WINGHAVEN

STORMWATER DETENTION

5500-68

July 18, 2000

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APPROVED
9.12.2000

SUMMARY

Winghaven is a mixed use land development in O'Fallon, Missouri. The development is roughly bounded by Highway N on the North, Bates Road and its Southerly projection on the East, Dardenne Creek on the South, and Highway 40/61 and Post Road on the West. Before development, a part of this tract of land was used by Novus International for their research facilities and offices. Most of the rest of the tract was agricultural land with cropland, pastures and farm buildings. The rest of the tract was wooded with some wetlands in the Dardenne Creek Bottoms.

Development of the tract includes a golf course, single family and multi family residential, high tech commercial and a strip shopping center. Development of Dardenne Creek Bottoms will destroy some of the existing wetlands. Additional wetlands will be created to replace the destroyed wetlands.

Pondpack version 7.0 by Haestad Methods was used to calculate runoff both before and after development. The Soil Conservation Service TR-55 method was used within Pondpack to calculate runoff. Five stormwater detention lakes and one dry detention basin were included in the post development runoff model. The results of the two models, pre-developed and post-developed, were compared at all points where runoff leaves Winghaven and at critical points within Winghaven. At all locations where runoff leaves Winghaven the calculated peak runoff after development is less than the calculated peak runoff before development.

CALCULATIONS

To calculate runoff, Winghaven was divided into twelve subareas. Subarea 1 is tributary to a culvert under Post Road approximately 1100 feet South of Highway N. Before development 48 acres of Winghaven was tributary to this culvert. Of this, 41.3 acres was cultivated in row corps and the remaining 6.7 acres was wooded. In addition 23.58 acres from offsite drains to a dry detention basin in subarea 1. This area is called subarea 1A in the calculations. Soils in this watershed are hydrologic soil groups B and C. Peak runoff from this subarea before development was 85.94 cfs in a 2 year storm, 173.12 cfs in a 15 year storm, 193.50 cfs in a 25 year storm and 271.25 cfs in a 100 year storm.

After development 59.7 acres of Winghaven along with the 23.58 offsite acres drains to this culvert. Of this, 24.8 acres is residential development, 11.6 acres is golf course, 3.5 acres is left wooded and the remaining 19.8 acres is school and shopping center. In addition to the 23.58 offsite acres, 6.34 acres of residential development drains to the detention basin. Peak runoff from this subarea with detention after development is 83.89 cfs in a 2 year storm, 145.88 cfs in a 15 year storm, 159.79 cfs in a 25 year storm and 211.94 cfs in a 100 year storm.

The creek downstream from the Post Road culvert flows in a large arc and crosses Post Road again flowing through the Post Meadows Subdivision and back into Winghaven and through Winghaven to Dardenne Creek.

Subarea 2 is tributary to a small ditch that flows across the North line of Post Meadows and to the creek from subarea 1. Before development, 28.4 acres of Winghaven drained to this ditch at the property line. Of this, 18.7 acres was cultivated in row crops and the remaining 9.7 acres was wooded. Soils in this subarea are hydrologic soils groups B and C. Peak runoff from this subarea before development was 42.91 cfs in a 2 year storm, 91.75 cfs in a 15 year storm, 103.26 cfs in a 25 year storm and 147.45 cfs in a 100 year storm.

After development 17.0 acres is tributary to this ditch at the property line. This entire area is residential development. The remaining 11.4 acres from the undeveloped subarea is diverted in a closed sewer system to subarea 4. Peak runoff from this subarea after development is 24.35 cfs in a 2year storm, 48.19 cfs in a 15 year storm, 53.69 cfs in a 25 year storm and 74.59 cfs in a 100 year storm.

Subarea 3 is tributary to a small ditch that flows into Post Meadows near the Northeast corner of Post Meadows. Before development 5.5 acres of cultivated crops and woods from Winghaven drained into this ditch. Peak runoff from this subarea before development was 9.39 cfs in a 2 year storm, 20.68 cfs in a 15 year storm, 23.36 cfs in a 25 year storm and 33.69 cfs in a 100 year storm.

After development this entire area is diverted in a closed sewer system to subarea 4 except for the runoff from five rear yards which drains directly into Post Meadows. This area was ignored in this study.

Subarea 4 is tributary to a ditch that flows into Post Meadows approximately 1100 feet South of the Northeast corner of Post Meadows. Before development 188.8 acres of Winghaven drained to this ditch. Of this, 148.6 acres was cultivated in row crops and the remaining 40.2 acres was wooded. Soils in this subarea area hydrologic soil groups B, C and D. Peak runoff from this subarea was 276.67 cfs in a 2 year storm, 545.45 cfs in a 15 year storm, 607.39 cfs in a 25 year storm and 843.14 cfs in a 100 year storm.

After development, 182.8 acres of Winghaven drains to this ditch. Runoff from the remaining area is diverted to subareas 1, 7 and 10. The area draining to this point includes 96.9 acres of residential development 77.8 acres of golf course and 8.1 acres of undisturbed woods. Peak runoff from this subarea after development is 230.59 cfs in a 2 year storm, 458.36 cfs in a 15 year storm, 510.99 cfs in a 25 year storm and 711.19 cfs in a 100 year storm.

Subarea 5 drains to a ditch that flows into Post Meadows approximately 350 feet Southeast of the intersection of the Southwest line of Post Meadows and Post Road. Before development 7.8 acres of Winghaven drained to this ditch. Of this, 4.6 acres was pasture and the remaining 3.2 acres was wooded. Soils in this subarea are hydrologic soil groups B and C. Peak runoff from this subarea before development was 5.62 cfs in a 2 year storm, 15.55 cfs in a 15 year storm, 18.03 cfs in a 25 year storm and 27.88 cfs in a 100 year storm.

Subarea 6 drains to a ditch that flows into Post Meadows approximately 1200 feet Southeast of the intersection of the Southwest line of Post Meadows and Post Road. Before development 13.3 acres of Winghaven drained to this ditch. Of this, 8.4 acres was pasture and the remaining 4.9 acres was wooded. Soils in this subarea are hydrologic soil groups B and C. Peak runoff from this subarea before development was 10.22 cfs in a 2 year storm, 27.12 cfs in a 15 year storm, 31.30 cfs in a 25 year storm and 47.81 cfs in a 100 year storm.

Both subareas 5 and 6 will be developed as high tech commercial. Construction plans for these two subareas have not been completed. Preliminary planning is to take most of the runoff from these two subareas in a closed sewer system around Post Meadows. The ditches that drain subareas 2 through 6 are all tributary to the creek which drains subarea 1. This creek flows through Post Meadows and back into Winghaven in subarea 7. From there it flows South through Winghaven to Dardenne Creek. Runoff from subareas 7, 8, and 9 flows directly into this creek. After development the closed sewer system from subarea 5 and 6 will also discharge into this creek downstream from Post Meadow. Peak runoff from subareas 5 and 6 after development is 49.62 cfs in a 2 year storm, 80.50 cfs in a 15 year storm, 87.31 cfs in a 25 year storm and 112.71 cfs in a 100 year storm.

Subarea 7 drains directly into the creek described above. Before development 106.5 acres drained to the creek from subarea 7. Of this, 68.6 acres was cultivated in row crops, 5.2 acres was buildings and pavement and the remaining 32.7 acres was wooded. Soils in this subarea are hydrologic soil groups B and C. Peak runoff from this subarea before development was 143.50 cfs in a 2 year storm, 304.58 cfs in a 15 year storm, 342.45 cfs in a 25 year storm and 487.87 cfs in a 100 year storm.

After development there are two lakes in the golf course in subarea 7 which provide stormwater detention. Thirty four acres of golf course, woods and a small paved area drains to the first lake. The peak runoff to this lake is 74.32 cfs in a 2 year storm, 132.10 cfs in a 15 year storm, 145.22 cfs in a 25 year storm and 194.58 cfs in a 100 year storm. The peak flow out of the lake is reduced to 44.70 cfs in a 2 year storm, 89.45 cfs in a 15 year storm, 100.09 cfs in 25 year storm and 135.81 cfs in a 100 year storm. The flow out of this lake drains to the second lake along with the runoff from 8.3 acres of woods, golf course and paved area. The total peak flow into the second lake is 53.98 cfs in a 2 year storm, 110.38 cfs in a 15 year storm, 123.45 cfs in a 25 year storm and 170.62 cfs in a 100 year storm. The peak flow out of this lake is reduced to 38.23 cfs in a 2 year storm, 83.75 cfs in a 15 year storm, 94.61 cfs in a 25 year storm and 134.44 cfs in a 100 year storm. Flow from this lake drains through the golf course in a ditch to the creek. An additional 66.0 acres of woods, golf course, and pavement from subarea seven is downstream of the second lake and drains directly into the creek. Peak runoff from this area is 74.99 cfs in a 2 year storm, 169.98 cfs in a 15 year storm, 192.69 cfs in a 25 year storm and 280.71 cfs in a 100 year storm.

