DRAINAGE PLAN

BLACKSTONE ADDITION

TO

WICHITA, SEDGWICK COUNTY, KANSAS

Prepared By

Baughman

ENGINEERING | SURVEYING | PLANNING
LANDSCAPE ARCHITECTURE

November 28, 2005

Baughman

Drainage Plan
BLACKSTONE ADDITION
Wichita, Sedgwick County, Kansas

Baughman Company, P.A.
November 14, 2005
REVISED November 23, 2005

Existing Site Conditions

The proposed Blackstone Addition is located north on 13th Street North and in between 135th and 151st Streets West. The property is bounded on the west by Dry Creek. The development consists of approximately 60 acres of existing agricultural ground.

The soil types on the site consist of Type B and Type C. The western portion for the site is Type B whereas the Eastern portion of the site is Type C. Type D soil is present near the center of the property. All of the soil types are of the silty loam variety.

The Preliminary FEMA FIRM map (as provided by Sedgwick County) establishes Base Flood Elevations (BFE) ranging from a 1372.0 to a 1364.6 across and adjacent to portions of the proposed site. The site will be filled, where necessary, to raise the property above these elevations. The FEMA Floodway is also located on the site. These locations will be sequestered in Reserves.

Proposed Site Conditions

The proposed site will consist of a residential subdivision with associated streets, ponds, and utilities. The proposed subdivision will consist of approximately 105± lots. Storm sewer will be utilized throughout the subdivision to convey the runoff to detention pond systems. The detention ponds will limit the overall site developed runoff to at least the existing runoff. The pond is located near the center of the development in the Type D soils. The pond will discharge into a storm water sewer system that will drain into the proposed Cheryl's Hollow Addition. Backyard drainage along Dry Creek will be graded to allow direct runoff into the creek. All lots adjacent to Dry Creek will be raised to at least 1 foot above the adjacent BFE to not allow floodwaters to enter the development. All storm water sewer will also be protected from flood water inundation. The ditch along 13th Street North has a high point at an elevation of 1272.3. This elevation is above the BFE at this point and will be graded into Lots 5 and 6 to not allow flood waters to flow in the ditch.

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Proposed Pond

The proposed pond will be located near the center of the development. The pond will discharge into the proposed storm sewer system proposed in Cheryl's Hollow Addition. The pond will detain *at least* the developed runoff from the proposed subdivision. The pond's outlet will consist of a 24" RCP.

The static water surface elevation of the pond will be at a 1362.0. The 100-year design water surface elevation will be a 1365.2. The pond will have a maximum 100-yr discharge of 11 cfs. This outlet and storm water system will then drain an eastern portion of the subdivision and discharge approximately 40 cfs into Cheryl's Hollow Addition.

Per agreement with Ruggles & Bohm, PA, Cheryl's Hollow Addition will accept the discharge of <50 cfs at the southwest corner of the plat into its pond. Cheryl's Hollow Addition will then be allowed to drain <50 cfs at its north east corner into the proposed (future) Silverton Addition.

The backyard grades on the lots adjacent to the pond will be graded to 1 foot above 100-year WSE and the minimum openings on the structures on these lots will be 2 feet higher than that of the lowest lot corner.

Pond Summary

Static Water Surface Elevation	=	*1362.0*
100 year Design Surface Elevation	=	*1365.2*
Outlet	=	*24" RCP*

Offsite Flow

There is very little, if any, offsite flow. The ditch along 13th Street will carry drainage from Lots 1-6, Block C. A portion of the ditch as well as 13th Street is located in Zone AO (depth 1"). Upon development, the existing high point of 1372.3 will be graded into the corner (as shown on the grading plan) of Lot 5 to not allow the flood waters to inundate the ditch flowing to the east.

Detention Summary

The proposed development meets or exceeds current City of Wichita requirements pertaining to detention of existing and proposed runoff rates. The following summary chart relates existing and proposed discharges at critical points of the site.

POINT	Q_2 Existing	Q_2 Proposed	Q_{100} Existing	Q_{100} Proposed
Overall Site Runoff Produced	103 cfs	122 cfs	265 cfs	310 cfs
North Site Basin	6.0 cfs	3.5 cfs	42 cfs	10 cfs
Center Basin	13 cfs	11 cfs	100 cfs	44 cfs

The overall site flow is portrays that flow produced by developing the site as if there were *no* detention. The center basin flow is after detention effect of

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the pond. The north site basin has a lower proposed runoff due to the redirecting existing flow into the proposed pond.
The detention pond will accept a maximum 100 year runoff of 280 cfs and discharging via a 24" storm water sewer pipe a runoff of 11 cfs. The pond is detaining approximately 270 cfs of developed runoff.

Overall Site Flow Summary

The proposed development provides adequate detention as required by the City of Wichita. The existing site detains approximately 270 cfs in the proposed pond. The existing agricultural land produces approximately 265 cfs of runoff. The proposed development produces approximately 310 cfs of runoff. Per City of Wichita requirements, the pond only has to detain 50 cfs.

NOTES:

The Preliminary FEMA FIRM Map Panel 310 shows a BFE of a 1370 and a 1365 approximately 2000 feet north of 13th Street. The BFE boundary is separated by a Zone X boundary at this point. The BFE listed as a 1370 is an error in mapping and a BFE of 1365 was used in this area. The study of this region in 1999 notes a BFE of 1365 as does the FIS Profile.

The mapped FEMA Floodway encroaches the property in two locations. These locations are contained in Reserves and will not include any development.

All BFE's used in grading and drainage calculations were converted to NGVD. The Preliminary FEMA FIRM Maps are in NAVD.

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Drainage Plan Comments

To accompany email per Scott Lindebak (21 November 2005) Subject *"Drainage Plan & Concepts (11/30/05)"*

1. Black and Veatch FIS workmap is included in the re-submittal.
2. The flood boundary has not been delineated offsite of the proposed development. Our available topography only extends approximately 50' into the west offsite property. However, this is a studied area and based on floodplain boundaries that extend into our plat, the BFE appears to be accurate and follow the existing topography. All lots along the west edge of the plat will be filled (where needed) to at least 1 foot above the BFE.
3. The existing ditch at the south west corner of the development has a elevation of 1372.3 (per our site topography). This elevation will be matched at the corner of the plat (Lots 5, 6 Block C). This elevation will act as a natural levee and not allow floodwaters to enter the development.
4. Per agreement with Cheryl's Hollow Addition, this development can release up to 50 cfs of runoff at the southeast corner of the plat. Based on our revised PondPack calculations for the overall (Blackstone and Cheryl's Hollow) the pond will release less than the 90 cfs capacity of the CMPA. However, these calculations are for our use only and *DO NOT* reflect the design or plan for Cheryl's Hollow Addition.
5. An existing conditions workmap is provided in the re-submittal as well as a soil survey map.
6. Supporting PondPack documentation is provided in the re-submittal.
7. Basin 7 has been revised. Basin 14 and Basin 9 have been revised.
8. There is approximately 5.1 acres draining into Storm Water System 4 undetained. Per Pondpack calculations this has a 100-yr discharge of approximately 35 cfs. Per StormCad calculations, the discharge is approximately 40 cfs. Both of these calculations are including the pond discharge of 11 cfs. Yes, detention modeling is used in PondPack and rational method is used in StormCad. However, the higher runoff will be utilized in order to be more conservative.
9. Flowline of the proposed culvert crossing are included on the Revised Grading Plan.
10. Offsite drainage agreements will be obtained.
11. Based on proposed grading, the site appears to have adequate ponding areas before offsite overflow is possible. Emergency overland grading is utilized in the subdivision to keep floodwaters directed toward the detention pond. However, areas along the east side of the plat may have emergency overflow to the north or east. These areas do have a 1 foot of ponding available before offsite overflow.

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12. There will be no storm sewer stub into the backyards of Lots 36 & 37, Block B. Basin 16 will drain undetained offsite to the north. The minimum pad will still be utilized as a 1366.1 due to the proximity of the FEMA floodplain elevations.
13. The grading plan has been revised to allow for emergency overflows of storm sewers.
14. Flow arrow has been revised.
15. Spot elevations on requested lots have been revised
16. A DWR permit will be obtained for the fill in the floodplain.

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Trevor Kurth

From: Lindebak, Scott [SLindebak@wichita.gov]
Sent: Monday, November 21, 2005 5:30 PM
To: Trevor R. Kurth (E-mail); Phil Meyer (E-mail)
Cc: Huang, Vicky ; Strahl, Neil
Subject: Drainage Plan & Concepts (11/30/05)
Sensitivity: Private

Trevor:

Please find the below comments for the drainage plan and concepts for the plats that will be heard on November 30:

Blackstone Addition Drainage Plan: Please resubmit a revised drainage plan addressing the following comments to have staff approval.

1. Include a copy of the Black & Vetch FIS workmap, with contours.

2. Delineate the flood boundary per BFE and identify the all lots that are below the BFE on a separate exhibit for permitting purposes. Identify any lots that will require a LOMR-f.

3. It appears the creek floodwaters could be diverted through this site at the southwest corner of the development. The BFE is at least a 1371.6 NGVD and the adjacent ground elevation is a 1370.0. Please provide additional topographic data to show the floodplain is contained west of this development. I was unsure where the high point (1272.3) in 13th Street ditch was located as referenced in the proposed site conditions narrative.

4. The flowrate to the existing 42"x60" CMPA located at 13th Street and 135th has capacity for only 90 cfs as indicated in the Cheryl's Hollow Addition Drainage Plan. The post development calculations calculates 105 cfs at this location. Please revise to prevent the capacity of the existing system to be exceeded.

5. An existing conditions topographic workmap should be included that supports the Tc calculations and soil conditions. It appears my delineations shows there are three main drainage patterns on the property. Use Pondpack to calculate the flow rates as used in the pond calculations.

6. The post-development pond calculations did not include curve numbers, Tc, drainage areas, boundary map of RB Basin/SE Basin/Blackstone nodes, etc. Please revise the drainage plan to include this supporting documentation.

7. Basin 7 includes a portion of the pond, should this be revised? Should there be a basin boundary for #14 around lot 6 & 5?

8. I calculated that 9.9 acres is draining to the southwest corner unrestricted for a 100-year discharge of 51 cfs per the discharge table, however the Pondpack calculations shows 31 cfs. I assume the rational method is being used only for storm sewer calculations and the Pondpack is used for detention routing. As stated in comment 5, please use same models to compare between pre/post development.

9. The drainage plan should show the flowline of the proposed 36" RCP in the 13th Street ROW.

10. An offsite drainage agreement should be obtained for basin 16 to allow street pavement to drain on the north abutting property. In addition, drainage to Cheryl's Hollow and to the west should be obtained.

11. It appears the drainage area that is being piped to the detention pond, 6.9 acres may not be tributary to the basin under 100-year conditions because the stormwater sewer may not be sized for these conditions and the emergency overland grading is not towards the pond. Please verify that all tributary basins in node "Blackstone" is tributary to the pond under 100-year design storm.

12. It appears the BFE to the pond is 1365.2 and the min. pad elevation for lots 34-37, blk b is a 1366.1. The pond routing model did not account for additional backwater runoff leaving the site to the north, as shown. Please regrade to contain the 100-year onsite.

13. The following V.O elevations to not have emergency outs as shown on the grading plan, please revise:

Lots 26,27,30,31 Blk B
Lots 35,36,37,38,39 Blk C
Lots 13,14,15,16 Blk C

Lot 1, Blk C - SW corner is the same elevation as the ditch. It appear that it may be too low.??

14. The flow arrow on Lot 23, Blk B should be shown draining to the south.

15. Spot elevations between lots should be shown on Lot 1,10,15 Blk D; Lot 4, Blk A; & Lot 16, Blk C.

16. A permit form DWR will be required for the floodway fringe fill prior to construction.

Towne Parc 8th Addition Drainage Concept: It is **approved** on the following two conditions:

1. A cross lot drainage agreement is obtained between the developer and the landowner of the offsite detention pond.

2. The drainage plan should account for off-site flow from adjacent lots that will be draining to the proposed storm sewers. The off-site basins were not delineated in the concept.

