

HYDROLOGY STUDY

FOR

TTM 34760

IN THE

City of Corona

COUNTY OF RIVERSIDE, CALIFORNIA

April 20, 2009

Armstrong & Brooks Consulting Engineers
1530 Consumer Circle, Unit "B"
Corona, CA 92880

PREPARED BY:

Dennis G. Armstrong
R.C.E. 48758
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INTRODUCTION

INTRODUCTION

The purpose of this preliminary drainage analysis is to ensure that the proposed drainage system is designed to accept and convey on-site and off-site flows through and/or around the project site in a safe and non-destructive manner while adhering to the regional and local design requirements, including those requirements for a site specific water quality management plan (WQMP).

Tentative Tract Map 34760 is an application to subdivide two existing undeveloped parcels into a clustered development of thirty-four (34) estate type, single family, half acre minimum residential lots.

The two existing parcels consist of a 39.9 acre parcel located within the City of Corona and an adjacent 24.4 acre parcel within the unincorporated area of Riverside County. The development application includes a request to annex the 24.4 acre parcel into the City of Corona. Therefore, the analysis contained herein focuses on the design criteria identified by the City of Corona.

The 64.3 acre project site lies adjacent and between the northerly boundary of the Cleveland National Forest and the southerly boundary of Tract 28153 within the Mountain Gate Specific Plan area in South Corona. The project site is bound by undeveloped vacant land to its east and west. The undeveloped land to the east has been entitled with an approved tentative map (TTM 32386), but maintains a conservation easement/open space buffer between the project site and the proposed development.

Primary access to the project site is from Malaga Street, south of Shepard Crest Drive. Secondary access is via an existing easement road off of Shepard Crest which runs adjacent to an un-named wash depicted on the 1997 USGS Quadrangle Map-Corona South.

The project site is located at the base of the Cleveland National Forest and accepts and conveys flow to Debris Basins "3" and "3D" as analyzed in the 1996 study prepared by Post, Buckley, Schuh & Jernigan Inc. (PBS&J)

"Hydrology & Hydraulic Report for Lincoln Ave. Storm Drain
FlowBy Detention/Park and Debris Basins"

Debris Basin "3" lies northerly of the northeasterly edge of the project site and has been designed to manage debris from a watershed of 190.0 acres. Debris Basin "3D" lies northerly of the northwesterly edge of the project site and has been designed to manage debris from a watershed of 332.3 acres.

PRELIMINARY DESIGN CRITERIA

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This Preliminary Drainage Study was based on the following Design Criteria identified by the City of Corona:

1. Tributary flows must be routed through the site in a safe and non-destructive manner while protecting the primary and secondary access roads from the 100-year event.
2. Increased flow differential between pre and post development conditions must be mitigated prior to release downstream.
3. Maximum velocity of “bulked” flows conveyed via RCP is 25 fps.
4. Maximum velocity of “clear” water flows via on-site storm drain is 40 fps.
5. Maintain a minimum of 1 ½” clearance between pipe invert to top of reinforcement for velocities greater than 20 fps.
6. 100-year water surface elevation at pipe inlets shall be contained on-site.
7. Proposed Water Quality Basins must drain empty within 48 hours.
8. The 10-year event shall be contained within the street section from curb to curb.
9. The 100-year event shall be contained within the public right-of-way.

PRELIMINARY DESIGN METHODOLOGY

1. **RATIONAL METHOD** – The Rational Method was used to determine the peak discharge for watersheds less than 1 square mile. Civil Design Software by Bonadiman and Associates was used to model the RCFC & WCD rational method for the project site. The following design data was used within our model:

- A. Rainfall (Rational) – Plate D4.1 of Riverside County Hydrology Manual was used to provide duration vs. intensity data for Corona.
- B. Infiltration – Soil Type “D” underlies the site area based on a review of the hydrologic soils group map for Corona-South, Plate C-1.27
- C. Antecedent Moisture Content (AMC) – AMC II was used for both Rational and Unit Hydrograph calculations based on Riverside County Hydrology Manual’s recommendations for use with the 10 and 100-year frequency storm (Pg. C-4). AMC III is only utilized for Debris Basin & Spillway Design.

2. **SYNTHETIC UNIT HYDROGRAPH** – The Synthetic Unit Hydrograph method was used in determining the inflow/outflow vs. depth relationship for Water Quality Basin “E-1”. The following design data was used within our model:

- A. Rainfall (Unit Hydrograph) – Plates E5.3 and E5.4 of Riverside County Hydrology Manual were used to provide rainfall data for project site.

3. **WATER SURFACE AND PRESSURE GRADIENT (WSPGW)** by Civil Design Software by Bonadiman and Associates was used to determine the water surface elevation and velocity throughout the proposed storm drain lines. The following design data was used within our model:

- A. Manning’s “n” – Our study utilized a Manning’s “n” roughness coefficient of 0.013 for reinforced concrete pipe (RCP).

3. **FLOWMASTER** by Haested Methods was used to determine the catch basin interception and bypass calculations as well as street capacity calculations.

4. **HEC-RAS** Software (Versions 3.1.3) by U.S. Army Corps of Engineers was used to determine the 100-year water surface for the un-named channel at the westerly extents of the project.

- A. Controlling Water Surface – An elevation of 1206.0 (Spillway Elevation + 2’) was used as the 100-year downstream controlling water surface within Basin “3D”.

5. **NATURAL MOUNTAIN CHANNEL VELOCITY NOMOGRAPH** per Riverside County Hydrology Manual, Plat D-6.3 was used to determine velocity within existing easterly natural channel.

NARRATIVE

Existing Conditions

The 64.3 acre project site ranges in elevation from approximately 1600 feet at the southeasterly corner to approximately to 1220 feet at the northwesterly corner leading into Debris Basin "3D". A series of small, on-site ridges define the five watershed boundaries which traverse the site. Approximately 68% of the project site consists of slopes ranging from 25.1% and greater. The site drainage pattern is generally from the south toward the north.

WATERSHED "A":

The southwesterly portion of the project site consists of natural hillside covered in dense native vegetation. This portion of the site accepts and conveys off-site flow from three sub-basin watersheds towards the existing, City maintained Debris Basin "3D". Two of sub-basin watersheds confluence on-site near the southwesterly boundary prior to a final confluence with the third and most westerly sub-basin at the off-site entrance to Debris Basin "3D". The three off-site sub-basin watersheds consist of natural hillside/mountainous terrain covered in dense native vegetation.

The most westerly of the three sub-basin watersheds conveys flow from 22.1 acres, which generate 61.0 cfs during the 100 year event. The site accepts off-site flow from 17.5 acres along the southwesterly portion of the site. While traversing a short reach across the project site, the drainage course accepts flow from 2.3 acres of on-site tributary area before exiting the site on its way to basin "3D". The remaining 2.3 acres of tributary area are located off-site, northwesterly of the project limits.

The most easterly of the three sub-basin watersheds conveys flow from 15.3 acres, which generate 41.4 cfs during the 100 year event. Off-site flow from 11.4 acres is accepted along the site's southerly boundary. Flow generated from 3.9 acres of on-site area is added prior to reaching the on-site confluence with the flow from the center or primary sub-basin watershed.

Run-off from the center or primary sub-basin watershed is conveyed to the site's southwesterly region via a natural valley channel. The site accepts off-site flow from 277.7 acres, which generate 701.7 cfs. The channel traverses a short reach into the project site while adding flow from 1.1 acres of off-site tributary area and 0.6 acres of on-site tributary area where it confluences with the flow from the most easterly sub-basin watershed. The confluenced flow of 742.1 cfs is generated by a tributary area of 294.7 acres.

The confluenced flow continues northerly toward basin "3D" via the un-named wash which runs adjacent to the existing secondary access or easement road off of Shepard Crest. An additional 3.5 acres of off-site tributary area and 6.2 acres of on-site tributary area are added to the watershed prior to exiting the site. The 304.6 acres generates 763.5 cfs prior to leaving the site along its northwesterly boundary. The remaining 1.6 acres of the primary sub-basin is located within a portion of basin "3D", which lies off-site, northwesterly of the project limits.

The three sub-basin watersheds which traverse the southwesterly portion of the project site total 328.1 acres and generate 819.4 cfs during the 100 year event at the entrance to basin "3D".

A HEC-RAS analysis was performed on the un-named wash leading to basin "3D" at a bulked flow of 1532.8 cfs (100%) to determine water surface elevation and velocity at 50 feet intervals. The un-named wash was modeled such that station 1500 represents the approximate point of entrance at the southwesterly site boundary and station 250 represents the approximate point of exit at the northwesterly site boundary and the entrance to existing debris basin "3D".

The existing secondary access or easement road, which runs adjacent to the easterly bank of the wash in the existing condition, appears to enter the wash approximately two hundred feet northerly (Sta. 1300) of the southerly project boundary at which point it rises out of the wash southeasterly toward an existing off-site structure. At approximately 300 feet northerly (Sta. 1200) of the southerly project boundary, the roadway has risen above the wash such that it maintains over 1 feet of freeboard during the remainder of the bulked flow analysis. Velocity ranged from 7.7 to 10.5 fps within the project boundary.

WATERSHED "B":

The easterly portion of the project site consists of densely covered groves of citrus and avocado. This portion of the site accepts and conveys off-site flow from two sub-basin watersheds which are tributary to the existing, City maintained Debris Basin "3". The two sub-basin watersheds are natural hillsides covered in dense native vegetation.

The most easterly of these two sub-basin watersheds accepts flow from 22.2 acres, which generate 62.4 cfs during the 100 year event. Flow from an additional 6.5 acres of on-site and off-site tributary area is added to this watershed prior to exiting the site along its easterly boundary. The 28.7 acres generate 78.7 cfs during the 100 year event.

An additional 2.2 acres of on-site area generates 5.5 cfs which exits the site's easterly boundary prior to confluencing with the flow described in the previous paragraph. Additional confluencing takes place off-site with flow generated by watersheds which do not pass through the site. The primary drainage course of Watershed "B" enters the easterly inlet of Debris Basin "3" at 299.4 cfs from 127.0 acres.

The existing second sub-basin watershed conveys flow from 41.7 acres, which generate 112.0 cfs during the 100 year event, to the site's southerly boundary via an existing natural channel. Flow from an additional 13.3 acres of on-site tributary area is added to this sub-basin watershed run off prior to exiting the site through the northerly boundary. The 55.0 acres generate 142.8 cfs during the 100 year event and enter Debris Basin "3" via the southwesterly inlet.

The total watershed tributary to Debris Basin "3" is 186.3 acres which generate a confluenced flow of 438.2 cfs during the 100 year event.

WATERSHED "C":

The middle portion of the project site consists of a relatively equal distribution of dense groves of avocado together with natural hillside covered in dense native vegetation. The flows generated by this watershed are conveyed to an existing HOA maintained detention basin located within Tract 28153. The basin outlets via an existing 36" CMP riser to an existing City maintained 24" RCP which has been designed to carry 50.3 cfs during the 100 year event.

The flows generated by this watershed enter the existing basin via two distinct drainage courses. The primary drainage course conveys flow from a small sub-area beginning along the project's southerly boundary, a ½ acre of which is located off-site. The sub-area drains northerly via a series of grove maintenance roads, interceptor drains and down drains before entering the off-site basin. The sub-area consists of 22.2 acres which generate 57.3 cfs during the 100 year event.

Of the final 9.7 acres tributary to the primary drainage course, approximately 4.2 acres is located northerly of the project site. The 9.7 acres generates 25.4 cfs or 2.6 cfs/acre. Therefore, it may be deduced that this watershed's primary drainage course conveys 46.4 cfs ($57.3 - (2.6 \times 4.2)$) from 18.0 acres ($22.2 - 4.2$) before exiting the project site and entering the existing off-site basin.

The secondary drainage course within Watershed "C" conveys flow from a small sub-area which begins on-site. The flow traverses its way to the existing off-site basin via the easement road off of Shepard Crest. The sub-area consists of 9.5 acres which generate 26.6 cfs during the 100 year event. Approximately 1.1 acres of this sub-area is an existing single family residential lot which is contained within the project boundary, but is not a part of the development application.

The two drainage courses confluence in the existing basin for a total watershed area 31.7 acres which generate a peak flow of 81.7 cfs during the 100 year event.

WATERSHED “D”:

This watershed is relatively small at 2.4 acres and consists of dense groves of avocado and unimproved maintenance roads. Flow from approximately 1.9 acres of on-site area exits the site at Malaga Street. This flow is conveyed via a combination of an unimproved roadway and road side swale until it enters the existing curb and gutter at the terminus end of the improved portion of Malaga Street. Flow from an additional 0.5 acres of off-site area is added for a total of 7.4 cfs during the 100 year event. The 7.4 cfs will be transported northerly by Malaga Street with each side of the street conveying 3.7 cfs.

WATERSHED “E”:

This watershed is contained entirely off-site within the boundary of Tract 28353 and consists of 1.1 acres of a HOA maintained slope and detention basin. The basin outlets via an existing 36” CMP riser to an existing City maintained 18” RCP within Malaga Street. The pipe has been designed to carry 17.5 cfs during the 100 year event.

Proposed Conditions

Tentative Tract Map 34760 is an application to develop approximately 50.8 acres of the existing 65.4 acre site into a clustered development of thirty-four (34) estate type, single family, half acre minimum residential lots. The proposed development also includes HOA maintained slopes, water quality basins and open space.

The developed area of the project site is bound on the west by the easterly bank of the un-named wash tributary to Debris Basin “3D” as described in existing Watershed “A”. The east side of the developed area is bound by the drainage course of the most easterly of the two sub-basin watersheds described in existing Watershed “B”.

While the developed area extends from the northerly site boundary to the southerly site boundary, the proposed development has attempted to maintain the existing drainage pattern by creating a series of high points within the project which coincide with the existing ridgelines separating existing watersheds “A” and “C” from watershed “B”.

Regional and local development standards require that a site specific Water Quality Management Plan (WQMP) be prepared to identify the methods and means of treating potential run-off pollutants generated by the proposed development. The existing topography and accompanying drainage patterns tend to favor implementation of two separate water quality basins for treatment of on-site flows prior to release downstream. The water quality basins (“E-1” and “E-2”) have been sized per the WQMP.

“E-1” is located at the northwesterly limits of the development and outlets directly into Debris Basin “3D” at the terminus of the un-named wash. “E-2” is located at the northeasterly limits of the development and outlets directly into Debris Basin “3” at the debris basin’s southwesterly inlet.

Off-site flow tributary to the project’s southerly boundary is being captured and passed through the site via a proposed system of HOA maintained interceptor drains, down drains and storm drains. In an effort to reduce the size of the on-site water quality basins, off-site flows are being passed through the site to an existing natural channel and existing Debris Basin “3”.

Off-site flow from the most easterly of the three sub-basin watersheds described in the write-up for watershed “A” is being captured and conveyed through the site to its previous point of confluence in the un-named wash. Off-site flow from the most westerly of the two sub-basin watersheds described in the write-up for watershed “B” is being captured and conveyed directly into Debris Basin “3”.

WATERSHED “A”:

The southwesterly portion of the project continues to accept and convey off-site flow from the three sub-basin watersheds towards Debris Basin “3D”. Flow from on-site Water Quality Basin “E-1” will be added at the terminus of the un-named wash prior to entering Debris Basin “3D”.

While the most westerly of the three sub-basin watersheds remains unchanged, the most easterly now conveys flow from 12.8 acres which generate 36.4 cfs during the 100 year event. The most easterly sub-basin watershed, which consists of offsite flow from 11.5 acres, is captured and conveyed through the site via a proposed system of HOA maintained interceptor drains, down drains and storm drain to the previous point of confluence in the un-named wash. Rip-rap and/or an energy dissipater located at the storm drain outlet will be designed during the final engineering phase to generate non-erosive velocities.

The center or primary sub-basin watershed is essentially unchanged to its point of confluence with flow generated from the easterly watershed. The confluenced flow of 735.7 cfs generated by a tributary area of 292.0 acres represents a reduction of 2.7 acres of tributary area and 6.3 cfs at this point in the un-named wash. The reduction in flow at this point does not impact the travel time to basin “3D” where the confluence of flows from the most westerly sub-basin occurs.

On-site water quality basin “E-1” accepts flow from 28.7 acres which generate 56.7 cfs during the 100 year event. The flows will be attenuated in water quality basin “E-1” and released to debris basin “3D” in a controlled manner such that the peak flow confluence within the debris basin is consistent with the PBS&J design peak of 827.9 cfs (AMC-II).

As it stands, a direct confluence (no attenuation) of the flow tributary to water quality basin "E-1" results in a total tributary area of 354.2 acres which generate 859.1 cfs at debris basin "3D" during the 100 year event. A direct confluence represents a net increase of 39.7 cfs from this study's existing peak flow of 819.4 cfs generated from 328.1 acres, but only an increase of 31.2 cfs from the peak rational method flow of 827.9 cfs generated from 332.3 acres identified in the PBS&J study. The basin and outflow shall be designed such that the peak flow released from water quality basin "E-1" to debris basin "3D" is 25.5 cfs or less (56.7-31.2).

The on-site watershed now tributary to water quality basin "E-1" was previously tributary to the off-site detention basin (Watershed "C") which is maintained by the HOA for Tr. 28153. Consideration has been given to a design which would route the flows treated by the vegetated swales (2.9 acres-5.8 cfs) to the existing off-site detention basin.

In an effort to simplify the model for the preliminary study, the effective capture rate of the flow-by basins tributary to water quality basin "E-1" has been assumed to be 100%. Peak on-site flow tributary to water quality basin "E-1" will be further reduced by 5.6 cfs from the actual effective capture rates of the proposed flow-by catch basins.

Our basin routing model focused on two drainage scenarios. Scenario 1 assumed that 100% of the 100-year peak rational flow rate of 56.7 cfs was captured and conveyed into Basin "E-1". Scenario 2 implemented a reduced peak flow rate by a combination of subtracting bypass flows from the 8 on-site "on-grade" catch basins (5.6 cfs) and routed flows treated by the vegetated swales (2.9 Ac. – 5.8 cfs) to the existing off-site detention basin, resulting in a reduced 100-year peak flow rate of 45.3 cfs (56.7-5.6-5.8). The 100-year, 6-hour unit hydrograph prepared for Scenario 1 was modified by decreasing the tributary area in order to achieve the reduced 45.3 cfs peak flow rate used for Scenario 2.

Both drainage scenarios were routed through the Water Quality Basin "E-1" to evaluate the 100-year water surface within the basin as well as peak outflow into Basin "3D". Our calculations for Scenario 1 show that when modeled with a 36" CMP riser, the peak flow rate of 56.7 cfs can be conveyed through Basin "E-1" while maintaining 1.8' of freeboard. However, the peak discharge of 49.9 cfs exceeds the allowable discharge of 25.5 cfs.

Scenario 2 analyzed the effects of varying the outflow design within Basin "E-1". A 24" and 36" CMP riser were each modeled with the reduced peak flow rate of 45.3 cfs. Our calculations show that when modeled with a 36" CMP riser, Basin "E-1" will have a 100-year peak discharge of 42.7 cfs while maintaining over 2' of freeboard. When modeled with a 24" CMP riser, Basin "E-1" will have a peak discharge of 28.7 cfs while maintaining a 0.5' of freeboard. In both scenarios Basin "E-1" drains empty in less than 9 hours.

A portion of the proposed private on-site storm drain which conveys flow to water quality basin "E-1" shall consist of a single 24" RCP or approved equal capable of conveying 38.2 cfs at a maximum velocity of 35.0 fps. The on-site flows are not required to be bulked nor are they expected to carry erosive materials such as gravel and rock. However, velocities exceeding 20.0 fps shall be mitigated with an additional thickness of pipe or other means of protection in accordance with Riverside County Flood Control District design standards.

The flow captured and passed through the site via a proposed system of HOA maintained interceptor drains, down drains and storm drains has been bulked to 100%. The pass through 48" RCP or approved equal storm drain is capable of conveying bulked flow of 69.8 cfs at a maximum velocity of 21.7 fps to its previous point of confluence in the un-named wash. Rip-rap and/or energy dissipaters will be utilized at the storm drain outlet to reduce the flow velocities to non-erosive levels.

