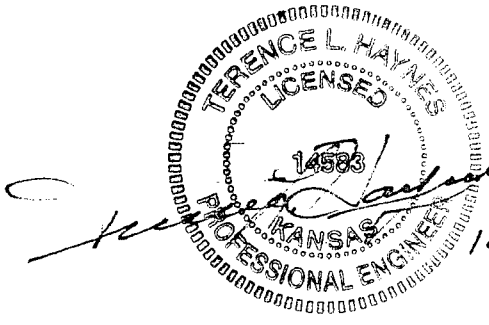
Drainage Impact Analysis
for
Wal-Mart Expansion
Taft Avenue and Julia Street
Wichita, Kansas

December 13, 2002



12/13/02

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Wal-Mart Expansion
Taft Avenue and Julia Street
Wichita, Kansas

Introduction:

The site is located at the intersection of Taft Avenue and Julia Street. It is proposed to expand the current Wal-Mart store. The proposed expansion is to the north and west, thus the additional parking will be on the south side of the existing Wal-Mart building. The additional parking will eliminate the two existing ponding areas and Wichita Inn.

During current conditions, the on-site storm sewer system will backflow into the existing ponding areas, which are located at the upstream end of the system. We are replacing these ponding areas with a proposed underground detention system and a proposed storm sewer system which will handle the "local" 100 year storm runoff. The proposed underground storm sewer system is located at the downstream end of the on-site storm sewer system and discharges directly to the existing storm sewer pipe along Taft Avenue.

This report compares the existing conditions versus the proposed improvements.

EXISTING DRAINAGE

Area A:

D.A. - 1.18 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 210 feet
H - 1.70 feet
Tc - 3.1 minutes, use 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 6.2 cfs

i100 - 10.32 in/hr Q100 = 11.6 cfs

Existing outflow pipe - 15" RCP at 0.67%, cap. 5.3 cfs

It is assumed the existing inlet has a greater capacity than the out flow pipe, also the capacity of the existing pipe is based on Manning's Equation using pipe slope, NOT hydraulic grade line slope. The assumption is during low flow the pipe slope and the HGL are the same and during high flows all inlets are submerged and the HGL is close to flat.

The pipe system flows back to the east, but during high flows the overflow from Area A is back to the west to an existing storm sewer system in Dugan Road, thus only 5.3 cfs flows east.

Area B:

D.A. - 1.35 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 190 feet
H - 1.70 feet
Tc - 2.67 minutes, use 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 7.1 cfs

i100 - 10.32 in/hr Q100 = 13.2 cfs

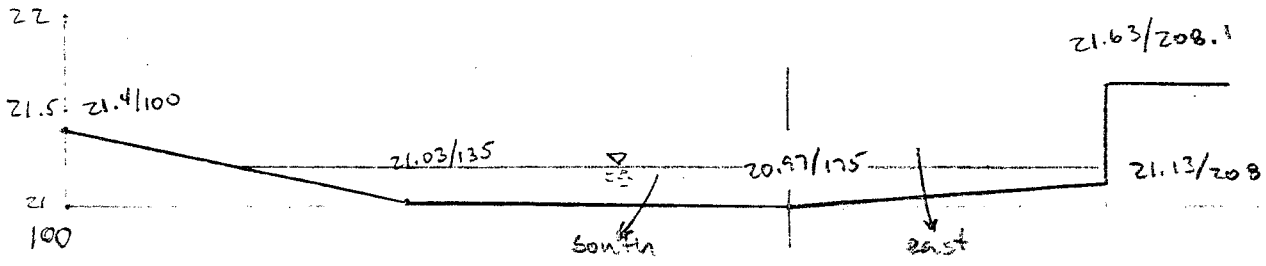
Areas A and B combined outflow pipe:

Q2 - 7.1 cfs + 5.3 cfs = 12.4 cfs

Q100 - 13.2 cfs 5.3 cfs = 18.5 cfs

Area B overflow occurs in the southeast corner of the drainage basin. A weir section was taken from the survey data, and the overflow is split to the east and to the south. The capacity of the existing outflow pipe from Area B, an 18" RCP at a slope of 0.58%, is 8.0 cfs. During high flows it is assumed minimal flow occurs in the existing storm sewer system and most flow occurs overland.

It is assumed 50% of the overflow flows east and the remaining 50% flows south. Based on the weir section the 100 year highwater elevation is 121.21 feet, indicating all overflow goes east and south, not north. The total Q100 flow for Areas A and B is 18.5 cfs, 9.3 cfs goes east and 9.2 cfs south and away from existing parking lot storm sewer system. During a 2 year storm frequency, 8.0 cfs is conveyed through the storm sewer system and the remaining 4.4 cfs is divided 50/50 east and south.



Weir section, no scale

Area C: (pond)

D.A. - 0.68 acres
C - 0.5

Time of Concentration - 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 1.9 cfs

i100 - 10.32 in/hr Q100 = 3.5 cfs

Area D: (pond)

D.A. - 0.18 acres
C - 0.5

Time of Concentration - 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 0.5 cfs

i100 - 10.32 in/hr Q100 = 0.9 cfs

Total flow into the ponding areas :

Q2 = 0.5 cfs + 1.9 cfs + 8.0 cfs(pipe) + 2.2 cfs(½ of overflow) = 12.6 cfs

Q100 = 0.9 cfs + 3.5 cfs + 9.3 cfs(½ of overflow) = 13.7 cfs

Outflow pipe from ponds - 18" RCP at 0.68%, cap.- 8.7 cfs. It is assumed there is some storage volume during the 2 year storm frequency. During the 100 year storm frequency, the entire storm sewer system is surcharged and the ponds just add storage volume for the backwater in the system.

Area E:

D.A. - 0.62 acres
C - 0.95

Time of Concentration - 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 3.3 cfs

i100 - 10.32 in/hr Q100 = 6.1 cfs

Combined flow from Area E and the ponds:

Q2 = 8.7 cfs + 3.3 cfs = 12.0 cfs

Q100 = 8.7 cfs + 6.1 cfs = 14.8 cfs

Existing outflow pipe - 18" RCP at 0.28%, cap. - 5.6 cfs, overflow during both 2- and 100-year storm events flows north.

Area G: (Sam's Club rooftop into roof drains and underground collection system)

D..A. - 1.89 acres
C - 0.95

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 10.0 cfs

i100 - 10.32 in/hr Q100 = 18.5 cfs

Existing collection pipe - 18" RCP at 1.0%, cap. - 10.5 cfs

Area F:

D.A. - 2.40 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 700 feet
H - 3.69 feet
Tc - 9.12 minutes

i2 - 4.68 in/hr Q2 = 10.7 cfs

i100 - 8.24 in/hr Q100 = 18.8 cfs

The existing outflow pipe is a 21" RCP at 0.57%, cap. - 12.0 cfs
Combined flow from Areas A, B, C, D, E, G and F:

Q2 = 8.7 cfs (from ponds) + 3.3 cfs + 10.0 cfs + 10.7 cfs = 32.7 cfs

Q100 = 8.7 cfs(from ponds) + 6.1 cfs + 18.5 + 18.8 cfs = 52.1 cfs

The existing outflow pipe is a 21" RCP at 1.71%, cap. - 20.7 cfs

According to the survey data, there is 1.46 feet of depth over the inlet for Area F. There is very little storage available and the overflow flows north out a driveway to Taft Avenue.

Area H:

D.A. - 3.26 acres (including roof area)
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 500 feet (including flow across roof)
Slope across parking lot - 1.20%
Adjusted H(based on slope) - 6.0 feet
Tc - 5.1 minutes

i2 - 5.55 in/hr Q2 = 17.2 cfs

i100 - 10.28 in/hr Q100 = 31.8 cfs

Existing outflow pipe - 18" CMP at 2.48%, cap. 9.0 cfs

Some storage volume is available in the parking lot, but overflow will occur through the same driveway as for Areas A - F.