Scott C. Lindebak, P.E. & CFM
Civil Engineer (Stormwater)
Public Works - Engineering Division
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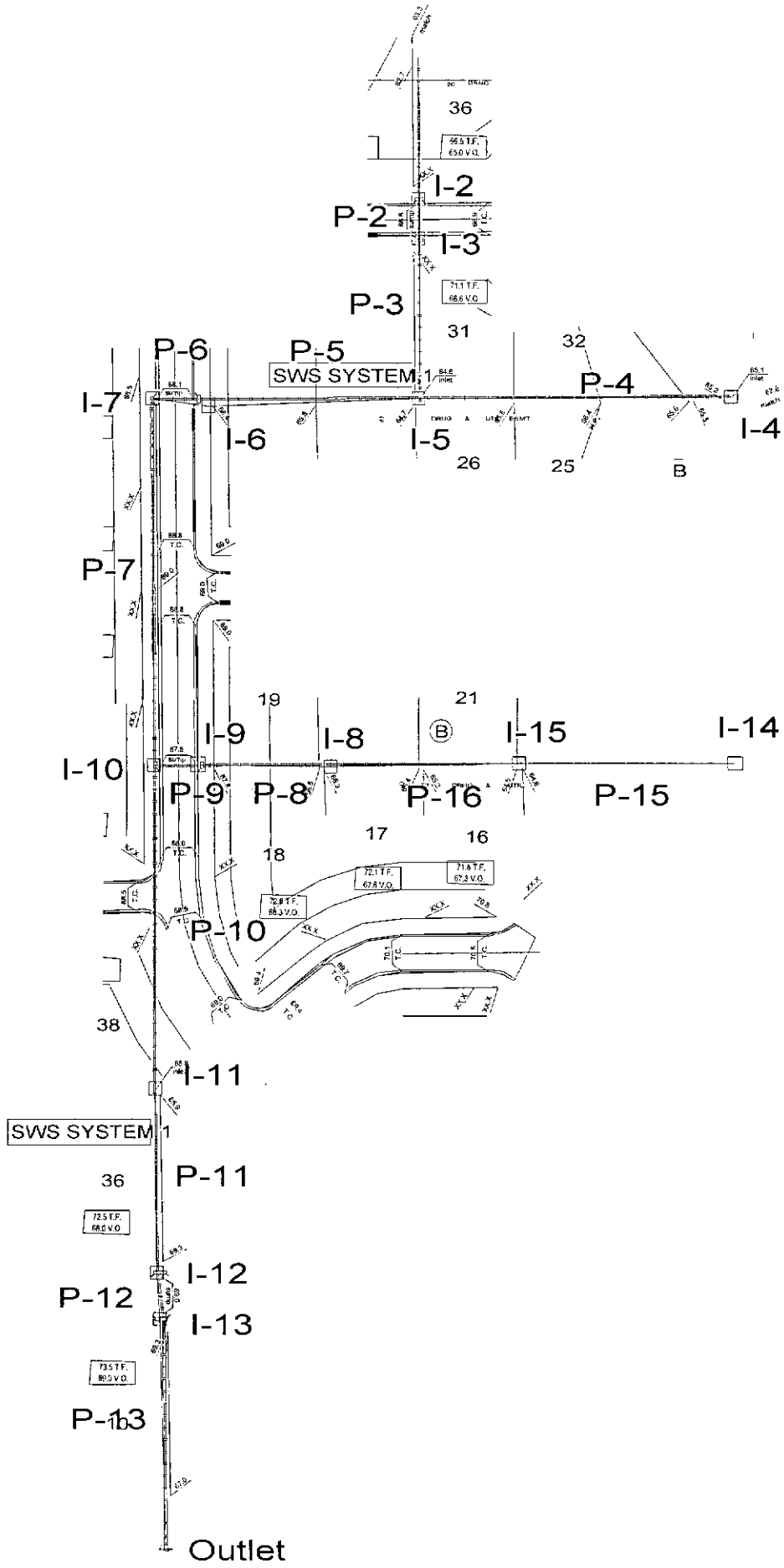
StormCad

Existing	2yr	5yr	100yr	*Developed*	2yr	5yr	100yr
Intensity	3.83	4.56	7.37	Intensity	3.83	4.56	7.37
Rational C	0.45	0.5	0.6	Rational C	0.53	0.56	0.7

Basin ID	Area	Existing Flowrates			Developed Flowrates		
	acres	2-yr cfs	5-yr cfs	100-yr cfs	2-yr cfs	5-yr cfs	100-yr cfs
1	0.4	0.7	0.9	2	0.8	1.0	2
2	1.0	1.7	2.3	4.4	2.0	2.6	5.2
3	0.3	0.5	0.7	1.3	0.6	0.8	1.5
4	1.0	1.7	2.3	4	2.0	2.6	5
5	1.0	1.7	2.3	4.4	2.0	2.6	5.2
6	0.7	1.2	1.6	3.1	1.4	1.8	3.6
7	2.0	3	5	9	4	5	10
8	8.4	14	19	37	17	21	43
9	7.6	13	17	34	15	19	39
10	3.7	6.4	8.4	16	7.5	9.4	19
11	1.3	2.2	3.0	5.7	2.6	3.3	6.7
12	4.8	8.3	11	21	9.7	12	25
13	1.6	2.8	3.6	7.1	3.2	4.1	8.3
14	2.0	3.4	4.6	9	4.1	5.1	10
15	1.3	2.2	3.0	5.7	2.6	3.3	6.7
16	1.7	2.9	3.9	7.5	3.5	4.3	8.8
17	0.9	1.6	2.1	4.0	1.8	2.3	4.6
18	1.1	1.9	2.5	4.9	2.2	2.8	5.7
19	2.1	3.6	4.8	9.3	4.3	5.4	11
20	1.0	1.7	2.3	4.4	2.0	2.6	5.2
21	2.4	4.1	5.5	11	4.9	6.1	12
22	0.4	0.7	0.9	1.8	0.8	1.0	2.1
23	0.2	0.3	0.5	0.9	0.4	0.5	1.0
24	0.4	0.7	0.9	1.8	0.8	1.0	2.1
25	9.0	16	21	40	18	23	46
26	0.4	0.7	0.9	1.8	0.8	1.0	2.1
27	0.0	-	-	-	-	-	-
28	0.8	1.4	1.8	3.5	1.6	2.0	4.1
29	1.4	2.4	3.2	6.2	2.8	3.6	7.2
30	1.0	1.7	2.3	4.4	2.0	2.6	5.2
TOTAL	**59.9**	**103**	**137**	**265**	**122**	**153**	**309**