The 6.0 cfs reduction in flow through the un-named wash does not warrant an additional HEC-RAS analysis, but it should be noted that the secondary access or easement road shall be improved for all weather access and re-aligned such that it is located out of the un-named wash and elevated to maintain a minimum of 1 foot of freeboard. The proposed road alignment has been plotted on the appropriate HEC-RAS sections.

Without encroaching into the un-named wash, the easement road shall be protected from potential erosive velocities and scour of the un-named wash's easterly channel bank. The final design for channel bank protection shall be determined during the final engineering phase of the proposed project.

WATERSHED "B":

The easterly portion of the project continues to accept and convey off-site flow from two sub-basin watersheds towards Debris Basin "3". Flow from on-site Water Quality Basin "E-2" will be released directly into Debris Basin "3" at the debris basin's existing southwesterly inlet.

The most easterly of these two sub-basin watersheds now consists of 21.7 acres (20.2 off-site, 1.5 on-site) which generate 61.0 cfs (57.0 cfs off-site, 4.0 cfs on-site) at the site's southerly boundary. Flow from an additional 6.2 acres of on-site and off-site tributary area is added to this watershed prior to confluencing at the site's easterly boundary with off-site flows from the westerly sub-basin watershed.

Off-site flow (110.0 cfs from 40.9 acres) from the westerly sub-basin watershed, together with a small portion of on-site flow (4.8 cfs from 1.9 acres), is captured along the project's southerly boundary and conveyed through the site via a

proposed system of HOA maintained interceptor drains, down drains and storm drain to its confluence with the outflow from water quality Basin "E-2".

As it stands, a direct confluence (no attenuation) of the flow tributary to water quality basin "E-2" results in a total tributary area of 189.5 acres which generate 426.2 cfs at Debris Basin "3" during the 100 year event. A direct confluence represents a net decrease of 12.0 cfs from this study's existing peak flow of 438.2 cfs generated from a watershed of 186.3 acres and a net decrease of 54.8 cfs from the peak rational method flow of 481.0 cfs (AMC-II) generated from a watershed of 190.0 acres identified in the PBS&J study.

In an effort to simplify the model for the preliminary study, the effective capture rate of the flow-by basins tributary to water quality basin "E-2" has been assumed to be 100%. Peak on-site flow tributary to water quality basin "E-2" will be further increased by a portion of those flows previously assumed to be captured by catch basins tributary to Watershed "A" (5.6 cfs) which are now captured by basins tributary to Watershed "B" .

A portion of the proposed private on-site storm drain which conveys flow to water quality basin "E-2" shall consist of a 24" RCP or approved equal capable of conveying 21.5 cfs at a maximum velocity of 24.9 fps. The on-site flows are not required to be bulked nor are they expected to carry erosive materials such as gravel and rock. However, velocities exceeding 20.0 fps shall be mitigated with an additional thickness of pipe or other means of protection in accordance with County Flood control design standards.

The flow captured along the southeasterly project boundary and passed through the site via a proposed system of HOA maintained interceptor drains, down drains and storm drains has been bulked to 100%. A 60" RCP or approved equal has been designed to convey bulked flows of 229.6 cfs at a maximum velocity of 24.8 fps to the northeasterly corner of the site where it discharges into a proposed 4'x6' reinforced concrete open channel. The proposed channel will further convey the bulked flow of 229.6 cfs at a maximum velocity of 38.8 fps to the southwesterly inlet to Debris Basin "3". Proposed energy dissipaters at both the outlet of the 60" RCP and at the terminus of the 4'x6' reinforced concrete channel will be designed during the Final Engineering phase to reduce the outlet velocity to non-erosive levels.

The 36.3 cfs tributary to water quality basin "E-2" confluenced with the 114.8 cfs conveyed via 60" HOA maintained storm drain represents a negligible increase of 0.7 cfs in the flow previously tributary to the southwesterly inlet of Debris Basin "3". This study identified 142.8 cfs from 55.0 acres tributary to the southwesterly inlet of Debris Basin "3" under existing conditions. The project proposes to route 143.5 cfs from 61.6 acres to the southwesterly inlet of Debris Basin "3".

An alternate design for the proposed 60" RCP would route the bulked flow into an existing natural channel along the easterly project boundary in lieu conveying the flow to the southwesterly inlet to Debris Basin "3".

The existing natural channel traversing the easterly project boundary currently conveys flow of 84.1 cfs upon exiting the project site at the easterly project boundary. When bulked to 168.2 cfs, velocities within the channel reach 12.5 fps (assumes that bulked flow properties remain consistent with those of un-bulked flows). The proposal to route additional flow from 42.8 acres to the existing natural channel results in a confluenced flow of 199.1 cfs. When bulked to 398.2 cfs, velocities within the channel increase to 16.5 fps.

An additional confluence of off-site flow occurs in the existing natural channel approximately 200 feet downstream. The existing peak flow at this point of confluence is currently 107.4 cfs and increases to 224.3 cfs with the additional tributary area.

A final confluence with the primary watershed tributary to the southeasterly inlet of Debris Basin "3" occurs approximately 630 feet downstream. The peak flow in the existing natural channel at this point is currently 116.4 cfs. When bulked to 232.8 cfs, velocities within the channel reach 9.5 fps. Routing flow from an additional 42.8 acres to this watershed increases the peak flow to 230.5 cfs. Bulked to 461.0 cfs, velocities in the channel reach 12.5 fps.

Un-bulked velocities are anticipated to range from 7.5 to 9.8 fps in the existing condition and 9.5 to 13.0 fps in the proposed condition. Bulked velocities are anticipated to range from 9.5 to 12.5 fps in the existing condition and 12.5 to 16.5 fps in the proposed condition. The range of velocities in the existing natural channel are anticipated to be erosive in both the existing and proposed conditions during the un-bulked and bulked 100 year event.

The existing natural channel that traverses the easterly edge of both Lot 20 and the proposed tennis courts will be required to be gunite/concrete lined with adequate slope protection. The design of the slope protection for Lot 20 and the tennis courts will be addressed during the final engineering phase of the project.

WATERSHED "C":

The watershed tributary to the existing HOA maintained detention basin located within Tract 28153 has been significantly reduced by the need to route a portion of on-site flows through water quality basin "E-1". The watershed has been reduced from 31.7 acres to 4.4 acres (3.9 off-site, 0.3 on-site) which generate 10.5 cfs during the 100 year event.

Should the final design dictate that it be necessary to route that portion of Watershed "A" flows treated by the vegetated swales to the existing off-site detention basin, the direct confluence of an additional 6.5 cfs will remain far below the 81.7 cfs tributary to the basin in the existing condition.

WATERSHED "D":

This watershed remains small at 0.7 acres which generate 2.7 cfs during the 100 year event. This flow will be increased by that amount escaping capture by the series of flow-by basins tributary to Malaga Road. This study anticipates a flow-by of 2.9 cfs. A direct confluence of the flows generated by the proposed watershed and the flow-by totals 5.6 cfs which remains below the existing peak flow of 7.4 cfs tributary to the terminus end of the improved portion of Malaga Road. The 5.6 cfs will be transported northerly by Malaga Street with each side of the street conveying approximately 3.0 cfs.

WATERSHED "E":

This watershed remains unchanged in the proposed conditions.

CONCLUSION

The preliminary drainage study was prepared to ensure that the proposed development was capable of meeting the City of Corona's design criteria. Our calculations show that of the five existing watershed, Watershed "A" experienced the only increased tributary flow rate during the 100- year event. This increased flow is due primarily to the re-routing of 26.7 acres of on-site area previously tributary to existing Watershed "C" to water Quality Basin "E-1" located within and tributary to Watershed "A".

The dynamic nature of the tentative stage prohibits a comprehensive design of Basin "E-1" as the layout of the map is ever-changing through this process. Our calculations for Scenario 1 and 2 exhibit the flexibility we have in designing the basin given the use of a multitude of outflow drainage devices. Our calculations also show that Basin "E-1" will drain within the required 48 hour limit. The final engineering design of Basin "E-1" is capable of meeting the City of Corona's design criteria.

The existing Debris Basin "3" (Watershed "B") experienced a decrease in tributary flow for the 100-year event. This decreased flow rate will allow the on-site flow tributary to Basin "E-2" to discharge into Debris Basin "3" without mitigation beyond that specified by the Water Quality Management Plan.

The tributary flow for Watershed "C" was significantly reduced due to the need to treat on-site flows prior to discharging downstream. On-site flows treated by the vegetated swale (5.8 cfs) will be discharged to the existing off-site detention basin within Watershed "C" and combined with the tributary flow rate of 10.5 cfs. The resultant 16.3 cfs (10.5+5.8) is well below the design flow rate of 50.3 cfs tributary to the existing 36" riser and 24" RCP storm drain.

The remaining watersheds, "D" and "E", did not experience increased tributary flow rates during the 100-year event.

A 100-year hydraulic analysis was performed on each of the four major on-site storm drain systems (A, B, C, and D). Storm drain lines "A" and "B" convey on-site "clear" water into water quality basins "E-1" and E-2" while lines "C" and "D" convey off-site "bulked" flows. Our calculations show that storm drain lines "A" and "B" do not exceed the 40 fps for "clear" water outlined within our "Design Criteria". Storm drain lines "C" and "D" also do not exceed their 25 fps threshold. Bulk flows within the 4'x6' reinforced concrete open channel, however, will exceed 25 fps. We believe that debris flows conveyed by the reinforced open channel can exceed the 25 fps threshold due to the fact that the channel can easily be inspected and repaired in the event of scouring. All four storm drain systems will be required to maintain a minimum of 1 ½ " cover from invert to top of rebar where the velocities exceed 20 fps.

In addition to the velocity restrictions for lines "C" and "D", each storm drain line must be adequately sized to ensure the upstream 100-year water surface at the

pipe inlet does not exceed the elevation of the drainage course at the site boundary. The 100-year water surface elevation shall be contained on-site. Our calculations show a 100-year water surface of 1359.4 at the entrance to storm drain line "C" resulting in over 5 feet of freeboard. A 100-year water surface of 1386.9 at the entrance to storm drain line "D" will result in total freeboard of 3 feet.

The secondary access road located along the westerly side of the project has been designed to maintain 1' of freeboard within the un-named channel during the 100-year event. Our calculations show that this road has sufficient elevation along the un-named channel to meet the freeboard requirements during the bulked 100-year event. Slope protection for the road will be required and addressed during the Final Engineering Phase. The proposed on-site storm drain system has been designed such that it can convey off-site and on-site flows in a safe and non-destructive manner while protecting the primary access from the 100-year event.

City of Corona Design Criteria specifies that the 10-year event be contained from curb-to-curb while the 100-year event is contained within the right-of-way. Our street capacity calculations show that all four proposed on-site streets ("A", "B", "C" and "D" Circles) can convey the 100-year event from curb-to-curb, therefore the smaller 10-year event, by inspection, can be conveyed from curb to curb making it unnecessary to provide 10-year rational calculations.

The proposal to develop Tentative Tract Map 34760 can be achieved as shown while adhering to the City of Corona's Design Criteria for drainage including those requirements for a site specific WQMP.

Appendix “A”

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.859
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 18.499(CFS)
Total initial stream area = 6.300(Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 120.000 to Point/Station
130.000
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 2632.000(Ft.)
End of natural channel elevation = 2268.000(Ft.)
Length of natural channel = 914.000(Ft.)
Estimated mean flow rate at midpoint of channel = 51.093(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 12.76(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.3982
Corrected/adjusted channel slope = 0.3982
Travel time = 1.19 min. TC = 11.24 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.856
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.240(In/Hr) for a 100.0 year storm
Subarea runoff = 61.608(CFS) for 22.200(Ac.)
Total runoff = 80.107(CFS) Total area = 28.500(Ac.)

++++
Process from Point/Station 130.000 to Point/Station
140.000
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 2268.000(Ft.)
End of natural channel elevation = 1852.000(Ft.)
Length of natural channel = 1374.000(Ft.)

Estimated mean flow rate at midpoint of channel = 137.166(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33})(slope^{.492})
Velocity using mean channel flow = 15.44(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.3028
Corrected/adjusted channel slope = 0.3028
Travel time = 1.48 min. TC = 12.72 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.053(In/Hr) for a 100.0 year storm
Subarea runoff = 105.849(CFS) for 40.600(Ac.)
Total runoff = 185.956(CFS) Total area = 69.100(Ac.)

++++
140.000 Process from Point/Station 130.000 to Point/Station
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 69.100(Ac.)
Runoff from this stream = 185.956(CFS)
Time of concentration = 12.72 min.
Rainfall intensity = 3.053(In/Hr)

++++
141.000 Process from Point/Station 142.000 to Point/Station
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 2533.000(Ft.)
Bottom (of initial area) elevation = 2260.000(Ft.)
Difference in elevation = 273.000(Ft.)
Slope = 0.27300 s(percent) = 27.30
TC = k(0.530)*[(length³)/(elevation change)]^{0.2}
Initial area time of concentration = 10.890 min.
Rainfall intensity = 3.289(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.857
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 24.526(CFS)
Total initial stream area = 8.700(Ac.)
Pervious area fraction = 1.000

++++
140.000 Process from Point/Station 141.000 to Point/Station
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 2260.000(Ft.)
End of natural channel elevation = 1852.000(Ft.)
Length of natural channel = 1434.000(Ft.)
Estimated mean flow rate at midpoint of channel = 48.630(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33}) (slope^{.492})
Velocity using mean channel flow = 10.64(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.2845
Corrected/adjusted channel slope = 0.2845
Travel time = 2.25 min. TC = 13.14 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.853
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.006(In/Hr) for a 100.0 year storm
Subarea runoff = 43.859(CFS) for 17.100(Ac.)
Total runoff = 68.386(CFS) Total area = 25.800(Ac.)

++++
140.000 Process from Point/Station 144.000 to Point/Station
***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 25.800(Ac.)
Runoff from this stream = 68.386(CFS)
Time of concentration = 13.14 min.
Rainfall intensity = 3.006(In/Hr)
Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|---------|-------|-------|
| 1 | 185.956 | 12.72 | 3.053 |
| 2 | 68.386 | 13.14 | 3.006 |

Largest stream flow has longer or shorter time of concentration

Qp = 185.956 + sum of
 Qa Tb/Ta
 68.386 * 0.968 = 66.209
 Qp = 252.165

Total of 2 streams to confluence:
 Flow rates before confluence point:
 185.956 68.386
 Area of streams before confluence:
 69.100 25.800

Results of confluence:
 Total flow rate = 252.165(CFS)
 Time of concentration = 12.719 min.
 Effective stream area after confluence = 94.900(Ac.)

++++
 +++++
 Process from Point/Station 140.000 to Point/Station
 150.000
 **** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1852.000(Ft.)
 End of natural channel elevation = 1720.000(Ft.)
 Length of natural channel = 855.000(Ft.)
 Estimated mean flow rate at midpoint of channel = 289.896(CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^{.33})(slope^{.492})
 Velocity using mean channel flow = 14.19(Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.1544
 Corrected/adjusted channel slope = 0.1544
 Travel time = 1.00 min. TC = 13.72 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.852
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.944(In/Hr) for a 100.0 year storm
 Subarea runoff = 71.255(CFS) for 28.400(Ac.)
 Total runoff = 323.420(CFS) Total area = 123.300(Ac.)

++++
150.000 Process from Point/Station 140.000 to Point/Station
***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 123.300 (Ac.)
Runoff from this stream = 323.420 (CFS)
Time of concentration = 13.72 min.
Rainfall intensity = 2.944 (In/Hr)

++++
152.000 Process from Point/Station 153.000 to Point/Station
***** INITIAL AREA EVALUATION *****

Initial area flow distance = 858.000 (Ft.)
Top (of initial area) elevation = 2420.000 (Ft.)
Bottom (of initial area) elevation = 1994.000 (Ft.)
Difference in elevation = 426.000 (Ft.)
Slope = 0.49650 s(percent) = 49.65
TC = $k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$
Initial area time of concentration = 9.088 min.
Rainfall intensity = 3.588 (In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.860
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil (AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 30.253 (CFS)
Total initial stream area = 9.800 (Ac.)
Pervious area fraction = 1.000

++++
151.000 Process from Point/Station 152.000 to Point/Station
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1994.000 (Ft.)
End of natural channel elevation = 1860.000 (Ft.)
Length of natural channel = 956.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 52.326 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(slope^{.492})$
Velocity using mean channel flow = 7.69 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)

Normal channel slope = 0.1402
Corrected/adjusted channel slope = 0.1402
Travel time = 2.07 min. TC = 11.16 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.857
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.251(In/Hr) for a 100.0 year storm
Subarea runoff = 39.821(CFS) for 14.300(Ac.)
Total runoff = 70.074(CFS) Total area = 24.100(Ac.)

++++
150.000 Process from Point/Station 151.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1860.000(Ft.)
End of natural channel elevation = 1720.000(Ft.)
Length of natural channel = 916.000(Ft.)
Estimated mean flow rate at midpoint of channel = 106.420(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 10.15(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1528
Corrected/adjusted channel slope = 0.1528
Travel time = 1.50 min. TC = 12.66 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.059(In/Hr) for a 100.0 year storm
Subarea runoff = 65.320(CFS) for 25.000(Ac.)
Total runoff = 135.394(CFS) Total area = 49.100(Ac.)

++++
150.000 Process from Point/Station 151.000 to Point/Station

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 49.100 (Ac.)
Runoff from this stream = 135.394 (CFS)
Time of concentration = 12.66 min.
Rainfall intensity = 3.059 (In/Hr)
Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 323.420 | 13.72 | 2.944 |
| 2 | 135.394 | 12.66 | 3.059 |

Largest stream flow has longer time of concentration

$Q_p = 323.420 + \text{sum of } \frac{Q_b \cdot I_a}{I_b}$
 $Q_p = 135.394 * 0.962 = 130.276$
 $Q_p = 453.695$

Total of 2 streams to confluence:
Flow rates before confluence point:
323.420 135.394

Area of streams before confluence:
123.300 49.100

Results of confluence:
Total flow rate = 453.695 (CFS)
Time of concentration = 13.723 min.
Effective stream area after confluence = 172.400 (Ac.)

++++
++++
Process from Point/Station 150.000 to Point/Station
160.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1720.000 (Ft.)
End of natural channel elevation = 1369.000 (Ft.)
Length of natural channel = 2156.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 530.013 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 17.78 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1628
Corrected/adjusted channel slope = 0.1628
Travel time = 2.02 min. TC = 15.74 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.756(In/Hr) for a 100.0 year storm
Subarea runoff = 135.743(CFS) for 58.000(Ac.)
Total runoff = 589.438(CFS) Total area = 230.400(Ac.)

++++
170.000 Process from Point/Station 160.000 to Point/Station
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1369.000(Ft.)
End of natural channel elevation = 1320.000(Ft.)
Length of natural channel = 602.000(Ft.)
Estimated mean flow rate at midpoint of channel = 612.719(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33}) (slope^{.492})
Velocity using mean channel flow = 13.26(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0814
Corrected/adjusted channel slope = 0.0814
Travel time = 0.76 min. TC = 16.50 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.695(In/Hr) for a 100.0 year storm
Subarea runoff = 41.593(CFS) for 18.200(Ac.)
Total runoff = 631.031(CFS) Total area = 248.600(Ac.)