Subarea 8 drains to the creek in a ditch just South of the Novus International office and research facility. Before development there was 129.7 acres in this subarea including 92.5 acres cultivated in row crops, 31.3 acres of woods and 5.9 acres of pavement. This subarea includes the area of the proposed interchange at Winghaven Boulevard, Highway DD and Highway 40/61. The soils in this subareas are hydrologic soils groups B and C. Peak runoff from this subarea before development was 159.85 cfs in a 2 year storm, 334.89 cfs in a 15 year storm, 375.92 cfs in a 25 year storm, and 533.17 cfs in a 100 year storm.

In addition to the Winghaven Boulevard, Highway 40/61 interchange this subarea includes the MasterCard World Headquarters and other high tech commercial development. A dam will be built across the ditch at the downstream end of this subarea to create a lake which will be used for stormwater detention. After development there is 129.7 acres in this watershed including 38.0 acres of landscape/grass areas, 80.8 acres of buildings and pavement, and 10.9 acres of lake. After development peak runoff to the lake is 284.61 cfs in a 2 year storm, 474.60 cfs in a 15 year storm, 516.62 cfs in a 25 year storm and 673.40 cfs in a 100 year storm. The peak flow out of the lake is 83.31 cfs in a 2 year storm, 166.23 cfs in a 15 year storm, 186.12 cfs in a 25 year storm and 258.02 cfs in a 100 year storm.

Subarea 9 includes the remaining area of Winghaven tributary to the creek from subarea 1 at the point the creek leaves Winghaven and enters Martel Subdivision. Before development this subarea contained 152.4 acres including 75.7 acres of pasture, 65.0 acres of woods and 11.7 acres of building and pavement. Soils in this subarea are hydrologic soil groups B and C. Peak runoff before development from this subarea was 106.21 cfs in a 2 year storm, 267.52 cfs in a 15 year storm , 307.02 cfs in a 25 year storm and 462.21 cfs in a 100 year storm.

After development subarea 9 contains 152.4 acres including 89.2 acres of high tech commercial, 18.9 acres of residential development and the remaining 44.3 acres is woods that is left undisturbed. Peak runoff after development from this subarea is 216.63 cfs in a 2 year storm, 409.70 cfs in a 15 year storm, 453.70 cfs in a 25 year storm and 619.87 cfs in a 100 year storm.

Subarea 10 drains to a creek that flows through Winghaven. The Southern end of this subarea is along the North line of a small nonurban tract of land on Bates Road that is not part of Winghaven. The creek flows through this nonurban tract and back into Winghaven at the South line of that nonurban tract. Before development this subarea contained 120.8 acres including 110.9 acres cultivated in row crops, 3.4 acres of building and pavement and 6.5 acres of woods. Soils in this subarea are hydrologic soil groups B and C. Peak runoff before development was 176.26 cfs in a 2 year storm. 347.76 cfs in a 15 year storm, 387.30 cfs in a 25 year storm and 537.48 cfs in a 100 year storm.

After development there are two lakes in the golf course in subarea 10 which provide stormwater detention. The watershed tributary to the first lake is 20.3 acres including 11.8 acres of residential development, 7.3 acres of golf course and 1.2 acres of lake. The peak runoff to this lake is 22.32 cfs in a 2 year storm, 47.76 cfs in a 15 year storm, 53.82 cfs in a 25 year storm and 77.17 cfs in a 100 year storm. The peak flow out of the lake is reduced to 12.21 cfs in a 2 year storm, 31.03 cfs in a 15 year storm, 35.92 cfs in a 25 year storm and 55.01 cfs in a 100 year storm. The flow out of the first lake drains to the second lake along with the runoff from 37.6 acres of residential development, 15.5 acres of golf course, 1.6 acres of pavement and the 4.4 acre lake. The total peak flow to the second lake is 88.85 cfs in a 2 year storm, 186.20 cfs in a 15 year storm, 209.39 cfs in a 25 year storm and 298.40 cfs in 100 year storm. The peak flow out of the second lake is reduced to 32.58 cfs in a 2 year storm, 85.25 cfs in a 15 year storm, 99.13 cfs in a 25 year storm and 154.85 cfs in a 100 year storm. The flow out of the second lake flows in the creek to the downstream end of subarea 10 along with the runoff from 51.1 acres in subarea 10 downstream of the lakes. This 51.1 acres includes 12.9 acres of residential development, 6.3 acres of buildings and pavement, 28.6 acres of golf course and landscape area and 3.3 acres of undisturbed woods. The peak flow leaving subarea 10 after development is 71.33 cfs in a 2 year storm, 156.35 cfs in a 15 year storm, 179.37 cfs in a 25 year storm and 275.12 cfs in a 100 year storm.

Subarea 11 drains to the creek downstream from subarea 10. The downstream end of subarea 11 is at the point where the creek enters the Dardenne Creek Bottoms. Before development this subarea contained 67.7 acres including 20.8 acres of pasture and 46.9 acres of woods. Soils in this subarea are hydrologic soil groups B and C. Peak runoff before development from the subarea is 13.26 cfs in a 2 year storm, 50.58 cfs in a 15 year storm, 61.03 cfs in a 25 year storm and 104.09 cfs in a 100 year storm.

After development subarea 11 will contain 50.7 acres of residential development, 6.7 acres of commercial development, and 10.3 acres of open space. The peak runoff from subarea 11 after development is 82.70 cfs in a 2 year storm, 167.29 cfs in a 15 year storm, 186.93 in a 25 year storm and 261.83 in a 100 year storm.

Subarea 12 is the Dardenne Creek Bottoms. Before development this subarea included extensive wetlands. With a U.S. Army Corps of Engineers permit, these wetlands are being mitigated with constructed wetlands with the same total size and general characteristics as the pre-development wetlands. Since these wetlands do not have a well defined area and control structure they would be very difficult to model as a detention ponds. Since the total area of the wetland after development is very nearly the same as before development, the wetlands were modeled in this study as grass or landscaped area both before and after development. This gives a somewhat higher total peak runoff than the actual runoff but the increase is the same both before and after development. Before development subarea 12 contained 252.2 acres including 143.7 acres of pasture and grass and 108.5 acres of woods. Soil in this subarea is hydrologic soil groups B and C. The peak runoff from this subarea before development was 84.16 cfs in a 2 year storm, 252.77 cfs in a 15 year storm, 295.79 cfs in a 25 year storm and 468.51 cfs in a 100 year storm.

After development subarea 12 will contain 252.2 acres including 106.4 acres of residential development, 52.5 acres of buildings and pavement and 93.3 acres of open space and landscaping. The peak runoff from subarea 12 after development is 291.33 cfs in a 2 year storm, 579.86 cfs in a 15 year storm, 646.56 cfs in a 25 year storm and 900.39 cfs in a 100 year storm.

The total peak runoff from Winghaven in Dardenne Creek as it leaves Winghaven before development is 756.32 cfs in a 2 year storm, 1855.32 cfs in a 15 year storm, 2133.96 cfs in a 25 year storm and 3195.35 cfs in a 100 year storm. The total peak runoff from Winghaven at the same location after development is 730.27 cfs in a 2 year storm, 1640.48 cfs in a 15 year storm, 1859.18 cfs in a 25 year storm and 2735.42 cfs in a 100 year storm.

ATTACHMENTS

Schematic layouts of Winghaven showing subareas, flow paths and lakes for both before and after development are attached. Peak flows are endorsed on these schematics for each subarea and junction of flows from subareas. Separate schematics are attached for each of the four storms.

Printouts of Curve Number, Time of Concentrations and Runoff Hydrographs for each subarea are included as well as a summary of peak flow for both before and after development. Inflow and outflow hydrographs of the five lakes and one detention basin are also attached. The rest of the calculations by pondpack have been converted to a text file and are included on a disc.

Site plans at a scale of 1 inch = 200 feet are also attached. These site plans show the limits of the subareas, flow paths, and the limits of the hydrologic soil groups on the site plans. Proposed development and lakes are also shown on the after development site plans.

CONCLUSION

Winghaven as planned meets the requirements of the City of O'Fallon Stormwater Detention Ordinanc The peak runoff from Winghaven after development is less than the peak runoff from Winghaven befo development at all points where runoff leaves Winghaven during the storms studied.

