MASTER DEVELOPMENT DRAINAGE PLAN
FOR
UNION BOULEVARD/BRIARGATE PARKWAY AND
PRELIMINARY/FINAL DRAINAGE REPORT
FOR PORTIONS OF UNION BOULEVARD,
BRIARGATE PARKWAY,
FAMILY PLACE AND
AUSTIN BLUFFS PARKWAY

J·R ENGINEERING
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July 2001

Prepared For:

LP47, LLC
dba LA PLATA INVESTMENTS
2315 Briargate Parkway, Suite 100
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(719) 260-7477

Prepared By:

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4310 ArrowsWest Drive
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Job No. 8716.11

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ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Vancel S. Fossinger 1-21-02

Vancel S. Fossinger, Colorado P.E. No. 31972 Date
For and On Behalf of JR Engineering, LLC

COLORADO REGISTERED VANCEL S FOSSINGER 31972 PROFESSIONAL ENGINEER

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: LP47, LLC dba La Plata Investments

By: Thomas Taylor

Title: Director of Land Development

Address: 2315 Briargate Parkway, Suite 100

Colorado Springs, CO 80920

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

Jim Mather for
City Engineer

Jan 30, 2002
Date

Conditions:

4310 ArrowsWest Drive, Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6613 • www.jrengineering.com

July 17, 2001

J R ENGINEERING

City of Colorado Springs
Subdivision Engineering Review Team
101 West Costilla Street, Suite 113
Colorado Springs, CO 80903

ATTN: Mr. Tim Mitros

RE: Master Development Drainage Plan for Union Boulevard/Briargate Parkway and Preliminary/Final Drainage Report for Portions of Union Boulevard, Briargate Parkway, Family Place and Austin Bluffs Parkway

Dear Tim:

Please find attached the updated above referenced M.D.D.P. and Preliminary Drainage Report. The current update reflects the following changes:

A) The final storm drain flows from Summerfield No. 9 are reflected.
B) The final storm drain flows from Sagewood No. 6 are reflected.
C) Abandonment of the on-site YMCA detention pond is reflected.
D) The drainage basins and inlet locations in proposed Briargate Parkway have been revised to be consistent with the final street grading. It is assumed that slightly more area on the north side of Briargate Parkway will be tributary to the street inlets.
E) Basin PS6-13A on the northeast corner of the Briargate Parkway/Brainard Drive intersection has been added with a stub to the main in Briargate Parkway.

There are no significant changes in flow rates that would impact the design of the R.C.B. Thus, some of the calculations reflect the previous design flows as noted in the report.

The area north of Briargate Parkway and Union Boulevard shall be addressed in future final drainage reports when adequate information is available.

Drainage plan sheets 1 through 5 are included in the report.

Plans for the various storm drain facilities will be submitted separately.

Your initial review copy of the M.D.D.P. is also attached.

4310 ArrowsWest Drive, Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6613 • www.jrengineering.com

If you have any questions, please feel free to call me at 593-2593, extension 205.

Sincerely,

JR Engineering

John R Bessette

John R. Bessette, P.E.
Senior Project Engineer II

/kd/8716.11/letters/MDDPletter-tim mitros

Encl.

cc: Mr. Thomas Taylor, LP47, LLC dba La Plata Investments

MASTER DEVELOPMENT DRAINAGE PLAN FOR UNION BOULEVARD/BRIARGATE PARKWAY AND PRELIMINARY/FINAL DRAINAGE REPORT FOR PORTIONS OF UNION BOULEVARD, BRIARGATE PARKWAY, FAMILY PLACE AND AUSTIN BLUFFS PARKWAY

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MASTER DEVELOPMENT DRAINAGE PLAN FOR UNION BOULEVARD/BRIARGATE PARKWAY AND PRELIMINARY/FINAL DRAINAGE REPORT FOR PORTIONS OF UNION BOULEVARD, BRIARGATE PARKWAY, FAMILY PLACE AND AUSTIN BLUFFS PARKWAY

PURPOSE

This is the Master Development Drainage Plan for the Union Boulevard/Briargate Parkway area and the Preliminary/Final Drainage Report for Union Boulevard from Charity Drive to Briargate Parkway, Briargate Parkway from Union Boulevard to Future Powers Boulevard, Family Place, and Austin Bluffs Parkway from Charity Drive to Briargate Parkway. The Master Development Drainage Plan (M.D.D.P.) includes the area bounded by the Pine Creek/Cottonwood Creek Basin boundary on the south, proposed Union Boulevard on the west and north, and proposed Powers Boulevard on the East. Also included in the study is a portion of future Summerfield Filing No. 9 lying to the west of Union Boulevard. This area includes Basins PS6, PS7, PS8 and PS9 as defined in the "Amendment No. 2 to the Pine Creek Drainage Basin Planning Study and Master Developed Plan for Pine Creek Subdivision," prepared by JR Engineering, Ltd., dated October 1998.

The purpose of this drainage study is to:

1. Quantify requirements for the major drainage conveyance proposed along proposed Briargate Parkway from proposed Powers Boulevard east to existing Detention Facility "C" and prepare a design for the conveyance. This includes the conveyance of runoff from east of proposed Powers Boulevard west to existing Detention Facility "C".

2. Estimate anticipated stormwater runoff quantities and recommend solutions for the necessary stormwater conveyance in Family Place to connection with proposed facilities in proposed Union Boulevard, Union Boulevard from the end of existing facilities at Charity Drive north to connection with the proposed conveyance on the north side of proposed Briargate Parkway, and Austin Bluffs Parkway from existing facilities at Family Place north to connection with the proposed conveyance on the north side of proposed Briargate Parkway.

3. At the M.D.D.P. level, quantify the runoff generated in the (Town Center) area of study north of proposed Briargate Parkway and outline conveyance to the proposed conveyance on the north side of proposed Briargate Parkway. The Town Center area land planning is not complete at this time. The area shall be studied in future drainage reports. Runoff shall be directed to the interception points provided in the major conveyance.

GENERAL DESCRIPTION

The study area lies within the northwest quarter of Section 35, Township 12 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso, State of Colorado.

According to the "Soil Survey of El Paso County Area" prepared by S.C.S., the following soils are in the study area.

Map Symbol	Name	Hydrolic Group
8	Blakeland	A
12	Bresser	B
83	Stapleton	B
85	Stapleton part	B
85	Bernal part	D

A copy of the area soils map is included in the Appendix of this report.

EXISTING DRAINAGE CONDITIONS

The study area contains both improved and unimproved areas. Improved areas include the portion of Sagewood development in Pine Creek Basin. This area was studied in previous M.D.D.P.'s and drainage reports, and presently discharges runoff to temporary detention ponds until such time as the major conveyance along the north side of Briargate Parkway comes into service. The existing YMCA site and adjacent existing Family Place are included in the study

area. The rear lot areas of existing Briargate Subdivision Filing No. 5 and drainage area tributary existing Charity Drive are also included in the study area.

The study area lies along the south branch of Pine Creek which flows intermittently from the northeast to southwest across the study area.

The unimproved portion of the site has grass vegetation and the majority of the study area slopes from east to west at 3 to 4%. Steeper slopes of 15 to 20% lie along portions of the north and south limits of the study area.

The study area is included in "Amendment 2 to the Pine creek Drainage Basin Planning Study and Master Development Plan for Pine Creek Subdivision" (D.B.P.S.) by JR Engineering, Ltd., dated October 1998. The D.B.P.S. defined the drainage concept for the study area, drainage criteria for the individual sites, as well as the requirements for major drainage infrastructure.

PROPOSED DRAINAGE CHARACTERISTICS

In accordance with the purpose of this study the following proposed conveyances are addressed:

1. The major conveyance along the north side proposed of Briargate Parkway from proposed Powers Boulevard east to existing Detention Facility "C".
2. Stormwater facilities required in Briargate Parkway, from proposed Union Boulevard to proposed Powers Boulevard.
3. Stormwater facilities in proposed Union Boulevard from Charity Drive north to the proposed conveyance on the north side of Briargate Parkway.
4. Stormwater facilities in the remainder of proposed Family Place from the neighbor park site west to the junction with proposed facilities in proposed Union Boulevard.
5. Stormwater facilities in Austin Bluffs Parkway from Family Place north to the proposed conveyance on the north side of proposed Briargate Parkway. This would negate the need for temporary Detention Pond "B", Sagewood Filing No. 5.

6. Connection of existing stormwater outfall from Sagewood Filing No. 3 to the proposed conveyance on the north side of proposed Briargate Parkway, thus negating the need for temporary Detention Pond "A".

In addition to the above, the necessary facilities are outlined in this study to convey stormwater runoff to the major conveyances outlined above. A detailed description follows.

Area Tributary to Proposed Union Boulevard Storm Drain (Sheet 2 of 5)

The following basins and related facilities are tributary to the proposed Union Boulevard storm drain. Basin PS8-12 $Q_5 = 3$ cfs, $Q_{100} = 6$ cfs, Austin Bluffs Parkway is conveyed by street gutter north to the junction with Family Place then in the south flowline of Family Place combining with runoff from Basins PS8-11, $Q_5 = 8$ cfs, $Q_{100} = 15$ cfs, PS8-19, $Q_5 = 2$ cfs, $Q_{100} = 3$ cfs, and PS8-10, $Q_5 = 10$ cfs, $Q_{100} = 20$ cfs, direct discharged since the on-site detention pond at the YMCA site has be abandoned. The total of these combined flows at AP-U9 in the south flowline of Family Place is $Q_5 = 20$ cfs, $Q_{100} = 36$ cfs. The flow at AP-U9 is conveyed in the south flowline of Family Place, combining with runoff from Basins PS8-9, $Q_5 = 4$ cfs, $Q_{100} = 9$ cfs, and PS8-17, $Q_5 = 2$ cfs, $Q_{100} = 3$ cfs. The combined flow is $Q_5 = 23$ cfs and $Q_{100} = 43$ cfs, at AP-U11, a proposed 12' at-grade inlet.

Runoff from Basin PS8-18, $Q_5 = 4$ cfs, $Q_{100} = 7$ cfs, is collected and conveyed in the north flowline of Family Place to AP-U12, a proposed 8' at-grade inlet.

AP-U11 plus AP-U12, $Q_5 = 36$ cfs, $Q_{100} = 48$ cfs, represents the combined routed flows of AP-U11 and AP-U12. It is assumed that during the 100-year frequency storm flow will be divided equally, at 5% grade the street capacity is approximately 23 cfs, per side at the crown.

At AP-U11 the proposed 12' at-grade inlet will intercept 7 cfs, with a flow-by of 17 cfs, to AP-U14 in the 100-year frequency storm. In the 5-year frequency storm 7 cfs, will be intercepted, 16 cfs, will flow-by to AP-U14 in the street gutter.

At AP-U12 the proposed 8' inlet will intercept 5 cfs, with a flow-by of 19 cfs, in the 100-year frequency storm and 2 cfs, with a flow-by of 2 cfs, in the 5-year frequency storm.

Runoff from Basin PS8-8, Q_5 = 11 cfs, Q_{100} = 23 cfs, is collected and conveyed in a proposed 30" R.C.P. to AP-U13, Q_5 = 24 cfs, Q_{100} = 43 cfs, which includes the intercepted flows from AP-U11 and AP-U12. The combined flow is routed west to AP-U18 in a proposed 30" R.C.P. increasing in 42" diameter prior to the junction.

The flow-by from AP-U12 is routed in the north flowline of Family Place combining with runoff from Basin PS8-15, Q_5 = 2 cfs, Q_{100} = 3 cfs. At AP-U17, Q_5 = 3 cfs, Q_{100} = 21 cfs, a proposed 8' sump inlet intercepts the combined flow which is conveyed to AP-U18 in a proposed 24" R.C.P. The combined flows Q_5 = 26 cfs, Q_{100} = 63cfs, at AP-U18 are conveyed west in the proposed 42" R.C.P. to AP-U19.

The flow-by from AP-U11 is routed in the south flowline of Family Place combining with flow from basin PS8-16, Q_5 = 1 cfs, Q_{100} = 3 cfs. At AP-U14, the combined flows Q_5 = 16 cfs, Q_{100} = 18 cfs, are intercepted by a proposed 10' sump inlet and routed to AP-U16 in a proposed 24" R.C.P.

Runoff from Basin PS8-7, Q_5 = 24 cfs, Q_{100} = 41 cfs, is collected and routed to the proposed 36" R.C.P. outfall pipe at AP-U15.

At AP-U16, Q_5 = 39 cfs, Q_{100} = 58 cfs, the combined flows from AP-U15 and AP-U14 are conveyed to AP-U19 in a proposed 36" R.C.P.

At AP-U19 the combined flows from AP-U16 and AP-U17, Q_5 = 64 cfs, Q_{100} = 118 cfs, are conveyed in the proposed 42" R.C.P. to AP-U20, junction with the proposed 60" R.C.P. in Union Boulevard.

Runoff from existing residential development Basin PS8-3, Q_5 = 10 cfs, Q_{100} = 21 cfs, is routed to the existing 10' at-grade inlet at AP-U2, Q_5 = 10 cfs, Q_{100} = 21 cfs. The intercepted flows Q_5 = 5 cfs, Q_{100} = 7 cfs, are routed in the existing 18" R.C.P. to the existing 10' at-grade inlet at AP-U3. The flow-by Q_5 = 5 cfs, Q_{100} = 14 cfs, is routed to AP-U7 in proposed Union Boulevard.

Runoff from existing residential Basin PS8-4, Q_5 = 8 cfs, Q_{100} = 17 cfs, is routed to the existing 10' at-grade inlet AP-U3, Q_5 = 8 cfs, Q_{100} = 17 cfs. The intercepted flow Q_5 = 4 cfs, Q_{100} = 6 cfs, is combined with intercepted flow from AP-U2, and routed to AP-U4 in the existing 18" R.C.P. to AP-U4. Flow-by, Q_5 = 4 cfs, Q_{100} = 11 cfs, is routed in proposed Union Boulevard to AP-U7.

Runoff from developed Basin PS8-2, Q_5 = 3 cfs, Q_{100} = 6 cfs, in Union Boulevard is routed to the existing 5' at-grade inlet at AP-U1. The intercepted flow, Q_5 = 1 cfs, Q_{100} = 2 cfs, is conveyed in an existing 18" R.C.P. to AP-U4. The flow-by, Q_5 = 2 cfs, Q_{100} = 4 cfs, is routed to AP-U21 in proposed Union Boulevard.

Runoff from Basin PS8-1, Q_5 = 14 cfs, Q_{100} = 29 cfs, a portion of future Summerfield Filing No. 9, is assumed to be intercepted in future sump inlets and conveyed in the proposed 30" R.C.P. outfall pipe from AP-U5, Q_5 = 14 cfs, Q_{100} = 29 cfs, to AP-U6, storm drain in proposed Union Boulevard.

The combined flows at AP-U4, Q_5 = 9 cfs, Q_{100} = 14 cfs, are conveyed in a proposed 24" R.C.P./30" R.C.P. to AP-U6, Q_5 = 26 cfs, Q_{100} = 48 cfs, to include flow from AP-U5. The combined flow is routed to AP-U8 in a proposed 30" R.C.P. storm drain in proposed Union Boulevard.

The flow-by from AP-U2 and AP-U3 combined with runoff from Basin PS8-6, Q_5 = 3 cfs, Q_{100} = 5 cfs, is routed to AP-U7. A proposed 8' at-grade inlet at AP-U7 intercepts Q_5 = 5 cfs, Q_{100} = 7 cfs, with a flow-by of Q_5 = 5 cfs, Q_{100} = 19 cfs. The flow-by is routed in proposed Union Boulevard to AP-U21, a proposed sump inlet.

At storm drain junction point AP-U8 the intercepted routed flow from AP-U7 and the routed flow from AP-U6, Q_5 =26 cfs, Q_{100} = 48 cfs, are combined, Q_5 = 30 cfs, Q_{100} = 52 cfs, in a proposed 48" storm drain in proposed Union Boulevard. The combined routed flow is conveyed from AP-U8 to AP-U20 in the proposed 48" storm drain.

At storm drain junction point AP-U20, Q_5 = 92 cfs, Q_{100} = 167 cfs, the proposed storm drain increases to 60" to receive flows from AP-U19 and AP-U8. The combined intercepted flows are conveyed in the proposed 60" R.C.P. north in proposed Union Boulevard to AP-U22.

Runoff from Basin PS8-5, Q_5 = 12 cfs, Q_{100} = 21 cfs, and flow-by from AP-U1, AP-U7, and AP-B11B combine in proposed Union Boulevard and are intercepted by a proposed 22" sump inlet at AP-U21, Q_5 = 16 cfs, Q_{100} = 39 cfs. The intercepted flow is conveyed in a proposed 30" R.C.P. to AP-U22.

At AP-U22 the combined flows Q_5 = 102 cfs, Q_{100} = 193 cfs, from AP-U21 and AP-U20 are conveyed in the proposed 60" R.C.P. to AP-U26.

Runoff from Basin PS8-13A, Q_5 = 4 cfs, Q_{100} = 8 cfs, is combined with flow-by from AP-B12, Q_5 = 5 cfs, Q_{100} = 23 cfs, in the flowlines of proposed Briargate Parkway and proposed Union Boulevard and intercepted by a proposed 16' sump inlet at AP-U24, Q_5 = 9 cfs, Q_{100} = 29 cfs. The intercepted flow is routed to AP-U23 in a proposed 30" R.C.P. to AP-U25.

Note that a Neenah inlet is provided in the median flowline opposite AP-U24, Union Boulevard, to pickup nuisance flow in the carry curb. The capacity is neglected in the 5 and 100-year events.

Runoff from Basin PS8-14, Q_5 = 38 cfs, Q_{100} = 65 cfs, is collected and routed to the proposed 53" x 34" elliptical outfall pipe at AP-U23. The flow is routed in the 53" x 34" elliptical pipe to AP-U25, Q_5 = 40 cfs, Q_{100} = 78 cfs, junction with the flow from AP-U24. The combined flow is then routed in the 53" x 34" to AP-U26, Q_5 = 141 cfs, Q_{100} = 270 cfs. The combined flow is routed to the proposed conveyance on the north side of proposed Briargate Parkway in the proposed 60" R.C.P.

Area Tributary to Austin Bluffs Storm Drain (Sheets 2 & 3 of 5)

The proposed Austin Bluffs storm drain is intended to convey intercepted flows from existing at-grade inlets on Family Place, Sagewood Subdivision Filing No. 5 and future Filing No. 6 north along proposed Austin Bluffs Parkway to the proposed conveyance on the north side of proposed

Briargate Parkway. As previously stated this will eliminate the need for temporary Detention Pond "B".

More specifically, runoff from Basin PS6-7, $Q_5 = 9$ cfs, $Q_{100} = 19$ cfs, is routed to the existing 14' at-grade inlet at AP-A1, $Q_5 = 9$ cfs, $Q_{100} = 19$ cfs. The intercepted flow $Q_5 = 6$ cfs, $Q_{100} = 9$ cfs, is routed in an existing 18" R.C.P. to the existing 12' at-grade inlet at AP-A3.

Runoff from Basin PS6-6, $Q_5 = 7$ cfs, $Q_{100} = 14$ cfs, PS6-9, $Q_5 = 4$ cfs, $Q_{100} = 9$ cfs, PS6-10, $Q_5 = 2$ cfs, $Q_{100} = 4$ cfs, are routed by street gutter to AP-A2, $Q_5 = 12$ cfs, $Q_{100} = 24$ cfs. At AP-A2 the existing 12' at-grade inlet intercepts $Q_5 = 6$ cfs, $Q_{100} = 8$ cfs. The combined intercepted flow at AP-A3 $Q_5 = 11$ cfs, $Q_{100} = 16$ cfs, is routed to AP-A5 in a proposed 24" R.C.P. The flow-by from AP-A1, $Q_5 = 3$ cfs, $Q_{100} = 10$ cfs, and AP-A2, $Q_5 = 6$ cfs, $Q_{100} = 16$ cfs, is combined in the east flowline of Austin Bluffs with runoff from Basin PS6-8, $Q_5 = 5$ cfs, $Q_{100} = 9$ cfs. The combined flow is routed with runoff from Basin PS6-11A, $Q_5 = 2$ cfs, $Q_{100} = 5$ cfs, in the east flowline of proposed Austin Bluffs Parkway to AP-A4, $Q_5 = 13$ cfs, $Q_{100} = 33$ cfs, a proposed 16' at-grade inlet. The intercepted flow, $Q_5 = 8$ cfs, $Q_{100} = 14$ cfs, is routed to AP-A5 in a 18" R.C.P. where it is combined with flow from AP-A3.

Flow is routed from AP-A5 to AP-A7 in a proposed 24" R.C.P.

Basin PS6-11, $Q_5 = 2$ cfs, $Q_{100} = 5$ cfs, and flow-by from AP-A4 is routed in Austin Bluffs Parkway to a proposed 14' at-grade inlet at AP-A6, $Q_5 = 7$ cfs, $Q_{100} = 22$ cfs. The intercepted flow, $Q_5 = 5$ cfs, $Q_{100} = 11$ cfs, is conveyed to AP-A7 in a proposed 18" R.C.P. The flow-by, $Q_5 = 2$ cfs, $Q_{100} = 11$ cfs, combines with runoff form Basin PS6-12, $Q_5 = 4$ cfs, $Q_{100} = 8$ cfs, and flows west in the Briargate Parkway south flowline to AP-B10.

The combined flow at AP-A7, $Q_5 = 23$ cfs, $Q_{100} = 38$ cfs, is conveyed to AP-A8 in a proposed 30" R.C.P. At AP-A8, $Q_5 = 30$ cfs, $Q_{100} = 47$ cfs, the combined intercepted flow from AP-B9B, $Q_5 = 8$ cfs, $Q_{100} = 11$ cfs, from inlets AP-B9 and AP-B9A, and the flow from storm drain AP-A7 is conveyed to AP-A9 in a proposed 36" R.C.P.

At AP-A9, Q_5 = 43 cfs, Q_{100} = 63 cfs, the combined intercepted flow from AP-B8B, Q_5 = 15 cfs, Q_{100} = 19 cfs, (from inlets AP-B8 and AP-B8A) and the flow from AP-A8 is conveyed to the proposed R.C.B. conveyance on the north side of Briargate parkway in a proposed 36" R.C.P.

Tributary to Proposed Briargate Parkway (Sheets 4 and 5 of 5)

Beginning at the easterly limit of this study the approximate west boundary of proposed Powers Boulevard and proceeding west the proposed drainage condition is outlined as follows. Note this is intended to be the preliminary/final drainage report for proposed Briargate Parkway.

It is assumed that there will be a flow-by of Q_5 = 4 cfs, Q_{100} = 6 cfs, in each of the north and south flowlines of proposed Briargate Parkway. This flow-by is added directly to the flow at proposed inlets at AP-B2 and AP-B4.

Runoff from Basin PS6-14, Q_5 = 7 cfs, Q_{100} = 13 cfs, is combined with the assumed flow-by and routed in the street gutter to AP-B2, Q_5 = 11 cfs, Q_{100} = 19 cfs, a proposed 8' at-grade inlet. The intercepted flow Q_5 = 4 cfs, Q_{100} = 5 cfs, is routed to AP-B3 in a proposed 18" R.C.P.

The runoff from Basin PS6-16, Q_5 = 15 cfs, Q_{100} = 30 cfs, shall be routed to a proposed 30" R.C.P. service, AP-B2, then to AP-B3 in the same 30" R.C.P. The combined flow at AP-B3, Q_5 = 17 cfs, Q_{100} = 36 cfs, is conveyed to the proposed major conveyance in Briargate Parkway in a proposed 30" R.C.P.

The runoff form Basin PS6-13, Q_5 = 6 cfs, Q_{100} = 12 cfs, is collected and conveyed in Briargate Parkway to a proposed 8' at-grade inlet at AP-B4, Q_5 = 10 cfs, Q_{100} = 18 cfs. The intercepted flow, Q_5 = 4 cfs, Q_{100} = 5 cfs, is conveyed to the major conveyance in Briargate Parkway. The flow-by is carried in the north flowline of Briargate Parkway to AP-B8.

Basin PS6-13A, Q_5 = 16 cfs, Q_{100} = 30 cfs, is routed to AP-B5. A 30" R.C.P. service is provided at AP-B5, Q_5 = 16 cfs, Q_{100} = 30 cfs, to convey the runoff from AP-B5 to AP-B7.

Runoff from Basin PS6-15, Q_5 = 1 cfs, Q_{100} = 2 cfs, is routed in the street to AP-B6, Q_5 = 1 cfs, Q_{100} = 2 cfs, a 4' at-grade inlet. The intercepted flow, Q_5 = 1 cfs, Q_{100} = 1 cfs, is conveyed to

AP-B7 in a proposed 18" R.C.P. The combined flow at AP-B7, Q_5 = 21 cfs, Q_{100} = 35cfs, is conveyed to the major conveyance in Briargate Parkway in the proposed 30" R.C.P. The flow-by from AP-B6, Q_5 = 0 cfs, Q_{100} = 1 cfs, is routed in Briargate Parkway to AP-B8.

Runoff from basin PS6-5, Q_5 = 12 cfs, Q_{100} = 24 cfs, and flow-by from AP-B2, AP-B4, AP-B6 are routed in Briargate Parkway to AP-B8, Q_5 = 21 cfs, Q_{100} = 43 cfs, a proposed 12' at-grade inlet. The intercepted flow, Q_5 = 9 cfs, Q_{100} = 11 cfs, is conveyed to AP-B8A, a proposed 8' at-grade inlet in a proposed 18" R.C.P. The flow-by from AP-B8 flows in the Briargate Parkway north flowline to AP-B8A, Q_5 = 12 cfs, Q_{100} = 32 cfs, where Q_5 = 6 cfs, Q_{100} = 8 cfs is intercepted by a proposed 10' at-grade inlet. The total intercepted flow at AP-B8 and AP-B8A, AP-B8B, Q_5 = 15 cfs, Q_{100} = 19 cfs, is conveyed to AP-A9 in a proposed 18" R.C.P. The flow-by is routed to future sump inlets at AP7-3.

The existing 30" R.C.P. outfall from Sagewood AP-S2, Q_5 = 15 cfs, Q_{100} = 31 cfs, is proposed to be extended across proposed Briargate Parkway to the proposed R.C.P. conveyance in Briargate Parkway. This eliminates the need for temporary detention pond "A".

Runoff from PS6-3, Q_5 = 13cfs, Q_{100} = 26 cfs, is collected and conveyed in Briargate Parkway to AP-B9, Q_5 = 13 cfs, Q_{100} = 26 cfs, a proposed 8' at-grade inlet. The intercepted flow Q_5 = 4 cfs, Q_{100} = 6 cfs, is conveyed to AP-B9A in a proposed 18" R.C.P. The flow-by, Q_5 = 9 cfs, Q_{100} = 20 cfs, is conveyed in the south flowline of Briargate Parkway to AP-B9A, a proposed 8' at-grade inlet. The intercepted flow, Q_5 = 4 cfs, Q_{100} = 5 cfs, is conveyed to AP-B9B, Q_5 = 8 cfs, Q_{100} = 11 cfs, in a proposed 18" R.C.P., combing with flow from the proposed Austin Bluffs storm drain at storm drain junction AP-A8. The flow-by from AP-B9A flows to future sump inlets AP7-3 in future Austin Bluffs Parkway north of Briargate Parkway.

As previously stated, flow-by from proposed inlet AP-A6 plus flow from Basin PS6-12 is routed west in the south flowline of proposed Briargate Parkway combining with runoff from Basin PS8-21, Q_5 = 7 cfs, Q_{100} = 14 cfs, to AP-B10, Q_5 = 14 cfs, Q_{100} = 39 cfs, a proposed 16' at-grade inlet. The proposed inlet will intercept Q_5 = 9 cfs, Q_{100} = 14 cfs, which is routed to AP-B10A in a proposed 18" R.C.P.

The combined flow from AP-B10 and AP-P3 is routed to AP-B10A, Q_5 = 35 cfs, Q_{100} = 59 cfs, then to AP-B10C in a proposed 36" R.C.P. Flow-by from AP-B10, Q_5 = 5 cfs, Q_{100} = 25 cfs, is routed by street gutter to AP-B12, a proposed 8' at-grade inlet.

Runoff from Basin PS8-22, Q_5 = 9 cfs, Q_{100} = 16 cfs, is routed in proposed Briargate Parkway to AP-B10B, Q_5 = 9 cfs, Q_{100} = 16 cfs, a proposed 10' at-grade inlet. The intercepted flow Q_5 = 4 cfs, Q_{100} = 6 cfs, is routed to AP-B10C in a proposed 18" R.C.P. The combined flows at AP-B10C, Q_5 = 38 cfs, Q_{100} = 65 cfs, are routed in a proposed 36" R.C.P. to the proposed R.C.B. on the north side of proposed Briargate Parkway.

The flow-by from AP-B10B, Q_5 = 9 cfs, Q_{100} = 16 cfs, is routed by street gutter to AP-11, a proposed at-grade inlet.

Runoff from Basin PS8-20, Q_5 = 4 cfs, Q_{100} = 8 cfs, is routed in Briargate Parkway combining with flow-by from AP-B10B at AP-B11, a proposed at-grade inlet. Note that in the future, flow-by from AP-B10B is to be routed to future sump inlets as indicated on the attached drainage map, sheet 4 of 5.

Initially at AP-B11, Q_5 = 9 cfs, Q_{100} = 17 cfs, a proposed 10' at-grade inlet intercepts Q_5 = 5 cfs, Q_{100} = 7 cfs which is routed to AP-B11A, a proposed 6' at-grade inlet in a proposed 18" R.C.P.

At AP-B11A, Q_5 = 4 cfs, Q_{100} = 10 cfs, the proposed 6' at-grade inlet intercepts Q_5 = 2 cfs, Q_{100} = 3 cfs, of the flow-by from AP-B11. At AP-11B, Q_5 = 7 cfs, Q_{100} = 10 cfs, the intercepted flow from AP-11 and AP-11A, is conveyed to the proposed R.C.B. conveyance on the north side of Briargate Parkway in a propose 18" R.C.P. The flow-by from AP-11B is conveyed in Briargate Parkway and Union Boulevard to AP-U21 as previously discussed.

At AP-B12, Q_5 = 9 cfs, Q_{100} = 30 cfs, flow-by from AP-B10 is combined with runoff from Basin PS8-13, Q_5 = 5 cfs, Q_{100} = 9 cfs. The proposed 8' at-grade inlet at AP-B12 intercepts Q_5 = 4 cfs, Q_{100} = 7 cfs. The intercepted flow is routed to the proposed R.C.B. on the north side of Briargate Parkway in a proposed 18" R.C.P. The flow-by Q_5 = 5 cfs, Q_{100} = 23 cfs, is routed to AP-U24 in the east flowline of proposed Union Boulevard previously discussed.

Proposed Drainage conditions, the Area North of Proposed Briargate Parkway, South and East of Proposed Union Boulevard and West of Proposed Powers Boulevard (Sheet 4 & 5 of 5)

Analysis of this area is based on very preliminary information as detailed land planning has not been done at the time of this report. The primary purpose of studying this area is to quantify runoff and determine the routing of developed flows to the proposed conveyance on the north side of proposed Briargate Parkway and the impact on the design of the conveyance.

Based on minimal current information available, the area was divided into basins and routed to the proposed conveyance on the north side of Briargate Parkway as follows.

Runoff from Basin PS9-2, $Q_5 = 4$ cfs, $Q_{100} = 7$ cfs, is routed in the future Union Boulevard street gutter to AP9-1, $Q_5 = 4$ cfs, $Q_{100} = 7$ cfs. This flow continues in this street gutter to AP9-2.

Runoff from Basin PS9-1, $Q_5 = 8$ cfs, $Q_{100} = 14$ cfs, is also routed to AP9-2 combining with flow from AP9-1. At AP9-2, $Q_5 = 10$ cfs, $Q_{100} = 19$ cfs, a portion of the flow is intercepted by proposed 10' and 12' at-grade inlets. The proposed inlets will intercept a total of $Q_5 = 9$ cfs, $Q_{100} = 15$ cfs. Intercepted flow is routed in a 24" R.C.P. to the proposed conveyance on the north side of proposed Briargate Parkway. Flow-by at AP9-2, $Q_5 = 1$ cfs, $Q_{100} = 4$ cfs, is routed south in the west flowline of Union Boulevard, then west in the flowline of existing Briargate Parkway to an existing inlet.

Runoff from Basin PS9-5, $Q_5 = 4$ cfs, $Q_{100} = 8$ cfs, is routed in future Union Boulevard to AP9-3, $Q_5 = 4$ cfs, $Q_{100} = 8$ cfs. Flow at AP9-3 is routed to AP9-4 in the flow line of future Union Boulevard. Runoff in PS9-4, $Q_5 = 6$ cfs, $Q_{100} = 12$ cfs, is conveyed in future Union Boulevard to AP9-4 combining with flow from AP9-3. At AP9-4, $Q_5 = 10$ cfs, $Q_{100} = 19$ cfs, a portion of the flow, $Q_5 = 9$ cfs, $Q_{100} = 15$ cfs, is intercepted by proposed 10' and 12' at-grade inlets. This intercepted flow is routed in AP9-6 in a proposed 18" R.C.P. The flow-by at AP9-4 is routed with flow-by from AP9-2 west in the flowline of existing Briargate Parkway to an existing inlet.

The total flow-by at AP9-2 and AP9-4, $Q_5 = 2$ cfs, $Q_{100} = 8$ cfs, is less than the allowance made in Briargate Parkway Filing No. 2, Final Drainage Report, $Q_5 = 6$ cfs, $Q_{100} = 13$ cfs, in the north

flowline of existing Briargate Parkway.

Basins PS9-5 and PS9-4 and the inlets at AP9-4 shall be reviewed based on the final design of Union Boulevard. If Union Boulevard is super-elevated, cross flow shall be addressed.

Runoff from Basin PS9-6, Q_5 = 45 cfs, Q_{100} = 90 cfs, is collected at AP9-5and routed to AP9-6 in the proposed 42" R.C.P. service. The combined flow at AP9-6, Q_5 = 54 cfs, Q_{100} = 104 cfs, from AP9-4 and AP9-5 is routed to the proposed conveyance on the north side of proposed Briargate Parkway in a proposed 42" R.C.P.

Runoff from Basin PS9-8, Q_5 = 49 cfs, Q_{100} = 97 cfs, is collected and conveyed to AP9-10, Q_5 = 49 cfs, Q_{100} = 97 cfs, in a proposed 36" R.C.P. outfall pipe. The flow at AP9-10 is routed in the proposed 36" R.C.P. to AP9-11B.

The combined runoff from Basin PS9-7, Q_5 = 4 cfs, Q_{100} = 8 cfs, and flow-by from AP-B10B, Q_5 = 5 cfs, Q_{100} = 10 cfs, is proposed to be intercepted by future sump inlets at AP9-11, Q_5 = 10 cfs, Q_{100} = 20 cfs. The combined intercepted flow is conveyed to AP9-11B.

The runoff from Basin PS9-9, Q_5 = 21 cfs, Q_{100} = 42 cfs, is proposed to be routed to AP9-11A, a proposed 36" R.C.P. service then to AP9-11B in the same proposed 36" R.C.P.

The combined flow at AP9-11B, Q_5 = 74 cfs, Q_{100} = 146 cfs, is conveyed to the proposed R.C.B. conveyance on the north side of Briargate Parkway in a proposed 48" R.C.P.

At AP9-7 and AP9-8, a flow-by of Q_5 = 8 cfs, Q_{100} = 16 cfs, is assumed in each flowline from proposed Union and Powers Boulevard east of the study area. This flow is combined with runoff from Basin PS9-3, Q_5 = 17 cfs, Q_{100} = 33 cfs, and collected in future sump inlets at an anticipated low point in proposed Union Boulevard, AP9-9, Q_5 = 33 cfs, Q_{100} = 65 cfs. The intercepted flow is routed to AP7-2 in a proposed 36" R.C.P. The overflow condition for flows in excess of the design at AP9-9 shall be addressed in future drainage report(s).

Runoff from Basin PS7-2, Q_5 = 146 cfs, Q_{100} = 253 cfs, is collected and routed to future inlets.

The collected flow shall then be routed from AP7-1, Q_5 = 128 cfs, Q_{100} = 220 cfs, to AP7-2 in a proposed 66" R.C.P.

Combined runoff from Basin PS7-1, Q_5 = 6 cfs, Q_{100} = 12 cfs, and flow-by from AP-B8A, Q_5 = 6 cfs, Q_{100} = 24 cfs and AP-B9A, Q_5 = 5 cfs, Q_{100} = 15 cfs, is collected at AP7-3, Q_5 = 10 cfs, Q_{100} = 28 cfs.

In a review of current proposed street grades on proposed Union Boulevard and Briargate Parkway, it appears that a low point will fall near AP7-1. If so, the plugged flow condition overflow shall be addressed in future drainage reports.

At AP7-3A, Q_5 = 152 cfs, Q_{100} = 277 cfs, the combined routed flows from AP7-2 and AP7-3 are conveyed in a proposed 66" R.C.P. to the proposed conveyance on the north side of proposed Briargate Parkway.

Runoff from Basin PS9-10, Q_5 = 30 cfs, Q_{100} = 61 cfs, is collected and routed to AP9-12, Q_5 = 30 cfs, Q_{100} = 61 cfs, a proposed 36" R.C.P. outfall pipe to the proposed conveyance on the north side of proposed Briargate Parkway.

Runoff from Basin PS7-3, Q_5 = 36 cfs, Q_{100} = 72 cfs, is collected and routed to AP7-4, Q_5 = 36 cfs, Q_{100} = 72 cfs, a proposed 42" R.C.P. outfall pipe to the proposed conveyance on the north side of proposed Briargate Parkway.

Runoff from Basin PS7-4, Q_5 = 18 cfs, Q_{100} = 35 cfs, is collected and routed to AP7-5, Q_5 = 18 cfs, Q_{100} = 35 cfs, a proposed 30" R.C.P. outfall pipe to the proposed conveyance on the north side of proposed Briargate Parkway.

It should be noted that the referenced Pine Creek Drainage Basin Planning Study (D.B.P.S.) designated Briargate Parkway as a stormwater conveyance path for plugged flow and storms in excess of the design storm. In general, it is assumed the flows from the east would travel west in Briargate Parkway. At the intersection with Union, the majority of the flow would go south to the low point in Union Boulevard overflowing onto the Park site, flowing to existing detention

facility "B". Flow continuing west in Briargate Parkway would to go a westerly low point in Briargate Parkway in the flow path for the plugged condition of existing detention facilities "B" and "C". In application of this concept it is recommended the developed condition grading along Briargate Parkway should provide a minimum of 1.5' of relief above the centerline elevation of Briargate Parkway to contain flow in the street and reduce any potential for property damage.

Proposed Condition, Briargate Parkway Major Conveyance

The referenced Pine Creek Drainage Basin Planning Study called for the design of a major conveyance along Briargate Parkway to replace the existing natural channel. The proposed storm drain was intended to have the capacity to convey 100-year frequency developed flows from the tributary basins east of proposed Powers Boulevard to existing Detention Facility "C".

Flow data used for the design of the conveyance is obtained from the fully developed condition in the referenced Drainage Basin Planning Study. Three analysis points are applicable; Analysis Point 6, Q_5 = 247 cfs, Q_{100} = 470 cfs, located at proposed Powers Boulevard, Analysis Point 7, Q_5 = 349 cfs, Q_{100} = 681 cfs, located at the intersection of proposed Austin Bluffs and proposed Briargate Parkway, Analysis Point 9, Q_5 = 935 cfs, Q_{100} = 1778 cfs, total storm drain flow into existing Detention Facility "C". It should be noted that the 72" storm drain shown in Drainage Basin PS-6 of the referenced D.B.P.S. has been deleted in this study and the runoff from Drainage Basin PS-6 routed to the proposed conveyance on the north side of proposed Briargate Parkway.

Beginning with the flows at D.B.P.S. Analysis Point 6, Q_5 = 247 cfs, Q_{100} = 470 cfs, the lateral flows as generated by the rational method in this report were accumulated by direct addition in the proposed conveyance. When the accumulated flows were tabulated at existing Detention Facility "C", the total with the rational method flows between analysis point 6 and Detention Facility "C" was Q_5 = 935 cfs, Q_{100} = 1750 cfs, current analysis, Q_5 = 952 cfs, Q_{100} = 1781 cfs in the first draft of this report as compared to analysis point 9 of the D.P.B.S., Q_5 = 935 cfs, Q_{100} = 1778 cfs. On this basis the tabulated flows in the following table were deemed suitable for design of the major conveyance, and because of the minor difference in flow rates calculations of capacities based on the previous draft flow rates were not recalculated.

Tabulations of both the first draft and current data follow:

Briargate Parkway
Major Conveyance
Design Flows and Proposed Conveyance(s)
First Draft Flow Data 9/--/2000

Pine Creek D.B.P.S.			Design Flows					
Analysis Point	Q_5 cfs	Q_{100} cfs	Q_5 cfs		Q_{100} cfs		Description	Proposed Conveyance
			Lateral	Accum	Lateral	Accum		
6	247	470		247		470	At Powers Blvd.	72" R.C.P.
			6	253	9	479	AP-B3A[1]	78" R.C.P.
			26	279	47	526	AP-B5A[3]	78" R.C.P.
			15	294	31	557	AP-S2[2]	78" R.C.P.
			5	299	7	564	AP-B6A[1]	78" R.C.P.
			22	321	45	609	AP7-5[2]	6' X 9' R.C.B.
			39	360	77	686	AP7-4[2]	6' X 9' R.C.B.
7	349	681	—	—	—	—	At Austin Bluffs	6' X 9' R.C.B.
			37	397	61	747	AP-A11[4]	6' X 9' R.C.B.
			171	568	304	1051	AP7-3A[2]	6' X 9' R.C.B.
			29	597	53	1104	AP-P1[2]	Transition
			32	629	64	1168	AP9-12[2]	6' X 10' R.C.B.
			39	668	68	1236	AP-B10A[5]	6' X 10' R.C.B.
			73	741	147	1383	AP9-11B[2]	6' X 10' R.C.B.
			3	744	5	1388	AP-B11A[6]	6' X 10' R.C.B.
			55	799	107	1495	AP9-6[2]	Transition
			144	943	271	1766	AP-U26[2]	2 – 8 X 6.5
9	935	1778	99	952	15	1781	AP9-2A[2]	2 – 8 X 6.5
						1781	____	Baffle Drop Chute

1778 cfs ≈ 1781 cfs

1 Deleted, inlets deleted
2 Same except for minor flow change
3 Inlet and piping configuration change now AP-B3 and AP-B7
4 Currently AP-A9
5 Currently AP-B10C
6 Inlet location changed, currently inlet AP-B12

Briargate Parkway
Major Conveyance
Design Flows and Proposed Conveyance(s)
Current Flow Data 6/--/2001

Pine Creek D.B.P.S.			Design Flows					
Analysis Point	Q_5 cfs	Q_{100} cfs	Q_5 cfs		Q_{100} cfs		Description	Proposed Conveyance
			Lateral	Accum	Lateral	Accum		
6	247	470		247		470	At Powers Blvd.	72" R.C.P.
			17	264	36	506	AP-B3	78" R.C.P.
			21	285	35	541	AP-B7	78" R.C.P.
			15	300	31	572	AP-S2	78" R.C.P.
			17	317	35	609	AP7-5	78" R.C.P.
			36	353	72	679	AP7-4	6' X 9' R.C.B.
7	349	681	—	—	—	—	At Austin Bluffs	6' X 9' R.C.B.
			43	396	63	742	AP-A9	6' X 9' R.C.B.
			152	548	277	1019	AP7-3A	6' X 9' R.C.B.
			29	577	53	1074	AP-P1	Transition
			30	607	61	1133	AP9-12	6' X 10' R.C.B.
			38	645	65	1198	AP-B10C	6' X 10' R.C.B.
			7	652	10	1208	AP-B11B	6' X 10' R.C.B.
			74	726	146	1354	AP9-11B	6' X 10' R.C.B.
			4	730	7	1361	INLET AP-B12	6' X 10' R.C.B.
			54	784	104	1465	AP9-6	Transition
			141	925	270	1735	AP-U26	2 – 8 X 6.5
9	935	1778	9	934	15	1750	AP9-2A	2 – 8 X 6.5
						1750	____	Baffle Drop Chute

1778 cfs ≈ 1750 cfs

Based on the analysis of the flow data and available slope of 2 to 2.5% the proposed conveyances are tabulated with the design flow data.

An analysis based on full pipe flow was made to determine the adequacy of the proposed 72" to 78" R.C.P. storm drains along Briargate Parkway. The results are shown in a data spreadsheet and the hydraulic grade line (HGL) profile is plotted on the plan/profile drawings. Full pipe flow velocities were calculated to be in the range of 14.4 fps to 19.2 fps. The HGL calculations shall be updated with any changes in the design of the easterly portion of the storm drain.

Selection of the proposed reinforced concrete box culvert sections was based on supercritical design. Free board of 1.5' +/- above normal depth with inclined drops at junctions, where possible, provided to insure super-critical flow could be maintained. At junctions and bend locations where constraints prevented the use of inclined drops an analysis was made to insure that the water surface would not contact the top of the R.C.B. for any substantial length. Computation sheets for the inclined drops are included in the appendix of this report

The design calculations for the proposed reinforced concrete box culvert (R.C.B.) predict velocities in the order of 26 fps. The upstream drainage basin is mostly undeveloped at this time. However, development is planned in the near future. In consideration of the high velocities and source of sediment until the basin is fully developed it is recommended that additional concrete cover be provided over the reinforcing steel in the invert and interior walls of the proposed R.C.B. Note that construction of Detention Facility "D" will greatly reduce the potential of course sediment carried in the proposed R.C.B.

The assumption of supercritical flow in the proposed R.C.B. necessitated free discharge to existing Detention Facility "C". This is complicated by the required depth of the proposed 60" R.C.P. storm drain in proposed Union Boulevard to facilitate the water main and sanitary sewer main crossings. As shown on the Plan/Profile drawings for the proposed R.C.B., included with this report, the elevation of the channel invert at the top of proposed drop structure is 6873.22. The peak storage elevation of Detention Facilities "C" in the developed condition of the referenced Pine Creek D.B.P.S. is 6877.4 which is greater than 6873.22 potentially creating backwater in the proposed R.C.B.

To explore the discharge condition in the 100-year frequency design storm the hydrographs for existing Detention Facility "C" prepared in the referenced D.B.P.S. were reviewed. A total of nine (9) flow conditions were reviewed. Eight of those conditions were modeled with HEC-RAS to analyze the outfall drop structure and effects of the Detention Facility water surface on the discharge from the R.C.B.

The design of the inlet structure is a variation on the U.S.B.R. Stilling Basin IV. The variation being a 5:1 channel width expansion (each side wall) and discharge to a pond rather than a channel. The optional outlet still was replaced with a single row of teeth.

The following flow rate versus pond water surface elevations were taken from the fully developed basin condition HEC-1 model for analysis of the proposed inlet structure.

Flow Condition	Q_{100} Incoming Flow Rate (cfs)	Pond Water Surface Elevation
(1)	1190	6866.3
(2)	1440	6867.5
(3)	1580	6868.7
(4)	1778 (Peak)	6872.6
(5)	1600	6874.9
(6)	1240	6875.8
(7)	900	6876.4
(8)	640	6876.8
(9)	280/227	6877.4 (Peak)

Note that Q_5 = 935 cfs in the fully developed basin condition.

The selection of the structure configuration was based on allowing free flow from the 2 cell R.C.B., while reducing the velocity of initial flows at shallow pond water depths.

As previously stated, a HEC-RAS model was compiled to substantiate that the proposed structure and rip-rap splash pool would function as expected.

Flow condition (4), peak inflow was not modeled in HEC-RAS. The peak flow, Q_{100} = 1840 cfs, into Detention Facility "C" occurs at 6:00 hours into the design storm. The water surface elevation is 6872.6 at that point, which will allow free discharge of 1778 cfs from the proposed R.C.B. outfall.

The HEC-RAS model included flow conditions (1), (2), (3), (5), (6), (7), (8) and (9) listed above.

Flow conditions (1) through (3) modeled in HEC-RAS evaluated the ability of the proposed drop structure and rip-rap outfall to provide a stable rip-rap outfall and to reduce water velocities across the pond bottom to tolerable levels. The model confirmed the need for the rip-rap splash pool.

Flow conditions (5) through (9) modeled in HEC-RAS indicated that no back-water conditions resulted which would cause the water surface to contact the inside top of the R.C.B. The results also confirmed the rising water depths ability to attenuate the velocity of large flows.

Copies of the above described HEC-RAS and related data are included in the appendix of this report.

With the outfall conditions analyzed the analysis of the proposed R.C.B. proceeded upstream.

The left and right cells of the two-cell R.C.B. were analyzed next, each cell requiring independent analysis. Openings in the common wall were considered to equalize flows between the cells, but in application deemed unpredictable.

Thus, the analysis assumed the Q_{100} flow of 1388 cfs, as previously stated final routing caused a small reduction from the flow rates used in previous calculations, at station 4+62.86 would be split equally between the left and right cells.

Analysis of the left cell (looking upstream) is outlined as follows. At station 4+56, a lateral adds Q_{100} = 107 cfs to the left cell. An inclined drop is provided at this location to keep the increase

in down stream water surface below the interior top of the R.C.B. and prevent the increase in water depth from moving upstream.

The inclined drops are calculated using a method from "Hydraulic analysis of Junctions", Bureau of Engineering, City of Los Angeles. Normal depths are computed for the upstream condition using Flow Master V5.10, software by Halstad Methods, Inc.

The combined flow down stream of the junction at station 4+56 is Q_{100} = 801 cfs. The combined flow goes down an inclined drop station 3+71 to 3+91 which is design for the 5' diameter pipe junction in the right cell. However, in the left cell the inclined drop will have the effect of preventing the rise in the water surface due to the 19.5° bend loss from traveling upstream. Normal depth calculations and estimated bend loss calculations are included in the appendix of this report which demonstrate the adequacy of the left cell of the proposed R.C.B. to convey Q_{100} flows with a free water surface. Note that junctions with lateral flows less than 15 cfs have negligible impact on the water surface elevation.

Analysis of the right cell of the 2-cell R.C.B. can be outlined as follows. The flow is split equally between the two cells at station 4+62.86. Q_{100} = 694 cfs, in the right cell travels down the same inclined drop provided for the lateral junction station 4+56 in the left cell. Since there is no junction in the right cell, flow downstream of the inclined drop will be flowing at less than normal depth. This reach was modeled in HEC-RAS to estimate the water depth upstream of the 5' R.C.P. junction. The computed depth was used in the L.A. formula to estimate the water surface downstream of the junction. The bend in the proposed R.C.B. and the 5' R.C.P. conjunction are aligned to conserve as much momentum in the direction of flow as possible. The bend and junction loss calculations are combined. The computed water depth downstream of the junction slowly drops toward normal depth. The Q_{100} = 965 cfs, flow and channel characteristics were input to HEC-RAS to estimate the drop in the water surface at the downstream bend station 2+96.82. The estimated increase in the water surface due to bend was then added to the calculated water depth prior to the bend. The resulting estimated water surface was less than proposed R.C.B. interior height. Detailed calculations as outlined above are included in the appendix of this report. Note the water surface downstream of the 5' diameter junction Union Boulevard storm drain is critical for HGL calculations for Union Boulevard storm drain.

Calculation are included in the appendix of this report to verify that the estimated water surface in the 5' R.C.P. bend station 3+74.49 Union Boulevard storm drain is slightly below the interior crown of the pipe, the original assumption being that the HGL calculations would start at the crown of the pipe at the 45° bend.

Inclined drops for R.C.B. lateral junctions station 11+70 to 22+23 are computed using a method from "Hydraulic Analysis of Junctions", Bureau of Engineering, City of Los Angeles. The junctions were categorized based on flow and "Z" values, the vertical component of the inclined drops were calculated. The calculations are included in the appendix of the report.