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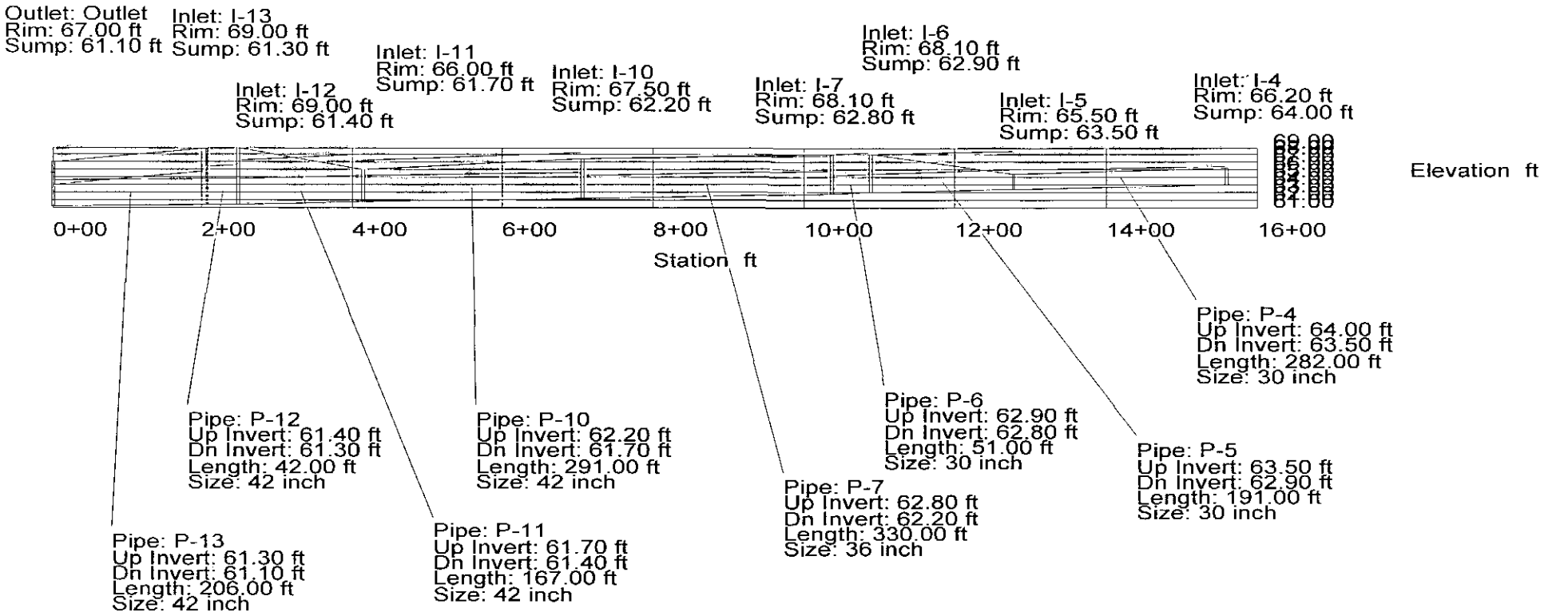
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666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Size: 42 inch
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Dn Invert: 61.30 ft
Length: 42.00 ft
Size: 42 inch
Pipe: P-11
Up Invert: 61.70 ft
Dn Invert: 61.40 ft
Length: 167.00 ft
Size: 42 inch
Pipe: P-10
Up Invert: 62.20 ft
Dn Invert: 61.70 ft
Length: 291.00 ft
Size: 42 inch
Pipe: P-7
Up Invert: 62.80 ft
Dn Invert: 62.20 ft
Length: 330.00 ft
Size: 36 inch
Pipe: P-6
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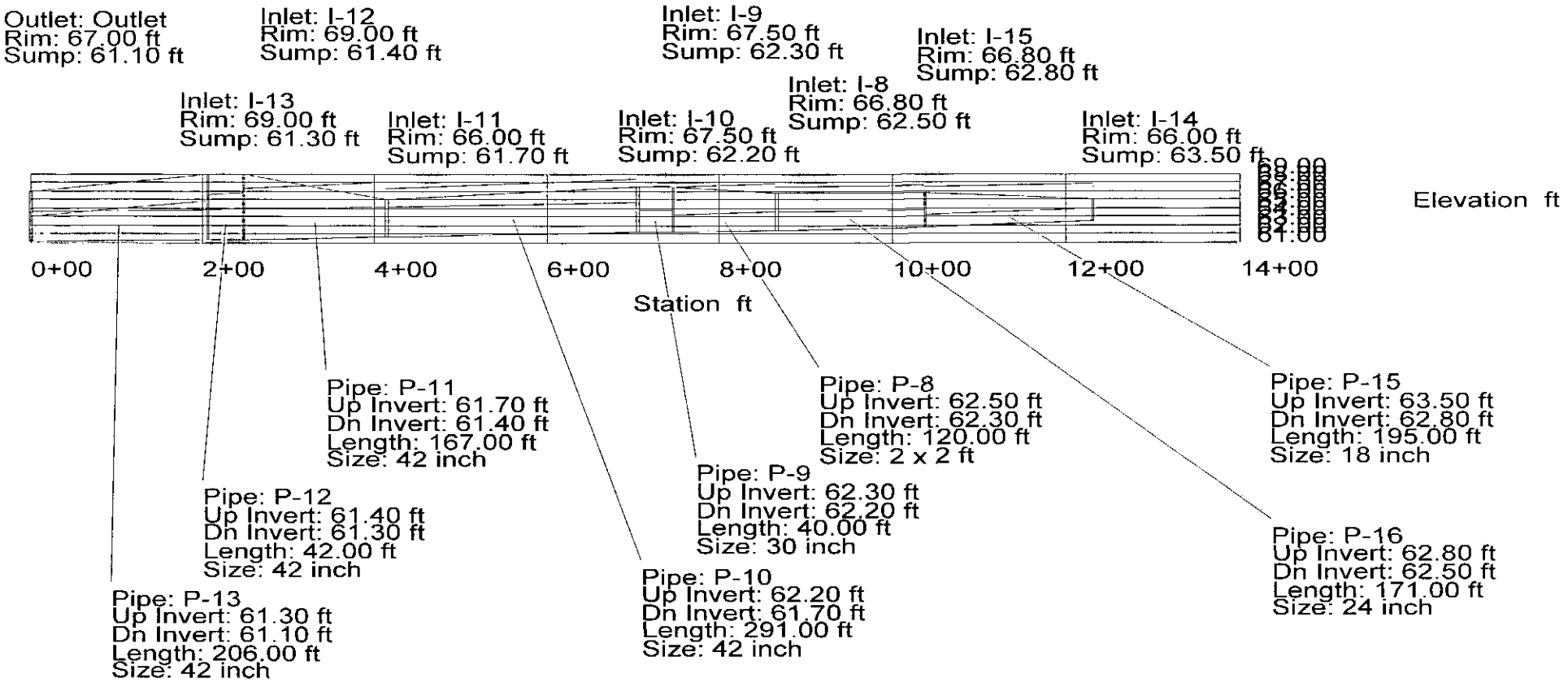
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Dn Invert: 62.50 ft
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Size: 24 inch
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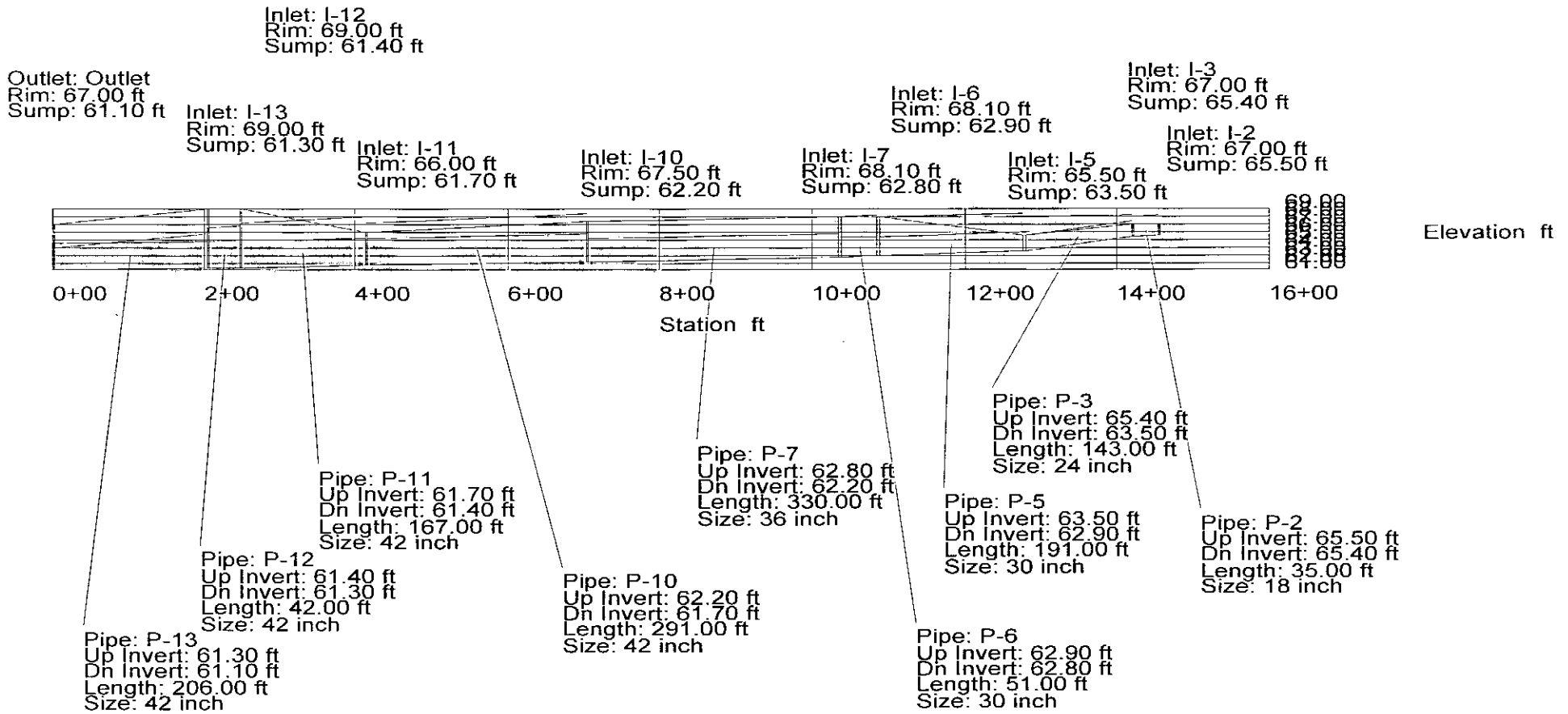
Size: 42 inch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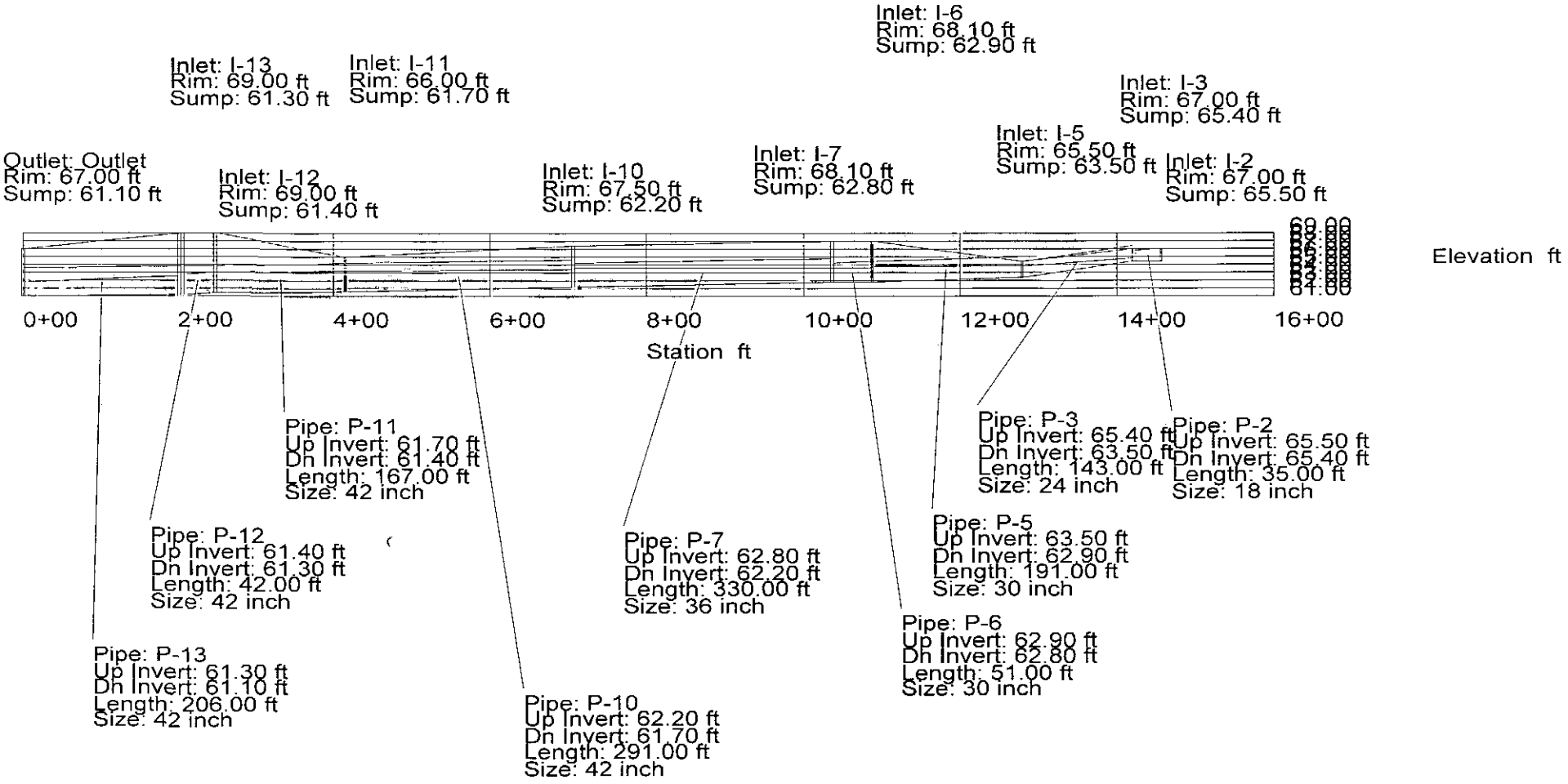