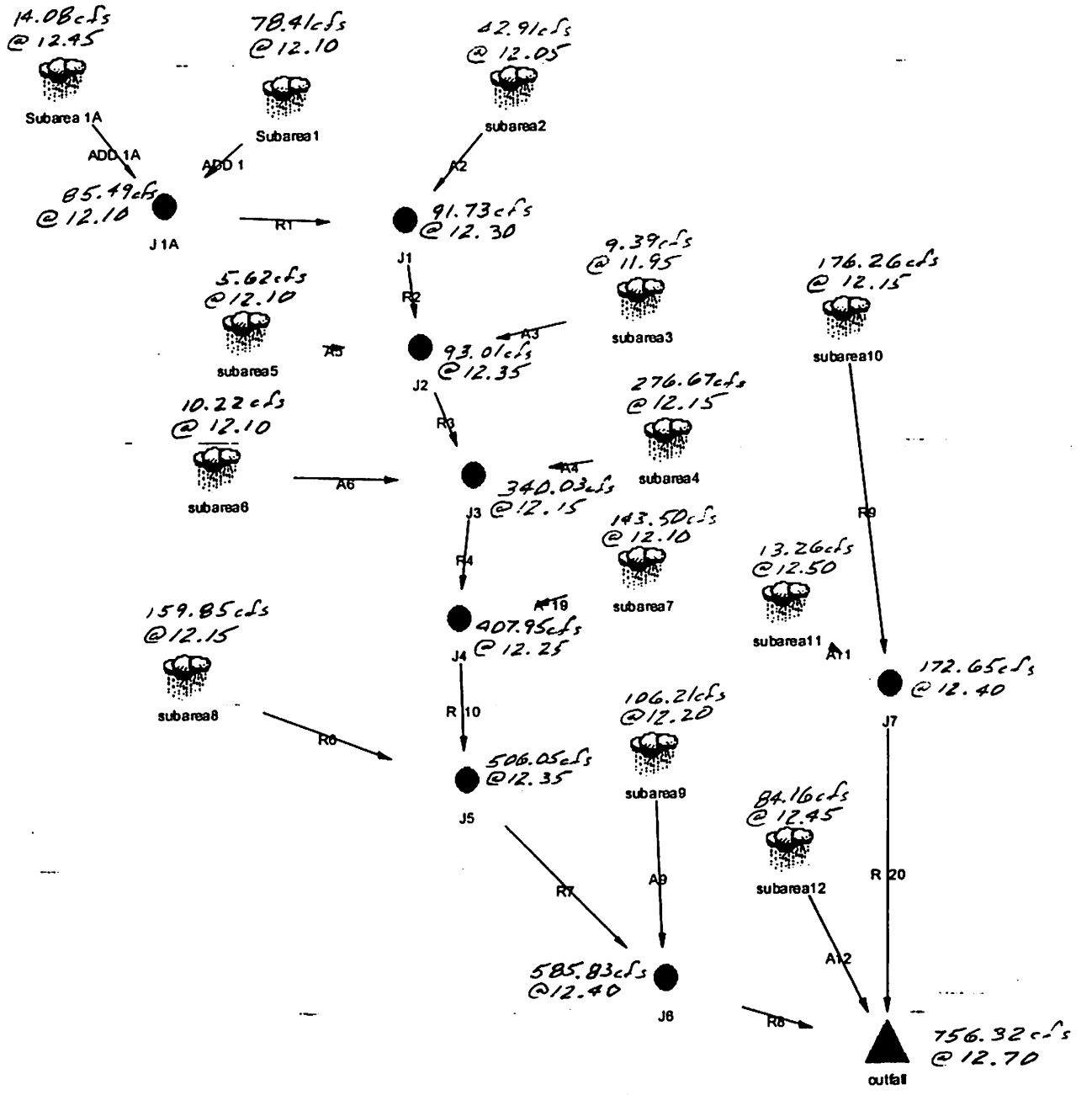
Elmer A. Krussel, P.E.

STATE OF MISSOURI
REGISTERED PROFESSIONAL ENGINEER
ELMER ANTHONY KRUSSEL
NUMBER E-16146

BEFORE

DEVELOPMENT

2 Yr. Storm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subarea2
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J1A
R1
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J1
9.39cfs @11.95
subarea3
176.26cfs @12.15
subarea10
5.62cfs @12.10
subarea5
A5
R2
A3
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J2
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subarea4
10.22cfs @12.10
subarea6
A6
R3
A4
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J3
143.50cfs @12.10
subarea7
R9
13.26cfs @12.50
subarea11
R4
159.85cfs @12.15
subarea8
A10
407.95cfs @12.25
J4
A11
172.65cfs @12.40
J7
106.21cfs @12.20
subarea9
R10
R8
506.05cfs @12.35
J5
84.16cfs @12.45
subarea12
R20
R7
A9
A12
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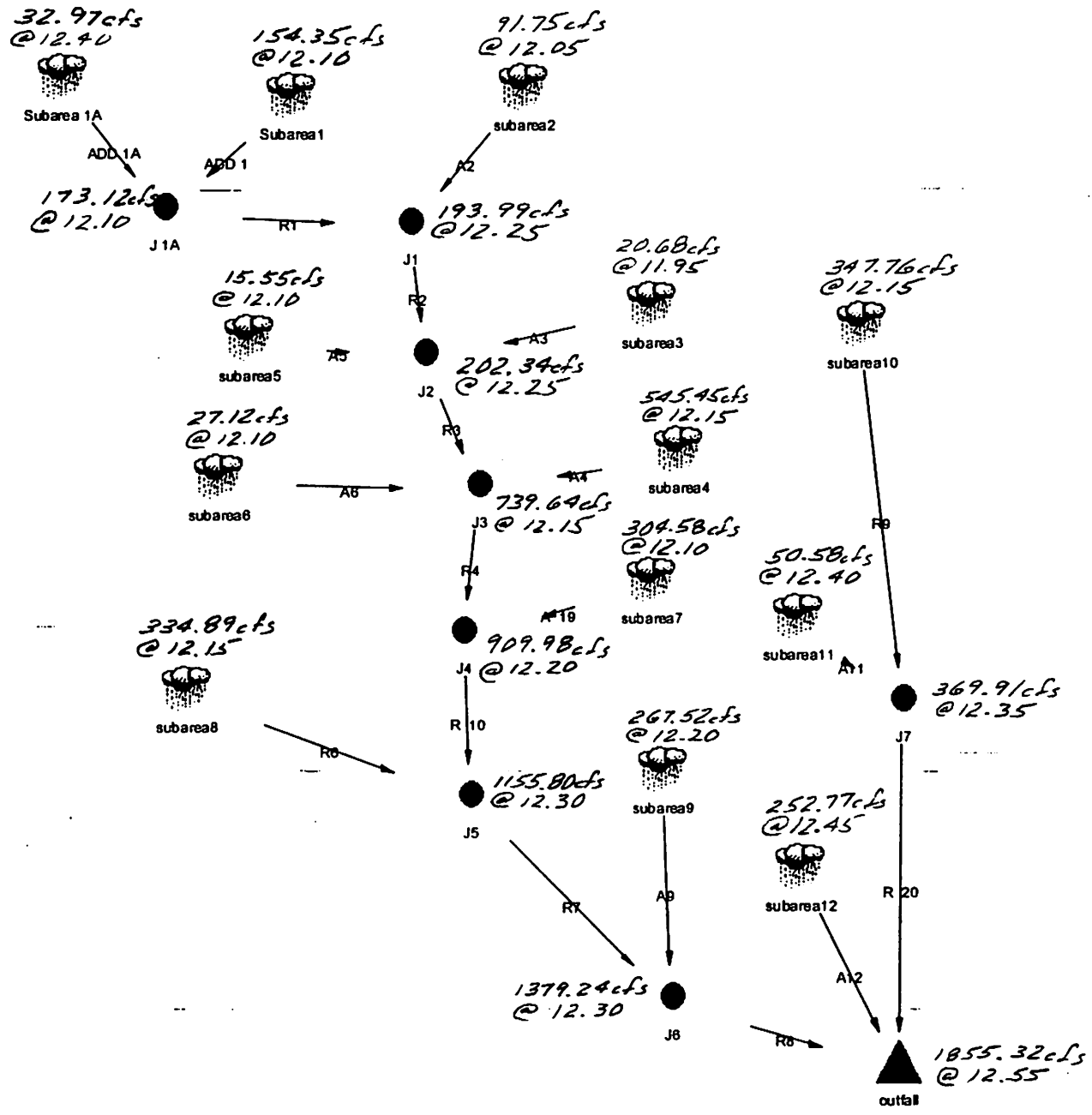
J6
R8
756.32cfs @12.70
outfall