The final analysis of water depths in the proposed R.C.B. was required at the lateral junctions stations 23+01 and 23+17. The importance of this analysis was the determination of the water depth downstream of the Austin Bluffs Parkway storm drain and thus the starting point for HGL calculations for the Austin Bluffs storm drain lateral. A water surface 4.8' above the R.C.B. invert was calculated to be an appropriate starting point. The calculations are included in the appendix of the report.

For laterals where a downstream water depth was not calculated, a reasonable starting point for lateral HGL calculations was estimated based on the estimated "Z" and the upstream water depth.

HGL calculations are included in the appendix of this report based on the final design of the R.C.B. and laterals.

HYDRAULIC CALCULATIONS

Storm drain facility sizes were estimated using Mannings Equation in Flow Master V5.10, Software by Haestad Methods, Inc., HEC-RAS V2.2, and spread sheets. Copies of the data sheets are included in the appendix of this report.

EROSION CONTROL PLAN

The City of Colorado Springs Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan be submitted in conjunction with the Overlot Grading Plan and construction assurances be posted prior to obtaining a grading permit for the specific site.

FLOODPLAIN STATEMENT

A portion of this site is within a designated F.E.M.A. floodplain, as determined from Flood Insurance Rate Maps Community Panel Numbers 08041C0528 F, 08041C0507 F, 08041C0530 F and 08041C0509 F, effective date March 17, 1997, a copy of the portion of the maps showing the site is included in the appendix of this report. The master planned drainage facilities to be located along the north side of Briargate Parkway will be required to eliminate the physical flood plain from the study area. A C.L.O.M.R./L.O.M.R. process will be required to eliminate the floodplain from the F.E.M.A. maps. A C.L.O.M.R. has been submitted to F.E.M.A.

CONSTRUCTION COST OPINION

Public Drainage Facilities on Union Boulevard
Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
1.	18" X 36" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
2.	30" X 30" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
3.	42" X 36" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
4.	48" X 30" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
5.	53" X 34" X 30" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
6.	60" X 30" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
7.	60" X 42" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
8.	53" X 34" X 60" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
9.	18" R.C.P.	25 L.F.	$ 25/L.F.	$ 625.00
10.	30" R.C.P.	620 L.F.	$ 40/L.F.	$ 24,800.00
11.	36" R.C.P.	60 L.F.	$ 50/L.F.	$ 3,000.00
12.	42" R.C.P.	125 L.F.	$ 70/L.F.	$ 8,750.00
13.	48" R.C.P.	80 L.F.	$ 90/L.F.	$ 7,200.00
14.	53" X 34" R.C.P.	150 L.F.	$ 105/L.F.	$ 15,750.00
15.	60" R.C.P.	805 L.F.	$ 120/L.F.	$ 96,600.00
16.	30" R.C.P. Bend	2 EACH	$ 1,200/EA	$ 2,400.00
17.	42" R.C.P. Bend	1 EACH	$ 1,200/EA	$ 1,200.00
18.	48" R.C.P. Bend	1 EACH	$ 1,200/EA	$ 1,200.00
19.	60" R.C.P. Bend	1 EACH	$ 1,200/EA	$ 1,200.00
20.	8' Inlet	1 EACH	$ 4,000/EA	$ 4,000.00
21.	16' Inlet	1 EACH	$ 6,400/EA	$ 6,400.00
22.	22' Inlet	1 EACH	$ 8,500/EA	$ 8,500.00
23.	18" X 48" Reducer	1 EACH	$ 1,500/EA	$ 1,500.00
24.	60" X 48" Reducer	1 EACH	$ 1,500/EA	$ 1,500.00
			Sub-Total	**$ 196,625.00**
		15% Engineering and Contingencies		$ 29,494.00
			TOTAL	**$ 226,119.00**

CONSTRUCTION COST OPINION (Continued)

Public Drainage Facilities on Family Place
Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
1.	18" X 30" Wye	2 EACH	$1,500/EA	$ 3,000.00
2.	42" X 42" Wye	1 EACH	$1,500/EA	$ 1,500.00
3.	18" R.C.P.	120 L.F.	$25/L.F.	$ 3,000.00
4.	24" R.C.P.	15 L.F.	$35/L.F.	$ 525.00
5.	30" R.C.P.	245 L.F.	$40/L.F.	$ 9,800.00
6.	42" R.C.P.	285 L.F.	$70/L.F.	$ 19,950.00
7.	8' Inlet	1 EACH	$4,000/EA	$ 4,000.00
8.	10' Inlet	2 EACH	$4,600/EA	$ 9,200.00
9.	12' Inlet	1 EACH	$5,200/EA	$ 5,200.00
10.	42" X 30" Reducer	1 EACH	$1,500/EA	$ 1,500.00
			Sub-Total	**$ 57,675.00**
		15% Engineering and Contingencies		$ 8,651.00
			TOTAL	**$ 66,326.00**

Public Drainage Facilities on Austin Bluffs Parkway
Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
1.	18" X 24" Wye	1 EACH	$1,500/EA	$ 1,500.00
2.	24" R.C.P.	720 L.F.	$35/L.F.	$ 25,200.00
3.	24" R.C.P. Bend	1 EACH	$1,200/EA	$ 1,200.00
4.	18" R.C.P. Bend	1 EACH	$1,200/EA	$ 1,200.00
5.	14' Inlet	1 EACH	$5,800/EA	$ 5,800.00
6.	16' Inlet	1 EACH	$6,400/EA	$ 6,400.00
			Sub-Total	$ 41,300.00
		15% Engineering and Contingencies		$ 6,195.00
			TOTAL	**$ 47,495.00**

CONSTRUCTION COST OPINION (Continued)

Public Drainage Facilities on Briargate Parkway

Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
1.	18" X 30" Wye	3 EA	$1,500 /EA	$4,500.00
2.	18" X 36" Wye	2 EA	$1,500 /EA	$3,000.00
3.	24" X 36" Wye	1 EA	$1,500 /EA	$1,500.00
4.	36" X 36" Wye	1 EA	$1,500 /EA	$1,500.00
5.	18" R.C.P.	452 L.F.	$25 /L.F.	$11,300.00
6.	24" R.C.P.	80 L.F.	$35 /L.F.	$2,800.00
7.	30" R.C.P.	492 L.F.	$40 /L.F.	$19,680.00
8.	36" R.C.P.	465 L.F.	$50 /L.F.	$23,250.00
9.	18" Bend	3 L.F.	$1,200 /L.F.	$3,600.00
10.	24" Bend	1 L.F.	$1,200 /L.F.	$1,200.00
11.	30" Bend	2 L.F.	$1,200 /L.F.	$2,400.00
12.	36" Bend	2 L.F.	$1,200 /L.F.	$2,400.00
13.	4' Inlet	1 EA	$2,800 /EA	$2,800.00
14.	6' Inlet	1 EA	$3,400 /EA	$3,400.00
15.	8' Inlet	5 EA	$4,000 /EA	$20,000.00
16.	10' Inlet	3 EA	$4,600 /EA	$13,800.00
17.	12' Inlet	1 EA	$5,200 /EA	$5,200.00
18.	16' Inlet	2 EA	$6,400 /EA	$12,800.00
19.	24" X 36" Reducer	1 EA	$1,500 /EA	$1,500.00
20.	30" X 36" Reducer	1 EA	$1,500 /EA	$1,500.00
			Subtotal	$138,130.00
			15% Engineering and Contingencies	$20,720.00
			TOTAL	**$158,850.00**

CONSTRUCTION COST OPINION (Continued)

Public Drainage Facilities on The Area North of Briargate Parkway
Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
1.	18" X 30" Wye	2 EACH$	1,500/EA $	3,000.00
2.	18" X 36" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
3.	24" X 48" Wye	1 EACH	$ 1,500/EA	$ 3,000.00
4.	24" X 66" Wye	4 EACH	$ 1,500/EA	$ 6,000.00
5.	30" X 30" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
6.	36" X 48" Wye	2 EACH	$ 1,500/EA	$ 3,000.00
7.	66" X 66" Wye	1 EACH	$ 1,500/EA	$ 1,500.00
8.	18" R.C.P.	90 L.F.	$ 25/L.F.	$ 2,250.00
9.	24" R.C.P.	270 L.F.	$ 35/L.F.	$ 9,450.00
10.	30" R.C.P.	200 L.F.	$ 40/L.F.	$ 8,000.00
11.	36" R.C.P.	1620 L.F.	$ 50/L.F.	$ 81,000.00
12.	42" R.C.P.	60 L.F.	$ 70/L.F.	$ 4,200.00
13.	48" R.C.P.	130 L.F.	$ 90/L.F.	$ 11,700.00
14.	66" R.C.P.	1570 L.F.	$ 150/L.F.	$ 235,500.00
15.	18" R.C.P. Bend	2 EACH	$ 1,200/EA	$ 2,400.00
16.	24" R.C.P. Bend	1 EACH	$ 1,200/EA	$ 1,200.00
17.	30" R.C.P. Bend	3 EACH	$ 1,200/EA	$ 3,600.00
18.	66" R.C.P. Bend	2 EACH	$ 1,200/EA	$ 2,400.00
19.	4' Inlet	2 EACH	$ 2,800/EA	$ 5,600.00
20.	6' Inlet	2 EACH	$ 3,400/EA	$ 6,800.00
21.	8' Inlet	4 EACH	$ 4,000/EA	$ 16,000.00
22.	10' Inlet	4 EACH	$ 4,600/EA	$ 18,400.00
23.	12' Inlet	2 EACH	$ 5,200/EA	$ 10,400.00
24.	18' Inlet	2 EACH	$ 7,000/EA	$ 14,000.00
			Sub-Total	**$ 450,900.00**
		15% Engineering and Contingencies		$ 67,635.00
			TOTAL	**$ 518,535.00**

TOTAL CONSTRUCTION COST ESTIMATE **$ 1,005,158.00**

CONSTRUCTION COST OPINION

Public Drainage Facilities
Major Conveyance, Briargate Parkway from Proposed Powers Boulevard, East to Existing Detention Facility "C"

Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
Splash Pool				
1.	Rip-Rap	360 C.Y.	$50/C.Y.	$ 18,000.00
2.	Bedding Material	60 C.Y.	$8/C.Y.	$ 480.00
			Subtotal	**$ 18,480.00**
Baffled Chute Drop Structure 97 L.F. (+/-)				
1.	Excavation	1200 C.Y.	$6/C.Y.	$ 7,200.00
2.	Reinf. Concrete	200 C.Y.	$380/C.Y.	$ 76,000.00
3.	Back Fill	500 C.Y.	$8/C.Y.	$ 4,000.00
			Subtotal	**$ 87,200.00**

2 Cell – 6' to 6.5' Height by 8' Wide, 267 L.F.

Item	Description	Quantity	Unit Cost	Total
1.	Excavation[1]	554 C.Y.	$6.00/C.Y.	$ 3,324.00
	Excavation[1]	11,095 C.Y.	$1.50/C.Y.	$ 16,642.00
2.	Reinforced Concrete[2]	560 C.Y.	$355.00/C.Y.	$ 198,800.00
3.	Back Fill[3]	633 C.Y.	$8.00/C.Y.	$ 5,064.00
	Back Fill[3]	9,416 C.Y.	$2.00/C.Y.	$ 18,832.00
			Sub-Total	**$ 242,662.00**

1 Cell - 11' x 6', 793 L.F.

Item	Description	Quantity	Unit Cost	Total
4.	Excavation	1,233 C.Y.	$6.00/C.Y.	$ 7,398.00
	Excavation	18,680 C.Y.	$1.50/C.Y.	$ 28,020.00
5.	Reinforced Concrete	1,190 C.Y.	$363.00/C.Y.	$ 431,970.00
6.	Back Fill	1,880 C.Y.	$8.00/C.Y.	$ 15,040.00
	Back Fill	14,979 C.Y.	$2.00/C.Y.	$ 29,958.00
			Sub-Total	**$ 512,386.00**

CONSTRUCTION COST OPINION (Continued)

1 Cell – 10' x 6', 538 L.F.

Item	Description	Quantity	Unit Cost	Total
7.	Excavation	797 C.Y.	$6.00/C.Y.	$ 4,782.00
	Excavation	12,434 C.Y.	$1.50/C.Y.	$ 18,651.00
8.	Reinforced Concrete	760 C.Y.	$360.00/C.Y.	$ 273,600.00
9.	Back Fill	1,275 C.Y.	$8.00/C.Y.	$ 10,200.00
	Back Fill	10,042 C.Y.	$2.00/C.Y.	$ 20,084.00
			Sub-Total	**$ 327,317.00**

1 Cell - 9' x 6', 558 L.F.

Item	Description	Quantity	Unit Cost	Total
10.	Excavation	784 C.Y.	$6.00/C.Y.	$ 4,704.00
	Excavation	12,630 C.Y.	$1.50/C.Y.	$ 18,945.00
11.	Reinforced Concrete	697 C.Y.	$375.00/C.Y.	$ 261,375.00
12.	Back Fill	1,320 C.Y.	$8.00/C.Y.	$ 10,560.00
	Back Fill	10,280 C.Y.	$2.00/C.Y.	$ 20,560.00
			Sub-Total	**$ 316,144.00**

[1]Structural excavation at $6.00/C.Y., common excavation at $1.50/C.Y.
[2]Includes estimated cost of concrete, forming and placement
[3]Structural backfill at $8.00/C.Y., remaining backfill at $2.00/C.Y.

Public Drainage Facilities
Major Conveyance, Briargate Parkway from Proposed Powers Boulevard, East to Existing Detention Facility "C"

Public Non-Reimbursable

Item	Description	Quantity	Unit Cost	Cost
R.C.P. Storm Drain				
1.	78" R.C.P.	1,570L.F.	$222 L.F.	$ 348,540.00
2.	72" R.C.P.	570 L.F.	$179 L.F.	$ 102,030.00
3.	Bends	6 EACH	$2,340/EA	$ 14,040.00
4.	78" X 72" Reducer	1 EACH	$1,500/EA	$ 1,500.00
5.	Wyes	4 EACH	$2,000/EA	$ 8,000.00
			Sub-Total	**$ 474,110.00**
			Total Briargate Parkway Major Conveyance	$ 1,978,299.00
			15% Engineering and Contingencies	$ 296,745.00
			TOTAL COST ESTIMATE	**$ 2,275,044.00**

JR Engineering cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgement as design professionals familiar with the construction industry and this development in particular.

DRAINAGE FEES

This area lies within the Pine Creek Drainage Basin. The Pine Creek Drainage Basin has been designated a "closed" or "no fee" basin. As such the developer of land within the basin is responsible for the construction of drainage improvements required to support the development but is not assessed a separate drainage fee.

SUMMARY

Development of the study area as outlined in this report will not adversely affect surrounding developments under the conditions assumed in this study. Where noted additional analysis will be needed at the time that detailed construction plans are prepared for the various facilities in order to refine the sizes, and locations of drainage facilities. Prior to development of this study area, the "Interim Condition Plan" that is included in "Amendment 2 to the Pine Creek D.B.P.S." should be updated per the conditions that exist at that time in order to ensure that adequate capacity exists in the downstream drainage system.

Final design of the proposed drainage conveyance on the north side of Briargate Parkway shall include the design of temporary swales, sediments ponds and raiser inlets as necessary to intercept runoff from the undeveloped drainage areas and safely convey it to existing Retention/Detention Facility "C".

PREPARED BY:

JR Engineering

John R Bessette

John R. Bessette, P.E.
Senior Project Engineer

/kd/871611/mddp revised 6-13-01

REFERENCES:

1. "City of Colorado Springs/County of El Paso Drainage Criteria Manual," November 1991.

2. "Soils Survey of El Paso County Area," Colorado Soil Conservation Service.

3. "Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas," Federal Emergency Management Agency, revised March 17, 1997.

4. "Amendment No. 2 to Pine Creek Drainage Basin Planning Study and Master Development Drainage Plan for Pine Creek Subdivision," JR Engineering, Ltd., October 1998.

5. "M.D.D.P. and Preliminary/Final Drainage Report for Sagewood Filings No. 1 through 4," JR Engineering, Ltd., June 1998.

6. "Final Drainage Report and Plan for Briargate Subdivision Filing No. 52, YMCA Facility," Leigh Whitehead & Associates, Inc., February 1998.

7. "Final Drainage Report for Gatehouse Neighborhood Park," JR Engineering, draft dated July 1999.

8. "Preliminary/Final Drainage Report for Penrose St. Francis Briargate Medical Health Center," JR Engineering, July 2000.

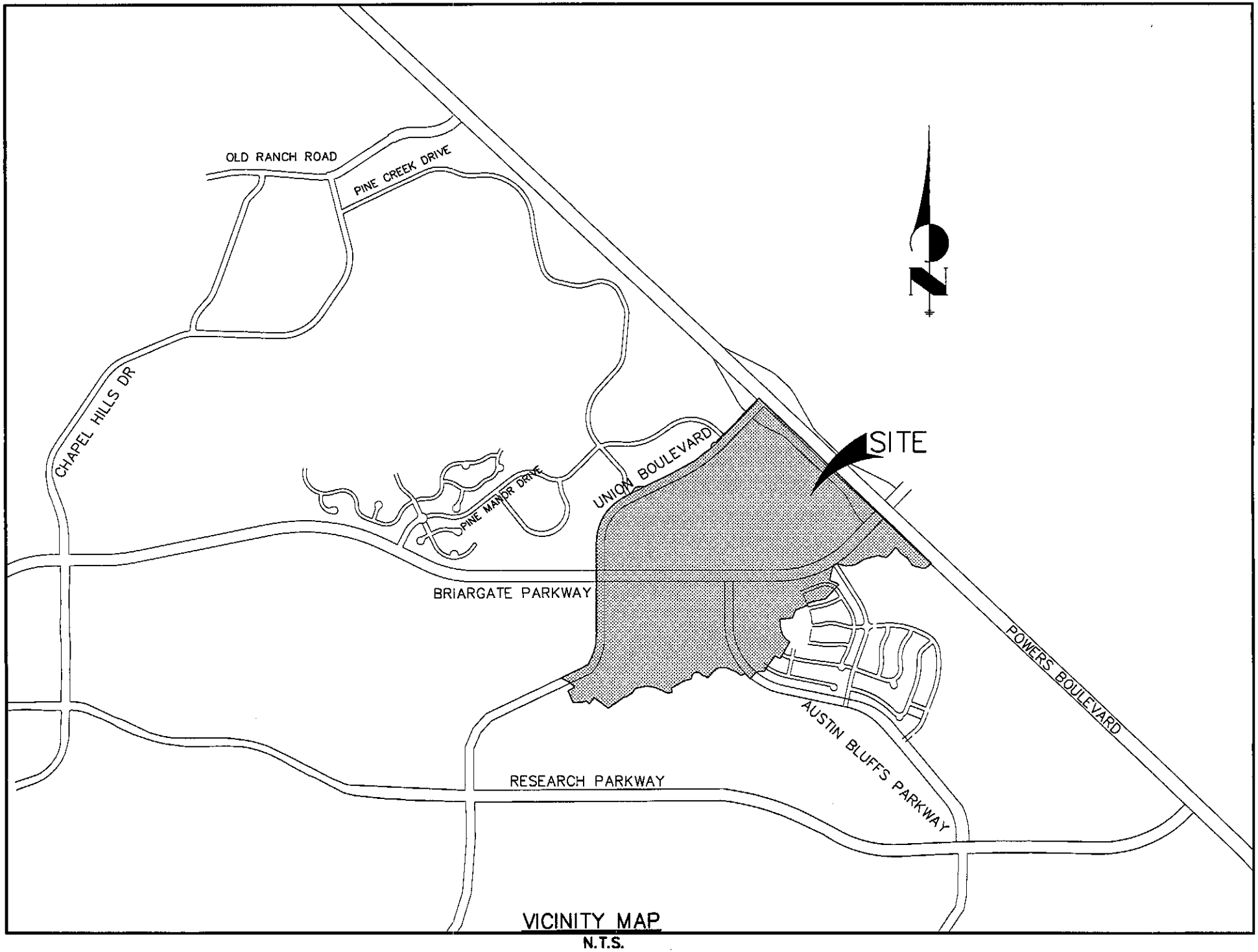
9. "Final Drainage Report for Briargate Parkway Filing No. 2," JR Engineering, June 1998.

10. "Preliminary/Final Drainage Report for Summerfield Filing No. 9," JR Engineering, August 15, 2000.

11. "Final Drainage Report for Sagewood Filing No. 6," JR Engineering, June 2001.

APPENDIX

VICINITY MAP

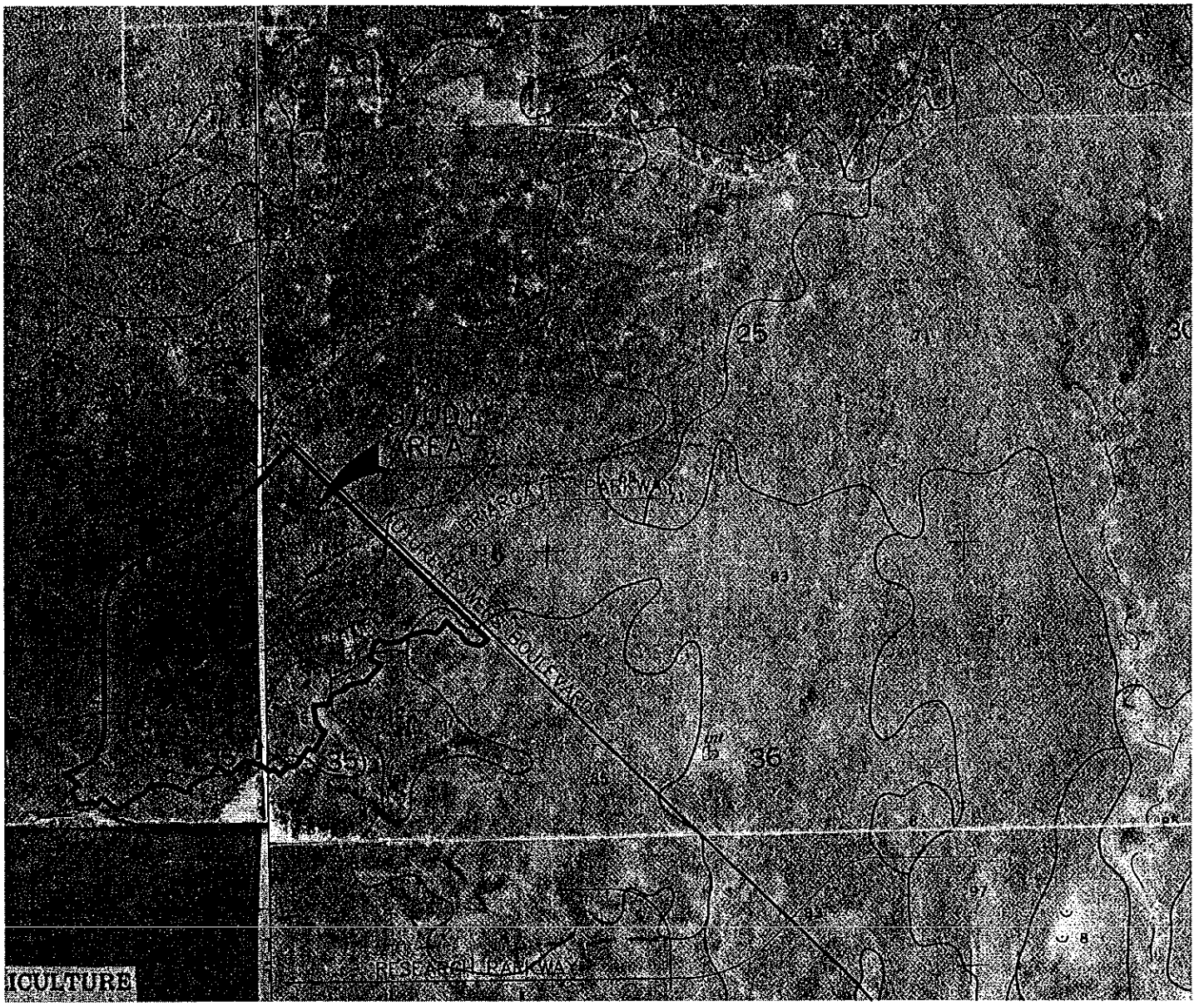


VICINITY MAP

N.T.S.

S.C.S. MAP

SHEET NO. 9
EL PASO COUNTY AREA, COLORADO
(FALCON NW QUADRANGLE)



2000 1000 0 2000 4000

SCALE: 1" = 2000'

SOILS MAP
MDDP DRAINAGE PLAN
JOB NO. 8716.11
08\08\00
SHEET 1 OF 1

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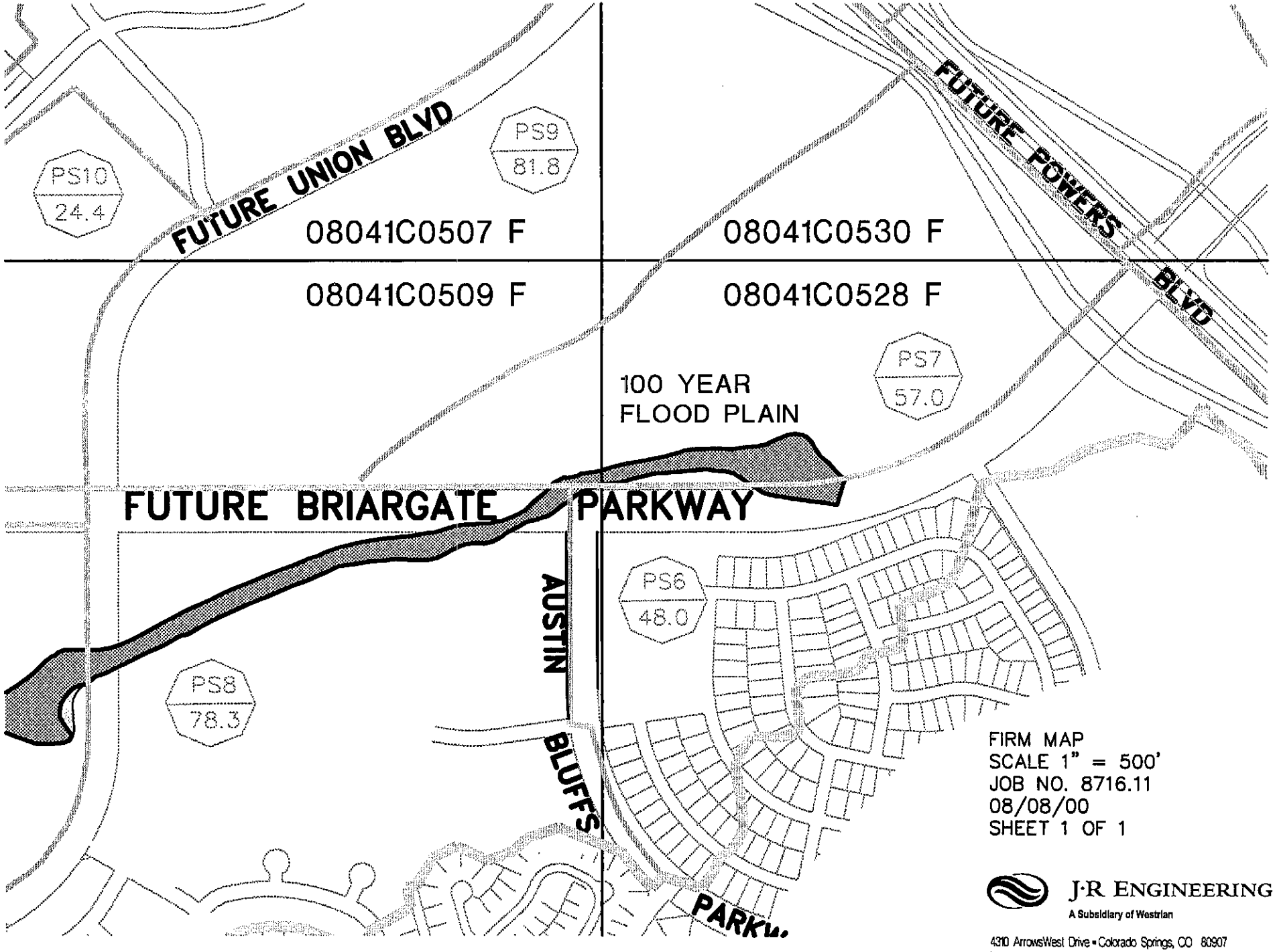
F.E.M.A. FLOODPLAIN MAP



FIRM MAP
SCALE 1" = 500'
JOB NO. 8716.11
08/08/00
SHEET 1 OF 1

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1:00 DRAINAGE BASINS TRIBUTARY TO PROPOSED UNION BOULEVARD STORM DRAIN

1:01 HYDROLOGIC BASIN CALCULATIONS: PS6-1 THROUGH PS6-16; PS8-1 THROUGH PS8-22

1:02 COMPOSITE "CA" SPREADSHEETS: AP-U1 THROUGH AP-U26

1:03 ROUTING SPREADSHEETS: AP-U1 THROUGH AP-U26

1:04 INLET SPREADSHEETS: AP-U1 THROUGH AP-U3, AP-U7, AP-U11, AP-U12, AP-U14, AP-U17, AP-U21 AND UP-U24

1:05 HGL SPREADSHEETS FOR UNION BOULEVARD AND FAMILY PLACE STORM DRAINS

1:01 HYDROLOGIC BASIN CALCULATIONS: PS6-1 THROUGH PS6-16; PS8-1 THROUGH PS8-22

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Sagewood, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-1 (AP-S1)	4.50	0.58	0.68	0.25	50	2.00	7.11	300 530	1.00% 4.00%	3.50 7.00	1.43 1.26	9.80	4.09	7.13	11	22
														CA(equiv.)	2.61	3.06
PS6-2 (AP-S2)	1.80	0.64	0.71	0.25	50	2.00	7.11	300 530	1.00% 4.00%	3.50 7.00	1.43 1.26	9.80	4.09	7.13	5	9
														CA(equiv.)	1.15	1.28
PS6-3 (AP-B9)	7.41	0.53	0.61	0.25 0.25 0.90	50 50 60	3.00 16.00 1.50	6.22 3.58 2.14	1300	2.60%	5.64	3.84	15.78	3.39	5.75	13	26
														CA(equiv.)	3.93	4.52
PS6-4	not	used														
PS6-5 (AP-B4)	5.72	0.55	0.65	0.25	75	3.00	8.71	1300	2.60%	5.64	3.84	12.55	3.73	6.41	12	24
														CA(equiv.)	3.15	3.72
PS6-6 (AP-A2)	5.04	0.47	0.56	0.25	180	3.00	18.02	300 200 400	3.60% 1.00% 4.50%	6.64 3.50 7.42	0.75 0.95 0.90	20.62	3.00	5.01	7	14
														CA(equiv.)	2.37	2.82
TOTAL	24.47															

mddp-basins 6/1/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Sagewood, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-7	4.44	0.51	0.61	0.25	50	2.00	7.11	300	2.00%	4.95	1.01	9.97	4.07	7.08	**9**	**19**
(AP-A1)								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90					
														CA(equiv.)	**2.26**	**2.71**
PS6-8	2.23	0.61	0.68	0.25	80	2.00	10.51	700	1.50%	4.29	2.72	13.23	3.65	6.25	**5**	**9**
(AP-A6)														CA(equiv.)	**1.36**	**1.52**
PS6-9	2.30	0.52	0.62	0.25	100	2.00	12.65	400	2.00%	4.95	1.35	13.99	3.57	6.09	**4**	**9**
(AP-A3)														CA(equiv.)	**1.20**	**1.43**
PS6-10	0.86	0.57	0.65	0.25	40	2.00	5.91	400	2.00%	4.95	1.35	7.26	4.52	8.01	**2**	**4**
(AP-A4)														CA(equiv.)	**0.49**	**0.56**
PS6-11	1.15	0.61	0.70	0.25	50	1.00	8.94	360	2.00%	4.95	1.21	15.10	3.46	5.87	**2**	**5**
(AP-A5)				0.25	50	6.00	4.95									
														CA(equiv.)	**0.70**	**0.81**
PS6-11A	1.01	0.48	0.58	0.25	50	1.00	8.94	290	2.00%	4.95	0.98	12.23	3.77	6.48	**2**	**4**
(AP-A5)				0.25	20	6.00	2.31									
														CA(equiv.)	**0.48**	**0.59**
TOTAL	11.99															

mddp-basins 6/1/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Briargate Pkwy, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-12 (AP-B10)	1.21	0.73	0.77	0.25	20	1.50	3.66	700	2.00%	4.95	2.36	6.01	4.77	8.55	4	8
														CA(equiv.)	0.88	0.93
PS6-13 (AP-B4)	2.41	0.69	0.75	0.25 0.90	50 50	1.00 1.50	8.94 1.84	500	3.20%	6.26	1.33	12.11	3.78	6.51	6	12
														CA(equiv.)	1.66	1.81
PS6-13A (AP-B5)	5.20	0.75	0.80	0.25 0.90	50 75	5.00 1.50	5.26 2.58	600	2.00%	4.95	2.02	9.85	4.09	7.12	16	30
														CA(equiv.)	3.90	4.16
PS6-14 (AP-B2)	1.93	0.84	0.90	0.25 0.90	10 100	0.30 2.00	3.50 2.98	700	2.60%	5.64	2.07	8.54	4.29	7.54	7	13
														CA(equiv.)	1.62	1.74
PS6-15 (AP-B6)	0.32	0.74	0.80	0.25 0.90	20 50	0.50 1.00	5.25 2.10	250	2.00%	4.95	0.84	8.20	4.35	7.66	1	2
														CA(equiv.)	0.24	0.26
PS6-16 (AP-B1)	4.67	0.70	0.80	0.25 0.90	30 50	4.00 3.00	3.70 1.46	700	2.00%	4.95	2.36	7.52	4.47	7.91	15	30
														CA(equiv.)	3.27	3.74
TOTAL	14.53															

mddp-basins 5/30/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Tributary to Union S.D., Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS8-1	8.92	0.50	0.60	0.25	120	2.40	13.85	640	0.70%	2.93	3.64	18.34	3.17	5.33	14	29
(AP-U5)								405	0.60%	8.00	0.84					
SUMFLD 9																
SD-4														CA(equiv.)	4.46	5.35
PS8-2	1.34	0.58	0.65	0.25	100	2.50	11.75	370	5.70%	8.36	0.74	12.49	3.74	6.42	3	6
(AP-U1)																
														CA(equiv.)	0.78	0.87
PS8-3	6.30	0.40	0.50	0.25	50	1.00	8.94	100	0.80%	3.13	0.53	11.30	3.89	6.71	10	21
(AP-U2)								130	5.20%	7.98	0.27					
								150	2.12%	5.10	0.49					
								230	2.23%	5.23	0.73					
								120	2.90%	5.96	0.34					
														CA(equiv.)	2.52	3.15
PS8-4	5.46	0.40	0.50	0.25	50	1.00	8.94	300	0.80%	3.13	1.60	12.93	3.69	6.32	8	17
(AP-U3)								450	3.95%	6.96	1.08					
								470	2.90%	5.96	1.31					
														CA(equiv.)	2.18	2.73
PS8-5	3.65	0.85	0.90	0.25	25	1.00	5.03	230	4.20%	7.17	0.53	12.15	3.78	6.50	12	21
(AP-U21)				0.90	50	2.00	1.67	130	7.60%	9.65	0.22					
								170	4.10%	7.09	0.40					
								175	2.30%	5.31	0.55					
								770	0.96%	3.43	3.74					
														CA(equiv.)	3.10	3.29
PS8-6	0.69	0.90	0.90	0.25	10	0.20	4.00	120	4.10%	7.09	0.28	7.20	4.53	8.04	3	5
(AP-U7)				0.90	100	4.00	2.37	175	2.30%	5.31	0.55					
														CA(equiv.)	0.62	0.62
TOTAL	26.36															

MDDP-BASINS 5/23/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Tributary to Union S.D., Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS8-7	8.52	0.76	0.77	0.25	150	10.00	10.41	100	2.00%	4.95	0.34	13.09	3.67	6.28	24	41
(AP-U15)				0.90	50	8.00	1.06	200	8.00%	9.90	0.34					
								200	1.00%	3.50	0.95					
														CA(equiv.)	6.48	6.56
PS8-8	8.53	0.50	0.60	0.25	150	6.00	12.32	700	2.80%	5.86	1.99	25.68	2.69	4.43	11	23
(AP-U10)				0.25	110	6.00	9.52	300	2.00%	4.95	1.01					
								350	4.00%	7.00	0.83					
														CA(equiv.)	4.27	5.12
PS8-9	1.73	0.55	0.60	0.25	50	6.00	4.95	330	2.50%	5.53	0.99	6.32	4.70	8.41	4	9
(AP-U11)								170	4.70%	7.59	0.37					
														CA(equiv.)	0.95	1.04
PS8-10	3.54	0.71	0.79	0.25	100	18.00	6.12	150	6.00%	8.57	0.29	9.42	4.15	7.25	10	20
(AP-U9)								360	1.00%	3.50	1.71					
YMCA								320	1.40%	4.14	1.29					
														CA(equiv.)	2.51	2.80
PS8-11	2.15	0.73	0.77	0.25	40	10.00	3.48	200	1.50%	4.29	0.78	5.14	4.97	8.99	8	15
(AP-U9)								350	3.50%	6.55	0.89					
YMCA																
														CA(equiv.)	1.57	1.66
PS8-12	1.26	0.65	0.70	0.25	50	1.00	8.94	650	1.75%	4.63	2.34	11.28	3.89	6.72	3	6
(AP-U9)																
														CA(equiv.)	0.82	0.88
TOTAL	25.73															

PS8-10 ADJUSTED DET. POND DELETED

mddp-basins 5/22/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Tributary to Union S.D., Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5) For Calcs See Runoff Summary	WEIGHTED C(100) For Calcs See Runoff Summary	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
PS8-13 (AP-B12)	1.76	0.62	0.69	0.25	40	2.00	5.91	850	2.40%	5.42	2.61	8.52	4.29	7.54	5	9
														CA(equiv.)	1.09	1.21
PS8-13A (AP-U24)	1.10	0.90	0.95	0.25 0.90	12 100	1.00 1.00	2.74 3.74	300	1.00%	3.50	1.43	7.90	4.40	7.77	4	8
														CA(equiv.)	0.99	1.05
PS8-14 (AP-U23)	11.23	0.90	0.90	0.25 0.90	50 150	2.00 6.00	7.11 2.90	800	2.20%	5.19	2.57	12.58	3.73	6.40	38	65
														CA(equiv.)	10.11	10.11
PS8-15 (AP-U17)	0.72	0.60	0.65	0.25	35	0.70	7.48	500	2.40%	5.42	1.54	9.02	4.21	7.38	2	3
														CA(equiv.)	0.43	0.47
PS8-16 (AP-U14)	0.37	0.75	0.80	0.25	10	0.20	4.00	500	2.40%	5.42	1.54	5.54	4.88	8.78	1	3
														CA(equiv.)	0.28	0.30
PS8-17 (AP-U11)	0.42	0.75	0.80	0.25	10	0.20	4.00	600	3.60%	6.64	1.51	5.50	4.88	8.80	2	3
														CA(equiv.)	0.32	0.34
PS8-18 (AP-U12)	1.15	0.75	0.80	0.25	10	0.20	4.00	630 600	3.50% 3.60%	6.55 6.64	1.60 1.51	7.11	4.55	8.07	4	7
														CA(equiv.)	0.86	0.92
PS8-19 (AP-U9)	0.50	0.75	0.80	0.25	10	0.20	4.00	630	3.50%	6.55	1.60	5.60	4.86	8.75	2	3
														CA(equiv.)	0.38	0.40
TOTAL	17.25															

mddp-basins 6/11/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Briargate Pkwy, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS8-20 (AP-B11)	1.68	0.64	0.70	0.25	70	2.00	9.40	450	2.60%	5.64	1.33	10.73	3.96	6.87	4	8
														CA(equiv.)	1.08	1.18
PS8-21 (AP-B10)	2.88	0.61	0.68	0.25	70	4.00	7.48	950	2.60%	5.64	2.81	10.29	4.02	6.99	7	14
														CA(equiv.)	1.76	1.96
PS8-22 (AP-B10B)	3.17	0.68	0.75	0.25	60	2.00	8.28	875	2.60%	5.64	2.58	10.86	3.94	6.83	9	16
														CA(equiv.)	2.16	2.38
TOTAL	3.17															

mddp-basins 5/23/2001

1:02 COMPOSITE "CA" SPREADSHEETS: AP-U1 THROUGH AP-U26

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, TRIBUTARY TO UNION S.D., DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-U1 EX. INLET	PS8-2	1.34	0.78	0.87		
	TOTAL	1.34			0.78	0.87
AP-U2 EX. INLET	PS8-3	6.3	2.52	3.15		
	TOTAL	6.3			2.52	3.15
AP-U3 EX. INLET	PS8-4	5.46	2.18	2.73		
	TOTAL	5.46			2.18	2.73
AP-U4 PIPE	INLET U1		0.25	0.25		
	INLET U2		1.23	1.06		
	INLET U3		1.10	0.99		
	TOTAL				2.58	2.30
AP-U5 SUMFLD 9 SMP INLETS S.D.	PS8-1	8.92	4.46	5.35		
	TOTAL	8.92			4.46	5.35
AP-U6 PIPE	AP-U4		2.58	2.30		
	S.D.- U5	8.92	4.46	5.35		
	TOTAL	8.92			7.04	7.65
AP-U7 INLET	PS8-6	0.69	0.62	0.62		
	FLBY U2		1.29	2.09		
	FLBY U3		1.08	1.74		
	TOTAL	0.69			2.99	4.45
AP-U8 PIPE	AP-U6		7.04	7.65		
	INLET-U7		1.54	1.21		
	TOTAL				8.58	8.86
AP-U9 STREET GUTTER	PS8-10	3.54	2.51	2.80		
	PS8-11	2.15	1.57	1.66		
	PS8-12	1.26	0.82	0.88		
	PS8-19	0.5	0.38	0.40		
	TOTAL	7.45			5.28	5.74

COMP-UNION 6/3/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, TRIBUTARY TO UNION S.D., DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-U10 PIPE ENTRA.	PS8-8	8.53	4.27	5.12		
	TOTAL	8.53			4.27	5.12
AP-U11 INLET	AP-U9	7.45	5.28	5.74		
	PS8-9	1.73	0.95	1.04		
	PS8-17	0.42	0.32	0.34		
	TOTAL	9.6			6.55	7.12
AP-U12 INLET	PS8-18	1.15	0.86	0.92		
	TOTAL	1.15			0.86	0.92
AP-U11+12 INLET	AP-U9	7.45	5.28	5.74		
	PS8-9	1.73	0.95	1.04		
	PS8-17	0.42	0.32	0.34		
	PS8-18	1.15	0.86	0.92		
	TOTAL	10.75			7.41	8.04
AP-U13 PIPE	INLET U10		4.27	5.12		
	INLET U11		2.02	1.20		
	INLET U12		0.42	0.86		
	TOTAL				6.71	7.18
AP-U14 SMP INLET	PS8-16	0.37	0.28	0.30		
	FLBY U11		4.53	2.82		
	TOTAL	0.37			4.81	3.12
AP-U15 SERVICE	PS8-7	8.52	6.48	6.56		
	TOTAL	8.52			6.48	6.56
AP-U16 PIPE	AP-U15		6.48	6.56		
	INLET U14		4.81	3.12		
	TOTAL				11.29	9.68
AP-U17 SMP INLET	PS8-15	0.72	0.43	0.47		
	FLBY U12		0.44	3.16		
	TOTAL	0.72			0.87	3.63
AP-U18 PIPE	AP-U13		6.93	7.52		
	INLET U17		0.87	3.63		
	TOTAL				7.80	11.15

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, TRIBUTARY TO UNION S.D., DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-U19	AP-U16		11.29	9.68		
PIPE	AP-U18		7.80	11.15		
	TOTAL				19.09	20.83
AP-U20	AP-U8		8.58	8.86		
PIPE	AP-U19		19.09	20.83		
	TOTAL				27.67	29.69
AP-U21	PS8-5	3.65	3.1	3.29		
SMP INLET	FLBY U1		0.53	0.64		
	FLBY U7		1.45	3.24		
	TOTAL	3.65			5.08	7.17
AP-U22	AP-U20		27.67	29.69		
PIPE	AP-U21		5.08	7.17		
	TOTAL				32.75	36.86
AP-U23	PS8-14	11.23	10.11	10.11		
OUTFALL PIPE						
	TOTAL	11.23			10.11	10.11
AP-U24	PS8-13A	1.18	0.99	1.05		
SMP INLET	FLBY B12		1.30	3.45		
	TOTAL	1.18			2.29	4.50
AP-U25	AP-U23		10.11	10.11		
PIPE	INLET U24		2.29	4.50		
	TOTAL				12.40	14.61
AP-U26	AP-U22		32.75	36.86		
PIPE	AP-U25		12.40	14.61		
	TOTAL				45.15	51.47

COMP-UNION 6/3/2001

1:03 ROUTING SPREADSHEETS: AP-U1 THROUGH AP-U26

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(PINE CREEK BASIN, TRIBUTARY TO UNION, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-U1 INLET	1.34	0.78	0.87	0.25	100	2.50	11.75	370	5.70%	8.36	0.74	12.49	3.74	6.42	3	6
AP-U2 INLET	6.30	2.52	3.15	0.25	50	1.00	8.94	100 130 150 230 120	0.80% 5.20% 2.12% 2.23% 2.90%	3.13 7.98 5.10 5.23 5.96	0.53 0.27 0.49 0.73 0.34	11.30	3.89	6.71	10	21
AP-U3 INLET	5.46	2.18	2.73	0.25	50	1.00	8.94	300 450 470	0.80% 3.95% 2.90%	3.13 6.96 5.96	1.60 1.08 1.31	12.93	3.69	6.32	8	17
AP-U4 PIPE	4.47	2.58	2.30	0.25	50	1.00	8.94	300 450 470 110	0.80% 3.95% 2.90% 4.00%	3.13 6.96 5.96 7.00	1.60 1.08 1.31 0.26	13.19	3.66	6.26	9	14
AP-U5 SUMFLD 9 SD4	8.92	4.46	5.35	0.25	50	3.50	5.91	900	1.20%	3.83	3.91	9.83	4.09	7.13	18	38
AP-U6 PIPE	8.92	7.04	7.65	0.25	50	1.00	8.94	300 450 470 160	0.80% 3.95% 2.90% 4.00%	3.13 6.96 5.96 7.00	1.60 1.08 1.31 0.38	13.31	3.65	6.24	26	48
AP-U7 INLET	0.69	2.99	4.45	0.25	50	1.00	8.94	300 450 470 110 250 250	0.80% 3.95% 2.90% 4.00% 2.40% 1.00%	3.13 6.96 5.96 7.00 5.42 3.50	1.60 1.08 1.31 0.26 0.77 1.19	15.15	3.45	5.86	10	26
AP-U8 PIPE		8.58	8.86	0.25	50	1.00	8.94	300 450 470 160 150 250	0.80% 3.95% 2.90% 4.00% 2.40% 1.00%	3.13 6.96 5.96 7.00 5.42 3.50	1.60 1.08 1.31 0.38 0.46 1.19	14.96	3.47	5.90	30	52

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, TRIBUTARY TO UNION, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	OVERLAND/POND OUTFLOW Length (ft)	OVERLAND/POND OUTFLOW Height (ft)	OVERLAND/POND OUTFLOW Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	STREET / CHANNEL/ PIPE Slope (%)	STREET / CHANNEL/ PIPE Velocity (fps)	STREET / CHANNEL/ PIPE Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-U9 STREET GUTTER		5.28	5.74	0.25	50	1.00	8.94	650 630	1.75% 3.50%	4.63 6.55	2.34 1.60	12.88	3.69	6.33	20	36
AP-U10 PIPE ENTR.	8.53	4.27	5.12	0.25 0.25	150 110	6.00 6.00	12.32 9.52	700 300 350	2.80% 2.00% 4.00%	5.86 4.95 7.00	1.99 1.01 0.83	25.68	2.69	4.43	11	23
AP-U11 INLET		6.55	7.12	0.25	50	1.00	8.94	650 630 600	1.75% 3.50% 3.70%	4.63 6.55 6.73	2.34 1.60 1.49	14.37	3.53	6.02	23	43
AP-U12 INLET	1.15	0.86	0.92	0.25	10	0.20	4.00	630 600	3.50% 3.60%	6.55 6.64	1.60 1.51	7.11	4.55	8.07	4	7
AP-U11+12 INLETS		7.41	8.04	0.25	50	1.00	8.94	650 630 600	1.75% 3.50% 3.70%	4.63 6.55 6.73	2.34 1.60 1.49	14.37	3.53	6.02	26	48
AP-U13 PIPE		6.71	7.18	0.25	50	1.00	8.94	650 630 600 40	1.75% 3.50% 3.70% 1.00%	4.63 6.55 6.73 3.50	2.34 1.60 1.49 0.19	14.56	3.51	5.98	24	43
AP-U14 SUMP INLET		4.81	3.12	0.25	50	1.00	8.94	650 630 600 500	1.75% 3.50% 3.70% 2.40%	4.63 6.55 6.73 5.42	2.34 1.60 1.49 1.54	15.91	3.38	5.72	16	18

RTGUNION 6/3/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(PINE CREEK BASIN, TRIBUTARY TO UNION, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-U15 SERVICE	8.52	6.48	6.56	0.25 0.90	150 50	10.00 8.00	10.41 1.06	100 200 200	2.00% 8.00% 1.00%	4.95 9.90 3.50	0.34 0.34 0.95	13.09	3.67	6.28	24	41
AP-U16 PIPE		10.73	9.19	0.25 0.90	150 50	10.00 8.00	10.41 1.06	100 200 200	2.00% 8.00% 1.00%	4.95 9.90 3.50	0.34 0.34 0.95	13.09	3.67	6.28	39	58
AP-U17 SUMP INLET		0.87	3.63	0.25	50	1.00	8.94	650 630 600 500	1.75% 3.50% 3.70% 2.40%	4.63 6.55 6.73 5.42	2.34 1.60 1.49 1.54	15.91	3.38	5.72	3	21
AP-U18 PIPE	0.72	7.80	11.15	0.25	50	1.00	8.94	650 630 600 40 500	1.75% 3.50% 3.70% 1.00% 2.40%	4.63 6.55 6.73 3.50 5.42	2.34 1.60 1.49 0.19 1.54	16.10	3.37	5.69	26	63
AP-U19 PIPE		19.09	20.83	0.25	50	1.00	8.94	650 630 600 40 500 30	1.75% 3.50% 3.70% 1.00% 2.40% 2.00%	4.63 6.55 6.73 3.50 5.42 4.95	2.34 1.60 1.49 0.19 1.54 0.10	16.20	3.36	5.67	64	118
AP-U20 PIPE		27.67	29.69	0.25	50	1.00	8.94	650 630 600 40 500 130	1.75% 3.50% 3.70% 1.00% 2.40% 2.00%	4.63 6.55 6.73 3.50 5.42 4.95	2.34 1.60 1.49 0.19 1.54 0.44	16.54	3.33	5.62	92	167