Area I:

D.A. - 2.14 acres (including roof area)
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 500 feet (including flow across roof)
Slope across parking lot - 0.51%
Adjusted H(based on slope) - 2.55 feet
Tc - 7.1 minutes

i2 - 5.07 in/hr Q2 = 10.3 cfs

i100 - 9.47 in/hr Q100 = 19.3 cfs

Existing outflow pipe - 15" PVC at 2.48%, cap. 10.2 cfs

Some storage volume is available in the parking lot, but overflow will occur through a driveway to the east onto Julia Street.

Area J:

D.A. - 4.19 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 410 feet
H - 4.91 feet
Tc - 4.40 minutes, use 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 22.2 cfs

i100 - 10.32 in/hr Q100 = 41.1 cfs

Existing outflow pipe - 18" CMP at 1.70%, cap. 7.4 cfs

Some storage volume is available in the parking lot, but overflow will occur over the top of curb to the east onto Julia Street.

PROPOSED DRAINAGE

Area A: (no change)

D.A. - 1.18 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 210 feet
H - 1.70 feet
Tc - 3.1 minutes, use 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 6.2 cfs

i100 - 10.32 in/hr Q100 = 11.6 cfs

Existing outflow pipe - 15" RCP at 0.67%, cap. 5.3 cfs

It is assumed the existing inlet has a greater capacity than the out flow pipe, also the capacity of the existing pipe is based on Manning's Equation using pipe slope, NOT hydraulic grade line slope. The assumption is during low flow the pipe slope and the HGL are the same and during high flows all inlets are submerged and the HGL is close to flat.

The pipe system flows back to the east, but during high flows the overflow from Area A is back to the west to an existing storm sewer system in Dugan Road, thus only 5.3 cfs flows east.

Area B: (no change)

D.A. - 1.35 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 190 feet
H - 1.70 feet
Tc - 2.67 minutes, use 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 7.1 cfs

i100 - 10.32 in/hr Q100 = 13.2 cfs

Areas A and B combined outflow pipe:

Q2 - 7.1 cfs + 5.3 cfs = 12.4 cfs

Q100 - 13.2 cfs + 5.3 cfs = 18.5 cfs

Area B overflow occurs in the southeast corner of the drainage basin. A weir section was taken from the survey data, and the overflow is split to the east and to the south. The capacity of the existing outflow pipe from Area B, an 18" RCP at a slope of 0.58%, is 8.0 cfs. During high flows it is assumed minimal flow occurs in the existing storm sewer system and most flow occurs overland.

It is assumed 50% of the overflow flows east and the remaining 50% flows south. Based on the weir section the 100 year highwater elevation is 121.21 feet, indicating all overflow goes east and south, not north. The total Q100 flow for Areas A and B is 18.5 cfs, 9.3 cfs goes east and 9.2 cfs south and away from existing parking lot storm sewer system. During a 2 year storm frequency, 8.0 cfs is conveyed through the storm sewer system and the remaining 4.4 cfs is divided 50/50 east and south.

Same weir section as existing conditions.

Due to overflow diversion from drainage basin, the effective areas from basins A and B will be computed based on effective flow, thus;

2 year: Areas A and B - contributing flow/total flow - 12.4 cfs/13.3 cfs - 93% or 2.35 acres

100 year: Areas A and B - 18.5 cfs/24.8 cfs - 75% or 1.90 acres

Area C:

D.A. - 1.20 acres from Area C

2 year - 1.20 ac + 2.35 ac = 3.55 ac

100 year - 1.20 ac + 1.90 ac = 3.10 ac

C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 18.8 cfs

i100 - 10.32 in/hr Q100 = 30.4 cfs

Already in Areas A and B outflow pipe - 8.0 cfs

Pick up 10.8 cfs during a 2 year storm, 22.4 cfs during a 100 year storm.

Use a standard parking lot inlet with a capacity of at least 22.4 cfs at 6" depth.

Area C outflow pipe - 18" x 28½" RCPA at 0.50%, cap. - 13.2 cfs

The 100 year overflow will flow north .

Area C1:

D.A. - 0.35 acres from Area C1

2 year - 1.20 ac + 2.35 ac + 0.35 ac = 3.90 ac

100 year - 1.20 ac + 1.90 ac + 0.35 ac = 3.45 ac

C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 20.6 cfs

i100 - 10.32 in/hr Q100 = 33.8 cfs

Use a slotted drain along the length of the pipe to capture runoff.

Outflow pipe from end of slotted drain:

Combined outflow pipe - 36" RCP at 0.45%, cap. - 44.7 cfs. The proposed outflow pipe will handle the local 100 year storm event.

Area D1:

D.A. - 0.15 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 0.8 cfs

i100 - 10.32 in/hr Q100 = 1.5 cfs

Area D1 outflow pipe - 15" RCP at 0.25%, cap. - 3.2 cfs

Area D2:

D.A. - 0.08 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 0.4 cfs

i100 - 10.32 in/hr Q100 = 0.8 cfs

Use a standard parking lot inlet with a capacity of at least 0.8 cfs at 6" depth.

Outflow pipe:

O2 - 1.2 cfs

Q100 - 2.3 cfs

Areas D1 and D2 outflow pipe - 15" RCP at 0.25%, cap. - 3.2 cfs

Area E:

D.A. - 0.07 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 0.4 cfs

i100 - 10.32 in/hr Q100 = 0.7 cfs

Use a standard parking lot inlet with a capacity of at least 0.7 cfs at 6" depth.

Outflow pipe:

O2 - 1.6 cfs

Q100 - 3.0 cfs

Areas E outflow pipe - 15" RCP at 0.25%, cap. - 3.2 cfs

Combine Areas A, B, C, C1, D1, D2 and E:

2 year D.A. - 4.20 acres
100 year D.A. - 3.75 acres

C - 0.95

Tc -5.0 minutes

i2 - 5.57 in/hr Q2 = 22.2 cfs

i100 - 10.32 in/hr Q100 = 36.8 cfs

Combined outflow pipe - 36" RCP at 0.45%, cap. - 44.7 cfs

Area F:

D.A. - 0.30 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 1.6 cfs

i100 - 10.32 in/hr Q100 = 2.9 cfs

Use a standard parking lot inlet with a capacity of at least 2.9 cfs at 6" depth.

Areas F outflow pipe - 15" RCP at 0.25%, cap. - 3.2 cfs

Combine Areas A, B, C, C1, D1, D2, E and F:

2 year D.A. - 4.50 acres
100 year D.A. - 4.05 acres

C - 0.95

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 23.8 cfs

i100 - 10.32 in/hr Q100 = 39.7 cfs

Combined outflow pipe - 36" RCP at 0.45%, cap. - 44.70.0 cfs

Area F1:

D.A. - 0.32 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 1.7 cfs

i100 - 10.32 in/hr Q100 = 3.1 cfs

Use a standard curb inlet with a capacity of at least 3.1 cfs at 6" depth.

Area F1 outflow pipe - 15" RCP at 0.25%, cap. - 3.2 cfs

Combine Areas A, B, C, C1, D1, D2, E, F1 and F:

2 year D.A. - 4.82 acres
100 year D.A. - 4.37 acres
C - 0.95

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 25.5 cfs

i100 - 10.32 in/hr Q100 = 42.8 cfs

Combined outflow pipe - 36" RCP at 0.45%, cap. - 44.7 cfs

There is no overflow onto Taft Avenue.

Area F2: (inlet only)

D.A. - 0.30 acres

C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 1.6 cfs

i100 - 10.32 in/hr Q100 = 2.9 cfs

Use a standard curb inlet with a capacity of at least 2.9 cfs at 6" depth.