15 Yr. Storm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subarea2
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A2
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J1A
R1
193.99cfs @12.25
J1
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subarea3
347.76cfs @12.15
subarea10
15.55cfs @12.10
subarea5
R2
A3
A5
202.34cfs @12.25
J2
545.45cfs @12.15
subarea4
27.12cfs @12.10
subarea6
R3
A6
A4
739.64cfs @12.15
J3
304.58cfs @12.10
subarea7
R9
50.58cfs @12.40
subarea11
R4
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J4
A11
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J7
R10
267.52cfs @12.20
subarea9
R6
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J5
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subarea12
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R7
A9
A12
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J6
R8
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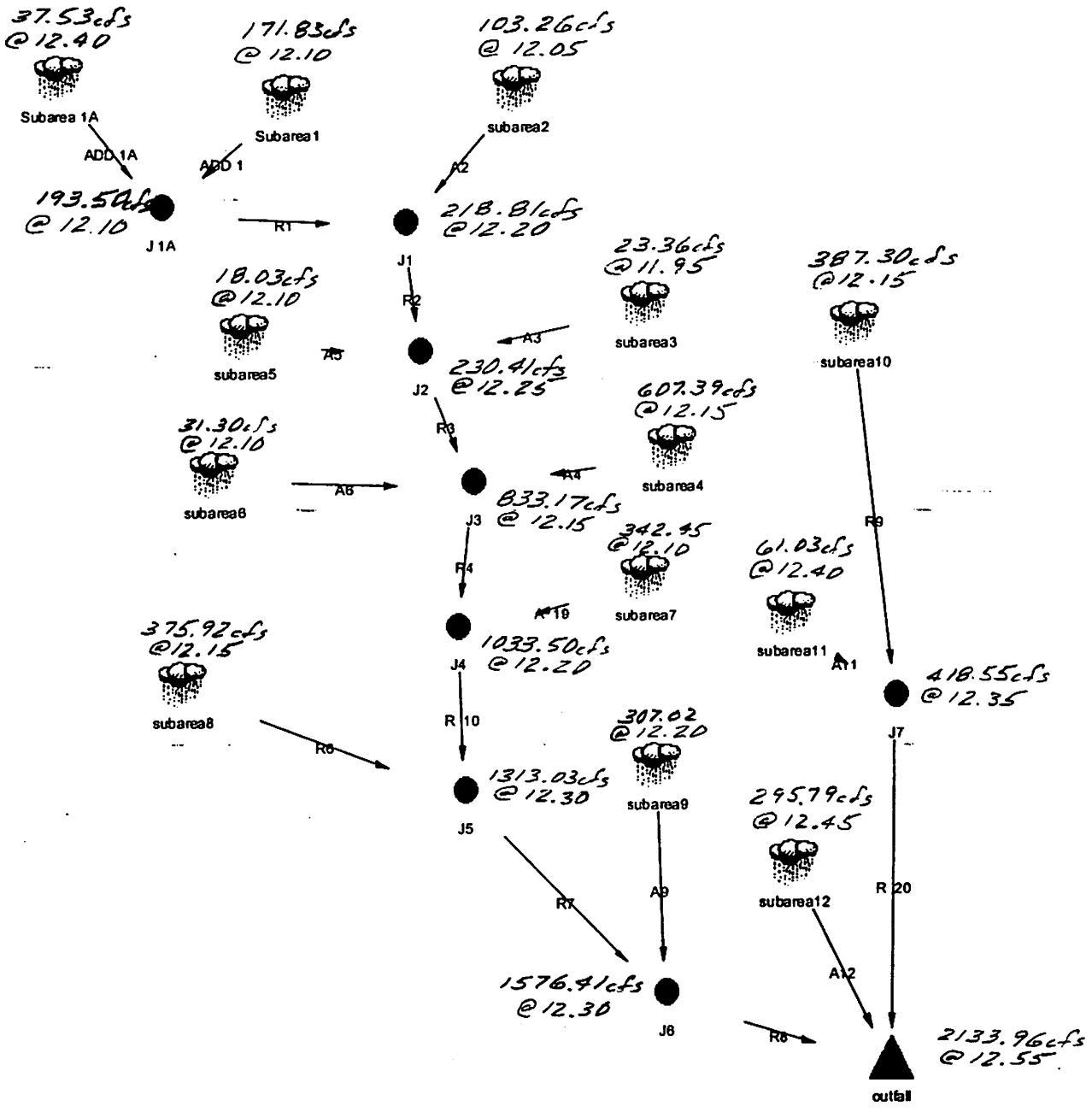
outfall

25 Yr. Storm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R1
103.26cfs
@12.05
subarea2
A2
218.81cfs
@12.20
J1
R2
18.03cfs
@12.10
subarea5
A5
23.36cfs
@11.95
subarea3
A3
230.41cfs
@12.25
J2
387.30cfs
@12.15
subarea10
R3
607.39cfs
@12.15
subarea4
A4
31.30cfs
@12.10
subarea6
A6
833.17cfs
@12.15
J3
R4
342.45
@12.10
subarea7
A10
61.03cfs
@12.40
subarea11
A11
R9
375.92cfs
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subarea8
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R10
R8
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J5
295.79cfs
@12.45
subarea12
R20
R7
A9
A12
1576.41cfs
@12.30
J6
R6
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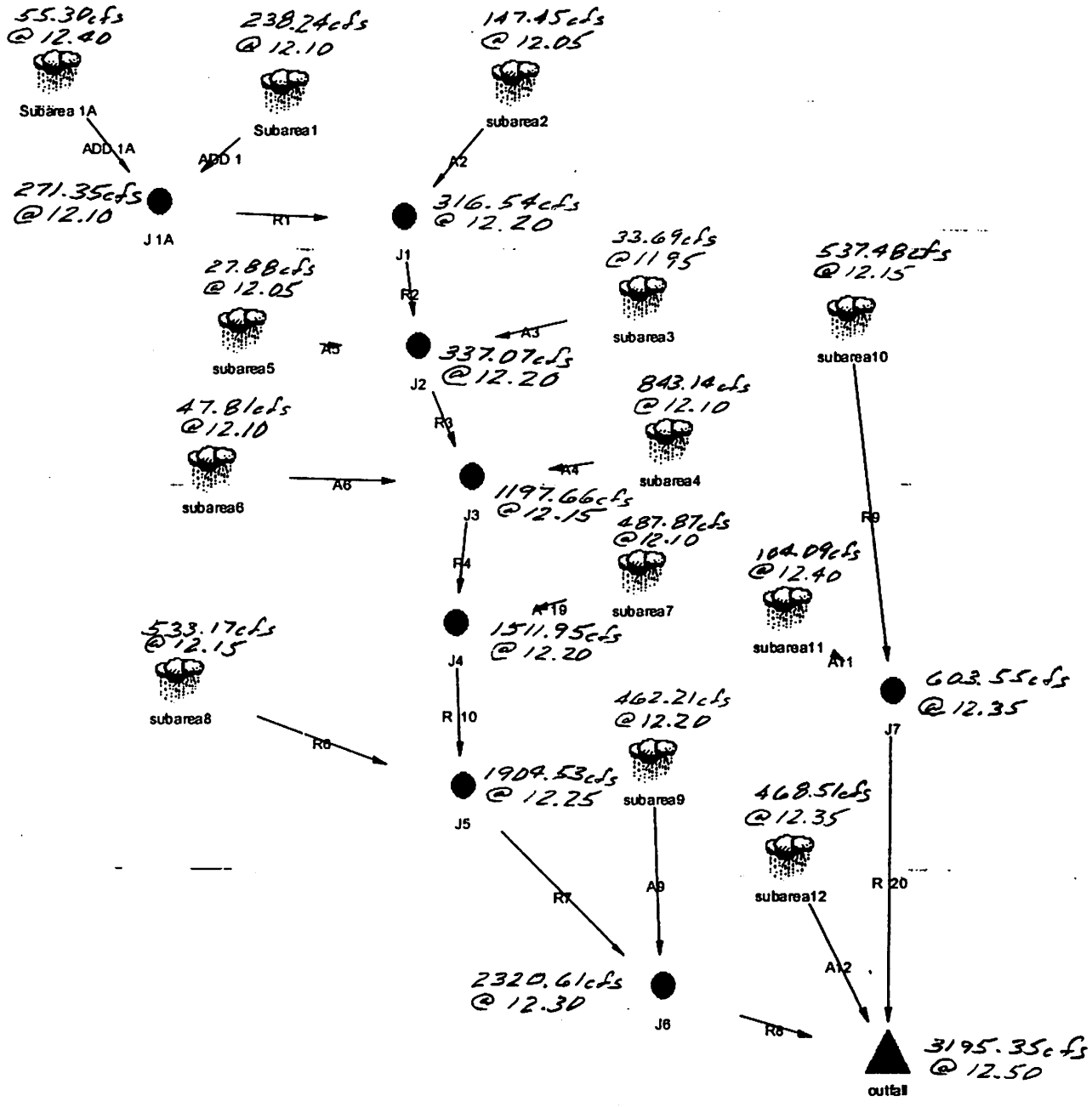
@12.35
J7
2133.96cfs
@12.55
outfall