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, TRIBUTARY TO UNION, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Cales See Runoff Summary														
AP-U21 SUMP INLET	3.65	5.08	7.17	0.25	50	1.00	8.94	300	0.80%	3.13	1.60	17.91	3.21	5.39	16	39
								450	3.95%	6.96	1.08					
								470	2.90%	5.96	1.31					
								110	4.00%	7.00	0.26					
								250	2.40%	5.42	0.77					
								250	1.00%	3.50	1.19					
								580	1.00%	3.50	2.76					
AP-U22 PIPE		32.75	36.86	0.25	50	1.00	8.94	650	1.75%	4.63	2.34	18.92	3.13	5.24	102	193
								630	3.50%	6.55	1.60					
								600	3.70%	6.73	1.49					
								40	1.00%	3.50	0.19					
								500	2.40%	5.42	1.54					
								130	2.00%	4.95	0.44					
								500	1.00%	3.50	2.38					
AP-U23 INLET	11.23	10.11	10.11	0.25	50	2.00	7.11	800	2.20%	5.19	2.57	12.58	3.73	6.40	38	65
				0.90	150	6.00	2.90									
AP-U24 SUMP INLET		2.29	4.50	0.25	20	1.50	3.66	700	2.00%	4.95	2.36	12.70	3.71	6.37	9	29
								950	2.60%	5.64	2.81					
								800	2.00%	4.95	2.69					
								250	1.00%	3.50	1.19					
AP-U25 PIPE		12.40	14.61	0.25	50	1.00	8.94	650	1.75%	4.63	2.34	18.17	3.19	5.35	40	78
								630	3.50%	6.55	1.60					
								600	3.70%	6.73	1.49					
								500	2.40%	5.42	1.54					
								450	1.00%	3.50	2.14					
								70	8.00%	9.90	0.12					
AP-U26 PIPE		45.15	51.47	0.25	170	22.00	8.90	650	1.75%	4.63	2.34	18.88	3.13	5.25	141	270
								630	3.50%	6.55	1.60					
								600	3.70%	6.73	1.49					
								40	1.00%	3.50	0.19					
								500	2.40%	5.42	1.54					
								130	2.00%	4.95	0.44					
								500	1.00%	3.50	2.38					

1:04 INLET SPREADSHEETS: AP-U1 THROUGH AP-U3, AP-U7, AP-U11, AP-U12, AP-U14, AP-U17, AP-U21 AND UP-U24

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Existing 5' Inlet at UNION, AP-U1

100-YR. FLOW					
Q(100)	6	I(100)	6.4		
DEPTH	0.28	Fr	2.40	Inlet size ? L(i) =	5
SPREAD	9.8	L(1)	18.0	If Li < L(2) then Qi =	2
CROSS SLOPE	2.0%	L(2)	10.8	If Li > L(2) then Qi =	3
STREET SLOPE	4.0%	L(3)	38.6	FB =	4
				CA(eqv.)=	0.62

5-YR. FLOW					
Q(5)	3	I(5)	3.7		
DEPTH	0.23	Fr	2.25	Inlet size ? L(i) =	5
SPREAD	7.3	L(1)	12.6	If Li < L(2) then Qi =	1
CROSS SLOPE	2.0%	L(2)	7.5	If Li > L(2) then Qi =	2
STREET SLOPE	4.0%	L(3)	26.9	FB =	2
				CA(eqv.)=	0.53

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

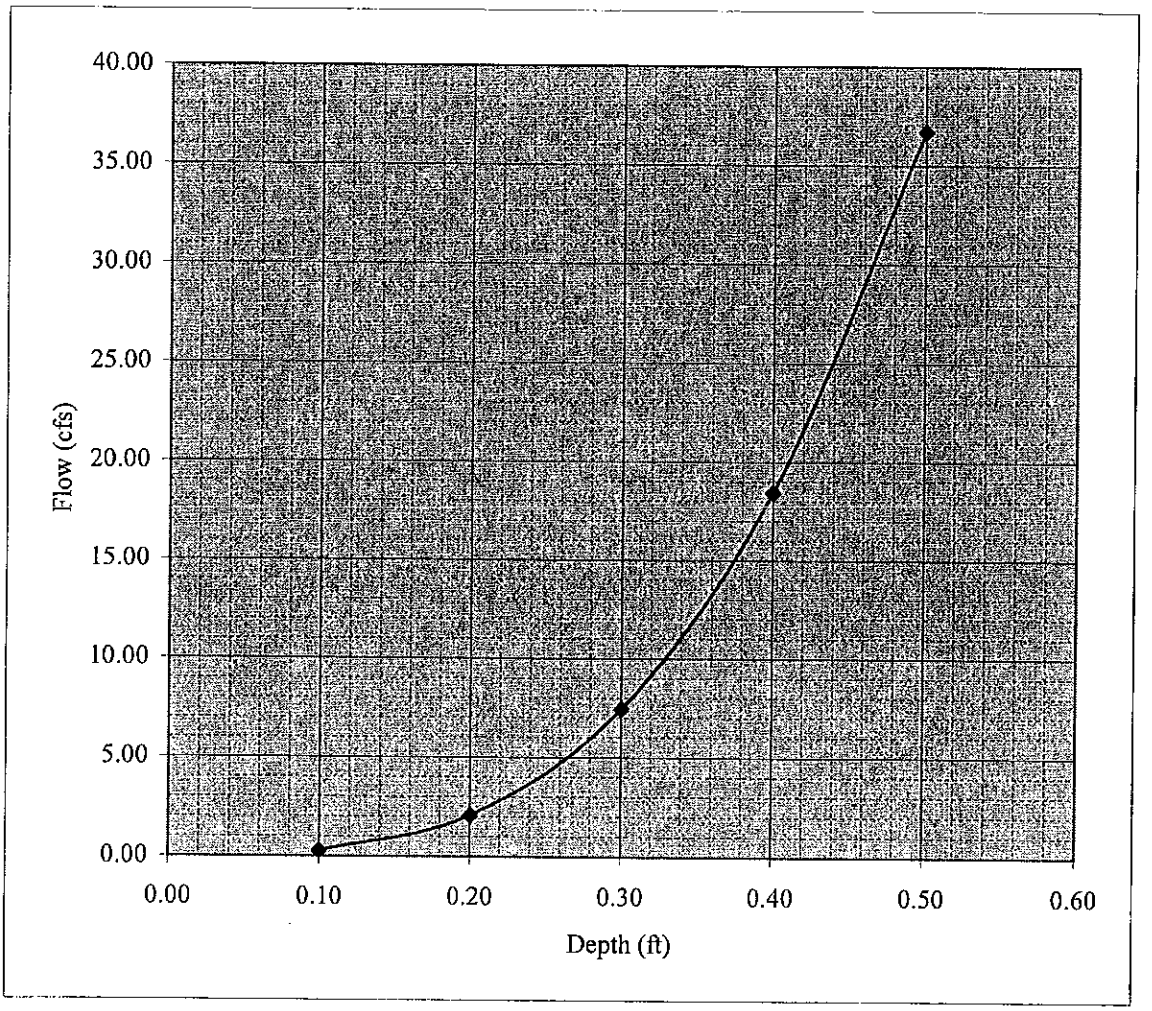
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.04 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.30
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		2.06
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		7.44
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		18.43
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		36.68



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Existing 10' Inlet at Charity Dr, AP-U2

100-YR. FLOW					
Q(100)	21	I(100)	6.7		
DEPTH	0.44	Fr	2.30	Inlet size ? L(i) =	10
SPREAD	17.8	L(1)	31.4	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	18.9	If Li > L(2) then Qi =	10
STREET SLOPE	2.9%	L(3)	67.4	FB =	14
				CA(eqv.)=	2.09

5-YR. FLOW					
Q(5)	10	I(5)	3.9		
DEPTH	0.34	Fr	2.16	Inlet size ? L(i) =	10
SPREAD	12.8	L(1)	21.2	If Li < L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	12.7	If Li > L(2) then Qi =	5
STREET SLOPE	2.9%	L(3)	45.4	FB =	5
				CA(eqv.)=	1.29

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

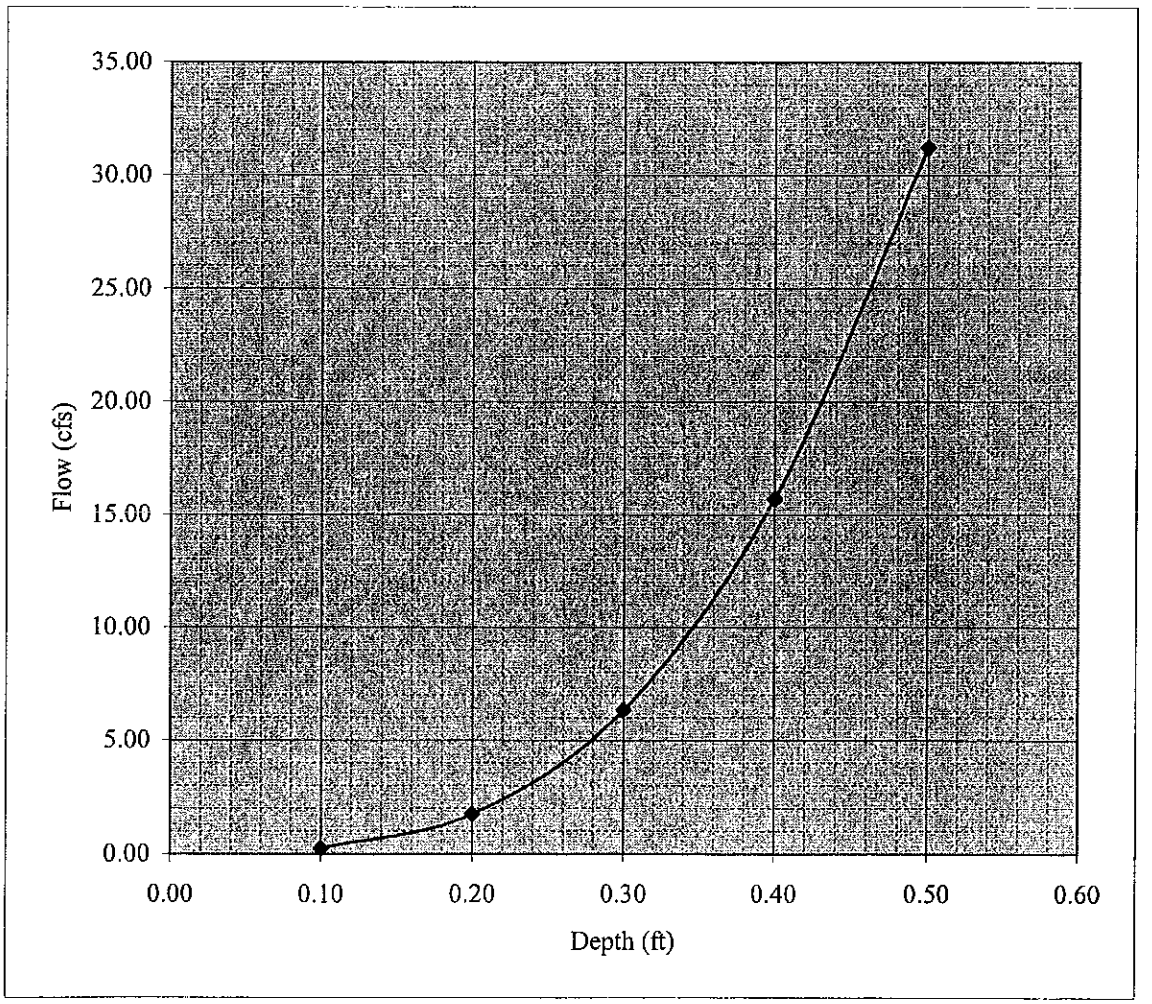
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.029 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.25
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.76
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.34
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.70
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		31.23



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Existing 10' Inlet atCharity Dr, AP-U3

100-YR. FLOW					
Q(100)	17	I(100)	6.3		
DEPTH	0.41	Fr	2.26	Inlet size ? L(i) =	10
SPREAD	16.3	L(1)	28.3	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	17.0	If Li > L(2) then Qi =	8
STREET SLOPE	2.9%	L(3)	60.7	FB =	11
				CA(eqv.)=	1.74

5-YR. FLOW					
Q(5)	8	I(5)	3.7		
DEPTH	0.32	Fr	2.12	Inlet size ? L(i) =	10
SPREAD	11.8	L(1)	19.2	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	11.5	If Li > L(2) then Qi =	5
STREET SLOPE	2.9%	L(3)	41.2	FB =	4
				CA(eqv.)=	1.08

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

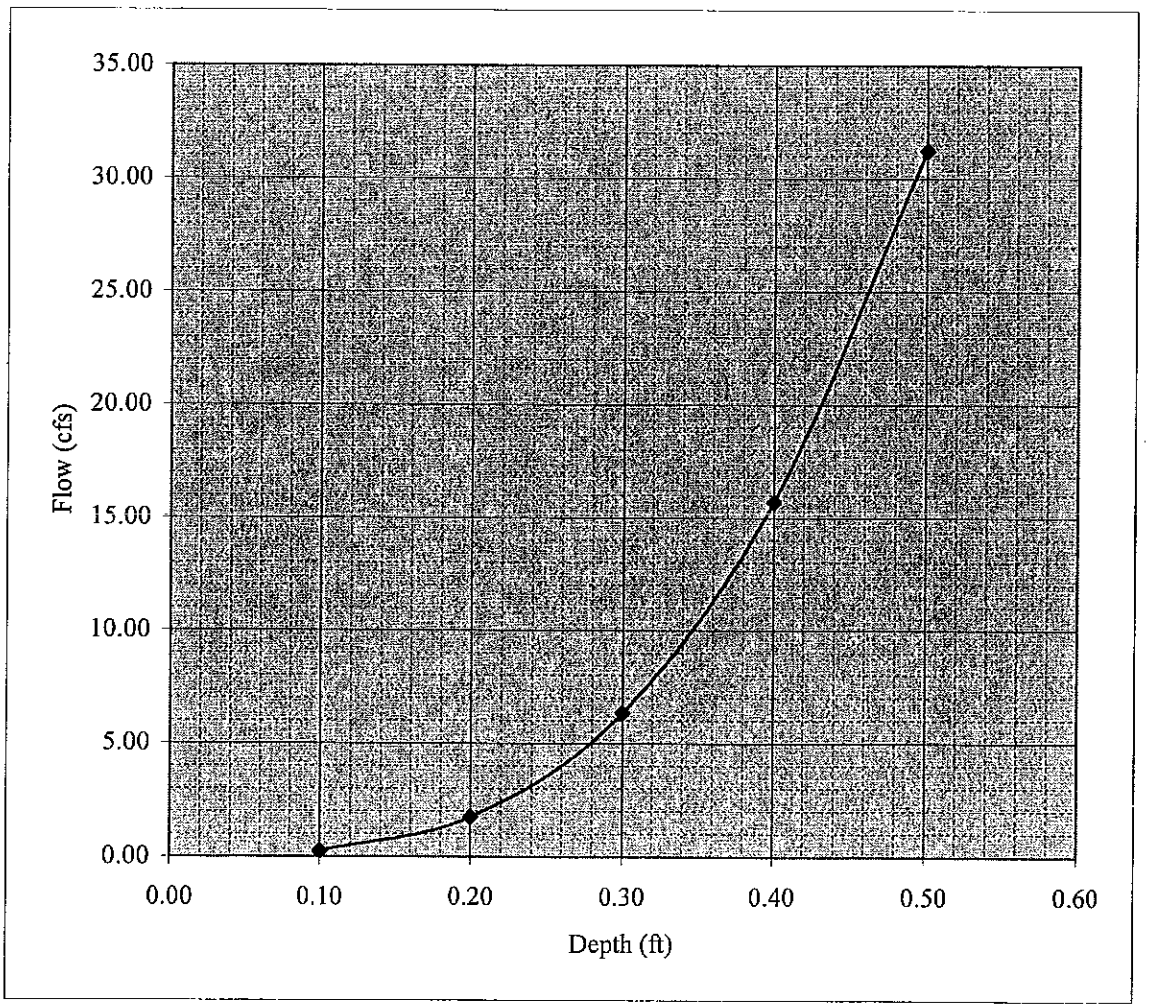
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.029 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.25
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.76
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.34
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.70
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		31.23



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 8' Inlet at Union, AP-U7

100-YR. FLOW					
Q(100)	26	I(100)	5.9		
DEPTH	0.61	Fr	1.45	Inlet size ? L(i) =	8
SPREAD	26.3	L(1)	29.3	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	17.6	If Li > L(2) then Qi =	11
STREET SLOPE	1.0%	L(3)	62.9	FB =	19
				CA(eqv.)=	3.24

5-YR. FLOW					
Q(5)	10	I(5)	3.5		
DEPTH	0.41	Fr	1.33	Inlet size ? L(i) =	8
SPREAD	16.3	L(1)	16.6	If Li < L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	10.0	If Li > L(2) then Qi =	6
STREET SLOPE	1.0%	L(3)	35.6	FB =	5
				CA(eqv.)=	1.45

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

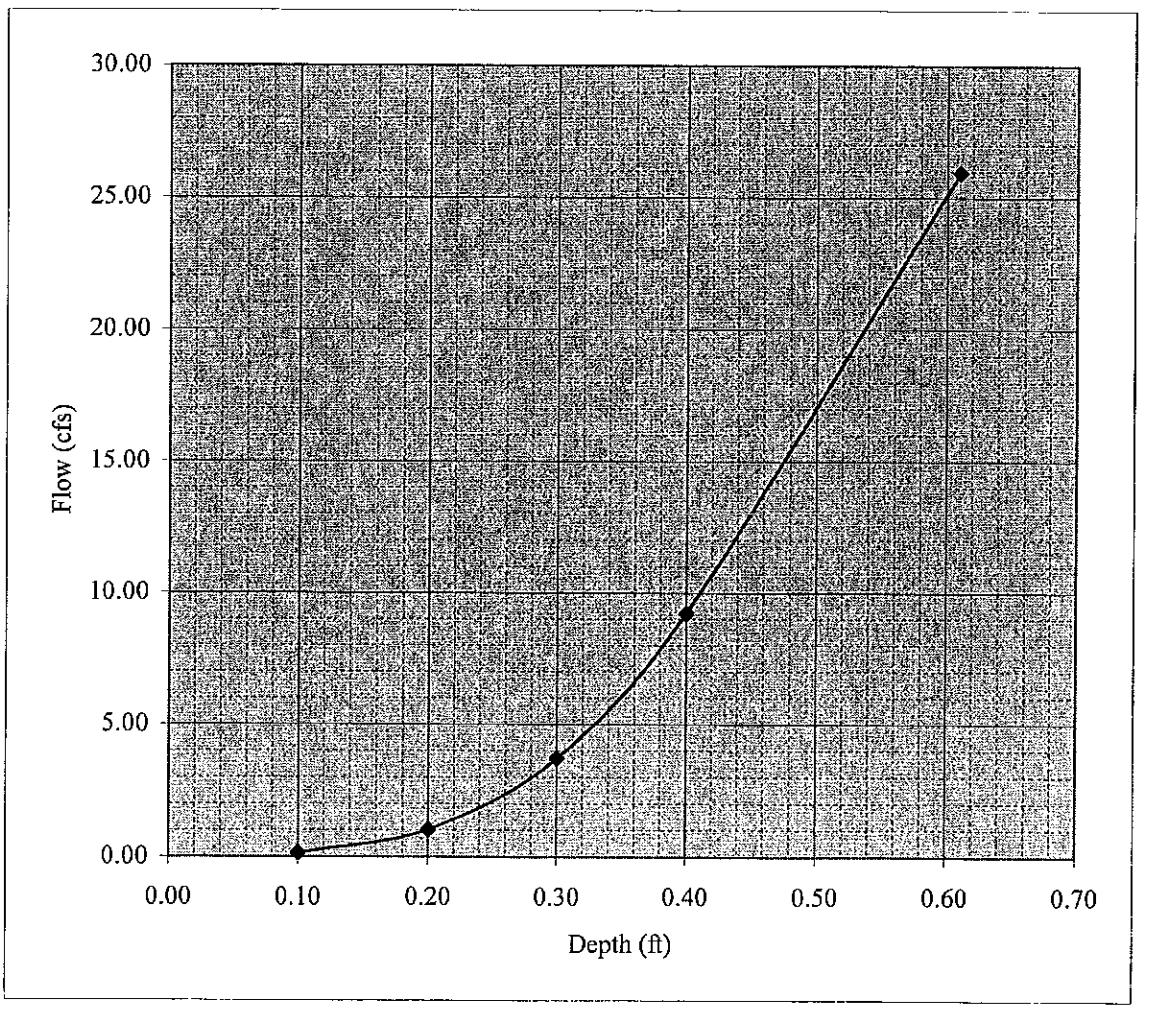
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.01 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.15
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.03
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		3.72
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		9.22
0.61	$0.37^{8/3}$	$0.61^{8/3} - 0.37^{8/3}$		25.93



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 12' Inlet at Family Place, AP-U11

100-YR. FLOW					
Q(100)	24	I(100)	6.0		
DEPTH	0.42	Fr	2.99	Inlet size ? L(i) =	12
SPREAD	16.8	L(1)	38.5	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	23.1	If Li > L(2) then Qi =	11
STREET SLOPE	5.0%	L(3)	82.6	FB =	17
				CA(eqv.)=	2.82

5-YR. FLOW					
Q(5)	23	I(5)	3.5		
DEPTH	0.41	Fr	2.97	Inlet size ? L(i) =	12
SPREAD	16.3	L(1)	37.2	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	22.3	If Li > L(2) then Qi =	11
STREET SLOPE	5.0%	L(3)	79.6	FB =	16
				CA(eqv.)=	4.53

ASSUMES 100 YR FLOW AT U11, U12 WILL BE DIVIDED EQUALLY TO EACH FLOWLINE

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

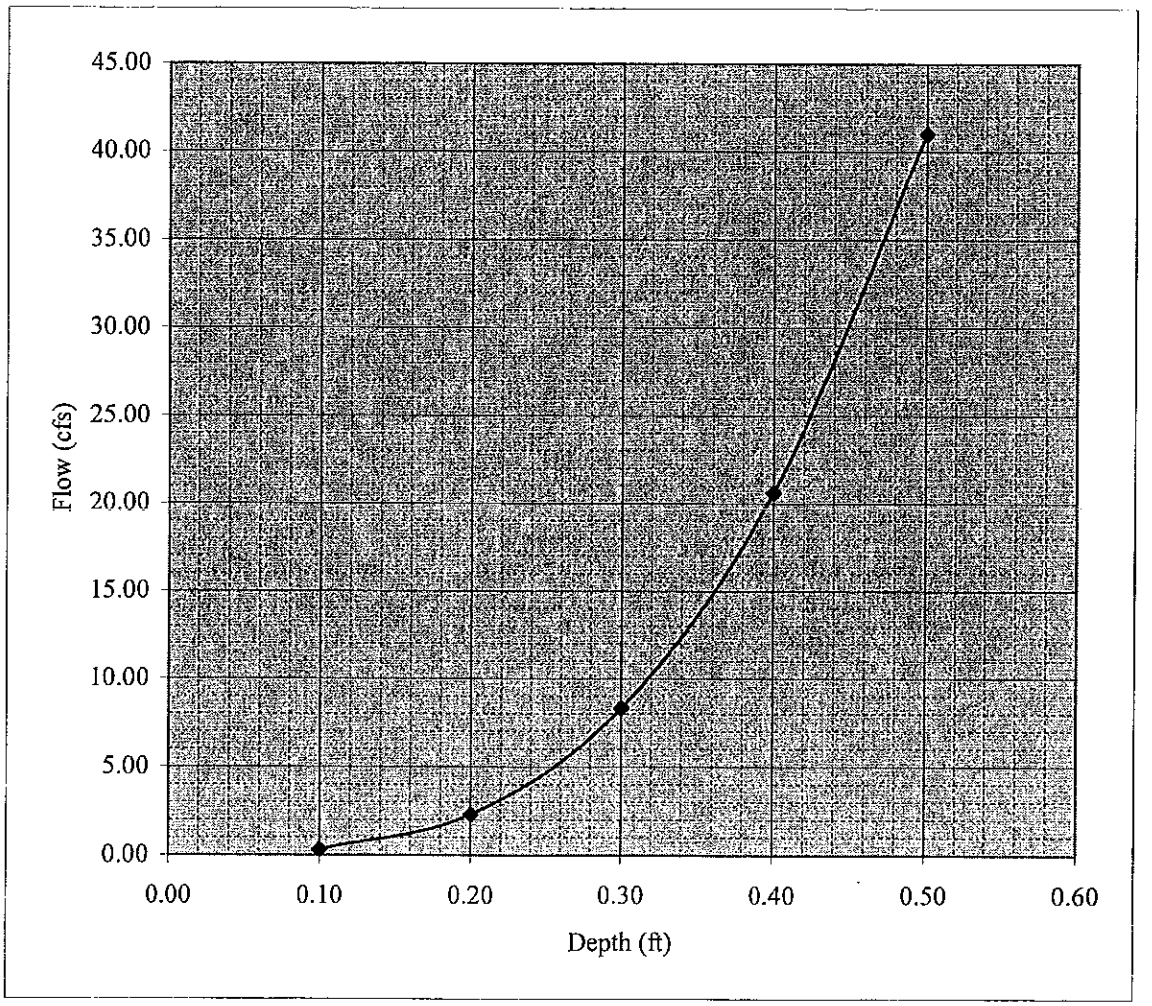
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.05 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.33
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		2.31
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		8.32
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		20.61
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		41.01



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 8' Inlet at Family Place, AP-U12

100-YR. FLOW					
Q(100)	24	I(100)	6.0		
DEPTH	0.42	Fr	2.99	Inlet size ? L(i) =	8
SPREAD	16.8	L(1)	38.5	If Li < L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	23.1	If Li > L(2) then Qi =	9
STREET SLOPE	5.0%	L(3)	82.6	FB =	19
				CA(eqv.)=	3.16

5-YR. FLOW					
Q(5)	4	I(5)	4.6		
DEPTH	0.24	Fr	2.55	Inlet size ? L(i) =	8
SPREAD	7.8	L(1)	15.2	If Li < L(2) then Qi =	2
CROSS SLOPE	2.0%	L(2)	9.2	If Li > L(2) then Qi =	2
STREET SLOPE	5.0%	L(3)	32.7	FB =	2
				CA(eqv.)=	0.44

ASSUMES 100 YR FLOW AT U11, U12 WILL BE DIVIDED EQUALLY TO EACH FLOWLINE

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

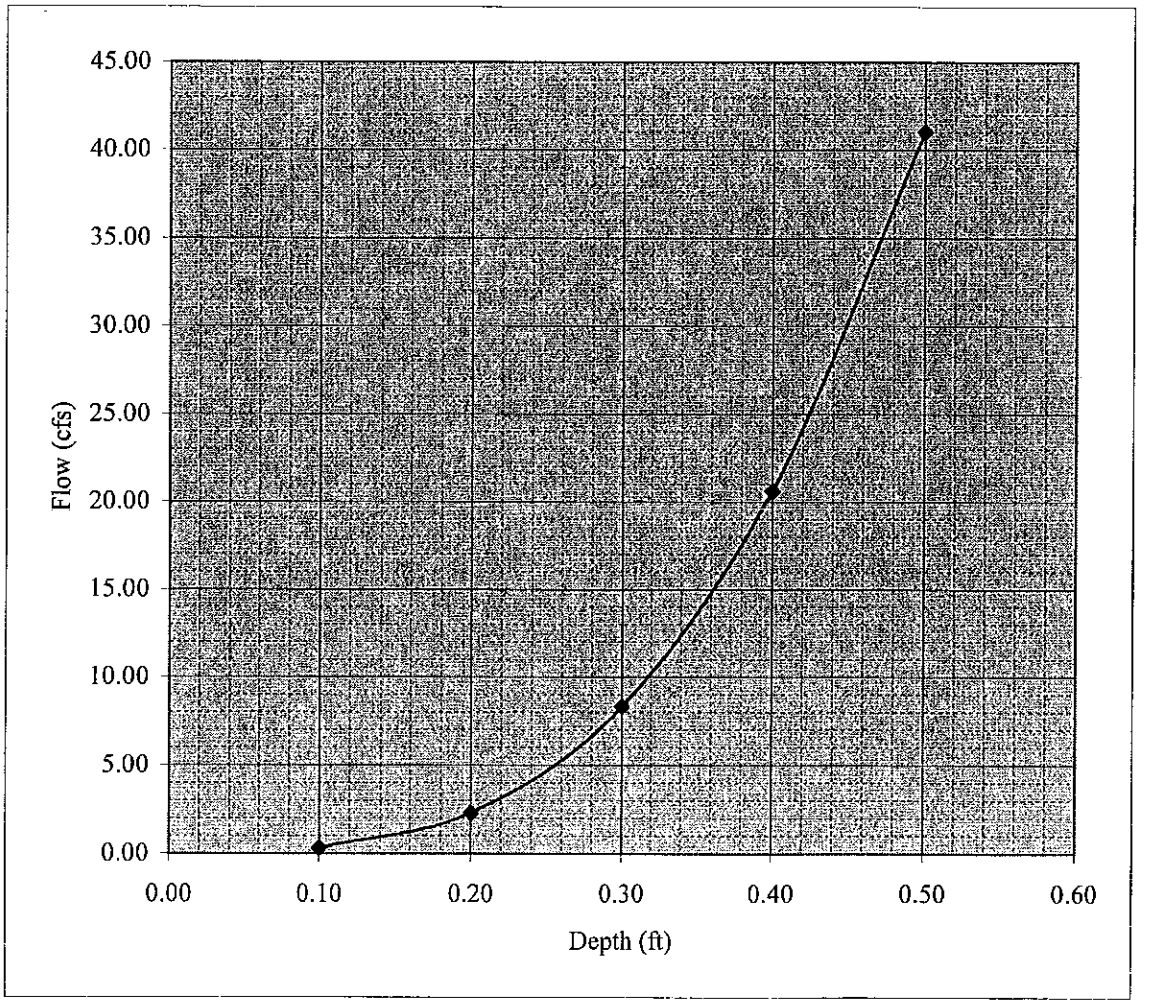
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.05 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.33
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		2.31
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		8.32
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		20.61
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		41.01



UNION/ BRIARGATE
MASTER DEVELOPMENT
DRAINAGE PLAN
(Inlet Calculations - Sump Condition)

Design Point AP-U14

Total Flow:	Q_5	=	**16** cfs
	Q_{100}	=	**18** cfs

Maximum allowable ponding depth at sump:

D_5	=	0.50
D_{100}	=	0.67 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event:	**10**	foot inlet required
100-Year Event:	**8**	foot inlet required

(Install an 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: JRB
Date: 5/29/2001
Checked by:

UNION/ BRIARGATE
MASTER DEVELOPMENT
DRAINAGE PLAN
(Inlet Calculations - Sump Condition)

Design Point AP-U17

Total Flow:

Q_5 = **3** cfs

Q_{100} = **21** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4** foot inlet required

100-Year Event: **10** foot inlet required

(Install an 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: JRB

Date: 6/03/2001

Checked by: _____

UNION/ BRIARGATE
MASTER DEVELOPMENT
DRAINAGE PLAN
(Inlet Calculations - Sump Condition)

Design Point AP-U21

Total Flow:

Q_5 = **16** cfs

Q_{100} = **39** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **10** foot inlet required

100-Year Event: **22** foot inlet required

(Install a 22' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: jrb

Date: 6/3/2001

Checked by: _____

UNION/ BRIARGATE
MASTER DEVELOPMENT
DRAINAGE PLAN
(Inlet Calculations - Sump Condition)

Design Point AP-U24

Total Flow:

Q_5 = **9** cfs

Q_{100} = **29** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4** foot inlet required

100-Year Event: **16** foot inlet required

(Install a 16' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: jrb

Date: 6/3/2001

Checked by: _____

1:05 HGL SPREADSHEETS FOR UNION BOULEVARD AND FAMILY PLACE STORM DRAINS

MANNINGS n = 0.013

PINE CREEK
UNION BOULEVARD STORM DRAIN
RCB CONNECTION SOUTH TO CHARITY DRIVE
HGL CALCULATION

10/22/2000

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
370.75	60	271																	
370.75	60	271	19.625	13.81	2604	0.011	0.00				0.00					0.00	6884.46	2.96	6881.50
374.49	60	271	19.625	13.81	2604	0.011	3.74				0.04		0.00			0.04	6884.50	2.96	6881.54
374.49	60	271	19.625	13.81	2604	0.011	0.00			0.35	0.00	1.04	0.00			1.04	6885.54	2.96	6882.58
550.00	60	271	19.625	13.81	2604	0.011	175.51				1.90	0.00	0.00			1.90	6887.44	2.96	6884.48
550.00	60	187	19.625	9.53	2604	0.005	0.00	42	45		0.00	0.00	0.73			0.73	6888.17	1.41	6886.76
672.48	60	187	19.625	9.53	2604	0.005	122.48				0.63	0.00	0.00			0.63	6888.80	1.41	6887.39
672.48	60	185	19.625	9.43	2604	0.005	0.00	30	45		0.00	0.00	0.03			0.03	6888.83	1.38	6887.45
678.24	60	185	19.625	9.43	2604	0.005	5.76				0.03	0.00	0.00			0.03	6888.86	1.38	6887.48
678.24	60	167	19.625	8.51	2604	0.004	0.00	15	45		0.00	0.00	-0.04			-0.04	6888.82	1.12	6887.69
1161.32	60	167	19.625	8.51	2604	0.004	483.08				1.99	0.00	0.00			1.99	6890.80	1.12	6889.68
1161.32	60	57	19.625	2.90	2604	0.000	0.00	42	45		0.00	0.00	-0.41			-0.41	6890.39	0.13	6890.26
1165.32	60	57	19.625	2.90	2604	0.000	4.00				0.00	0.00	0.00			0.00	6890.39	0.13	6890.26
1165.32	60	57	19.625	2.90	2604	0.000	0.00				0.00	0.00	0.00			0.00	6890.39	0.13	6890.26
1173.32	48	57	12.560	4.54	1435	0.002	8.00				0.01	0.00	0.00			0.01	6890.40	0.32	6890.08
1173.32	48	57	12.560	4.54	1435	0.002	0.00				0.00	0.00	0.00		0.06	0.06	6890.46	0.32	6890.14
1320.77	48	57	12.560	4.54	1435	0.002	147.45				0.23	0.00	0.00			0.23	6892.44	0.32	6892.12
1320.77	48	57	12.560	4.54	1435	0.002	0.00			0.35	0.00	0.11	0.00			0.11	6892.55	0.32	6892.23
1351.20	48	57	12.560	4.54	1435	0.002	30.43				0.05	0.00	0.00			0.05	6893.42	0.32	6893.10
1351.20	48	51	12.560	4.06	1435	0.001	0.00	48	45		0.00	0.00	0.06			0.06	6893.48	0.26	6893.22
1363.20	30	51	4.906	10.39	409	0.016	12.00				0.19	0.00	0.00			0.19	6895.17	1.68	6893.49
1363.20	30	51	4.906	10.39	409	0.016	0.00				0.00	0.00	0.00		0.06	0.06	6895.17	1.68	6893.49
1646.10	30	51	4.906	10.39	409	0.016	282.90				4.39	0.00	0.00			4.39	6899.41	1.68	6897.73
1646.10	30	51	4.906	10.39	409	0.016	0.00			0.2	0.00	0.34	0.00			0.34	6899.74	1.68	6898.07
1663.22	30	51	4.906	10.39	409	0.016	17.12				0.27	0.00	0.00			0.27	6901.62	1.68	6899.94
1663.22	30	17	4.906	3.46	409	0.002	0.00	30	45		0.00	0.00	0.44			0.44	6902.05	0.19	6901.87
1678.28	24	17	3.140	5.41	226	0.006	15.06				0.09	0.00	0.00			0.09	6902.14	0.46	6901.69
1678.28	24	17	3.140	5.41	226	0.006	0.00				0.00	0.00	0.00		0.2	0.20	6902.34	0.46	6901.89

NOTES:
IT IS ASSUMBED THAT THE WATER SURFACE AT THE OUTLET OF THE 5' DIA. RCP IN THE PROPOSED RCB IS NORMAL DEPTH IN THE RCB AT Q_{100} + 0.5' +/- THIS TURNED OUT TO BE EQUAL TO ASSUMING THAT THE HGL WOULD AT THE INSIDE CROWN OF THE PIPE AT THE 45 DEGREE BEND, STA. 3+74.49.

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN

LATERAL "A"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	42	87																	
0	42	87	9.616	9.05	1005	0.007	0.00				0.00		0.00			0.00	6888.17	1.27	6886.90
146.62	42	87	9.616	9.05	1005	0.007	146.62				1.10		0.00			1.10	6889.27	1.27	6888.00
146.62	42	58	9.616	6.03	1005	0.003	0.00	30	45		0.00	0.00	0.31			0.31	6889.58	0.56	6889.02
160.62	42	58	9.616	6.03	1005	0.003	14.00				0.05	0.00	0.00			0.05	6889.63	0.56	6889.06

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN

LATERAL "B"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	30	33																	
0	30	33	4.906	6.73	409	0.007	0.00				0.00		0.00			0.00	6889.58	0.70	6888.88
83	30	33	4.906	6.73	409	0.007	142.94				0.93		0.00			0.93	6890.51	0.70	6889.81
83	30	33	4.906	6.73	409	0.007	0.00				0.00	0.00	0.00		1.05	1.05	6891.56	0.70	6890.86

MANNINGS n = 0.009

UNION BOULEVARD STORM DRAIN

LATERAL "H"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	15	2.3																	
0	15	2.3	1.227	1.88	64	0.001	0.00				0.00		0.00			0.00	6888.82	0.05	6888.76
47.44	15	2.3	1.227	1.88	64	0.001	47.44				0.06		0.00			0.06	6888.88	0.05	6888.82
47.44	15	2.3	1.227	1.88	64	0.001	0.00				0.00	0.00	0.00		0.08	0.08	6888.96	0.05	6888.91

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN

LATERAL "C"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	30	30																	887.81
0	30	30	4.906	6.11	409	0.005	0.00				0.00		0.00			0.00	6888.83	0.58	6888.25
17.9	30	30	4.906	6.11	409	0.005	17.90				0.10		0.00			0.10	6888.92	0.58	6888.34
17.9	30	30	4.906	6.11	409	0.005	0.00				0.00	0.00	0.00		0.87	0.87	6889.80	0.58	6889.21

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN TO FAMILY PLACE

LATERAL "D"/FAMILY PLACE MAIN

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	ANSITIO LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	42	114																	
0	42	114	9.616	11.85	1005	0.013	0.00				0.00		0.00			0.00	6890.39	2.18	6888.21
36	42	114	9.616	11.85	1005	0.013	36.00				0.46		0.00			0.46	6890.85	2.18	6888.67
36	42	114	9.616	11.85	1005	0.013	0.00			0.45	0.00	0.98	0.00			0.98	6891.83	2.18	6889.65
94.55	42	114	9.616	11.85	1005	0.013	58.55				0.75		0.00			0.75	6892.59	2.18	6890.41
94.55	42	62	9.616	6.45	1005	0.004	0.00	36	45		0.00		0.66			0.66	6893.25	0.65	6892.61
172.64	42	62	9.616	6.45	1005	0.004	78.09				0.30	0.00	0.00			0.30	6893.55	0.65	6892.90
172.64	42	45	9.616	4.68	1005	0.002	0.00	24	45		0.00	0.00	0.10			0.10	6893.64	0.34	6893.30
184.64	42	45	9.616	4.68	1005	0.002	12.00				0.02	0.00	0.00			0.02	6893.67	0.34	6893.33
184.64	42	45	9.616	4.68	1005	0.002	0.00				0.00	0.00	0.00		0.05	0.05	6893.72	0.34	6893.38
192.64	30	45	4.906	9.17	409	0.012	20.00				0.24	0.00	0.00			0.24	6893.89	1.31	6892.58
192.64	30	45	4.906	9.17	409	0.012	0.00				0.00	0.00	0.00			0.00	6893.89	1.31	6892.58
207.64	30	45	4.906	9.17	409	0.012	15.00				0.18	0.00	0.00			0.18	6894.07	1.31	6892.76
450	30	45	4.906	9.17	409	0.012	242.36			0.1	2.93	0.13	0.00			3.06	6897.13	1.31	6895.82
616.13	30	45	4.906	9.17	409	0.012	166.13				2.01	0.00	0.00			2.01	6903.92	1.31	6902.61
616.13	30	36	4.906	7.34	409	0.008	0.00	18	45		0.00	0.00	0.27			0.27	6904.19	0.84	6903.35
624.13	30	36	4.906	7.34	409	0.008	8.00				0.06	0.00	0.00			0.06	6904.25	0.84	6903.41
624.13	30	23	4.906	4.69	409	0.003	0.00	18	45		0.00	0.00	0.07			0.07	6904.31	0.34	6903.97
726.72	30	23	4.906	4.69	409	0.003	102.59				0.32	0.00	0.00			0.32	6908.30	0.34	6907.96

MANNINGS n = 0.013

FAMILY PLACE STORM DRAIN

LATERAL "4"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	24	19																	
0	24	19	3.140	6.05	226	0.007	0.00				0.00		0.00			0.00	6893.64	0.57	6893.08
16.08	24	19	3.140	6.05	226	0.007	16.08				0.11		0.00			0.11	6893.76	0.57	6893.19
16.08	24	19	3.140	6.05	226	0.007	0.00				0.00	0.00	0.00		0.85	0.85	6894.61	0.57	6894.04

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN TO FAMILY PLACE

LATERAL "E"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	36	58																	
0	36	58	7.065	8.21	666	0.008	0.00				0.00		0.00			0.00	6893.25	1.05	6892.20
46.2	36	58	7.065	8.21	666	0.008	46.20				0.35		0.00			0.35	6893.60	1.05	6892.56
46.2	36	41	7.065	5.80	666	0.004	0.00	24	45		0.00	0.00	0.24			0.24	6893.84	0.52	6893.32
62.2	36	41	7.065	5.80	666	0.004	16.00				0.06		0.00			0.06	6893.90	0.52	6893.38

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN TO FAMILY PLACE

LATERAL "F"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	48	8																	
3.44	48	8	12.560	0.64	1435	0.000	3.44				0.00		0.00			0.00	6893.48	0.01	6893.47
12	18	8	1.766	4.53	105	0.006	8.56				0.05		0.00			0.05	6894.71	0.32	6894.39
12	18	8	1.766	4.53	105	0.006	0.00				0.00	0.00	0.00	0.06		0.06	6894.77	0.32	6894.45
21.43	18	8	1.766	4.53	105	0.006	9.43				0.06		0.00			0.06	6895.73	0.32	6895.41
21.43	18	8	1.766	4.53	105	0.006	0.00				0.00		0.00		0.48	0.48	6896.21	0.32	6895.89

MANNINGS n = 0.013

UNION BOULEVARD STORM DRAIN TO FAMILY PLACE

LATERAL "G"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	30	40																	
0	30	40	4.906	8.15	409	0.010	0.00				0.00		0.00			0.00	6902.05	1.03	6901.02
38.24	18	10	1.766	5.66	105	0.009	38.24				0.35		0.00			0.35	6902.40	0.50	6901.91

0.013

FAMILY PLACE STORM DRAIN

LATERAL "3"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	24	15																	
0	24	15	3.140	4.78	226	0.004	0.00				0.00		0.00			0.00	6893.84	0.35	6893.48
75.88	24	15	3.140	4.78	226	0.004	75.88				0.34		0.00			0.34	6894.17	0.35	6893.82
75.88	24	15	3.140	4.78	226	0.004	0.00				0.00	0.00	0.00		0.53	0.53	6894.71	0.35	6894.35
																		60.00	

0.013

FAMILY PLACE STORM DRAIN

LATERAL "5"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	18	9																	
0	18	9	1.766	5.10	105	0.007	0.00				0.00		0.00			0.00	6904.19	0.40	6903.78
44.47	18	9	1.766	5.10	105	0.007	44.47				0.33		0.00			0.33	6904.51	0.40	6904.11
44.47	18	9	1.766	5.10	105	0.007	0.00				0.00	0.00	0.00		0.60	0.60	6905.12	0.40	6904.72

0.013

FAMILY PLACE STORM DRAIN

LATERAL "6"

HGL CALCULATION

7/16/2001 15:02

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	JUNCTION DATA LATERAL SIZE (inches)	JUNCTION DATA LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	XPNSN LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
0	18	6																	
0	18	6	1.766	3.40	105	0.003	0.00				0.00		0.00			0.00	6904.31	0.18	6904.13
14.97	18	6	1.766	3.40	105	0.003	14.97				0.05		0.00			0.05	6904.36	0.18	6904.18
14.97	18	6	1.766	3.40	105	0.003	0.00				0.00	0.00	0.00		0.27	0.27	6904.63	0.18	6904.45

2:00 DRAINAGE BASINS TRIBUTARY TO PROPOSED AUSTIN BLUFFS PARKWAY STORM DRAIN TO INCLUDE TRIBUTARY SAGEWOOD BASINS

2:01 HYDROLOGIC BASIN CALCULATIONS: PS6-7 THROUGH PS6-12

2:02 COMPOSITE "CA" SPREADSHEETS; AP-A1 THROUGH AP-A9

2:03 ROUTING SPREADSHEETS: AP-A1 THROUGH AP-A9

2:04 INLET SPREADSHEETS: AP-A1, AP-A2, AP-A4 AND AP-A6

2:05 HGL SPREADSHEETS FOR AUSTIN BLUFFS PARKWAY STORM DRAIN

2:01 HYDROLOGIC BASIN CALCULATIONS: PS6-7 THROUGH PS6-12

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Sagewood, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-7	4.44	0.51	0.61	0.25	50	2.00	7.11	300	2.00%	4.95	1.01	9.97	4.07	7.08	9	19
(AP-A1)								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90					
														CA(equiv.)	2.26	2.71
PS6-8	2.23	0.61	0.68	0.25	80	2.00	10.51	700	1.50%	4.29	2.72	13.23	3.65	6.25	5	9
(AP-A6)														CA(equiv.)	1.36	1.52
PS6-9	2.30	0.52	0.62	0.25	100	2.00	12.65	400	2.00%	4.95	1.35	13.99	3.57	6.09	4	9
(AP-A3)														CA(equiv.)	1.20	1.43
PS6-10	0.86	0.57	0.65	0.25	40	2.00	5.91	400	2.00%	4.95	1.35	7.26	4.52	8.01	2	4
(AP-A4)														CA(equiv.)	0.49	0.56
PS6-11	1.15	0.61	0.70	0.25	50	1.00	8.94	360	2.00%	4.95	1.21	15.10	3.46	5.87	2	5
(AP-A5)				0.25	50	6.00	4.95									
														CA(equiv.)	0.70	0.81
PS6-11A	1.01	0.48	0.58	0.25	50	1.00	8.94	290	2.00%	4.95	0.98	12.23	3.77	6.48	2	4
(AP-A5)				0.25	20	6.00	2.31									
														CA(equiv.)	0.48	0.59
TOTAL	11.99															

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Briargate Pkwy, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-12 (AP-B10)	1.21	0.73	0.77	0.25	20	1.50	3.66	700	2.00%	4.95	2.36	6.01	4.77	8.55	4	8
														CA(equiv.)	0.88	0.93
PS6-13 (AP-B4)	2.41	0.69	0.75	0.25 0.90	50 50	1.00 1.50	8.94 1.84	500	3.20%	6.26	1.33	12.11	3.78	6.51	6	12
														CA(equiv.)	1.66	1.81
PS6-13A (AP-B5)	5.20	0.75	0.80	0.25 0.90	50 75	5.00 1.50	5.26 2.58	600	2.00%	4.95	2.02	9.85	4.09	7.12	16	30
														CA(equiv.)	3.90	4.16
PS6-14 (AP-B2)	1.93	0.84	0.90	0.25 0.90	10 100	0.30 2.00	3.50 2.98	700	2.60%	5.64	2.07	8.54	4.29	7.54	7	13
														CA(equiv.)	1.62	1.74
PS6-15 (AP-B6)	0.32	0.74	0.80	0.25 0.90	20 50	0.50 1.00	5.25 2.10	250	2.00%	4.95	0.84	8.20	4.35	7.66	1	2
														CA(equiv.)	0.24	0.26
PS6-16 (AP-B1)	4.67	0.70	0.80	0.25 0.90	30 50	4.00 3.00	3.70 1.46	700	2.00%	4.95	2.36	7.52	4.47	7.91	15	30
														CA(equiv.)	3.27	3.74
TOTAL	14.53															

mddp-basins 5/30/2001

2:02 COMPOSITE "CA" SPREADSHEETS; AP-A1 THROUGH AP-A9

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, SAGEWOOD, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-S1 EXIST'G SMP INLET	PS6-1	4.5	2.61	3.06		
	TOTAL	4.5			2.61	3.06
AP-S2 PIPE	PS6-1	4.5	2.61	3.06		
	PS6-2	1.8	1.15	1.28		
	TOTAL	6.3			3.76	4.34
AP-A1 EX. INLET	PS6-7	4.44	2.26	2.71		
	TOTAL	4.44			2.26	2.71
AP-A2 EX. INLET	PS6-6	5.04	2.37	2.82		
	PS6-9	2.3	1.20	1.43		
	PS6-10	0.86	0.49	0.56		
	TOTAL	8.2			4.06	4.81
AP-A3 PIPE	INLET-A1		1.52	1.30		
	INLET-A2		2.06	1.62		
	TOTAL				3.58	2.92
AP-A4 INLET	PS6-11A	1.01	0.48	0.59		
	PS6-8	2.23	1.36	1.52		
	FLBY A1		0.74	1.41		
	FLBY A2		2.00	3.19		
	TOTAL	3.24			4.58	6.71
AP-A5 PIPE	AP-A3		3.58	2.92		
	INLET A4		2.87	2.81		
	TOTAL	0			6.45	5.73
AP-A6 INLET	PS6-11	1.15	0.7	0.81		
	FLBY A4		1.71	3.90		
	TOTAL				2.41	4.71

COMP-UNION 6/6/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, AUSTIN BLUFFS, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-A7	INLET-A6		1.71	2.38		
PIPE	AP-A5		6.45	5.73		
	TOTAL				8.16	8.11
AP-A8	AP-A7		8.16	8.11		
PIPE	AP-B9B		2.46	1.91		
	TOTAL				10.62	10.02
AP-A9	AP-A8		10.62	10.02		
PIPE	AP-B8B		4.56	3.42		
TO RCB						
	TOTAL				15.18	13.44

COMP-UNION 6/6/2001

2:03 ROUTING SPREADSHEETS: AP-A1 THROUGH AP-A9

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, SAGEWOOD/ AUSTIN BLUFFS PKWY, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100)	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-S1 EXIST'G SUMP INLET	4.50	2.61	3.06	0.25	50	2.00	7.11	300 530	1.00% 4.00%	3.50 7.00	1.43 1.26	9.80	4.09	7.13	11	22
AP-S2 PIPE	6.30	3.76	4.34	0.25	50	2.00	7.11	300 530	1.00% 4.00%	3.50 7.00	1.43 1.26	9.80	4.09	7.13	15	31
AP-A1 EXIST'G INLET	4.44	2.26	2.71	0.25	50	2.00	7.11	300 200 400	2.00% 1.00% 4.50%	4.95 3.50 7.42	1.01 0.95 0.90	9.97	4.07	7.08	9	19
AP-A2 EXIST'G INLET	8.20	4.06	4.81	0.25	180	3.00	18.02	300 200 400	3.60% 1.00% 4.50%	6.64 3.50 7.42	0.75 0.95 0.90	20.62	3.00	5.01	12	24
AP-A3 PIPE		3.58	2.92	0.25	180	3.00	18.02	300 200 400	3.60% 1.00% 4.50%	6.64 3.50 7.42	0.75 0.95 0.90	20.62	3.00	5.01	11	15
AP-A4 INLET		4.58	6.71	0.25	180	3.00	18.02	300 200 400 310	3.60% 1.00% 4.50% 2.00%	6.64 3.50 7.42 4.95	0.75 0.95 0.90 1.04	21.66	2.93	4.87	13	33
AP-A5 PIPE		6.45	5.73	0.25	180	3.00	18.02	300 200 400 300	3.60% 1.00% 4.50% 2.00%	6.64 3.50 7.42 4.95	0.75 0.95 0.90 1.01	21.63	2.94	4.88	19	28