++++
170.000 Process from Point/Station 160.000 to Point/Station
***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 248.600(Ac.)
Runoff from this stream = 631.031(CFS)
Time of concentration = 16.50 min.
Rainfall intensity = 2.695(In/Hr)

++++
Process from Point/Station 173.000 to Point/Station
172.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000 (Ft.)
Top (of initial area) elevation = 2312.000 (Ft.)
Bottom (of initial area) elevation = 1920.000 (Ft.)
Difference in elevation = 392.000 (Ft.)
Slope = 0.39200 s(percent) = 39.20
TC = $k(0.530)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 10.130 min.
Rainfall intensity = 3.406 (In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 16.664 (CFS)
Total initial stream area = 5.700 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 172.000 to Point/Station
171.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1920.000 (Ft.)
End of natural channel elevation = 1596.000 (Ft.)
Length of natural channel = 1012.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 33.913 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(slope^{.492})$
Velocity using mean channel flow = 10.01 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.3202
Corrected/adjusted channel slope = 0.3202
Travel time = 1.68 min. TC = 11.82 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.855
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00

Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.163(In/Hr) for a 100.0 year storm
Subarea runoff = 31.928(CFS) for 11.800(Ac.)
Total runoff = 48.592(CFS) Total area = 17.500(Ac.)

++++
++++

Process from Point/Station 171.000 to Point/Station
170.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1596.000(Ft.)
End of natural channel elevation = 1320.000(Ft.)
Length of natural channel = 1066.000(Ft.)
Estimated mean flow rate at midpoint of channel = 64.697(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 11.16(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.2589
Corrected/adjusted channel slope = 0.2589
Travel time = 1.59 min. TC = 13.41 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.853
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.977(In/Hr) for a 100.0 year storm
Subarea runoff = 29.448(CFS) for 11.600(Ac.)
Total runoff = 78.041(CFS) Total area = 29.100(Ac.)

++++
++++

Process from Point/Station 171.000 to Point/Station
170.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 29.100(Ac.)
Runoff from this stream = 78.041(CFS)
Time of concentration = 13.41 min.
Rainfall intensity = 2.977(In/Hr)
Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

1 631.031 16.50 2.695
 2 78.041 13.41 2.977
 Largest stream flow has longer time of concentration
 Qp = 631.031 + sum of
 Qb Ia/Ib
 78.041 * 0.905 = 70.639
 Qp = 701.671

Total of 2 streams to confluence:
 Flow rates before confluence point:
 631.031 78.041
 Area of streams before confluence:
 248.600 29.100
 Results of confluence:
 Total flow rate = 701.671(CFS)
 Time of concentration = 16.500 min.
 Effective stream area after confluence = 277.700(Ac.)

+++++
 ++++
 Process from Point/Station 170.000 to Point/Station
 180.000
 **** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1320.000(Ft.)
 End of natural channel elevation = 1300.000(Ft.)
 Length of natural channel = 298.000(Ft.)
 Estimated mean flow rate at midpoint of channel = 703.818(CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^{.33}) (slope^{.492})
 Velocity using mean channel flow = 12.63(Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0671
 Corrected/adjusted channel slope = 0.0671
 Travel time = 0.39 min. TC = 16.89 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.848
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.664(In/Hr) for a 100.0 year storm
 Subarea runoff = 3.839(CFS) for 1.700(Ac.)
 Total runoff = 705.510(CFS) Total area = 279.400(Ac.)

+++++
 ++++
 Process from Point/Station 170.000 to Point/Station

180.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 279.400(Ac.)
 Runoff from this stream = 705.510(CFS)
 Time of concentration = 16.89 min.
 Rainfall intensity = 2.664(In/Hr)

+++++

++++

Process from Point/Station 182.000 to Point/Station

181.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000(Ft.)
 Top (of initial area) elevation = 1654.000(Ft.)
 Bottom (of initial area) elevation = 1352.000(Ft.)
 Difference in elevation = 302.000(Ft.)
 Slope = 0.30200 s(percent)= 30.20
 $TC = k(0.530)*[(length^3)/(elevation\ change)]^{0.2}$
 Initial area time of concentration = 10.673 min.
 Rainfall intensity = 3.321(In/Hr) for a 100.0 year storm
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.857
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Initial subarea runoff = 20.789(CFS)
 Total initial stream area = 7.300(Ac.)
 Pervious area fraction = 1.000

+++++

++++

Process from Point/Station 181.000 to Point/Station

180.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1352.000(Ft.)
 End of natural channel elevation = 1300.000(Ft.)
 Length of natural channel = 678.000(Ft.)
 Estimated mean flow rate at midpoint of channel = 32.323(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33}) (slope^{.492})
Velocity using mean channel flow = 4.88(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0767
Corrected/adjusted channel slope = 0.0767
Travel time = 2.32 min. TC = 12.99 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.853
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 3.022(In/Hr) for a 100.0 year storm
 Subarea runoff = 20.894(CFS) for 8.100(Ac.)
 Total runoff = 41.684(CFS) Total area = 15.400(Ac.)

++++
 +-----+
 180.000 Process from Point/Station 181.000 to Point/Station
 ***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 15.400(Ac.)
 Runoff from this stream = 41.684(CFS)
 Time of concentration = 12.99 min.
 Rainfall intensity = 3.022(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 705.510 | 16.89 | 2.664 |
| 2 | 41.684 | 12.99 | 3.022 |

Largest stream flow has longer time of concentration
 $Q_p = 705.510 + \text{sum of } Q_b \cdot I_a/I_b$
 $41.684 * 0.881 = 36.744$
 $Q_p = 742.253$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 705.510 41.684
 Area of streams before confluence:
 279.400 15.400
 Results of confluence:
 Total flow rate = 742.253(CFS)
 Time of concentration = 16.894 min.
 Effective stream area after confluence = 294.800(Ac.)

++++
 +-----+
 190.000 Process from Point/Station 180.000 to Point/Station
 ***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1300.000(Ft.)

End of natural channel elevation = 1187.000(Ft.)
Length of natural channel = 1381.000(Ft.)
Estimated mean flow rate at midpoint of channel = 756.353(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 14.25(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0818
Corrected/adjusted channel slope = 0.0818
Travel time = 1.61 min. TC = 18.51 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.550(In/Hr) for a 100.0 year storm
Subarea runoff = 24.144(CFS) for 11.200(Ac.)
Total runoff = 766.397(CFS) Total area = 306.000(Ac.)

++++
Process from Point/Station 180.000 to Point/Station
190.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 306.000(Ac.)
Runoff from this stream = 766.397(CFS)
Time of concentration = 18.51 min.
Rainfall intensity = 2.550(In/Hr)

++++
Process from Point/Station 193.000 to Point/Station
192.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 716.000(Ft.)
Top (of initial area) elevation = 1662.000(Ft.)
Bottom (of initial area) elevation = 1392.000(Ft.)
Difference in elevation = 270.000(Ft.)
Slope = 0.37709 s(percent)= 37.71
 $TC = k(0.530)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$
Initial area time of concentration = 8.932 min.
Rainfall intensity = 3.618(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.861

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 17.438(CFS)
Total initial stream area = 5.600(Ac.)
Pervious area fraction = 1.000

++++
191.000 Process from Point/Station 192.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1392.000(Ft.)
End of natural channel elevation = 1316.000(Ft.)
Length of natural channel = 527.000(Ft.)
Estimated mean flow rate at midpoint of channel = 26.625(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33}) (slope^{.492})
Velocity using mean channel flow = 6.24(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1442
Corrected/adjusted channel slope = 0.1442
Travel time = 1.41 min. TC = 10.34 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.372(In/Hr) for a 100.0 year storm
Subarea runoff = 17.073(CFS) for 5.900(Ac.)
Total runoff = 34.511(CFS) Total area = 11.500(Ac.)

++++
190.000 Process from Point/Station 191.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1316.000(Ft.)
End of natural channel elevation = 1187.000(Ft.)
Length of natural channel = 1313.000(Ft.)
Estimated mean flow rate at midpoint of channel = 50.416(CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^{.33}) (slope^{.492})
 Velocity using mean channel flow = 6.38 (Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0982
 Corrected/adjusted channel slope = 0.0982
 Travel time = 3.43 min. TC = 13.77 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.852
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil (AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.939 (In/Hr) for a 100.0 year storm
 Subarea runoff = 26.550 (CFS) for 10.600 (Ac.)
 Total runoff = 61.061 (CFS) Total area = 22.100 (Ac.)

++++
 ++++++
 Process from Point/Station 191.000 to Point/Station
 190.000
 ***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 22.100 (Ac.)
 Runoff from this stream = 61.061 (CFS)
 Time of concentration = 13.77 min.
 Rainfall intensity = 2.939 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 766.397 | 18.51 | 2.550 |
| 2 | 61.061 | 13.77 | 2.939 |

Largest stream flow has longer time of concentration
 Qp = 766.397 + sum of
 Qb Ia/Ib
 61.061 * 0.868 = 52.978
 Qp = 819.375

Total of 2 streams to confluence:
 Flow rates before confluence point:
 766.397 61.061
 Area of streams before confluence:
 306.000 22.100
 Results of confluence:
 Total flow rate = 819.375 (CFS)
 Time of concentration = 18.509 min.
 Effective stream area after confluence = 328.100 (Ac.)

End of computations, total study area = 328.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 1.000
Area averaged RI index number = 89.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2001 Version

6.4

Rational Hydrology Study

Date: 04/09/09

File:105588existb.out

100 - YEAR HYDROLOGY STUDY
105.588 "TRACT 34760"
AREA "B" (EXISTING CONDITIONS)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

***** Hydrology Study Control Information *****

English (in-lb) Units used in input data file

Armstrong & Brooks Consulting Engineers - S/N 785

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [Corona] area used.

10 year storm 10 minute intensity = 2.220(In/Hr)

10 year storm 60 minute intensity = 0.940(In/Hr)

100 year storm 10 minute intensity = 3.430(In/Hr)

100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.450(In/Hr)

Slope of intensity duration curve = 0.4800

++++
++++
Process from Point/Station 210.000 to Point/Station
220.000
***** INITIAL AREA EVALUATION *****

Initial area flow distance = 850.000(Ft.)
Top (of initial area) elevation = 2403.000(Ft.)
Bottom (of initial area) elevation = 2180.000(Ft.)
Difference in elevation = 223.000(Ft.)
Slope = 0.26235 s(percent)= 26.24
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.286 min.
Rainfall intensity = 3.381(In/Hr) for a 100.0 year storm

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 26.690 (CFS)
Total initial stream area = 9.200 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 220.000 to Point/Station
230.000
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 2180.000 (Ft.)
End of natural channel elevation = 1782.000 (Ft.)
Length of natural channel = 1270.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 54.106 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 11.56 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.3134
Corrected/adjusted channel slope = 0.3134
Travel time = 1.83 min. TC = 12.12 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.855
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.125 (In/Hr) for a 100.0 year storm
Subarea runoff = 50.491 (CFS) for 18.900 (Ac.)
Total runoff = 77.182 (CFS) Total area = 28.100 (Ac.)

++++
Process from Point/Station 230.000 to Point/Station
240.000
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1782.000 (Ft.)
End of natural channel elevation = 1582.000 (Ft.)
Length of natural channel = 1009.000 (Ft.)

Estimated mean flow rate at midpoint of channel = 100.803(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33}) (slope^{.492})
Velocity using mean channel flow = 11.33(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1982
Corrected/adjusted channel slope = 0.1982
Travel time = 1.48 min. TC = 13.60 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.956(In/Hr) for a 100.0 year storm
Subarea runoff = 43.346(CFS) for 17.200(Ac.)
Total runoff = 120.528(CFS) Total area = 45.300(Ac.)

++++
++++
Process from Point/Station 240.000 to Point/Station
250.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1582.000(Ft.)
End of natural channel elevation = 1453.000(Ft.)
Length of natural channel = 1530.000(Ft.)
Estimated mean flow rate at midpoint of channel = 143.676(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33}) (slope^{.492})
Velocity using mean channel flow = 8.36(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0843
Corrected/adjusted channel slope = 0.0843
Travel time = 3.05 min. TC = 16.65 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000

Rainfall intensity = 2.683(In/Hr) for a 100.0 year storm
Subarea runoff = 39.580(CFS) for 17.400(Ac.)
Total runoff = 160.107(CFS) Total area = 62.700(Ac.)

++++
Process from Point/Station 250.000 to Point/Station
260.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1453.000(Ft.)
End of natural channel elevation = 1272.000(Ft.)
Length of natural channel = 1750.000(Ft.)
Estimated mean flow rate at midpoint of channel = 181.557(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})$ (slope^{.492})
Velocity using mean channel flow = 9.99(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1034
Corrected/adjusted channel slope = 0.1034
Travel time = 2.92 min. TC = 19.57 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.844
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.482(In/Hr) for a 100.0 year storm
Subarea runoff = 35.199(CFS) for 16.800(Ac.)
Total runoff = 195.306(CFS) Total area = 79.500(Ac.)

++++
Process from Point/Station 250.000 to Point/Station
260.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 79.500(Ac.)
Runoff from this stream = 195.306(CFS)
Time of concentration = 19.57 min.
Rainfall intensity = 2.482(In/Hr)
Program is now starting with Main Stream No. 2

++++

Process from Point/Station 266.000 to Point/Station
265.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 905.000(Ft.)
Top (of initial area) elevation = 2120.000(Ft.)
Bottom (of initial area) elevation = 1656.000(Ft.)
Difference in elevation = 464.000(Ft.)
Slope = 0.51271 s(percent)= 51.27
TC = $k(0.530)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 9.225 min.
Rainfall intensity = 3.562(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.860
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 22.981(CFS)
Total initial stream area = 7.500(Ac.)
Pervious area fraction = 1.000

++++
++++

Process from Point/Station 265.000 to Point/Station
264.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1656.000(Ft.)
End of natural channel elevation = 1421.000(Ft.)
Length of natural channel = 1370.000(Ft.)
Estimated mean flow rate at midpoint of channel = 45.502(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(slope^{.492})$
Velocity using mean channel flow = 8.11(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1715
Corrected/adjusted channel slope = 0.1715
Travel time = 2.81 min. TC = 12.04 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.855
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.135(In/Hr) for a 100.0 year storm
Subarea runoff = 39.401(CFS) for 14.700(Ac.)

Total runoff = 62.381(CFS) Total area = 22.200(Ac.)

++++
263.000

Process from Point/Station 264.000 to Point/Station

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1421.000(Ft.)
End of natural channel elevation = 1369.000(Ft.)
Length of natural channel = 644.000(Ft.)
Estimated mean flow rate at midpoint of channel = 65.332(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})$ (slope^{.492})
Velocity using mean channel flow = 6.31(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0807
Corrected/adjusted channel slope = 0.0807
Travel time = 1.70 min. TC = 13.74 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.942(In/Hr) for a 100.0 year storm
Subarea runoff = 5.266(CFS) for 2.100(Ac.)
Total runoff = 67.647(CFS) Total area = 24.300(Ac.)

++++
262.000

Process from Point/Station 263.000 to Point/Station

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1369.000(Ft.)
Downstream point/station elevation = 1365.000(Ft.)
Pipe length = 50.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 67.647(CFS)
Nearest computed pipe diameter = 27.00(In.)
Calculated individual pipe flow = 67.647(CFS)
Normal flow depth in pipe = 17.81(In.)
Flow top width inside pipe = 25.59(In.)
Critical depth could not be calculated.
Pipe flow velocity = 24.32(Ft/s)
Travel time through pipe = 0.03 min.
Time of concentration (TC) = 13.77 min.

++++
Process from Point/Station 2621.000 to Point/Station
262.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 13.77 min.
Rainfall intensity = 2.939(In/Hr) for a 100.0 year storm
Subarea runoff = 11.019(CFS) for 4.400(Ac.)
Total runoff = 78.666(CFS) Total area = 28.700(Ac.)

++++
Process from Point/Station 262.000 to Point/Station
261.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1365.000(Ft.)
End of natural channel elevation = 1320.000(Ft.)
Length of natural channel = 200.000(Ft.)
Estimated mean flow rate at midpoint of channel = 81.681(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})$ (slope^{.492})
Velocity using mean channel flow = 11.25(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.2250
Corrected/adjusted channel slope = 0.2250
Travel time = 0.30 min. TC = 14.07 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.909(In/Hr) for a 100.0 year storm
Subarea runoff = 5.450(CFS) for 2.200(Ac.)
Total runoff = 84.116(CFS) Total area = 30.900(Ac.)

++++

++++
Process from Point/Station 262.000 to Point/Station
261.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area = 30.900(Ac.)
Runoff from this stream = 84.116(CFS)
Time of concentration = 14.07 min.
Rainfall intensity = 2.909(In/Hr)

++++
Process from Point/Station 2612.000 to Point/Station
2611.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 1615.000(Ft.)
Bottom (of initial area) elevation = 1536.000(Ft.)
Difference in elevation = 79.000(Ft.)
Slope = 0.07900 s(percent)= 7.90
TC = $k(0.530)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$
Initial area time of concentration = 13.956 min.
Rainfall intensity = 2.920(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 11.443(CFS)
Total initial stream area = 4.600(Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 2611.000 to Point/Station
261.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1536.000(Ft.)
End of natural channel elevation = 1320.000(Ft.)
Length of natural channel = 1393.000(Ft.)
Estimated mean flow rate at midpoint of channel = 21.643(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 6.04(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1551

Corrected/adjusted channel slope = 0.1551
Travel time = 3.84 min. TC = 17.80 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.846
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.598(In/Hr) for a 100.0 year storm
Subarea runoff = 18.032(CFS) for 8.200(Ac.)
Total runoff = 29.476(CFS) Total area = 12.800(Ac.)

++++
Process from Point/Station 2611.000 to Point/Station
261.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 2
Stream flow area = 12.800(Ac.)
Runoff from this stream = 29.476(CFS)
Time of concentration = 17.80 min.
Rainfall intensity = 2.598(In/Hr)
Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|--------|-------|-------|
| 1 | 84.116 | 14.07 | 2.909 |
| 2 | 29.476 | 17.80 | 2.598 |

Largest stream flow has longer or shorter time of concentration
Qp = 84.116 + sum of
Qa Tb/Ta
29.476 * 0.791 = 23.302
Qp = 107.418

Total of 2 streams to confluence:
Flow rates before confluence point:
84.116 29.476
Area of streams before confluence:
30.900 12.800
Results of confluence:
Total flow rate = 107.418(CFS)
Time of concentration = 14.070 min.
Effective stream area after confluence = 43.700(Ac.)

++++
Process from Point/Station 261.000 to Point/Station
260.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1320.000 (Ft.)
End of natural channel elevation = 1272.000 (Ft.)
Length of natural channel = 631.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 112.088 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 7.32 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0761
Corrected/adjusted channel slope = 0.0761
Travel time = 1.44 min. TC = 15.51 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.850
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil (AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.776 (In/Hr) for a 100.0 year storm
Subarea runoff = 8.962 (CFS) for 3.800 (Ac.)
Total runoff = 116.380 (CFS) Total area = 47.500 (Ac.)

++++
++++
Process from Point/Station 261.000 to Point/Station
260.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
Stream flow area = 47.500 (Ac.)
Runoff from this stream = 116.380 (CFS)
Time of concentration = 15.51 min.
Rainfall intensity = 2.776 (In/Hr)
Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|---------|-------|-------|
| 1 | 195.306 | 19.57 | 2.482 |
| 2 | 116.380 | 15.51 | 2.776 |

Largest stream flow has longer time of concentration

$Q_p = 195.306 + \text{sum of}$
 $Q_b \quad I_a/I_b$
 $116.380 * 0.894 = 104.072$
 $Q_p = 299.378$

Total of 2 main streams to confluence:
Flow rates before confluence point:

195.306 116.380
Area of streams before confluence:
79.500 47.500

Results of confluence:
Total flow rate = 299.378 (CFS)
Time of concentration = 19.573 min.
Effective stream area after confluence = 127.000 (Ac.)

++++
270.000 Process from Point/Station 260.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1272.000 (Ft.)
End of natural channel elevation = 1268.000 (Ft.)
Length of natural channel = 346.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 301.853 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 4.02 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0116
Corrected/adjusted channel slope = 0.0116
Travel time = 1.43 min. TC = 21.01 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil (AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.400 (In/Hr) for a 100.0 year storm
Subarea runoff = 4.244 (CFS) for 2.100 (Ac.)
Total runoff = 303.621 (CFS) Total area = 129.100 (Ac.)