100 Yr. Storm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J1A
R1
316.54cfs @12.20
J1
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subarea3
537.48cfs @12.15
subarea10
27.88cfs @12.05
subarea5
R2
A3
A5
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J2
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subarea4
47.81cfs @12.10
subarea6
R3
A4
A6
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J3
R9
487.87cfs @12.10
subarea7
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subarea11
R4
A10
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J4
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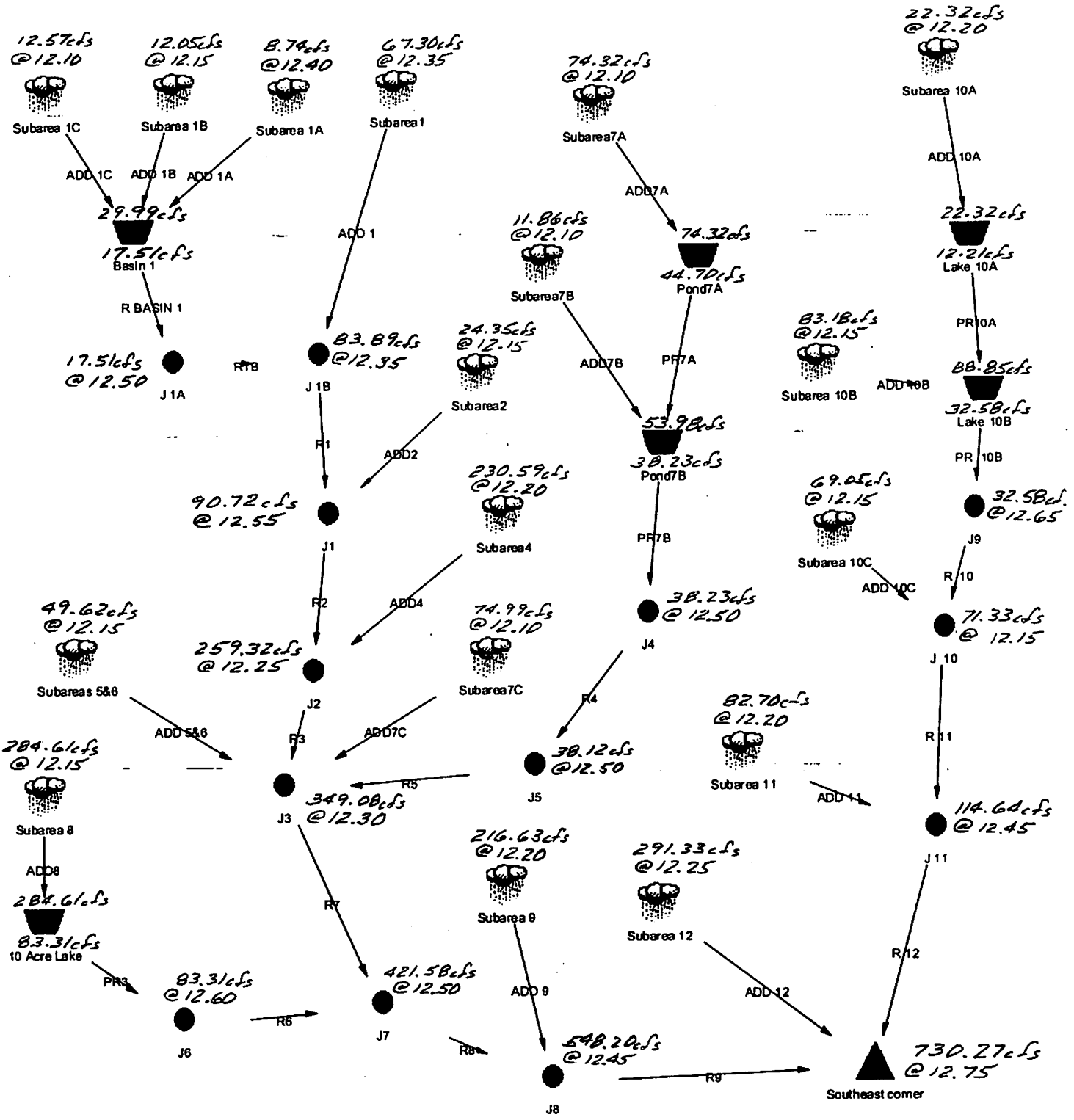
subarea8
A11
603.55cfs @12.35
J7
462.21cfs @12.20
subarea9
R10
R8
1909.53cfs @12.25
J5
468.51cfs @12.35
subarea12
R20
R7
A9
A12
2320.61cfs @12.30
J6
R6
3195.35cfs @12.50
outfall

AFTER

DEVELOPMENT

24 Yr. Storm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Subarea 1B
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Subarea 1A
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ADD 1C
ADD 1B
ADD 1A
29.99cfs
17.51cfs
Basin 1
R BASIN 1
17.51cfs @12.50
J 1A
RTB
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J 1B
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Subarea7A
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Subarea7B
74.32cfs
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Pond7A
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PR7A
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Subarea2
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38.23cfs
Pond7B
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J1
230.59cfs @12.20
Subarea4
PR7B
38.23cfs @12.50
J4
R2
ADD4
259.32cfs @12.25
J2
74.99cfs @12.10
Subarea7C
49.62cfs @12.15
Subareas 5&6
ADD 5&6
R3
ADD7C
R4
38.12cfs @12.50
J5
R5
349.08cfs @12.30
J3
284.61cfs @12.15
Subarea 8
ADD8
284.61cfs
83.31cfs
10 Acre Lake
PR8
83.31cfs @12.60
J6
R6
421.58cfs @12.50
J7
R7
216.63cfs @12.20
Subarea 9
ADD 9
548.20cfs @12.45
J8
R8
291.33cfs @12.25
Subarea 12
ADD 12
R9
730.27cfs @12.75
Southeast corner
22.32cfs @12.20
Subarea 10A
ADD 10A
22.32cfs
12.21cfs
Lake 10A
PR10A
83.18cfs @12.15
Subarea 10B
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88.85cfs
32.58cfs
Lake 10B
PR 10B
32.58cfs @12.65
J9
69.05cfs @12.15
Subarea 10C
ADD 10C
R10
71.33cfs @12.15
J 10
R11
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Subarea 11
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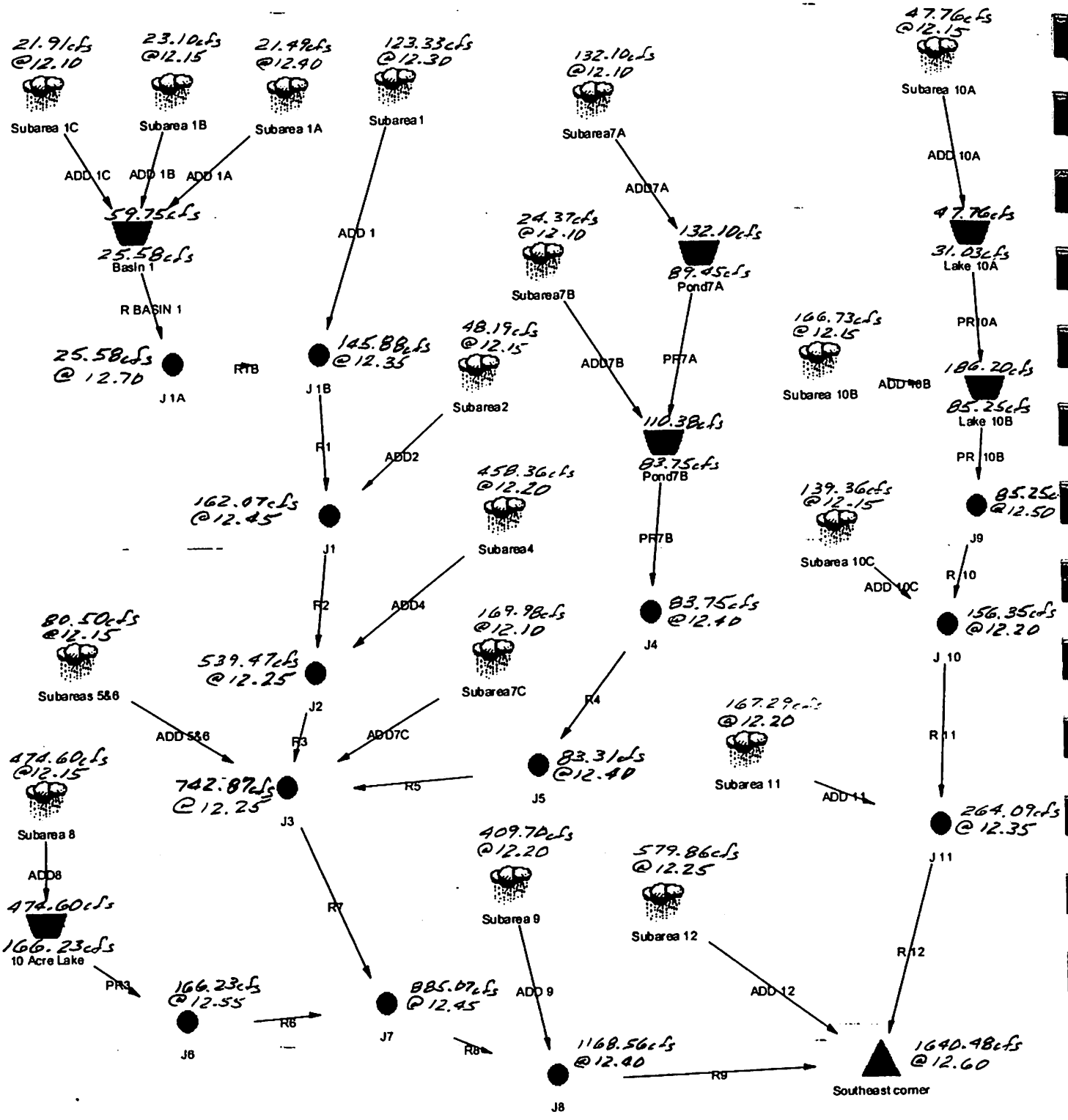
114.64cfs @12.45
J 11
R12