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, AUSTIN BLUFFS, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	OVERLAND/POND OUTFLOW Length (ft)	OVERLAND/POND OUTFLOW Height (ft)	OVERLAND/POND OUTFLOW Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	STREET / CHANNEL/ PIPE Slope (%)	STREET / CHANNEL/ PIPE Velocity (fps)	STREET / CHANNEL/ PIPE Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-A6 INLET		2.41	4.71	0.25	180	3.00	18.02	300	3.60%	6.64	0.75	22.98	2.85	4.72	7	22
								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90					
								700	2.00%	4.95	2.36					
AP-A7 PIPE		8.16	8.11	0.25	180	3.00	18.02	300	3.60%	6.64	0.75	23.04	2.84	4.71	23	38
								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90					
								720	2.00%	4.95	2.42					
AP-A8 PIPE		10.62	10.02	0.25	180	3.00	18.02	300	3.60%	6.64	0.75	23.31	2.83	4.68	30	47
								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90					
								800	2.00%	4.95	2.69					
AP-A9 PIPE TO RCB		15.18	13.44	0.25	180	3.00	18.02	300	3.60%	6.64	0.75	23.48	2.82	4.66	43	63
								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90					
								850	2.00%	4.95	2.86					

RTGUNION 6/6/2001

2:04 INLET SPREADSHEETS: AP-A1, AP-A2, AP-A4 AND AP-A6

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Existing 14' Inlet Family Place, AP-A1

100-YR. FLOW					
Q(100)	19	I(100)	7.1		
DEPTH	0.41	Fr	2.38	Inlet size ? L(i) =	14
SPREAD	16.3	L(1)	29.7	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	17.9	If Li > L(2) then Qi =	10
STREET SLOPE	3.2%	L(3)	63.7	FB =	10
				CA(eqv.)=	1.41

5-YR. FLOW					
Q(5)	9	I(5)	4.1		
DEPTH	0.33	Fr	2.25	Inlet size ? L(i) =	14
SPREAD	12.3	L(1)	21.2	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	12.7	If Li > L(2) then Qi =	6
STREET SLOPE	3.2%	L(3)	45.5	FB =	3
				CA(eqv.)=	0.74

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

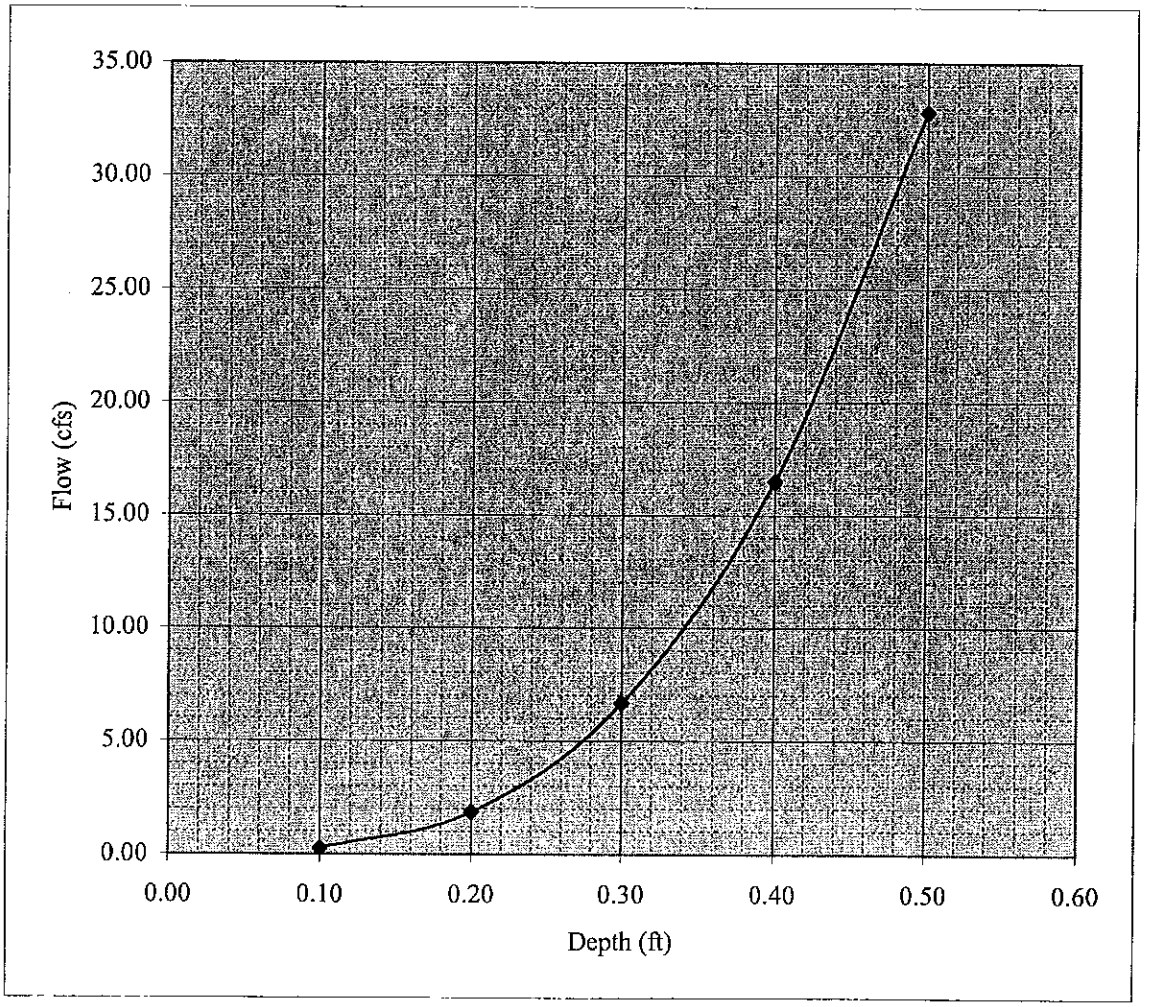
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.032 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.27
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.84
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.66
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		16.49
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		32.81



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Existing 12' Inlet Family Place, AP-A2

100-YR. FLOW

Q(100)	24	I(100)	5.0		
DEPTH	0.45	Fr	2.43	Inlet size ? L(i) =	12
SPREAD	18.3	L(1)	34.1	If Li < L(2) then Qi =	8
CROSS SLOPE	2.0%	L(2)	20.5	If Li > L(2) then Qi =	12
STREET SLOPE	3.2%	L(3)	73.1	FB =	16
				CA(eqv.)=	3.19

5-YR. FLOW

Q(5)	12	I(5)	3.0		
DEPTH	0.36	Fr	2.30	Inlet size ? L(i) =	12
SPREAD	13.8	L(1)	24.4	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	14.6	If Li > L(2) then Qi =	7
STREET SLOPE	3.2%	L(3)	52.2	FB =	6
				CA(eqv.)=	2.00

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

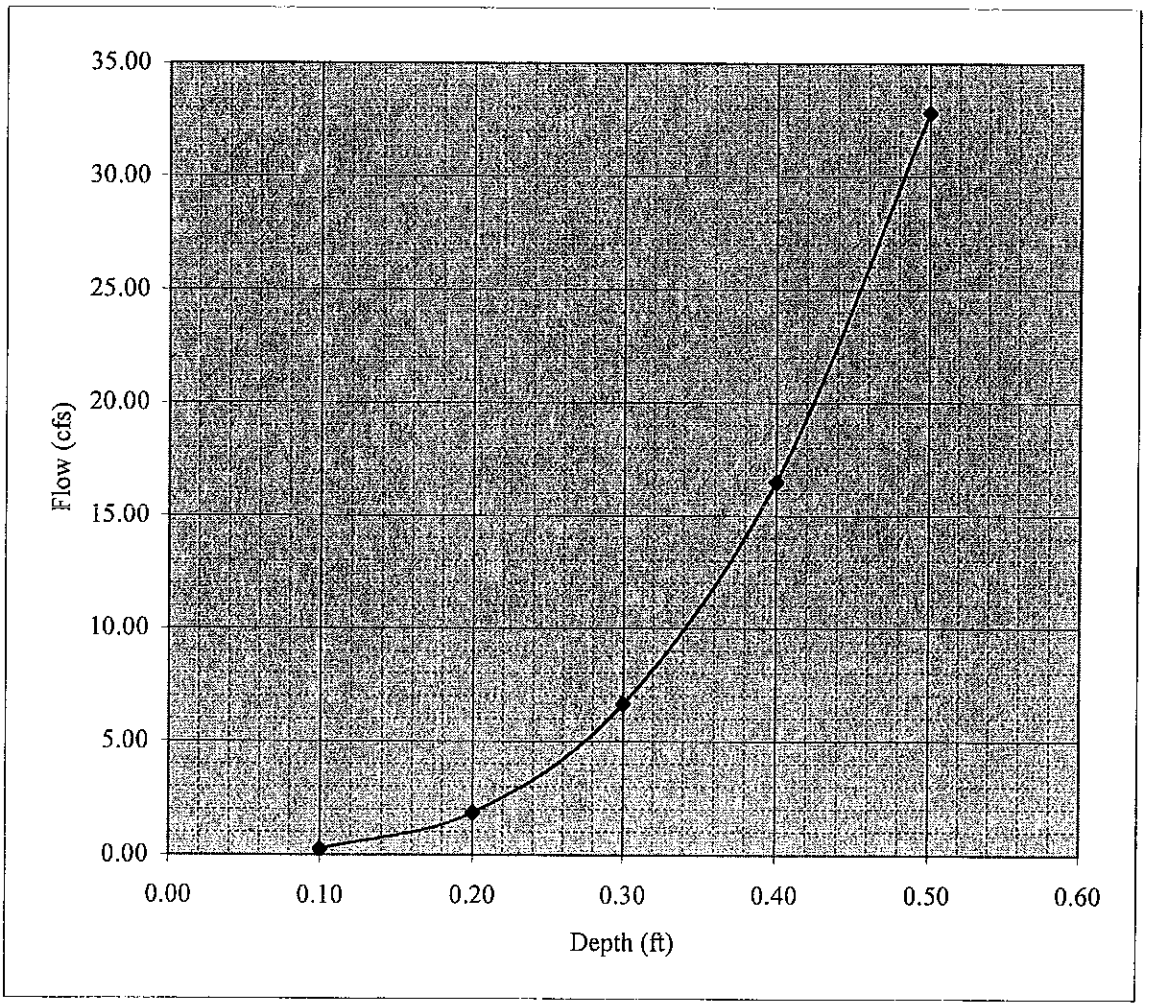
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.032 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.27
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.84
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.66
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		16.49
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		32.81



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

16' Inlet Austin Bluffs Pkwy, AP-A4

100-YR. FLOW					
Q(100)	33	I(100)	4.9		
DEPTH	0.58	Fr	2.03	Inlet size ? L(i) =	16
SPREAD	24.8	L(1)	38.7	If Li < L(2) then Qi =	14
CROSS SLOPE	2.0%	L(2)	23.2	If Li > L(2) then Qi =	17
STREET SLOPE	2.0%	L(3)	82.9	FB =	19
				CA(eqv.)=	3.90

5-YR. FLOW					
Q(5)	13	I(5)	2.9		
DEPTH	0.40	Fr	1.87	Inlet size ? L(i) =	16
SPREAD	15.8	L(1)	22.6	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	13.6	If Li > L(2) then Qi =	8
STREET SLOPE	2.0%	L(3)	48.5	FB =	5
				CA(eqv.)=	1.71

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

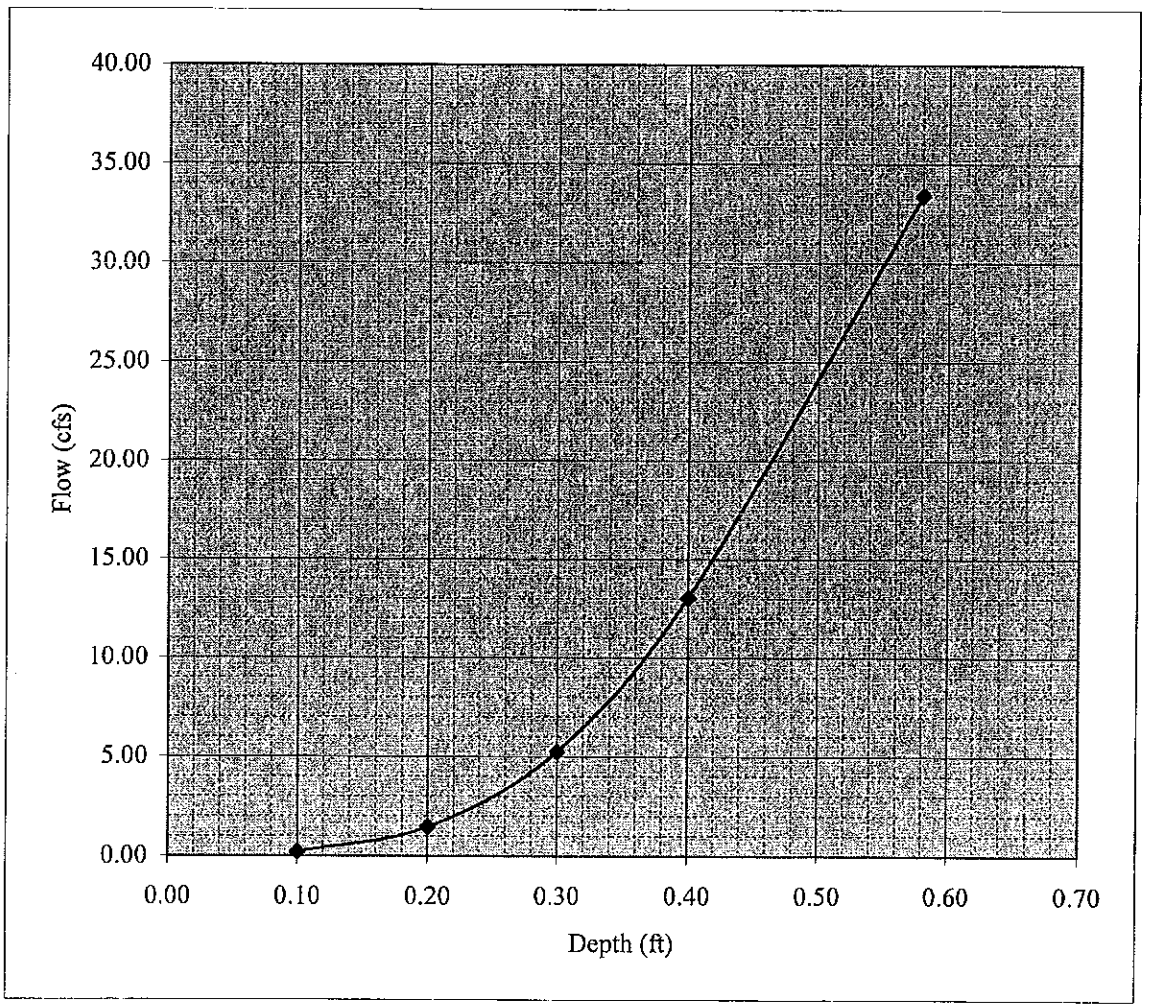
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.46
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.26
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.04
0.58	$0.37^{8/3}$	$0.58^{8/3} - 0.37^{8/3}$		33.39



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

14' Inlet Austin Bluffs Pkwy, AP-A6

100-YR. FLOW					
Q(100)	22	I(100)	4.7		
DEPTH	0.47	Fr	1.94	Inlet size ? L(i) =	14
SPREAD	19.3	L(1)	28.7	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	17.3	If Li > L(2) then Qi =	12
STREET SLOPE	2.0%	L(3)	61.6	FB =	11
				CA(eqv.)=	2.33

5-YR. FLOW					
Q(5)	7	I(5)	2.9		
DEPTH	0.33	Fr	1.78	Inlet size ? L(i) =	14
SPREAD	12.3	L(1)	16.8	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	10.1	If Li > L(2) then Qi =	5
STREET SLOPE	2.0%	L(3)	35.9	FB =	2
				CA(eqv.)=	0.70

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

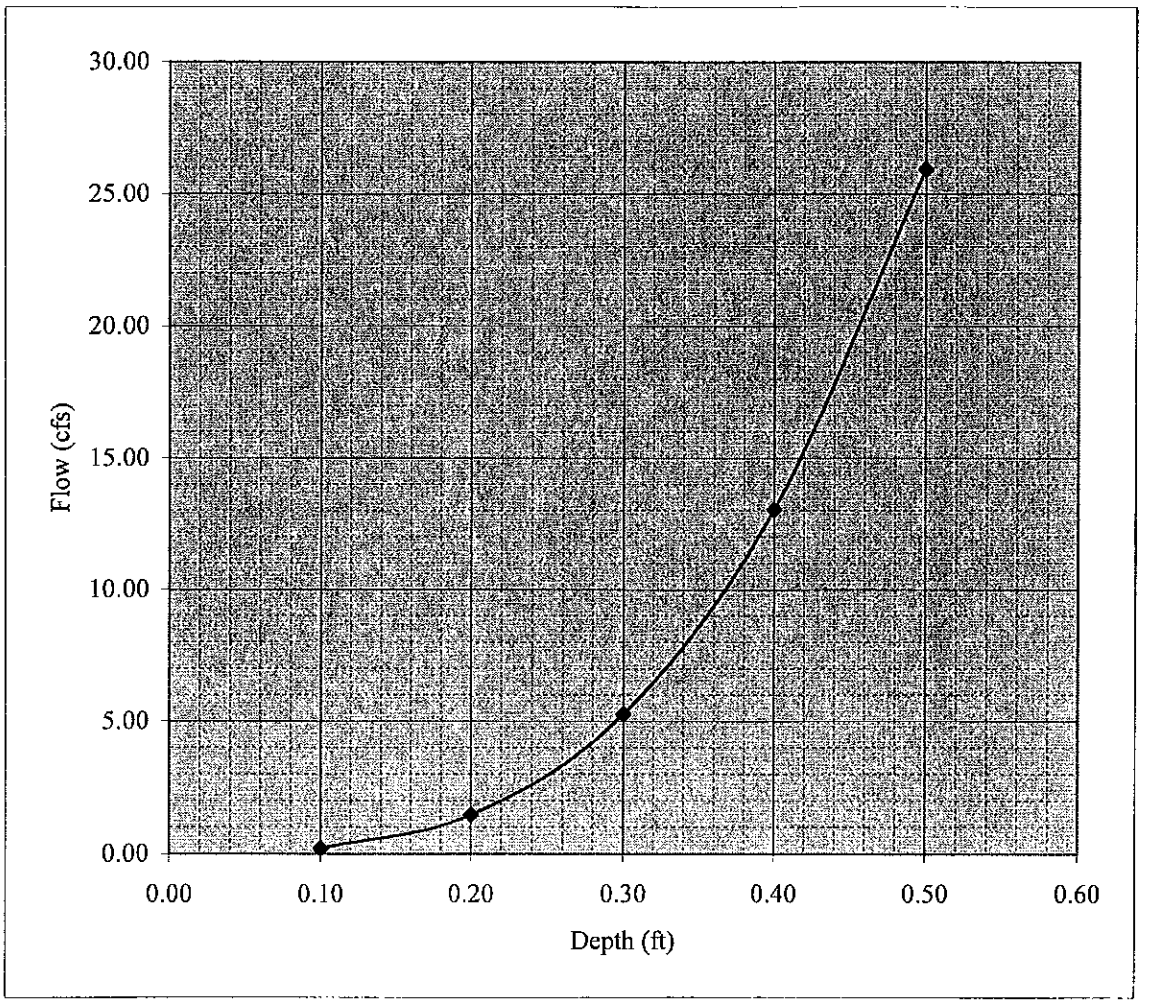
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.46
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.26
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.04
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		25.94



2:05 HGL SPREADSHEETS FOR AUSTIN BLUFFS PARKWAY STORM DRAIN

MANNINGS n = 0.013

BRIARGATE PARKWAY-AUSTING BLUFF PARKWAY

LATERAL L - AUSTING BLUFFS MAIN

HGL CALCULATION

7/16/01 12:25

3.13

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND/R LOSS K	FRICTION LOSS (ft)	D/REDU LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	36	63																	6933.17
100		36	63	7.065	8.92	666	0.009	0.00				0.00					0.00	6934.40	1.23	6933.17
113.83		36	63	7.065	8.92	666	0.009	13.83				0.12	0.00	0.00			0.12	6934.53	1.23	6933.29
113.83	36X36WY	36	47	7.065	6.65	666	0.005	0.00	36	45		0.00	0.00	0.43			0.43	6934.96	0.69	6934.28
202.22		36	47	7.065	6.65	666	0.005	88.39				0.44	0.00	0.00			0.44	6935.40	0.69	6934.72
202.22	30X24WY	36	38	7.065	5.38	666	0.003	0.00	24	45		0.00	0.00	0.16			0.16	6935.56	0.45	6935.11
208.55		36	38	7.065	5.38	666	0.003	6.33				0.02	0.00	0.00			0.02	6935.58	0.45	6935.13
208.55	BEG RED	36	38	7.065	5.38	666	0.003	0.00			0.35	0.00	0.16	0.00			0.16	6935.74	0.45	6935.29
216.55		30	38	4.906	7.75	409	0.009	8.00				0.07	0.00	0.00			0.07	6935.81	0.93	6934.88
216.55	END RED	30	38	4.906	7.75	409	0.009	0.00				0.00	0.00	0.00			0.00	6935.81	0.93	6934.88
290.07		30	38	4.906	7.75	409	0.009	73.52				0.63	0.00	0.00			0.63	6936.44	0.93	6935.51
290.07	END PLUG	30	38	4.906	7.75	409	0.009	0.00				0.00	0.00	0.00			0.00	6936.44	0.93	6935.51
294.07		30	38	4.906	7.75	409	0.009	4.00				0.03	0.00	0.00			0.03	6936.48	0.93	6935.55
294.07	30X18WY	30	28	4.906	5.71	409	0.005	0.00	18	45		0.00	0.00	0.17			0.17	6936.65	0.51	6936.14
315.99		30	28	4.906	5.71	409	0.005	21.92				0.10	0.00	0.00			0.10	6936.75	0.51	6936.25
315.99	REDUCER	30	28	4.906	5.71	409	0.005	0.00			0.35	0.00	0.18	0.00			0.18	6936.93	0.51	6936.42
347.99		24	28	3.140	8.92	226	0.015	32.00				0.49	0.00	0.00			0.49	6937.42	1.23	6936.19
347.99	V-BEND	24	28	3.140	8.92	226	0.015	0.00			0.35	0.00	0.43	0.00			0.43	6937.85	1.23	6936.62
686.16		24	28	3.140	8.92	226	0.015	338.17				5.21	0.00	0.00			5.21	6943.07	1.23	6941.83
686.16	INLET OU	24	28	3.140	8.92	226	0.015	0.00				0.00	0.00	0.00		1.4817	1.48	6944.55	1.23	6943.31
702.16		24	15	3.140	4.78	226	0.004	16.00				0.07	0.00	0.00			0.07	6944.62	0.35	6944.27
702.16	INLET IN	24	15	3.140	4.78	226	0.004	0.00				0.00	0.00	0.00			0.00	6944.62	0.35	6944.27
783.52		24	15	3.140	4.78	226	0.004	81.36				0.36	0.00	0.00			0.36	6944.98	0.35	6944.63
954.96		24	15	3.140	4.78	226	0.004	171.44				0.76	0.00	0.00			0.76	6950.10	0.35	6949.75
954.96	45-BEND	24	15	3.140	4.78	226	0.004	0.00			0.35	0.00	0.12	0.00			0.12	6950.23	0.35	6949.87
960.12		24	15	3.140	4.78	226	0.004	5.16				0.02	0.00	0.00			0.02	6950.25	0.35	6949.90
1012.83		24	15	3.140	4.78	226	0.004	52.71				0.23	0.00	0.00			0.23	6951.83	0.35	6951.48
1012.83	45-BEND	24	15	3.140	4.78	226	0.004	0.00			0.35	0.00	0.12	0.00			0.12	6951.96	0.35	6951.60
1016.83		24	15	3.140	4.78	226	0.004	4.00				0.02	0.00	0.00			0.02	6951.98	0.35	6951.62
1016.83	INLET	24	15	3.140	4.78	226	0.004	0.00				0.00	0.00	0.00		0.5315	0.53	6952.51	0.35	6952.15

* HGL @ BEGINNING COMES FROM DEPTH + ELEV @ STORM BOX STA 23+01.87 AND THE EGL COMES FROM THE HGL

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL L3
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	11			*														
100		18	11	1.766	6.23	105	0.011	0.00				0.00					0.00	6936.65	0.60	6936.05
108		18	11	1.766	6.23	105	0.011	8.00				0.09					0.09	6936.74	0.60	6936.14
108	BEND	18	11	1.766	6.23	105	0.011	0.00			0.35	0.00	0.21				0.21	6936.95	0.60	6936.35
146.21		18	11	1.766	6.23	105	0.011	38.21				0.42					0.42	6937.37	0.60	6936.77
163		18	11	1.766	6.23	105	0.011	16.79				0.19					0.19	6938.85	0.60	6938.25
163	INLET	18	11	1.766	6.23	105	0.011	0.00				0.00				0.90	0.90	6939.76	0.60	6939.15

* BEGINNING EGL COMES FROM LAT L STA 278

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL N
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	30	31																	
100		30	31	4.906	6.32	409	0.006	0.00				0.00					0.00	6965.28	0.62	6964.66
162.35		30	31	4.906	6.32	409	0.006	62.35				0.36					0.36	6965.64	0.62	6965.02
162.35	BEND	30	31	4.906	6.32	409	0.006	0.00			0.35	0.00	0.22				0.22	6965.85	0.62	6965.23
276.66		30	31	4.906	6.32	409	0.006	114.31				0.66					0.66	6966.51	0.62	6965.89
276.66	END	30	31	4.906	6.32	409	0.006	0.00				0.00					0.00	6966.51	0.62	6965.89

* BEGINNING EGL COMES FROM ST MAIN STA 34+31

3:00 DRAINAGE BASINS TRIBUTARY TO PROPOSED BRIARGATE PARKWAY STORM DRAIN FROM PROPOSED EASTERLY TEMPORARY TERMINATION POINT WEST TO THE JUNCTION WITH AUSTIN BLUFFS PARKWAY STORM DRAINS, NOT INCLUDING BASINS NORTH OF PROPOSED BRIARGATE PARKWAY EXCEPT FOR BASIN PS6-13A

3:01 HYDROLOGIC BASIN CALCULATIONS: PS6-1 THROUGH PS6-6; PS6-13 THROUGH PS6-16

3:02 COMPOSITE "CA" SPREADSHEETS: AP-B1 THROUGH AP-B9B; AP-S1 AND AP-S2

3:03 ROUTING SPREADSHEETS: AP-B1 THROUGH AP-B9B; AP-S1 AND AP-S2

3:04 INLET SPREADSHEETS: AP-B2, AP-B4, AP-B6, AP-B8, AP-B8A, AP-B9 AND AP-B9A

3:05 HGL SPREADSHEETS FOR BRIARGATE PARKWAY STORM DRAIN EAST OF JUNCTION WITH PROPOSED AUSTIN BLUFFS PARKWAY

3:00 DRAINAGE BASINS TRIBUTARY TO PROPOSED BRIARGATE PARKWAY STORM DRAIN FROM PROPOSED EASTERLY TEMPORARY TERMINATION POINT WEST TO THE JUNCTION WITH AUSTIN BLUFFS PARKWAY STORM DRAINS, NOT INCLUDING BASINS NORTH OF PROPOSED BRIARGATE PARKWAY EXCEPT FOR BASIN PS6-13A

3:01 HYDROLOGIC BASIN CALCULATIONS: PS6-1 THROUGH PS6-6; PS6-13 THROUGH PS6-16

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Sagewood, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-1 (AP-S1)	4.50	0.58	0.68	0.25	50	2.00	7.11	300	1.00%	3.50	1.43	9.80	4.09	7.13	**11**	**22**
								530	4.00%	7.00	1.26			CA(equiv.)	**2.61**	**3.06**
PS6-2 (AP-S2)	1.80	0.64	0.71	0.25	50	2.00	7.11	300	1.00%	3.50	1.43	9.80	4.09	7.13	**5**	**9**
								530	4.00%	7.00	1.26			CA(equiv.)	**1.15**	**1.28**
PS6-3 (AP-B9)	7.41	0.53	0.61	0.25	50	3.00	6.22	1300	2.60%	5.64	3.84	15.78	3.39	5.75	**13**	**26**
				0.25	50	16.00	3.58									
				0.90	60	1.50	2.14							CA(equiv.)	**3.93**	**4.52**
PS6-4	not	used														
PS6-5 (AP-B4)	5.72	0.55	0.65	0.25	75	3.00	8.71	1300	2.60%	5.64	3.84	12.55	3.73	6.41	**12**	**24**
														CA(equiv.)	**3.15**	**3.72**
PS6-6 (AP-A2)	5.04	0.47	0.56	0.25	180	3.00	18.02	300	3.60%	6.64	0.75	20.62	3.00	5.01	**7**	**14**
								200	1.00%	3.50	0.95					
								400	4.50%	7.42	0.90			CA(equiv.)	**2.37**	**2.82**
TOTAL	24.47															

mddp-basins 6/1/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Briargate Pkwy, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-12 (AP-B10)	1.21	0.73	0.77	0.25	20	1.50	3.66	700	2.00%	4.95	2.36	6.01	4.77	8.55	4	8
														CA(equiv.)	0.88	0.93
PS6-13 (AP-B4)	2.41	0.69	0.75	0.25 0.90	50 50	1.00 1.50	8.94 1.84	500	3.20%	6.26	1.33	12.11	3.78	6.51	6	12
														CA(equiv.)	1.66	1.81
PS6-13A (AP-B5)	5.20	0.75	0.80	0.25 0.90	50 75	5.00 1.50	5.26 2.58	600	2.00%	4.95	2.02	9.85	4.09	7.12	16	30
														CA(equiv.)	3.90	4.16
PS6-14 (AP-B2)	1.93	0.84	0.90	0.25 0.90	10 100	0.30 2.00	3.50 2.98	700	2.60%	5.64	2.07	8.54	4.29	7.54	7	13
														CA(equiv.)	1.62	1.74
PS6-15 (AP-B6)	0.32	0.74	0.80	0.25 0.90	20 50	0.50 1.00	5.25 2.10	250	2.00%	4.95	0.84	8.20	4.35	7.66	1	2
														CA(equiv.)	0.24	0.26
PS6-16 (AP-B1)	4.67	0.70	0.80	0.25 0.90	30 50	4.00 3.00	3.70 1.46	700	2.00%	4.95	2.36	7.52	4.47	7.91	15	30
														CA(equiv.)	3.27	3.74
TOTAL	14.53															

mddp-basins 5/30/2001

3:02 COMPOSITE "CA" SPREADSHEETS: AP-B1 THROUGH AP-B9B; AP-S1 AND AP-S2

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, SAGEWOOD, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-S1 EXIST'G SMP INLET	PS6-1	4.5	2.61	3.06		
	TOTAL	4.5			2.61	3.06
AP-S2 PIPE	PS6-1	4.5	2.61	3.06		
	PS6-2	1.8	1.15	1.28		
	TOTAL	6.3			3.76	4.34
AP-A1 EX. INLET	PS6-7	4.44	2.26	2.71		
	TOTAL	4.44			2.26	2.71
AP-A2 EX. INLET	PS6-6	5.04	2.37	2.82		
	PS6-9	2.3	1.20	1.43		
	PS6-10	0.86	0.49	0.56		
	TOTAL	8.2			4.06	4.81
AP-A3 PIPE	INLET-A1		1.52	1.30		
	INLET-A2		2.06	1.62		
	TOTAL				3.58	2.92
AP-A4 INLET	PS6-11A	1.01	0.48	0.59		
	PS6-8	2.23	1.36	1.52		
	FLBY A1		0.74	1.41		
	FLBY A2		2.00	3.19		
	TOTAL	3.24			4.58	6.71
AP-A5 PIPE	AP-A3		3.58	2.92		
	INLET A4		2.87	2.81		
	TOTAL	0			6.45	5.73
AP-A6 INLET	PS6-11	1.15	0.7	0.81		
	FLBY A4		1.71	3.90		
	TOTAL				2.41	4.71

UNION/ BRIARGATE

MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, BRIARGATE PKWY, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-B1 STUB	PS6-16	4.67	3.27	3.74		
	TOTAL	4.67			3.27	3.74
AP-B2 INLET	PS6-14	1.93	1.62	1.74		
	TOTAL	1.93			1.62	1.74
AP-B3	PS6-16	4.67	3.27	3.74		
	INLET B2		0.66	0.93		
	TOTAL	4.67			3.93	4.67
AP-B4	PS6-13	2.41	1.66	1.81		
	TOTAL	2.41			1.66	1.81
AP-B5	PS6-13A	5.2	3.90	4.16		
	TOTAL	5.2			3.90	4.16
AP-B6	PS6-15	0.32	0.24	0.26		
	TOTAL	0.32			0.24	0.26
AP-B7	INLET B6		0.24	0.13		
	AP-B5	5.2	3.90	4.16		
	INLET B4		1.05	0.77		
	TOTAL	5.2			5.19	5.06
AP-B8 INLET	PS6-5	5.72	3.15	3.72		
	FLBY B2		1.63	1.86		
	FLBY B4		1.59	2.00		
	FLBY B6		0.00	0.13		
	TOTAL				6.37	7.71
AP-B8A INLET	FLBY B8		3.61	5.71		
	TOTAL				3.61	5.71
AP-B8B PIPE	INLET B8		2.76	2.00		
	INLET B8A		1.80	1.42		
	TOTAL				4.56	3.42

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, BRIARGATE PKWY, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-B9	PS6-3	7.41	3.93	4.52		
INLET						
	TOTAL	7.41			3.93	4.52
AP-B9A	FLBY B9		2.65	3.48		
INLET						
	TOTAL				2.65	3.48
AP-B9B	INLET B9		1.28	1.04		
PIPE	INLET B9A		1.18	0.87		
	TOTAL	0			2.46	1.91
AP-B10	PS8-21	2.88	1.76	1.96		
INLET	FLBY A6		0.70	2.33		
	PS6-12	1.21	0.88	0.93		
	TOTAL	4.09			3.34	5.22
AP-B10A	AP-P3	6.84	6.11	6.18		
PIPE	INLET-B10		2.26	1.86		
	TOTAL	6.84			8.37	8.04
AP-B10B	PS8-22	3.17	2.16	2.38		
INLET						
	TOTAL				2.16	2.38
AP-B10C	AP-B10A		8.37	8.04		
PIPE	INLET-B10B		0.89	0.92		
	TOTAL				9.26	8.96
AP-B11	PS8-20	1.68	1.08	1.18		
INLET	FLBY B10B		1.27	1.46		
	TOTAL	1.68			2.35	2.64
AP-B11A	FLBY B11		1.07	1.56		
INLET						
	TOTAL				1.07	1.56
AP-B11B	INLET-B11		1.28	1.08		
PIPE	INLET-B11A		0.54	0.47		
	TOTAL				1.82	1.55
AP-B12	FLBY		1.18	3.36		
INLET	PS8-13		1.09	1.21		
	TOTAL				2.27	4.57

3:03 ROUTING SPREADSHEETS: AP-B1 THROUGH AP-B9B; AP-S1 AND AP-S2

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, BRIARGATE PKWY, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	OVERLAND/POND OUTFLOW Length (ft)	OVERLAND/POND OUTFLOW Height (ft)	OVERLAND/POND OUTFLOW Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	STREET / CHANNEL/ PIPE Slope (%)	STREET / CHANNEL/ PIPE Velocity (fps)	STREET / CHANNEL/ PIPE Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-B1	4.67	3.27	3.74	0.25	30	4.00	3.70	700	2.00%	4.95	2.36	7.52	4.47	7.91	15	30
PS6-16				0.90	50	3.00	1.46									
AP-B2	1.93	1.62	1.74	0.25	10	0.30	3.50	700	2.60%	5.64	2.07	8.55	4.29	7.54	7	13
PS6-14				0.90	100	2.00	2.98									
INLET																
AP-B3	4.67	3.93	4.67	0.25	30	4.00	3.70	700	2.00%	4.95	2.36	8.00	4.38	7.73	17	36
PIPE				0.90	50	3.00	1.46	100	1.00%	3.50	0.48					
AP-B4	2.41	1.66	1.81	0.25	50	1.00	8.94	500	2.60%	5.64	1.48	12.26	3.77	6.48	6	12
PS6-13				0.90	50	1.50	1.84									
INLET																
AP-B5	5.20	3.90	4.16	0.25	50	5.00	5.26	600	2.00%	4.95	2.02	9.85	4.09	7.12	16	30
PS6-13A				0.90	75	1.50	2.58									
STUB																
AP-B6	0.32	0.24	0.26	0.25	30	4.00	3.70	700	2.00%	4.95	2.36	7.52	4.47	7.91	1	2
PS6-15				0.90	50	3.00	1.46									
INLET																
AP-B7	5.20	5.19	5.06	0.25	50	5.00	5.26	600	2.00%	4.95	2.02	10.36	4.01	6.97	21	35
PIPE				0.90	75	1.50	2.58	150	2.00%	4.95	0.51					
AP-B8	5.72	6.37	7.71	0.25	50	1.00	8.94	500	2.60%	5.64	1.48	16.65	3.32	5.60	21	43
INLET				0.90	50	1.50	1.84	1400	2.30%	5.31	4.40					

RTGUNION 6/26/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, BRIARGATE PKWY, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
AP-B8A		3.61	5.71	0.25	50	1.00	8.94	500	2.60%	5.64	1.48	16.65	3.32	5.60	12	32
INLET				0.90	50	1.50	1.84	1400	2.30%	5.31	4.40					
AP-B8B		4.56	3.42	0.25	50	1.00	8.94	500	2.60%	5.64	1.48	16.65	3.32	5.60	15	19
PIPE				0.90	50	1.50	1.84	1400	2.30%	5.31	4.40					
AP-B9	7.41	3.93	4.52	0.25	50	3.00	6.22	1300	2.60%	5.64	3.84	15.78	3.39	5.75	13	26
INLET				0.25	50	16.00	3.58									
PS6-3				0.90	60	1.50	2.14									
AP-B9A		2.65	3.48	0.25	50	3.00	6.22	1300	2.60%	5.64	3.84	15.78	3.39	5.75	9	20
INLET				0.25	50	16.00	3.58									
FLBY B9				0.90	60	1.50	2.14									
AP-B9B		2.46	1.91	0.25	50	3.00	6.22	1300	2.60%	5.64	3.84	15.78	3.39	5.75	8	11
PIPE				0.25	50	16.00	3.58									
				0.90	60	1.50	2.14									

RTGUNION 6/6/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, SAGEWOOD/ AUSTIN BLUFFS PKWY, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	OVERLAND/POND OUTFLOW Length (ft)	OVERLAND/POND OUTFLOW Height (ft)	OVERLAND/POND OUTFLOW Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	STREET / CHANNEL/ PIPE Slope (%)	STREET / CHANNEL/ PIPE Velocity (fps)	STREET / CHANNEL/ PIPE Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP-S1 EXIST'G SUMP INLET	4.50	2.61	3.06	0.25	50	2.00	7.11	300 530	1.00% 4.00%	3.50 7.00	1.43 1.26	9.80	4.09	7.13	**11**	**22**
AP-S2 PIPE	6.30	3.76	4.34	0.25	50	2.00	7.11	300 530	1.00% 4.00%	3.50 7.00	1.43 1.26	9.80	4.09	7.13	**15**	**31**

3:04 INLET SPREADSHEETS: AP-B2, AP-B4, AP-B6, AP-B8, AP-B8A, AP-B9 AND AP-B9A

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

8' Inlet Briargate Pkwy, AP-B2

100-YR. FLOW					
Q(100)	19	I(100)	7.5		
DEPTH	0.44	Fr	2.05	Inlet size ? L(i) =	8
SPREAD	17.8	L(1)	28.0	If Li < L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	16.8	If Li > L(2) then Qi =	8
STREET SLOPE	2.3%	L(3)	60.0	FB =	14
				CA(eqv.)=	1.86

5-YR. FLOW					
Q(5)	11	I(5)	4.3		
DEPTH	0.37	Fr	1.96	Inlet size ? L(i) =	8
SPREAD	14.3	L(1)	21.6	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	12.9	If Li > L(2) then Qi =	5
STREET SLOPE	2.3%	L(3)	46.2	FB =	7
				CA(eqv.)=	1.63

Includes a Flowby of Q(100)=6 cfs, Q(5)=4 cfs from Powers

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

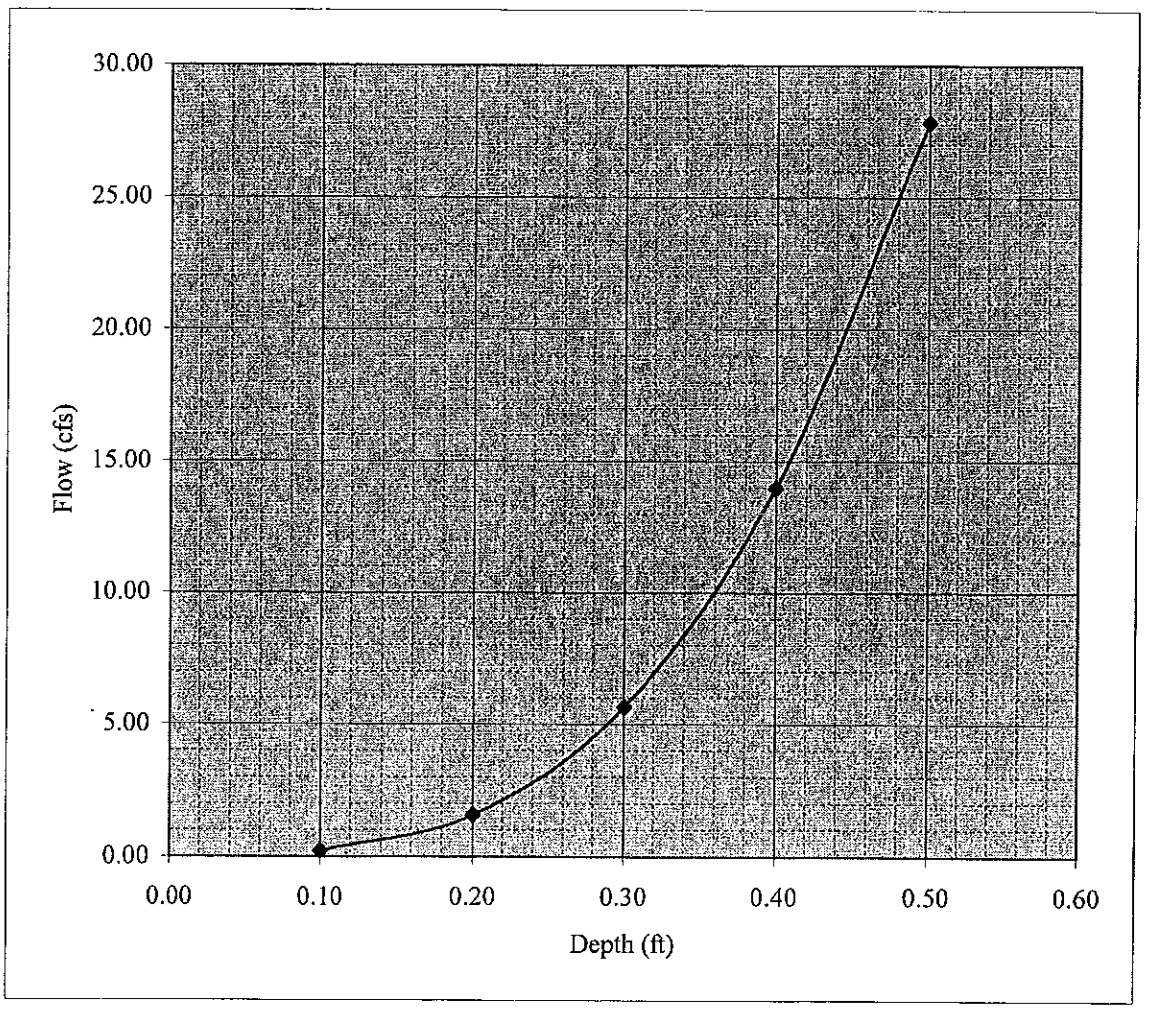
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.023 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.23
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.56
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.64
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.98
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		27.81



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

8' Inlet Briargate Pkwy, AP-B4

100-YR. FLOW					
Q(100)	18	I(100)	6.5		
DEPTH	0.43	Fr	2.04	Inlet size ? L(i) =	8
SPREAD	17.3	L(1)	27.1	If Li < L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	16.3	If Li > L(2) then Qi =	8
STREET SLOPE	2.3%	L(3)	58.0	FB =	13
				CA(eqv.)=	2.00

5-YR. FLOW					
Q(5)	10	I(5)	3.8		
DEPTH	0.36	Fr	1.95	Inlet size ? L(i) =	8
SPREAD	13.8	L(1)	20.7	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	12.4	If Li > L(2) then Qi =	5
STREET SLOPE	2.3%	L(3)	44.3	FB =	6
				CA(eqv.)=	1.59

Includes a Flowby of Q(100)=6 cfs, Q(5)=4 cfs from Powers

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

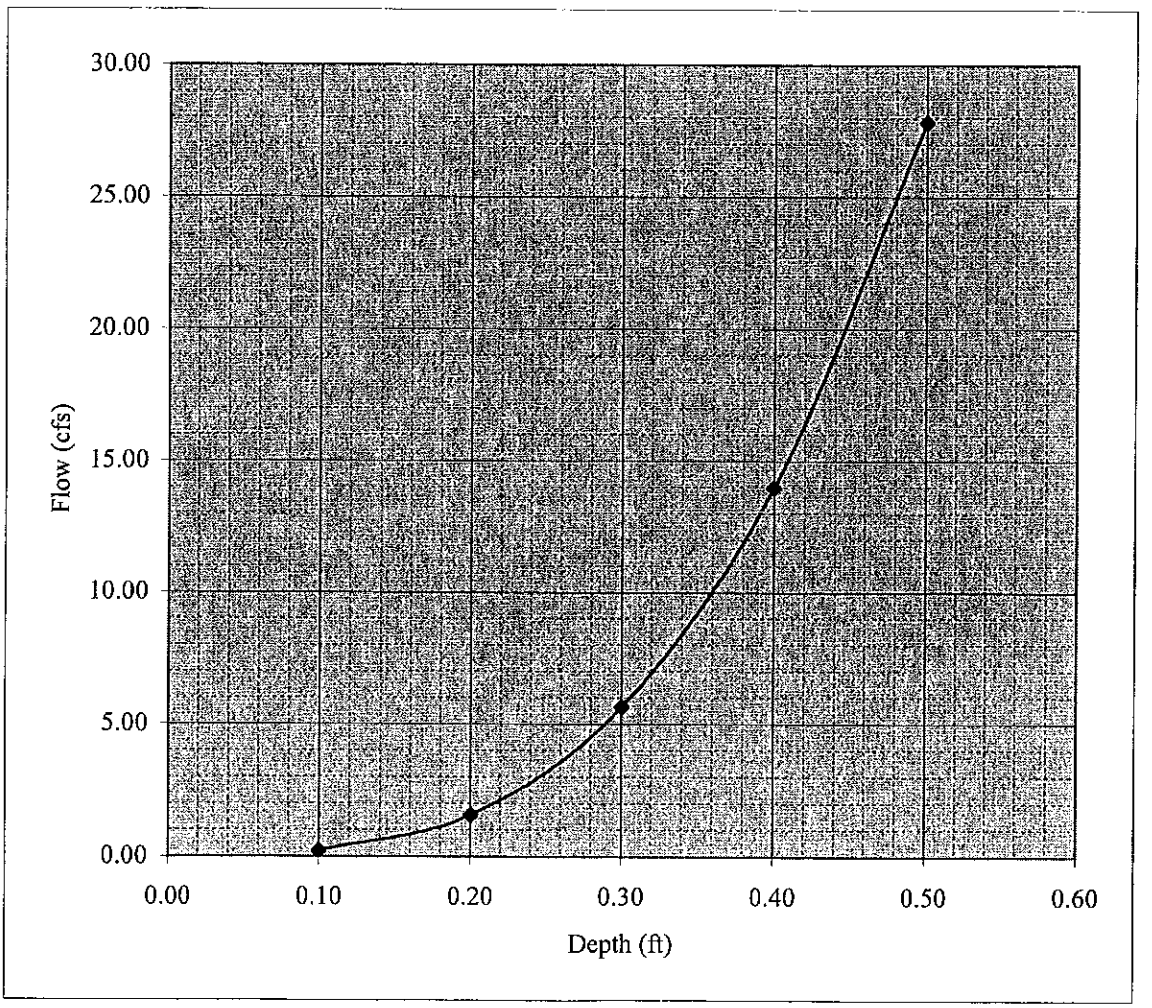
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.023 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.23
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.56
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.64
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.98
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		27.81



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

4' Inlet Briargate Pkwy, AP-B6

100-YR. FLOW					
Q(100)	2	I(100)	7.7		
DEPTH	0.22	Fr	1.56	Inlet size ? L(i) =	4
SPREAD	6.8	L(1)	8.1	If Li < L(2) then Qi =	1
CROSS SLOPE	2.0%	L(2)	4.9	If Li > L(2) then Qi =	1
STREET SLOPE	2.0%	L(3)	17.4	FB =	1
				CA(eqv.)=	0.13

5-YR. FLOW					
Q(5)	1	I(5)	4.4		
DEPTH	0.18	Fr	1.43	Inlet size ? L(i) =	4
SPREAD	4.8	L(1)	5.2	If Li < L(2) then Qi =	1
CROSS SLOPE	2.0%	L(2)	3.1	If Li > L(2) then Qi =	1
STREET SLOPE	2.0%	L(3)	11.2	FB =	0
				CA(eqv.)=	0.00

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

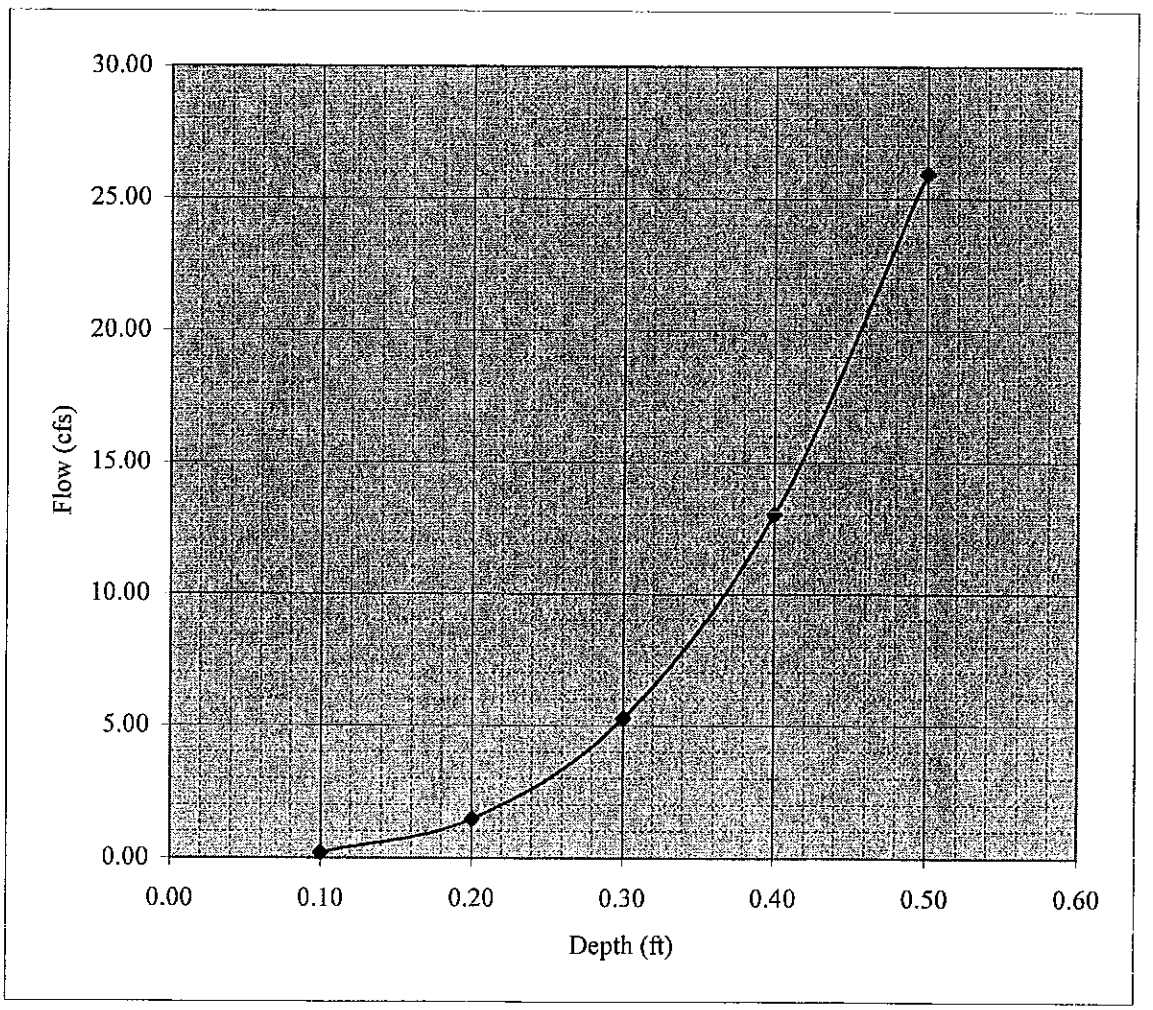
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	-----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.46
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.26
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.04
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		25.94