++++
270.000 Process from Point/Station 260.000 to Point/Station
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 129.100 (Ac.)
Runoff from this stream = 303.621 (CFS)
Time of concentration = 21.01 min.
Rainfall intensity = 2.400 (In/Hr)

++++
Process from Point/Station 276.000 to Point/Station
275.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 939.000 (Ft.)
Top (of initial area) elevation = 2298.000 (Ft.)
Bottom (of initial area) elevation = 1960.000 (Ft.)
Difference in elevation = 338.000 (Ft.)
Slope = 0.35996 s(percent) = 36.00
TC = $k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$
Initial area time of concentration = 10.048 min.
Rainfall intensity = 3.419 (In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.859
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil (AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 16.145 (CFS)
Total initial stream area = 5.500 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 275.000 to Point/Station
274.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1960.000 (Ft.)
End of natural channel elevation = 1636.000 (Ft.)
Length of natural channel = 774.000 (Ft.)
Estimated mean flow rate at midpoint of channel = 35.079 (CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(slope^{.492})$
Velocity using mean channel flow = 11.55 (Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.4186
Corrected/adjusted channel slope = 0.4186
Travel time = 1.12 min. TC = 11.17 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.857
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000

RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.250(In/Hr) for a 100.0 year storm
Subarea runoff = 35.913(CFS) for 12.900(Ac.)
Total runoff = 52.058(CFS) Total area = 18.400(Ac.)

++++
Process from Point/Station 274.000 to Point/Station
273.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1636.000(Ft.)
End of natural channel elevation = 1470.000(Ft.)
Length of natural channel = 896.000(Ft.)
Estimated mean flow rate at midpoint of channel = 73.136(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 9.86(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1853
Corrected/adjusted channel slope = 0.1853
Travel time = 1.52 min. TC = 12.68 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.058(In/Hr) for a 100.0 year storm
Subarea runoff = 38.905(CFS) for 14.900(Ac.)
Total runoff = 90.964(CFS) Total area = 33.300(Ac.)

++++
Process from Point/Station 273.000 to Point/Station
272.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1470.000(Ft.)
End of natural channel elevation = 1379.000(Ft.)
Length of natural channel = 633.000(Ft.)
Estimated mean flow rate at midpoint of channel = 102.437(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 9.72(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1438
Corrected/adjusted channel slope = 0.1438
Travel time = 1.09 min. TC = 13.77 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.939(In/Hr) for a 100.0 year storm
Subarea runoff = 21.042(CFS) for 8.400(Ac.)
Total runoff = 112.006(CFS) Total area = 41.700(Ac.)

++++
++++
Process from Point/Station 272.000 to Point/Station
271.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1379.000(Ft.)
End of natural channel elevation = 1273.000(Ft.)
Length of natural channel = 1157.000(Ft.)
Estimated mean flow rate at midpoint of channel = 129.868(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})$ (slope^{.492})
Velocity using mean channel flow = 8.42(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0916
Corrected/adjusted channel slope = 0.0916
Travel time = 2.29 min. TC = 16.05 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.730(In/Hr) for a 100.0 year storm
Subarea runoff = 30.820(CFS) for 13.300(Ac.)
Total runoff = 142.826(CFS) Total area = 55.000(Ac.)

++++

++++
 Process from Point/Station 271.000 to Point/Station
 270.000
 **** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1273.000 (Ft.)
 End of natural channel elevation = 1268.000 (Ft.)
 Length of natural channel = 289.000 (Ft.)
 Estimated mean flow rate at midpoint of channel = 145.683 (CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
 Velocity using mean channel flow = 3.85 (Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0173
 Corrected/adjusted channel slope = 0.0173
 Travel time = 1.25 min. TC = 17.30 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.847
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil (AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.634 (In/Hr) for a 100.0 year storm
 Subarea runoff = 4.908 (CFS) for 2.200 (Ac.)
 Total runoff = 147.734 (CFS) Total area = 57.200 (Ac.)

++++
 Process from Point/Station 271.000 to Point/Station
 270.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 57.200 (Ac.)
 Runoff from this stream = 147.734 (CFS)
 Time of concentration = 17.30 min.
 Rainfall intensity = 2.634 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 303.621 | 21.01 | 2.400 |
| 2 | 147.734 | 17.30 | 2.634 |

Largest stream flow has longer time of concentration
 $Q_p = 303.621 + \text{sum of } Q_b \text{ Ia/Ib}$
 $147.734 * 0.911 = 134.603$

Qp = 438.224

Total of 2 streams to confluence:

Flow rates before confluence point:

303.621 147.734

Area of streams before confluence:

129.100 57.200

Results of confluence:

Total flow rate = 438.224(CFS)

Time of concentration = 21.008 min.

Effective stream area after confluence = 186.300(Ac.)

End of computations, total study area = 186.30 (Ac.)

The following figures may

be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged RI index number = 89.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2001 Version

6.4

Rational Hydrology Study

Date: 12/24/08

File:105588existingc.out

100 - YEAR HYDROLOGY STUDY
105.588 "TRACT 34760"
AREA "C" (EXISTING CONDITIONS)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

***** Hydrology Study Control Information *****

English (in-lb) Units used in input data file

Armstrong & Brooks Consulting Engineers - S/N 785

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [Corona] area used.

10 year storm 10 minute intensity = 2.220 (In/Hr)

10 year storm 60 minute intensity = 0.940 (In/Hr)

100 year storm 10 minute intensity = 3.430 (In/Hr)

100 year storm 60 minute intensity = 1.450 (In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.450 (In/Hr)

Slope of intensity duration curve = 0.4800

++++

Process from Point/Station 310.000 to Point/Station

320.000

***** INITIAL AREA EVALUATION *****

Initial area flow distance = 833.000 (Ft.)

Top (of initial area) elevation = 1553.200 (Ft.)

Bottom (of initial area) elevation = 1300.000 (Ft.)

Difference in elevation = 253.200 (Ft.)

Slope = 0.30396 s(percent) = 30.40

TC = k(0.530)*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 9.908 min.

Rainfall intensity = 3.442 (In/Hr) for a 100.0 year storm

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.859
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 25.720 (CFS)
Total initial stream area = 8.700 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 310.000 to Point/Station
320.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 8.700 (Ac.)
Runoff from this stream = 25.720 (CFS)
Time of concentration = 9.91 min.
Rainfall intensity = 3.442 (In/Hr)

++++
Process from Point/Station 321.000 to Point/Station
320.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 975.000 (Ft.)
Top (of initial area) elevation = 1358.000 (Ft.)
Bottom (of initial area) elevation = 1300.000 (Ft.)
Difference in elevation = 58.000 (Ft.)
Slope = 0.05949 s(percent) = 5.95
TC = $k(0.530) * [(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 14.622 min.
Rainfall intensity = 2.856 (In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.851
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 9.233 (CFS)
Total initial stream area = 3.800 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 321.000 to Point/Station
320.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 3.800(Ac.)
 Runoff from this stream = 9.233(CFS)
 Time of concentration = 14.62 min.
 Rainfall intensity = 2.856(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|--------|-------|-------|
| 1 | 25.720 | 9.91 | 3.442 |
| 2 | 9.233 | 14.62 | 2.856 |

Largest stream flow has longer or shorter time of concentration
 $Q_p = 25.720 + \text{sum of}$
 $Q_a \quad T_b/T_a$
 $9.233 * 0.678 = 6.256$
 $Q_p = 31.976$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 25.720 9.233
 Area of streams before confluence:
 8.700 3.800

Results of confluence:
 Total flow rate = 31.976(CFS)
 Time of concentration = 9.908 min.
 Effective stream area after confluence = 12.500(Ac.)

+++++
 ++++ Process from Point/Station 320.000 to Point/Station
 330.000
 ***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1300.000(Ft.)
 End of natural channel elevation = 1213.000(Ft.)
 Length of natural channel = 966.000(Ft.)
 Estimated mean flow rate at midpoint of channel = 44.383(CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = $5.48(q^{.33}) (\text{slope}^{.492})$
 Velocity using mean channel flow = 5.86(Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0901
 Corrected/adjusted channel slope = 0.0901
 Travel time = 2.75 min. TC = 12.65 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.854
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.061(In/Hr) for a 100.0 year storm
Subarea runoff = 25.354(CFS) for 9.700(Ac.)
Total runoff = 57.330(CFS) Total area = 22.200(Ac.)

++++
330.000 Process from Point/Station 320.000 to Point/Station
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 22.200(Ac.)
Runoff from this stream = 57.330(CFS)
Time of concentration = 12.65 min.
Rainfall intensity = 3.061(In/Hr)
Program is now starting with Main Stream No. 2

++++
332.000 Process from Point/Station 333.000 to Point/Station
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 460.000(Ft.)
Top (of initial area) elevation = 1480.000(Ft.)
Bottom (of initial area) elevation = 1310.000(Ft.)
Difference in elevation = 170.000(Ft.)
Slope = 0.36957 s(percent)= 36.96
TC = $k(0.530) * [(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.513 min.
Rainfall intensity = 3.931(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 3.395(CFS)
Total initial stream area = 1.000(Ac.)
Pervious area fraction = 1.000

++++
331.000 Process from Point/Station 332.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1310.000(Ft.)
End of natural channel elevation = 1276.000(Ft.)

Length of natural channel = 489.000(Ft.)
Estimated mean flow rate at midpoint of channel = 6.960(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 2.80(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0695
Corrected/adjusted channel slope = 0.0695
Travel time = 2.91 min. TC = 10.42 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.359(In/Hr) for a 100.0 year storm
Subarea runoff = 6.052(CFS) for 2.100(Ac.)
Total runoff = 9.447(CFS) Total area = 3.100(Ac.)

++++
Process from Point/Station 332.000 to Point/Station
331.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area = 3.100(Ac.)
Runoff from this stream = 9.447(CFS)
Time of concentration = 10.42 min.
Rainfall intensity = 3.359(In/Hr)

++++
Process from Point/Station 333.000 to Point/Station
331.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 663.000(Ft.)
Top (of initial area) elevation = 1480.000(Ft.)
Bottom (of initial area) elevation = 1276.000(Ft.)
Difference in elevation = 204.000(Ft.)
Slope = 0.30769 s(percent) = 30.77
TC = $k(0.530)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$
Initial area time of concentration = 9.021 min.
Rainfall intensity = 3.600(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.861
Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Initial subarea runoff = 9.296(CFS)
 Total initial stream area = 3.000(Ac.)
 Pervious area fraction = 1.000

+++++
 ++++ Process from Point/Station 333.000 to Point/Station
 331.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 2
 Stream flow area = 3.000(Ac.)
 Runoff from this stream = 9.296(CFS)
 Time of concentration = 9.02 min.
 Rainfall intensity = 3.600(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|-------|-------|-------|
| 1 | 9.447 | 10.42 | 3.359 |
| 2 | 9.296 | 9.02 | 3.600 |

Largest stream flow has longer time of concentration

$Q_p = 9.447 + \text{sum of } Q_b \frac{I_a}{I_b}$
 $Q_p = 9.447 + 9.296 * 0.933 = 18.120$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 9.447 9.296
 Area of streams before confluence:
 3.100 3.000
 Results of confluence:
 Total flow rate = 18.120(CFS)
 Time of concentration = 10.424 min.
 Effective stream area after confluence = 6.100(Ac.)

+++++
 ++++ Process from Point/Station 331.000 to Point/Station
 330.000
 **** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1276.000(Ft.)
 End of natural channel elevation = 1213.000(Ft.)
 Length of natural channel = 866.000(Ft.)
 Estimated mean flow rate at midpoint of channel = 23.170(CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:

Velocity = 5.48(q^{.33}) (slope^{.492})
 Velocity using mean channel flow = 4.26(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)

Normal channel slope = 0.0727
 Corrected/adjusted channel slope = 0.0727
 Travel time = 3.39 min. TC = 13.81 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.852
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.935(In/Hr) for a 100.0 year storm
 Subarea runoff = 8.502(CFS) for 3.400(Ac.)
 Total runoff = 26.622(CFS) Total area = 9.500(Ac.)

++++
 +++++
 330.000 Process from Point/Station 331.000 to Point/Station
 ***** CONFLUENCE OF MAIN STREAMS *****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 9.500(Ac.)
 Runoff from this stream = 26.622(CFS)
 Time of concentration = 13.81 min.
 Rainfall intensity = 2.935(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|--------|-------|-------|
| 1 | 57.330 | 12.65 | 3.061 |
| 2 | 26.622 | 13.81 | 2.935 |

Largest stream flow has longer or shorter time of concentration

Qp = 57.330 + sum of
 Qa Tb/Ta
 26.622 * 0.916 = 24.388
 Qp = 81.718

Total of 2 main streams to confluence:

Flow rates before confluence point:
 57.330 26.622
 Area of streams before confluence:
 22.200 9.500

Results of confluence:

Total flow rate = 81.718(CFS)
 Time of concentration = 12.654 min.

Effective stream area after confluence = 31.700 (Ac.)
End of computations, total study area = 31.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 1.000
Area averaged RI index number = 89.0

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 6.302(CFS)
Total initial stream area = 2.400(Ac.)
Pervious area fraction = 1.000
End of computations, total study area = 2.40 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 89.0

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.853
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 2.775(CFS)
Total initial stream area = 1.100(Ac.)
Pervious area fraction = 1.000
End of computations, total study area = 1.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 1.000
Area averaged RI index number = 89.0

**AREA "A" (EXISTING CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 110-120 | 6.3 | 10.04 | 18.5 | 18.5 | INITIAL AREA |
| 120-130 | 22.2 | 11.24 | 61.6 | 80.1 | SUB-AREA ADDITION |
| 130-140 | 40.6 | 12.72 | 105.9 | 186.0 | SUB-AREA ADDITION |
| 142-141 | 8.7 | 10.89 | 24.5 | 24.5 | INITIAL AREA |
| 141-140 | 17.1 | 13.14 | 43.9 | 68.4 | SUB AREA ADDITION |
| 141-140 | 94.9 | 12.72 | - | 252.2 | CONFLUENCE |
| 140-150 | 28.4 | 13.72 | 71.3 | 323.4 | SUB-AREA ADDITION |
| 153-152 | 9.8 | 9.09 | 30.3 | 30.3 | INITIAL AREA |
| 152-151 | 14.3 | 11.16 | 39.8 | 70.1 | SUB-AREA ADDITION |
| 151-150 | 25.0 | 12.66 | 65.3 | 135.4 | SUB-AREA ADDITION |
| 151-150 | 172.4 | 13.72 | - | 453.7 | CONFLUENCE |
| 150-160 | 58.0 | 15.74 | 135.7 | 589.4 | SUB-AREA ADDITION |
| 160-170 | 18.2 | 16.50 | 41.6 | 631.0 | SUB-AREA ADDITION |
| 173-172 | 5.7 | 10.13 | 16.7 | 16.7 | INITIAL AREA |
| 172-171 | 11.8 | 11.82 | 31.9 | 48.6 | SUB-AREA ADDITION |
| 171-170 | 11.6 | 13.41 | 29.5 | 78.0 | SUB-AREA ADDITION |
| 171-170 | 277.7 | 16.50 | - | 701.7 | CONFLUENCE |
| 170-180 | 1.7 | 16.89 | 3.8 | 705.5 | SUB-AREA ADDITION |
| 182-181 | 7.3 | 10.67 | 20.8 | 20.8 | INITIAL AREA |
| 181-180 | 8.1 | 12.99 | 20.9 | 41.7 | SUB-AREA ADDITION |
| 181-180 | 294.8 | 16.89 | - | 742.3 | CONFLUENCE |
| 180-190 | 11.2 | 18.51 | 24.1 | 766.4 | SUB-AREA ADDITION |
| 193-192 | 5.6 | 8.93 | 17.4 | 17.4 | INITIAL AREA |
| 192-191 | 5.9 | 10.34 | 17.1 | 34.5 | SUB-AREA ADDITION |
| 191-190 | 10.6 | 13.77 | 26.6 | 61.1 | SUB-AREA ADDITION |
| 191-190 | 328.1 | 18.51 | - | 819.4 | CONFLUENCE |

AREA "B" (EXISTING CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 210-220 | 9.2 | 10.29 | 26.7 | 26.7 | INITIAL AREA |
| 220-230 | 18.9 | 12.12 | 50.5 | 77.2 | SUB-AREA ADDITION |
| 230-240 | 17.2 | 13.60 | 43.4 | 120.5 | SUB-AREA ADDITION |
| 240-250 | 17.4 | 16.65 | 39.6 | 160.1 | SUB-AREA ADDITION |
| 250-260 | 16.8 | 19.57 | 35.2 | 195.3 | SUB-AREA ADDITION |
| 266-265 | 7.5 | 9.23 | 23.0 | 23.0 | INITIAL AREA |
| 265-264 | 14.7 | 12.04 | 39.4 | 62.4 | SUB-AREA ADDITION |
| 264-263 | 2.1 | 13.74 | 5.3 | 67.7 | SUB-AREA ADDITION |
| 2621-262 | 4.4 | 13.77 | 11.0 | 78.7 | SUB-AREA ADDITION |
| 262-261 | 2.2 | 14.07 | 5.5 | 84.1 | SUB-AREA ADDITION |
| 2612-2611 | 4.6 | 13.96 | 11.4 | 11.4 | INITIAL AREA |
| 2611-261 | 8.2 | 17.80 | 18.0 | 29.5 | SUB-AREA ADDITION |
| 2611-261 | 43.7 | 14.07 | - | 107.4 | CONFLUENCE |
| 261-260 | 3.8 | 15.51 | 9.0 | 116.4 | SUB-AREA ADDITION |
| 261-260 | 127.0 | 19.57 | - | 299.4 | CONFLUENCE |
| 260-270 | 2.1 | 21.01 | 4.2 | 303.6 | SUB-AREA ADDITION |
| 276-275 | 5.5 | 10.05 | 16.2 | 16.2 | INITIAL AREA |
| 275-274 | 12.9 | 11.17 | 35.9 | 52.1 | SUB-AREA ADDITION |
| 274-273 | 14.9 | 12.68 | 38.9 | 91.0 | SUB-AREA ADDITION |
| 273-272 | 8.4 | 13.77 | 21.0 | 112.0 | SUB-AREA ADDITION |
| 272-271 | 13.3 | 16.05 | 30.8 | 142.8 | SUB-AREA ADDITION |
| 271-270 | 2.2 | 17.30 | 4.9 | 147.7 | SUB-AREA ADDITION |
| 271-270 | 186.3 | 21.01 | - | 438.2 | CONFLUENCE |

**AREA 'C' (EXISTING CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 310-320 | 8.7 | 9.91 | 25.7 | 25.7 | INITIAL AREA |
| 321-320 | 3.8 | 14.62 | 9.2 | 9.2 | INITIAL AREA |
| 321-320 | 12.5 | 9.91 | - | 32.0 | CONFLUENCE |
| 320-330 | 9.7 | 12.65 | 25.4 | 57.3 | SUB-AREA ADDITION |
| 333-332 | 1.0 | 7.51 | 3.4 | 3.4 | INITIAL AREA |
| 332-331 | 2.1 | 10.42 | 6.1 | 9.5 | SUB-AREA ADDITION |
| 333-331 | 3.0 | 9.02 | 9.3 | 9.3 | INITIAL AREA |
| 333-331 | 6.1 | 10.42 | - | 18.1 | CONFLUENCE |
| 331-330 | 3.4 | 13.81 | 8.5 | 26.6 | SUB-AREA ADDITION |
| 331-330 | 31.7 | 12.65 | - | 81.7 | CONFLUENCE |

**AREA 'D' (EXISTING CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-----------------|
| 510-520 | 2.4 | 12.54 | 6.3 | 6.3 | INITIAL AREA |

**AREA 'E' (EXISTING CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-----------------|
| 710-720 | 1.1 | 13.58 | 2.8 | 2.8 | INITIAL AREA |

Appendix “B”

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 26.620 (CFS)
Total initial stream area = 9.300 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 183.000 to Point/Station
182.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1355.000 (Ft.)
Downstream point/station elevation = 1346.000 (Ft.)
Pipe length = 276.00 (Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 26.620 (CFS)
Nearest computed pipe diameter = 21.00 (In.)
Calculated individual pipe flow = 26.620 (CFS)
Normal flow depth in pipe = 16.03 (In.)
Flow top width inside pipe = 17.85 (In.)
Critical depth could not be calculated.
Pipe flow velocity = 13.51 (Ft/s)
Travel time through pipe = 0.34 min.
Time of concentration (TC) = 10.91 min.