Area L(truckwell):

D.A. - 0.08 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 0.4 cfs

i100 - 10.32 in/hr Q100 = 0.8 cfs

Area L outflow pipe - 12" RCP at 0.25%, cap. - 1.8 cfs

Combine Areas A, B, C, C1, D1, D2, E, F1, F2, F and L:

2 year - 4.82 ac + 0.30 ac + 0.08 ac = 5.20 ac

100 year - 4.37 ac + 0.30 ac 0.08 ac = 4.75 ac

C - 0.95

Tc -5.0 minutes

i2 - 5.57 in/hr Q2 = 27.5 cfs

i100 - 10.32 in/hr Q100 = 46.6 cfs

Combined outflow pipe - 36" RCP at 0.45%, cap. - 44.7 cfs

This last pipe segment will flow into an underground storage system.

Area H: (roof top)

D.A. - 4.95 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 400 feet
H - 2.00 feet
Tc - 6.05 minutes

i2 - 5.31 in/hr Q2 = 25.0 cfs

i100 - 9.87 in/hr Q100 = 46.4 cfs

The downspout system will carry 46.4 cfs to the underground detention area.

Area I:

D.A. - 1.34 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 700 feet
H - 3.50 feet
Tc - 9.3 minutes

i2 - 4.65 in/hr Q2 = 5.9 cfs

i100 - 8.74 in/hr Q100 = 11.1 cfs

Use a standard parking lot inlet with a capacity of at least 11.1 cfs at 6" depth. This inlet will tie directly to the underground storage system.

Area K(truckwell):

D.A. - 0.14 acres
C - 0.95

Time of Concentration - Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 0.7 cfs

i100 - 10.32 in/hr Q100 = 1.4 cfs

Area K outflow pipe - 12" RCP at 0.25%, cap. - 1.8 cfs

Detention calculations:

Total flow to underground detention system:

2 year D.A. - 11.82 acres
100 year D.A. - 11.37 acres

C - 0.95

Tc - 9.3 minutes

i2 - 4.65 in/hr Q2 = 50.2 cfs

i100 - 8.74 in/hr Q100 = 94.4 cfs

Using 11 - 60" pipes x 2375 feet

Approximate total volume - 46,621 cu.ft.

Flowline - 112.17 feet

The outlet structure for the underground storage - 15" RCP at 0.50%

The 2 year outflow from the underground storage vault - 7.90 cfs

2 year water surface elevation - 114.71 feet

The 100 year outflow from the underground storage vault - 12.21 cfs

100 year water surface elevation - 117.02 feet

Please refer to Appendix A for detention calculations.

Area J1:

D.A. - 2.0 acres
C - 0.95

Time of Concentration - (use $T=0.0078(L^3/H)^{0.385}$
L - 280 feet
H - 2.75 feet
Tc - 3.54 minutes, use 5.0 minutes (minimum recommended)

i2 - 5.57 in/hr Q2 = 10.6 cfs

i100 - 10.32 in/hr Q100 = 19.6 cfs

Use a standard parking lot inlet with a capacity of at least 10.6 cfs at 6" depth

Proposed outflow pipe - 13½" x 22" RCPA at 0.50%, cap. 5.9 cfs

Area J2:

D.A. - 4.55 acres (includes Area J1)
C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 24.1 cfs

i100 - 10.32 in/hr Q100 = 44.6 cfs

Use a standard parking lot inlet with a capacity of at least 24.1 cfs at 6" depth. The inlets are sized for the 2 year storm in case improvements are made in the future to the outflow system.

Existing outflow pipe - 18" CGMP at 1.70%, cap. 7.4 cfs.

Some storage volume is available in the parking lot, but overflow will occur over the top of curb to the east onto Julia Street.

Area M:

D.A. - 0.75 acres
C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 4.0 cfs

i100 - 10.32 in/hr Q100 = 7.4 cfs

Use the existing parking lot inlet and outflow pipe.

Area N:

D.A. - 1.25 acres
C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 7.0 cfs

i100 - 10.32 in/hr Q100 = 12.3 cfs

A 12 ft wide curb opening is proposed in the SW corner of the proposed curb line. The opening length is based on

$L = Q/CH^{3/2}$ or $L = 12.3/(3*0.5^{3/2}) = 11.6$ ft, use 12 ft.

Area O:

D.A. - 0.40 acres
C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 2.1 cfs

i100 - 10.32 in/hr Q100 = 3.9 cfs

A 4 ft wide curb opening is proposed in the SE corner of the proposed curb line. The opening length is based on

$L = Q/CH^{3/2}$ or $L = 3.9/(3*0.5^{3/2}) = 3.7$ ft, use 4 ft.

Area P:

D.A. - 0.15 acres
C - 0.95

Time of Concentration -

Tc - 5.0 minutes

i2 - 5.57 in/hr Q2 = 0.8 cfs

i100 - 10.32 in/hr Q100 = 1.5 cfs

A 2 ft wide curb opening is proposed in the SW corner of the proposed curb line. The opening length is based on

$L = Q/CH^{3/2}$ or $L = 1.5/(3*0.5^{3/2}) = 1.4$ ft, use 2 ft.

Conclusion:

When comparing the current flow from the site to the proposed flow, there are several areas to consider.

Areas A through G currently discharges 32.7 cfs during a 2 year storm event and 52.1 cfs during a 100 year storm event into the existing Taft Avenue storm sewer system. This includes 10.0 cfs and 18.5 cfs, 2 year and 100 year respectively, from Sam's Club rooftop.

Area H discharges 17.2 cfs and 31.8 cfs, 2 year and 100 year storm events respectively, into the same system along Taft Avenue.

The backwater from the existing system is stored in the existing ponds at the upstream end, but the discharge from the site is not controlled.

The proposed system collects runoff from **Areas A through K** and conveys the discharge to the proposed underground storage system, where discharge into the Taft Avenue system is being controlled using a 15" RCP. The Sam's Club rooftop drainage is being conveyed to the Taft Avenue system using the existing storm sewer pipes, and does not enter the proposed underground detention system.

Thus the 2 year flow from the site to the Taft Avenue system has been reduced by (22.7 - 7.9)cfs = 14.8 cfs or 65%. Roof top flow from Sam's club is not included, since it has been separated from proposed system.

During the 100 year storm event the downstream system is surcharged, thus the flow from site equals the existing conditions.

Area I (existing) compares to **Area M** (proposed):

Storm	Area I	Area M
2 yr	10.3 cfs	4.0 cfs
100 yr	19.3 cfs	7.4 cfs.

The area has been reduced due to expansion.

The remaining drainage areas did not significantly change, thus the proposed discharges from the site equals current conditions.

Appendix A

Detention calculations

User Name: Ole M. Marcussen
Project: Undergroound detention
Scenario: Proposed expansion

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SUMMARY REPORT

[RAINFALL]
Wichita

[FLOOD HYDROGRAPH]
1 - 2 year inflow
Type : Rational
Peak Flow : 52.51 cfs
Peak Time : 9.30 min

2 - 100 year inflow
Type : Rational
Peak Flow : 96.55 cfs
Peak Time : 9.30 min

3 - 2 year routing
Type : Reservoir: Storage Indication
Peak Flow : 7.90 cfs
Peak Time : 17.00 min

Inflow Hydrograph
1 - 2 year inflow

4 - 100 year routing
Type : Reservoir: Storage Indication
Peak Flow : 12.21 cfs
Peak Time : 17.00 min

Inflow Hydrograph
2 - 100 year inflow

[OUTLET STRUCTURE]
1 - Outlet
Type : Circular Concrete w/ groove end projecting
Maximum Discharge : 12.35 cfs

[RESERVOIR]
1 - Underground vault
Type : Underground Pipe
Maximum Storage : 46436.67 cu ft
Maximum Discharge : 12.35 cfs

Discharge Structure:
1 - Outlet

User Name: Ole M. Marcussen

Project: Undergroound detention
Scenario: Proposed expansion

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FLOOD HYDROGRAPH REPORT

Number	Name	Type	Defined
1	2 year inflow	Modified Rational	Yes
2	100 year inflow	Modified Rational	Yes
3	2 year routing	Reservoir: Storage	Yes
4	100 year routing	Reservoir: Storage	Yes

FLOOD HYDROGRAPH REPORT

Hydrograph Number: 1
Name: 2 year inflow
Type: Modified Rational

[HYDROGRAPH INFORMATION]