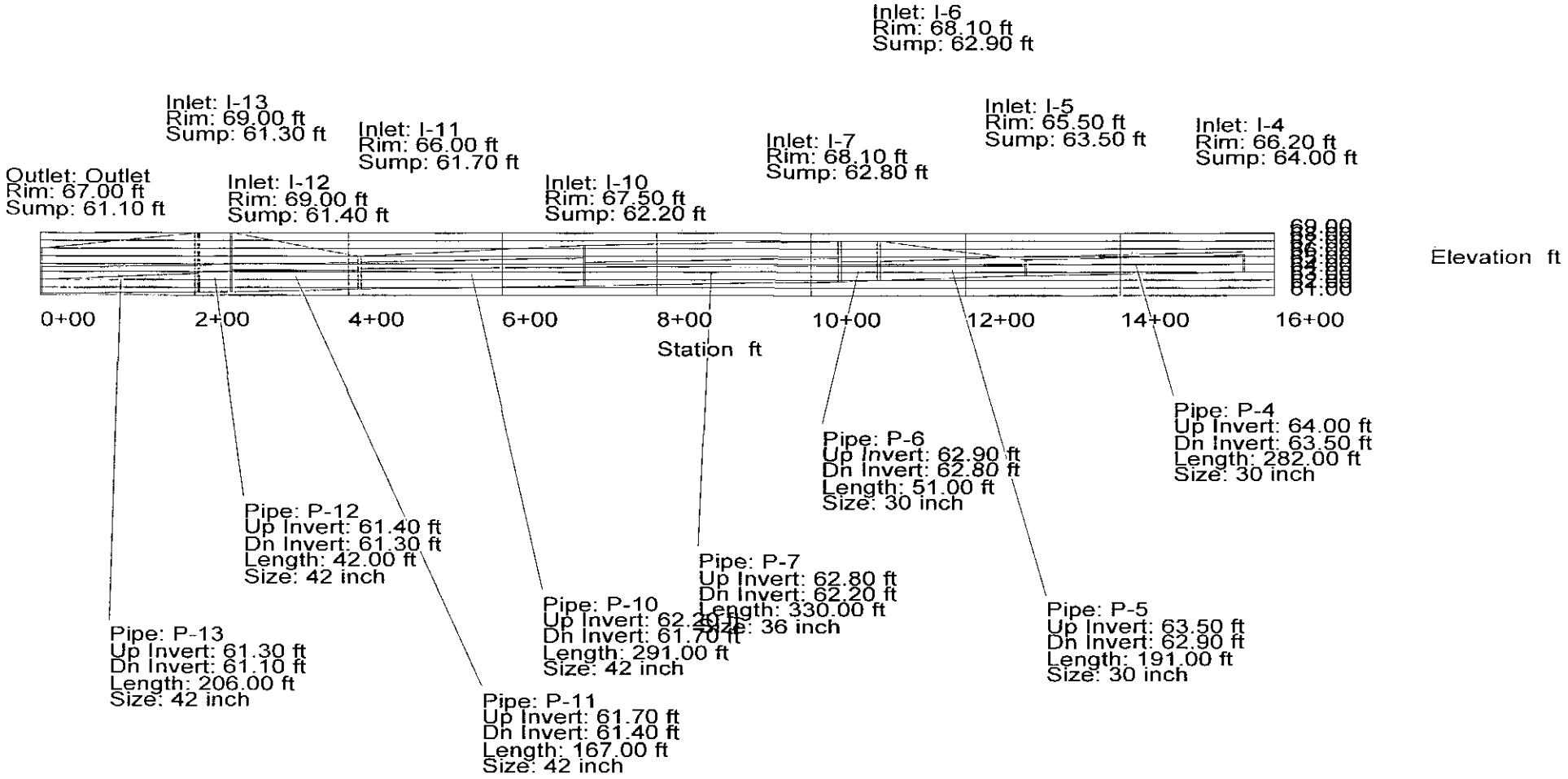
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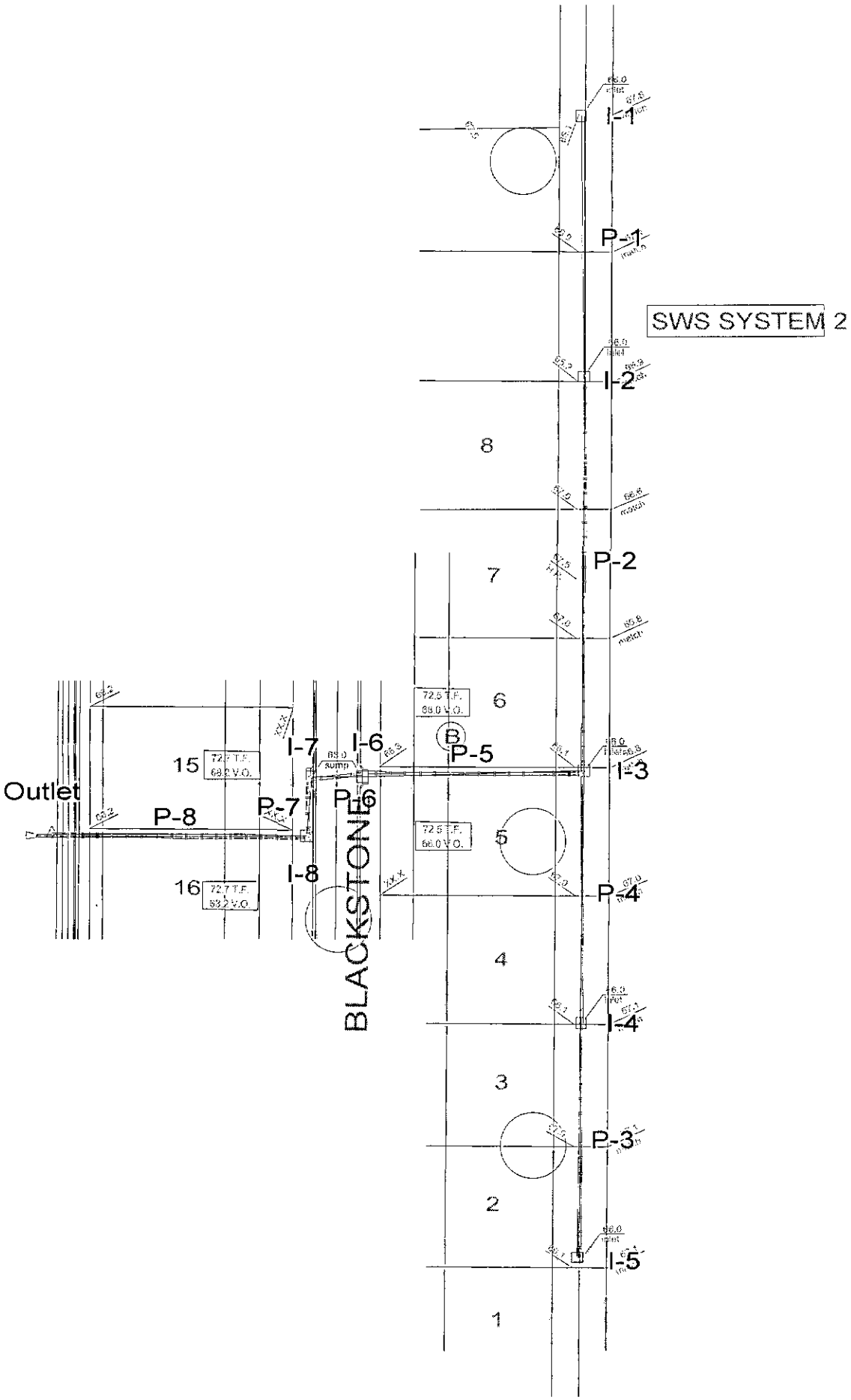
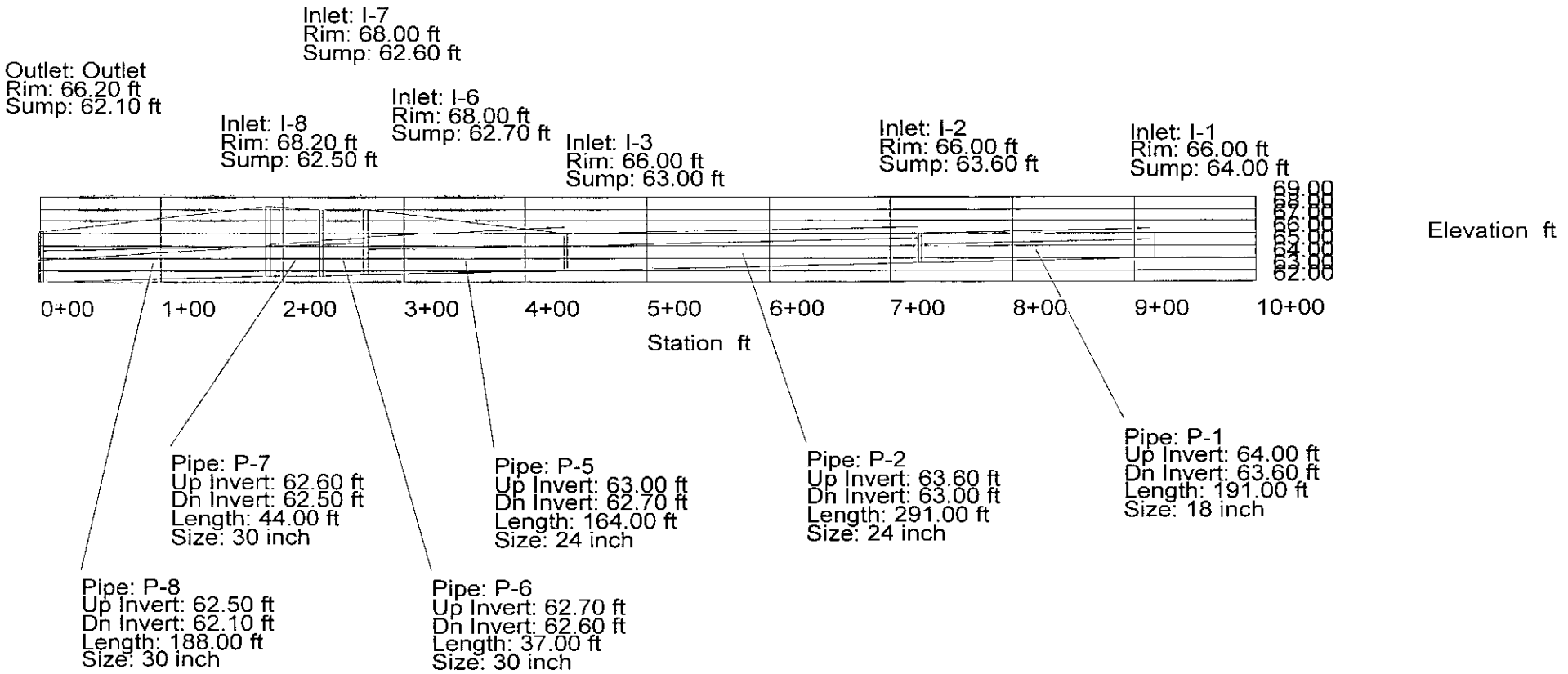
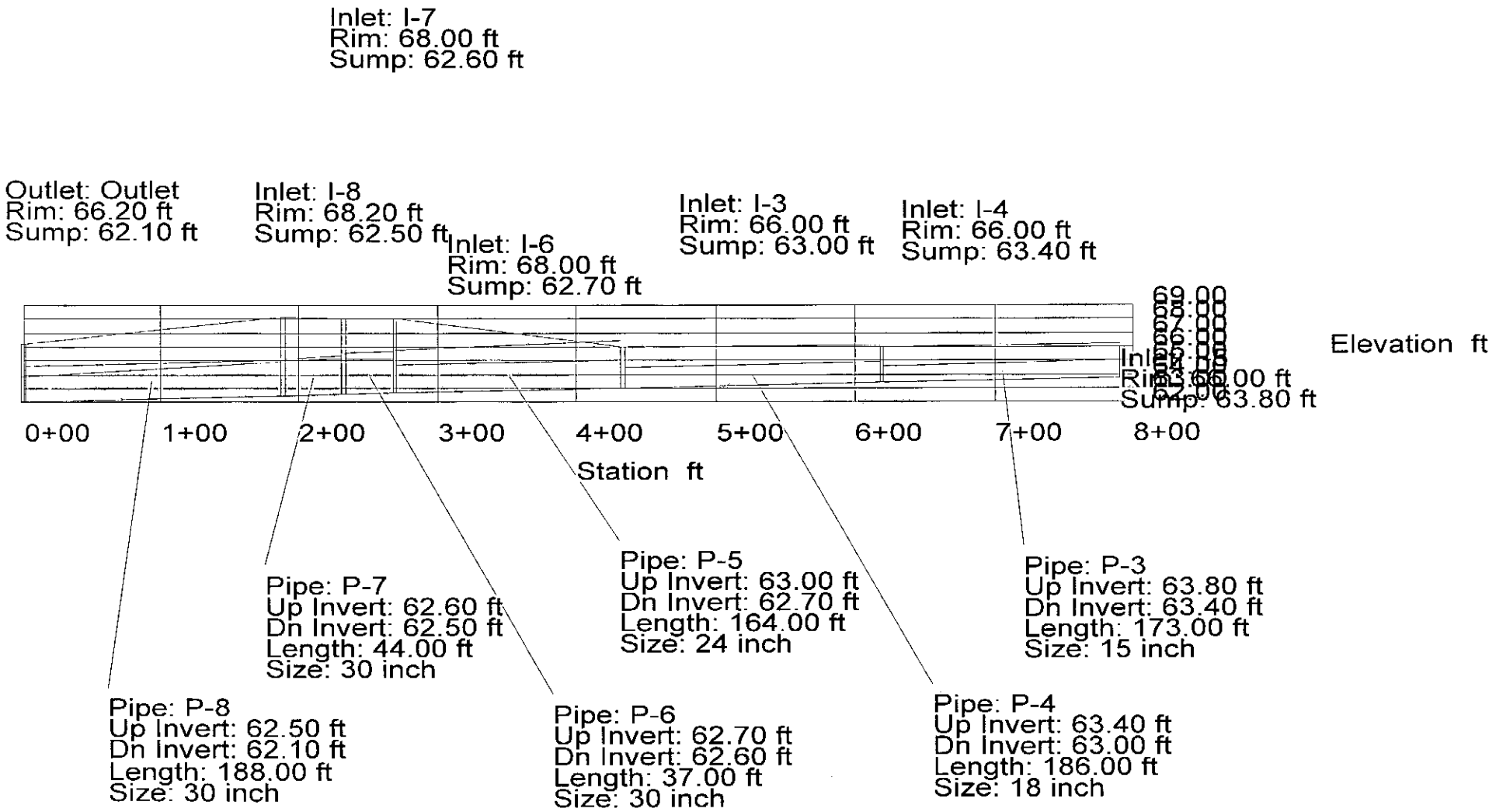
Up Invert: 61.70 ft
Dn Invert: 61.40 ft
Length: 167.00 ft
Size: 42 inch