++++
Process from Point/Station 183.000 to Point/Station
182.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 9.300 (Ac.)
Runoff from this stream = 26.620 (CFS)
Time of concentration = 10.91 min.
Rainfall intensity = 3.287 (In/Hr)

++++
Process from Point/Station 1822.000 to Point/Station
1821.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 448.000 (Ft.)
Top (of initial area) elevation = 1480.000 (Ft.)
Bottom (of initial area) elevation = 1355.000 (Ft.)
Difference in elevation = 125.000 (Ft.)
Slope = 0.27902 s(percent) = 27.90
TC = $k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$

Initial area time of concentration = 7.864 min.
 Rainfall intensity = 3.846(In/Hr) for a 100.0 year storm
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.863
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Initial subarea runoff = 9.625(CFS)
 Total initial stream area = 2.900(Ac.)
 Pervious area fraction = 1.000

++++
 Process from Point/Station 1821.000 to Point/Station
 182.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1355.000(Ft.)
 Downstream point/station elevation = 1346.000(Ft.)
 Pipe length = 25.00(Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 9.625(CFS)
 Nearest computed pipe diameter = 9.00(In.)
 Calculated individual pipe flow = 9.625(CFS)
 Normal flow depth in pipe = 7.15(In.)
 Flow top width inside pipe = 7.28(In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 25.60(Ft/s)
 Travel time through pipe = 0.02 min.
 Time of concentration (TC) = 7.88 min.

++++
 Process from Point/Station 1821.000 to Point/Station
 182.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 2.900(Ac.)
 Runoff from this stream = 9.625(CFS)
 Time of concentration = 7.88 min.
 Rainfall intensity = 3.842(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 26.620 | 10.91 | 3.287 |
| 2 | 9.625 | 7.88 | 3.842 |

Largest stream flow has longer time of concentration
 $Q_p = 26.620 + \text{sum of } Q_b \frac{I_a}{I_b}$
 $Q_p = 26.620 + 9.625 * 0.856 = 34.855$

Total of 2 streams to confluence:
Flow rates before confluence point:
 26.620 9.625
Area of streams before confluence:
 9.300 2.900
Results of confluence:
Total flow rate = 34.855(CFS)
Time of concentration = 10.906 min.
Effective stream area after confluence = 12.200(Ac.)

++++
Process from Point/Station 182.000 to Point/Station
181.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1346.000(Ft.)
Downstream point/station elevation = 1326.000(Ft.)
Pipe length = 172.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 34.855(CFS)
Nearest computed pipe diameter = 18.00(In.)
Calculated individual pipe flow = 34.855(CFS)
Normal flow depth in pipe = 14.34(In.)
Flow top width inside pipe = 14.48(In.)
Critical depth could not be calculated.
Pipe flow velocity = 23.10(Ft/s)
Travel time through pipe = 0.12 min.
Time of concentration (TC) = 11.03 min.

++++
Process from Point/Station 181.000 to Point/Station
180.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1326.000(Ft.)
End of natural channel elevation = 1300.000(Ft.)
Length of natural channel = 254.000(Ft.)
Estimated mean flow rate at midpoint of channel = 36.141(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33})(slope^{.492})
Velocity using mean channel flow = 5.83(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1024
Corrected/adjusted channel slope = 0.1024
Travel time = 0.73 min. TC = 11.76 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.856
Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.171(In/Hr) for a 100.0 year storm
Subarea runoff = 2.441(CFS) for 0.900(Ac.)
Total runoff = 37.297(CFS) Total area = 13.100(Ac.)

++++
180.000 Process from Point/Station 181.000 to Point/Station
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 13.100(Ac.)
Runoff from this stream = 37.297(CFS)
Time of concentration = 11.76 min.
Rainfall intensity = 3.171(In/Hr)

++++
170.000 Process from Point/Station 160.000 to Point/Station
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 2.695(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
User specified values are as follows:
TC = 16.50 min. Rain intensity = 2.69(In/Hr)
Total area = 277.70(Ac.) Total runoff = 701.70(CFS)

++++
180.000 Process from Point/Station 170.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1320.000(Ft.)
End of natural channel elevation = 1300.000(Ft.)
Length of natural channel = 298.000(Ft.)
Estimated mean flow rate at midpoint of channel = 703.469(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33})(slope^{.492})
Velocity using mean channel flow = 12.62(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0671
 Corrected/adjusted channel slope = 0.0671
 Travel time = 0.39 min. TC = 16.89 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.848
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.664(In/Hr) for a 100.0 year storm
 Subarea runoff = 3.161(CFS) for 1.400(Ac.)
 Total runoff = 704.861(CFS) Total area = 279.100(Ac.)

++++
 ++++++
 Process from Point/Station 170.000 to Point/Station
 180.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 279.100(Ac.)
 Runoff from this stream = 704.861(CFS)
 Time of concentration = 16.89 min.
 Rainfall intensity = 2.664(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 37.297 | 11.76 | 3.171 |
| 2 | 704.861 | 16.89 | 2.664 |

Largest stream flow has longer time of concentration
 $Q_p = 704.861 + \text{sum of } Q_b \frac{I_a}{I_b}$
 $37.297 * 0.840 = 31.339$
 $Q_p = 736.200$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 37.297 704.861
 Area of streams before confluence:
 13.100 279.100
 Results of confluence:
 Total flow rate = 736.200(CFS)
 Time of concentration = 16.893 min.
 Effective stream area after confluence = 292.200(Ac.)

++++
 ++++++

Process from Point/Station 180.000 to Point/Station
190.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1300.000(Ft.)
End of natural channel elevation = 1187.000(Ft.)
Length of natural channel = 1381.000(Ft.)
Estimated mean flow rate at midpoint of channel = 750.309(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 14.22(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0818
Corrected/adjusted channel slope = 0.0818
Travel time = 1.62 min. TC = 18.51 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.550(In/Hr) for a 100.0 year storm
Subarea runoff = 24.141(CFS) for 11.200(Ac.)
Total runoff = 760.341(CFS) Total area = 303.400(Ac.)

++++
++++
Process from Point/Station 180.000 to Point/Station
190.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 303.400(Ac.)
Runoff from this stream = 760.341(CFS)
Time of concentration = 18.51 min.
Rainfall intensity = 2.550(In/Hr)

++++
++++
Process from Point/Station 191.000 to Point/Station
190.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 2.939(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 User specified values are as follows:
 TC = 13.77 min. Rain intensity = 2.94(In/Hr)
 Total area = 22.10(Ac.) Total runoff = 61.10(CFS)

+++++
 ++++ Process from Point/Station 191.000 to Point/Station
 190.000
 ***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 22.100(Ac.)
 Runoff from this stream = 61.100(CFS)
 Time of concentration = 13.77 min.
 Rainfall intensity = 2.939(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|---------|-------|-------|
| 1 | 760.341 | 18.51 | 2.550 |
| 2 | 61.100 | 13.77 | 2.939 |

Largest stream flow has longer time of concentration

$Q_p = 760.341 + \text{sum of}$
 $Q_b \quad I_a/I_b$
 $61.100 * 0.868 = 53.008$
 $Q_p = 813.350$

Total of 2 streams to confluence:

Flow rates before confluence point:

760.341 61.100

Area of streams before confluence:

303.400 22.100

Results of confluence:

Total flow rate = 813.350(CFS)

Time of concentration = 18.513 min.

Effective stream area after confluence = 325.500(Ac.)

End of computations, total study area = 325.50 (Ac.)

The following figures may

be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 1.000

Area averaged RI index number = 89.0

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.858
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 26.620 (CFS)
Total initial stream area = 9.300 (Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 183.000 to Point/Station
182.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1355.000 (Ft.)
Downstream point/station elevation = 1346.000 (Ft.)
Pipe length = 276.00 (Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 26.620 (CFS)
Nearest computed pipe diameter = 21.00 (In.)
Calculated individual pipe flow = 26.620 (CFS)
Normal flow depth in pipe = 16.03 (In.)
Flow top width inside pipe = 17.85 (In.)
Critical depth could not be calculated.
Pipe flow velocity = 13.51 (Ft/s)
Travel time through pipe = 0.34 min.
Time of concentration (TC) = 10.91 min.

++++
Process from Point/Station 183.000 to Point/Station
182.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 9.300 (Ac.)
Runoff from this stream = 26.620 (CFS)
Time of concentration = 10.91 min.
Rainfall intensity = 3.287 (In/Hr)

++++
Process from Point/Station 1822.000 to Point/Station
1821.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 448.000 (Ft.)
Top (of initial area) elevation = 1480.000 (Ft.)
Bottom (of initial area) elevation = 1355.000 (Ft.)
Difference in elevation = 125.000 (Ft.)
Slope = 0.27902 s(percent) = 27.90
TC = $k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$

Initial area time of concentration = 7.864 min.
 Rainfall intensity = 3.846(In/Hr) for a 100.0 year storm
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.863
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Initial subarea runoff = 9.625(CFS)
 Total initial stream area = 2.900(Ac.)
 Pervious area fraction = 1.000

++++
 Process from Point/Station 1821.000 to Point/Station
 182.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1355.000(Ft.)
 Downstream point/station elevation = 1346.000(Ft.)
 Pipe length = 25.00(Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 9.625(CFS)
 Nearest computed pipe diameter = 9.00(In.)
 Calculated individual pipe flow = 9.625(CFS)
 Normal flow depth in pipe = 7.15(In.)
 Flow top width inside pipe = 7.28(In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 25.60(Ft/s)
 Travel time through pipe = 0.02 min.
 Time of concentration (TC) = 7.88 min.

++++
 Process from Point/Station 1821.000 to Point/Station
 182.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 2.900(Ac.)
 Runoff from this stream = 9.625(CFS)
 Time of concentration = 7.88 min.
 Rainfall intensity = 3.842(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 26.620 | 10.91 | 3.287 |
| 2 | 9.625 | 7.88 | 3.842 |

Largest stream flow has longer time of concentration
 $Q_p = 26.620 + \text{sum of } Q_b \frac{I_a}{I_b}$
 $Q_p = 26.620 + 9.625 * 0.856 = 34.855$

Total of 2 streams to confluence:
Flow rates before confluence point:
26.620 9.625
Area of streams before confluence:
9.300 2.900
Results of confluence:
Total flow rate = 34.855(CFS)
Time of concentration = 10.906 min.
Effective stream area after confluence = 12.200(Ac.)

++++
Process from Point/Station 182.000 to Point/Station
181.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1346.000(Ft.)
Downstream point/station elevation = 1326.000(Ft.)
Pipe length = 172.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 34.855(CFS)
Nearest computed pipe diameter = 18.00(In.)
Calculated individual pipe flow = 34.855(CFS)
Normal flow depth in pipe = 14.34(In.)
Flow top width inside pipe = 14.48(In.)
Critical depth could not be calculated.
Pipe flow velocity = 23.10(Ft/s)
Travel time through pipe = 0.12 min.
Time of concentration (TC) = 11.03 min.

++++
Process from Point/Station 181.000 to Point/Station
180.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1326.000(Ft.)
End of natural channel elevation = 1300.000(Ft.)
Length of natural channel = 254.000(Ft.)
Estimated mean flow rate at midpoint of channel = 36.141(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33})(slope^{.492})
Velocity using mean channel flow = 5.83(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1024
Corrected/adjusted channel slope = 0.1024
Travel time = 0.73 min. TC = 11.76 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.856
Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.171(In/Hr) for a 100.0 year storm
Subarea runoff = 2.441(CFS) for 0.900(Ac.)
Total runoff = 37.297(CFS) Total area = 13.100(Ac.)

++++
180.000 Process from Point/Station 181.000 to Point/Station
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 13.100(Ac.)
Runoff from this stream = 37.297(CFS)
Time of concentration = 11.76 min.
Rainfall intensity = 3.171(In/Hr)

++++
170.000 Process from Point/Station 160.000 to Point/Station
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 2.695(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
User specified values are as follows:
TC = 16.50 min. Rain intensity = 2.69(In/Hr)
Total area = 277.70(Ac.) Total runoff = 701.70(CFS)

++++
180.000 Process from Point/Station 170.000 to Point/Station
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1320.000(Ft.)
End of natural channel elevation = 1300.000(Ft.)
Length of natural channel = 298.000(Ft.)
Estimated mean flow rate at midpoint of channel = 703.469(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33})(slope^{.492})
Velocity using mean channel flow = 12.62(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0671
 Corrected/adjusted channel slope = 0.0671
 Travel time = 0.39 min. TC = 16.89 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.848
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Rainfall intensity = 2.664(In/Hr) for a 100.0 year storm
 Subarea runoff = 3.161(CFS) for 1.400(Ac.)
 Total runoff = 704.861(CFS) Total area = 279.100(Ac.)

++++
 Process from Point/Station 170.000 to Point/Station 180.000
 ***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 279.100(Ac.)
 Runoff from this stream = 704.861(CFS)
 Time of concentration = 16.89 min.
 Rainfall intensity = 2.664(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 37.297 | 11.76 | 3.171 |
| 2 | 704.861 | 16.89 | 2.664 |

Largest stream flow has longer time of concentration
 $Q_p = 704.861 + \text{sum of } \frac{Q_b \cdot I_a}{I_b}$
 $37.297 * 0.840 = 31.339$
 $Q_p = 736.200$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 37.297 704.861
 Area of streams before confluence:
 13.100 279.100
 Results of confluence:
 Total flow rate = 736.200(CFS)
 Time of concentration = 16.893 min.
 Effective stream area after confluence = 292.200(Ac.)

++++

Process from Point/Station 180.000 to Point/Station
190.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1300.000(Ft.)
End of natural channel elevation = 1187.000(Ft.)
Length of natural channel = 1381.000(Ft.)
Estimated mean flow rate at midpoint of channel = 750.309(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 14.22(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0818
Corrected/adjusted channel slope = 0.0818
Travel time = 1.62 min. TC = 18.51 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.550(In/Hr) for a 100.0 year storm
Subarea runoff = 24.141(CFS) for 11.200(Ac.)
Total runoff = 760.341(CFS) Total area = 303.400(Ac.)

++++
++++
Process from Point/Station 180.000 to Point/Station
190.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 303.400(Ac.)
Runoff from this stream = 760.341(CFS)
Time of concentration = 18.51 min.
Rainfall intensity = 2.550(In/Hr)

++++
++++
Process from Point/Station 191.000 to Point/Station
190.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 2.939(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 User specified values are as follows:
 TC = 13.77 min. Rain intensity = 2.94(In/Hr)
 Total area = 22.10(Ac.) Total runoff = 61.10(CFS)

+++++
 ++++ Process from Point/Station 191.000 to Point/Station
 190.000
 ***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 22.100(Ac.)
 Runoff from this stream = 61.100(CFS)
 Time of concentration = 13.77 min.
 Rainfall intensity = 2.939(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|---------|-------|-------|
| 1 | 760.341 | 18.51 | 2.550 |
| 2 | 61.100 | 13.77 | 2.939 |

Largest stream flow has longer time of concentration

$Q_p = 760.341 + \text{sum of}$
 $Q_b \quad I_a/I_b$
 $61.100 * 0.868 = 53.008$
 $Q_p = 813.350$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 760.341 61.100
 Area of streams before confluence:
 303.400 22.100

Results of confluence:
 Total flow rate = 813.350(CFS)
 Time of concentration = 18.513 min.
 Effective stream area after confluence = 325.500(Ac.)
 End of computations, total study area = 325.50 (Ac.)
 The following figures may
 be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 1.000
 Area averaged RI index number = 89.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2001 Version

6.4

Rational Hydrology Study

Date: 04/13/09

File:105588PROPOSEDB2.out

100 - YEAR HYDROLOGY STUDY
105.588 "TRACT 34760"
AREA "B" (PROPOSED CONDITIONS + OFFSITES)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

***** Hydrology Study Control Information *****

English (in-lb) Units used in input data file

Armstrong & Brooks Consulting Engineers - S/N 785

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [Corona] area used.

10 year storm 10 minute intensity = 2.220(In/Hr)

10 year storm 60 minute intensity = 0.940(In/Hr)

100 year storm 10 minute intensity = 3.430(In/Hr)

100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.450(In/Hr)

Slope of intensity duration curve = 0.4800

++++

Process from Point/Station 284.000 to Point/Station

283.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 881.000(Ft.)

Top (of initial area) elevation = 1396.800(Ft.)

Bottom (of initial area) elevation = 1392.000(Ft.)

Difference in elevation = 4.800(Ft.)

Slope = 0.00545 s(percent)= 0.54

TC = k(0.420)*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 17.947 min.

Rainfall intensity = 2.588(In/Hr) for a 100.0 year storm

SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.821
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 12.109(CFS)
Total initial stream area = 5.700(Ac.)
Pervious area fraction = 0.600

++++
Process from Point/Station 283.000 to Point/Station
282.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1388.000(Ft.)
Downstream point/station elevation = 1352.000(Ft.)
Pipe length = 402.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 12.109(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 12.109(CFS)
Normal flow depth in pipe = 8.60(In.)
Flow top width inside pipe = 14.84(In.)
Critical depth could not be calculated.
Pipe flow velocity = 16.63(Ft/s)
Travel time through pipe = 0.40 min.
Time of concentration (TC) = 18.35 min.

++++
Process from Point/Station 283.000 to Point/Station
282.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 5.700(Ac.)
Runoff from this stream = 12.109(CFS)
Time of concentration = 18.35 min.
Rainfall intensity = 2.561(In/Hr)
Program is now starting with Main Stream No. 2

++++
Process from Point/Station 2824.000 to Point/Station
2823.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 795.000(Ft.)
Top (of initial area) elevation = 1370.000(Ft.)
Bottom (of initial area) elevation = 1366.000(Ft.)
Difference in elevation = 4.000(Ft.)

Slope = 0.00503 s(percent)= 0.50
TC = k(0.710)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 29.585 min.
Rainfall intensity = 2.036(In/Hr) for a 100.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.800
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 84.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 2.444(CFS)
Total initial stream area = 1.500(Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 2823.000 to Point/Station
2821.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1365.000(Ft.)
Downstream point/station elevation = 1362.000(Ft.)
Pipe length = 90.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 2.444(CFS)
Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 2.444(CFS)
Normal flow depth in pipe = 6.14(In.)
Flow top width inside pipe = 8.38(In.)
Critical Depth = 8.26(In.)
Pipe flow velocity = 7.61(Ft/s)
Travel time through pipe = 0.20 min.
Time of concentration (TC) = 29.78 min.

++++
Process from Point/Station 2823.000 to Point/Station
2821.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area = 1.500(Ac.)
Runoff from this stream = 2.444(CFS)
Time of concentration = 29.78 min.
Rainfall intensity = 2.029(In/Hr)

++++
Process from Point/Station 2822.000 to Point/Station
2821.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 1370.000(Ft.)

Bottom (of initial area) elevation = 1366.000 (Ft.)
 Difference in elevation = 4.000 (Ft.)
 Slope = 0.00400 s (percent) = 0.40
 $TC = k(0.420) * [(length^3) / (elevation\ change)]^{0.2}$
 Initial area time of concentration = 20.083 min.
 Rainfall intensity = 2.452 (In/Hr) for a 100.0 year storm
 SINGLE FAMILY (1/2 Acre Lot)
 Runoff Coefficient = 0.817
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil (AMC 2) = 75.00
 Pervious area fraction = 0.600; Impervious fraction = 0.400
 Initial subarea runoff = 8.616 (CFS)
 Total initial stream area = 4.300 (Ac.)
 Pervious area fraction = 0.600

+++++

 Process from Point/Station 2822.000 to Point/Station
 2821.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 2
 Stream flow area = 4.300 (Ac.)
 Runoff from this stream = 8.616 (CFS)
 Time of concentration = 20.08 min.
 Rainfall intensity = 2.452 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 2.444 | 29.78 | 2.029 |
| 2 | 8.616 | 20.08 | 2.452 |

Largest stream flow has longer or shorter time of concentration
 $Q_p = 8.616 + \text{sum of}$
 $\frac{Q_a}{T_b/T_a}$
 $2.444 * 0.674 = 1.648$
 $Q_p = 10.263$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 2.444 8.616
 Area of streams before confluence:
 1.500 4.300
 Results of confluence:
 Total flow rate = 10.263 (CFS)
 Time of concentration = 20.083 min.
 Effective stream area after confluence = 5.800 (Ac.)