Peak Flow (Qp)	=	52.51 (cfs)
Time to Peak (Tp)	=	9.30 (min)
Time of Base (Tb)	=	18.60 (min)
Volume	=	0.67 (ac-ft)
Time Step	=	1.00 (min)
Flow Multiplier	=	1.00

[RATIONAL HYDROGRAPH INFORMATION]

Flow Multiplier	=	1.00
Receding Limb Factor	=	1.00

[APPROXIMATE STORAGE]

Maximum Outflow	=	0.00 (cfs)
Maximum Storage	=	0.67 (cu ft)

[BASIN INFORMATION]

[WEIGHTED WATERSHED AREA]

Description	Area	CN	Runoff Coef
<None>			
Overall Approximation	11.82	NA	0.95

[TIME CONCENTRATION -- User Defined]

Time of Concentration (Tc)	=	9.30 (min)

[RAINFALL DESCRIPTION]

Distribution Type	=	Synthetic
Total Precipitation	=	0.72 (in)
Return Period	=	2 (yr)
Storm Duration	=	0.16 (hr)

[Hydrograph Flow Values: Time vs. Flow]
[TIME CONCENTRATION -- 1.00]

Time Interval	Time (min)	Incremental Rainfall (in)	Cumulative Rainfall (in)	Incremental Outflow (cfs)	Design Outflow (cfs)
1	1.00	0.00	0.08	0.00	5.65

FLOOD HYDROGRAPH REPORT

2	2.00	0.08	0.15	5.65	11.29
3	3.00	0.08	0.23	5.65	16.94
4	4.00	0.08	0.31	5.65	22.59
5	5.00	0.08	0.39	5.65	28.23
6	6.00	0.08	0.46	5.65	33.88
7	7.00	0.08	0.54	5.65	39.52
8	8.00	0.08	0.62	5.65	45.17
9	9.00	0.08	0.70	5.65	50.82
10	10.00	0.02	0.72	-2.26	48.56
11	11.00	0.00	0.72	-5.65	42.91
12	12.00	0.00	0.72	-5.65	37.27
13	13.00	0.00	0.72	-5.65	31.62
14	14.00	0.00	0.72	-5.65	25.97
15	15.00	0.00	0.72	-5.65	20.33
16	16.00	0.00	0.72	-5.65	14.68
17	17.00	0.00	0.72	-5.65	9.03
18	18.00	0.00	0.72	-5.65	3.39
19	18.60	0.00	0.72	-3.39	0.00

FLOOD HYDROGRAPH REPORT

Hydrograph Number: 2
Name: 100 year inflow
Type: Modified Rational

[HYDROGRAPH INFORMATION]

Peak Flow (Qp)	=	96.55 (cfs)
Time to Peak (Tp)	=	9.30 (min)
Time of Base (Tb)	=	18.60 (min)
Volume	=	1.24 (ac-ft)
Time Step	=	1.00 (min)
Flow Multiplier	=	1.00

[RATIONAL HYDROGRAPH INFORMATION]

Flow Multiplier	=	1.00
Receding Limb Factor	=	1.00

[APPROXIMATE STORAGE]

Maximum Outflow	=	0.00 (cfs)
Maximum Storage	=	1.24 (cu ft)

[BASIN INFORMATION]

[WEIGHTED WATERSHED AREA]

Description	Area	CN	Runoff Coef
<None>			
Overall Approximation	11.37	NA	0.95

[TIME CONCENTRATION -- User Defined]

Time of Concentration (Tc)	=	9.30 (min)

[RAINFALL DESCRIPTION]

Distribution Type	=	Synthetic
Total Precipitation	=	1.37 (in)
Return Period	=	100 (yr)
Storm Duration	=	0.16 (hr)

[Hydrograph Flow Values: Time vs. Flow]
[TIME CONCENTRATION -- 1.00]

Time Interval	Time (min)	Incremental Rainfall (in)	Cumulative Rainfall (in)	Incremental Outflow (cfs)	Design Outflow (cfs)
1	1.00	0.00	0.15	0.00	10.38

FLOOD HYDROGRAPH REPORT

2	2.00	0.15	0.30	10.38	20.76
3	3.00	0.15	0.44	10.38	31.14
4	4.00	0.15	0.59	10.38	41.53
5	5.00	0.15	0.74	10.38	51.91
6	6.00	0.15	0.89	10.38	62.29
7	7.00	0.15	1.03	10.38	72.67
8	8.00	0.15	1.18	10.38	83.05
9	9.00	0.15	1.33	10.38	93.43
10	10.00	0.04	1.37	-4.15	89.28
11	11.00	0.00	1.37	-10.38	78.90
12	12.00	0.00	1.37	-10.38	68.52
13	13.00	0.00	1.37	-10.38	58.14
14	14.00	0.00	1.37	-10.38	47.75
15	15.00	0.00	1.37	-10.38	37.37
16	16.00	0.00	1.37	-10.38	26.99
17	17.00	0.00	1.37	-10.38	16.61
18	18.00	0.00	1.37	-10.38	6.23
19	18.60	0.00	1.37	-6.23	0.00

FLOOD HYDROGRAPH REPORT

Hydrograph Number: 3
Name: 2 year routing
Type: Reservoir: Storage Indication

[HYDROGRAPH INFORMATION]

Peak Flow (Qp)	=	7.90 (cfs)
Time to Peak (Tp)	=	17.00 (min)
Time of Base (Tb)	=	1440.00 (min)
Volume	=	0.67 (ac-ft)
Time Step	=	1.00 (min)
Peak Elevation	=	114.71 (ft)
Detention Time	=	NA

[RESERVOIR STRUCTURE INFORMATION]

Number	=	1
Name	=	Underground vault
Storage Type	=	Underground Pipe
Maximum Storage	=	46436.67 (cu ft)
Maximum Discharge	=	12.35 (cfs)

[INFLOW HYDROGRAPH INFORMATION]

Number	=	1
Name	=	2 year inflow
Peak Flow (Qp)	=	52.51 (cfs)
Time to Peak (Tp)	=	9.30 (min)
Time of Base (Tb)	=	18.60 (min)
Volume	=	0.67 (ac-ft)
Flow Multiplier	=	1.00

[EQUATION]

$0.5(I1+I2)dt + S1-0.5(O2)dt$

Where:
I1 = Previous Inflow
I2 = Current Inflow
dt = Time increment
S1 = Previous Storage
S2 = Current Storage
O1 = Previous Outflow
O2 = Current Outflow

$A = 0.5\ (I1+I2)\ dt$
$B = S1 - 0.5\ (O1)\ dt$
$C = S2 + 0.5\ (O2)\ dt$

FLOOD HYDROGRAPH REPORT

Computation of Reservoir Outflow Table of Storage Indication Method
[The time interval is 1.00 min]