15 Yr Storm


21.91cfs @12.10
Subarea 1C
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Subarea 1B
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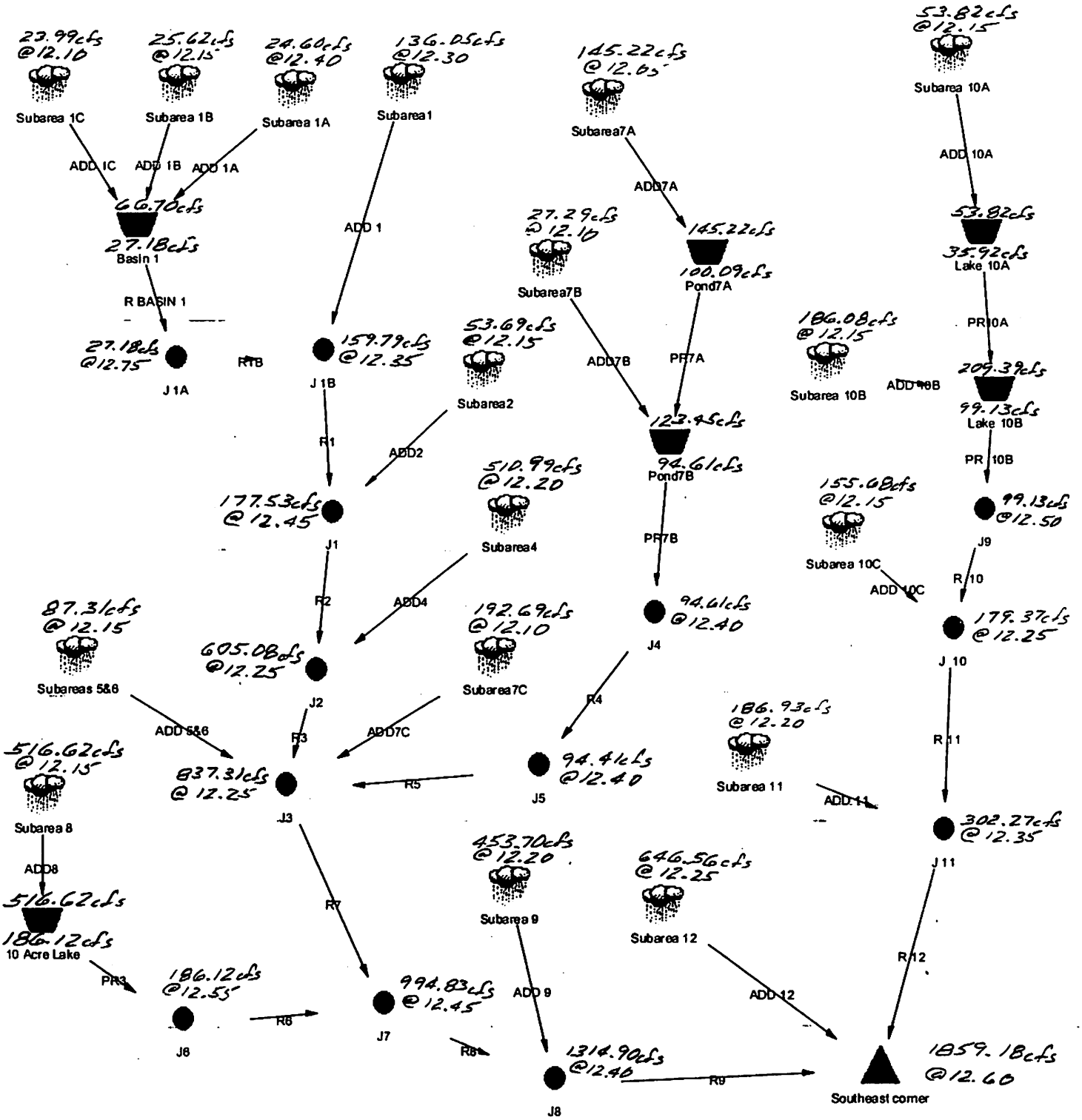
Subarea 1A
123.33cfs @12.30
Subarea1
ADD 1C
ADD 1B
ADD 1A
59.75cfs
25.58cfs
Basin 1
R BASIN 1
25.58cfs @ 12.70
J 1A
R1B
ADD 1
145.88cfs @12.35
J 1B
R1
ADD2
48.19cfs @12.15
Subarea2
162.07cfs @12.45
J1
458.36cfs @12.20
Subarea4
R2
ADD4
539.47cfs @12.25
J2
80.50cfs @12.15
Subareas 5&6
ADD 5&6
R3
ADD7C
169.98cfs @12.10
Subarea7C
474.60cfs @12.15
Subarea 8
ADD8
474.60cfs
166.23cfs
10 Acre Lake
PR3
166.23cfs @12.55
J6
R6
742.87cfs @12.25
J3
R7
885.07cfs @12.45
J7
R8
132.10cfs @12.10
Subarea7A
ADD7A
24.37cfs @12.10
Subarea7B
132.10cfs
89.45cfs
Pond7A
ADD7B
PR7A
110.38cfs
83.75cfs
Pond7B
PR7B
83.75cfs @12.40
J4
R4
83.31cfs @12.40
J5
R5
47.76cfs @12.15
Subarea 10A
ADD 10A
47.76cfs
31.03cfs
Lake 10A
PR10A
166.73cfs @12.15
Subarea 10B
ADD10B
186.20cfs
85.25cfs
Lake 10B
PR 10B
139.36cfs @12.15
Subarea 10C
ADD 10C
85.25cfs @12.50
J9
R 10
156.35cfs @12.20
J 10
R 11
167.29cfs @12.20
Subarea 11
ADD 11
264.09cfs @12.35
J 11
R 12
409.70cfs @12.20
Subarea 9
ADD 9
579.86cfs @12.25
Subarea 12
ADD 12
1168.56cfs @12.40
J8
R9
1640.48cfs @12.60
Southeast corner