+++++

 Process from Point/Station 2821.000 to Point/Station
 282.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1362.000 (Ft.)
 Downstream point/station elevation = 1352.000 (Ft.)
 Pipe length = 32.00 (Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 10.263 (CFS)
 Nearest computed pipe diameter = 12.00 (In.)
 Calculated individual pipe flow = 10.263 (CFS)
 Normal flow depth in pipe = 6.11 (In.)
 Flow top width inside pipe = 12.00 (In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 25.55 (Ft/s)
 Travel time through pipe = 0.02 min.
 Time of concentration (TC) = 20.10 min.

+++++
 +++++
 Process from Point/Station 2821.000 to Point/Station
 282.000
 ***** CONFLUENCE OF MAIN STREAMS *****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 5.800 (Ac.)
 Runoff from this stream = 10.263 (CFS)
 Time of concentration = 20.10 min.
 Rainfall intensity = 2.451 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|--------|-------|-------|
| 1 | 12.109 | 18.35 | 2.561 |
| 2 | 10.263 | 20.10 | 2.451 |

Largest stream flow has longer or shorter time of concentration

$Q_p = 12.109 + \text{sum of}$
 $Q_a \quad T_b/T_a$
 $10.263 * 0.913 = 9.368$
 $Q_p = 21.477$

Total of 2 main streams to confluence:

Flow rates before confluence point:

12.109 10.263

Area of streams before confluence:

5.700 5.800

Results of confluence:

Total flow rate = 21.477 (CFS)

Time of concentration = 18.350 min.

Effective stream area after confluence = 11.500 (Ac.)

+++++
 +++++
 Process from Point/Station 282.000 to Point/Station
 281.000
 ***** PIPEFLOW TRAVEL TIME (Program estimated size) *****

Upstream point/station elevation = 1352.000 (Ft.)
Downstream point/station elevation = 1295.000 (Ft.)
Pipe length = 550.00 (Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 21.477 (CFS)
Nearest computed pipe diameter = 18.00 (In.)
Calculated individual pipe flow = 21.477 (CFS)
Normal flow depth in pipe = 10.42 (In.)
Flow top width inside pipe = 17.78 (In.)
Critical depth could not be calculated.
Pipe flow velocity = 20.27 (Ft/s)
Travel time through pipe = 0.45 min.
Time of concentration (TC) = 18.80 min.

++++
Process from Point/Station 282.000 to Point/Station
281.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 11.500 (Ac.)
Runoff from this stream = 21.477 (CFS)
Time of concentration = 18.80 min.
Rainfall intensity = 2.531 (In/Hr)
Program is now starting with Main Stream No. 2

++++
Process from Point/Station 293.000 to Point/Station
292.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 931.000 (Ft.)
Top (of initial area) elevation = 1356.000 (Ft.)
Bottom (of initial area) elevation = 1300.000 (Ft.)
Difference in elevation = 56.000 (Ft.)
Slope = 0.06015 s(percent) = 6.02
TC = $k(0.710) * [(length^3) / (elevation\ change)]^{0.2}$
Initial area time of concentration = 19.186 min.
Rainfall intensity = 2.506 (In/Hr) for a 100.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.817
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil (AMC 2) = 84.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 5.120 (CFS)
Total initial stream area = 2.500 (Ac.)
Pervious area fraction = 1.000

++++

++++
Process from Point/Station 292.000 to Point/Station
291.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1297.000(Ft.)
Downstream point/station elevation = 1295.500(Ft.)
Pipe length = 19.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 5.120(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 5.120(CFS)
Normal flow depth in pipe = 6.08(In.)
Flow top width inside pipe = 12.00(In.)
Critical Depth = 11.07(In.)
Pipe flow velocity = 12.82(Ft/s)
Travel time through pipe = 0.02 min.
Time of concentration (TC) = 19.21 min.

++++
Process from Point/Station 292.000 to Point/Station
291.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area = 2.500(Ac.)
Runoff from this stream = 5.120(CFS)
Time of concentration = 19.21 min.
Rainfall intensity = 2.505(In/Hr)

++++
Process from Point/Station 2912.000 to Point/Station
2911.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 912.000(Ft.)
Top (of initial area) elevation = 1357.000(Ft.)
Bottom (of initial area) elevation = 1300.000(Ft.)
Difference in elevation = 57.000(Ft.)
Slope = 0.06250 s(percent) = 6.25
 $TC = k(0.300)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 7.979 min.
Rainfall intensity = 3.819(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.891
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 75.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 3.401(CFS)
Total initial stream area = 1.000(Ac.)
Pervious area fraction = 0.100

++++
 +-----+
 Process from Point/Station 2911.000 to Point/Station
 291.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1297.000 (Ft.)
 Downstream point/station elevation = 1296.500 (Ft.)
 Pipe length = 60.00 (Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 3.401 (CFS)
 Nearest computed pipe diameter = 15.00 (In.)
 Calculated individual pipe flow = 3.401 (CFS)
 Normal flow depth in pipe = 8.17 (In.)
 Flow top width inside pipe = 14.94 (In.)
 Critical Depth = 8.92 (In.)
 Pipe flow velocity = 4.97 (Ft/s)
 Travel time through pipe = 0.20 min.
 Time of concentration (TC) = 8.18 min.

++++
 +-----+
 Process from Point/Station 2911.000 to Point/Station
 291.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 2
 Stream flow area = 1.000 (Ac.)
 Runoff from this stream = 3.401 (CFS)
 Time of concentration = 8.18 min.
 Rainfall intensity = 3.774 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 5.120 | 19.21 | 2.505 |
| 2 | 3.401 | 8.18 | 3.774 |

Largest stream flow has longer time of concentration
 $Q_p = 5.120 + \text{sum of } \frac{Q_b \cdot I_a/I_b}{I_b}$
 $Q_p = 3.401 * 0.664 = 2.258$
 $Q_p = 7.378$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 5.120 3.401
 Area of streams before confluence:
 2.500 1.000
 Results of confluence:
 Total flow rate = 7.378 (CFS)
 Time of concentration = 19.211 min.
 Effective stream area after confluence = 3.500 (Ac.)

++++
 +-----+

Process from Point/Station 291.000 to Point/Station
290.000

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1296.500(Ft.)
Downstream point/station elevation = 1296.000(Ft.)
Pipe length = 30.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 7.378(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 7.378(CFS)
Normal flow depth in pipe = 10.97(In.)
Flow top width inside pipe = 13.30(In.)
Critical Depth = 13.00(In.)
Pipe flow velocity = 7.67(Ft/s)
Travel time through pipe = 0.07 min.
Time of concentration (TC) = 19.28 min.

++++

Process from Point/Station 291.000 to Point/Station
290.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area = 3.500(Ac.)
Runoff from this stream = 7.378(CFS)
Time of concentration = 19.28 min.
Rainfall intensity = 2.501(In/Hr)

++++

Process from Point/Station 2903.000 to Point/Station
2902.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 673.000(Ft.)
Top (of initial area) elevation = 1398.000(Ft.)
Bottom (of initial area) elevation = 1350.000(Ft.)
Difference in elevation = 48.000(Ft.)
Slope = 0.07132 s(percent) = 7.13
TC = $k(0.710) * [(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 16.286 min.
Rainfall intensity = 2.711(In/Hr) for a 100.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.823
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 84.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 2.231(CFS)
Total initial stream area = 1.000(Ac.)
Pervious area fraction = 1.000

++++
Process from Point/Station 2902.000 to Point/Station
2901.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1350.000(Ft.)
Downstream point elevation = 1299.000(Ft.)
Channel length thru subarea = 533.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 2.000
Slope or 'Z' of right channel bank = 20.000
Estimated mean flow rate at midpoint of channel = 4.463(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 4.463(CFS)
Depth of flow = 0.236(Ft.), Average velocity = 7.307(Ft/s)
Channel flow top width = 5.184(Ft.)
Flow Velocity = 7.31(Ft/s)
Travel time = 1.22 min.
Time of concentration = 17.50 min.

Sub-Channel No. 1 Critical depth = 0.398(Ft.)
' ' ' Critical flow top width = 8.766(Ft.)
' ' ' Critical flow velocity= 2.556(Ft/s)
' ' ' Critical flow area = 1.746(Sq.Ft)

Adding area flow to channel
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.820
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 84.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.619(In/Hr) for a 100.0 year storm
Subarea runoff = 4.298(CFS) for 2.000(Ac.)
Total runoff = 6.529(CFS) Total area = 3.000(Ac.)

++++
Process from Point/Station 2901.000 to Point/Station
290.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1297.000(Ft.)
Downstream point/station elevation = 1296.000(Ft.)
Pipe length = 9.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 6.529(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 6.529(CFS)
Normal flow depth in pipe = 6.35(In.)
Flow top width inside pipe = 11.98(In.)
Critical depth could not be calculated.
Pipe flow velocity = 15.48(Ft/s)
Travel time through pipe = 0.01 min.
Time of concentration (TC) = 17.51 min.

++++
 Process from Point/Station 2901.000 to Point/Station
 290.000
 ***** CONFLUENCE OF MINOR STREAMS *****

Along Main Stream number: 2 in normal stream number 2
 Stream flow area = 3.000(Ac.)
 Runoff from this stream = 6.529(CFS)
 Time of concentration = 17.51 min.
 Rainfall intensity = 2.619(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|-------|-------|-------|
| 1 | 7.378 | 19.28 | 2.501 |
| 2 | 6.529 | 17.51 | 2.619 |

Largest stream flow has longer time of concentration
 $Q_p = 7.378 + \text{sum of}$
 $Q_b \quad I_a/I_b$
 $6.529 * 0.955 = 6.235$
 $Q_p = 13.614$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 7.378 6.529
 Area of streams before confluence:
 3.500 3.000
 Results of confluence:
 Total flow rate = 13.614(CFS)
 Time of concentration = 19.276 min.
 Effective stream area after confluence = 6.500(Ac.)

++++
 Process from Point/Station 290.000 to Point/Station
 281.000
 ***** PIPEFLOW TRAVEL TIME (Program estimated size) *****

Upstream point/station elevation = 1296.000(Ft.)
 Downstream point/station elevation = 1295.000(Ft.)
 Pipe length = 95.00(Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 13.614(CFS)
 Nearest computed pipe diameter = 21.00(In.)
 Calculated individual pipe flow = 13.614(CFS)
 Normal flow depth in pipe = 14.70(In.)
 Flow top width inside pipe = 19.25(In.)
 Critical Depth = 16.47(In.)
 Pipe flow velocity = 7.57(Ft/s)
 Travel time through pipe = 0.21 min.
 Time of concentration (TC) = 19.49 min.

++++

++++
 Process from Point/Station 290.000 to Point/Station
 281.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 6.500 (Ac.)
 Runoff from this stream = 13.614 (CFS)
 Time of concentration = 19.49 min.
 Rainfall intensity = 2.488 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|--------|-------|-------|
| 1 | 21.477 | 18.80 | 2.531 |
| 2 | 13.614 | 19.49 | 2.488 |

Largest stream flow has longer or shorter time of concentration

Qp = 21.477 + sum of
 Qa Tb/Ta
 13.614 * 0.965 = 13.136
 Qp = 34.613

Total of 2 main streams to confluence:

Flow rates before confluence point:

21.477 13.614

Area of streams before confluence:

11.500 6.500

Results of confluence:

Total flow rate = 34.613 (CFS)

Time of concentration = 18.802 min.

Effective stream area after confluence = 18.000 (Ac.)

++++
 Process from Point/Station 2811.000 to Point/Station
 281.000
 **** SUBAREA FLOW ADDITION ****

UNDEVELOPED (fair cover) subarea

Runoff Coefficient = 0.818

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 1.000

RI index for soil (AMC 2) = 84.00

Pervious area fraction = 1.000; Impervious fraction = 0.000

Time of concentration = 18.80 min.

Rainfall intensity = 2.531 (In/Hr) for a 100.0 year storm

Subarea runoff = 1.656 (CFS) for 0.800 (Ac.)

Total runoff = 36.269 (CFS) Total area = 18.800 (Ac.)

++++

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++++
Process from Point/Station      281.000 to Point/Station
280.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
-----

Upstream point/station elevation = 1295.000(Ft.)
Downstream point/station elevation = 1290.000(Ft.)
Pipe length = 55.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 36.269(CFS)
Nearest computed pipe diameter = 21.00(In.)
Calculated individual pipe flow = 36.269(CFS)
Normal flow depth in pipe = 13.69(In.)
Flow top width inside pipe = 20.01(In.)
Critical depth could not be calculated.
Pipe flow velocity = 21.85(Ft/s)
Travel time through pipe = 0.04 min.
Time of concentration (TC) = 18.84 min.

++++
Process from Point/Station      280.000 to Point/Station
270.000
**** CONFLUENCE OF MINOR STREAMS ****
-----

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 18.800(Ac.)
Runoff from this stream = 36.269(CFS)
Time of concentration = 18.84 min.
Rainfall intensity = 2.528(In/Hr)

++++
Process from Point/Station      274.000 to Point/Station
2632.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
-----

Rainfall intensity = 3.058(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
User specified values are as follows:
TC = 12.68 min. Rain intensity = 3.06(In/Hr)
Total area = 33.30(Ac.) Total runoff = 91.00(CFS)

++++
Process from Point/Station      2632.000 to Point/Station
2631.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
-----

```

Top of natural channel elevation = 1470.000(Ft.)
End of natural channel elevation = 1375.000(Ft.)
Length of natural channel = 652.000(Ft.)
Estimated mean flow rate at midpoint of channel = 103.980(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 9.84(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1457
Corrected/adjusted channel slope = 0.1457
Travel time = 1.10 min. TC = 13.78 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.937(In/Hr) for a 100.0 year storm
Subarea runoff = 23.781(CFS) for 9.500(Ac.)
Total runoff = 114.781(CFS) Total area = 42.800(Ac.)

++++
++++
Process from Point/Station 2631.000 to Point/Station
280.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1378.000(Ft.)
Downstream point/station elevation = 1300.000(Ft.)
Pipe length = 1530.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 114.781(CFS)
Nearest computed pipe diameter = 33.00(In.)
Calculated individual pipe flow = 114.781(CFS)
Normal flow depth in pipe = 25.97(In.)
Flow top width inside pipe = 27.03(In.)
Critical depth could not be calculated.
Pipe flow velocity = 22.90(Ft/s)
Travel time through pipe = 1.11 min.
Time of concentration (TC) = 14.90 min.

++++
++++
Process from Point/Station 2631.000 to Point/Station
280.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2

Stream flow area = 42.800 (Ac.)
 Runoff from this stream = 114.781 (CFS)
 Time of concentration = 14.90 min.
 Rainfall intensity = 2.830 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 36.269 | 18.84 | 2.528 |
| 2 | 114.781 | 14.90 | 2.830 |

Largest stream flow has longer or shorter time of concentration
 $Q_p = 114.781 + \text{sum of } \frac{Q_a}{T_b/T_a}$
 $36.269 * 0.791 = 28.675$
 $Q_p = 143.456$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 36.269 114.781
 Area of streams before confluence:
 18.800 42.800
 Results of confluence:
 Total flow rate = 143.456 (CFS)
 Time of concentration = 14.899 min.
 Effective stream area after confluence = 61.600 (Ac.)

++++
 Process from Point/Station 280.000 to Point/Station
 270.000
 ***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1300.000 (Ft.)
 End of natural channel elevation = 1273.000 (Ft.)
 Length of natural channel = 457.000 (Ft.)
 Estimated mean flow rate at midpoint of channel = 146.018 (CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
 Velocity using mean channel flow = 7.06 (Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0591
 Corrected/adjusted channel slope = 0.0591
 Travel time = 1.08 min. TC = 15.98 min.

Adding area flow to channel
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.849
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil (AMC 2) = 89.00

Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.736(In/Hr) for a 100.0 year storm
Subarea runoff = 5.110(CFS) for 2.200(Ac.)
Total runoff = 148.567(CFS) Total area = 63.800(Ac.)

++++
Process from Point/Station 280.000 to Point/Station
270.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 63.800(Ac.)
Runoff from this stream = 148.567(CFS)
Time of concentration = 15.98 min.
Rainfall intensity = 2.736(In/Hr)

++++
Process from Point/Station 260.000 to Point/Station
270.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 2.399(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
User specified values are as follows:
TC = 21.02 min. Rain intensity = 2.40(In/Hr)
Total area = 125.70(Ac.) Total runoff = 296.00(CFS)

++++
Process from Point/Station 260.000 to Point/Station
270.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 125.700(Ac.)
Runoff from this stream = 296.000(CFS)
Time of concentration = 21.02 min.
Rainfall intensity = 2.399(In/Hr)
Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 148.567 | 15.98 | 2.736 |
| 2 | 296.000 | 21.02 | 2.399 |

Largest stream flow has longer time of concentration

$$Q_p = 296.000 + \text{sum of} \\ \frac{Q_b}{I_a/I_b} \\ 148.567 * 0.877 = 130.241 \\ Q_p = 426.241$$

Total of 2 streams to confluence:

Flow rates before confluence point:
148.567 296.000

Area of streams before confluence:
63.800 125.700

Results of confluence:

Total flow rate = 426.241 (CFS)

Time of concentration = 21.020 min.

Effective stream area after confluence = 189.500 (Ac.)

End of computations, total study area = 189.50 (Ac.)

The following figures may

be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (A_p) = 0.974

Area averaged RI index number = 88.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2001 Version

6.4

Rational Hydrology Study

Date: 04/07/09

File:105588PROPOSEDB.out

100-YEAR HYDROLOGY STUDY
105.588 TRACT 34760
AREA "B" - OFFSITES (PROPOSED CONDITIONS
ARMSTRONG & BROOKS CONSULTING ENGINEERS

***** Hydrology Study Control Information *****

English (in-lb) Units used in input data file

Armstrong & Brooks Consulting Engineers - S/N 785

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [Corona] area used.

10 year storm 10 minute intensity = 2.220 (In/Hr)

10 year storm 60 minute intensity = 0.940 (In/Hr)

100 year storm 10 minute intensity = 3.430 (In/Hr)

100 year storm 60 minute intensity = 1.450 (In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.450 (In/Hr)

Slope of intensity duration curve = 0.4800

++++

Process from Point/Station 266.000 to Point/Station

265.000

**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 3.561 (In/Hr) for a 100.0 year storm

UNDEVELOPED (poor cover) subarea

Runoff Coefficient = 0.860

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 1.000

RI index for soil(AMC 2) = 89.00

Pervious area fraction = 1.000; Impervious fraction = 0.000
User specified values are as follows:
TC = 9.23 min. Rain intensity = 3.56(In/Hr)
Total area = 7.50(Ac.) Total runoff = 23.00(CFS)

++++
++++

Process from Point/Station 265.000 to Point/Station
264.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1656.000(Ft.)
End of natural channel elevation = 1421.000(Ft.)
Length of natural channel = 1370.000(Ft.)
Estimated mean flow rate at midpoint of channel = 44.773(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 8.07(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.1715
Corrected/adjusted channel slope = 0.1715
Travel time = 2.83 min. TC = 12.06 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.855
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 3.132(In/Hr) for a 100.0 year storm
Subarea runoff = 38.029(CFS) for 14.200(Ac.)
Total runoff = 61.029(CFS) Total area = 21.700(Ac.)

++++
++++

Process from Point/Station 264.000 to Point/Station
263.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1421.000(Ft.)
End of natural channel elevation = 1369.000(Ft.)
Length of natural channel = 615.000(Ft.)
Estimated mean flow rate at midpoint of channel = 63.560(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 6.40(Ft/s)

Correction to map slope used on extremely rugged channels with drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0846
Corrected/adjusted channel slope = 0.0846
Travel time = 1.60 min. TC = 13.66 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.950(In/Hr) for a 100.0 year storm
Subarea runoff = 4.526(CFS) for 1.800(Ac.)
Total runoff = 65.555(CFS) Total area = 23.500(Ac.)

++++
Process from Point/Station 263.000 to Point/Station
262.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1369.000(Ft.)
Downstream point/station elevation = 1365.000(Ft.)
Pipe length = 50.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 65.555(CFS)
Nearest computed pipe diameter = 24.00(In.)
Calculated individual pipe flow = 65.555(CFS)
Normal flow depth in pipe = 20.25(In.)
Flow top width inside pipe = 17.43(In.)
Critical depth could not be calculated.
Pipe flow velocity = 23.18(Ft/s)
Travel time through pipe = 0.04 min.
Time of concentration (TC) = 13.70 min.

++++
Process from Point/Station 263.000 to Point/Station
262.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 23.500(Ac.)
Runoff from this stream = 65.555(CFS)
Time of concentration = 13.70 min.
Rainfall intensity = 2.946(In/Hr)

++++
Process from Point/Station 2621.000 to Point/Station
262.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 828.000(Ft.)
 Top (of initial area) elevation = 1600.000(Ft.)
 Bottom (of initial area) elevation = 1365.000(Ft.)
 Difference in elevation = 235.000(Ft.)
 Slope = 0.28382 s(percent)= 28.38
 $TC = k(0.530)*[(length^3)/(elevation\ change)]^{0.2}$
 Initial area time of concentration = 10.020 min.
 Rainfall intensity = 3.423(In/Hr) for a 100.0 year storm
 UNDEVELOPED (poor cover) subarea
 Runoff Coefficient = 0.859
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 Initial subarea runoff = 12.934(CFS)
 Total initial stream area = 4.400(Ac.)
 Pervious area fraction = 1.000

+++++
 ++++ Process from Point/Station 2621.000 to Point/Station
 262.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 4.400(Ac.)
 Runoff from this stream = 12.934(CFS)
 Time of concentration = 10.02 min.
 Rainfall intensity = 3.423(In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|--------|-------|-------|
| 1 | 65.555 | 13.70 | 2.946 |
| 2 | 12.934 | 10.02 | 3.423 |

Largest stream flow has longer time of concentration

$Q_p = 65.555 + \text{sum of } Q_b \text{ Ia/Ib}$
 $12.934 * 0.861 = 11.132$
 $Q_p = 76.687$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 65.555 12.934

Area of streams before confluence:
 23.500 4.400

Results of confluence:

Total flow rate = 76.687(CFS)
 Time of concentration = 13.697 min.
 Effective stream area after confluence = 27.900(Ac.)

+++++