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

12' Inlet Briargate Pkwy, AP-B8

100-YR. FLOW					
Q(100)	43	I(100)	5.6		
DEPTH	0.66	Fr	2.09	Inlet size ? L(i) =	12
SPREAD	28.8	L(1)	46.2	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	27.7	If Li > L(2) then Qi =	18
STREET SLOPE	2.0%	L(3)	99.0	FB =	32
				CA(eqv.)=	5.71

5-YR. FLOW					
Q(5)	21	I(5)	3.3		
DEPTH	0.46	Fr	1.93	Inlet size ? L(i) =	12
SPREAD	18.8	L(1)	27.9	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	16.7	If Li > L(2) then Qi =	11
STREET SLOPE	2.0%	L(3)	59.7	FB =	12
				CA(eqv.)=	3.61

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

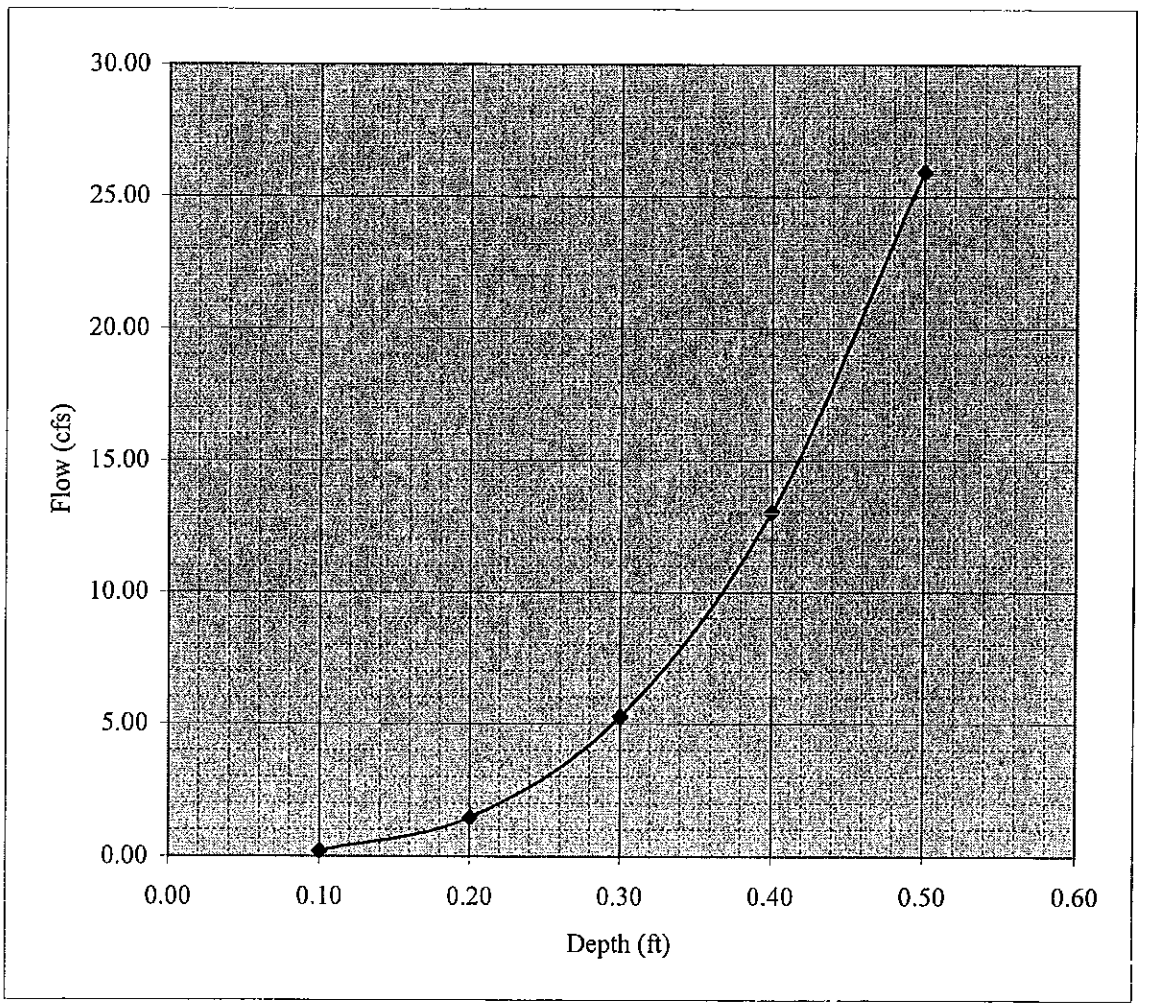
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.46
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.26
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.04
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		25.94



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

10' Inlet Briargate Pkwy, AP-B8A

100-YR. FLOW

Q(100)	32	I(100)	5.6		
DEPTH	0.57	Fr	2.02	Inlet size ? L(i) =	10
SPREAD	24.3	L(1)	37.8	If Li < L(2) then Qi =	8
CROSS SLOPE	2.0%	L(2)	22.7	If Li > L(2) then Qi =	14
STREET SLOPE	2.0%	L(3)	81.0	FB =	24
				CA(eqv.)=	4.29

5-YR. FLOW

Q(5)	12	I(5)	3.3		
DEPTH	0.39	Fr	1.86	Inlet size ? L(i) =	10
SPREAD	15.3	L(1)	21.8	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	13.1	If Li > L(2) then Qi =	6
STREET SLOPE	2.0%	L(3)	46.7	FB =	6
				CA(eqv.)=	1.81

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

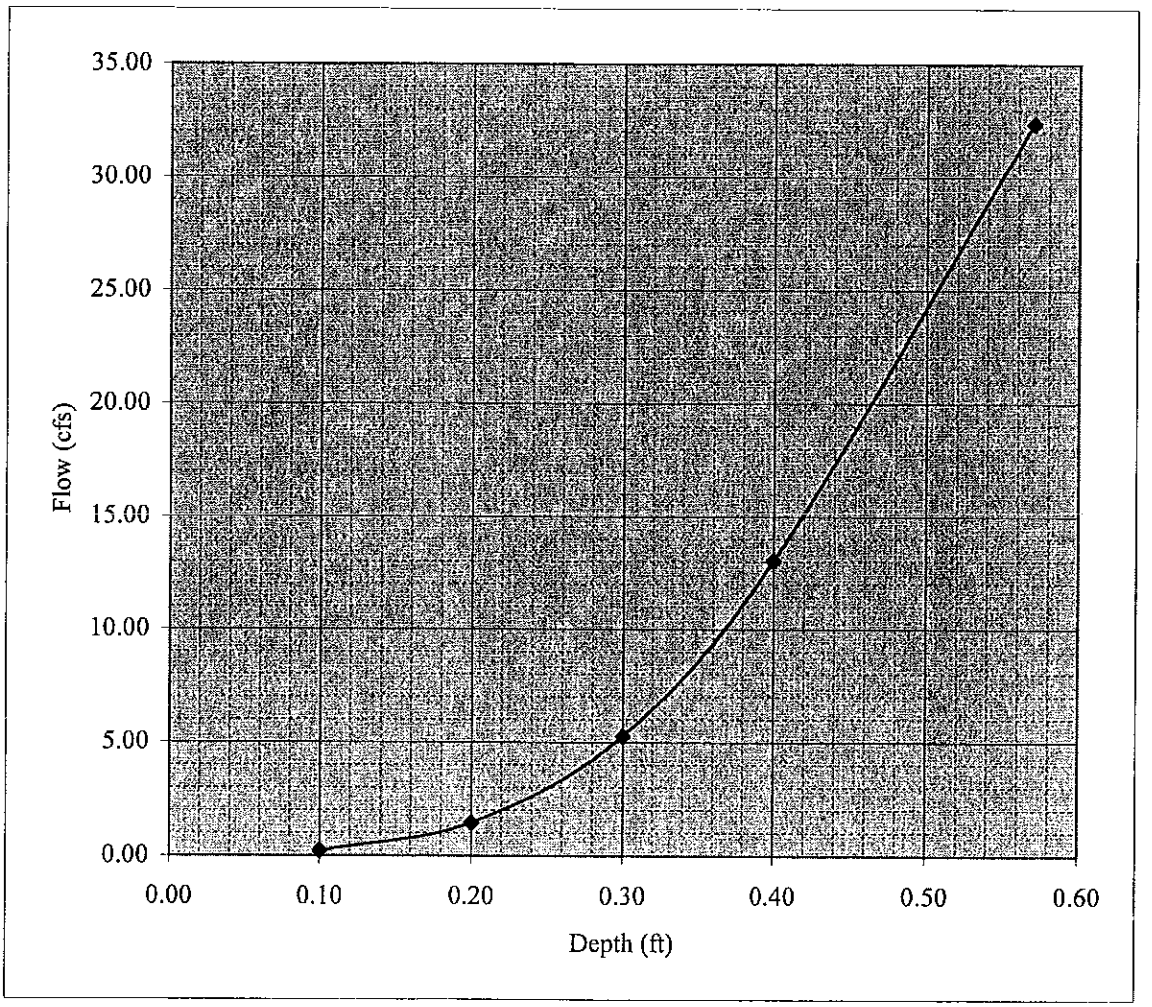
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.46
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.26
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.04
0.57	$0.37^{8/3}$	$0.57^{8/3} - 0.37^{8/3}$		32.36



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

8' Inlet Briargate Pkwy, AP-B9

100-YR. FLOW					
Q(100)	26	I(100)	5.8		
DEPTH	0.46	Fr	1.93	Inlet size ? L(i) =	8
SPREAD	25.9	L(1)	34.6	If Li < L(2) then Qi =	6
CROSS SLOPE	1.4%	L(2)	19.4	If Li > L(2) then Qi =	10
STREET SLOPE	2.0%	L(3)	82.6	FB =	20
				CA(eqv.)=	3.48

5-YR. FLOW					
Q(5)	13	I(5)	3.4		
DEPTH	0.37	Fr	1.83	Inlet size ? L(i) =	8
SPREAD	19.5	L(1)	24.7	If Li < L(2) then Qi =	4
CROSS SLOPE	1.4%	L(2)	13.8	If Li > L(2) then Qi =	6
STREET SLOPE	2.0%	L(3)	58.9	FB =	9
				CA(eqv.)=	2.65

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

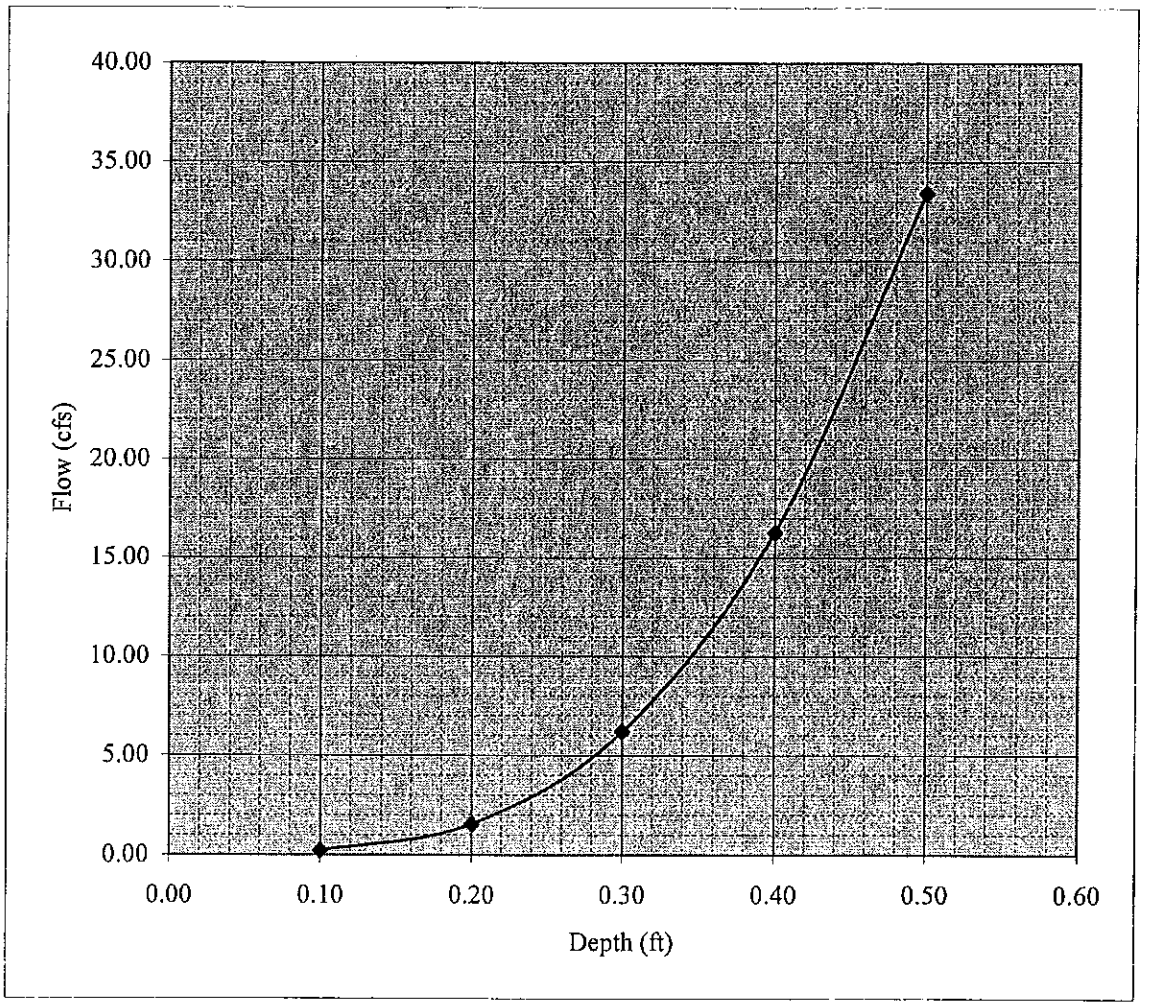
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.014 ft/ft ZA= 71.4

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.55
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.20
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		16.27
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		33.42



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

8' Inlet Briargate Pkwy, AP-B9A

100-YR. FLOW					
Q(100)	20	I(100)	5.8		
DEPTH	0.43	Fr	1.90	Inlet size ? L(i) =	8
SPREAD	23.8	L(1)	31.3	If Li < L(2) then Qi =	5
CROSS SLOPE	1.4%	L(2)	17.5	If Li > L(2) then Qi =	8
STREET SLOPE	2.0%	L(3)	74.6	FB =	15
				CA(eqv.)=	2.61

5-YR. FLOW					
Q(5)	9	I(5)	3.4		
DEPTH	0.31	Fr	1.75	Inlet size ? L(i) =	8
SPREAD	15.2	L(1)	18.4	If Li < L(2) then Qi =	4
CROSS SLOPE	1.4%	L(2)	10.3	If Li > L(2) then Qi =	5
STREET SLOPE	2.0%	L(3)	43.9	FB =	5
				CA(eqv.)=	1.47

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

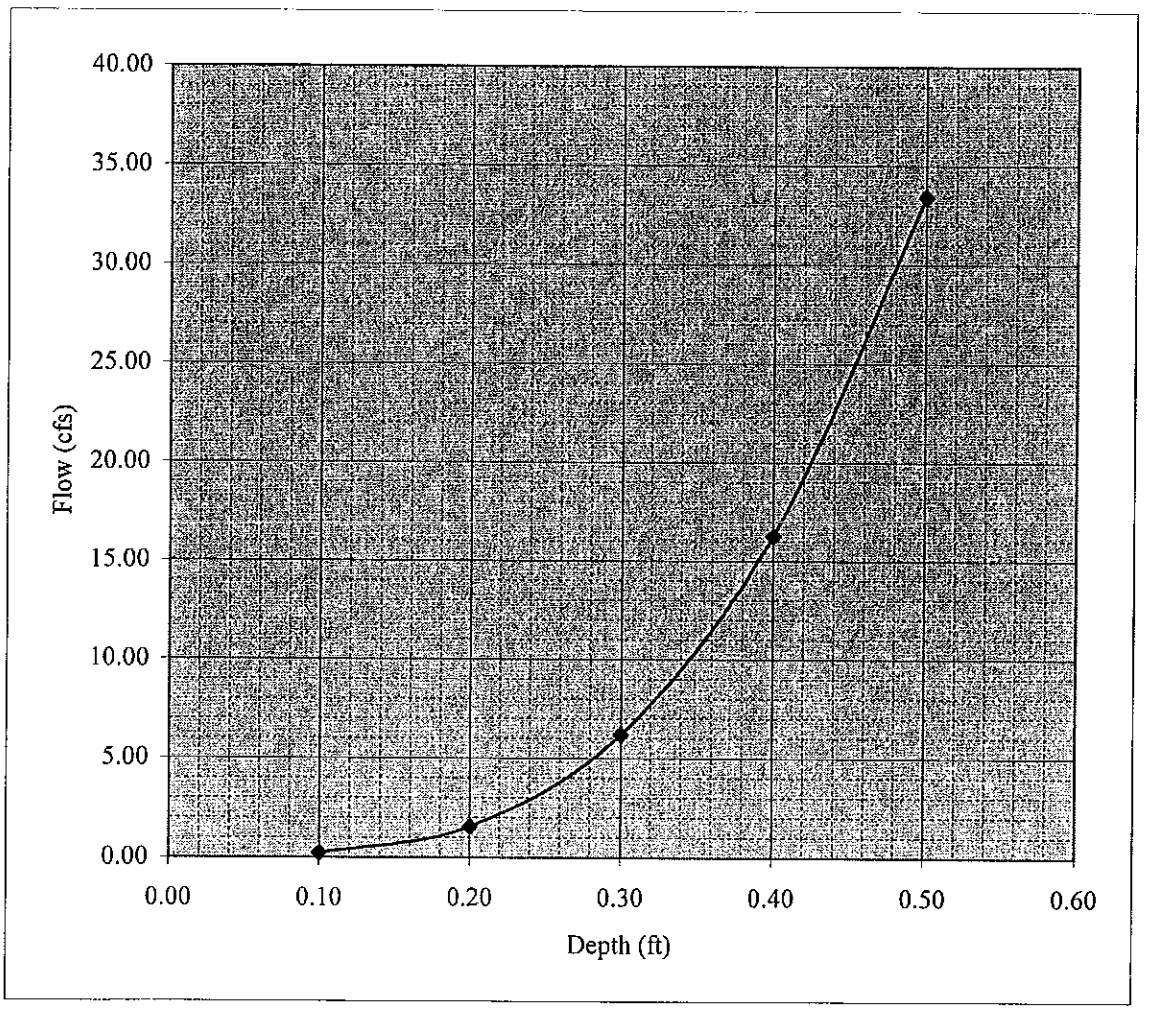
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.014 ft/ft ZA= 71.4

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.55
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.20
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		16.27
0.50	$0.37^{8/3}$	$0.50^{8/3} - 0.37^{8/3}$		33.42



3:05 HGL SPREADSHEETS FOR BRIARGATE PARKWAY STORM DRAIN EAST OF JUNCTION WITH PROPOSED AUSTIN BLUFFS PARKWAY

MANNINGS n = 0.013

PINE CREEK
BRIARGATE PARKWAY STORM DRAIN
72"/78" RCP Station 23+50 to 44+82
HGL CALCULATION

7/2/2001

STATION	PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LENGTH (ft)	JUNCTION DATA LATERAL SIZE (inches)	JUNCTION DATA LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
2350.00	78	609														940.11		
2350.00	78	609	33.166	18.36	5247	0.013										940.11	5.24	934.87
2400.00	78	609	33.166	18.36	5247	0.013	50.00				0.67				0.67	941.26	5.24	936.02
2400.00	78	609	33.166	18.36	5247	0.013	0.00			0.12	0.00	0.63	0.00		0.63	941.89	5.24	936.65
2575.61	78	609	33.166	18.36	5247	0.013	175.61				2.37	0.00	0.00		2.37	946.03	5.24	940.79
2575.61	78	609	33.166	18.36	5247	0.013	0.00			0.12	0.00	0.63	0.00		0.63	946.66	5.24	941.42
2905.00	78	609	33.166	18.36	5247	0.013	329.39				4.44	0.00	0.00		4.44	954.98	5.24	949.74
2905.00	78	609	33.166	18.36	5247	0.013	0.00				0.00	0.00	0.00	1.05	1.05	956.03	5.24	950.79
2926.07	78	609	33.166	18.36	5247	0.013	21.07				0.28	0.00	0.00		0.28	956.31	5.24	951.08
2926.07	78	572	33.166	17.25	5247	0.012	0.00	36	45		0.00	0.00	0.49		0.49	956.80	4.62	952.18
2969.44	78	572	33.166	17.25	5247	0.012	43.37				0.52	0.00	0.00		0.52	957.32	4.62	952.70
2969.44	78	572	33.166	17.25	5247	0.012	0.00			0.1	0.00	0.46	0.00		0.46	957.78	4.62	953.16
3272.74	78	572	33.166	17.25	5247	0.012	303.30				3.60	0.00	0.00		3.60	961.82	4.62	957.20
3272.74	78	572	33.166	17.25	5247	0.012	0.00			0.1	0.00	0.46	0.00		0.46	962.28	4.62	957.66
3431.00	78	572	33.166	17.25	5247	0.012	158.26				1.88	0.00	0.00		1.88	964.92	4.62	960.30
3431.00	78	541	33.166	16.31	5247	0.011	0.00	30	45		0.00	0.00	0.36		0.36	965.28	4.13	961.15
3447.00	78	541	33.166	16.31	5247	0.011	16.00				0.17	0.00	0.00		0.17	965.45	4.13	961.32
3447.00	72	541	28.260	19.14	4237	0.016	0.00				0.00	0.00	0.00	1.14	1.14	966.59	5.69	960.90
3488.25	72	541	28.260	19.14	4237	0.016	41.25				0.67	0.00	0.00		0.67	967.26	5.69	961.57
3488.25	72	541	28.260	19.14	4237	0.016	0.00				0.00	0.00	0.00	1.14	1.14	968.40	5.69	962.71
3631.76	72	541	28.260	19.14	4237	0.016	143.51				2.34	0.00	0.00		2.34	970.74	5.69	965.05
3631.76	72	541	28.260	19.14	4237	0.016	0.00			0.1	0.00	0.57	0.00		0.57	971.31	5.69	965.62
3803.00	72	541	28.260	19.14	4237	0.016	171.24				2.79	0.00	0.00		2.79	974.10	5.69	968.41
3803.00	72	506	28.260	17.91	4237	0.014	0.00	30	45		0.00	0.00	0.52		0.52	974.62	4.98	969.64
3840.25	72	506	28.260	17.91	4237	0.014	37.25				0.53	0.00	0.00		0.53	975.15	4.98	970.17
3840.25	72	470	28.260	16.63	4237	0.012	0.00	30	45		0.00	0.00	0.48		0.48	975.63	4.30	971.33
3910.86	72	470	28.260	16.63	4237	0.012	70.61				0.87	0.00	0.00		0.87	976.50	4.30	972.20
3910.86	72	470	28.260	16.63	4237	0.012	0.00			0.1	0.00	0.43	0.00		0.43	976.93	4.30	972.63
4482.00	72	470	28.260	16.63	4237	0.012	571.14				7.03	0.00	0.00		7.03	987.90	4.30	983.60
4482.00	72	470	28.260	16.63	4237	0.012	0.00				0.00	0.00	0.00		0.00	987.90	4.30	983.60

The hydraulic grade line is assumed to be at the inside crown of the pipe at station 23+50.

4:00 DRAINAGE BASINS IN AND SOUTH OF PROPOSED BRIARGATE PARKWAY FROM JUNCTION WITH PROPOSED AUSTIN BLUFFS STORM DRAIN WEST TO DETENTION FACILITY "C", TO INCLUDE THE PENROSE SITE BASINS

4:01 HYDROLOGIC BASINS CALCULATIONS: PS6-12, PS8-P1 THROUGH PS8-P5, PS8-13 THROUGH PS8-22

4:02 COMPOSITE "CA" SPREADSHEETS: AP-B10 THROUGH AP-B12, AP-P1 THROUGH AP-P3

4:03 ROUTING SPREADSHEETS: AP-B10 THROUGH AP-B12

4:04 INLET SPREADSHEETS: AP-B10, AP-B10B, AP-B11, AP-B11A, AP-B12

4:05 HGL SPREADSHEETS FOR LATERALS IN PROPOSED BRIARGATE PARKWAY

4:01 HYDROLOGIC BASINS CALCULATIONS: PS6-12, PS8-P1 THROUGH PS8-P5, PS8-13 THROUGH PS8-22

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Briargate Pkwy, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS6-12 (AP-B10)	1.21	0.73	0.77	0.25	20	1.50	3.66	700	2.00%	4.95	2.36	6.01	4.77	8.55	4	8
														CA(equiv.)	0.88	0.93
PS6-13 (AP-B4)	2.41	0.69	0.75	0.25 0.90	50 50	1.00 1.50	8.94 1.84	500	3.20%	6.26	1.33	12.11	3.78	6.51	6	12
														CA(equiv.)	1.66	1.81
PS6-13A (AP-B5)	5.20	0.75	0.80	0.25 0.90	50 75	5.00 1.50	5.26 2.58	600	2.00%	4.95	2.02	9.85	4.09	7.12	16	30
														CA(equiv.)	3.90	4.16
PS6-14 (AP-B2)	1.93	0.84	0.90	0.25 0.90	10 100	0.30 2.00	3.50 2.98	700	2.60%	5.64	2.07	8.54	4.29	7.54	7	13
														CA(equiv.)	1.62	1.74
PS6-15 (AP-B6)	0.32	0.74	0.80	0.25 0.90	20 50	0.50 1.00	5.25 2.10	250	2.00%	4.95	0.84	8.20	4.35	7.66	1	2
														CA(equiv.)	0.24	0.26
PS6-16 (AP-B1)	4.67	0.70	0.80	0.25 0.90	30 50	4.00 3.00	3.70 1.46	700	2.00%	4.95	2.36	7.52	4.47	7.91	15	30
														CA(equiv.)	3.27	3.74
TOTAL	14.53															

mddp-basins 5/30/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Penrose Site, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS8-P1 SMP INLETS	3.76	0.82	0.84	0.25	35	5.00	3.91	280	2.90%	5.96	0.78	4.69	5.08	9.23	**16**	**29**
														CA(equiv.)	**3.08**	**3.16**
PS8-P2 SMP INLET	3.45	0.91	0.91	0.25	30	4.00	3.70	340	2.30%	5.31	1.07	4.77	5.06	9.19	**16**	**29**
														CA(equiv.)	**3.14**	**3.14**
PS8-P3 SMP INLET	0.64	0.82	0.84	0.25 0.95	20 50	2.00 1.50	3.32 1.38	100	2.00%	4.95	0.34	5.04	4.99	9.04	**3**	**5**
														CA(equiv.)	**0.52**	**0.54**
PS8-P4 SMP INLET	1.03	0.81	0.85	0.25	50	4.00	5.66	80	1.50%	4.29	0.31	5.97	4.78	8.57	**4**	**8**
														CA(equiv.)	**0.83**	**0.88**
PS8-P5 INLETS	5.17	0.92	0.92	0.25	50	4.00	5.66	540	2.60%	5.64	1.59	7.25	4.52	8.01	**21**	**38**
														CA(equiv.)	**4.76**	**4.76**
TOTAL	14.05															

mddp-basins 8/7/2000

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Tributary to Union S.D., Developed Condition)

BASIN	AREA TOTAL	WEIGHTED		OVERLAND				STREET / CHANNEL					INTENSITY		TOTAL FLOWS	
		C(5)	C(100)	C(5)	Length	Height	Tc	Length	Slope	Velocity	Tc	TOTAL	I(5)	I(100)	Q(5)	Q(100)
	(Ac)	For Calcs See Runoff Summary			(ft)	(ft)	(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	
PS8-13 (AP-B12)	1.76	0.62	0.69	0.25	40	2.00	5.91	850	2.40%	5.42	2.61	8.52	4.29	7.54	5	9
														CA(equiv.)	1.09	1.21
PS8-13A (AP-U24)	1.10	0.90	0.95	0.25 0.90	12 100	1.00 1.00	2.74 3.74	300	1.00%	3.50	1.43	7.90	4.40	7.77	4	8
														CA(equiv.)	0.99	1.05
PS8-14 (AP-U23)	11.23	0.90	0.90	0.25 0.90	50 150	2.00 6.00	7.11 2.90	800	2.20%	5.19	2.57	12.58	3.73	6.40	38	65
														CA(equiv.)	10.11	10.11
PS8-15 (AP-U17)	0.72	0.60	0.65	0.25	35	0.70	7.48	500	2.40%	5.42	1.54	9.02	4.21	7.38	2	3
														CA(equiv.)	0.43	0.47
PS8-16 (AP-U14)	0.37	0.75	0.80	0.25	10	0.20	4.00	500	2.40%	5.42	1.54	5.54	4.88	8.78	1	3
														CA(equiv.)	0.28	0.30
PS8-17 (AP-U11)	0.42	0.75	0.80	0.25	10	0.20	4.00	600	3.60%	6.64	1.51	5.50	4.88	8.80	2	3
														CA(equiv.)	0.32	0.34
PS8-18 (AP-U12)	1.15	0.75	0.80	0.25	10	0.20	4.00	630 600	3.50% 3.60%	6.55 6.64	1.60 1.51	7.11	4.55	8.07	4	7
														CA(equiv.)	0.86	0.92
PS8-19 (AP-U9)	0.50	0.75	0.80	0.25	10	0.20	4.00	630	3.50%	6.55	1.60	5.60	4.86	8.75	2	3
														CA(equiv.)	0.38	0.40
TOTAL	17.25															

mddp-basins 6/11/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, Briargate Pkwy, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS8-20 (AP-B11)	1.68	0.64	0.70	0.25	70	2.00	9.40	450	2.60%	5.64	1.33	10.73	3.96	6.87	4	8
														CA(equiv.)	1.08	1.18
PS8-21 (AP-B10)	2.88	0.61	0.68	0.25	70	4.00	7.48	950	2.60%	5.64	2.81	10.29	4.02	6.99	7	14
														CA(equiv.)	1.76	1.96
PS8-22 (AP-B10B)	3.17	0.68	0.75	0.25	60	2.00	8.28	875	2.60%	5.64	2.58	10.86	3.94	6.83	9	16
														CA(equiv.)	2.16	2.38
TOTAL	3.17															

mddp-basins 5/23/2001

4:02 COMPOSITE "CA" SPREADSHEETS: AP-B10 THROUGH AP-B12, AP-P1 THROUGH AP-P3

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, BRIARGATE PKWY, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-B9 INLET	PS6-3	7.41	3.93	4.52		
	TOTAL	7.41			3.93	4.52
AP-B9A INLET	FLBY B9		2.65	3.48		
	TOTAL				2.65	3.48
AP-B9B PIPE	INLET B9		1.28	1.04		
	INLET B9A		1.18	0.87		
	TOTAL	0			2.46	1.91
AP-B10 INLET	PS8-21	2.88	1.76	1.96		
	FLBY A6		0.70	2.33		
	PS6-12	1.21	0.88	0.93		
	TOTAL	4.09			3.34	5.22
AP-B10A PIPE	AP-P3	6.84	6.11	6.18		
	INLET-B10		2.26	1.86		
	TOTAL	6.84			8.37	8.04
AP-B10B INLET	PS8-22	3.17	2.16	2.38		
	TOTAL				2.16	2.38
AP-B10C PIPE	AP-B10A		8.37	8.04		
	INLET-B10B		0.89	0.92		
	TOTAL				9.26	8.96
AP-B11 INLET	PS8-20	1.68	1.08	1.18		
	FLBY B10B		1.27	1.46		
	TOTAL	1.68			2.35	2.64
AP-B11A INLET	FLBY B11		1.07	1.56		
	TOTAL				1.07	1.56
AP-B11B PIPE	INLET-B11		1.28	1.08		
	INLET-B11A		0.54	0.47		
	TOTAL				1.82	1.55
AP-B12 INLET	FLBY		1.18	3.36		
	PS8-13		1.09	1.21		
	TOTAL				2.27	4.57

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, PENROSE SITE, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP-P1	PS8-P1	3.76	3.08	3.16		
PIPE	PS8-P2	3.45	3.14	3.14		
	TOTAL	7.21			6.22	6.30
AP-P2	PS8-P3	0.64	0.52	0.54		
PIPE	PS8-P4	1.03	0.83	0.88		
	TOTAL	1.67			1.35	1.42
AP-P3	PS8-P5	5.17	4.76	4.76		
PIPE	AP-P2	1.67	1.35	1.42		
	TOTAL	6.84			6.11	6.18

4:03 ROUTING SPREADSHEETS: AP-B10 THROUGH AP-B12

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, BRIARGATE PKWY, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL	WEIGHTED		OVERLAND/POND OUTFLOW				STREET / CHANNEL/ PIPE				Tc	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)	C(5)	Length	Height	Tc	Length	Slope	Velocity	Tc	TOTAL	I(5)	I(100)	Q(5)	Q(100)
	(Ac)	* For Calcs See Runoff Summary			(ft)	(ft)	(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
AP-B10 INLET	4.09	3.34	5.22	0.25	20	1.50	3.66	700 950	2.00% 2.60%	4.95 5.64	2.36 2.81	8.82	4.25	7.44	14	39
AP-B10A PIPE		8.37	8.04	0.25	20	1.50	3.66	700 1000	2.00% 2.60%	4.95 5.64	2.36 2.95	8.97	4.22	7.40	35	59
AP-B10B INLET	3.17	2.16	2.38	0.25	60	2.00	8.28	875	2.60%	5.64	2.58	10.86	3.94	6.83	9	16
AP-B10C PIPE		9.26	8.96	0.25	20	1.50	3.66	700 950 120	2.00% 2.60% 1.00%	4.95 5.64 3.50	2.36 2.81 0.57	9.39	4.16	7.26	38	65
AP-B11 INLET	1.68	2.35	2.64	0.25	60	2.00	8.28	875 550	2.60% 2.54%	5.64 5.58	2.58 1.64	12.50	3.74	6.42	9	17
AP-B11A INLET		1.07	1.56	0.25	60	2.00	8.28	875 550	2.60% 2.54%	5.64 5.58	2.58 1.64	12.50	3.74	6.42	4	10
AP-B11B		1.82	1.55	0.25	60	2.00	8.28	875 550 24	2.60% 2.54% 1.00%	5.64 5.58 5.58	2.58 1.643 0.072	12.57	3.73	6.40	7	10
AP-B12		2.27	4.57	0.25	20	1.50	3.66	700 950 800	2.00% 2.60% 2.00%	4.95 5.64 4.95	2.36 2.81 2.69	11.51	3.86	6.66	9	30

RTGUNION 6/4/2001

4:04 INLET SPREADSHEETS: AP-B10, AP-B10B, AP-B11, AP-B11A AND AP-B12

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

16' Inlet Austin Bluffs Pkwy, AP-B10

100-YR. FLOW					
Q(100)	39	I(100)	7.4		
DEPTH	0.58	Fr	2.36	Inlet size ? L(i) =	16
SPREAD	24.8	L(1)	45.0	If Li < L(2) then Qi =	14
CROSS SLOPE	2.0%	L(2)	27.0	If Li > L(2) then Qi =	19
STREET SLOPE	2.7%	L(3)	96.4	FB =	25
				CA(eqv.)=	3.36

5-YR. FLOW					
Q(5)	14	I(5)	4.3		
DEPTH	0.39	Fr	2.16	Inlet size ? L(i) =	16
SPREAD	15.3	L(1)	25.3	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	15.2	If Li > L(2) then Qi =	9
STREET SLOPE	2.7%	L(3)	54.3	FB =	5
				CA(eqv.)=	1.18

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

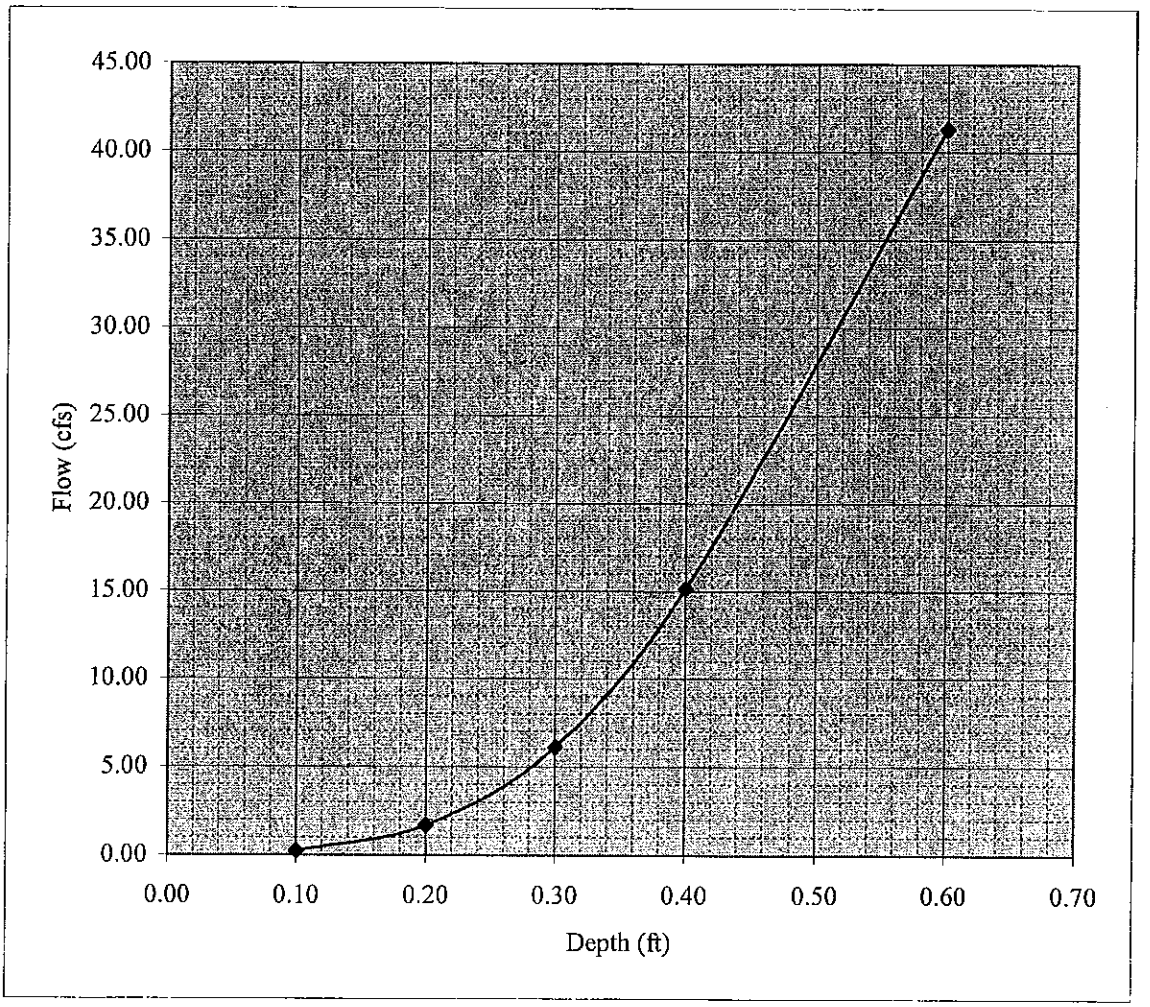
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.027 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.24
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.69
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.11
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.15
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		41.30



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

10' Inlet Austin Bluffs Pkwy, AP-B10B

100-YR. FLOW					
Q(100)	16	I(100)	6.8		
DEPTH	0.41	Fr	2.18	Inlet size ? L(i) =	10
SPREAD	16.3	L(1)	27.3	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	16.4	If Li > L(2) then Qi =	8
STREET SLOPE	2.7%	L(3)	58.5	FB =	10
				CA(eqv.)=	1.46

5-YR. FLOW					
Q(5)	9	I(5)	3.9		
DEPTH	0.34	Fr	2.08	Inlet size ? L(i) =	10
SPREAD	12.8	L(1)	20.4	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	12.3	If Li > L(2) then Qi =	5
STREET SLOPE	2.7%	L(3)	43.8	FB =	5
				CA(eqv.)=	1.27

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

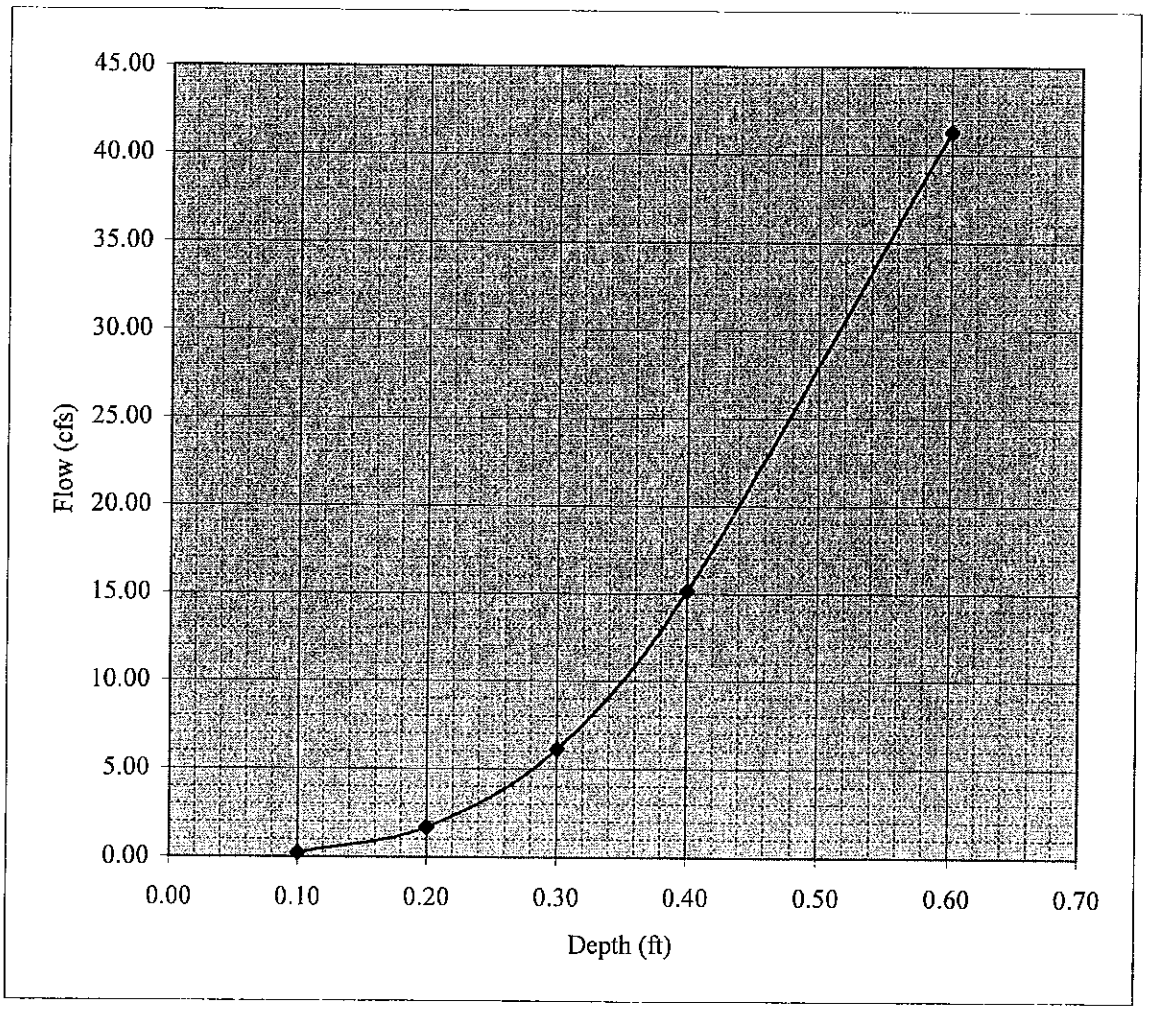
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.027 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.24
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.69
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.11
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.15
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		41.30



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

10' Inlet Austin Bluffs Pkwy, AP-B11

100-YR. FLOW

Q(100)	17	I(100)	6.4		
DEPTH	0.44	Fr	1.91	Inlet size ? L(i) =	10
SPREAD	17.8	L(1)	26.1	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	15.7	If Li > L(2) then Qi =	9
STREET SLOPE	2.0%	L(3)	55.9	FB =	10
				CA(eqv.)=	1.56

5-YR. FLOW

Q(5)	9	I(5)	3.7		
DEPTH	0.36	Fr	1.82	Inlet size ? L(i) =	10
SPREAD	13.8	L(1)	19.3	If Li < L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	11.6	If Li > L(2) then Qi =	5
STREET SLOPE	2.0%	L(3)	41.3	FB =	4
				CA(eqv.)=	1.07

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

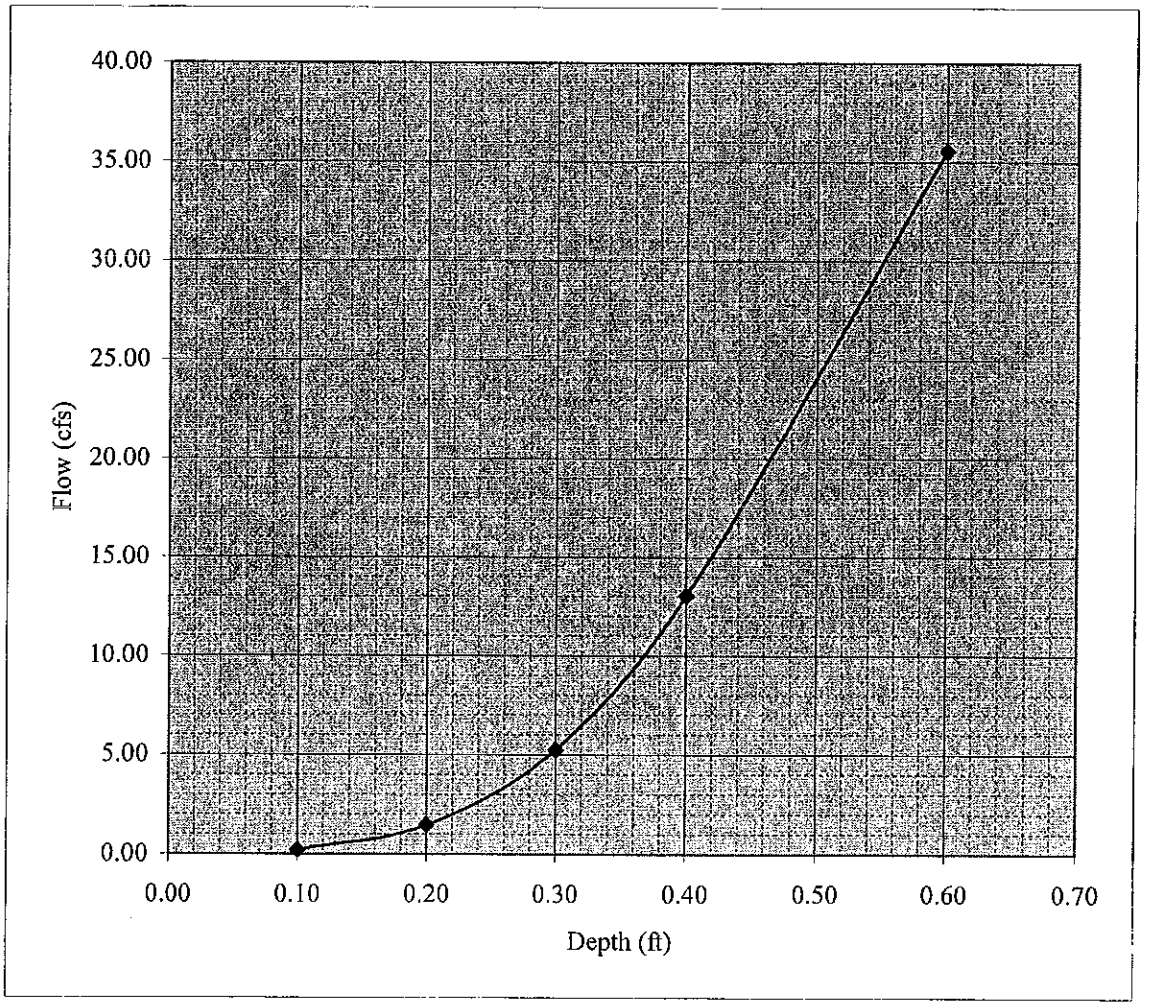
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.02 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.21
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.46
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		5.26
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		13.04
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		35.55



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

6' Inlet Austin Bluffs Pkwy, AP-B11A

100-YR. FLOW					
Q(100)	10	I(100)	6.4		
DEPTH	0.35	Fr	1.81	Inlet size ? L(i) =	6
SPREAD	13.3	L(1)	18.4	If Li < L(2) then Qi =	3
CROSS SLOPE	2.0%	L(2)	11.1	If Li > L(2) then Qi =	5
STREET SLOPE	2.0%	L(3)	39.5	FB =	7
				CA(eqv.)=	1.09

5-YR. FLOW					
Q(5)	4	I(5)	3.7		
DEPTH	0.26	Fr	1.66	Inlet size ? L(i) =	6
SPREAD	8.8	L(1)	11.2	If Li < L(2) then Qi =	2
CROSS SLOPE	2.0%	L(2)	6.7	If Li > L(2) then Qi =	2
STREET SLOPE	2.0%	L(3)	23.9	FB =	2
				CA(eqv.)=	0.53