Intv	Time (min)	Inflow (cfs)	A (cfs)	B (cfs)	C (cfs)	Outflow (cfs)	Storage (cu ft)	Elev (ft)
1	1.00	5.65	5.65	0.00	336.93	0.03	168.48	112.19
2	2.00	11.29	16.94	336.93	1341.03	0.17	670.60	112.32
3	3.00	16.94	28.23	1341.03	2995.45	0.48	1497.97	112.47
4	4.00	22.59	39.52	2995.45	5278.33	0.99	2639.66	112.64
5	5.00	28.23	50.82	5278.33	8166.05	1.69	4083.87	112.83
6	6.00	33.88	62.11	8166.05	11635.96	2.57	5819.26	113.02
7	7.00	39.52	73.40	11635.96	15672.95	3.53	7838.24	113.24
8	8.00	45.17	84.69	15672.95	20277.51	4.41	10140.96	113.46
9	9.00	50.82	95.99	20277.51	25458.52	5.22	12731.87	113.70
10	10.00	48.56	99.38	25458.52	30751.41	5.93	15378.67	113.94
11	11.00	42.91	91.47	30751.41	35493.18	6.50	17749.84	114.14
12	12.00	37.27	80.18	35493.18	39496.95	6.94	19751.94	114.32
13	13.00	31.62	68.89	39496.95	42775.70	7.29	21391.50	114.46
14	14.00	25.97	57.59	42775.70	45340.06	7.56	22673.81	114.56
15	15.00	20.33	46.30	45340.06	47199.89	7.74	23603.82	114.64
16	16.00	14.68	35.01	47199.89	48364.20	7.86	24186.03	114.69
17	17.00	9.03	23.71	48364.20	48841.35	7.90	24424.63	114.71
18	18.00	3.39	12.42	48841.35	48639.38	7.88	24323.63	114.70
19	19.00	0.00	3.39	48639.38	47900.96	7.81	23954.39	114.67
20	20.00	0.00	0.00	47900.96	46969.15	7.72	23488.43	114.63
21	21.00	0.00	0.00	46969.15	46048.33	7.63	23027.98	114.59
22	22.00	0.00	0.00	46048.33	45138.53	7.54	22573.03	114.56
23	23.00	0.00	0.00	45138.53	44239.71	7.45	22123.58	114.52
24	24.00	0.00	0.00	44239.71	43351.92	7.35	21679.64	114.48
25	25.00	0.00	0.00	43351.92	42475.25	7.26	21241.26	114.44
26	26.00	0.00	0.00	42475.25	41609.62	7.17	20808.39	114.41
27	27.00	0.00	0.00	41609.62	40754.99	7.08	20381.03	114.37
28	28.00	0.00	0.00	40754.99	39911.31	6.99	19959.15	114.33
29	29.00	0.00	0.00	39911.31	39078.46	6.90	19542.68	114.30
30	30.00	0.00	0.00	39078.46	38256.34	6.81	19131.58	114.26
31	31.00	0.00	0.00	38256.34	37444.85	6.72	18725.78	114.23
32	32.00	0.00	0.00	37444.85	36643.95	6.63	18325.29	114.19
33	33.00	0.00	0.00	36643.95	35853.79	6.54	17930.16	114.16
34	34.00	0.00	0.00	35853.79	35074.35	6.45	17540.40	114.13
35	35.00	0.00	0.00	35074.35	34305.60	6.36	17155.98	114.09
36	36.00	0.00	0.00	34305.60	33547.62	6.27	16776.95	114.06
37	37.00	0.00	0.00	33547.62	32800.36	6.18	16403.27	114.03
38	38.00	0.00	0.00	32800.36	32063.77	6.09	16034.93	114.00
39	39.00	0.00	0.00	32063.77	31337.93	6.00	15671.97	113.96
40	40.00	0.00	0.00	31337.93	30622.80	5.92	15314.36	113.93

FLOOD HYDROGRAPH REPORT

41	41.00	0.00	0.00	30622.80	29918.29	5.83	14962.06	113.90
42	42.00	0.00	0.00	29918.29	29224.52	5.74	14615.13	113.87
43	43.00	0.00	0.00	29224.52	28541.53	5.65	14273.59	113.84
44	44.00	0.00	0.00	28541.53	27869.16	5.56	13937.36	113.81
45	45.00	0.00	0.00	27869.16	27207.69	5.47	13606.58	113.78
46	46.00	0.00	0.00	27207.69	26557.40	5.37	13281.39	113.75
47	47.00	0.00	0.00	26557.40	25918.13	5.28	12961.71	113.72
48	48.00	0.00	0.00	25918.13	25289.76	5.19	12647.48	113.70
49	49.00	0.00	0.00	25289.76	24672.26	5.10	12338.68	113.67
50	50.00	0.00	0.00	24672.26	24065.50	5.01	12035.26	113.64
51	51.00	0.00	0.00	24065.50	23469.31	4.93	11737.12	113.61
52	52.00	0.00	0.00	23469.31	22883.85	4.83	11444.34	113.58
53	53.00	0.00	0.00	22883.85	22309.30	4.74	11157.02	113.56
54	54.00	0.00	0.00	22309.30	21745.50	4.65	10875.08	113.53
55	55.00	0.00	0.00	21745.50	21192.32	4.57	10598.44	113.51
56	56.00	0.00	0.00	21192.32	20650.12	4.47	10327.29	113.48
57	57.00	0.00	0.00	20650.12	20119.10	4.38	10061.74	113.45
58	58.00	0.00	0.00	20119.10	19599.04	4.29	9801.66	113.43
59	59.00	0.00	0.00	19599.04	19089.79	4.20	9547.00	113.41
60	60.00	0.00	0.00	19089.79	18591.55	4.11	9297.83	113.38
61	61.00	0.00	0.00	18591.55	18104.39	4.01	9054.20	113.36
62	62.00	0.00	0.00	18104.39	17628.08	3.93	8816.00	113.33
63	63.00	0.00	0.00	17628.08	17162.38	3.84	8583.11	113.31
64	64.00	0.00	0.00	17162.38	16707.54	3.74	8355.64	113.29
65	65.00	0.00	0.00	16707.54	16263.83	3.65	8133.74	113.27
66	66.00	0.00	0.00	16263.83	15831.00	3.56	7917.28	113.24
67	67.00	0.00	0.00	15831.00	15408.79	3.48	7706.13	113.22
68	68.00	0.00	0.00	15408.79	14997.17	3.39	7500.28	113.20
69	69.00	0.00	0.00	14997.17	14596.48	3.29	7299.88	113.18
70	70.00	0.00	0.00	14596.48	14206.81	3.20	7105.00	113.16
71	71.00	0.00	0.00	14206.81	13827.85	3.11	6915.48	113.14
72	72.00	0.00	0.00	13827.85	13459.32	3.03	6731.18	113.12
73	73.00	0.00	0.00	13459.32	13101.07	2.94	6552.01	113.10
74	74.00	0.00	0.00	13101.07	12753.25	2.86	6378.05	113.08
75	75.00	0.00	0.00	12753.25	12415.82	2.77	6209.30	113.07
76	76.00	0.00	0.00	12415.82	12088.48	2.69	6045.59	113.05
77	77.00	0.00	0.00	12088.48	11770.93	2.61	5886.77	113.03
78	78.00	0.00	0.00	11770.93	11462.86	2.53	5732.70	113.02
79	79.00	0.00	0.00	11462.86	11164.02	2.45	5583.23	113.00
80	80.00	0.00	0.00	11164.02	10874.12	2.38	5438.25	112.98
81	81.00	0.00	0.00	10874.12	10592.90	2.31	5297.61	112.97
82	82.00	0.00	0.00	10592.90	10320.11	2.24	5161.18	112.95
83	83.00	0.00	0.00	10320.11	10055.50	2.17	5028.83	112.94
84	84.00	0.00	0.00	10055.50	9798.81	2.11	4900.46	112.92
85	85.00	0.00	0.00	9798.81	9549.81	2.04	4775.93	112.91
86	86.00	0.00	0.00	9549.81	9308.31	1.98	4655.14	112.89
87	87.00	0.00	0.00	9308.31	9074.10	1.92	4538.01	112.88
88	88.00	0.00	0.00	9074.10	8846.96	1.86	4424.41	112.87

FLOOD HYDROGRAPH REPORT

Hydrograph Number: 4
Name: 100 year routing
Type: Reservoir: Storage Indication

[HYDROGRAPH INFORMATION]

Peak Flow (Qp)	=	12.21 (cfs)
Time to Peak (Tp)	=	17.00 (min)
Time of Base (Tb)	=	1440.00 (min)
Volume	=	1.24 (ac-ft)
Time Step	=	1.00 (min)
Peak Elevation	=	117.02 (ft)
Detention Time	=	NA

[RESERVOIR STRUCTURE INFORMATION]

Number	=	1
Name	=	Underground vault
Storage Type	=	Underground Pipe
Maximum Storage	=	46436.67 (cu ft)
Maximum Discharge	=	12.35 (cfs)

[INFLOW HYDROGRAPH INFORMATION]