SWS SYSTEM 2
I-1
P-1
I-2
8
P-2
7
6
I-3
P-5
5
P-4
4
I-4
3
P-3
2
I-5
1
I-6
I-7
I-8
P-6
P-7
P-8
15
16
Outlet
BLACKSTONE


Inlet: I-7
Rim: 68.00 ft
Sump: 62.60 ft
Outlet: Outlet
Rim: 66.20 ft
Sump: 62.10 ft
Inlet: I-6
Rim: 68.00 ft
Sump: 62.70 ft
Inlet: I-8
Rim: 68.20 ft
Sump: 62.50 ft
Inlet: I-3
Rim: 66.00 ft
Sump: 63.00 ft
Inlet: I-2
Rim: 66.00 ft
Sump: 63.60 ft
Inlet: I-1
Rim: 66.00 ft
Sump: 64.00 ft
69.00
68.00
67.00
66.00
65.00
64.00
63.00
62.00
Elevation ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
Station ft
Pipe: P-7
Up Invert: 62.60 ft
Dn Invert: 62.50 ft
Length: 44.00 ft
Size: 30 inch
Pipe: P-5
Up Invert: 63.00 ft
Dn Invert: 62.70 ft
Length: 164.00 ft
Size: 24 inch
Pipe: P-2
Up Invert: 63.60 ft
Dn Invert: 63.00 ft
Length: 291.00 ft
Size: 24 inch
Pipe: P-1
Up Invert: 64.00 ft
Dn Invert: 63.60 ft
Length: 191.00 ft
Size: 18 inch
Pipe: P-8
Up Invert: 62.50 ft
Dn Invert: 62.10 ft
Length: 188.00 ft
Size: 30 inch
Pipe: P-6
Up Invert: 62.70 ft
Dn Invert: 62.60 ft
Length: 37.00 ft
Size: 30 inch



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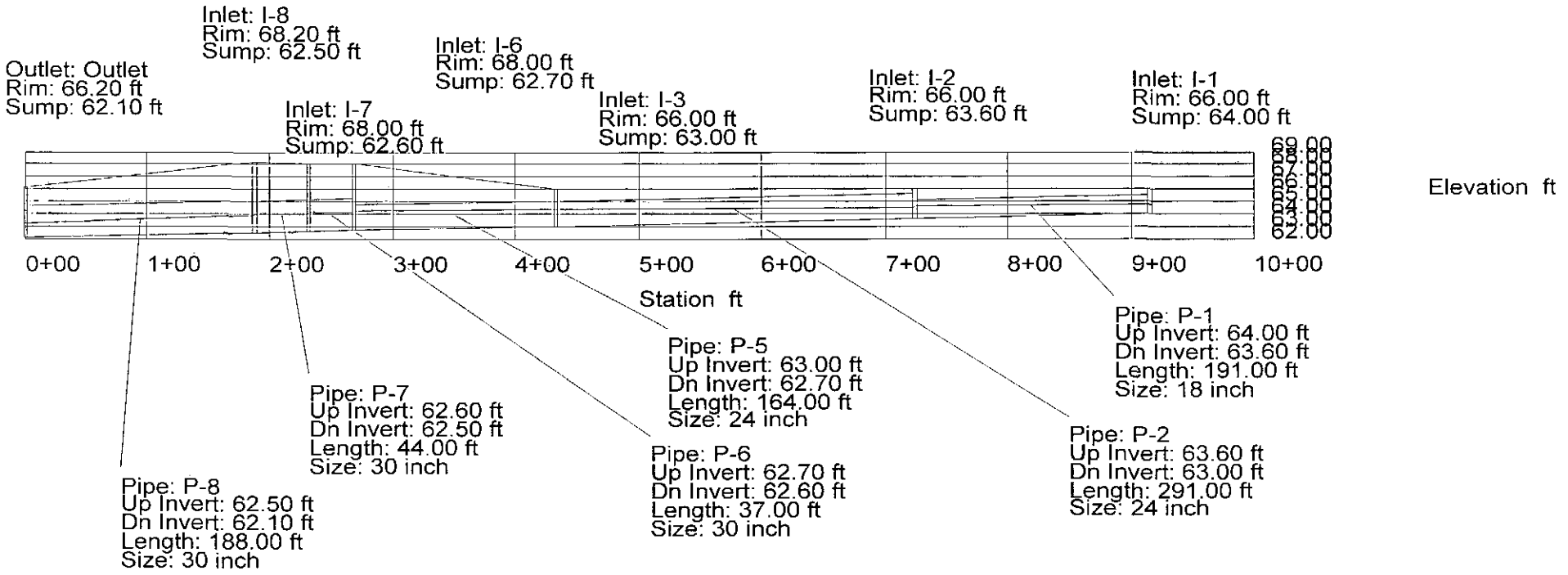
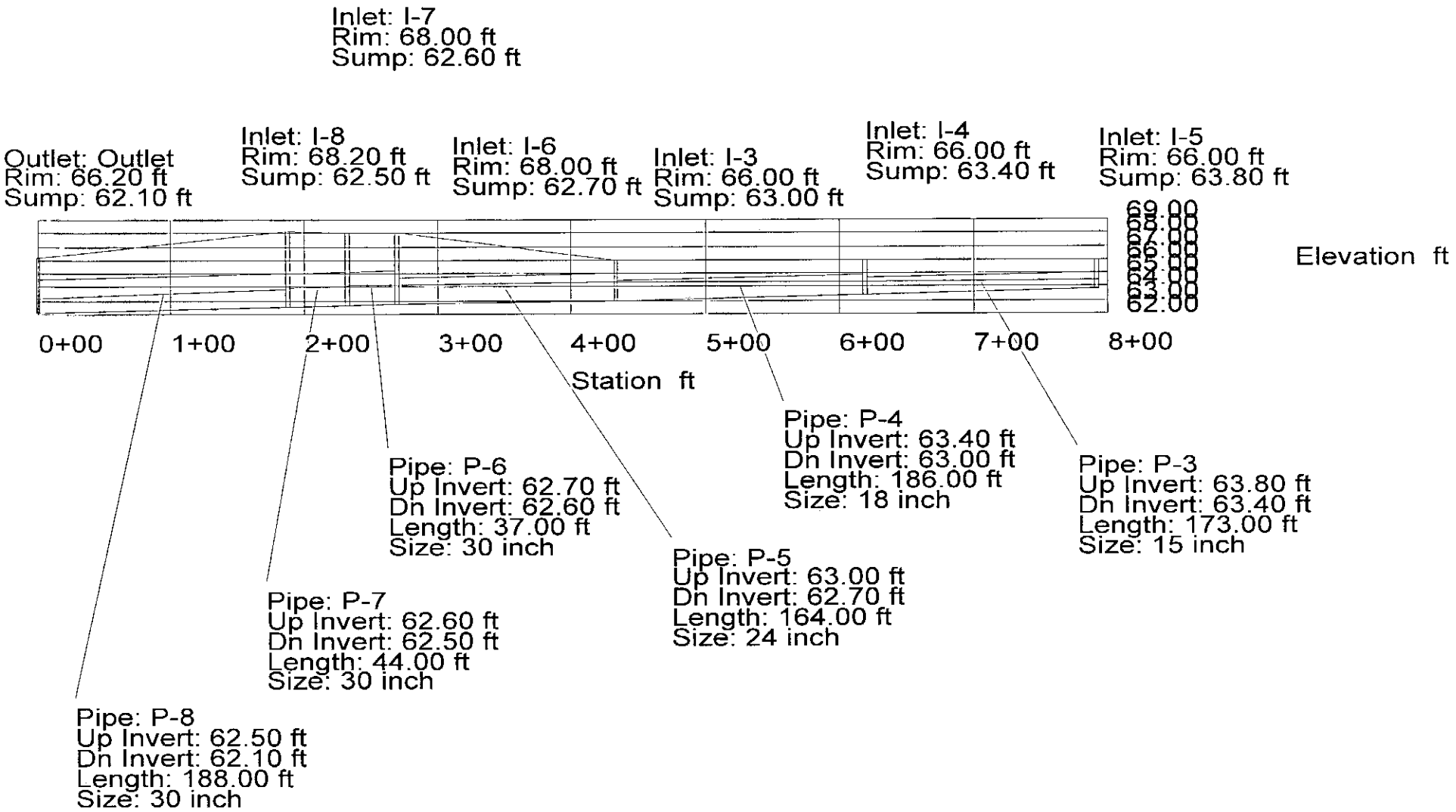

Outlet: Outlet
Rim: 66.20 ft
Sump: 62.10 ft
Inlet: I-8
Rim: 68.20 ft
Sump: 62.50 ft
Inlet: I-7
Rim: 68.00 ft
Sump: 62.60 ft
Inlet: I-6
Rim: 68.00 ft
Sump: 62.70 ft
Inlet: I-3
Rim: 66.00 ft
Sump: 63.00 ft
Inlet: I-2
Rim: 66.00 ft
Sump: 63.60 ft
Inlet: I-1
Rim: 66.00 ft
Sump: 64.00 ft
69.00
68.00
67.00
66.00
65.00
64.00
63.00
62.00
Elevation ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
Station ft
Pipe: P-8
Up Invert: 62.50 ft
Dn Invert: 62.10 ft
Length: 188.00 ft
Size: 30 inch
Pipe: P-7
Up Invert: 62.60 ft
Dn Invert: 62.50 ft
Length: 44.00 ft
Size: 30 inch
Pipe: P-6
Up Invert: 62.70 ft
Dn Invert: 62.60 ft
Length: 37.00 ft
Size: 30 inch
Pipe: P-5
Up Invert: 63.00 ft
Dn Invert: 62.70 ft
Length: 164.00 ft
Size: 24 inch
Pipe: P-2
Up Invert: 63.60 ft
Dn Invert: 63.00 ft
Length: 291.00 ft
Size: 24 inch
Pipe: P-1
Up Invert: 64.00 ft
Dn Invert: 63.60 ft
Length: 191.00 ft
Size: 18 inch