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

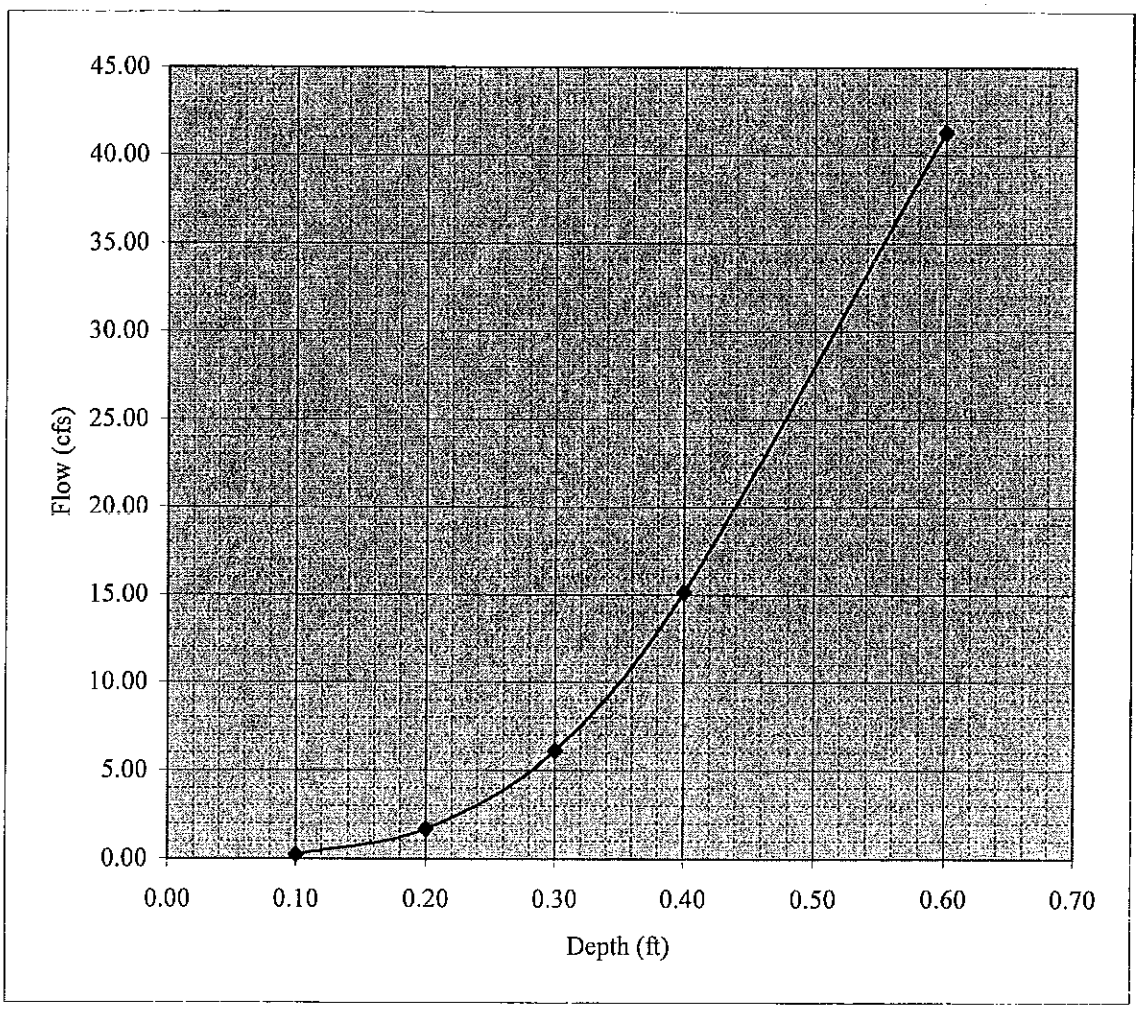
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.027 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.24
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.69
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.11
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.15
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		41.30



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

8' Inlet Austin Bluffs Pkwy, AP-B12

100-YR. FLOW					
Q(100)	30	I(100)	6.7		
DEPTH	0.56	Fr	1.91	Inlet size ? L(i) =	8
SPREAD	23.8	L(1)	35.0	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	21.0	If Li > L(2) then Qi =	12
STREET SLOPE	1.8%	L(3)	74.9	FB =	23
				CA(eqv.)=	3.45

5-YR. FLOW					
Q(5)	9	I(5)	3.9		
DEPTH	0.36	Fr	1.73	Inlet size ? L(i) =	8
SPREAD	13.8	L(1)	18.3	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	11.0	If Li > L(2) then Qi =	5
STREET SLOPE	1.8%	L(3)	39.2	FB =	5
				CA(eqv.)=	1.30

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

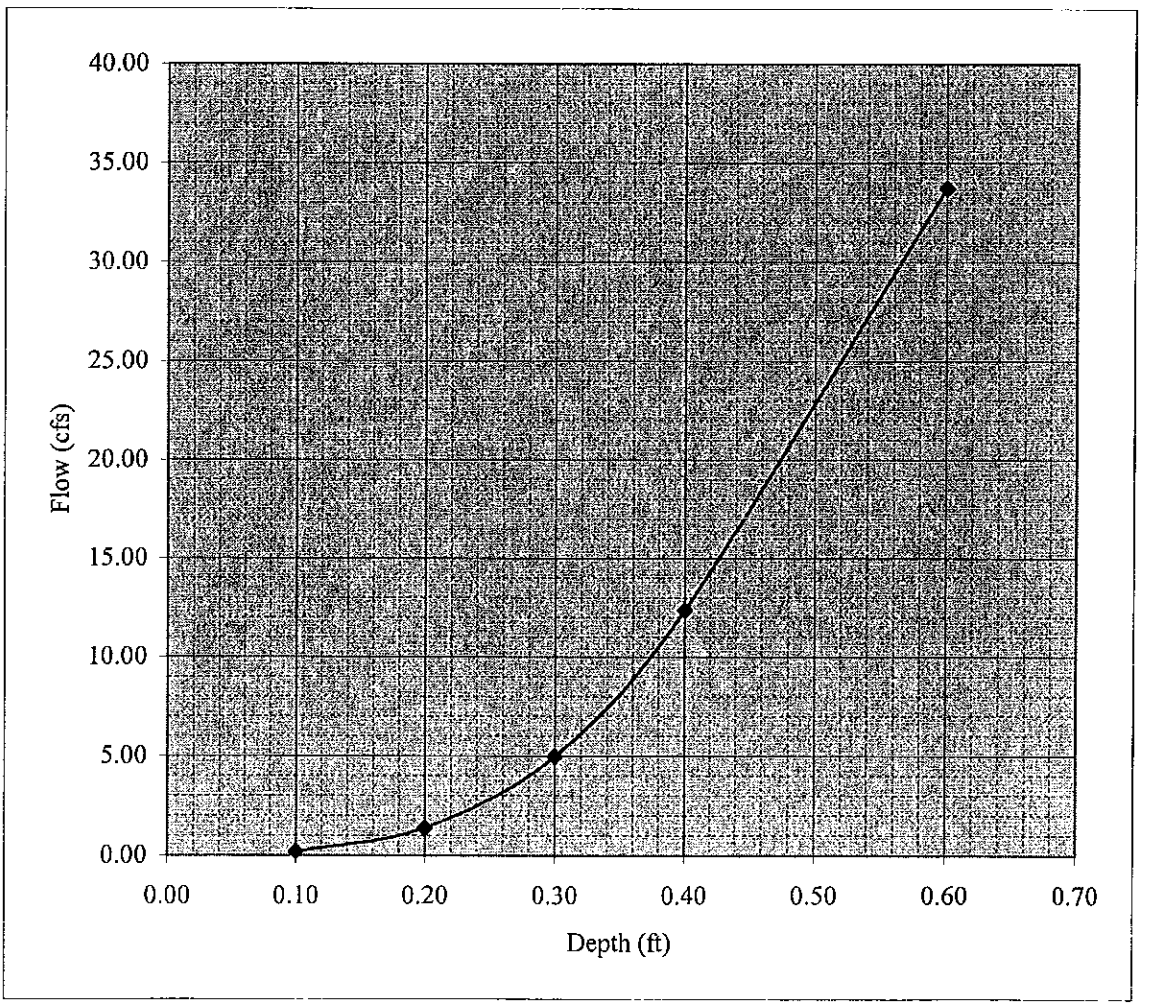
z = 1/Sx

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

ENTER: street slope (S) = 0.018 ft/ft na = 0.016

ENTER: cross slope (Sx) = 0.02 ft/ft ZA= 50

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.20
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.38
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		4.99
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		12.37
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		33.72



4:05 HGL SPREADSHEETS FOR LATERALS IN PROPOSED BRIARGATE PARKWAY

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL D
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	7																	6887.71
100		18	7	1.766	3.96	105	0.004	0.00				0.00					0.00	6887.95	0.24	6887.71
112.99		18	7	1.766	3.96	105	0.004	12.99				0.06					0.06	6888.01	0.24	6887.79
137.95		18	7	1.766	3.96	105	0.004	24.96				0.11		0.00			0.11	6888.07	0.24	6891.53
137.95	BEND	18	7	1.766	3.96	105	0.004	0.00			0.35	0.00	0.09	0.00			0.09	6891.88	0.24	6891.64
145.71		18	7	1.766	3.96	105	0.004	7.76				0.03					0.03	6891.92	0.24	6891.67
269.78		18	7	1.766	3.96	105	0.004	124.07				0.56	0.00	0.00			0.56	6894.42	0.24	6894.18
269.78	INLET	18	7	1.766	3.96	105	0.004	0.00				0.00	0.00	0.00		0.37	0.37	6894.79	0.24	6894.55

* HGL @ BEGINNING COMES FROM DEPTH + ELEV @ STORM BOX STA 4+92.92 AND THE EGL COMES FROM THE HGL

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL E
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND/R LOSS K	FRICTION LOSS (ft)	D/REDU LOSS (ft)	JUNCTION LOSS (ft)	XPNS LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	11																	6892.06
100		18	11	1.766	6.23	105	0.011	0.00				0.00					0.00	6892.66	0.60	6892.06
114.36		18	11	1.766	6.23	105	0.011	14.36				0.16					0.16	6892.82	0.60	6892.22
135.83		18	11	1.766	6.23	105	0.011	21.47				0.24	0.00	0.00			0.24	6896.04	0.60	6895.44
135.83	INLET-O	18	11	1.766	6.23	105	0.011	0.00				0.00	0.00	0.00		0.90	0.90	6896.95	0.60	6896.34
138.66		18	8	1.766	4.53	105	0.006	2.83				0.02	0.00	0.00			0.02	6896.96	0.32	6896.64
138.66	INLET-I	18	8	1.766	4.53	105	0.006	0.00				0.00	0.00	0.00			0.00	6896.96	0.32	6896.64
152.17		18	8	1.766	4.53	105	0.006	13.51				0.08	0.00	0.00			0.08	6897.04	0.32	6896.72
178.96		18	8	1.766	4.53	105	0.006	26.79				0.16	0.00	0.00			0.16	6896.38	0.32	6896.06
178.96	INLET-O	18	8	1.766	4.53	105	0.006	0.00				0.00	0.00	0.00		0.48	0.48	6896.86	0.32	6896.54

* HGL @ BEGINNING COMES FROM DEPTH + ELEV @ STORM BOX STA 7+06.42 AND THE EGL COMES FROM THE HGL

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL G
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND/R LOSS K	FRICTION LOSS (ft)	D/REDU LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	36	65																	6905.75
100		36	65	7.065	9.20	666	0.010	0.00				0.00	0.00	0.00			0.00	6907.06	1.31	6905.75
140.07		36	65	7.065	9.20	666	0.010	40.07				0.38	0.00	0.00			0.38	6907.45	1.31	6906.13
140.07	WYE	36	59	7.065	8.35	666	0.008	0.00	18	45		0.00	0.00	0.17			0.17	6907.61	1.08	6906.53
146.63		36	59	7.065	8.35	666	0.008	6.56				0.05	0.00	0.00			0.05	6907.67	1.08	6906.58
146.63	BEND	36	59	7.065	8.35	666	0.008	0.00			0.35	0.00	0.38	0.00			0.38	6908.04	1.08	6906.96
270.08		36	59	7.065	8.35	666	0.008	123.45				0.97	0.00	0.00			0.97	6909.01	1.08	6907.93
270.08	WYE	36	48	7.065	6.79	666	0.005	0.00	18	45		0.00	0.00	0.15			0.15	6909.17	0.72	6908.45
288.39		36	48	7.065	6.79	666	0.005	18.31				0.10	0.00	0.00			0.10	6909.26	0.72	6908.55
288.39	PLUG	36	48	7.065	6.79	666	0.005	0.00				0.00	0.00	0.00			0.00	6909.26	0.72	6908.55

* HGL @ BEGINNING COMES FROM DEPTH + ELEV @ STORM BOX STA 1173.66 AND THE EGL COMES FROM THE HGL

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL G1
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	6																	
100		18	6	1.766	3.40	105	0.003	0.00				0.00					0.00	6907.61	0.18	6907.44
115.33		18	6	1.766	3.40	105	0.003	15.33				0.05					0.05	6907.66	0.18	6907.49
128		18	6	1.766	3.40	105	0.003	12.67				0.04		0.00			0.04	6910.46	0.18	6910.28
128	INLET	18	6	1.766	3.40	105	0.003	0.00				0.00	0.00	0.00		0.2688	0.27	6910.73	0.18	6910.55

* BEGINNING EGL COMES FROM THE EGL OF LAT G STA 1+40.07

MANNINGS n = 0.013

BRIARGATE PARKWAY

LATERAL G2

HGL CALCULATION

7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	NTRANC LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	14																	
100		18	14	1.766	7.93	105	0.018	0.00				0.00	0.00				0.00	6909.17	0.98	6908.19
110.99		18	14	1.766	7.93	105	0.018	10.99				0.20	0.00				0.20	6909.36	0.98	6908.39
110.99	BEND	18	14	1.766	7.93	105	0.018	0.00			0.35	0.00	0.34				0.34	6909.71	0.98	6908.73
122.67		18	14	1.766	7.93	105	0.018	11.68				0.21	0.00				0.21	6909.92	0.98	6908.94
128.88		18	14	1.766	7.93	105	0.018	6.21				0.11	0.00	0.00			0.11	6911.29	0.98	6910.31
128.88	INLET	18	14	1.766	7.93	105	0.018	0.00				0.00	0.00	0.00		1.4634	1.46	6912.75	0.98	6911.77

* BEGINNING EGL COMES FROM THE EGL OF LAT G STA 270.08

MANNINGS n = 0.013

BRIARGATE PARKWAY

LATERAL I

HGL CALCULATION

7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND/R LOSS K	FRICTION LOSS (ft)	D/REDU LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	36	53																	6919.37
100		36	53	7.065	7.50	666	0.006	0.00				0.00					0.00	6920.24	0.87	6919.37
207.14		36	53	7.065	7.50	666	0.006	107.14				0.68					0.68	6920.92	0.87	6920.05
287.02		36	53	7.065	7.50	666	0.006	79.88				0.51	0.00	0.00			0.51	6922.51	0.87	6921.64
287.02	PLUG	36	53	7.065	7.50	666	0.006	0.00				0.00	0.00	0.00			0.00	6922.51	0.87	6921.64

* HGL @ BEGINNING COMES FROM DEPTH + ELEV @ STORM BOX STA 17+97.87 AND THE EGL COMES FROM THE HGL

MANNINGS n = 0.013

BRIARGATE PARKWAY-AUSTING BLUFF PARKWAY

LATERAL L - AUSTING BLUFFS MAIN

HGL CALCULATION

7/16/01 12:25

3.13

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND/R LOSS K	FRICTION LOSS (ft)	D/REDU LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	36	63																	6933.17
100		36	63	7.065	8.92	666	0.009	0.00				0.00					0.00	6934.40	1.23	6933.17
113.83		36	63	7.065	8.92	666	0.009	13.83				0.12	0.00	0.00			0.12	6934.53	1.23	6933.29
113.83	36X36WY	36	47	7.065	6.65	666	0.005	0.00	36	45		0.00	0.00	0.43			0.43	6934.96	0.69	6934.28
202.22		36	47	7.065	6.65	666	0.005	88.39				0.44	0.00	0.00			0.44	6935.40	0.69	6934.72
202.22	30X24WY	36	38	7.065	5.38	666	0.003	0.00	24	45		0.00	0.00	0.16			0.16	6935.56	0.45	6935.11
208.55		36	38	7.065	5.38	666	0.003	6.33				0.02	0.00	0.00			0.02	6935.58	0.45	6935.13
208.55	BEG RED	36	38	7.065	5.38	666	0.003	0.00			0.35	0.00	0.16	0.00			0.16	6935.74	0.45	6935.29
216.55		30	38	4.906	7.75	409	0.009	8.00				0.07	0.00	0.00			0.07	6935.81	0.93	6934.88
216.55	END RED	30	38	4.906	7.75	409	0.009	0.00				0.00	0.00	0.00			0.00	6935.81	0.93	6934.88
290.07		30	38	4.906	7.75	409	0.009	73.52				0.63	0.00	0.00			0.63	6936.44	0.93	6935.51
290.07	END PLUG	30	38	4.906	7.75	409	0.009	0.00				0.00	0.00	0.00			0.00	6936.44	0.93	6935.51
294.07		30	38	4.906	7.75	409	0.009	4.00				0.03	0.00	0.00			0.03	6936.48	0.93	6935.55
294.07	30X18WY	30	28	4.906	5.71	409	0.005	0.00	18	45		0.00	0.00	0.17			0.17	6936.65	0.51	6936.14
315.99		30	28	4.906	5.71	409	0.005	21.92				0.10	0.00	0.00			0.10	6936.75	0.51	6936.25
315.99	REDUCER	30	28	4.906	5.71	409	0.005	0.00			0.35	0.00	0.18	0.00			0.18	6936.93	0.51	6936.42
347.99		24	28	3.140	8.92	226	0.015	32.00				0.49	0.00	0.00			0.49	6937.42	1.23	6936.19
347.99	V-BEND	24	28	3.140	8.92	226	0.015	0.00			0.35	0.00	0.43	0.00			0.43	6937.85	1.23	6936.62
686.16		24	28	3.140	8.92	226	0.015	338.17				5.21	0.00	0.00			5.21	6943.07	1.23	6941.83
686.16	INLET OU	24	28	3.140	8.92	226	0.015	0.00				0.00	0.00	0.00		1.4817	1.48	6944.55	1.23	6943.31
702.16		24	15	3.140	4.78	226	0.004	16.00				0.07	0.00	0.00			0.07	6944.62	0.35	6944.27
702.16	INLET IN	24	15	3.140	4.78	226	0.004	0.00				0.00	0.00	0.00			0.00	6944.62	0.35	6944.27
783.52		24	15	3.140	4.78	226	0.004	81.36				0.36	0.00	0.00			0.36	6944.98	0.35	6944.63
954.96		24	15	3.140	4.78	226	0.004	171.44				0.76	0.00	0.00			0.76	6950.10	0.35	6949.75
954.96	45-BEND	24	15	3.140	4.78	226	0.004	0.00			0.35	0.00	0.12	0.00			0.12	6950.23	0.35	6949.87
960.12		24	15	3.140	4.78	226	0.004	5.16				0.02	0.00	0.00			0.02	6950.25	0.35	6949.90
1012.83		24	15	3.140	4.78	226	0.004	52.71				0.23	0.00	0.00			0.23	6951.83	0.35	6951.48
1012.83	45-BEND	24	15	3.140	4.78	226	0.004	0.00			0.35	0.00	0.12	0.00			0.12	6951.96	0.35	6951.60
1016.83		24	15	3.140	4.78	226	0.004	4.00				0.02	0.00	0.00			0.02	6951.98	0.35	6951.62
1016.83	INLET	24	15	3.140	4.78	226	0.004	0.00				0.00	0.00	0.00		0.5315	0.53	6952.51	0.35	6952.15

* HGL @ BEGINNING COMES FROM DEPTH + ELEV @ STORM BOX STA 23+01.87 AND THE EGL COMES FROM THE HGL

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL L1
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND/R LOSS K	FRICTION LOSS (ft)	D/REDU LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	36	21																	
100		36	21	7.065	2.97	666	0.001	0.00				0.00					0.00	6934.96	0.14	6934.83
107.46		36	21	7.065	2.97	666	0.001	7.46				0.01		0.00			0.01	6934.97	0.14	6934.83
107.46	BEG RED	36	21	7.065	2.97	666	0.001	0.00			0.35	0.00	0.05	0.00			0.05	6935.02	0.14	6934.88
115.46		18	21	1.766	11.89	105	0.040	8.00				0.32	0.00	0.00			0.32	6935.34	2.20	6933.15
115.46	END RED	18	21	1.766	11.89	105	0.040	0.00				0.00	0.00	0.00			0.00	6935.34	2.20	6933.15
119.46		18	21	1.766	11.89	105	0.040	4.00				0.16	0.00	0.00			0.16	6935.50	2.20	6933.31
119.46	45-BEND	18	21	1.766	11.89	105	0.040	0.00			0.35	0.00	0.77	0.00			0.77	6936.27	2.20	6934.08
128.53		18	21	1.766	11.89	105	0.040	9.07				0.37	0.00	0.00			0.37	6936.64	2.20	6934.44
153.54		18	21	1.766	11.89	105	0.040	25.01				1.01	0.00	0.00			1.01	6939.58	2.20	6937.38
153.54	INLET IN	18	12	1.766	6.79	105	0.013	0.00				0.00	0.00	0.00		0.8601	0.86	6940.44	0.72	6939.72
203.54		18	12	1.766	6.79	105	0.013	50.00				0.66	0.00	0.00			0.66	6941.09	0.72	6940.38
203.54	INLET	18	12	1.766	6.79	105	0.013	0.00				0.00	0.00	0.00		1.0751	1.08	6942.17	0.72	6941.45

* BEGINNING EGL COMES FROM LAT L STA 115.78

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL L2
HGL CALCULATION
7/16/01 12:25

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	11																	
100		18	11	1.766	6.23	105	0.011	0.00				0.00					0.00	6935.56	0.60	6934.96
108		18	11	1.766	6.23	105	0.011	8.00				0.09					0.09	6935.65	0.60	6935.05
108	BEND	18	11	1.766	6.23	105	0.011	0.00			0.35	0.00	0.21				0.21	6935.86	0.60	6935.26
128.06		18	11	1.766	6.23	105	0.011	20.06				0.22					0.22	6936.08	0.60	6935.48
136		18	11	1.766	6.23	105	0.011	7.94				0.09					0.09	6937.11	0.60	6936.51
136	INLET	18	5	1.766	2.83	105	0.002	0.00				0.00				0.19	0.19	6937.30	0.12	6937.17
148.81		18	5	1.766	2.83	105	0.002	12.81				0.03					0.03	6937.33	0.12	6937.20
168		18	5	1.766	2.83	105	0.002	19.19				0.04					0.04	6940.08	0.12	6939.96
168	INLET	18	5	1.766	2.83	105	0.002	0.00				0.00				0.19	0.19	6940.27	0.12	6940.15

* BEGINNING EGL COMES FROM LAT L STA 202

MANNINGS n = 0.013

BRIARGATE PARKWAY

LATERAL L3

HGL CALCULATION

7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	11																	
100		18	11	1.766	6.23	105	0.011	0.00				0.00					0.00	6936.65	0.60	6936.05
108		18	11	1.766	6.23	105	0.011	8.00				0.09					0.09	6936.74	0.60	6936.14
108	BEND	18	11	1.766	6.23	105	0.011	0.00			0.35	0.00	0.21				0.21	6936.95	0.60	6936.35
146.21		18	11	1.766	6.23	105	0.011	38.21				0.42					0.42	6937.37	0.60	6936.77
163		18	11	1.766	6.23	105	0.011	16.79				0.19					0.19	6938.85	0.60	6938.25
163	INLET	18	11	1.766	6.23	105	0.011	0.00				0.00				0.90	0.90	6939.76	0.60	6939.15

* BEGINNING EGL COMES FROM LAT L STA 278

MANNINGS n = 0.013

BRIARGATE PARKWAY

LATERAL N

HGL CALCULATION

7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	30	31																	
100		30	31	4.906	6.32	409	0.006	0.00				0.00					0.00	6961.52	0.62	6960.90
162.35		30	31	4.906	6.32	409	0.006	62.35				0.36					0.36	6961.88	0.62	6961.26
162.35	BEND	30	31	4.906	6.32	409	0.006	0.00			0.35	0.00	0.22				0.22	6962.09	0.62	6961.47
276.66		30	31	4.906	6.32	409	0.006	114.31				0.66					0.66	6962.75	0.62	6962.13
276.66	END	30	31	4.906	6.32	409	0.006	0.00				0.00					0.00	6962.75	0.62	6962.13

* BEGINNING HGL COMES FROM ST MAIN STA 34+31

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL O
HGL CALCULATION
7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	30	34																	
100		30	34	4.906	6.93	409	0.007	0.00				0.00					0.00	6970.65	0.75	6969.90
127.12		30	34	4.906	6.93	409	0.007	27.12				0.19					0.19	6970.83	0.75	6970.09
127.12	WYE	30	33	4.906	6.73	409	0.007	0.00	18	45		0.00		0.04			0.04	6970.87	0.70	6970.17
136.68		30	33	4.906	6.73	409	0.007	9.56				0.06					0.06	6970.94	0.70	6970.23
136.68	WYE	30	30	4.906	6.11	409	0.005	0.00	18	45		0.00		0.10			0.10	6971.03	0.58	6970.45
190		30	30	4.906	6.11	409	0.005	53.32				0.29					0.29	6971.32	0.58	6970.74
190	END	30	30	4.906	6.11	409	0.005	0.00				0.00					0.00	6971.32	0.58	6970.74

* BEGINNING EGL COMES FROM ST MAIN STA 38+03

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL O1
HGL CALCULATION
7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	1																	
100		18	1	1.766	0.57	105	0.000	0.00				0.00					0.00	6970.87	0.00	6970.87
152.69		18	1	1.766	0.57	105	0.000	52.69				0.00					0.00	6970.88	0.00	6970.87
152.69	INLET	18	1	1.766	0.57	105	0.000	0.00				0.00				0.01	0.01	6970.89	0.00	6970.88

* BEGINNING EGL COMES FROM LAT L STA 278LAT O STA 127.12

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL O2
HGL CALCULATION
7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	5																	
100		18	5	1.766	2.83	105	0.002	0.00				0.00					0.00	6971.03	0.12	6970.91
140.47		18	5	1.766	2.83	105	0.002	40.47				0.09					0.09	6971.13	0.12	6971.00
140.47	INLET	18	5	1.766	2.83	105	0.002	0.00				0.00				0.19	0.19	6971.31	0.12	6971.19

* BEGINNING EGL COMES FROM LAT 0 STA 136.68

MANNINGS n = 0.013

BRIARGATE PARKWAY
LATERAL P
HGL CALCULATION
7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	LATERAL SIZE (inches)	LATERAL ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	30	36																	
100		30	36	4.906	7.34	409	0.008	0.00				0.00					0.00	6972.43	0.84	6971.59
116.5		30	36	4.906	7.34	409	0.008	16.50				0.13					0.13	6972.55	0.84	6971.72
116.5	BEND	30	36	4.906	7.34	409	0.008	0.00			0.35	0.00	0.29				0.29	6972.85	0.84	6972.01
158.23		30	36	4.906	7.34	409	0.008	41.73				0.32					0.32	6973.17	0.84	6972.33
158.23	WYE	30	30	4.906	6.11	409	0.005	0.00	18	45		0.00		0.16			0.16	6973.33	0.58	6972.75
251		30	30	4.906	6.11	409	0.005	92.77				0.50					0.50	6973.83	0.58	6973.25
251	END	30	30	4.906	6.11	409	0.005	0.00				0.00					0.00	6973.83	0.58	6973.25

* BEGINNING EGL COMES FROM ST MAIN STA 38+40.25

MANNINGS n = 0.013

BRIARGATE PARKWAY

LATERAL P1

HGL CALCULATION

7/17/01 10:26

STATION		PIPE SIZE (inches)	PEAK RATE (cfs)	AREA (sf)	VELOCITY (fps)	CONV. K	FRICTION SLOPE (ft/ft)	JUNCTION DATA LATERAL LENGTH (ft)	SIZE (inches)	ANGLE (degrees)	BEND LOSS K	FRICTION LOSS (ft)	BEND LOSS (ft)	JUNCTION LOSS (ft)	M.H. LOSS (ft)	TRANS LOSS (ft)	TOTAL LOSS (ft)	ENERGY GRADE LINE (elevation)	VELOCITY HEAD (ft)	HYDRAULIC GRADE LINE (elevation)
100	BEGIN	18	5																	
100		18	5	1.766	2.83	105	0.002	0.00				0.00					0.00	6973.33	0.12	6973.21
106.76		18	5	1.766	2.83	105	0.002	6.76				0.02					0.02	6973.35	0.12	6973.22
106.76	BEND	18	5	1.766	2.83	105	0.002	0.00			0.35	0.00	0.04				0.04	6973.39	0.12	6973.27
139.35		18	5	1.766	2.83	105	0.002	32.59				0.07					0.07	6973.47	0.12	6973.34
139.35	INLET	18	5	1.766	2.83	105	0.002	0.00				0.00				0.19	0.19	6973.65	0.12	6973.53

* BEGINNING EGL COMES FROM LAT P STA 158.23

5:00 PRELIMINARY DRAINAGE BASINS NORTH OF PROPOSED BRIARGATE PARKWAY

5:01 HYDROLOGIC BASIN CALCULATIONS: PS-7-1 THROUGH PS7-4; PS9-1 THROUGH PS9-10

5:02 COMPOSITE "CA" SPREADSHEETS: AP9-1 THROUGH AP9-11B; AP7-1 THROUGH AP7-5

5:03 ROUTING SPREADSHEETS: AP9-1 THROUGH AP9-11B; AP7-1 THROUGH AP7-5

5:04 INLET SPREADSHEETS: PRELIMINARY INLETS AT AP9-2 AND AP9-4

5:05 PRELIMINARY PIPE SIZE DATA SHEETS

5:01 HYDROLOGIC BASIN CALCULATIONS: PS-7-1 THROUGH PS7-4; PS9-1 THROUGH PS9-10

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, DBPS Basin PS9, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS9-1 INLET	2.24	0.82	0.87	0.25 0.90	15 50	0.30 2.00	4.90 1.67	1300	4.00%	7.00	3.10	9.67	4.11	7.17	8	14
														CA(equiv.)	1.84	1.95
PS9-2 STREET GUTTER	1.02	0.82	0.87	0.25 0.90	15 50	0.30 2.00	4.90 1.67	650	4.00%	7.00	1.55	8.12	4.36	7.69	4	7
														CA(equiv.)	0.84	0.89
PS9-3 SMP INLET	4.74	0.82	0.87	0.25 0.90	30 50	5.00 1.00	3.44 2.10	580	2.00%	4.95	1.95	7.50	4.47	7.92	17	33
														CA(equiv.)	3.89	4.12
PS9-4 INLET	1.87	0.82	0.87	0.25 0.90	15 50	0.30 2.00	4.90 1.67	1100	4.00%	7.00	2.62	9.19	4.19	7.32	6	12
														CA(equiv.)	1.53	1.63
PS9-5 STREET GUTTER	1.24	0.82	0.87	0.25 0.90	15 50	0.30 2.00	4.90 1.67	800	4.00%	7.00	1.90	8.48	4.30	7.56	4	8
														CA(equiv.)	1.02	1.08
PS9-6 PIPE OUTFALL	15.48	0.70	0.80	0.25 0.90	100 50	33.00 1.50	5.01 1.84	950	3.00%	6.06	2.61	9.47	4.14	7.24	45	90
														CA(equiv.)	10.84	12.38
PS9-7 SMP INLET	1.20	0.84	0.88	0.25 0.90	15 50	0.30 1.80	4.90 1.73	500	3.50%	6.55	1.27	7.90	4.40	7.77	4	8
														CA(equiv.)	1.01	1.06
TOTAL	27.79															

mddp-basins 6/11/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Pine Creek Basin Drainage Summary, DBPS Basins PS9 & PS7, Developed Condition)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100)
		For Calcs See Runoff Summary														
PS9-8	16.74	0.72	0.82	0.25	20	1.00	4.18	400	2.50%	5.53	1.20	10.03	4.06	7.06	49	97
PIPE				0.90	50	1.25	1.95	800	2.00%	4.95	2.69					
OUTFALL														CA(equiv.)	12.05	13.73
PS9-9	6.90	0.70	0.80	0.25	20	2.00	3.32	350	1.00%	3.50	1.67	8.27	4.34	7.63	21	42
PIPE				0.90	50	1.00	2.10	350	2.00%	4.95	1.18					
OUTFALL														CA(equiv.)	4.83	5.52
PS9-10	10.48	0.70	0.80	0.25	30	2.00	4.66	950	2.00%	4.95	3.20	9.53	4.13	7.22	30	61
PIPE				0.90	50	2.00	1.67									
OUTFALL														CA(equiv.)	7.34	8.38
PS7-1	1.86	0.82	0.87	0.25	20	1.00	4.18	850	2.00%	4.95	2.86	9.14	4.19	7.34	6	12
SMP INLETS				0.90	50	1.00	2.10									
														CA(equiv.)	1.53	1.62
PS7-2	36.70	0.90	0.90	0.25	40	5.00	4.37	200	2.50%	5.53	0.60	11.45	3.87	6.68	128	220
PIPE				0.90	50	1.00	2.10	1300	2.00%	4.95	4.38					
OUTFALL														CA(equiv.)	33.03	33.03
PS7-3	13.41	0.70	0.80	0.25	30	1.20	5.51	1150	2.00%	4.95	3.87	11.49	3.86	6.67	36	72
PIPE				0.90	50	1.00	2.10									
OUTFALL														CA(equiv.)	9.39	10.73
PS7-4	5.62	0.70	0.80	0.25	20	2.00	3.32	650	2.00%	4.95	2.19	7.62	4.45	7.87	18	35
PIPE				0.90	50	1.00	2.10									
OUTFALL														CA(equiv.)	3.93	4.50
TOTAL	91.71															

5:02 COMPOSITE "CA" SPREADSHEETS: AP9-1 THROUGH AP9-11B; AP7-1 THROUGH AP7-5

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, BASIN PS9, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP9-1 STREET GUTTER	PS9-2	1.02	0.84	0.89		
	TOTAL	1.02			0.84	0.89
AP9-2 INLET	AP9-1	1.02	0.84	0.89		
	PS9-1	2.24	1.84	1.95		
	TOTAL	3.26			2.68	2.84
AP9-2A PIPE	INLETS-9-2 2 REQ.		2.42	2.24		
	TOTAL	0			2.42	2.24
AP9-3 STREET GUTTER	PS9-5	1.24	1.02	1.08		
	TOTAL	1.24			1.02	1.08
AP9-4 INLET	AP9-3		1.02	1.08		
	PS9-4	1.87	1.53	1.63		
	TOTAL	1.87			2.55	2.71
AP9-5 OUTFALL PIPE	PS9-6	15.48	10.84	12.38		
	TOTAL	15.48			10.84	12.38
AP9-6 PIPE	AP9-5		10.84	12.38		
	INLET-9-4		2.29	2.12		
	TOTAL				13.13	14.50
AP9-7 ASSUMED FLBY	FLBY		1.79	2.02		
	TOTAL				1.79	2.02
AP9-8 ASSUMED FLBY	FLBY		1.79	2.02		
	TOTAL				1.79	2.02

COMP-UNION 6/11/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

PINE CREEK BASIN, BASINS PS9 & PS7, DEVELOPED CONDITION

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
AP9-9	AP9-7		1.79	2.02		
SMP INLETS	AP9-8		1.79	2.02		
OUTFALL	PS9-3	4.74	3.89	4.12		
PIPE						
	TOTAL	4.74			7.47	8.16
AP9-10	PS9-8	16.74	12.05	13.73		
OUTFALL						
PIPE						
	TOTAL	16.74			12.05	13.73
AP9-11	PS9-7	1.2	1.01	1.06		
SMP INLETS	FWBY B10B		1.27	1.46		
	TOTAL	1.2			2.28	2.52
AP9-11A	PS9-9	6.9	4.83	5.52		
OUTFALL						
PIPE	TOTAL	6.9			4.83	5.52
AP9-11B	AP9-11A	6.9	4.83	5.52		
PIPE	AP9-11		2.28	2.52		
	AP9-10	16.74	12.05	13.73		
	TOTAL	6.9			19.16	21.77
AP7-1	PS7-2	36.7	33.03	33.03		
INLETS						
OUTFALL						
PIPE	TOTAL	36.7			33.03	33.03
AP7-2	AP7-1	36.7	33.03	33.03		
PIPE	AP9-9		7.47	8.16		
	TOTAL	36.7			40.50	41.19
AP7-3	PS7-1	1.86	1.53	1.62		
SMP INLETS	FLBY-B8A		1.81	4.29		
	FLBY-B9A		1.47	2.61		
	TOTAL	1.86			3.34	5.91
AP7-3A	AP7-2		40.50	41.19		
PIPE	AP7-3		3.34	5.91		
	TOTAL				43.84	47.10
AP7-4	PS7-3	13.41	9.39	10.73		
PIPE						
OUTFALL						
	TOTAL				9.39	10.73
AP7-5	PS7-4	5.62	3.93	4.50		
PIPE						
OUTFALL						
	TOTAL				3.93	4.50

COMP-UNION 6/12/2001

5:03 ROUTING SPREADSHEETS: AP9-1 THROUGH AP9-11B; AP7-1 THROUGH AP7-5

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, DBPS BASIN PS9, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP9-1 STREET GUTTER	1.02	0.84	0.89	0.25 0.90	15 50	0.30 2.00	4.90 1.67	650	4.00%	7.00	1.55	8.12	4.36	7.69	4	7
AP9-2 INLET	3.26	2.68	2.84	0.25 0.90	15 50	0.30 2.00	4.90 1.67	650 1450	4.00% 4.00%	7.00 7.00	1.55 3.45	11.57	3.85	6.65	10	19
AP9-2A PIPE		2.42	2.24	0.25 0.90	15 50	0.30 2.00	4.90 1.67	650 1450	4.00% 4.00%	7.00 7.00	1.55 3.45	11.57	3.85	6.65	9	15
AP9-3 STREET GUTTER	1.24	1.02	1.08	0.25 0.90	15 50	0.30 2.00	4.90 1.67	800	4.00%	7.00	1.90	8.48	4.30	7.56	4	8
AP9-4 INLET	1.87	2.55	2.71	0.25 0.90	15 50	0.30 2.00	4.90 1.67	800 1150	4.00% 4.00%	7.00 7.00	1.90 2.74	11.21	3.90	6.74	10	18
AP9-5 OUTFALL PIPE	15.48	10.84	12.38	0.25 0.90	100 50	33.00 1.50	5.01 1.84	950	3.00%	6.06	2.61	9.47	4.14	7.24	45	90
AP9-6 PIPE		13.13	14.50	0.25 0.90	100 50	33.00 1.50	5.01 1.84	950 20	3.00% 1.00%	6.06 3.50	2.61 0.10	9.56	4.13	7.21	54	104

RTGUNION 6/11/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, DBPS BASINS PS9, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP9-7 ASSUMED FLBY		1.79	2.02	0.25 0.90	30 50	5.00 1.00	3.44 2.10	580	2.00%	4.95	1.95	7.50	4.47	7.92	8	16
AP9-8 ASSUMED FLBY		1.79	2.02	0.25 0.90	30 50	5.00 1.00	3.44 2.10	580	2.00%	4.95	1.95	7.50	4.47	7.92	8	16
AP9-9 INLETS		7.47	8.16	0.25 0.90	30 50	5.00 1.00	3.44 2.10	580	2.00%	4.95	1.95	7.50	4.47	7.92	33	65
AP9-10 OUTFALL PIPE	16.74	12.05	13.73	0.25 0.90	20 50	1.00 1.25	4.18 1.95	400 800	2.50% 2.00%	5.53 4.95	1.20 2.69	10.03	4.06	7.06	49	97
AP9-11 SMP INLETS		2.28	2.52	0.25 0.90	15 50	0.30 1.80	4.90 1.73	500	3.50%	6.55	1.27	7.90	4.40	7.77	10	20
AP9-11A OUTFALL PIPE	6.90	4.83	5.52	0.25 0.90	20 50	2.00 1.00	3.32 2.10	350 350	1.00% 2.00%	3.50 4.95	1.67 1.18	8.27	4.34	7.63	21	42
AP9-11B PIPE		19.16	21.77	0.25 0.90	20 50	1.00 1.25	4.18 1.95	400 800 600	4.00% 2.00% 3.50%	7.00 4.95 6.55	0.95 2.69 1.53	11.31	3.89	6.71	74	146
AP9-12 OUTFALL PIPE	10.48	7.34	8.38	0.25 0.90	30 50	2.00 2.00	4.66 1.67	950	2.00%	4.95	3.20	9.53	4.13	7.22	30	61

RTGUNION 6/11/2001

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN

(PINE CREEK BASIN, DBPS BASIN PS7, DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	WEIGHTED CA(100) * For Calcs See Runoff Summary	OVERLAND/POND OUTFLOW C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/ PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
AP7-1	36.70	33.03	33.03	0.25	40	5.00	4.37	200	2.50%	5.53	0.60	11.45	3.87	6.68	128	220
OUTFALL				0.90	50	1.00	2.10	1300	2.00%	4.95	4.38					
PIPE																
AP7-2		40.50	41.19	0.25	40	5.00	4.37	500	2.50%	5.53	1.51	13.70	3.60	6.15	146	253
PIPE				0.90	50	1.00	2.10	1300	2.00%	4.95	4.38					
								200	0.50%	2.47	1.35					
AP7-3		3.34	5.91	0.25	20	0.40	5.66	1950	2.60%	5.64	5.76	13.99	3.57	6.09	12	36
SMP INLETS				0.90	50	1.00	2.10	100	1.00%	3.50	0.48					
AP7-3A		43.84	47.10	0.25	40	5.00	4.37	500	2.50%	5.53	1.51	15.10	3.46	5.87	152	277
PIPE				0.90	50	1.00	2.10	1300	2.00%	4.95	4.38					
								200	0.50%	2.47	1.35					
								550	3.50%	6.55	1.40					
AP7-4	13.41	9.39	10.73	0.25	30	1.20	5.51	1150	2.00%	4.95	3.87	11.49	3.86	6.67	36	72
PIPE				0.90	50	1.00	2.10									
OUTFALL																
AP7-5	5.62	3.93	4.50	0.25	20	2.00	3.32	650	2.00%	4.95	2.19	7.62	4.45	7.87	17	35
PIPE				0.90	50	1.00	2.10									
OUTFALL																

RTGUNION 6/11/2001

5:04 INLET SPREADSHEETS: PRELIMINARY INLETS AT AP9-2 AND AP9-4

UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 12' Inlet at UNION, AP9-2

100-YR. FLOW					
Q(100)	19	I(100)	6.7		
DEPTH	0.43	Fr	2.27	Inlet size ? L(i) =	12
SPREAD	15.0	L(1)	26.2	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	15.7	If Li > L(2) then Qi =	10
STREET SLOPE	3.0%	L(3)	56.1	FB =	10
				CA(eqv.)=	1.50

5-YR. FLOW					
Q(5)	10	I(5)	3.9		
DEPTH	0.34	Fr	2.12	Inlet size ? L(i) =	12
SPREAD	10.8	L(1)	17.6	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	10.5	If Li > L(2) then Qi =	6
STREET SLOPE	3.0%	L(3)	37.6	FB =	4
				CA(eqv.)=	1.04

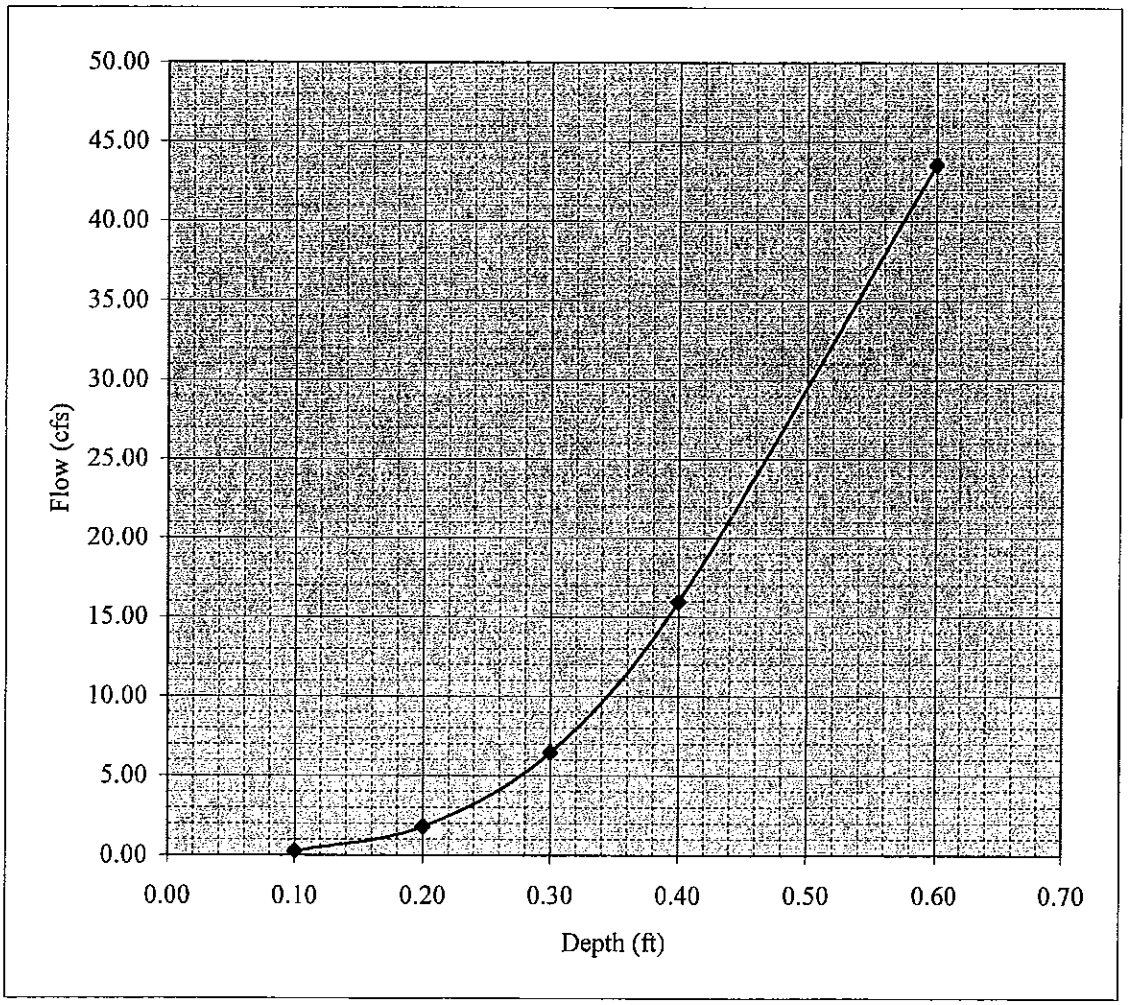
UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

z = 1/s zA = 50

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

slope (s) = 0.03 ft/ft na = 0.016

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.26
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.79
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.44
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.96
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		43.54



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 10' Inlet at UNION, AP9-2, SECOND INLET

100-YR. FLOW					
Q(100)	10	I(100)	6.7		
DEPTH	0.34	Fr	2.11	Inlet size ? L(i) =	10
SPREAD	10.5	L(1)	17.1	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	10.3	If Li > L(2) then Qi =	6
STREET SLOPE	3.0%	L(3)	36.6	FB =	4
				CA(eqv.)=	0.60

5-YR. FLOW					
Q(5)	4	I(5)	3.9		
DEPTH	0.26	Fr	1.92	Inlet size ? L(i) =	10
SPREAD	6.8	L(1)	10.0	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	6.0	If Li > L(2) then Qi =	3
STREET SLOPE	3.0%	L(3)	21.3	FB =	1
				CA(eqv.)=	0.26

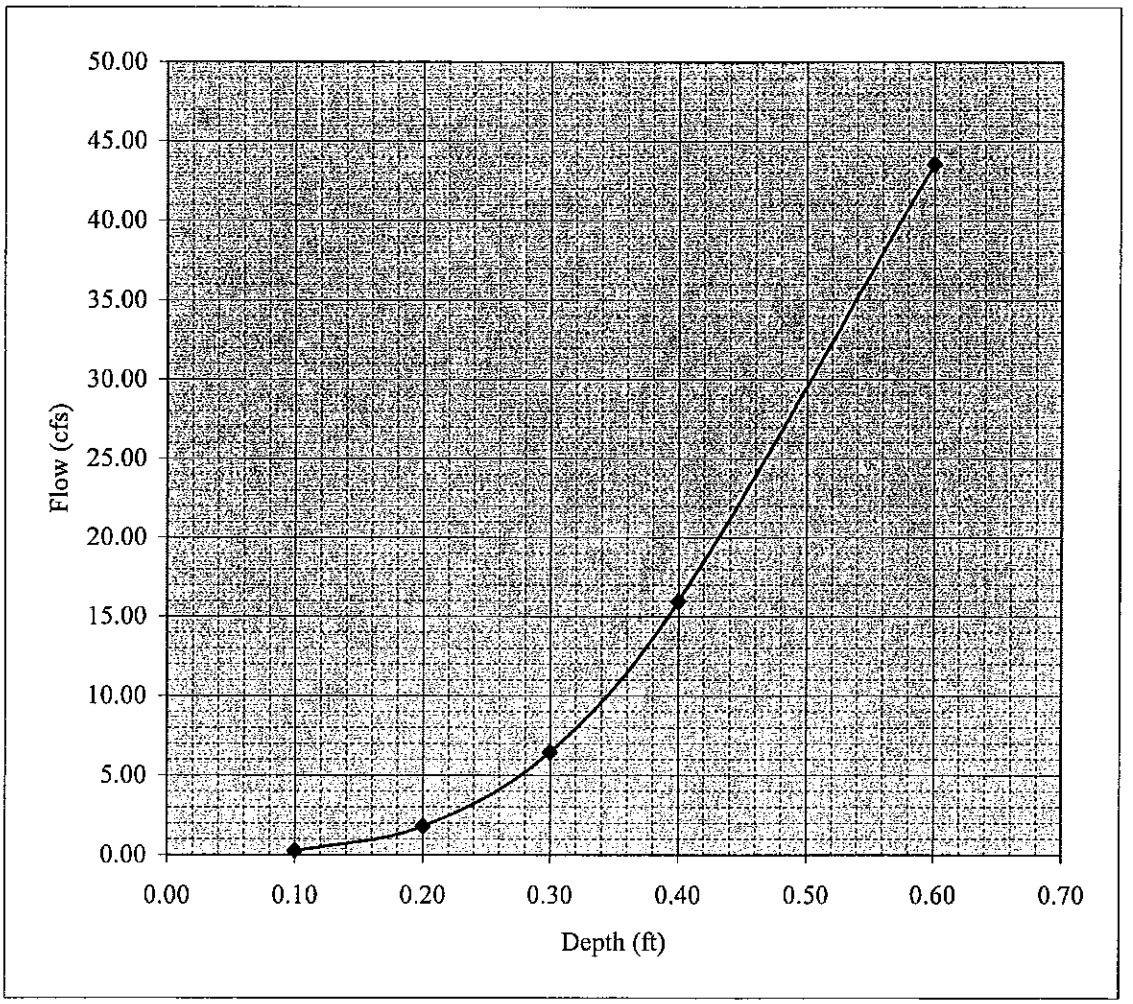
UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

z = 1/s zA = 50

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

slope (s) = 0.03 ft/ft na = 0.016

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.26
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.79
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.44
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.96
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		43.54



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 12' Inlet at UNION, AP9-4

100-YR. FLOW					
Q(100)	18	I(100)	6.7		
DEPTH	0.42	Fr	2.25	Inlet size ? L(i) =	12
SPREAD	14.5	L(1)	25.1	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	15.1	If Li > L(2) then Qi =	10
STREET SLOPE	3.0%	L(3)	53.9	FB =	9
				CA(eqv.)=	1.34

5-YR. FLOW					
Q(5)	10	I(5)	3.9		
DEPTH	0.34	Fr	2.12	Inlet size ? L(i) =	12
SPREAD	10.8	L(1)	17.6	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	10.5	If Li > L(2) then Qi =	6
STREET SLOPE	3.0%	L(3)	37.6	FB =	4
				CA(eqv.)=	1.02