Number	=	2
Name	=	100 year inflow
Peak Flow (Qp)	=	96.55 (cfs)
Time to Peak (Tp)	=	9.30 (min)
Time of Base (Tb)	=	18.60 (min)
Volume	=	1.24 (ac-ft)
Flow Multiplier	=	1.00

[EQUATION]

$0.5(I1+I2)dt + S1-0.5(O2)dt$

Where:
I1 = Previous Inflow
I2 = Current Inflow
dt = Time increment
S1 = Previous Storage
S2 = Current Storage
O1 = Previous Outflow
O2 = Current Outflow

$A = 0.5\ (I1+I2)\ dt$
$B = S1 - 0.5\ (O1)\ dt$
$C = S2 + 0.5\ (O2)\ dt$

FLOOD HYDROGRAPH REPORT

Computation of Reservoir Outflow Table of Storage Indication Method
[The time interval is 1.00 min]

Intv	Time (min)	Inflow (cfs)	A (cfs)	B (cfs)	C (cfs)	Outflow (cfs)	Storage (cu ft)	Elev (ft)
1	1.00	10.38	10.38	0.00	618.92	0.07	309.49	112.23
2	2.00	20.76	31.14	618.92	2461.07	0.37	1230.72	112.43
3	3.00	31.14	51.91	2461.07	5490.38	1.04	2745.71	112.65
4	4.00	41.53	72.67	5490.38	9663.00	2.07	4832.53	112.91
5	5.00	51.91	93.43	9663.00	14940.87	3.37	7472.12	113.20
6	6.00	62.29	114.20	14940.87	21313.74	4.59	10659.17	113.51
7	7.00	72.67	134.96	21313.74	28794.06	5.68	14399.87	113.85
8	8.00	83.05	155.72	28794.06	37392.60	6.71	18699.66	114.23
9	9.00	93.43	176.48	37392.60	47113.70	7.73	23560.72	114.64
10	10.00	89.28	182.71	47113.70	57090.63	8.68	28549.65	115.06
11	11.00	78.90	168.18	57090.63	66090.51	9.49	33050.00	115.46
12	12.00	68.52	147.42	66090.51	73755.62	10.17	36882.89	115.81
13	13.00	58.14	126.65	73755.62	80099.64	10.74	40055.19	116.13
14	14.00	47.75	105.89	80099.64	85133.61	11.24	42572.43	116.42
15	15.00	37.37	85.13	85133.61	88867.29	11.65	44439.47	116.67
16	16.00	26.99	64.36	88867.29	91310.20	11.99	45661.09	116.88
17	17.00	16.61	43.60	91310.20	92473.88	12.21	46243.05	117.02
18	18.00	6.23	22.84	92473.88	92380.22	12.19	46196.20	117.01
19	19.00	0.00	6.23	92380.22	91303.63	11.99	45657.81	116.88
20	20.00	0.00	0.00	91303.63	89877.57	11.78	44944.68	116.75
21	21.00	0.00	0.00	89877.57	88474.39	11.61	44243.00	116.64
22	22.00	0.00	0.00	88474.39	87091.25	11.45	43551.35	116.55
23	23.00	0.00	0.00	87091.25	85726.48	11.30	42868.89	116.46
24	24.00	0.00	0.00	85726.48	84378.93	11.16	42195.04	116.38
25	25.00	0.00	0.00	84378.93	83047.79	11.03	41529.41	116.30
26	26.00	0.00	0.00	83047.79	81732.38	10.90	40871.64	116.22
27	27.00	0.00	0.00	81732.38	80432.07	10.78	40221.42	116.15
28	28.00	0.00	0.00	80432.07	79146.36	10.66	39578.51	116.08
29	29.00	0.00	0.00	79146.36	77874.88	10.54	38942.71	116.02
30	30.00	0.00	0.00	77874.88	76617.29	10.42	38313.86	115.95
31	31.00	0.00	0.00	76617.29	75373.35	10.31	37691.83	115.89
32	32.00	0.00	0.00	75373.35	74142.80	10.20	37076.50	115.83
33	33.00	0.00	0.00	74142.80	72925.39	10.09	36467.74	115.77
34	34.00	0.00	0.00	72925.39	71720.94	9.98	35865.46	115.72
35	35.00	0.00	0.00	71720.94	70529.23	9.88	35269.56	115.66
36	36.00	0.00	0.00	70529.23	69350.12	9.77	34679.95	115.61
37	37.00	0.00	0.00	69350.12	68183.44	9.67	34096.56	115.55
38	38.00	0.00	0.00	68183.44	67029.06	9.57	33519.32	115.50
39	39.00	0.00	0.00	67029.06	65886.86	9.47	32948.16	115.45
40	40.00	0.00	0.00	65886.86	64756.71	9.37	32383.04	115.40

FLOOD HYDROGRAPH REPORT

41	41.00	0.00	0.00	64756.71	63638.58	9.27	31823.92	115.35
42	42.00	0.00	0.00	63638.58	62532.37	9.17	31270.77	115.30
43	43.00	0.00	0.00	62532.37	61437.98	9.07	30723.53	115.25
44	44.00	0.00	0.00	61437.98	60355.29	8.97	30182.13	115.20
45	45.00	0.00	0.00	60355.29	59284.20	8.88	29646.54	115.16
46	46.00	0.00	0.00	59284.20	58224.60	8.78	29116.69	115.11
47	47.00	0.00	0.00	58224.60	57176.44	8.69	28592.56	115.07
48	48.00	0.00	0.00	57176.44	56139.67	8.59	28074.13	115.02
49	49.00	0.00	0.00	56139.67	55114.27	8.50	27561.38	114.98
50	50.00	0.00	0.00	55114.27	54100.23	8.40	27054.31	114.94
51	51.00	0.00	0.00	54100.23	53097.49	8.31	26552.90	114.89
52	52.00	0.00	0.00	53097.49	52106.01	8.22	26057.11	114.85
53	53.00	0.00	0.00	52106.01	51125.71	8.12	25566.92	114.81
54	54.00	0.00	0.00	51125.71	50156.55	8.03	25082.29	114.77
55	55.00	0.00	0.00	50156.55	49198.51	7.94	24603.22	114.73
56	56.00	0.00	0.00	49198.51	48251.53	7.85	24129.69	114.69
57	57.00	0.00	0.00	48251.53	47315.60	7.75	23661.68	114.65
58	58.00	0.00	0.00	47315.60	46390.66	7.66	23199.16	114.61
59	59.00	0.00	0.00	46390.66	45476.73	7.57	22742.15	114.57
60	60.00	0.00	0.00	45476.73	44573.83	7.48	22290.65	114.53
61	61.00	0.00	0.00	44573.83	43681.92	7.39	21844.66	114.49
62	62.00	0.00	0.00	43681.92	42801.10	7.29	21404.20	114.46
63	63.00	0.00	0.00	42801.10	41931.36	7.20	20969.28	114.42
64	64.00	0.00	0.00	41931.36	41072.64	7.11	20539.87	114.38
65	65.00	0.00	0.00	41072.64	40224.89	7.02	20115.96	114.35
66	66.00	0.00	0.00	40224.89	39388.01	6.93	19697.47	114.31
67	67.00	0.00	0.00	39388.01	38561.89	6.84	19284.37	114.28
68	68.00	0.00	0.00	38561.89	37746.44	6.75	18876.60	114.24
69	69.00	0.00	0.00	37746.44	36941.56	6.66	18474.11	114.21
70	70.00	0.00	0.00	36941.56	36147.35	6.57	18076.96	114.17
71	71.00	0.00	0.00	36147.35	35363.93	6.48	17685.21	114.14
72	72.00	0.00	0.00	35363.93	34591.17	6.40	17298.78	114.11
73	73.00	0.00	0.00	34591.17	33829.14	6.31	16917.72	114.07
74	74.00	0.00	0.00	33829.14	33077.90	6.22	16542.06	114.04
75	75.00	0.00	0.00	33077.90	32337.30	6.13	16171.72	114.01
76	76.00	0.00	0.00	32337.30	31607.42	6.04	15806.73	113.98
77	77.00	0.00	0.00	31607.42	30888.31	5.95	15447.13	113.94
78	78.00	0.00	0.00	30888.31	30179.81	5.86	15092.84	113.91
79	79.00	0.00	0.00	30179.81	29482.01	5.77	14743.89	113.88
80	80.00	0.00	0.00	29482.01	28795.03	5.68	14400.35	113.85
81	81.00	0.00	0.00	28795.03	28118.72	5.59	14062.15	113.82
82	82.00	0.00	0.00	28118.72	27453.19	5.50	13729.35	113.79
83	83.00	0.00	0.00	27453.19	26798.74	5.41	13402.08	113.76
84	84.00	0.00	0.00	26798.74	26155.38	5.32	13080.35	113.73
85	85.00	0.00	0.00	26155.38	25522.94	5.23	12764.08	113.71
86	86.00	0.00	0.00	25522.94	24901.38	5.13	12453.26	113.68
87	87.00	0.00	0.00	24901.38	24290.64	5.05	12147.84	113.65
88	88.00	0.00	0.00	24290.64	23690.53	4.96	11847.74	113.62