25 Yr. Storm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Subarea 1C
25.62cfs @12.15
Subarea 1B
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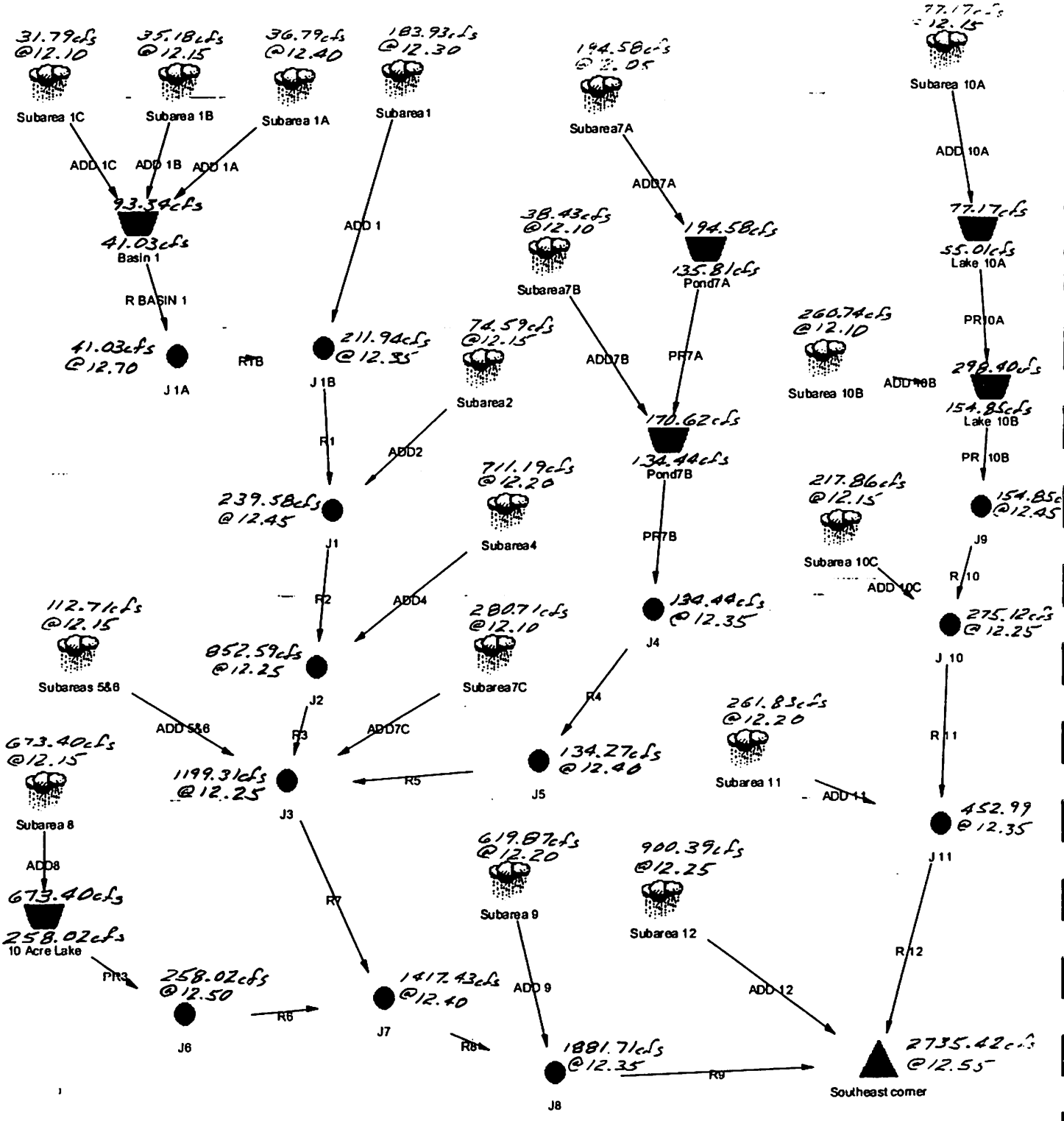
Subarea 1A
136.05cfs @12.30
Subarea1
ADD 1C
ADD 1B
ADD 1A
66.70cfs
27.18cfs
Basin 1
R BASIN 1
27.18cfs @12.75
J 1A
RTB
159.79cfs @12.35
J 1B
ADD 1
145.22cfs @12.05
Subarea7A
ADD7A
27.29cfs @12.10
Subarea7B
145.22cfs
100.09cfs
Pond7A
53.69cfs @12.15
Subarea2
ADD7B
PR7A
123.45cfs
94.61cfs
Pond7B
R1
ADD2
177.53cfs @12.45
J1
510.99cfs @12.20
Subarea4
PR7B
87.31cfs @12.15
Subareas 5&6
605.08cfs @12.25
J2
R2
ADD4
192.69cfs @12.10
Subarea7C
94.61cfs @12.40
J4
R4
ADD 5&6
R3
ADD7C
516.62cfs @12.15
Subarea 8
837.31cfs @12.25
J3
R5
94.41cfs @12.40
J5
ADD8
516.62cfs
186.12cfs
10 Acre Lake
PR3
186.12cfs @12.55
J6
R6
994.83cfs @12.45
J7
R7
453.70cfs @12.20
Subarea 9
ADD 9
R8
1314.90cfs @12.40
J8
R9
646.56cfs @12.25
Subarea 12
ADD 12
53.82cfs @12.15
Subarea 10A
ADD 10A
53.82cfs
35.92cfs
Lake 10A
PR10A
186.08cfs @12.15
Subarea 10B
ADD 10B
209.39cfs
99.13cfs
Lake 10B
PR 10B
155.68cfs @12.15
Subarea 10C
ADD 10C
99.13cfs @12.50
J9
R10
179.37cfs @12.25
J 10
R11
186.93cfs @12.20
Subarea 11
ADD 11
302.27cfs @12.35
J11
R12
1859.18cfs @12.60
Southeast corner

100 Yr. Storm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Subarea 1C
35.18cfs @12.15
Subarea 1B
36.79cfs @12.40
Subarea 1A
183.93cfs @12.30
Subarea1
ADD 1C
ADD 1B
ADD 1A
93.54cfs
41.03cfs
Basin 1
R BASIN 1
41.03cfs @12.70
J 1A
RTB
211.94cfs @12.35
J 1B
ADD 1
194.58cfs @12.05
Subarea7A
ADD7A
38.43cfs @12.10
Subarea7B
194.58cfs
135.81cfs
Pond7A
ADD7B
PR7A
74.59cfs @12.15
Subarea2
170.62cfs
134.44cfs
Pond7B
PR7B
R1
ADD2
239.58cfs @12.45
J1
711.19cfs @12.20
Subarea4
R2
ADD4
852.59cfs @12.25
J2
280.71cfs @12.10
Subarea7C
112.71cfs @12.15
Subareas 5&6
ADD 5&6
R3
ADD7C
1199.31cfs @12.25
J3
R5
134.27cfs @12.40
J5
R4
134.44cfs @12.35
J4
673.40cfs @12.15
Subarea 8
ADD8
673.40cfs
258.02cfs
10 Acre Lake
PR8
258.02cfs @12.50
J6
R6
1417.43cfs @12.40
J7
R7
619.87cfs @12.20
Subarea 9
ADD 9
1881.71cfs @12.35
J8
R8
900.39cfs @12.25
Subarea 12
ADD 12
R9
2735.42cfs @12.55
Southeast corner
77.17cfs @12.15
Subarea 10A
ADD 10A
77.17cfs
55.01cfs
Lake 10A
PR10A
260.74cfs @12.10
Subarea 10B
ADD 10B
298.40cfs
154.85cfs
Lake 10B
PR 10B
217.86cfs @12.15
Subarea 10C
ADD 10C
154.85cfs @12.45
J9
R10
275.12cfs @12.25
J 10
R11
261.83cfs @12.20
Subarea 11
ADD 11
452.99 @12.35
J11
R12

FILE
WINGHAVEN DETENTION

100 NORTH MAIN STREET
O'FALLON, MISSOURI 63366
636.240.2000
FACSIMILE 636.978.4144

September 12, 2000

Elmer Krussel, P.E.
Volz Engineering
5933 South Highway 94, Suite 201
St. Charles, MO 63301

Re: Winghaven – Revised Detention Analysis

Dear Mr. Krussel:

The revised detention analysis for the overall Winghaven development has been reviewed and approved. This revision accounts for the detention basin in Timber Creek and includes the new Phase Three layout. All detention facilities on site are the responsibility of Winghaven, L.L.C. Regular maintenance of all facilities is required to allow the planned detention to function as designed in the submitted analysis. If any erosion occurs, on or off-site, because of the Winghaven development, additional detention or erosion control measures may be required by the City and implemented by Winghaven, L.L.C. to protect the existing creek channels in the surrounding area.

All future development in Winghaven shall comply with the drainage layout from this report. If any changes are proposed, a revised analysis must be submitted for review and approval.

If you have any further questions, please call me at (636) 379-5563.

Sincerely,

Chris Linneman, EIT
Engineer III

cc Patrick Banger, Todd Criswell, File thru Frank Godwin F.G.

FILE
WINGHAVEN
DETENTION

Federal Emergency Management Agency

Washington, D.C. 20472

January 31, 2000

Mr. Elmer A. Krussel, P.E.
VOLZ, Inc.
5933 South Highway 94, Suite 201
St. Charles, MO 63304-5611

IN REPLY REFER TO:
Case No.: 00-07-204P
Community: City of O'Fallon, MO
Community No.: 290316

316-ACK.FRQ

Dear Mr. Krussel:

This responds to your request dated January 11, 2000, that the Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for St. Charles County, Missouri and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Winghaven Phase I Apartment Area
Flooding Source:	Dardenne Creek and Tributary No. 15
FIRM Panel(s) Affected:	29183C0430 E

To minimize the financial burden on the policyholders while maintaining the National Flood Insurance Program (NFIP) as self-sustaining, FEMA implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. Effective March 1, 1999, FEMA revised the fee schedule. A copy of the notice published in the *Federal Register* is enclosed for your information. In accordance with this schedule, the fee for your request is $4,000 and must be submitted before we can continue processing your request. Payment of this fee must be made in the form of a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or credit card payment. For identification purposes, the case number referenced above must be included on the check or money order. We will not perform a detailed technical review of your request until payment is received.