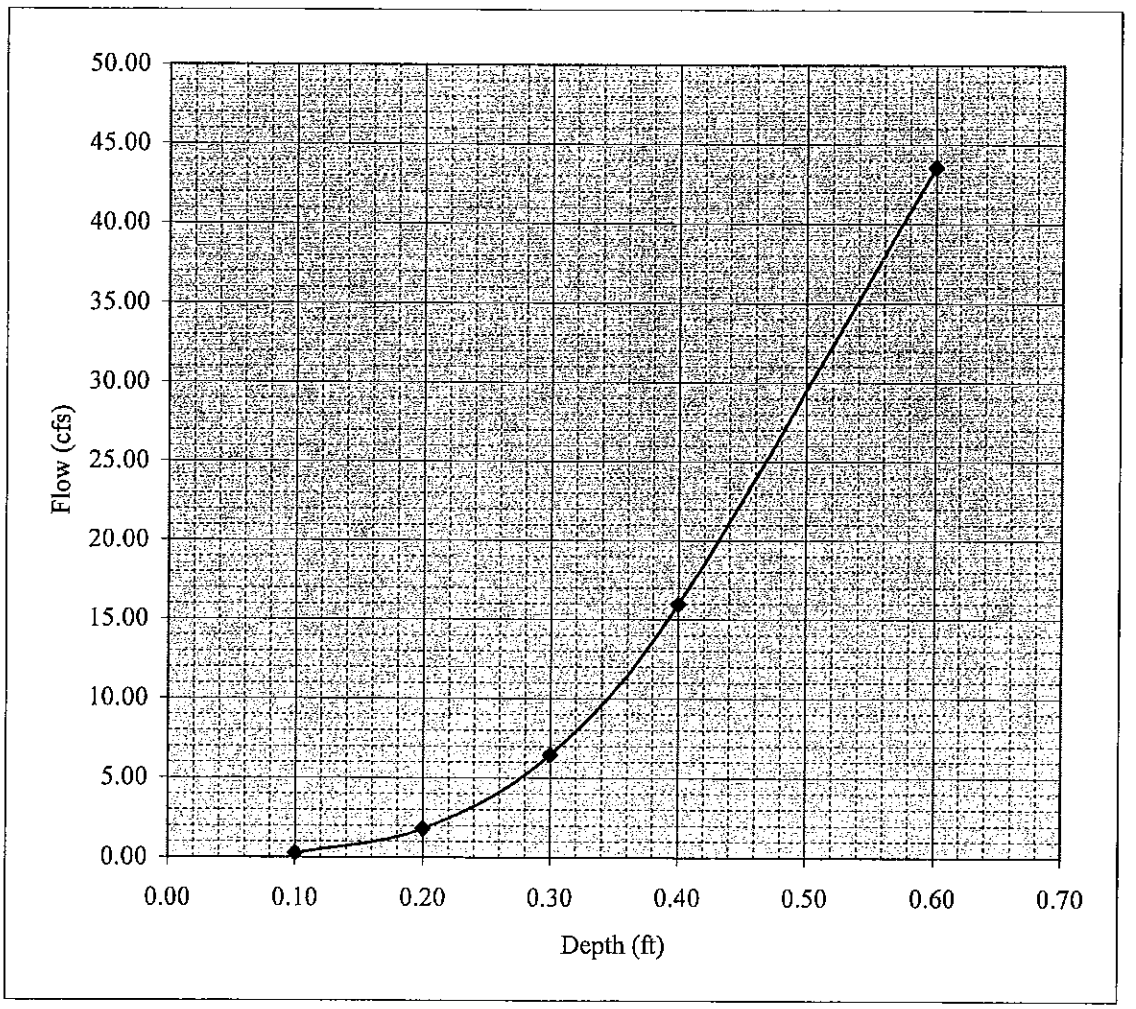
UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

z = 1/s zA = 50

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

slope (s) = 0.03 ft/ft na = 0.016

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.26
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.79
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.44
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.96
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		43.54



UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

Proposed 10' Inlet at UNION, AP9-4, Second inlet

100-YR. FLOW					
Q(100)	9	I(100)	6.7		
DEPTH	0.33	Fr	2.09	Inlet size ? L(i) =	10
SPREAD	10.0	L(1)	16.1	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	9.7	If Li > L(2) then Qi =	5
STREET SLOPE	3.0%	L(3)	34.5	FB =	4
				CA(eqv.)=	0.59

5-YR. FLOW					
Q(5)	4	I(5)	3.9		
DEPTH	0.26	Fr	1.92	Inlet size ? L(i) =	10
SPREAD	6.8	L(1)	10.0	If Li < L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	6.0	If Li > L(2) then Qi =	3
STREET SLOPE	3.0%	L(3)	21.3	FB =	1
				CA(eqv.)=	0.26

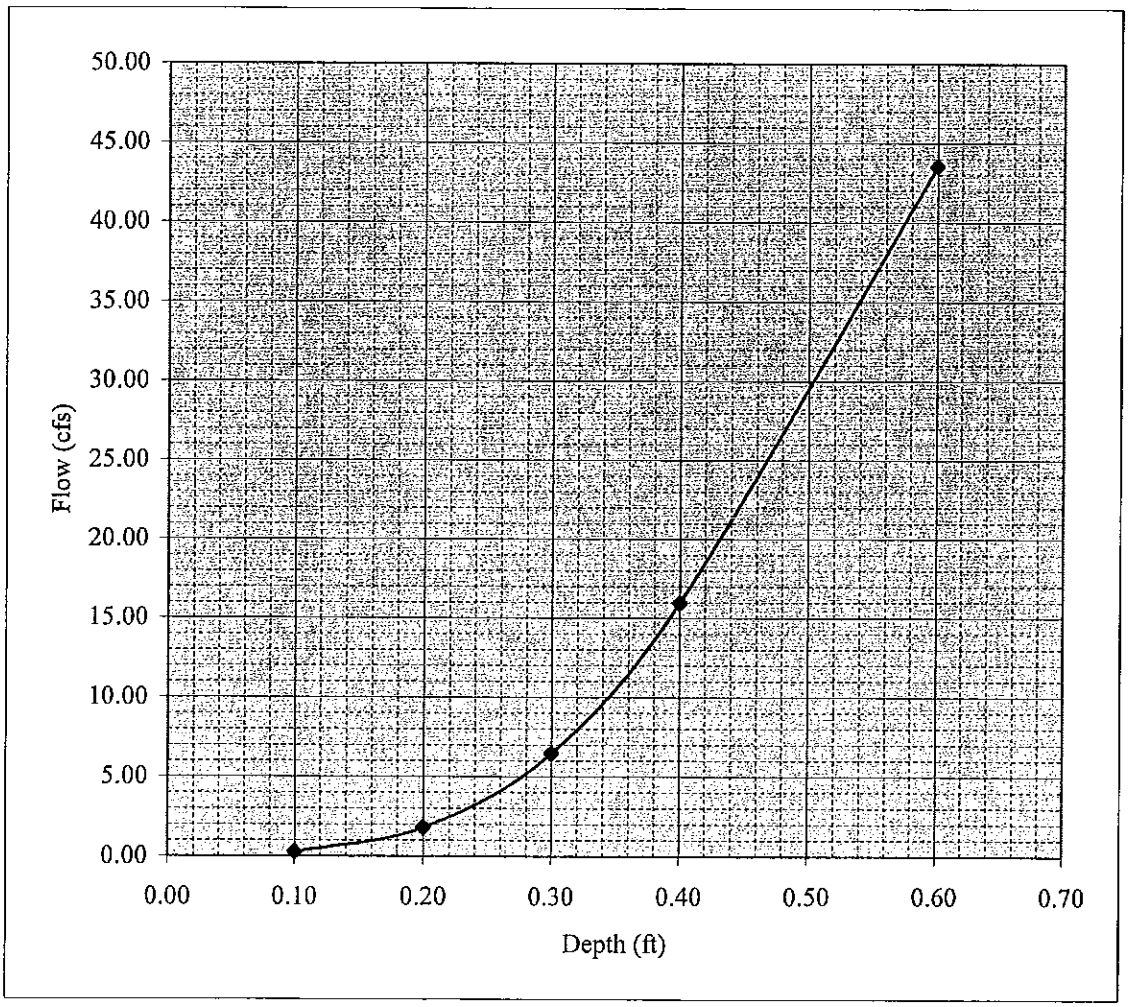
UNION/ BRIARGATE
MASTER DEVELOPMENT DRAINAGE PLAN
(Inlet Calculations - At-Grade)

z = 1/s zA = 50

Q = 0.56 (z/n) d^(8/3) s^(1/2) nb = 0.013 zB = 16

slope (s) = 0.03 ft/ft na = 0.016

Total Depth dT (ft)	Depth of A dA (ft)	Depth of B dB (ft)	Depth of C dC (ft)	Flow Q (cfs)
0.10	----	$0.10^{8/3}$		0.26
0.20	$0.07^{8/3}$	$0.20^{8/3} - 0.07^{8/3}$		1.79
0.30	$0.17^{8/3}$	$0.30^{8/3} - 0.17^{8/3}$		6.44
0.40	$0.27^{8/3}$	$0.40^{8/3} - 0.27^{8/3}$		15.96
0.60	$0.37^{8/3}$	$0.60^{8/3} - 0.37^{8/3}$		43.54



5:05 PRELIMINARY PIPE SIZE DATA SHEETS

ESTIMATED STORM DRAIN DIAMETERS FOR THE AREA NORTH OF BRIARGATE PARKWAY

AP9-2A TO RCB
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	24.00	in
Discharge	15.00	cfs

Results		
Channel Slope	0.004397	ft/ft
Depth	24.0	in
Flow Area	3.14	ft²
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.40	ft
Percent Full	100.00	
Critical Slope	0.006319	ft/ft
Velocity	4.77	ft/s
Velocity Head	0.35	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	16.14	cfs
Full Flow Capacity	15.00	cfs
Full Flow Slope	0.004397	ft/ft

AP9-5 TO AP9-6
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	42.00	in
Discharge	90.00	cfs

Results		
Channel Slope	0.008003	ft/ft
Depth	42.0	in
Flow Area	9.62	ft²
Wetted Perimeter	11.00	ft
Top Width	0.00	ft
Critical Depth	2.94	ft
Percent Full	100.00	
Critical Slope	0.007661	ft/ft
Velocity	9.35	ft/s
Velocity Head	1.36	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	96.81	cfs
Full Flow Capacity	90.00	cfs
Full Flow Slope	0.008003	ft/ft

AP9-6 TO RCB
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	42.00	in
Discharge	104.00	cfs

Results		
Channel Slope	0.010686	ft/ft
Depth	42.0	in
Flow Area	9.62	ft²
Wetted Perimeter	11.00	ft
Top Width	0.00	ft
Critical Depth	3.11	ft
Percent Full	100.00	
Critical Slope	0.009511	ft/ft
Velocity	10.81	ft/s
Velocity Head	1.82	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	111.87	cfs
Full Flow Capacity	104.00	cfs
Full Flow Slope	0.010686	ft/ft

AP9-10 TO AP9-11B
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	36.00	in
Discharge	97.00	cfs

Results		
Channel Slope	0.021152	ft/ft
Depth	36.0	in
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.88	ft
Percent Full	100.00	
Critical Slope	0.018443	ft/ft
Velocity	13.72	ft/s
Velocity Head	2.93	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	104.34	cfs
Full Flow Capacity	97.00	cfs
Full Flow Slope	0.021152	ft/ft

AP9-11A TO AP9-11B
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	36.00	in
Discharge	45.00	cfs (HZ)

Results		
Channel Slope	0.004552	ft/ft
Depth	36.0	in
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.19	ft
Percent Full	100.00	
Critical Slope	0.005868	ft/ft
Velocity	6.37	ft/s
Velocity Head	0.63	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	48.41	cfs
Full Flow Capacity	45.00	cfs
Full Flow Slope	0.004552	ft/ft

AP9-11B TO RCB
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	48.00	in
Discharge	147.00	cfs (146)

Results		
Channel Slope	0.010474	ft/ft
Depth	48.0	in
Flow Area	12.57	ft²
Wetted Perimeter	12.57	ft
Top Width	0.00	ft
Critical Depth	3.57	ft
Percent Full	100.00	
Critical Slope	0.009284	ft/ft
Velocity	11.70	ft/s
Velocity Head	2.13	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	158.13	cfs
Full Flow Capacity	147.00	cfs
Full Flow Slope	0.010474	ft/ft

AP9-12 TO RCB
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	36.00	in
Discharge	64.00	cfs

(Q1)

Results		
Channel Slope	0.009208	ft/ft
Depth	36.0	in
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.57	ft
Percent Full	100.00	
Critical Slope	0.008576	ft/ft
Velocity	9.05	ft/s
Velocity Head	1.27	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	68.85	cfs
Full Flow Capacity	64.00	cfs
Full Flow Slope	0.009208	ft/ft

AP9-9 TO AP7-2
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	36.00	in
Discharge	65.00	cfs

Results		
Channel Slope	0.009498	ft/ft
Depth	36.0	in
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.59	ft
Percent Full	100.00	
Critical Slope	0.008771	ft/ft
Velocity	9.20	ft/s
Velocity Head	1.31	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	69.92	cfs
Full Flow Capacity	65.00	cfs
Full Flow Slope	0.009498	ft/ft

AP7-1 TO AP7-2
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	66.00	in
Discharge	253.00	cfs (220)

Results		
Channel Slope	0.005677	ft/ft
Depth	66.0	in
Flow Area	23.76	ft²
Wetted Perimeter	17.28	ft
Top Width	0.00	ft
Critical Depth	4.43	ft
Percent Full	100.00	
Critical Slope	0.005852	ft/ft
Velocity	10.65	ft/s
Velocity Head	1.76	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	272.15	cfs
Full Flow Capacity	253.00	cfs
Full Flow Slope	0.005677	ft/ft

AP7-2 TO AP7-3A
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	66.00	in
Discharge	291.00	cfs (253)

Results		
Channel Slope	0.007510	ft/ft
Depth	66.0	in
Flow Area	23.76	ft²
Wetted Perimeter	17.28	ft
Top Width	0.00	ft
Critical Depth	4.71	ft
Percent Full	100.00	
Critical Slope	0.006998	ft/ft
Velocity	12.25	ft/s
Velocity Head	2.33	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	313.03	cfs
Full Flow Capacity	291.00	cfs
Full Flow Slope	0.007510	ft/ft

AP7-3A TO RCB
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	66.00	in
Discharge	304.00	cfs (277)

Results		
Channel Slope	0.008196	ft/ft
Depth	66.0	in
Flow Area	23.76	ft²
Wetted Perimeter	17.28	ft
Top Width	0.00	ft
Critical Depth	4.79	ft
Percent Full	100.00	
Critical Slope	0.007466	ft/ft
Velocity	12.80	ft/s
Velocity Head	2.54	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	327.01	cfs
Full Flow Capacity	304.00	cfs
Full Flow Slope	0.008196	ft/ft

AP7-4 TO STORM MAIN
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	42.00	in
Discharge	77.00	cfs (72)

Results		
Channel Slope	0.005858	ft/ft
Depth	42.0	in
Flow Area	9.62	ft²
Wetted Perimeter	11.00	ft
Top Width	0.00	ft
Critical Depth	2.75	ft
Percent Full	100.00	
Critical Slope	0.006382	ft/ft
Velocity	8.00	ft/s
Velocity Head	1.00	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	82.83	cfs
Full Flow Capacity	77.00	cfs
Full Flow Slope	0.005858	ft/ft

AP7-5 TO STORM MAIN
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	AREA NORTH OF BRIARGATE PARKWAY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	36.00	in
Discharge	45.00	cfs (35)

Results		
Channel Slope	0.004552	ft/ft
Depth	36.0	in
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.19	ft
Percent Full	100.00	
Critical Slope	0.005868	ft/ft
Velocity	6.37	ft/s
Velocity Head	0.63	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	48.41	cfs
Full Flow Capacity	45.00	cfs
Full Flow Slope	0.004552	ft/ft

6:00 DATA SHEETS AND CALCULATIONS FOR PROPOSED BRIARGATE PARKWAY MAJOR CONVEYANCE

6:01 ANALYSIS OF PROPOSED R.C.B. OUTFALL TO DETENTION FACILITY "C"

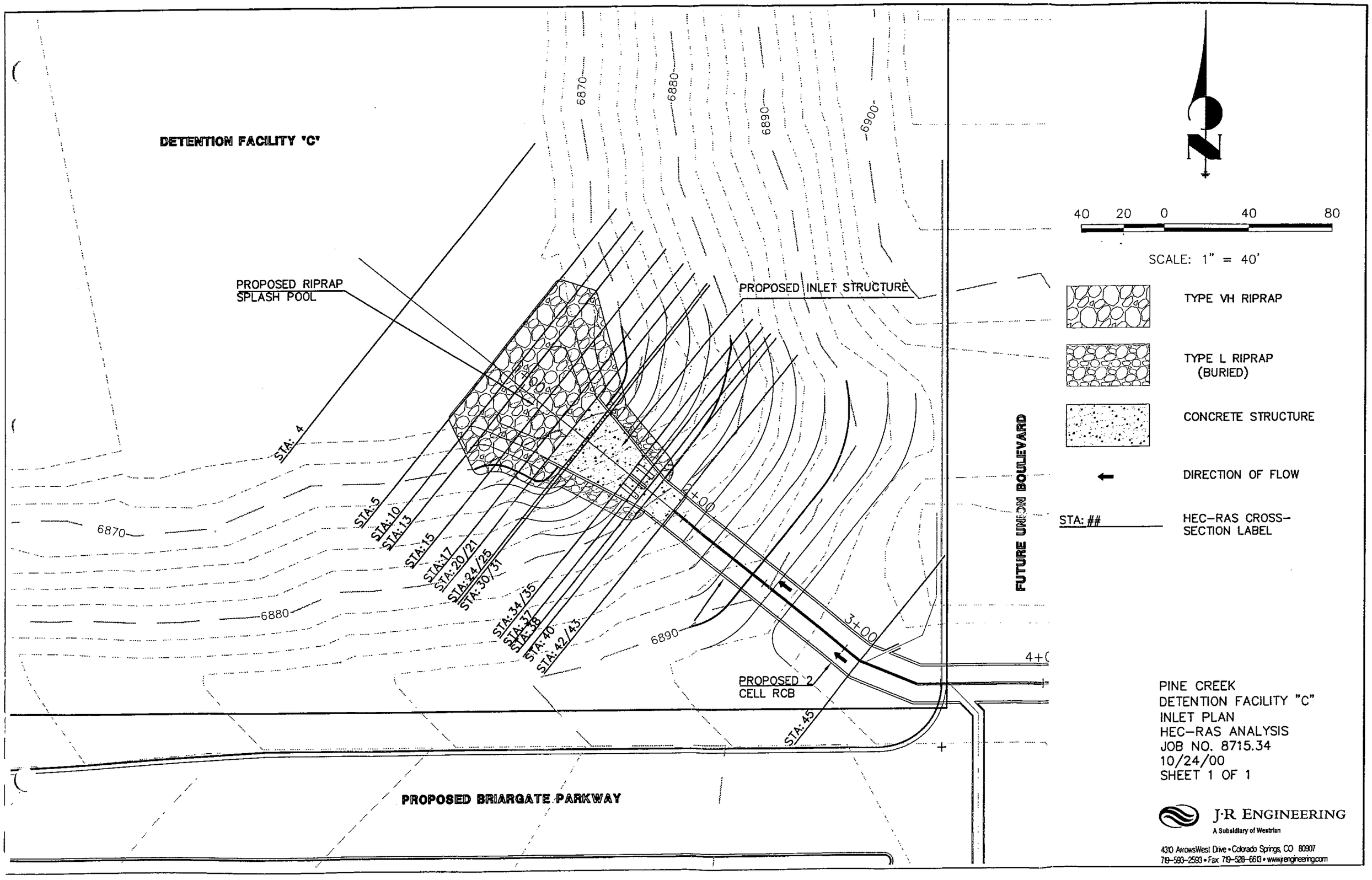
6:02 ANALYSIS OF R.C.B. BENDS STATIONS 2+96.82 AND 3+57.24 FOR HEIGHT NECESSARY TO PROVIDE A FREE WATER SURFACE

6:03 ANALYSIS OF JUNCTION OF 5' DIAMETER R.C.P. FROM UNION BOULEVARD AND RIGHT CELL OF R.C.B.

6:04 DESIGN CONCEPT AND SAMPLE CALCULATIONS FOR PROPOSED R.C.B. STATION 11+70 TO 22+23

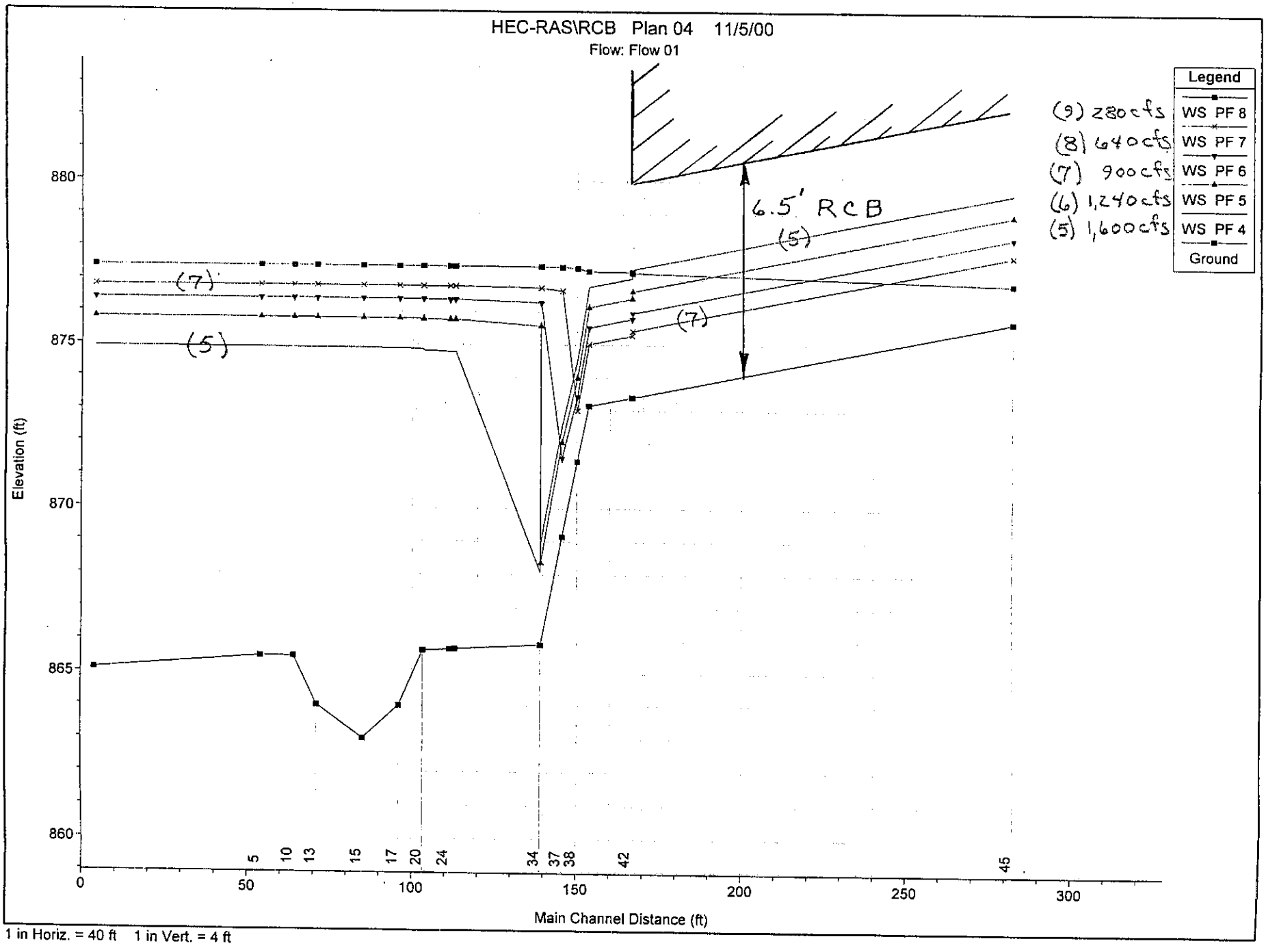
6:05 FLOWMASTER DATA SHEETS FOR NORMAL DEPTH CALCULATIONS IN THE PROPOSED R.C.B.

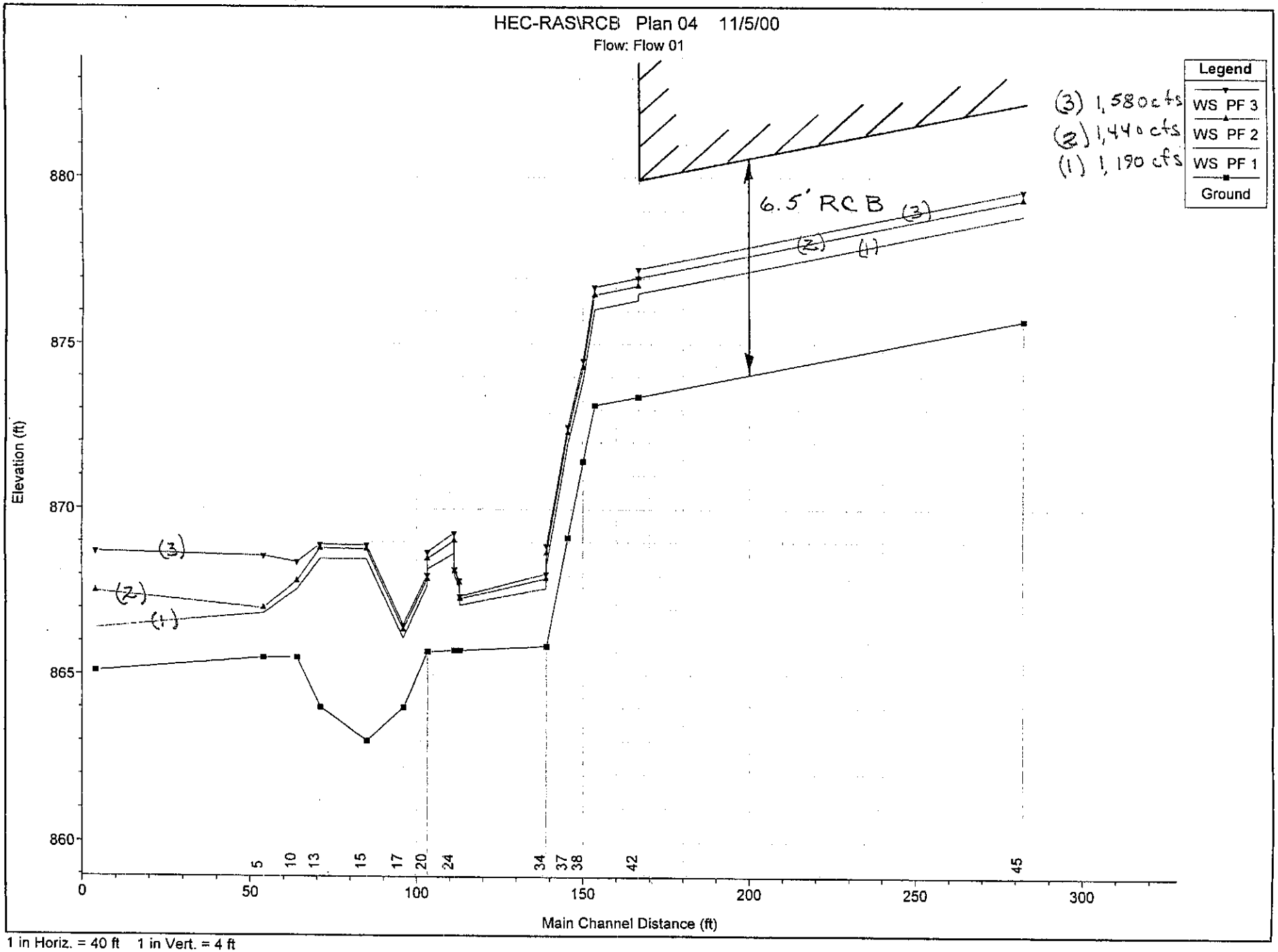
6:01 ANALYSIS OF PROPOSED R.C.B. OUTFALL TO DETENTION FACILITY "C"



PINE CREEK
DETENTION FACILITY "C"
INLET PLAN
HEC-RAS ANALYSIS
JOB NO. 8715.34
10/24/00
SHEET 1 OF 1

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613 • www.jrengineering.com


HEC-RAS\RCB Plan 04 11/5/00
Flow: Flow 01
Legend
(9) 280cfs WS PF 8
(8) 640cfs WS PF 7
(7) 900cfs WS PF 6
(6) 1,240cfs WS PF 5
(5) 1,600cfs WS PF 4
Ground
6.5' RCB
(5)
(7)
(7)
(5)
Elevation (ft)
880
875
870
865
860
0
50
100
150
200
250
300
5
10
13
15
17
20
24
34
37
38
42
45
Main Channel Distance (ft)
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



1 in Horiz. = 40 ft 1 in Vert. = 4 ft

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X       X
X     X  X        X    X       X   X    X    X       X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: HEC-RAS\RCB
Project File : pondc.prj
Run Date and Time: 11/5/00 8:11:38 AM

Project in English units

Project Description:
OUTFALL TO POND C

PLAN DATA

Plan Title: Plan 04
Plan File : a:\pondc.p04

Geometry Title: GEOMETRIC DATA PINE CREEK
Geometry File : a:\pondc.g01

Flow Title : Flow 01
Flow File : a:\pondc.f01

Plan Description:
OUTFALL TO POND C

Plan Summary Information:
Number of: Cross Sections = 20 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: Between every coordinate point (HEC2 Style)
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Flow 01
Flow File : a:\pondc.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3
PF 4	PF 5	PF 6	PF 7	PF 8	
PINE CREEK	ONE	45	1190	1440	1580
1600	1240	900	640	280	

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
PINE CREEK	ONE	PF 1	Normal S = .02	Known WS = 866.3
PINE CREEK	ONE	PF 2	Normal S = .02	Known WS = 867.5
PINE CREEK	ONE	PF 3	Normal S = .02	Known WS = 868.7
PINE CREEK	ONE	PF 4	Normal S = .02	Known WS = 874.9
PINE CREEK	ONE	PF 5	Normal S = .02	Known WS = 875.8
PINE CREEK	ONE	PF 6	Normal S = .02	Known WS = 876.4
PINE CREEK	ONE	PF 7	Normal S = .02	Known WS = 876.8
PINE CREEK	ONE	PF 8	Normal S = .02	Known WS = 877.4

GEOMETRY DATA

Geometry Title: GEOMETRIC DATA PINE CREEK
Geometry File : a:\pondc.g01

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 45

INPUT
Description: 2 CELL RCB
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
91.5	882.21	91.5	875.71	99.5	875.71	99.5	882.21	100.5	882.21
100.5	875.71	108.5	875.71	108.5	882.21				

Manning's n Values num= 1

Sta	n Val
91.5	.013

```
Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          91.5   108.5             115.49  115.49  115.49             .1       .3

CROSS SECTION          RIVER: PINE CREEK
REACH: ONE               RS: 43

INPUT
Description: OUTLET OF 2 CELL RCB
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    91.5   879.9    91.5   873.4    99.5   873.4    99.5   879.9   100.5   879.9
   100.5   873.4   108.5   873.4   108.5   879.9

Manning's n Values        num=       1
     Sta   n Val
    91.5    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          91.5   108.5               .1      .1      .1             .15      .32

CROSS SECTION          RIVER: PINE CREEK
REACH: ONE               RS: 42

INPUT
Description: OUTFALL OF 2 CELL RCB JUST PAST STA: 43
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    91.5     883    91.5   873.4     100   873.4   108.5   873.4   108.5     883

Manning's n Values        num=       1
     Sta   n Val
    91.5    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          91.5   108.5               13      13      13             .15      .32

CROSS SECTION          RIVER: PINE CREEK
REACH: ONE               RS: 40

INPUT
Description: AT STA: 1+81.0 OF RCB
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    91.5  881.14    91.5  873.14     100  873.14   108.5  873.14   108.5  881.14

Manning's n Values        num=       1
     Sta   n Val
    91.5    .013

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          91.5   108.5             3.55     3.5    3.55             .2       .4

CROSS SECTION          RIVER: PINE CREEK
REACH: ONE               RS: 38

INPUT
Description: UPSTREAM EDGE OF THE 3 CONCRETE BLOCKS
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    90.8  880.51    90.8  871.43     100  871.43   109.2  871.43   109.2  880.51

Manning's n Values        num=       1
     Sta   n Val
    90.8    .035
```

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90.8	109.2	4.7	4.6	.1	.3

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 37

INPUT
Description: IN THE MIDDLE OF THE 3 CONCRETE BLOCKS
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
90	879.65	90	869.15	93.5	869.15	93.5	871.2	95.5	871.2
95.5	869.15	99	869.15	99	871.2	101	871.2	101	869.15
104.5	869.15	104.5	871.2	106.5	871.2	106.5	869.15	110	869.15
110	879.65								

Manning's n Values num= 1

Sta	n Val
90	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	110	6.6	6.4	.5	.6

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 35

INPUT
Description: DOWNSTREAM EDGE OF THE 3 CONCRETE BLOCKS
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	880	88.6	878.44	88.6	865.88	93	865.88	93	870.88
95	870.88	95	865.88	99	865.88	99	870.88	100	870.88
101	870.88	101	865.88	105	865.88	105	870.88	107	870.88
107	865.88	111.4	865.88	111.4	878.44	158	878	176	880

Manning's n Values num= 2

Sta	n Val	Sta	n Val
55	.03	88.6	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55	176	.1	.1	.5	.6

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 34

INPUT
Description: RIGHT AFTER THE 3 CONCRETE TEETH
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	880	88.6	878.44	88.6	865.88	100	865.88	111.4	865.88
111.4	878.44	158	878	176	880				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
55	.03	88.6	.013	111.4	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55	176	28 25.979	28	.3	.5

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 31

INPUT
Description: UPSTREAM EDGE OF THE 9 CONCRETE TEETH
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
15	880	52	876	83.4	872.35	83.4	865.75	100	865.75
116.6	865.75	116.6	872.35	160	874	198	880		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15	.03	83.4	.035	116.6	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
15	198	.1	.1	.1	.4	.6

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 30

INPUT
Description: UP STREAM EDGE OF THE 9 CONCRETE TEETH
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
15	880	52	876	83.4	872.35	83.4	865.75	85.25	865.75
85.25	866.75	86.75	866.75	86.75	865.75	88.75	865.75	88.75	866.75
90.25	866.75	90.25	865.75	92.25	865.75	92.25	866.75	93.75	866.75
93.75	865.75	95.75	865.75	95.75	866.75	97.25	866.75	97.25	865.75
99.25	865.75	99.25	866.75	100	866.75	100.75	866.75	100.75	865.75
102.75	865.75	102.75	866.75	104.25	866.75	104.25	865.75	106.25	865.75
106.25	866.75	107.75	866.75	107.75	865.75	109.75	865.75	109.75	866.75
111.25	866.75	111.25	865.75	113.25	865.75	113.25	866.75	114.75	866.75
114.75	865.75	116.6	865.75	116.6	872.35	160	874	198	880

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15	.03	83.4	.035	116.6	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
15	198	1.6	1.5	1.6	.6	.8

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 25

INPUT
Description: DOWN STREAM EDGE OF THE 9 CONCRETE TEETH
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5	880	51	876	83.15	871.98	83.15	865.74	85.25	865.74
85.25	866.75	86.75	866.75	86.75	865.74	88.75	865.74	88.75	866.75
90.25	866.75	90.25	865.74	92.25	865.74	92.25	866.75	93.75	866.75
93.75	865.74	95.75	865.74	95.75	866.75	97.25	866.75	97.25	865.74
99.25	865.74	99.25	866.75	100	866.75	100.75	866.75	100.75	865.74
102.75	865.74	102.75	866.75	104.25	866.75	104.25	865.74	106.25	865.74
106.25	866.75	107.75	866.75	107.75	865.74	109.75	865.74	109.75	866.74
111.25	866.75	111.25	865.74	113.25	865.74	113.25	866.75	114.75	866.75
114.75	865.74	116.85	865.74	116.85	871.98	162	874	198	880

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
5	.03	83.15	.035	116.85	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
5	198	.1	.1	.1	.6	.8

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 24

INPUT
Description: RIGHT AFTER THE BACK OF THE 9 CONCRETE DIVIDERS
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
15	880	51	876	83.15	871.98	83.15	865.74	100	865.74
116.85	865.74	116.85	871.98	162	874	198	880		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15	.03	83.15	.013	116.85	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
15	198	8.15	8	.3	.5

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 21

INPUT
Description: END OF RCB OUTFALL
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6	880	81.5	870	81.5	865.7	100	865.7	118.5	865.7
118.5	870	203	880						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
6	.03	81.5	.013	118.5	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
6	203	.1	.1	.15	.32

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 20

INPUT
Description: A SMALL DISTANCE PAST THE END OF THE OUTFALL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6	880	64	872	81.5	865.7	118.5	865.7	126	868
134	869	141	870	203	880				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
6	.03	64	.03	81.5	.035	134	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
6	203	9	7.25	9	.15	.32

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 17

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1	880	62	872	74	868	88	864	100	864
115	864	131	868	139	869	165	872	207	880

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1	.03	62	.035	139	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1	207	15	11	15	.4	.5

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 15

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
38	880	98	872	107	871	114	870	134	864
144	863	163	863	172	864	181	866	191	868
198	869	221	872						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
38	.03	107	.035	198	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
38	221	14	14	.4	.5

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 13

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
27	880	99	870	108	869	114	868	123	866
133	864	150	864	175	864	190	866	204	868
208	868.5	219	870	274	880				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
27	.03	108	.035	208	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
27	274	7	7	.4	.5

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 10

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
25	880	82	872	116	867	123	866	132	865.5
150	865.5	179	865.5	195	866	205	867.5	234	872
280	880								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
25	.03	116	.035	205	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25	280	10	10	.1	.3

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 5

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1	880	65	872	80	870	110	866	119	865.5
150	865.5	200	865.5	205	866	230	870	290	880

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1	.03	119	.035	200	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1	290	80	50	80	.1	.3

CROSS SECTION RIVER: PINE CREEK
REACH: ONE RS: 4

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4	880	50	872	66	870	110	866	112	865.1
200	865.4	300	866	330	870	346	872	390	880

Manning's n Values num= 1

Sta	n Val
4	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
4	390	.1	.3

SUMMARY OF MANNING'S N VALUES

River:PINE CREEK

Reach	River Sta.	n1	n2	n3	n4
ONE	45	.013			
ONE	43	.013			
ONE	42	.013			
ONE	40	.013			
ONE	38	.035			
ONE	37	.035			
ONE	35	.03	.013		
ONE	34	.03	.013	.03	
ONE	31	.03	.035	.03	
ONE	30	.03	.035	.03	
ONE	25	.03	.035	.03	
ONE	24	.03	.013	.03	
ONE	21	.03	.013	.03	
ONE	20	.03	.03	.035	.03
ONE	17	.03	.035	.03	
ONE	15	.03	.035	.03	
ONE	13	.03	.035	.03	
ONE	10	.03	.035	.03	
ONE	5	.03	.035	.03	
ONE	4	.03			

SUMMARY OF REACH LENGTHS

River: PINE CREEK

Reach	River Sta.	Left	Channel	Right
ONE	45	115.49	115.49	115.49
ONE	43	.1	.1	.1
ONE	42	13	13	13
ONE	40	3.55	3.5	3.55
ONE	38	4.7	4.6	4.7
ONE	37	6.6	6.4	6.6
ONE	35	.1	.1	.1

ONE	34	28	25.979	28
ONE	31	.1	.1	.1
ONE	30	1.6	1.5	1.6
ONE	25	.1	.1	.1
ONE	24	8.15	8	8.15
ONE	21	.1	.1	.1
ONE	20	9	7.25	9
ONE	17	15	11	15
ONE	15	14	14	14
ONE	13	7	7	7
ONE	10	10	10	10
ONE	5	80	50	80
ONE	4			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: PINE CREEK

Reach	River Sta.	Contr.	Expan.
ONE	45	.1	.3
ONE	43	.15	.32
ONE	42	.15	.32
ONE	40	.2	.4
ONE	38	.1	.3
ONE	37	.5	.6
ONE	35	.5	.6
ONE	34	.3	.5
ONE	31	.4	.6
ONE	30	.6	.8
ONE	25	.6	.8
ONE	24	.3	.5
ONE	21	.15	.32
ONE	20	.15	.32
ONE	17	.4	.5
ONE	15	.4	.5
ONE	13	.4	.5
ONE	10	.1	.3
ONE	5	.1	.3
ONE	4	.1	.3

HEC-RAS Plan: Plan 02 River: PINE CREEK Reach: ONE

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
ONE	45	1190.00	875.71	878.86	881.26	887.51	0.020029	23.60	50.42	16.00	2.34
ONE	45	1440.00	875.71	879.34	882.03	888.91	0.020024	24.83	58.00	16.00	2.30
ONE	45	1580.00	875.71	879.59	882.54	889.63	0.020020	25.42	62.15	16.00	2.27
ONE	45	1600.00	875.71	879.63	882.61	889.73	0.020024	25.50	62.74	16.00	2.27
ONE	45	1240.00	875.71	878.96	881.41	887.80	0.020029	23.87	51.95	16.00	2.33
ONE	45	900.00	875.71	878.29	880.31	885.69	0.020039	21.83	41.23	16.00	2.40
ONE	45	640.00	875.71	877.74	879.38	883.77	0.020005	19.71	32.47	16.00	2.44
ONE	45	280.00	875.71	876.87	877.83	880.40	0.020011	15.07	18.58	16.00	2.46
ONE	43	1190.00	873.40	876.55	878.94	885.22	0.020085	23.63	50.37	16.00	2.35
ONE	43	1440.00	873.40	877.02	879.72	886.61	0.020063	24.84	57.96	16.00	2.30
ONE	43	1580.00	873.40	877.28	880.23	887.33	0.020050	25.44	62.12	16.00	2.27
ONE	43	1600.00	873.40	877.32	880.30	887.43	0.020059	25.52	62.69	16.00	2.27
ONE	43	1240.00	873.40	876.64	879.10	885.51	0.020083	23.89	51.90	16.00	2.34
ONE	43	900.00	873.40	875.97	878.01	883.40	0.020134	21.87	41.16	16.00	2.40
ONE	43	640.00	873.40	875.43	877.06	881.46	0.020015	19.71	32.46	16.00	2.44
ONE	43	280.00	873.40	877.21	875.51	877.54	0.000661	4.59	60.99	16.00	0.41
ONE	42	1190.00	873.40	876.33	878.72	885.18	0.015417	23.87	49.86	17.00	2.46
ONE	42	1440.00	873.40	876.77	879.44	886.56	0.014891	25.11	57.35	17.00	2.41
ONE	42	1580.00	873.40	877.01	879.84	887.28	0.014629	25.71	61.45	17.00	2.38
ONE	42	1600.00	873.40	877.05	879.90	887.38	0.014603	25.80	62.02	17.00	2.38
ONE	42	1240.00	873.40	876.42	878.87	885.47	0.015305	24.13	51.38	17.00	2.45
ONE	42	900.00	873.40	875.80	877.82	883.36	0.016181	22.07	40.77	17.00	2.51
ONE	42	640.00	873.40	875.29	876.92	881.44	0.016923	19.90	32.17	17.00	2.55
ONE	42	280.00	873.40	877.24		877.52	0.000385	4.29	65.26	17.00	0.39
ONE	40	1190.00	873.14	876.06	878.48	884.97	0.015567	23.94	49.70	17.00	2.47
ONE	40	1440.00	873.14	876.50	879.20	886.36	0.015037	25.19	57.16	17.00	2.42
ONE	40	1580.00	873.14	876.74	879.59	887.08	0.014774	25.80	61.25	17.00	2.40
ONE	40	1600.00	873.14	876.78	879.64	887.18	0.014749	25.89	61.81	17.00	2.39
ONE	40	1240.00	873.14	876.15	878.63	885.26	0.015457	24.21	51.21	17.00	2.46
ONE	40	900.00	873.14	875.53	877.57	883.14	0.016335	22.14	40.65	17.00	2.52
ONE	40	640.00	873.14	875.03	876.66	881.21	0.017089	19.96	32.07	17.00	2.56
ONE	40	280.00	873.14	877.26		877.51	0.000314	4.00	70.04	17.00	0.35
ONE	38	1190.00	871.43	873.91	876.49	884.50	0.155194	26.12	45.57	18.40	2.92
ONE	38	1440.00	871.43	874.29	877.16	885.89	0.146136	27.32	52.70	18.40	2.84
ONE	38	1580.00	871.43	874.51	877.53	886.60	0.141855	27.91	56.62	18.40	2.80
ONE	38	1600.00	871.43	874.54	877.58	886.70	0.141378	27.99	57.16	18.40	2.80
ONE	38	1240.00	871.43	873.98	876.63	884.79	0.153248	26.38	47.01	18.40	2.91
ONE	38	900.00	871.43	873.43	875.62	882.75	0.172340	24.51	36.72	18.40	3.06
ONE	38	640.00	871.43	872.98	874.77	880.76	0.190182	22.38	28.59	18.40	3.16
ONE	38	280.00	871.43	877.35		877.45	0.000665	2.57	108.84	18.40	0.19
ONE	37	1190.00	869.15	871.96	874.55	883.40	0.336819	27.14	43.84	20.00	3.23
ONE	37	1440.00	869.15	872.30	875.20	884.85	0.312365	28.44	50.64	20.00	3.15
ONE	37	1580.00	869.15	872.48	875.53	885.64	0.302449	29.12	54.26	20.00	3.12
ONE	37	1600.00	869.15	872.51	875.58	885.70	0.298841	29.14	54.90	20.00	3.10
ONE	37	1240.00	869.15	872.02	874.68	883.78	0.335186	27.52	45.06	20.00	3.23
ONE	37	900.00	869.15	871.53	873.74	881.59	0.382516	25.45	35.37	20.00	3.37
ONE	37	640.00	869.15	876.66	872.92	877.00	0.002870	4.64	137.91	20.00	0.31
ONE	37	280.00	869.15	877.38		877.43	0.000411	1.84	152.26	20.00	0.12
ONE	35	1190.00	865.88	868.29	871.57	881.69	0.056605	29.37	40.51	16.80	3.33
ONE	35	1440.00	865.88	868.68	872.18	883.19	0.055998	30.56	47.12	16.80	3.22
ONE	35	1580.00	865.88	868.90	872.50	883.96	0.055805	31.14	50.73	16.80	3.16
ONE	35	1600.00	865.88	868.93	872.53	884.03	0.055605	31.18	51.31	16.80	3.14
ONE	35	1240.00	865.88	868.36	871.70	882.08	0.056893	29.72	41.73	16.80	3.32
ONE	35	900.00	865.88	876.27	870.33	876.56	0.000365	4.35	206.80	22.80	0.25
ONE	35	640.00	865.88	876.74		876.87	0.000159	2.94	217.56	22.80	0.17
ONE	35	280.00	865.88	877.39		877.41	0.000025	1.20	232.42	22.80	0.07
ONE	34	1190.00	865.88	867.63	870.26	881.46	0.039146	29.85	39.87	22.80	3.98
ONE	34	1440.00	865.88	867.92	870.85	882.82	0.035371	30.97	46.49	22.80	3.82
ONE	34	1580.00	865.88	868.07	871.16	883.67	0.034253	31.70	49.84	22.80	3.78
ONE	34	1600.00	865.88	868.09	871.23	883.75	0.033974	31.76	50.38	22.80	3.77

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
ONE	34	1240.00	865.88	875.57	870.39	876.06	0.000265	5.61	220.92	22.80	0.32
ONE	34	900.00	865.88	876.29		876.52	0.000115	3.79	237.44	22.80	0.21
ONE	34	640.00	865.88	876.75		876.85	0.000052	2.58	247.84	22.80	0.14
ONE	34	280.00	865.88	877.39		877.41	0.000008	1.07	262.47	22.80	0.06
ONE	31	1190.00	865.75	867.11	869.15	877.83	0.280934	26.26	45.31	33.20	3.96
ONE	31	1440.00	865.75	867.30	869.62	879.49	0.274162	28.03	51.38	33.20	3.97
ONE	31	1580.00	865.75	867.38	869.86	880.57	0.277594	29.14	54.22	33.20	4.02
ONE	31	1600.00	865.75	874.80	869.91	875.05	0.001004	4.01	399.01	102.77	0.36
ONE	31	1240.00	865.75	875.76		875.85	0.000350	2.46	504.24	117.07	0.21
ONE	31	900.00	865.75	876.38		876.42	0.000131	1.55	580.31	126.64	0.13
ONE	31	640.00	865.75	876.79		876.81	0.000054	1.01	633.45	133.02	0.08
ONE	31	280.00	865.75	877.40		877.40	0.000008	0.39	716.96	142.47	0.03
ONE	30	1190.00	865.75	867.61	869.56	877.01	0.398023	24.61	48.36	33.20	3.59
ONE	30	1440.00	865.75	867.80	870.02	878.67	0.396934	26.46	54.41	33.20	3.64
ONE	30	1580.00	865.75	867.87	870.27	879.86	0.414189	27.79	56.86	33.20	3.74
ONE	30	1600.00	865.75	874.77		875.04	0.001703	4.19	382.30	102.30	0.38
ONE	30	1240.00	865.75	875.75		875.85	0.000547	2.53	489.88	116.96	0.22
ONE	30	900.00	865.75	876.38		876.42	0.000197	1.59	566.49	126.60	0.13
ONE	30	640.00	865.75	876.79		876.81	0.000078	1.03	619.82	133.01	0.08
ONE	30	280.00	865.75	877.40		877.40	0.000011	0.40	703.43	142.47	0.03
ONE	25	1190.00	865.74	868.01	869.51	873.55	0.170763	18.89	63.01	33.70	2.43
ONE	25	1440.00	865.74	868.14	869.97	875.28	0.203630	21.45	67.13	33.70	2.68
ONE	25	1580.00	865.74	868.18	870.22	876.38	0.226812	22.98	68.76	33.70	2.83
ONE	25	1600.00	865.74	874.77		875.02	0.001496	3.96	404.35	105.83	0.36
ONE	25	1240.00	865.74	875.75		875.84	0.000481	2.41	514.68	119.54	0.20
ONE	25	900.00	865.74	876.38		876.42	0.000174	1.52	592.85	129.68	0.13
ONE	25	640.00	865.74	876.79		876.81	0.000070	0.99	647.56	136.86	0.08
ONE	25	280.00	865.74	877.40		877.40	0.000010	0.38	733.85	147.48	0.03
ONE	24	1190.00	865.74	868.67	869.11	870.93	0.003286	12.05	98.72	33.70	1.24
ONE	24	1440.00	865.74	869.04	869.57	871.64	0.003301	12.93	111.36	33.70	1.25
ONE	24	1580.00	865.74	869.28	869.81	872.00	0.003215	13.25	119.23	33.70	1.24
ONE	24	1600.00	865.74	874.78		875.00	0.000151	3.83	418.30	105.88	0.34
ONE	24	1240.00	865.74	875.75		875.84	0.000059	2.35	528.42	119.55	0.20
ONE	24	900.00	865.74	876.38		876.42	0.000024	1.48	606.34	128.73	0.12
ONE	24	640.00	865.74	876.79		876.81	0.000010	0.97	660.42	134.88	0.08
ONE	24	280.00	865.74	877.40		877.40	0.000002	0.38	745.03	143.98	0.03
ONE	21	1190.00	865.70	868.19	868.87	870.78	0.004473	12.91	92.16	37.00	1.44
ONE	21	1440.00	865.70	868.51	869.30	871.49	0.004487	13.87	103.85	37.00	1.46
ONE	21	1580.00	865.70	868.71	869.53	871.84	0.004340	14.19	111.32	37.00	1.44
ONE	21	1600.00	865.70	874.82		874.96	0.000097	3.06	522.92	114.07	0.25
ONE	21	1240.00	865.70	875.77		875.83	0.000039	1.94	638.52	129.27	0.15
ONE	21	900.00	865.70	876.39		876.41	0.000016	1.25	721.72	139.19	0.10
ONE	21	640.00	865.70	876.79		876.80	0.000007	0.82	779.76	145.71	0.06
ONE	21	280.00	865.70	877.40		877.40	0.000001	0.32	870.86	155.39	0.02
ONE	20	1190.00	865.70	867.69	868.64	870.69	0.050083	13.89	85.67	49.03	1.85
ONE	20	1440.00	865.70	867.90	869.01	871.40	0.051920	15.01	95.95	50.28	1.91
ONE	20	1580.00	865.70	868.02	869.19	871.73	0.051789	15.46	102.17	51.12	1.93
ONE	20	1600.00	865.70	874.86		874.94	0.000264	2.30	695.39	127.86	0.17
ONE	20	1240.00	865.70	875.78		875.82	0.000103	1.51	819.10	140.27	0.11
ONE	20	900.00	865.70	876.39		876.41	0.000041	0.99	907.21	148.48	0.07
ONE	20	640.00	865.70	876.80		876.80	0.000018	0.66	968.29	153.91	0.05
ONE	20	280.00	865.70	877.40		877.40	0.000003	0.26	1063.55	162.02	0.02
ONE	17	1190.00	864.00	866.11	867.32	870.15	0.070956	16.11	73.85	42.86	2.16
ONE	17	1440.00	864.00	866.37	867.70	870.83	0.068975	16.94	85.00	44.77	2.17
ONE	17	1580.00	864.00	866.50	867.90	871.17	0.067910	17.34	91.12	45.78	2.17
ONE	17	1600.00	864.00	874.88		874.93	0.000140	1.91	836.41	140.02	0.14
ONE	17	1240.00	864.00	875.79		875.81	0.000057	1.28	969.65	151.78	0.09
ONE	17	900.00	864.00	876.40		876.41	0.000023	0.85	1064.07	159.59	0.06
ONE	17	640.00	864.00	876.80		876.80	0.000010	0.57	1129.35	164.77	0.04
ONE	17	280.00	864.00	877.40		877.40	0.000002	0.23	1230.87	172.52	0.02

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
ONE	15	1190.00	863.00	868.49	866.26	868.77	0.001787	4.26	279.60	75.36	0.39
ONE	15	1440.00	863.00	868.80	866.62	869.15	0.002106	4.74	303.49	78.57	0.43
ONE	15	1580.00	863.00	868.91	866.81	869.30	0.002351	5.06	312.23	79.71	0.45
ONE	15	1600.00	863.00	874.88		874.92	0.000085	1.59	1005.29	144.62	0.11
ONE	15	1240.00	863.00	875.79		875.81	0.000036	1.09	1139.81	151.44	0.07
ONE	15	900.00	863.00	876.40		876.40	0.000015	0.73	1232.74	155.97	0.05
ONE	15	640.00	863.00	876.80		876.80	0.000007	0.49	1296.03	158.99	0.03
ONE	15	280.00	863.00	877.40		877.40	0.000001	0.20	1393.01	163.50	0.01
ONE	13	1190.00	864.00	868.49		868.72	0.001719	3.82	311.72	96.85	0.37
ONE	13	1440.00	864.00	868.81		869.08	0.001884	4.20	343.16	101.09	0.40
ONE	13	1580.00	864.00	868.92		869.23	0.002053	4.45	354.81	102.62	0.42
ONE	13	1600.00	864.00	874.89		874.92	0.000059	1.32	1213.07	182.08	0.09
ONE	13	1240.00	864.00	875.79		875.81	0.000025	0.90	1383.27	193.59	0.06
ONE	13	900.00	864.00	876.40		876.40	0.000010	0.60	1502.36	201.25	0.04
ONE	13	640.00	864.00	876.80		876.80	0.000005	0.40	1584.13	206.35	0.03
ONE	13	280.00	864.00	877.40		877.40	0.000001	0.16	1710.44	213.98	0.01
ONE	10	1190.00	865.50	867.57	867.57	868.43	0.014537	7.47	159.37	93.29	1.01
ONE	10	1440.00	865.50	867.82	867.82	868.78	0.013639	7.86	183.14	96.61	1.01
ONE	10	1580.00	865.50	868.39		869.06	0.006962	6.56	241.03	104.24	0.76
ONE	10	1600.00	865.50	874.89		874.91	0.000067	1.34	1195.43	189.17	0.09
ONE	10	1240.00	865.50	875.79		875.81	0.000027	0.90	1372.34	200.85	0.06
ONE	10	900.00	865.50	876.40		876.40	0.000011	0.60	1495.89	208.62	0.04
ONE	10	640.00	865.50	876.80		876.80	0.000005	0.40	1580.66	213.78	0.03
ONE	10	280.00	865.50	877.40		877.40	0.000001	0.16	1711.48	221.52	0.01
ONE	5	1190.00	865.50	866.84	867.21	868.17	0.034289	9.27	128.39	106.52	1.49
ONE	5	1440.00	865.50	867.00	867.43	868.52	0.033752	9.89	145.58	108.71	1.51
ONE	5	1580.00	865.50	868.57		868.92	0.003108	4.73	333.81	130.36	0.52
ONE	5	1600.00	865.50	874.89		874.91	0.000045	1.12	1431.44	217.49	0.08
ONE	5	1240.00	865.50	875.80		875.81	0.000019	0.76	1633.83	230.15	0.05
ONE	5	900.00	865.50	876.40		876.40	0.000008	0.51	1774.95	238.58	0.03
ONE	5	640.00	865.50	876.80		876.80	0.000003	0.34	1871.70	244.19	0.02
ONE	5	280.00	865.50	877.40		877.40	0.000001	0.14	2020.90	252.60	0.01
ONE	4	1190.00	865.10	866.39	866.55	867.13	0.022916	6.87	173.23	197.29	1.29
ONE	4	1440.00	865.10	867.50	866.70	867.70	0.002301	3.58	402.71	217.75	0.46
ONE	4	1580.00	865.10	868.70	866.78	868.78	0.000558	2.33	677.33	239.95	0.24
ONE	4	1600.00	865.10	874.90	866.79	874.91	0.000012	0.65	2470.61	328.63	0.04
ONE	4	1240.00	865.10	875.80	866.58	875.80	0.000005	0.45	2770.92	338.75	0.03
ONE	4	900.00	865.10	876.40	866.38	876.40	0.000002	0.30	2976.21	345.50	0.02
ONE	4	640.00	865.10	876.80	866.20	876.80	0.000001	0.21	3115.29	350.00	0.01
ONE	4	280.00	865.10	877.40	865.87	877.40	0.000000	0.08	3327.33	356.75	0.00

COMPUTE RIPRAP SIZE FOR DETENTION FACILITY "C" INLET SPLASH POOL

1) Assume channel flow at shallow pond depth

   V_{max} = 17 fps at HEC-RAS Section Sta. 17

2) "Colorado Springs Drainage Criteria Manual"

   $VS^{0.17} / (S_s - 1)^{0.66}$

   V = 17 fps, S = 0.01 (slope)

   S_s = Specific gravity of rock

   $(17)(0.01)^{0.17} / (2.5 - 1)^{0.66} = 5.95$

   $5.6 < 5.95 < 6.4$ use type "VH" Riprap

   d_{max} = 42" d_{50} = 24"

3) Check size Exhibit 16-1 (Isbash curve)

   17 fps – Maximum stone size 41" diameter

   Type "VH" Riprap ok

4) Depth $2 \times d_{50} = 4'$

   $1.5 \times d_{max} = 63''$

   Use: 5' depth of "VH" Riprap

   6" depth of Type II bedding material over filter fabric.