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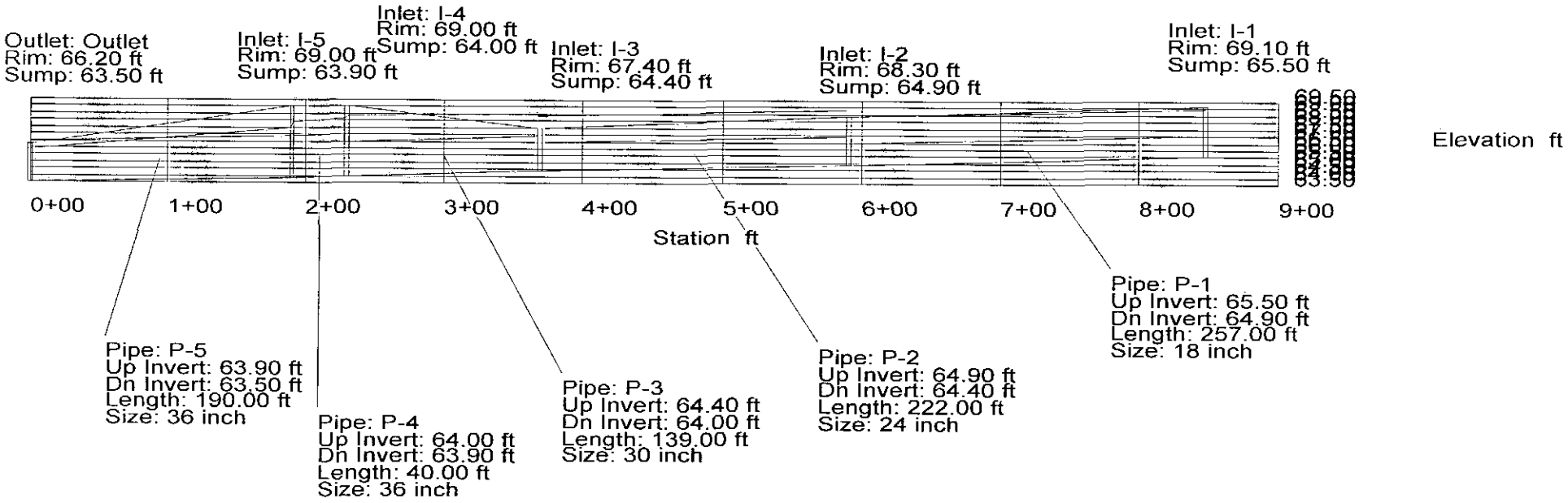
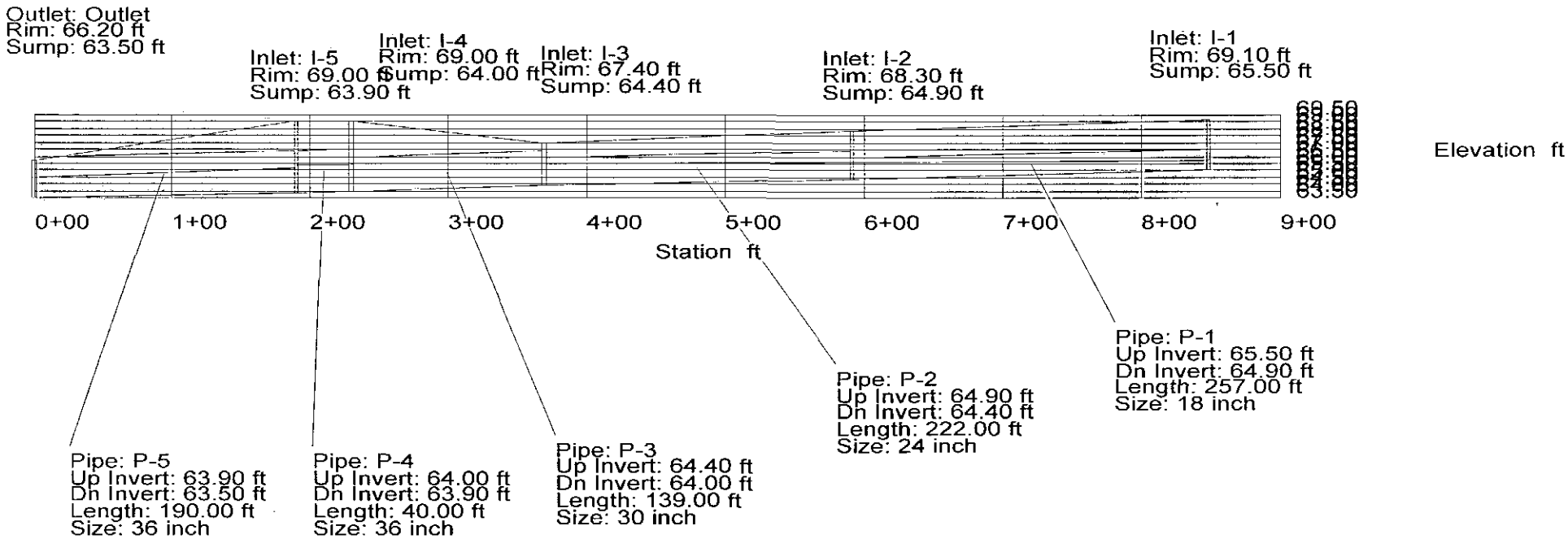
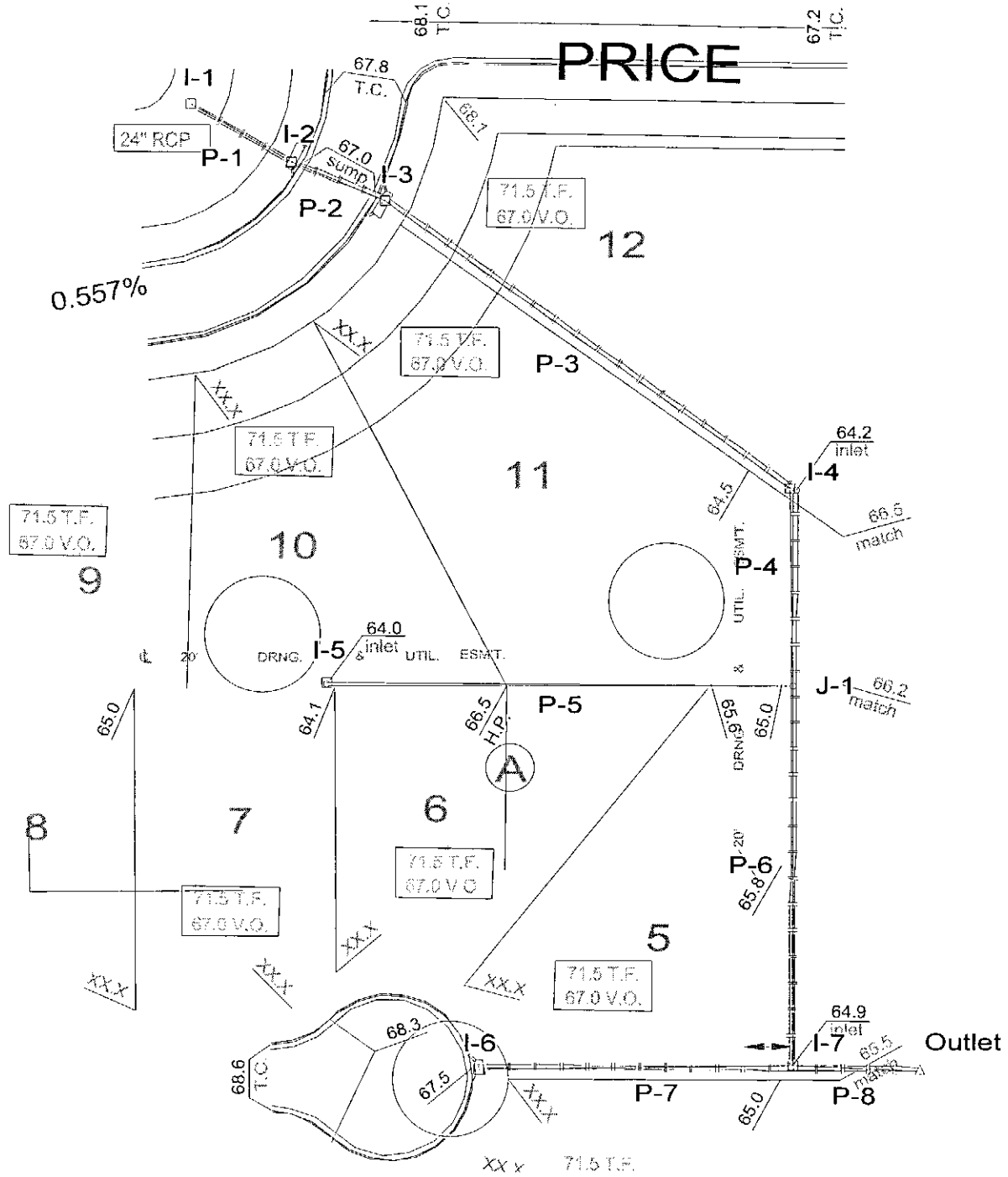
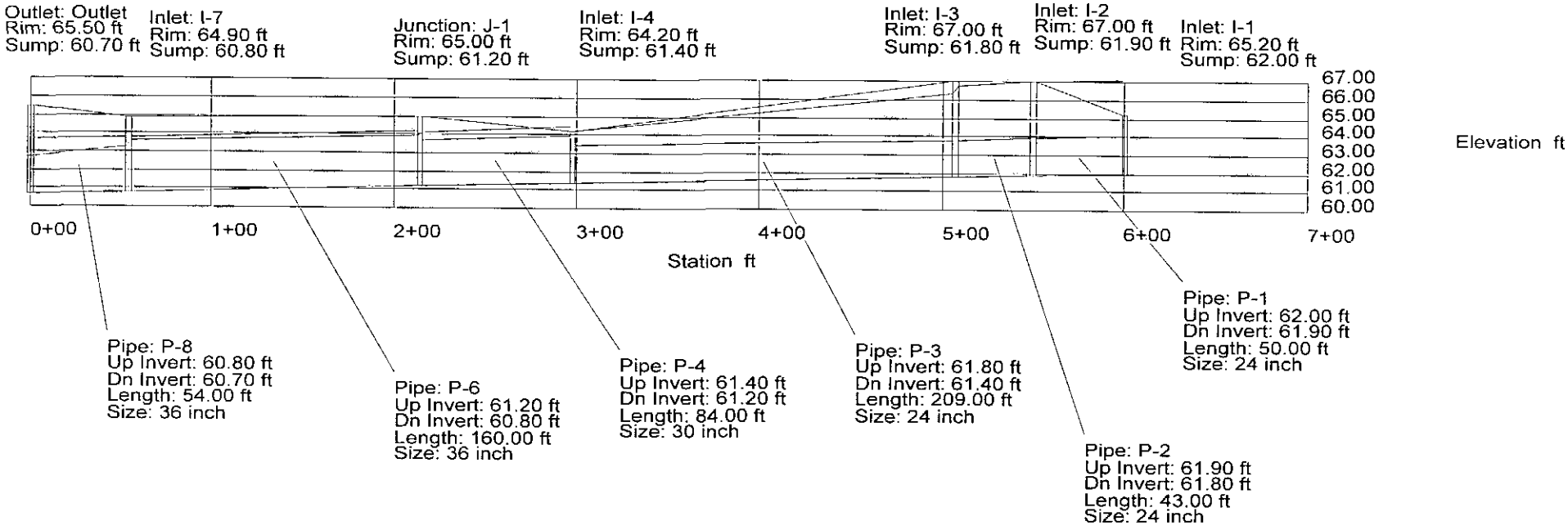
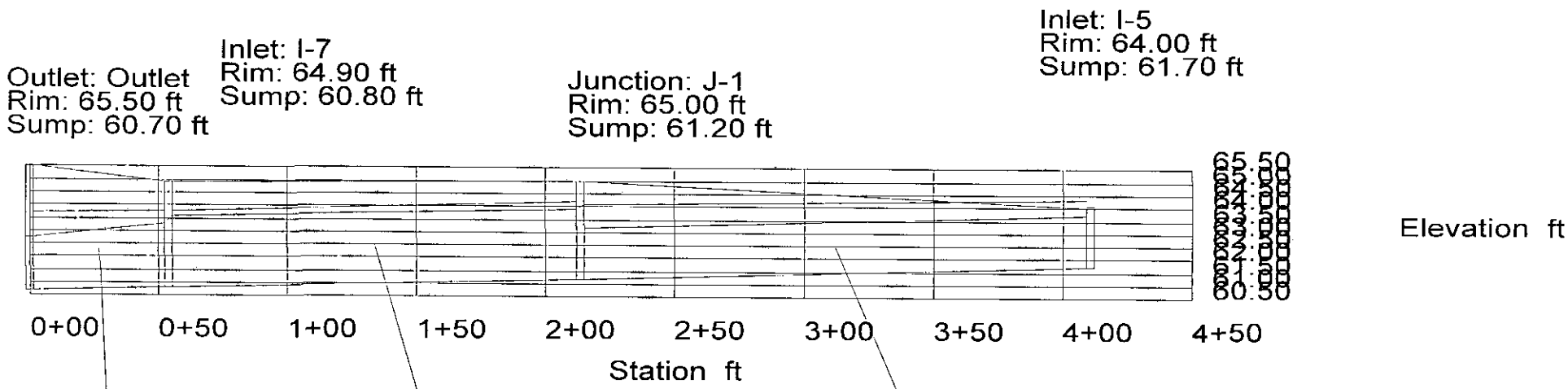

Outlet: Outlet
Rim: 66.20 ft
Sump: 63.50 ft
Inlet: I-5
Rim: 69.00 ft
Sump: 63.90 ft
Inlet: I-4
Rim: 69.00 ft
Sump: 64.00 ft
Inlet: I-3
Rim: 67.40 ft
Sump: 64.40 ft
Inlet: I-2
Rim: 68.30 ft
Sump: 64.90 ft
Inlet: I-1
Rim: 69.10 ft
Sump: 65.50 ft
Elevation ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
Station ft
Pipe: P-5
Up Invert: 63.90 ft
Dn Invert: 63.50 ft
Length: 190.00 ft
Size: 36 inch
Pipe: P-4
Up Invert: 64.00 ft
Dn Invert: 63.90 ft
Length: 40.00 ft
Size: 36 inch
Pipe: P-3
Up Invert: 64.40 ft
Dn Invert: 64.00 ft
Length: 139.00 ft
Size: 30 inch
Pipe: P-2
Up Invert: 64.90 ft
Dn Invert: 64.40 ft
Length: 222.00 ft
Size: 24 inch
Pipe: P-1
Up Invert: 65.50 ft
Dn Invert: 64.90 ft
Length: 257.00 ft
Size: 18 inch