OUTLET STRUCTURE LISTING

Number	Name	Type	Defined
1	Outlet	Culvert	Yes

OUTLET STRUCTURE REPORT

Structure Number : 1
Type : Circular Concrete w/ groove end projecting
Name : Outlet

[RATING CURVE LIMIT]

Minimum Elevation	=	112.11	(ft)
Maximum Elevation	=	117.11	(ft)
Elevation Increment	=	0.10	(ft)

[OUTLET STRUCTURE INFORMATION]

Diameter	=	1.25	(ft)
Invert Elevation	=	112.11	(ft)
Pipe Length	=	40.00	(ft)
Slope	=	0.01	(ft/ft)
Manning's n Value	=	0.01	
Orifice Coefficient	=	0.60	
Tailwater Elevation	=	112.00	(ft)
Number of Barrels	=	1	

[UNSUBMERGED EQUATION]

H/Diam = Hc/Diam+K*(Q/(A*Diam^0.5))^M-0.5*S

Coefficient K	=	0.00	
Coefficient M	=	2.00	
Q Maximum	=	4.80	(cfs)

[SUBMERGED EQUATION]

H/Diam = c*(Q/(A*Diam^0.5))^2+Y-0.5*S

Coefficient c	=	0.03	
Coefficient Y	=	0.69	
Q Minimum	=	5.49	(cfs)

[DEFINITIONS]

H = Headwater depth above inlet control section invert, (ft)
Diam = Interior height of culvert barrel, (ft)
Hc = Specific head at critical depth (dc+Vc^2/2g), (ft)
Q = Discharge, (cfs)
A = Full cross sectional area of culvert barrel, (sq ft)
S = Culvert barrel slope, (ft/ft)

[MAXIMUM DISCHARGE]

Q	=	12.35	(cfs)

[CULVERT STAGE VS. DISCHARGE]

Elevation (ft)	Stage (ft)	Discharge (cfs)
112.11	0.00	0.00

OUTLET STRUCTURE REPORT

112.21	0.10	0.04
112.31	0.20	0.15
112.41	0.30	0.33
112.51	0.40	0.58
112.61	0.50	0.88
112.71	0.60	1.23
112.81	0.70	1.62
112.91	0.80	2.05
113.01	0.90	2.50
113.11	1.00	2.97
113.21	1.10	3.42
113.31	1.20	3.83
113.41	1.30	4.22
113.51	1.40	4.58
113.61	1.50	4.92
113.71	1.60	5.24
113.81	1.70	5.56
113.91	1.80	5.85
114.01	1.90	6.13
114.11	2.00	6.41
114.21	2.10	6.67
114.31	2.20	6.93
114.41	2.30	7.18
114.51	2.40	7.43
114.61	2.50	7.67
114.71	2.60	7.90
114.81	2.70	8.13
114.91	2.80	8.35
115.01	2.90	8.57
115.11	3.00	8.78
115.21	3.10	8.99
115.31	3.20	9.19
115.41	3.30	9.39
115.51	3.40	9.59
115.61	3.50	9.78
115.71	3.60	9.97
115.81	3.70	10.16
115.91	3.80	10.34
116.01	3.90	10.52
116.11	4.00	10.70
116.21	4.10	10.88
116.31	4.20	11.05
116.41	4.30	11.22
116.51	4.40	11.39
116.61	4.50	11.55
116.71	4.60	11.72
116.81	4.70	11.88
116.91	4.80	12.04
117.01	4.90	12.19
117.11	5.00	12.35

User Name: Ole M. Marcussen
Project: Undergroound detention
Scenario: Proposed expansion

Date: 12-10-02
Time: 15:04:03

RESERVOIR LISTING

Number	Name	Type	Defined
1	Underground vault	Underground Pipe	Yes

User Name: Ole M. Marcussen
Project: Undergroound detention
Scenario: Proposed expansion

Date: 12-10-02
Time: 15:04:03
Page: 2

RESERVOIR REPORT

Reservoir Number: 1
Name: Underground vault

[RATING CURVE LIMIT]

Minimum Elevation	=	112.11 (ft)
Maximum Elevation	=	117.11 (ft)
Elevation Increment	=	0.10 (ft)

[STAGE STORAGE INFORMATION]
Storage Method: Underground Pipe

Length	=	215.00 (ft)
Diameter	=	5.00 (ft)

[DISCHARGE INFORMATION]
Structure Number: 1
Type: Circular Concrete - Groove End Projecting
Name: Outlet

[RESERVOIR STAGE STORAGE/DISCHARGE]

Elevation (ft)	Stage (ft)	Area (sq ft)	Storage (cu ft)	Discharge (cfs)
112.11	0.00	0.00	0.00	0.00
112.21	0.10	301.00	221.63	0.04
112.31	0.20	421.31	623.04	0.15
112.41	0.30	510.60	1137.52	0.33
112.51	0.40	583.28	1740.35	0.58
112.61	0.50	645.00	2416.75	0.88
112.71	0.60	698.67	3156.41	1.23
112.81	0.70	746.02	3951.51	1.62
112.91	0.80	788.20	4795.77	2.05
113.01	0.90	826.00	5683.95	2.50
113.11	1.00	860.00	6611.58	2.97
113.21	1.10	890.63	7574.72	3.42
113.31	1.20	918.23	8569.86	3.83
113.41	1.30	943.06	9593.81	4.22
113.51	1.40	965.35	10643.66	4.58
113.61	1.50	985.25	11716.70	4.92
113.71	1.60	1002.92	12810.40	5.24
113.81	1.70	1018.47	13922.36	5.56
113.91	1.80	1032.00	15050.30	5.85
114.01	1.90	1043.58	16192.05	6.13
114.11	2.00	1053.28	17345.49	6.41
114.21	2.10	1061.15	18508.59	6.67
114.31	2.20	1067.23	19679.37	6.93

RESERVOIR REPORT

114.41	2.30	1071.55	20855.86	7.18
114.51	2.40	1074.14	22036.15	7.43
114.61	2.50	1075.00	23218.33	7.67
114.71	2.60	1074.14	24400.52	7.90
114.81	2.70	1071.55	25580.81	8.13
114.91	2.80	1067.23	26757.30	8.35
115.01	2.90	1061.15	27928.07	8.57
115.11	3.00	1053.28	29091.18	8.78
115.21	3.10	1043.58	30244.62	8.99
115.31	3.20	1032.00	31386.36	9.19
115.41	3.30	1018.47	32514.31	9.39
115.51	3.40	1002.92	33626.27	9.59
115.61	3.50	985.25	34719.96	9.78
115.71	3.60	965.35	35793.00	9.97
115.81	3.70	943.06	36842.86	10.16
115.91	3.80	918.23	37866.81	10.34
116.01	3.90	890.63	38861.95	10.52
116.11	4.00	860.00	39825.08	10.70
116.21	4.10	826.00	40752.71	10.88
116.31	4.20	788.20	41640.90	11.05
116.41	4.30	746.02	42485.16	11.22
116.51	4.40	698.67	43280.25	11.39
116.61	4.50	645.00	44019.92	11.55
116.71	4.60	583.28	44696.31	11.72
116.81	4.70	510.60	45299.14	11.88
116.91	4.80	421.31	45813.62	12.04
117.01	4.90	301.00	46215.03	12.19
117.11	5.00	0.00	46436.67	12.35