6:02 ANALYSIS OF R.C.B. BENDS STATIONS 2+96.82 AND 3+57.24 FOR HEIGHT NECESSARY TO PROVIDE A FREE WATER SURFACE

ANALIZE RCB BEND STATION 2+96.82 DOWN STREAM OF 5' DIA. CONTUNCTION RIGHT CELL FOR NECESSARY RCB HEIGHT TO PROVIDE A FREE WATER SURFACE.

COMPUTED WATER DEPTH DOWN STREAM OF 5' DIA. JUNCTION AND BEND STA. 3+57.24 ——— 5.15'

THE DOWN STREAM WATER SURFACE WILL PRECEDE TOWARD NORMAL DEPTH. THE DROP IS ESTIMATED WITH HEC-RAS ANALYSIS ——— -0.13'

ESTIMATE THE INCREASE DUE TO THE BEND LOSS $Q_{100} = 965$ cfs

$V = 965/(5.02)(8) = 24$ fps

$$L_s = K_b \frac{V^2}{2g} = (0.25)\sqrt{\frac{19.5}{90}}\left(\frac{24^2}{64.4}\right) = +1.04'$$

6.06'

6.06' < 6.5' PROPOSED RCB HEIGHT

HEC-RAS Plan: Plan 01 River: PINE CREEK Reach: RCB

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
RCB	500	965.00	30.00	35.15	37.68	43.67	0.014231	23.42	41.20	8.00	1.82
RCB	475	965.00	29.50	34.60	37.18	43.29	0.014594	23.65	40.80	8.00	1.85
RCB	450	965.00	29.00	34.05	36.68	42.90	0.014935	23.86	40.44	8.00	1.87
RCB	425	965.00	28.50	33.51	36.18	42.50	0.015255	24.06	40.11	8.00	1.89
RCB	400	965.00	28.00	32.98	35.68	42.10	0.015555	24.24	39.81	8.00	1.92
RCB	375	965.00	27.50	32.44	35.18	41.69	0.015836	24.41	39.53	8.00	1.94
RCB	350	965.00	27.00	31.91	34.68	41.28	0.016100	24.56	39.28	8.00	1.95
RCB	325	965.00	26.50	31.38	34.18	40.86	0.016347	24.71	39.05	8.00	1.97

IN 70' THE W.S. WILL DROP

$\frac{70}{75}(5.15 - 5.01) = 0.13'$

ANALIZE RCB BENDS AT STATIONS 2+96.82 AND STATIONS 3+57.24 FOR NECESSARY RCB HEIGHT TO PROVIDE A FREE WATER SURFACE

LEFT CELL:

ASSUME NORMAL DEPTH UPSTREAM OF BEND AT ℄ STA. 3+57.24, NOTE THIS IGNORES THE INFLUENCE OF THE INCLINED DROP PROVIDED FUR THE 5'DIA JUNCTION IN THE RIGHT CELL.

NORMAL DEPTH UP STREAM OF STA 3+57	3.93'
ESTIMATE W.S. INCREASE DUE TO BEND LOSS	+1.17
DOWN STREAN WATER DEPTH	5.10'

IN THE 60' DOWN STREAM TO THE SECOND BEND THE W.S. WILL DROP TOWARD NORMAL DEPTH $\frac{60}{50}(5.10 - 4.84) =$ −0.28'

ADD INCREASE IN WATER SURFACE DUE TO SECOND BEND	+1.17
WATER DEPTH	5.99'

5.99' < 6.5' RCB HEIGHT

Worksheet
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project6.fm2
Worksheet	BRIARGATE PARKWAY
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	8.00	ft
Discharge	801.00	cfs

Results		
Depth	3.93	ft
Flow Area	31.41	ft²
Wetted Perimeter	15.85	ft
Top Width	8.00	ft
Critical Depth	6.78	ft
Critical Slope	0.004880	ft/ft
Velocity	25.50	ft/s
Velocity Head	10.11	ft
Specific Energy	14.03	ft
Froude Number	2.27	
Flow is supercritical.		

← NORMAL DEPTH

ESTIMATE BEND LOSS:

$Q = 801$ cfs $V = 25.5$ fps

BEND: 19.5° +/-

$K_b = 0.25\sqrt{\theta/90} = 0.25\sqrt{19.5/90} = 0.116$

$\text{BEND LOSS} = K_b\left(V^2/2g\right) = 0.116\,\frac{(25.5)^2}{2g} = 1.17'$

HEC-RAS Plan: Plan 01 River: PINE CREEK Reach: RCB

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
RCB	500	801.00	30.00	35.10	36.77	41.08	0.010055	19.63	40.80	8.00	1.53
RCB	475	801.00	29.50	34.46	36.27	40.79	0.010822	20.20	39.66	8.00	1.60
RCB	450	801.00	29.00	33.84	35.77	40.48	0.011509	20.68	38.73	8.00	1.66
RCB	425	801.00	28.50	33.25	35.27	40.14	0.012066	21.06	38.03	8.00	1.70
RCB	400	801.00	28.00	32.68	34.77	39.79	0.012594	21.41	37.42	8.00	1.74
RCB	375	801.00	27.50	32.11	34.27	39.44	0.013091	21.73	36.87	8.00	1.78
RCB	350	801.00	27.00	31.55	33.77	39.08	0.013557	22.02	36.38	8.00	1.82
RCB	325	801.00	26.50	30.99	33.27	38.70	0.013994	22.29	35.94	8.00	1.85

STARTING AT A W.S. OF 5.10' ABOVE THE INVERT.

THE W.S. WILL DROP $5.10' - 4.75 = 0.35'$ IN 75'

OR - $^{60}/_{75}(0.35) = -0.28'$

6:03 ANALYSIS OF JUNCTION OF 5' DIAMETER R.C.P. FROM UNION BOULEVARD AND RIGHT CELL OF R.C.B.

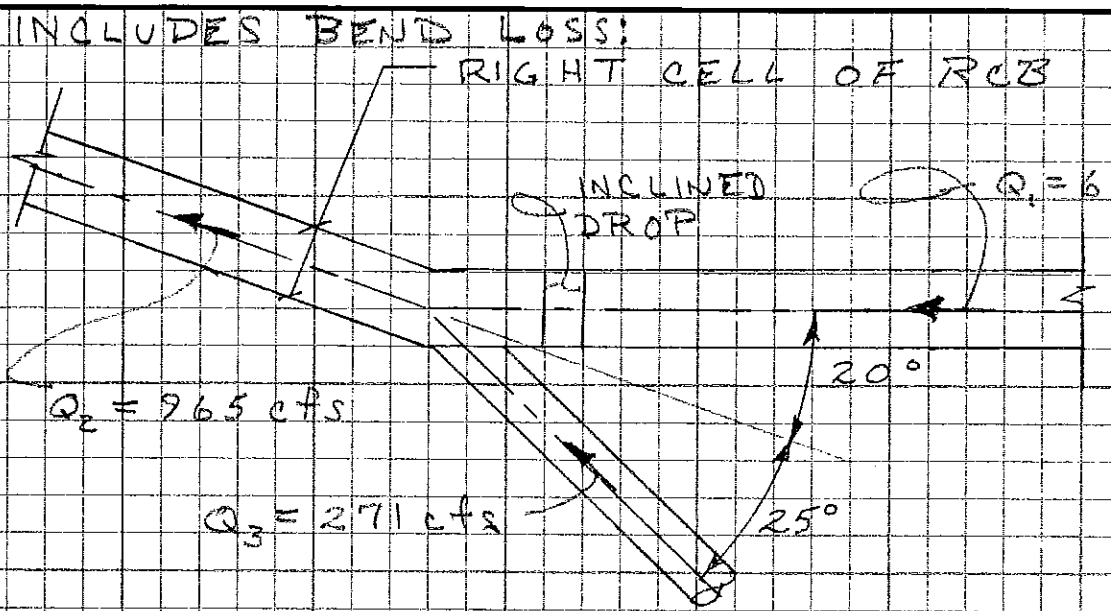
Client: _____ Job No: 87533

Project: RCB By: J.R.B Chk. By: _____ Date: 5/17/01

Subject: JUNCTION STA. 3+63 +/- Sheet No: 1 of 2

J·R ENGINEERING
A Subsidiary of Westrian

INCLUDES BEND LOSS!



REC-RAS ANALYSIS WAS MADE TO DETERMINE THE WATER DEPTH UPSTREAM OF THE JUNCTION. THAT W.D. WAS USED IN THE L.A. FORMULA TO DETERMINE THE W.D. DOWN STREAM OF THE JUNCTION.

$Q_1 = 694$ cfs $Q_2 = 965$ cfs $Q_3 = 271$ cfs

$b_1 = 8'$ $b_2 = 8'$ $d_3 = 60''$

$S_1 = 0.02$ $S_2 = 0.02$ $A_3 = 17.67$ s.f.

$D_1 = 2.91$ (REC-RAS)

$A_1 = (8)(2.91) = 23.28$ s.f.

Client: _____ Job No: 87153

Project: RCB By: J.R.B. Chk. By: _____ Date: 5/17/01

Subject: JUNCTION STA. 3463 +/- Sheet No: 2 of 2

J·R ENGINEERING
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$$M_2 \leq \cos 20^\circ (M_1) + \cos 25^\circ (M_3) + \tfrac{1}{2}(A_{1N} + A_2)(Z + D_1 - D_2)$$

ASSUME: $D_2 = 5.1$ COMPUTE Z

$$\frac{965^2}{40.8(32.2)} \leq (0.94)\left(\frac{6.94^2}{(23.38)(32.2)}\right) + (.91)\left(\frac{271^2}{(1963)32.2}\right) + \tfrac{1}{2}(23.38 + 40.8)(Z + 2.91 - 5.1)$$

$$709 \leq 604 + 106 + 32.04(Z - 2.29)$$

$$-1/32.04 \leq Z - 2.29$$

$$Z \geq 2.26' \qquad 2.2' \text{ PROVIDED}$$

USE $D_2 = 5.15$

CHECK UNION LATERAL HGL

ASSUMPTION.

ESTIMATE 45° BEND LOSS 5' DIA. S.D.

$K_b = 0.25\sqrt{45/90} = 0.18$

$L_B = 0.18\ V^2/2g = 0.18\left(\frac{13.8^2}{64.4}\right) = 0.53$

JUNCTION M.D. + 0.53 = 5.15 + 1.53 = 5.68

INTERIOR CROWN OF 5' DIA IS 5.75'

ABOVE THE RCB INVERT 5.25' > 5.68' O/K

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X   X XXXXXX  XXXX     XXXX    XX    XXXX
X   X X      X  X    X  X   X X  X
X   X X      X       X  X  X  X  X
XXXXXXX XXXX   X    XXX XXXX   XXXXXX  XXXX
X   X X      X       X X   X  X     X
X   X X      X  X    X  X  X  X     X
X   X XXXXXX  XXXX     X  X  X  X  XXXXX
```

PROJECT DATA
Project Title: BRIARGATE PARKWAY RCB
Project File : RCB.prj
Run Date and Time: 5/17/2001 10:41:36 AM

Project in English units

PLAN DATA

Plan Title: Plan 01
Plan File : x:\2870000.all\2871533\RCB.p01

Geometry Title: RCB
Geometry File : x:\2870000.all\2871533\RCB.g01

Flow Title : RIGHT CELL
Flow File : x:\2870000.all\2871533\RCB.f01

Plan Summary Information:
Number of: Cross Sections = 7 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance

Computational Flow Regime: Supercritical Flow

FLOW DATA

Flow Title: RIGHT CELL
Flow File : x:\2870000.all\2871533\RCB.f01

Flow Data (cfs)

River	Reach	RS	PF 1
RCB	ONE	700	1388
RCB	ONE	362.87	1930

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RCB	ONE	PF 1	Normal S = .0208	Normal S = .02

GEOMETRY DATA

Geometry Title: RCB
Geometry File : x:\2870000.all\2871533\RCB.g01

CROSS SECTION RIVER: RCB
REACH: ONE RS: 700

INPUT
Description: SINGLE CELL
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	893.76	0	887.76	11	887.76	11	893.76

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	11	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	11	237.12	237.12	.1	.3

CROSS SECTION RIVER: RCB
REACH: ONE RS: 462.88

INPUT
Description: BEGIN 2 CELL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	888.83	0	882.83	5.5	882.83	5.5	888.83	6.5	888.83
6.5	882.83	12	882.83	12	888.83				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	12	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	12	12.52	12.52	.1	.3

CROSS SECTION RIVER: RCB
REACH: ONE RS: 450.36

INPUT
Description: 2 CELL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	886.32	0	880.32	8	880.32	8	886.32	9	886.32
9	880.32	17	880.32	17	886.32				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	17	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	17	59.17	59.17	.1	.3

CROSS SECTION RIVER: RCB
REACH: ONE RS: 391.19

INPUT
Description: 2 CELL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	885.14	0	879.14	8	879.14	8	885.14	9	885.14
9	879.14	17	879.14	17	885.14				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	17	.013

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	17	20	20	.1	.3

CROSS SECTION RIVER: RCB
REACH: ONE RS: 371.19

INPUT
Description: 2 CELL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	882.94	0	876.94	8	876.94	8	882.94	9	882.94
9	876.94	17	876.94	17	882.94				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	17	.013

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 17 8.32 8.32 8.32 .1 .3

CROSS SECTION RIVER: RCB
REACH: ONE RS: 362.87

INPUT
Description: 2 CELL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	882.77	0	876.77	8	876.77	8	882.77	9	882.77
9	876.77	17	876.77	17	882.77				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	17	.013

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 17 162.87 162.87 162.87 .1 .3

CROSS SECTION RIVER: RCB
REACH: ONE RS: 200.00

INPUT
Description: 2 CELL
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	879.52	0	873.52	8	873.52	8	879.52	9	879.52
9	873.52	17	873.52	17	879.52				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	0	.013	17	.013

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 17 0 0 0 .1 .3

SUMMARY OF MANNING'S N VALUES

River:RCB

Reach	River Sta.	n1	n2	n3
ONE	700	.013	.013	.013
ONE	462.88	.013	.013	.013
ONE	450.36	.013	.013	.013
ONE	391.19	.013	.013	.013
ONE	371.19	.013	.013	.013
ONE	362.87	.013	.013	.013
ONE	200.00	.013	.013	.013

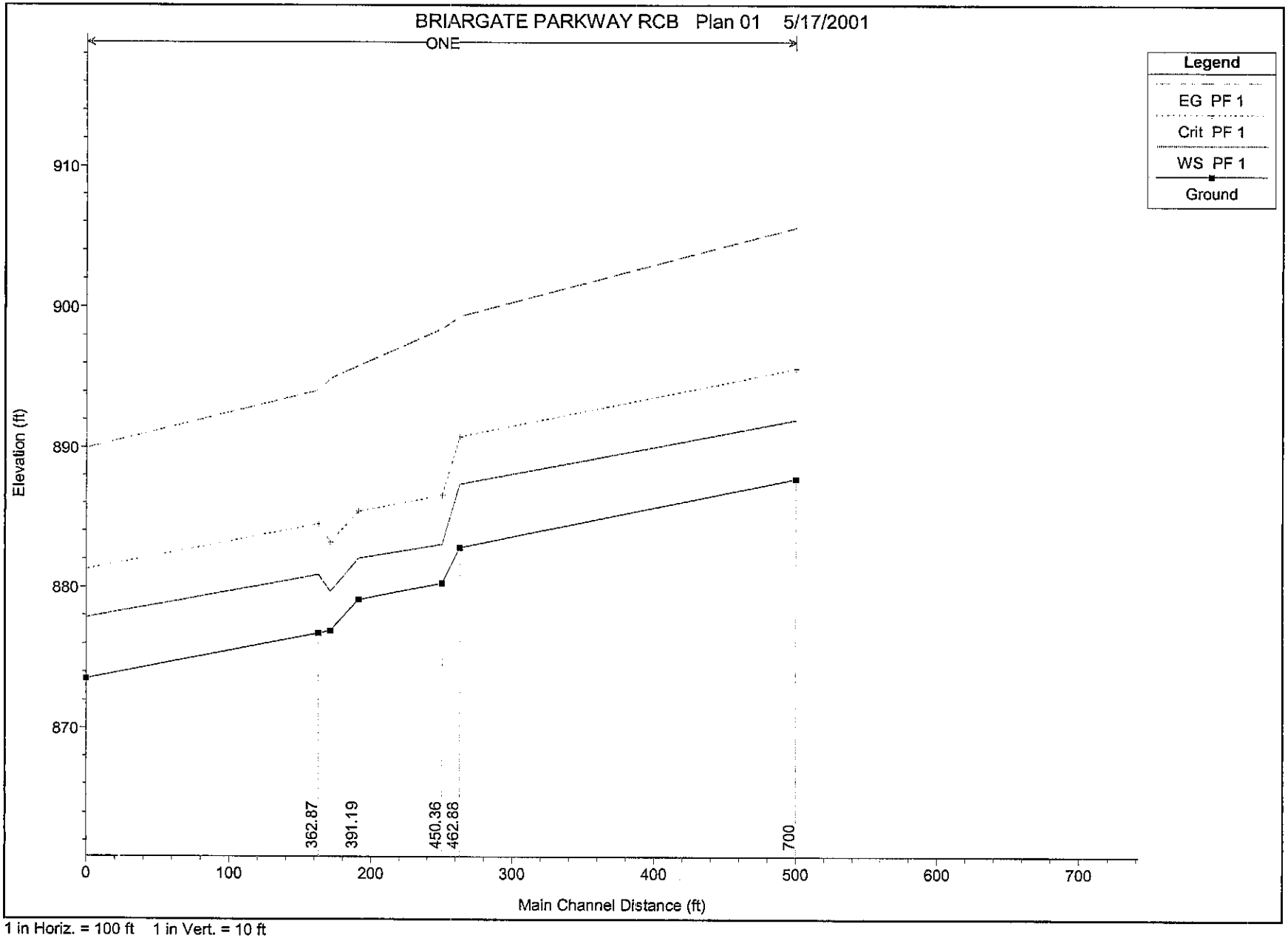
SUMMARY OF REACH LENGTHS

River: RCB

Reach	River Sta.	Left	Channel	Right
ONE	700	237.12	237.12	237.12
ONE	462.88	12.52	12.52	12.52
ONE	450.36	59.17	59.17	59.17
ONE	391.19	20	20	20
ONE	371.19	8.32	8.32	8.32
ONE	362.87	162.87	162.87	162.87
ONE	200.00	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RCB

Reach	River Sta.	Contr.	Expan.
ONE	700	.1	.3
ONE	462.88	.1	.3
ONE	450.36	.1	.3
ONE	391.19	.1	.3
ONE	371.19	.1	.3
ONE	362.87	.1	.3
ONE	200.00	.1	.3



1 in Horiz. = 100 ft 1 in Vert. = 10 ft

HEC-RAS Plan: Plan 01 River: RCB Reach: ONE

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
ONE	700	1388.00	887.76	892.03	895.68	905.62	0.020822	29.58	46.92	11.00	2.52
ONE	462.88	1388.00	882.83	887.37	890.79	899.37	0.028865	27.80	49.93	11.00	2.30
ONE	450.36	1388.00	880.32	883.07	886.58	898.51	0.039683	31.54	44.01	16.00	3.35
ONE	391.19	1388.00	879.14	882.05	885.40	895.86	0.033992	29.83	46.53	16.00	3.08
ONE	374.19	1388.00	876.94	879.71	883.20	894.96	0.038989	31.34	44.29	16.00	3.32
ONE	362.87	1930.00	876.77	880.91	884.50	894.12	0.025284	29.17	66.16	16.00	2.53
ONE	200.00	1930.00	873.52	877.84	881.25	889.95	0.022524	27.92	69.12	16.00	2.37

UPSTREAM DEPTH: 882.05 − 879.14 = 2.91

6:04 DESIGN CONCEPT AND SAMPLE CALCULATIONS FOR PROPOSED R.C.B. STATIONS 11+70 TO 22+23

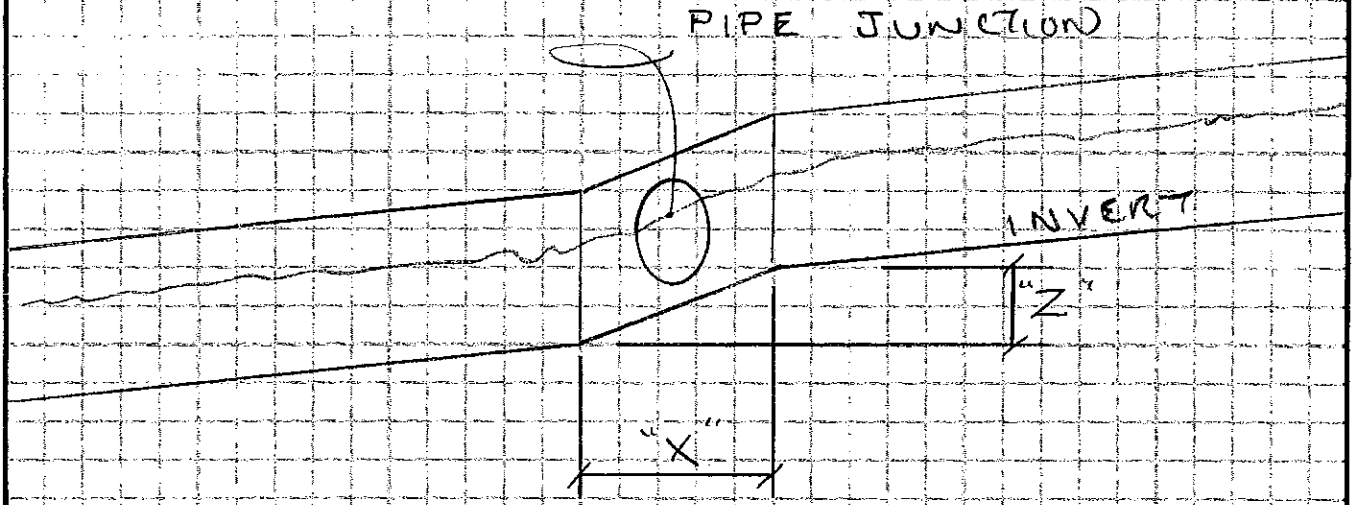
JR Engineering

CLIENT _____ JOB NO. _____

PROJECT BRIARGATE/ UNION BY _____ CHK. BY _____ DATE _____

SUBJECT RCB JUNCTION LOSS SHEET NO. _____ OF _____

DESIGN CONCEPT



PROFILE - PROPOSED RCB

CONCEPT IS TO MAINTAIN SUPERCRITICAL FLOW. "Z" IS COMPUTED TO PREVENT HYDRAULIC JUMP FROM OCCURING UPSTREAM OF THE JUNCTION

LATERAL FLOW $Q_{L.O}$	ESTIMATED "Z"	"X"
304 cfs	2.5'	12.5'
147 cfs	2'	10'
53 - 68 cfs	1.5'	7.5'
0 - 15 cfs	NEG.	NEG.

"Z" VALUES USED FOR PREL. RCB PROFILE OF RCB

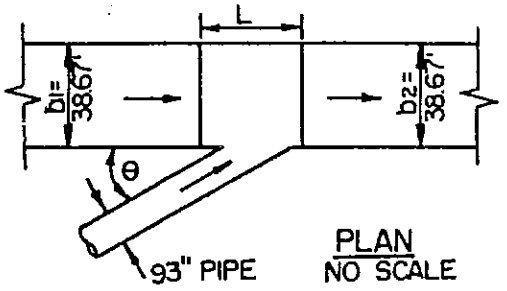
THE LATERAL INLET IS TO BE EITHER SUBMERGED OR TO HAVE A WATER SURFACE ELEVATION APPROX. EQUAL TO THE AVERAGE W.S. THRU THE JUNCTION

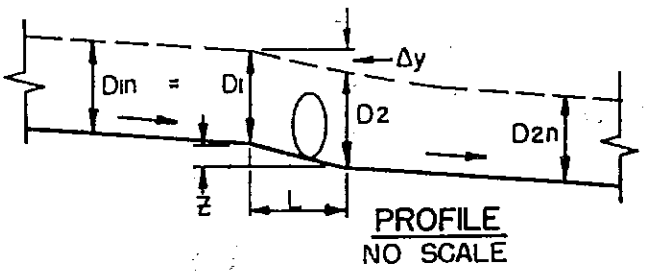
FROM HYDRAULIC ANALYSIS OF JUNCTIONS
BUREAU OF ENGINEERING, CITY OF LOS ANGELES

HYDRAULIC ANALYSIS OF JUNCTIONS

2. Rectangular Section - Supercritical Flow

Case C: Supercritical flow upstream and downstream; solve for value of Z so that a hydraulic jump cannot occur at the junction. SET $D_1 = D_{1n}$, MAXIMUM $D_2 = D_{2c}$.





GIVEN:

Q_1 = 11,015 cfs	Q_2 = 11,450 cfs	Q_3 = 435 cfs
b_1 = 38.67 ft.	b_2 = 38.67 ft.	d_3 = 93 in.
S_1 = 0.00357	S_2 = 0.00357	A_3 = 47 sq.ft.
D_{1n}= 11.90 ft.	D_{2c}= 13.98 ft.	θ = 30°
A_{1n}= 460 sq.ft.	A_{2c}= 540 sq.ft.	n = 0.014
	D_{2n}= 12.22 ft.	

FORMULA AND SOLUTION:

$$M_{2c} \leq M_{1n}+M_3\cos\theta+\tfrac{1}{2}(A_{1n}+A_{2c})(Z+D_{1n}-D_{2c})$$

$$\frac{(11{,}450)^2}{540(32.2)} = \frac{(11{,}015)^2}{460(32.2)}+\frac{(435)^2(.866)}{47(32.2)}$$

$$+\tfrac{1}{2}(460+540)(Z+11.90-13.98)$$

$$7540 \leq 8210+108+(500)(Z-2.08)$$

$$-778 \leq (500)(Z-2.08)$$

$$Z \geq 0.52 \text{ ft.}$$

NOTE: IF D_{2n} EXCEEDS BOX HEIGHT REDUCE D_2 TO ALLOW FOR BOX HEIGHT, CHECK A_2 BASED ON NEW D_2 AND COMPUTE APPROPRIATE Z.

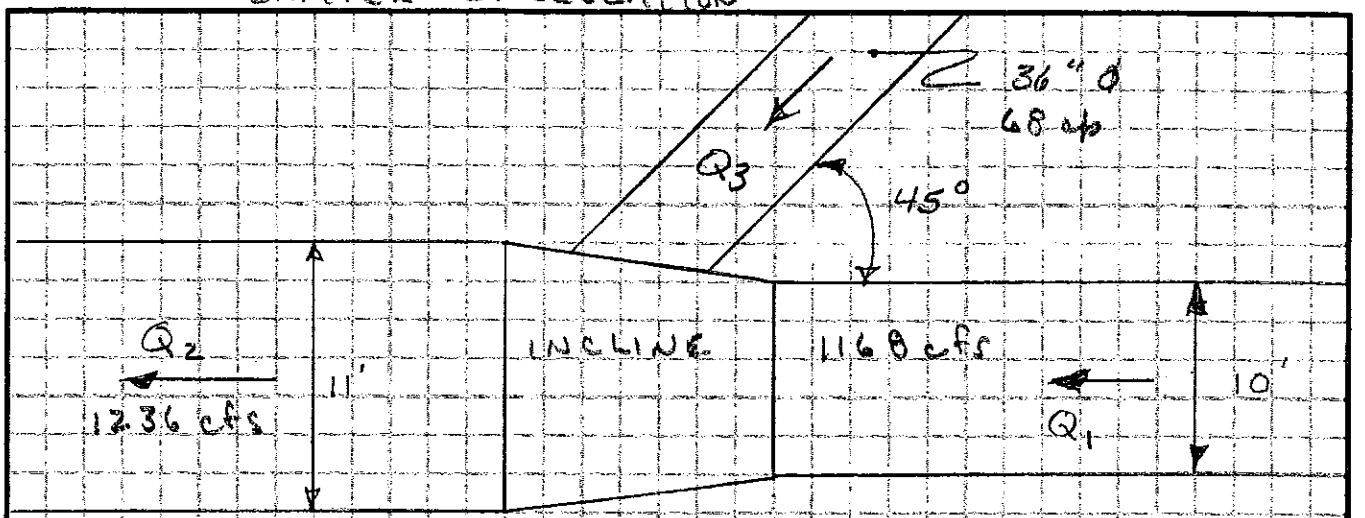
JR Engineering, Ltd.

CLIENT _____ JOB NO. _____

PROJECT BRIARGATE / UNION BY _____ CHK. BY _____ DATE _____

SUBJECT RCB JUNCTION LOSS SHEET NO. 1 OF 1

SAMPLE CALCULATION



$Q_1 = 11.68$ cfs $Q_2 = 12.36$ cfs $Q_3 = 68$ cfs

$b_1 = 10'$ $b_2 = 11'$ $d_3 = 36"$

$S_1 = 0.019$ $S_2 = 0.02$ $A_3 = 7.07$

$D_{1n} = 4.26'$ $D_{2n} = 3.28'$ $n = 0.013$

$A_{1n} = 42.56$ sf $A_{2n} = 43.77$ sf

$D_{2c} = 7.32$

$$M_2 \leq M_{1n} + M_3 \cos\theta + \tfrac{1}{2}(A_{1n} + A_2)(Z + D_{1n} - D_2)$$

LET $D_2 = 4.2'$, $A_2 = 46.2$ sf

$$\frac{12.36^2}{46.2(32.2)} \leq \frac{11.68^2}{42.56(32.2)} + \frac{6.8^2(.71)}{(7.07)(32.2)} + \tfrac{1}{2}(42.56+46.2)(Z+4.26-4.2)$$

$$10.26.9 \leq 995.47 + 14.4 + 44.38(Z - 0.06)$$

$$17.0 \leq 44.38(Z - 0.06$$

$$0.44 \leq Z \qquad \text{USED } 1.5' \text{ ok}$$

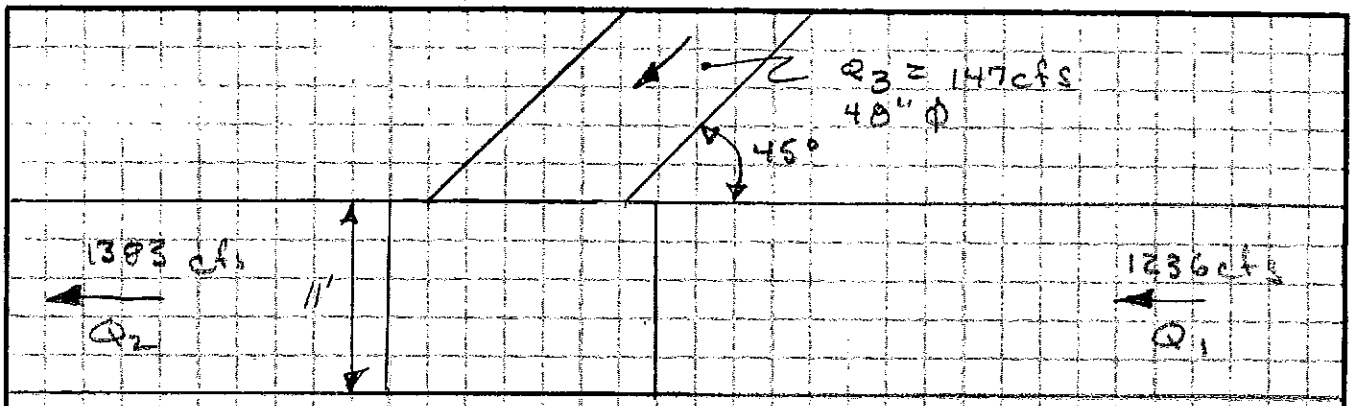
JR Engineering

CLIENT _____ JOB NO. _____

PROJECT BRIARGATE/UNION BY _____ CHK. BY _____ DATE _____

SUBJECT RCB JUNCTION LOSS SHEET NO. 1 OF 1

SAMPLE CALCULATION



$Q_1 = 1236$ cfs $\quad Q_2 = 1383$ cfs $\quad Q_3 = 147$ cfs

$b_1 = 11'$ $\quad b_2 = 11'$ $\quad d_3 = 48''$

$S_1 = 0.02$ $\quad S_2 = 0.02$ $\quad A_3 = 12.6$ sf

$D_{1n} = 3.98'$ $\quad D_{2n} = 4.26'$, $D_{2c} = 7.89'$

$A_{1n} = 43.77$ sf $\quad A_{2n} = 46.81$ sf

$$M_2 \leq M_{1n} + M_3 \cos\theta + \tfrac{1}{2}(A_{1n} + A_2)(Z + D_{1n} + D_2)$$

LET $D_2 = 4.8'$ $\quad A_2 = 52.8$ sf

$$\frac{1383^2}{(52.8)(32.2)} \leq \frac{1236^2}{43.77(32.2)} + \frac{147^2(.71)}{(12.6)(32.2)} + \tfrac{1}{2}(43.77 + 52.8)(Z + 3.98 - 4.8)$$

$$1125 \leq 1084 + 38 + 48.3(Z - 0.82)$$

$$3 = 48.3(Z - 0.82)$$

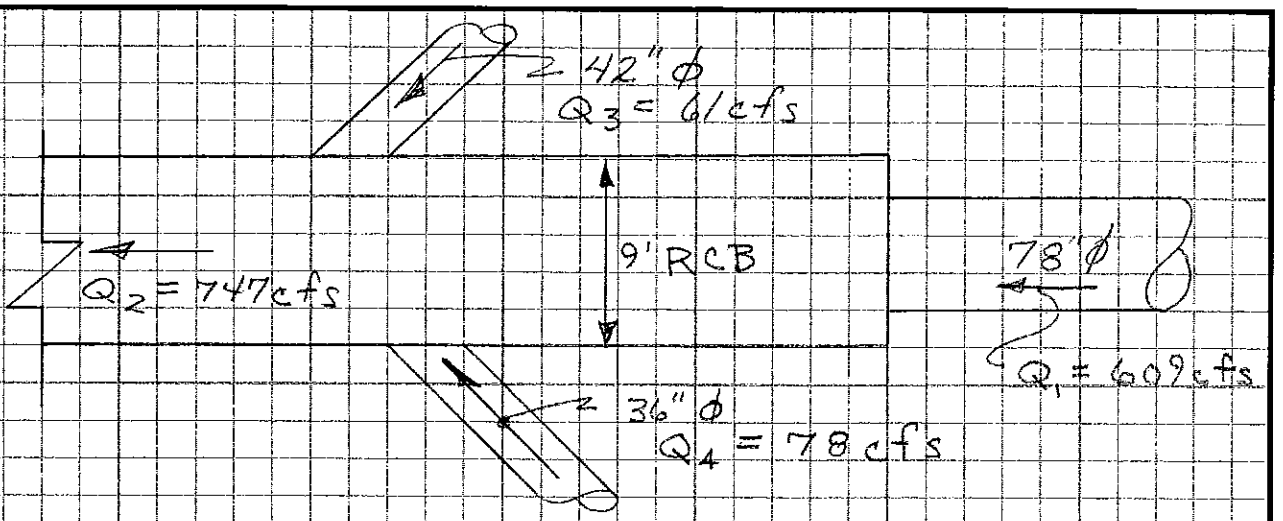
$$0.88 \leq Z \qquad Z = 0.9 \text{ m.m.}$$

Client: _____ Job No: _____

Project: RCB By: _____ Chk. By: _____ Date: _____

Subject: JUNCTIONS STA 23+01 & 23+17 Sheet No: ___ of ___

J-R ENGINEERING
A Subsidiary of Westrian



$Q_1 = 609$ cfs $Q_2 = 747$ cfs $Q_3 = 61$ cfs $Q_4 = 78$ cfs

$b_1 = 9'$ $b_2 = 9'$ $d = 42"$ $d = 36"$

$S_1 = 0.02$ $S_2 = 0.02$ $A = 9.62$ sf $A = 7.07$ sf

$D_1 = 2.88'$

$\theta = 45°$

$A_1 = 25.9$ sf

$M_2 \equiv M_1 + M_3 \cos\theta + M_4 \cos\theta + \frac{1}{2}(A_1 + A_2)(Z + D_1 - D_2)$

TRIAL #1 ASSUME $D_2 = 5.8$ $A_2 = 52.2$ sf

$$\frac{747^2}{(52.2)(32.2)} = \frac{609^2}{(25.9)(32.2)} + \frac{61^2(.707)}{(9.62)(32.2)} + \frac{78^2(.707)}{(7.07)(32.2)} + \frac{1}{2}(25.9 + 52.2)(Z + 2.88 - 5.8)$$

$$332 = 445 + 8 + 18 + (39.05)(Z - 2.92)$$

$$-139 = 39.05(Z - 2.92)$$

$Z = -3.56 + 2.92 = -0.64$ REDUCE D_2 IN SECOND TRIAL

Client: _____ Job No: _____

Project: _____ By: _____ Chk. By: _____ Date: _____

Subject: JUNCTION STA 23+01 & 23+17 Sheet No: ____ of ____

J·R ENGINEERING
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ASSUME $D_2 = 4.8'$, $A = 43.2$ S.F.

$$\frac{747^2}{(43.2)(32.2)} = \frac{609^2}{25.9(32.2)} + \frac{61^2(.707)}{9.62(32.2} + \frac{78^2(.707)}{(7.07)32.2}$$

$$+ \tfrac{1}{2}(25.9 + 43.2)(Z + 2.88 - 4.8)$$

$$401 = 445 + 8 + 18 + 34.55(Z - 1.92)$$

$$-70 = (34.55)(Z - 1.92)$$

$$-2 + 1.92 = Z = -0.08$$

USE: $D_2 = 4.8'$

THIS WATER DEPTH $D_2 = 4.8'$ SHALL BE USED AS A STARTING POINT FOR HGL CALCULATIONS FOR THE AUSTIN BLUFFS S.D. TRIBUTARY

BRIARGATE PARKWAY RCB
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	RCB STA. 18+00 TO 22+00 +/-
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.018000	ft/ft
Bottom Width	9.00	ft
Discharge	1,051.00	cfs

Results		
Depth	4.45	ft
Flow Area	40.06	ft²
Wetted Perimeter	17.90	ft
Top Width	9.00	ft
Critical Depth	7.51	ft
Critical Slope	0.004656	ft/ft
Velocity	26.24	ft/s
Velocity Head	10.70	ft
Specific Energy	15.15	ft
Froude Number	2.19	
Flow is supercritical.		

RCB
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	STA. 22 +23.11
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	9.00	ft
Discharge	747.00	cfs

Results		
Depth	3.33	ft
Flow Area	29.98	ft²
Wetted Perimeter	15.66	ft
Top Width	9.00	ft
Critical Depth	5.98	ft
Critical Slope	0.004189	ft/ft
Velocity	24.92	ft/s
Velocity Head	9.65	ft
Specific Energy	12.98	ft
Froude Number	2.41	
Flow is supercritical.		

BRIARGATE STORM DRAIN
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	RCB STA. 23+00
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	9.00	ft
Discharge	609.00	cfs

Results		
Depth	2.88	ft
Flow Area	25.89	ft²
Wetted Perimeter	14.75	ft
Top Width	9.00	ft
Critical Depth	5.22	ft
Critical Slope	0.003964	ft/ft
Velocity	23.52	ft/s
Velocity Head	8.60	ft
Specific Energy	11.47	ft
Froude Number	2.44	
Flow is supercritical.		

BRIARGATE STORM DRAIN
Worksheet for Circular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	STA. 23+50, 78" RCP TO RCB
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.023000	ft/ft
Diameter	78.00	in
Discharge	609.00	cfs

Results		
Depth	4.26	ft
Flow Area	23.06	ft²
Wetted Perimeter	12.27	ft
Top Width	6.18	ft
Critical Depth	6.14	ft
Percent Full	65.58	
Critical Slope	0.011670	ft/ft
Velocity	26.40	ft/s
Velocity Head	10.83	ft
Specific Energy	15.10	ft
Froude Number	2.41	
Maximum Discharge	855.25	cfs
Full Flow Capacity	795.06	cfs
Full Flow Slope	0.013495	ft/ft
Flow is supercritical.		

6:05 FLOWMASTER DATA SHEETS FOR NORMAL DEPTH CALCULATIONS IN R.C.B

DOUBLE 8' RCB STA: 1+85 TO 3+46
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	8.00	ft
Discharge	891.00	cfs

Results		
Depth	4.25	ft
Flow Area	34.03	ft^2
Wetted Perimeter	16.51	ft
Top Width	8.00	ft
Critical Depth	7.28	ft
Critical Slope	0.005062	ft/ft
Velocity	26.18	ft/s
Velocity Head	10.65	ft
Specific Energy	14.91	ft
Froude Number	2.24	
Flow is supercritical.		

DOUBLE 8' RCB STA: 3+91 TO 4+57
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	8.00	ft
Discharge	748.00	cfs / CELL

Results		
Depth	3.73	ft
Flow Area	29.85	ft^2
Wetted Perimeter	15.46	ft
Top Width	8.00	ft
Critical Depth	6.48	ft
Critical Slope	0.004770	ft/ft
Velocity	25.06	ft/s
Velocity Head	9.76	ft
Specific Energy	13.49	ft
Froude Number	2.29	
Flow is supercritical.		

11' RCB STA: 4+64 TO 11+70
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020800	ft/ft
Bottom Width	11.00	ft
Discharge	1,383.00	cfs

Results		
Depth	4.26	ft
Flow Area	46.81	ft^2
Wetted Perimeter	19.51	ft
Top Width	11.00	ft
Critical Depth	7.89	ft
Critical Slope	0.004052	ft/ft
Velocity	29.54	ft/s
Velocity Head	13.56	ft
Specific Energy	17.82	ft
Froude Number	2.52	
Flow is supercritical.		

11' RCB STA: 11+77 TO 12+50
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	11.00	ft
Discharge	1,236.00	cfs

Results		
Depth	3.98	ft
Flow Area	43.77	ft²
Wetted Perimeter	18.96	ft
Top Width	11.00	ft
Critical Depth	7.32	ft
Critical Slope	0.003920	ft/ft
Velocity	28.24	ft/s
Velocity Head	12.39	ft
Specific Energy	16.37	ft
Froude Number	2.50	
Flow is supercritical.		

10' RCB STA: 12+57 TO 16+55
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.019000	ft/ft
Bottom Width	10.00	ft
Discharge	1,168.00	cfs

Results		
Depth	4.26	ft
Flow Area	42.56	ft^2
Wetted Perimeter	18.51	ft
Top Width	10.00	ft
Critical Depth	7.51	ft
Critical Slope	0.004272	ft/ft
Velocity	27.44	ft/s
Velocity Head	11.71	ft
Specific Energy	15.96	ft
Froude Number	2.35	
Flow is supercritical.		

10' RCB STA: 16+62 TO 17+87
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.019000	ft/ft
Bottom Width	10.00	ft
Discharge	1,104.00	cfs

Results		
Depth	4.08	ft
Flow Area	40.84	ft^2
Wetted Perimeter	18.17	ft
Top Width	10.00	ft
Critical Depth	7.24	ft
Critical Slope	0.004199	ft/ft
Velocity	27.04	ft/s
Velocity Head	11.36	ft
Specific Energy	15.44	ft
Froude Number	2.36	
Flow is supercritical.		

9' RCB STA: 17+95 TO 22+12
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.018000	ft/ft
Bottom Width	9.00	ft
Discharge	1,051.00	cfs

Results		
Depth	4.45	ft
Flow Area	40.06	ft²
Wetted Perimeter	17.90	ft
Top Width	9.00	ft
Critical Depth	7.51	ft
Critical Slope	0.004656	ft/ft
Velocity	26.24	ft/s
Velocity Head	10.70	ft
Specific Energy	15.15	ft
Froude Number	2.19	
Flow is supercritical.		

9' RCB STA: 22+25 TO 23+00
Worksheet for Rectangular Channel

Project Description	
Project File	h:\fmw\project1.fm2
Worksheet	BRIARGATE PARKWAY RCB
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	9.00	ft
Discharge	747.00	cfs

Results		
Depth	3.33	ft
Flow Area	29.98	ft^2
Wetted Perimeter	15.66	ft
Top Width	9.00	ft
Critical Depth	5.98	ft
Critical Slope	0.004189	ft/ft
Velocity	24.92	ft/s
Velocity Head	9.65	ft
Specific Energy	12.98	ft
Froude Number	2.41	
Flow is supercritical.		

DRAINAGE MAPS
SHEETS 1 THRU 5