Outlet: Outlet
Rim: 66.20 ft
Sump: 63.50 ft
Inlet: I-5
Rim: 69.00 ft
Sump: 63.90 ft
Inlet: I-4
Rim: 69.00 ft
Sump: 64.00 ft
Inlet: I-3
Rim: 67.40 ft
Sump: 64.40 ft
Inlet: I-2
Rim: 68.30 ft
Sump: 64.90 ft
Inlet: I-1
Rim: 69.10 ft
Sump: 65.50 ft
Elevation ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
Station ft
Pipe: P-5
Up Invert: 63.90 ft
Dn Invert: 63.50 ft
Length: 190.00 ft
Size: 36 inch
Pipe: P-4
Up Invert: 64.00 ft
Dn Invert: 63.90 ft
Length: 40.00 ft
Size: 36 inch
Pipe: P-3
Up Invert: 64.40 ft
Dn Invert: 64.00 ft
Length: 139.00 ft
Size: 30 inch
Pipe: P-2
Up Invert: 64.90 ft
Dn Invert: 64.40 ft
Length: 222.00 ft
Size: 24 inch
Pipe: P-1
Up Invert: 65.50 ft
Dn Invert: 64.90 ft
Length: 257.00 ft
Size: 18 inch


PRICE
68.1 T.C.
67.2 T.C.
67.8 T.C.
I-1
24" RCP
P-1
I-2
67.0 sump
I-3
P-2
68.1
71.5 T.F. 67.0 V.O.
12
0.557%
XX.X
71.5 T.F. 67.0 V.O.
P-3
71.5 T.F. 67.0 V.O.
64.2 inlet
I-4
11
64.5
66.5 match
71.5 T.F. 67.0 V.O.
10
9
P-4
UTIL. ESMT.
DRNG. ESMT.
64.0 inlet
I-5
UTIL. ESMT.
J-1
66.2 match
64.1
66.5 H.P.
P-5
65.0
65.0
A
8
7
6
71.5 T.F. 67.0 V.O.
P-6
65.8
71.5 T.F. 67.0 V.O.
5
71.5 T.F. 67.0 V.O.
68.3
I-6
64.9 inlet
I-7
Outlet
68.6 T.C.
67.5
65.5 match
P-7
P-8
65.0
XX.X 71.5 T.F.


Outlet: Outlet
Rim: 65.50 ft
Sump: 60.70 ft
Inlet: I-7
Rim: 64.90 ft
Sump: 60.80 ft
Junction: J-1
Rim: 65.00 ft
Sump: 61.20 ft
Inlet: I-4
Rim: 64.20 ft
Sump: 61.40 ft
Inlet: I-3
Rim: 67.00 ft
Sump: 61.80 ft
Inlet: I-2
Rim: 67.00 ft
Sump: 61.90 ft
Inlet: I-1
Rim: 65.20 ft
Sump: 62.00 ft
67.00
66.00
65.00
64.00
63.00
62.00
61.00
60.00
Elevation ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
Station ft
Pipe: P-8
Up Invert: 60.80 ft
Dn Invert: 60.70 ft
Length: 54.00 ft
Size: 36 inch
Pipe: P-6
Up Invert: 61.20 ft
Dn Invert: 60.80 ft
Length: 160.00 ft
Size: 36 inch
Pipe: P-4
Up Invert: 61.40 ft
Dn Invert: 61.20 ft
Length: 84.00 ft
Size: 30 inch
Pipe: P-3
Up Invert: 61.80 ft
Dn Invert: 61.40 ft
Length: 209.00 ft
Size: 24 inch
Pipe: P-2
Up Invert: 61.90 ft
Dn Invert: 61.80 ft
Length: 43.00 ft
Size: 24 inch
Pipe: P-1
Up Invert: 62.00 ft
Dn Invert: 61.90 ft
Length: 50.00 ft
Size: 24 inch



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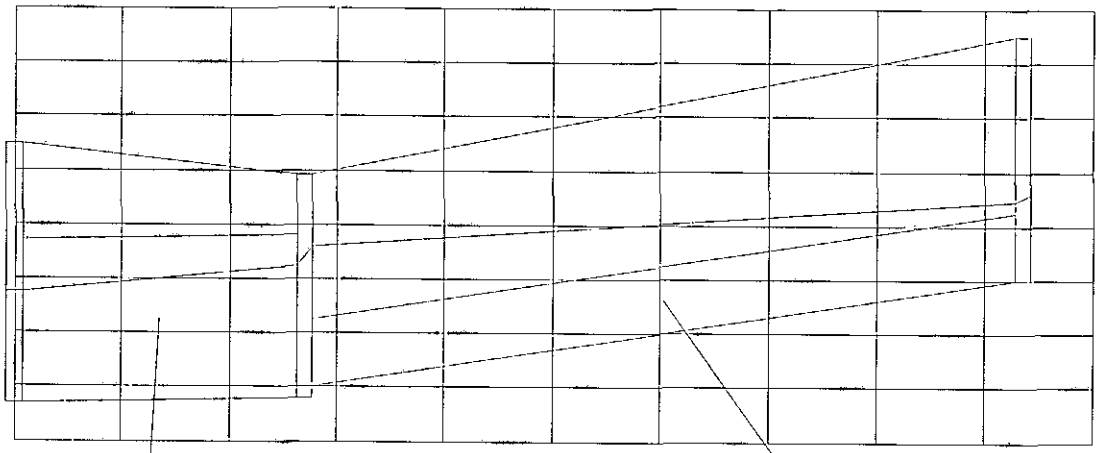
Outlet: Outlet
Rim: 65.50 ft
Sump: 60.70 ft

Inlet: I-7
Rim: 64.90 ft
Sump: 60.80 ft

Inlet: I-6
Rim: 67.50 ft
Sump: 63.00 ft

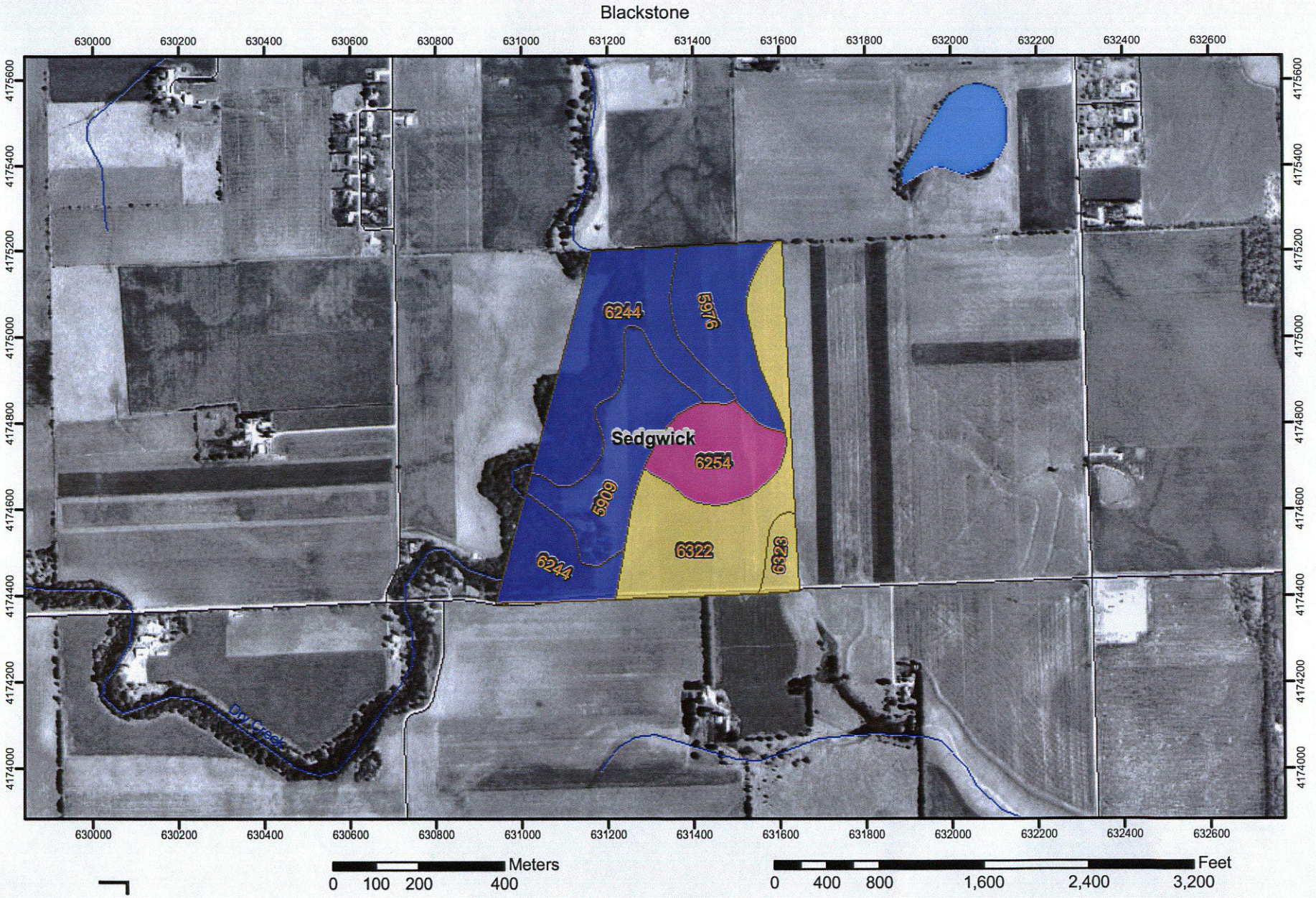


Pipe: P-8
Up Invert: 60.80 ft
Dn Invert: 60.70 ft
Length: 54.00 ft
Size: 36 inch

Pipe: P-7
Up Invert: 63.00 ft
Dn Invert: 61.00 ft
Length: 133.00 ft
Size: 15 inch

Soil Survey

HYDROLOGIC GROUP RATING FOR SEDGWICK COUNTY, KANSAS



USDA Natural Resources Conservation Service

Blackstone

MAP LEGEND

Hydrologic Group

{Dominant Condition, <}

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available
- Soil Map Units
- Cities
- Detailed Counties
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 14

Soil Survey Area: Sedgwick County, Kansas
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables - Hydrologic Group

Summary by Map Unit - Sedgwick County, Kansas

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Total Acres in AOI	Percent of AOI
5909	Naron fine sandy loam, 0 to 1 percent slopes	B	18.8	16.3
5976	Vanoss silt loam, 0 to 1 percent slopes	B	15.9	13.8
6244	Elandco silt loam, rarely flooded	B	36.3	31.4
6254	Waurika silt loam, 0 to 1 percent slopes	D	13.6	11.7
6322	Blanket silt loam, 0 to 1 percent slopes	C	27.8	24.0
6323	Blanket silt loam, 1 to 3 percent slopes	C	3.2	2.7

Description - Hydrologic Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are placed into four groups A, B, C, and D, and three dual classes, A/D, B/D, and C/D. Definitions of the classes are as follows:

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only soils that are rated D in their natural condition are assigned to dual classes.