Maximum Storage = 46436.67 (cu ft)
Maximum Discharge = 12.35 (cfs)

Exhibit 1

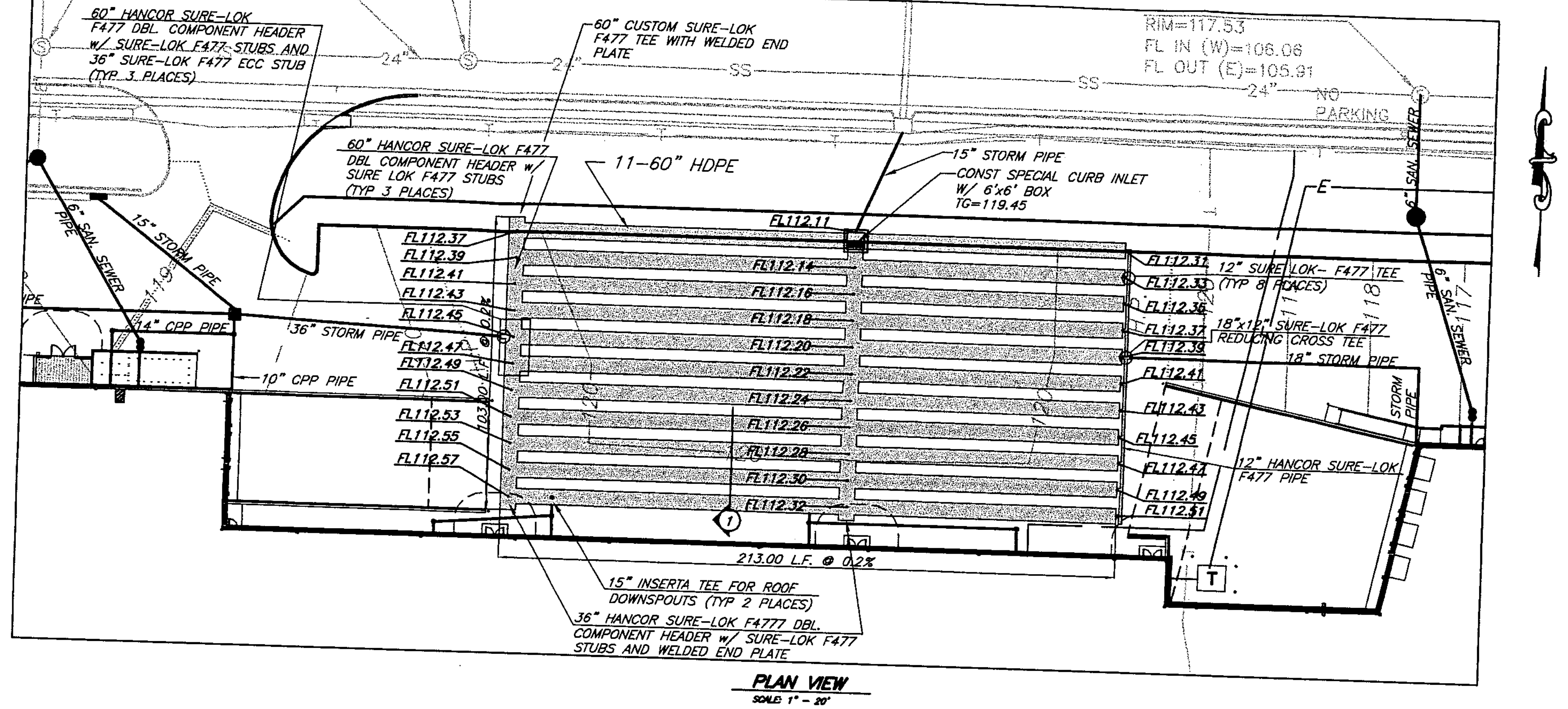
Existing drainage map

Exhibit 2

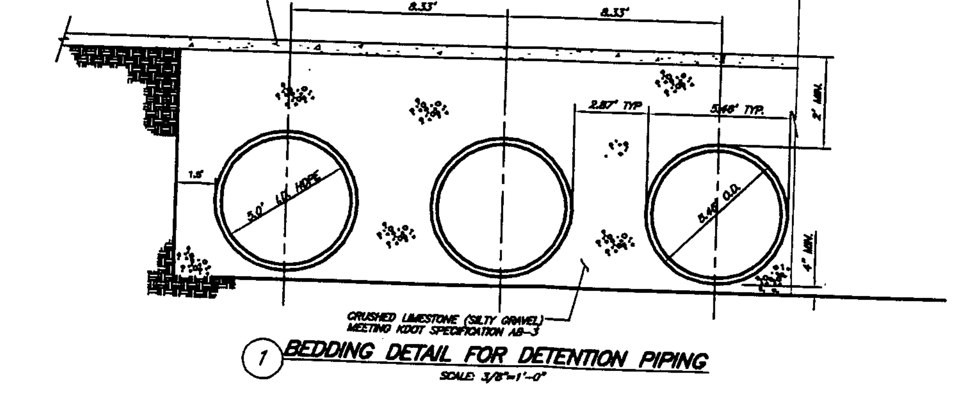
Proposed drainage map

Exhibit 3

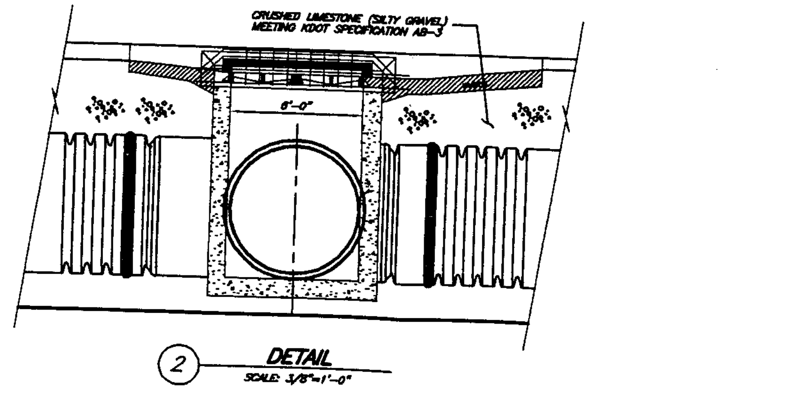
Proposed storm sewer plan and profile



PLAN VIEW
SCALE: 1" = 30'



1 **BEDDING DETAIL FOR DETENTION PIPING**
SCALE: 3/8"=1'-0"



2 **DETAIL**
SCALE: 3/8"=1'-0"

STORM SEWER DETAILS
UNDERGROUND DETENTION SYSTEM

WAL-MART EXPANSION #1221-02

KELLOGG DR. & JULIA ST.
WICHITA, KANSAS

SPEAR & McCALEB CO., P.C.
818 West Main – Oklahoma City, OK 73106
PH: 405-232-7715 Fax: 405-232-7808
SMC

TERENCE L. HAYNES
LICENSED
14583
KANSAS
PROFESSIONAL ENGINEER
NOT VALID FOR CONSTRUCTION UNLESS SIGNED IN THIS BLOCK

DATE: 12/12/02
DRAWN BY: KW
PROJECT NO.: 3816
SCALE: N.T.S.
ENGINEER: TERENCE L. HAYNES, P.E. #14583
SHEET NO. C-14
4 OF 4

Exhibit 4

Proposed underground detention plan