Payment must be forwarded to one of the addresses listed below.

Using U.S. Postal Service:
Federal Emergency Management Agency
Fee-Collection System Administrator
P.O. Box 3173
Merrifield, VA 22116-3173

Using overnight service:
Fee-Collection System Administrator
c/o Dewberry & Davis, METS Division
8401 Arlington Boulevard
Fairfax, VA 22031

We have completed an inventory of the items that you submitted. The item identified below is required before we can begin a detailed review of your request.

Please provide certification that all fill placed in the currently effective floodplain of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) and below the proposed base flood elevation is compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test method issued by the American Society for Testing and Materials (ASTM Standard D-698) or an acceptable equivalent method for all areas to be removed from the base floodplain.

If all required items are not submitted within 90 days of the date of this letter, we will treat any subsequent request as an original submittal, and it will be subject to all submittal/payment procedures.

If you are unable to meet the 90-day deadline for submittal of required items, and would like FEMA to continue processing your request, you must request an extension of the deadline. This request must be submitted to our Technical Evaluation Contractor in writing and must provide (1) the reason why the data cannot be submitted within the requested timeframe, and (2) a new date for the submittal of the data. We receive a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, the fees will be forfeited for any request for which neither the requested data nor a written extension request is received within 90 days.

Please direct all required items (except the required fee) and questions concerning your request to our Technical Evaluation Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attention: Mr. Thomas W. Smith, P.E.
(703) 317-6267

When you write us about your request, you must include the case number referenced above in your letter.

If you have any questions concerning FEMA policy, or the National Flood Insurance Program in general, please contact Mr. William R. Blanton, Jr., of our staff in Washington, DC, either by telephone at (202) 646-3151 or by facsimile at (202) 646-4596.

Sincerely,

Matthew B. Miller

Matthew B. Miller, P.E., Chief
Hazards Study Branch
Mitigation Directorate

Enclosure(s)

cc: Mr. James R. Piper
General Manager
Winghaven Residential, L.L.C.

Mr. Frank Godwin
City Engineer/Floodplain Administrator
City of O'Fallon
City Hall

100 NORTH MAIN STREET
O'FALLON, MISSOURI 63366
636.240.2000
FACSIMILE 636.978.4144

January 26, 2000

Elmer Krussel, P.E.
Volz Engineering
5933 South Highway 94, Suite 201
St. Charles, MO 63301

RE: Winghaven – Overall Detention Analysis

Dear Mr. Krussel:

The detention analysis for the overall Winghaven development has been reviewed and approved. All detention facilities on site are the responsibility of Winghaven, L.L.C. Regular maintenance of all facilities is required to allow the planned detention to function as designed in the submitted analysis. If any erosion occurs, on or off-site, because of the Winghaven development, additional detention or erosion control measures may be required by the City and implemented by Winghaven, L.L.C. to protect the existing creek channels in the surrounding area.

All future development in Winghaven shall comply with the drainage layout from this report. If any changes are proposed, a revised analysis must be submitted for review and approval. As stated in the report, a separate detention analysis will be submitted for the proposed "shopping center" at the corner of Winghaven Blvd. and Highway N.

If you have any further questions, please call me at (636) 379-5563.

Sincerely,

Chris Linneman, EIT
Engineer III

cc P. Banger, C. Bostic, D. Woods, J. Heitkamp, File thru F. Godwin

2

VOLZ

Engineers
Land Planners
Land Surveyors

5933 South Highway 94, Suite 201
St. Charles, Missouri 63304-5611
314-939-5155
314-939-5138 FAX

WINGHAVEN

GLOBAL DETENTION

NOVEMBER 22, 1999

5930

A detailed study of stormwater runoff both before and after development was prepared by Volz, Incorporated. This study showed that peak runoff is lower after development than before development at all points where runoff leaves Winghaven. Several stormwater management practices were used to reduce the peak runoff.

Runoff from the golf course is less than runoff from the pre-developed cultivated land. The golf course has much more dense vegetative cover than the row crops before development thereby reducing the velocity of runoff and causing more infiltration. This flow reduction more than offsets the increased runoff from the impervious areas at the clubhouse. The golf course by itself significantly reduces the runoff from the site.

Runoff from the residential areas of Winghaven increases due to the large amount of impervious surface area. There are six small lakes in the golf course. Two of these lakes are small and have very small watersheds so they do not provide a significant amount of stormwater detention. Control structures were built on the remaining four lakes so these lakes provide stormwater detention for the residential areas. In addition, a dry stormwater detention basin was built in the Northwest corner of Winghaven. Even though a part of the residential development is downstream from the detention, the detention facilities reduce the peak runoff from the residential areas of Winghaven including the residential areas downstream of the lakes to less than pre-developed runoff. There is an increase in runoff in some locations where runoff from the residential areas flow across the golf course to the detention lakes. Some maintenance of the creeks in these areas will be needed to prevent erosion. There is a significant decrease in runoff in the creeks downstream from the lakes.

The commercial area of Winghaven includes the Novus Campus; the Nordyne, Inc and GLA International buildings; the proposed MasterCard tract; the future Town Center development; the 26 acre area zoned High Tech Commercial District between Post Meadows, Highway 40/61, and Post Road; the Winghaven Boulevard Highway 40/61 interchange; the commercial tract along Highway 40/61 South of Phoenix Parkway; the 40 acre tract bounded by the golf course, Phoenix Parkway, and Winghaven Blvd.; the 19 acre tract along Phoenix Parkway East of the Nordyne, Inc. tract; and the future strip commercial on Highway N. A 10 acre lake is under construction between MasterCard and Novus International to provide stormwater detention for all the commercial areas of Winghaven except for the strip commercial along Highway N. Similar to the residential areas, only part of the commercial drains to this lake but after development the peak runoff from the commercial areas with detention is less than the peak runoff from those areas before development. There are several places within the commercial areas where the peak runoff will be higher after development than before development. The area between Post Meadows, Highway 40/61, and Post Road will have a significant increase in runoff. There is no design for this area

yet but we anticipate most of this runoff will be directed to a pipe sewer system through Town Center discharging into a creek downstream of the golf course lakes where the peak runoff is lower. Part of Town Center will also be directed to this creek. This storm sewer will have to be extended to the creek. If the sewer discharges into a small ditch tributary to the creek there will be a significant increase in flow in that ditch. This would cause excessive erosion in that ditch. Runoff from the Winghaven Boulevard Highway 40/61 interchange flows in a small creek to the proposed lake. This creek is being enclosed in a 48" storm sewer through the MasterCard site. When the interchange is built, MoDot will construct a storm sewer system to drain the interchange. This sewer system will eventually be extended to the lake. Runoff from GLA International flows directly into a creek downstream from the golf course lakes where peak runoff is lower than before development. Stormwater detention for the GLA International site is provided in the 10 acre lake. Runoff from Nordyne, Inc. flows in a ditch to the creek downstream of the golf course lakes. The peak flow in this ditch after development of Nordyne, Inc is approximately 5% higher than pre-developed peak flow. This ditch flows through a wooded area that will be left undisturbed. This very small increase in flow in a ditch flowing through a heavily wooded area should not be erosive therefore it was decided that stormwater detention for Nordyne, Inc. is not necessary and construction of a sewer system through the woods would cause more erosion than the small increase in flow in the ditch. Stormwater detention for Nordyne, Inc. is also provided in the 10 acre lake. Runoff from the commercial area along Highway 40/61 South of Phoenix Parkway should be directed to a storm sewer system draining directly to the creek. Detailed plans for the 40 acre tract bounded by the golf course, Phoenix Parkway and Winghaven Blvd. and the 19 acre tract along Phoenix Parkway East of the Nordyne tract have not been prepared. When detailed plans for these two tracts are prepared it will be determined if an enclosed sewer system or stormwater detention is needed to prevent erosion in the smaller ditches.

No stormwater detention is planned at this time for the strip commercial on Highway N. It is anticipated stormwater detention will be provided for this area when it is developed.

SUMMARY

The peak runoff after development is less than before development.

Peak runoff from the golf course is less than peak runoff from the same area before development.

Stormwater detention for the differential runoff from the residential area of Winghaven is provided in the four lakes in the golf course and in the detention basin near the Northeast corner of the development.

Stormwater detention for the differential runoff from the commercial area of Winghaven is provided in the 10 acre lake between MasterCard and Novus International.

Stormwater detention for the strip commercial on Highway N will be provided when that area is developed.

Elmer A. Krussel, P.E.