Parameter Summary - Hydrologic Group

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff:

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

PondPack

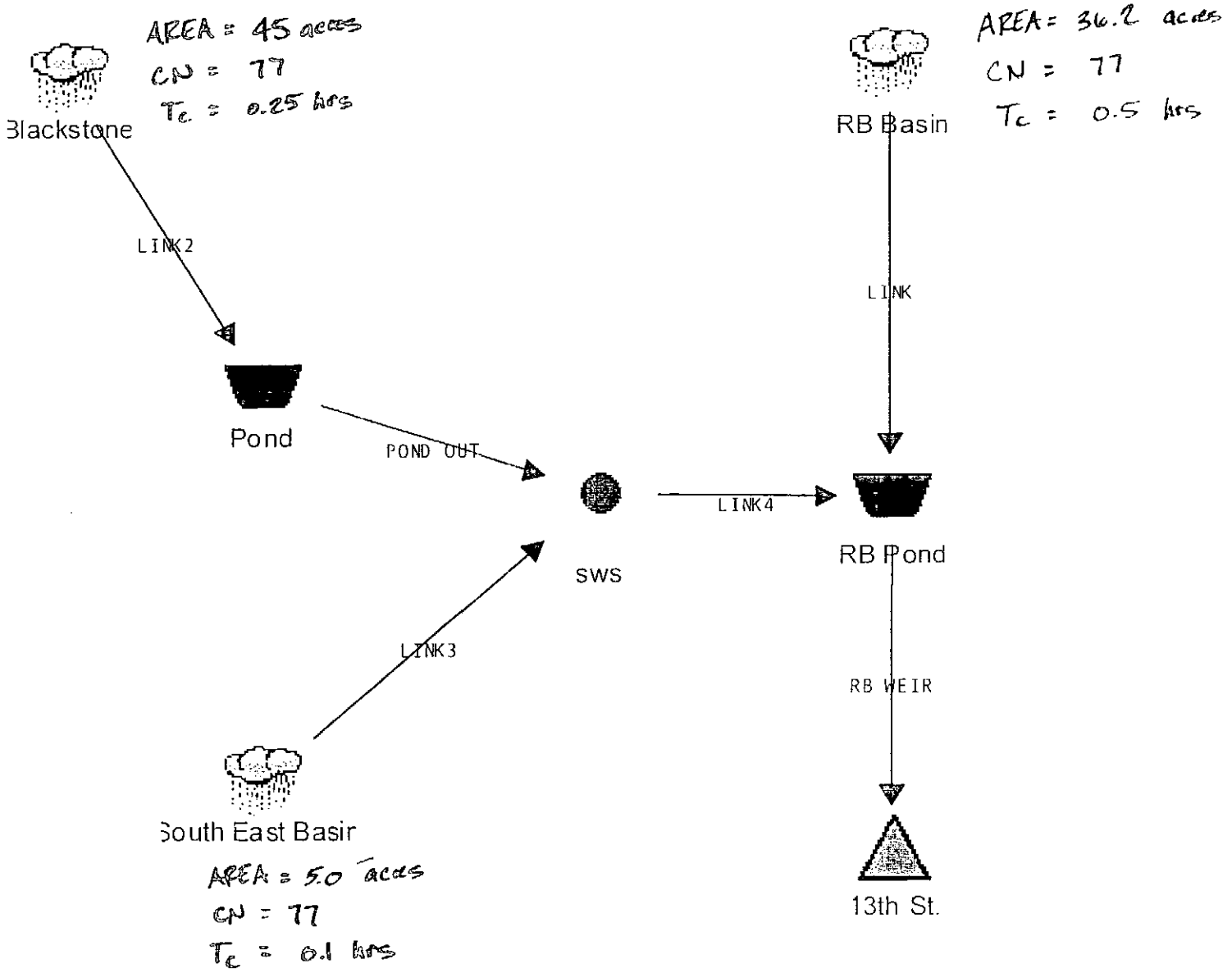

AREA = 45 acres
CN = 77
Tc = 0.25 hrs
Blackstone
LINK2
Pond
POND OUT
SWS
LINK3
South East Basir
AREA = 5.0 acres
CN = 77
Tc = 0.1 hrs
AREA = 36.2 acres
CN = 77
Tc = 0.5 hrs
RB Basin
LINK
LINK4
RB Pond
RB WEIR
13th St.

Table of Contents

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

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Sedgwick24..... 5y24h
Design Storms 2.03

********** POND VOLUMES **********

POND..... Vol: Elev-Area 3.01

RB POND..... Vol: Elev-Area 3.02

********** OUTLET STRUCTURES **********

POND OUT..... Outlet Input Data 4.01

RB WEIR..... Outlet Input Data 4.03

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID SEDGWICK.RNQ Sedgwick24

Return Event	Total Depth in	Rainfall Type	RNF File	RNF ID
5y24h	4.5000	Synthetic Curve	SCSTYPES	TypeII 24hr
25y24h	6.1000	Synthetic Curve	SCS	SCSII
100y24	7.9000	Synthetic Curve	SCSTYPES	TypeII 24hr
10y24h	5.3000	Synthetic Curve	SCSTYPES	TypeII 24hr
2y24h	3.5000	Synthetic Curve	SCSTYPES	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Storage Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond ac-ft
*13TH ST.		JCT	5	15.511		12.7500	23.34		
*13TH ST.		JCT	25	25.096		12.5500	38.95		
*13TH ST.		JCT	100	36.511		12.6000	73.52		
*13TH ST.		JCT	10	20.212		12.7000	33.86		
*13TH ST.		JCT	2	10.005		12.9000	12.32		
BLACKSTONE		AREA	5	8.290		12.0500	120.49		
BLACKSTONE		AREA	25	13.375		12.0000	88.02		
BLACKSTONE		AREA	100	19.435		12.0500	278.70		
BLACKSTONE		AREA	10	10.785		12.0500	156.72		
BLACKSTONE		AREA	2	5.365		12.0500	77.25		
POND	IN	POND	5	8.290		12.0500	120.49		
POND	IN	POND	25	13.375		12.0000	88.02		
POND	IN	POND	100	19.435		12.0500	278.70		
POND	IN	POND	10	10.785		12.0500	156.72		
POND	IN	POND	2	5.365		12.0500	77.25		
POND	OUT	POND	5	8.124		14.8000	5.02	1363.40	5.124
POND	OUT	POND	25	13.170		14.2500	8.62	1364.21	8.206
POND	OUT	POND	100	19.178		14.5000	10.92	1365.34	12.585
POND	OUT	POND	10	10.599		14.2000	7.08	1363.80	6.632

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

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

Storage Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond ac-ft
POND	OUT POND	2	5.228		16.1000	2.60	1362.94	3.434
RB BASIN	AREA	5	6.669		12.2000	67.99		
RB BASIN	AREA	25	10.759		12.0500	65.36		
RB BASIN	AREA	100	15.634		12.2000	159.36		
RB BASIN	AREA	10	8.676		12.2000	88.83		
RB BASIN	AREA	2	4.315		12.2000	43.22		
RB POND	IN POND	5	15.530		12.2000	73.13		
RB POND	IN POND	25	25.118		12.0000	77.83		
RB POND	IN POND	100	36.540		12.2000	173.89		
RB POND	IN POND	10	20.233		12.2000	96.47		
RB POND	IN POND	2	10.020		12.2000	45.93		
RB POND	OUT POND	5	15.511		12.7500	23.34	1360.61	3.131
RB POND	OUT POND	25	25.096		12.5500	38.95	1361.26	4.451
RB POND	OUT POND	100	36.511		12.6000	73.52	1362.47	6.936
RB POND	OUT POND	10	20.212		12.7000	33.86	1361.07	4.048
RB POND	OUT POND	2	10.005		12.9000	12.32	1360.05	2.024
SOUTH EAST BASIN	AREA	5	.737		11.9500	13.30		
SOUTH EAST BASIN	AREA	25	1.189		12.0000	8.10		
SOUTH EAST BASIN	AREA	100	1.727		11.9500	30.54		
SOUTH EAST BASIN	AREA	10	.959		11.9500	17.26		
SOUTH EAST BASIN	AREA	2	.477		11.9500	8.56		
SWS	JCT	5	8.861		11.9500	13.91		
SWS	JCT	25	14.359		12.0000	13.37		
SWS	JCT	100	20.906		11.9500	34.92		
SWS	JCT	10	11.558		11.9500	18.37		
SWS	JCT	2	5.705		11.9500	8.88		

JOB TITLE NOT SPECIFIED
Click Project Summary on the File Menu to enter title

DESIGN STORMS SUMMARY

Design Storm File,ID = SEDGWICK.RNQ Sedgwick24

Storm Tag Name = 5y24h
Description: Sedgwick County 5-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25y24h
Description: Sedgwick County - 25 year - 24hour

Data Type, File, ID = Synthetic Storm SCS.RNF SCSII
Storm Frequency = 25 yr
Total Rainfall Depth= 6.1000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= 1.0000 hrs End= 24.0000 hrs

Storm Tag Name = 100y24
Description: Sedgwick County 100-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.9000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 10y24h
Description: Sedgwick County 10-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.3000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... C:\HAESTAD\PPKW\RAINFALL\SEDGWICK.RNQ
Title...

JOB TITLE NOT SPECIFIED
Click Project Summary on the File Menu to enter title

DESIGN STORMS SUMMARY

Design Storm File,ID = SEDGWICK.RNQ Sedgwick24

Storm Tag Name = 2y24h
Description: Sedgwick County 2-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = SEDGWICK.RNQ Sedgwick24

Storm Tag Name = 5y24h
Description: Sedgwick County 5-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25y24h
Description: Sedgwick County - 25 year - 24hour

Data Type, File, ID = Synthetic Storm SCS.RNF SCSII
Storm Frequency = 25 yr
Total Rainfall Depth= 6.1000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= 1.0000 hrs End= 24.0000 hrs

Storm Tag Name = 100y24
Description: Sedgwick County 100-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.9000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 10y24h
Description: Sedgwick County 10-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.3000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

DESIGN STORMS SUMMARY

Design Storm File,ID = SEDGWICK.RNQ Sedgwick24

Storm Tag Name   = 2y24h
Description: Sedgwick County 2-yr 24 hour Duration

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency   = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... F:\HYDRO\PROJECTS\BLACKSTONE\PONDPACK\DEVELOPED.PPW

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
1362.00	-----	3.6000	.0000	.000	.000
1369.00	-----	4.3300	11.8782	27.716	27.716

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

File.... F:\HYDRO\PROJECTS\BLACKSTONE\PONDPACK\DEVELOPED.PPW

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
1359.00	-----	1.9000	.0000	.000	.000
1364.00	-----	2.2000	6.1445	10.241	10.241
1370.00	-----	2.2000	6.6000	13.200	23.441

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

File.... F:\HYDRO\PROJECTS\BLACKSTONE\PONDPACK\DEVELOPED.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 1362.00 ft
Increment = .50 ft
Max. Elev.= 1369.00 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-Circular	CV	--->	TW	1362.000	1369.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

Structure ID = CV
Structure Type = Culvert-Circular

No. Barrels	=	1	
Barrel Diameter	=	2.0000	ft
Upstream Invert	=	1362.00	ft
Dnstream Invert	=	1361.00	ft
Horiz. Length	=	1100.00	ft
Barrel Length	=	1100.00	ft
Barrel Slope	=	.00091	ft/ft

OUTLET CONTROL DATA...

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

INLET CONTROL DATA...

Equation form	=	1	
Inlet Control K	=	.0098	
Inlet Control M	=	2.0000	
Inlet Control c	=	.03980	
Inlet Control Y	=	.6700	
T1 ratio (HW/D)	=	1.160	
T2 ratio (HW/D)	=	1.306	
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 = 1364.32 ft ---> Flow = 15.55 cfs
At T2 Elev = 1364.61 ft ---> Flow = 17.77 cfs

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

File.... F:\HYDRO\PROJECTS\BLACKSTONE\PONDPACK\DEVELOPED.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 1359.00 ft
Increment = .50 ft
Max. Elev.= 1370.00 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
User Defined Table TW SETUP, DS Channel	WR	--->	TW	.000	1370.000

OUTLET STRUCTURE INPUT DATA

Structure ID = WR
Structure Type = User Defined Table

ELEV-FLOW RATING TABLE

Elev, ft	Flow, cfs
1359.00	.00
1359.50	4.00
1360.00	11.40
1360.50	20.90
1361.00	32.20
1361.50	45.00
1362.00	59.20
1362.50	74.60
1363.00	91.20
1363.50	108.80
1364.00	134.20
1370.00	437.00

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

Index of Starting Page Numbers for ID Names

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RB POND... 3.02
RB WEIR... 4.03

----- S -----
Sedgwick24... 2.01, 2.03

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