```

++++
Process from Point/Station      262.000 to Point/Station
261.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
-----

Top of natural channel elevation = 1365.000(Ft.)
End of natural channel elevation = 1320.000(Ft.)
Length of natural channel = 194.000(Ft.)
Estimated mean flow rate at midpoint of channel = 77.786(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow = 11.23(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.2320
Corrected/adjusted channel slope = 0.2320
Travel time = 0.29 min. TC = 13.99 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.852
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.917(In/Hr) for a 100.0 year storm
Subarea runoff = 1.988(CFS) for 0.800(Ac.)
Total runoff = 78.675(CFS) Total area = 28.700(Ac.)

++++
Process from Point/Station      262.000 to Point/Station
261.000
**** CONFLUENCE OF MINOR STREAMS ****
-----

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 28.700(Ac.)
Runoff from this stream = 78.675(CFS)
Time of concentration = 13.99 min.
Rainfall intensity = 2.917(In/Hr)

++++
Process from Point/Station      2611.000 to Point/Station
261.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
-----

Rainfall intensity = 2.598(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.846

```

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 RI index for soil(AMC 2) = 89.00
 Pervious area fraction = 1.000; Impervious fraction = 0.000
 User specified values are as follows:
 TC = 17.80 min. Rain intensity = 2.60 (In/Hr)
 Total area = 12.80 (Ac.) Total runoff = 29.50 (CFS)

+++++

++++ Process from Point/Station 2611.000 to Point/Station
 261.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 12.800 (Ac.)
 Runoff from this stream = 29.500 (CFS)
 Time of concentration = 17.80 min.
 Rainfall intensity = 2.598 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
| 1 | 78.675 | 13.99 | 2.917 |
| 2 | 29.500 | 17.80 | 2.598 |

Largest stream flow has longer or shorter time of concentration
 $Q_p = 78.675 + \text{sum of } \frac{Q_a \cdot T_b}{T_a}$
 $Q_p = 29.500 * 0.786 = 23.178$
 $Q_p = 101.853$

Total of 2 streams to confluence:
 Flow rates before confluence point:
 78.675 29.500
 Area of streams before confluence:
 28.700 12.800
 Results of confluence:
 Total flow rate = 101.853 (CFS)
 Time of concentration = 13.985 min.
 Effective stream area after confluence = 41.500 (Ac.)

+++++

++++ Process from Point/Station 261.000 to Point/Station
 260.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1320.000 (Ft.)
 End of natural channel elevation = 1272.000 (Ft.)
 Length of natural channel = 631.000 (Ft.)
 Estimated mean flow rate at midpoint of channel = 105.043 (CFS)

Natural mountain channel type used

L.A. County flood control district formula for channel velocity:
Velocity = 5.48(q^{.33})(slope^{.492})
Velocity using mean channel flow = 7.17(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0761
Corrected/adjusted channel slope = 0.0761
Travel time = 1.47 min. TC = 15.45 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.850
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.781(In/Hr) for a 100.0 year storm
Subarea runoff = 6.143(CFS) for 2.600(Ac.)
Total runoff = 107.996(CFS) Total area = 44.100(Ac.)

++++
Process from Point/Station 261.000 to Point/Station
260.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 44.100(Ac.)
Runoff from this stream = 107.996(CFS)
Time of concentration = 15.45 min.
Rainfall intensity = 2.781(In/Hr)

++++
Process from Point/Station 250.000 to Point/Station
260.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Rainfall intensity = 2.483(In/Hr) for a 100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.844
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
User specified values are as follows:
TC = 19.57 min. Rain intensity = 2.48(In/Hr)
Total area = 79.50(Ac.) Total runoff = 195.30(CFS)

++++

++++
 Process from Point/Station 250.000 to Point/Station
 260.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 79.500 (Ac.)
 Runoff from this stream = 195.300 (CFS)
 Time of concentration = 19.57 min.
 Rainfall intensity = 2.483 (In/Hr)
 Summary of stream data:

| Stream No. | Flow rate (CFS) | TC (min) | Rainfall Intensity (In/Hr) |
|------------|-----------------|----------|----------------------------|
|------------|-----------------|----------|----------------------------|

| | | | |
|---|---------|-------|-------|
| 1 | 107.996 | 15.45 | 2.781 |
| 2 | 195.300 | 19.57 | 2.483 |

Largest stream flow has longer time of concentration

Qp = 195.300 + sum of

$$Qb \quad Ia/Ib$$

$$107.996 * 0.893 = 96.419$$
 Qp = 291.719

Total of 2 streams to confluence:
 Flow rates before confluence point:
 107.996 195.300

Area of streams before confluence:
 44.100 79.500

Results of confluence:
 Total flow rate = 291.719 (CFS)
 Time of concentration = 19.570 min.
 Effective stream area after confluence = 123.600 (Ac.)

++++
 Process from Point/Station 260.000 to Point/Station
 270.000
 **** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1272.000 (Ft.)
 End of natural channel elevation = 1268.000 (Ft.)
 Length of natural channel = 346.000 (Ft.)
 Estimated mean flow rate at midpoint of channel = 294.197 (CFS)

Natural mountain channel type used
 L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^{.33}) (slope^{.492})
 Velocity using mean channel flow = 3.98 (Ft/s)

Correction to map slope used on extremely rugged channels with
 drops and waterfalls (Plate D-6.2)
 Normal channel slope = 0.0116
 Corrected/adjusted channel slope = 0.0116
 Travel time = 1.45 min. TC = 21.02 min.

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.399(In/Hr) for a 100.0 year storm
Subarea runoff = 4.243(CFS) for 2.100(Ac.)
Total runoff = 295.961(CFS) Total area = 125.700(Ac.)
End of computations, total study area = 125.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 89.0

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.851
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 8.266(CFS)
Total initial stream area = 3.400(Ac.)
Pervious area fraction = 1.000

++++
++++
Process from Point/Station 320.000 to Point/Station
330.000
***** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION *****

Top of natural channel elevation = 1217.000(Ft.)
End of natural channel elevation = 1212.000(Ft.)
Length of natural channel = 225.000(Ft.)
Estimated mean flow rate at midpoint of channel = 9.482(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
Velocity = $5.48(q^{.33})(\text{slope}^{.492})$
Velocity using mean channel flow = 1.77(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0222
Corrected/adjusted channel slope = 0.0222
Travel time = 2.12 min. TC = 16.72 min.

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 2.677(In/Hr) for a 100.0 year storm
Subarea runoff = 2.270(CFS) for 1.000(Ac.)
Total runoff = 10.536(CFS) Total area = 4.400(Ac.)
End of computations, total study area = 4.40 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(A_p) = 1.000
Area averaged RI index number = 89.0

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.853
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 2.775(CFS)
Total initial stream area = 1.100(Ac.)
Pervious area fraction = 1.000
End of computations, total study area = 1.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 89.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2001 Version

6.4

Rational Hydrology Study

Date: 01/07/09

File:105588PROPOSEDE.out

100 - YEAR "HYDROLOGY STUDY"
105.588 "TRACT 34760"
PROPOSED AREA "E"
ARMSTRONG & BROOKS CONSULTING ENGINEERS

***** Hydrology Study Control Information *****

English (in-lb) Units used in input data file

Armstrong & Brooks Consulting Engineers - S/N 785

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [Corona] area used.

10 year storm 10 minute intensity = 2.220 (In/Hr)

10 year storm 60 minute intensity = 0.940 (In/Hr)

100 year storm 10 minute intensity = 3.430 (In/Hr)

100 year storm 60 minute intensity = 1.450 (In/Hr)

Storm event year = 100.0

Calculated rainfall intensity data:

1 hour intensity = 1.450 (In/Hr)

Slope of intensity duration curve = 0.4800

++++

Process from Point/Station 810.000 to Point/Station

820.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 321.000 (Ft.)

Top (of initial area) elevation = 1273.000 (Ft.)

Bottom (of initial area) elevation = 1270.000 (Ft.)

Difference in elevation = 3.000 (Ft.)

Slope = 0.00935 s(percent) = 0.93

TC = $k(0.530) * [(length^3) / (elevation\ change)]^{0.2}$

Initial area time of concentration = 13.575 min.

Rainfall intensity = 2.959 (In/Hr) for a 100.0 year storm

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 89.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 2.669(CFS)
Total initial stream area = 0.700(Ac.)
Pervious area fraction = 1.000
End of computations, total study area = 0.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 89.0

**PROPOSED AREA "A" (OFFSITES)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 184-183 | 9.3 | 10.57 | 26.6 | 26.6 | INITIAL AREA |
| 1822-1821 | 2.9 | 7.86 | 9.6 | 9.6 | INITIAL AREA |
| 1821-182 | 12.2 | 10.91 | - | 34.9 | CONFLUENCE |
| 181-180 | 0.9 | 11.76 | 2.4 | 37.3 | SUB-AREA ADDITION |
| 160-170 | 277.7 | 16.5 | - | 701.7 | USER DEFINED |
| 170-180 | 1.4 | 16.89 | 3.2 | 704.9 | SUB-AREA ADDITION |
| 170-180 | 292.2 | 16.89 | - | 736.2 | CONFLUENCE |
| 180-190 | 11.2 | 18.51 | 24.1 | 760.3 | SUB-AREA ADDITION |
| 191-190 | 22.1 | 13.77 | - | 61.1 | USER DEFINED |
| 191-190 | 325.5 | 18.51 | - | 813.4 | CONFLUENCE |

**AREA "A" (PROP. CONDITIONS + OFFSITES)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 610-620 | 2.5 | 9.09 | 7.5 | 7.5 | INITIAL AREA |
| 620-630 | 5.4 | 10.63 | 8.1 | 15.6 | SUB-AREA ADDITION |
| 642-641 | 1.7 | 12.53 | 4.4 | 4.4 | INITIAL AREA |
| 6412-6411 | 0.4 | 19.96 | 0.8 | 0.8 | INITIAL AREA |
| 6411-641 | 2.1 | 12.53 | - | 4.9 | CONFLUENCE |
| 641-640 | 7.5 | 10.65 | - | 19.7 | CONFLUENCE |
| 652-651 | 0.4 | 11.82 | 1.1 | 1.1 | INITIAL AREA |
| 654-653 | 2.1 | 12.95 | 5.3 | 5.3 | INITIAL AREA |
| 653-650 | 10.0 | 10.97 | - | 25.2 | CONFLUENCE |
| 664-663 | 0.5 | 10.50 | 1.4 | 1.4 | INITIAL AREA |
| 663-662 | 4.9 | 14.82 | 10.3 | 11.7 | SUB-AREA ADDITION |
| 6614-6613 | 0.9 | 7.80 | 2.9 | 2.9 | INITIAL AREA |
| 6612-6611 | 1.0 | 12.14 | 2.6 | 5.5 | SUB-AREA ADDITION |
| 6615-6611 | 0.4 | 12.14 | 1.1 | 6.6 | SUB-AREA ADDITION |
| 6611-661 | 7.2 | 14.89 | - | 17.8 | CONFLUENCE |
| 661-660 | 17.2 | 11.04 | - | 38.2 | CONFLUENCE |
| 6706-670 | 0.6 | 11.25 | 1.7 | 39.9 | SUB-AREA ADDITION |
| 673-672 | 1.2 | 15.70 | 2.7 | 2.7 | INITIAL AREA |
| 672-671 | 2.4 | 16.69 | 5.3 | 8.0 | SUB-AREA ADDITION |
| 671-670 | 1.1 | 18.14 | 2.3 | 10.3 | SUB-AREA ADDITION |
| 6703-6702 | 0.5 | 13.08 | 1.3 | 1.3 | INITIAL AREA |
| 6704-6702 | 1.8 | 10.85 | 5 | 5.0 | INITIAL AREA |
| 6704-6702 | 2.3 | 10.85 | - | 6.0 | CONFLUENCE |
| 6702-6701 | 0.5 | 11.77 | 1.3 | 7.3 | SUB-AREA ADDITION |
| 6705-6701 | 3.4 | 15.36 | 7.8 | 7.8 | INITIAL AREA |
| 6705-6701 | 6.2 | 15.36 | - | 14.3 | CONFLUENCE |
| 6701-670 | 28.7 | 11.25 | - | 56.7 | CONFLUENCE |
| 680-190 | - | 11.80 | - | 56.7 | - |

**PROPOSED AREA "B" (OFFSITES)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 266-265 | 7.5 | 9.23 | - | 23.0 | USER DEFINED |
| 265-264 | 14.2 | 12.06 | 38.1 | 61.0 | SUB-AREA ADDITION |
| 264-263 | 1.8 | 13.66 | 4.5 | 65.6 | SUB-AREA ADDITION |
| 2621-262 | 4.4 | 10.02 | 12.9 | 12.9 | INITIAL AREA |
| 2621-262 | 27.9 | 13.70 | - | 76.7 | CONFLUENCE |
| 267-261 | 0.8 | 13.99 | 2.0 | 78.7 | SUB-AREA ADDITION |
| 2611-261 | 12.8 | 17.80 | - | 29.5 | USER DEFINED |
| 2611-261 | 41.5 | 17.80 | - | 101.9 | CONFLUENCE |
| 261-260 | 2.6 | 15.45 | 6.1 | 108.0 | SUB-AREA ADDITION |
| 250-260 | 79.5 | 19.57 | - | 195.3 | USER DEFINED |
| 250-260 | 123.6 | 19.57 | - | 291.7 | CONFLUENCE |
| 260-270 | 2.1 | 21.02 | 4.2 | 296.0 | SUB-AREA ADDITION |

**AREA "B" (PROP. CONDITIONS + OFFSITES)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 284-283 | 5.7 | 17.95 | 12.1 | 12.1 | INITIAL AREA |
| 2824-2823 | 1.5 | 29.59 | 2.4 | 2.4 | INITIAL AREA |
| 2822-2821 | 4.3 | 20.08 | 8.6 | 8.6 | INITIAL AREA |
| 2822-2821 | 5.8 | 20.08 | - | 10.3 | CONFLUENCE |
| 2821-282 | 11.5 | 18.35 | - | 21.5 | CONFLUENCE |
| 293-292 | 2.5 | 19.19 | 5.1 | 5.1 | INITIAL AREA |
| 2912-2911 | 1.0 | 7.98 | 3.4 | 3.4 | INITIAL AREA |
| 2911-291 | 3.5 | 19.21 | - | 7.4 | CONFLUENCE |
| 2903-2902 | 1.0 | 16.29 | 2.2 | 2.2 | INITIAL AREA |
| 2902-2901 | 2.0 | 17.50 | 4.3 | 6.5 | SUB-AREA ADDITION |
| 2901-290 | 6.5 | 19.28 | - | 13.6 | CONFLUENCE |
| 290-281 | 18.0 | 18.80 | - | 34.6 | CONFLUENCE |
| 2811-281 | 0.8 | 18.80 | 1.7 | 36.3 | SUB-AREA ADDITION |
| 274-2632 | 33.3 | 12.68 | - | 91.0 | USER DEFINED |
| 2632-2631 | 19.5 | 13.78 | 23.8 | 114.8 | SUB-AREA ADDITION |
| 2631-280 | 61.6 | 14.90 | - | 143.5 | CONFLUENCE |
| 280-270 | 2.2 | 15.98 | 5.1 | 148.6 | SUB-AREA ADDITION |
| 260-270 | 125.7 | 21.02 | - | 296.0 | USER DEFINED |
| 260-270 | 189.5 | 21.02 | - | 426.2 | CONFLUENCE |

**AREA "C" (PROPOSED CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-------------------|
| 310-320 | 3.4 | 14.61 | 8.3 | 8.3 | INITIAL AREA |
| 320-330 | 1.0 | 16.72 | 2.3 | 10.5 | SUB-AREA ADDITION |

**AREA "D" (PROPOSED CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-----------------|
| 710-720 | 0.7 | 5.96 | 2.7 | 2.7 | INITIAL AREA |

**AREA "E" (PROPOSED CONDITIONS)
100-YEAR RATIONAL CALCULATION TABLE**

| NODES | AREA (AC.) | TC(MIN) | Q100(SUB-AREA) | Q100(TOTAL) | COMMENTS |
|--------------|-------------------|----------------|-----------------------|--------------------|-----------------|
| 810-820 | 1.1 | 13.58 | 2.8 | 2.8 | INITIAL AREA |

| | | | | | |
|---------|-------|-------|---|-------|--------------|
| 180-190 | 325.5 | 18.51 | - | 813.4 | USER DEFINED |
| 180-190 | 354.2 | 18.51 | - | 859.1 | CONFLUENCE |

Appendix “C”

Cross Section

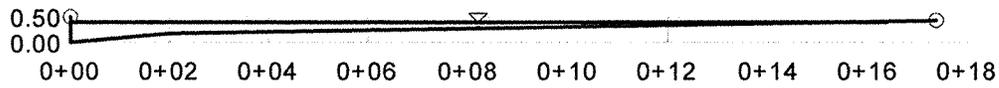
Cross Section for Gutter Section

Project Description

| | |
|-----------|----------------|
| Worksheet | "D" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

Section Data

| | |
|----------------------|----------------|
| Slope | 0.015000 ft/ft |
| Discharge | 11.70 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Spread | 16.39 ft |
| Mannings Coefficient | 0.013 |



V:1
H:1
NTS

Worksheet

Worksheet for Curb Inlet On Grade

| | |
|---------------------|---------------------|
| Project Description | |
| Worksheet | CB#10 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

| | |
|------------------------|----------------|
| Input Data | |
| Discharge | 5.90 cfs |
| Slope | 0.056000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 21.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

| | |
|---------------------------|---------------------|
| Results | |
| Efficiency | 0.86 |
| Intercepted Flow | 5.05 cfs |
| Bypass Flow | 0.85 cfs |
| Spread | 8.93 ft |
| Depth | 0.29 ft |
| Flow Area | 0.8 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 7.25 ft/s |
| Equivalent Cross Slope | 0.083870 ft/ft |
| Length Factor | 0.66 |
| Total Interception Length | 31.90 ft |

Worksheet

Worksheet for Curb Inlet On Grade

Project Description

| | |
|-----------|---------------------|
| Worksheet | CB#9 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

Input Data

| | |
|------------------------|----------------|
| Discharge | 8.20 cfs |
| Slope | 0.056000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 21.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

Results

| | |
|---------------------------|---------------------|
| Efficiency | 0.75 |
| Intercepted Flow | 6.17 cfs |
| Bypass Flow | 2.03 cfs |
| Spread | 10.50 ft |
| Depth | 0.31 ft |
| Flow Area | 1.1 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 7.65 ft/s |
| Equivalent Cross Slope | 0.075712 ft/ft |
| Length Factor | 0.54 |
| Total Interception Length | 38.95 ft |

Worksheet

Worksheet for Curb Inlet In Sag

Project Description

| | |
|-----------|-------------------|
| Worksheet | CB#8 |
| Type | Curb Inlet In Sag |
| Solve For | Spread |

Input Data

| | |
|------------------------|----------------|
| Discharge | 8.60 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Curb Opening Length | 14.00 ft |
| Opening Height | 0.50 ft |
| Curb Throat Type | Inclined |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |
| Throat Incline Angle | 90.00 degrees |

Results

| | |
|-------------------|---------|
| Spread | 2.47 ft |
| Depth | 0.35 ft |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |

Worksheet

Worksheet for Curb Inlet In Sag

Project Description

| | |
|-----------|-------------------|
| Worksheet | CB#7 |
| Type | Curb Inlet In Sag |
| Solve For | Spread |

Input Data

| | |
|------------------------|----------------|
| Discharge | 12.10 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Curb Opening Length | 14.00 ft |
| Opening Height | 0.50 ft |
| Curb Throat Type | Inclined |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |
| Throat Incline Angle | 90.00 degrees |

Results

| | |
|-------------------|---------|
| Spread | 7.86 ft |
| Depth | 0.44 ft |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |

Worksheet

Worksheet for Curb Inlet On Grade

Project Description

| | |
|-----------|---------------------|
| Worksheet | CB#6 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

Input Data

| | |
|------------------------|----------------|
| Discharge | 1.10 cfs |
| Slope | 0.015000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 7.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

Results

| | |
|---------------------------|---------------------|
| Efficiency | 0.93 |
| Intercepted Flow | 1.03 cfs |
| Bypass Flow | 0.07 cfs |
| Spread | 4.69 ft |
| Depth | 0.22 ft |
| Flow Area | 0.3 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 3.40 ft/s |
| Equivalent Cross Slope | 0.110304 ft/ft |
| Length Factor | 0.78 |
| Total Interception Length | 9.00 ft |

Worksheet Worksheet for Curb Inlet On Grade

Project Description

| | |
|-----------|---------------------|
| Worksheet | CB#5 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

Input Data

| | |
|------------------------|----------------|
| Discharge | 11.70 cfs |
| Slope | 0.015000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 21.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

Results

| | |
|---------------------------|---------------------|
| Efficiency | 0.78 |
| Intercepted Flow | 9.16 cfs |
| Bypass Flow | 2.54 cfs |
| Spread | 16.39 ft |
| Depth | 0.41 ft |
| Flow Area | 2.4 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 4.84 ft/s |
| Equivalent Cross Slope | 0.055488 ft/ft |
| Length Factor | 0.57 |
| Total Interception Length | 36.71 ft |

Worksheet

Worksheet for Curb Inlet On Grade

Project Description

| | |
|-----------|---------------------|
| Worksheet | CB#4 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

Input Data

| | |
|------------------------|----------------|
| Discharge | 5.30 cfs |
| Slope | 0.029000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 14.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

Results

| | |
|---------------------------|---------------------|
| Efficiency | 0.75 |
| Intercepted Flow | 3.97 cfs |
| Bypass Flow | 1.33 cfs |
| Spread | 9.97 ft |
| Depth | 0.31 ft |
| Flow Area | 1.0 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 5.40 ft/s |
| Equivalent Cross Slope | 0.078296 ft/ft |
| Length Factor | 0.54 |
| Total Interception Length | 26.09 ft |

Worksheet Worksheet for Curb Inlet On Grade

Project Description

| | |
|-----------|---------------------|
| Worksheet | CB#3 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

Input Data

| | |
|------------------------|----------------|
| Discharge | 8.70 cfs |
| Slope | 0.029000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 21.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

Results

| | |
|---------------------------|---------------------|
| Efficiency | 0.80 |
| Intercepted Flow | 7.00 cfs |
| Bypass Flow | 1.70 cfs |
| Spread | 12.54 ft |
| Depth | 0.35 ft |
| Flow Area | 1.5 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 5.91 ft/s |
| Equivalent Cross Slope | 0.067069 ft/ft |
| Length Factor | 0.60 |
| Total Interception Length | 35.25 ft |

Worksheet

Worksheet for Curb Inlet On Grade

| | |
|---------------------|---------------------|
| Project Description | |
| Worksheet | CB#2 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

| | |
|------------------------|----------------|
| Input Data | |
| Discharge | 4.40 cfs |
| Slope | 0.040000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 14.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

| | |
|---------------------------|---------------------|
| Results | |
| Efficiency | 0.77 |
| Intercepted Flow | 3.40 cfs |
| Bypass Flow | 1.00 cfs |
| Spread | 8.37 ft |
| Depth | 0.28 ft |
| Flow Area | 0.7 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 6.02 ft/s |
| Equivalent Cross Slope | 0.087136 ft/ft |
| Length Factor | 0.56 |
| Total Interception Length | 24.92 ft |

Worksheet Worksheet for Curb Inlet On Grade

Project Description

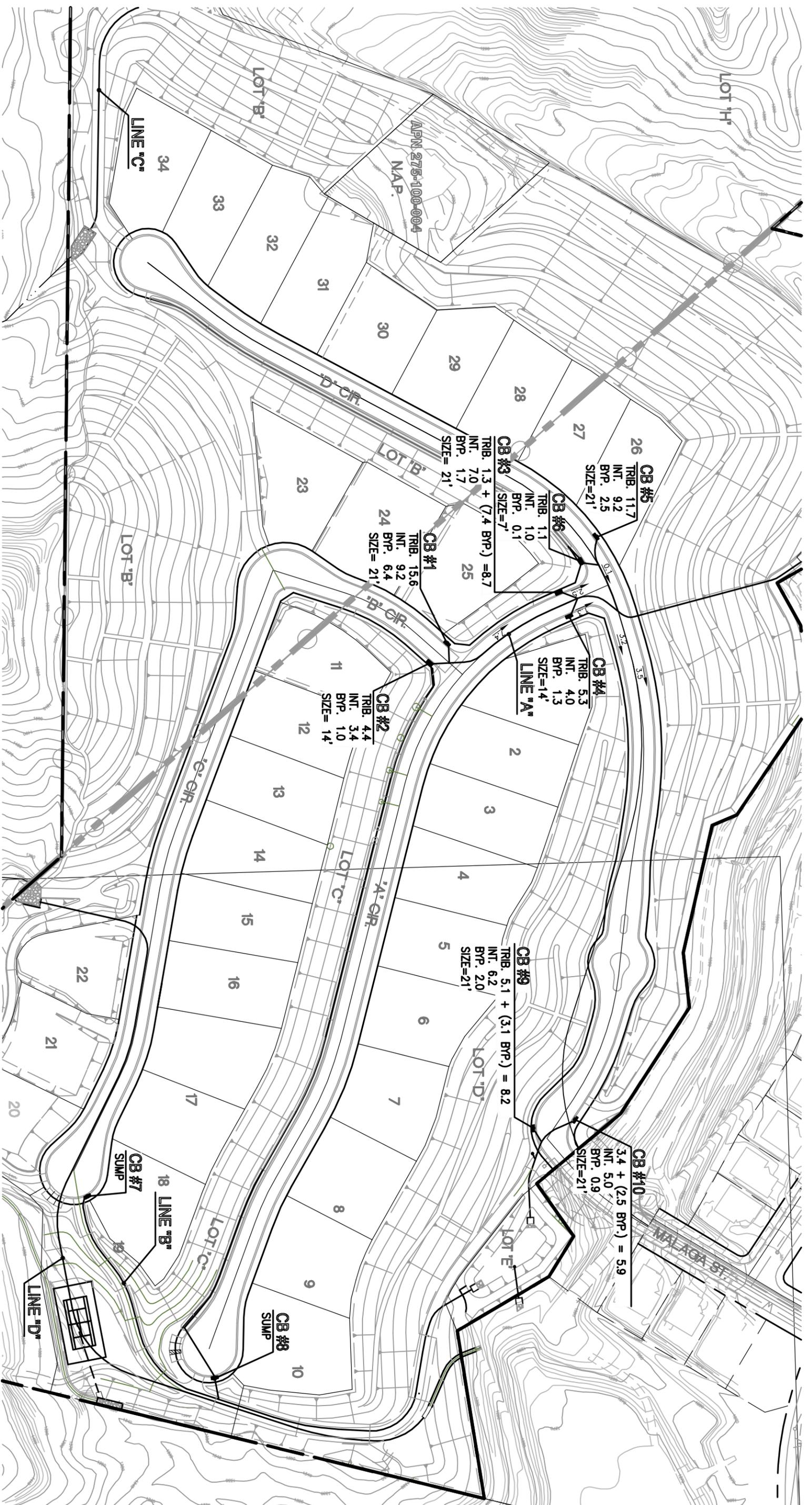
| | |
|-----------|---------------------|
| Worksheet | CB#1 |
| Type | Curb Inlet On Grade |
| Solve For | Efficiency |

Input Data

| | |
|------------------------|----------------|
| Discharge | 15.60 cfs |
| Slope | 0.040000 ft/ft |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |
| Curb Opening Length | 21.00 ft |
| Local Depression | 2.0 in |
| Local Depression Width | 3.00 ft |

Results

| | |
|---------------------------|---------------------|
| Efficiency | 0.59 |
| Intercepted Flow | 9.22 cfs |
| Bypass Flow | 6.38 cfs |
| Spread | 15.06 ft |
| Depth | 0.39 ft |
| Flow Area | 2.1 ft ² |
| Gutter Depression | 1.6 in |
| Total Depression | 3.6 in |
| Velocity | 7.56 ft/s |
| Equivalent Cross Slope | 0.058931 ft/ft |
| Length Factor | 0.39 |
| Total Interception Length | 53.62 ft |



ABBREVIATIONS

- PROP. PROPOSED
- PL PROPERTY LINE
- EXIST. EXISTING
- FG FINISHED GRADE
- INT. INTERCEPTED
- TRIB. TRIBUTARY
- BYP. BYPASS

- PROP. PROPOSED
- PL PROPERTY LINE
- EXIST. EXISTING
- FG FINISHED GRADE
- INT. INTERCEPTED
- TRIB. TRIBUTARY
- BYP. BYPASS



1" = 150'

ARMSTRONG & BROOKS CONSULTING ENGINEERS
 PLANNING, INFRASTRUCTURE, STRATEGIC CONSULTING, WATER RESOURCES
 1800 CONVENT ROAD, SUITE 300, CORONA, CA 92620
 P: 951-571-4400 F: 951-571-4400

CITY OF CORONA

CATCH BASIN EXHIBIT

TRACT 34760

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Worksheet

Worksheet for Gutter Section

Project Description

| | |
|-----------|----------------|
| Worksheet | "C" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

Input Data

| | |
|----------------------|----------------|
| Slope | 0.006000 ft/ft |
| Discharge | 12.10 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |

Results

| | |
|-------------------|---------------------|
| Spread | 20.03 ft |
| Flow Area | 3.5 ft ² |
| Depth | 0.48 ft |
| Gutter Depression | 1.6 in |
| Velocity | 3.41 ft/s |

Cross Section Cross Section for Gutter Section

| Project Description | |
|---------------------|----------------|
| Worksheet | "C" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

| Section Data | |
|----------------------|----------------|
| Slope | 0.006000 ft/ft |
| Discharge | 12.10 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Spread | 20.03 ft |
| Mannings Coefficient | 0.013 |



V:1
H:1
NTS

Worksheet

Worksheet for Gutter Section

Project Description

| | |
|-----------|----------------|
| Worksheet | "B" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

Input Data

| | |
|----------------------|----------------|
| Slope | 0.040000 ft/ft |
| Discharge | 15.60 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |

Results

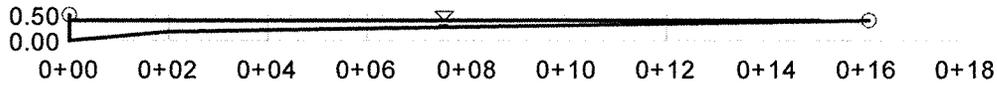
| | |
|-------------------|---------------------|
| Spread | 15.06 ft |
| Flow Area | 2.1 ft ² |
| Depth | 0.39 ft |
| Gutter Depression | 1.6 in |
| Velocity | 7.56 ft/s |

Cross Section

Cross Section for Gutter Section

| Project Description | |
|---------------------|----------------|
| Worksheet | "B" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

| Section Data | |
|----------------------|----------------|
| Slope | 0.040000 ft/ft |
| Discharge | 15.60 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Spread | 15.06 ft |
| Mannings Coefficient | 0.013 |



V:1
H:1
NTS

Worksheet

Worksheet for Gutter Section

Project Description

| | |
|-----------|----------------|
| Worksheet | "A" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

Input Data

| | |
|----------------------|----------------|
| Slope | 0.006000 ft/ft |
| Discharge | 8.60 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |

Results

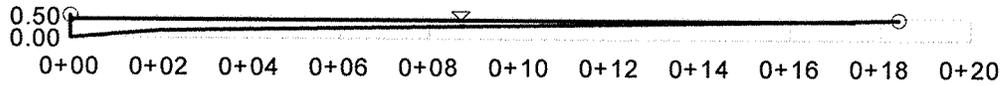
| | |
|-------------------|---------------------|
| Spread | 17.44 ft |
| Flow Area | 2.7 ft ² |
| Depth | 0.43 ft |
| Gutter Depression | 1.6 in |
| Velocity | 3.16 ft/s |

Cross Section

Cross Section for Gutter Section

| Project Description | |
|---------------------|----------------|
| Worksheet | "A" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

| Section Data | |
|----------------------|----------------|
| Slope | 0.006000 ft/ft |
| Discharge | 8.60 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Spread | 17.44 ft |
| Mannings Coefficient | 0.013 |



V:1
H:1
NTS

Worksheet

Worksheet for Rectangular Channel

Project Description

| | |
|--------------|-----------------------------------|
| Worksheet | 3'x3' REINFORCED CONCRETE CHANNEL |
| Flow Element | Rectangular Channel |
| Method | Manning's Formula |
| Solve For | Channel Depth |

Input Data

| | |
|----------------------|----------------|
| Mannings Coefficient | 0.013 |
| Slope | 0.085000 ft/ft |
| Bottom Width | 3.00 ft |
| Discharge | 131.20 cfs |

Results

| | |
|------------------|---------------------|
| Depth | 1.57 ft |
| Flow Area | 4.7 ft ² |
| Wetted Perimeter | 6.13 ft |
| Top Width | 3.00 ft |
| Critical Depth | 3.90 ft |
| Critical Slope | 0.008636 ft/ft |
| Velocity | 27.91 ft/s |
| Velocity Head | 12.10 ft |
| Specific Energy | 13.67 ft |
| Froude Number | 3.93 |
| Flow Type | Supercritical |

Cross Section

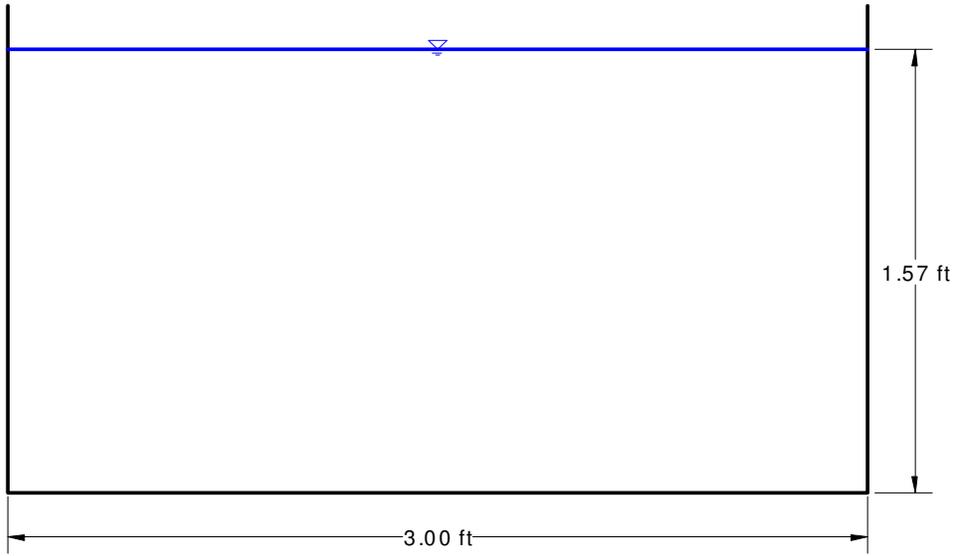
Cross Section for Rectangular Channel

Project Description

| | |
|--------------|-----------------------------------|
| Worksheet | 3'x3' REINFORCED CONCRETE CHANNEL |
| Flow Element | Rectangular Channel |
| Method | Manning's Formula |
| Solve For | Channel Depth |

Section Data

| | |
|----------------------|----------------|
| Mannings Coefficient | 0.013 |
| Slope | 0.085000 ft/ft |
| Depth | 1.57 ft |
| Bottom Width | 3.00 ft |
| Discharge | 131.20 cfs |



V:1
H:1
NTS

Worksheet

Worksheet for Gutter Section

Project Description

| | |
|-----------|----------------|
| Worksheet | "D" CIRCLE |
| Type | Gutter Section |
| Solve For | Spread |

Input Data

| | |
|----------------------|----------------|
| Slope | 0.015000 ft/ft |
| Discharge | 11.70 cfs |
| Gutter Width | 2.00 ft |
| Gutter Cross Slope | 0.085000 ft/ft |
| Road Cross Slope | 0.017000 ft/ft |
| Mannings Coefficient | 0.013 |

Results

| | |
|-------------------|---------------------|
| Spread | 16.39 ft |
| Flow Area | 2.4 ft ² |
| Depth | 0.41 ft |
| Gutter Depression | 1.6 in |
| Velocity | 4.84 ft/s |

Appendix “D”

100 - YEAR HYDRAULIC ANALYSIS
105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
100.000 | 1237.000 | 1.097 | 1238.097 | 34.50 | 19.54 | 5.93 | 1244.03 | .05 | 1.92 | 1.99 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
11.739 | .0578 | | | | | | .0694 | .81 | 1.14 | 3.66 | 1.16 | .013 | .00 | .00 | PIPE
111.739 | 1237.679 | 1.086 | 1238.765 | 34.50 | 19.78 | 6.08 | 1244.84 | .05 | 1.92 | 1.99 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
32.618 | .0578 | | | | | | .0752 | 2.45 | 1.13 | 3.73 | 1.16 | .013 | .00 | .00 | PIPE
144.357 | 1239.564 | 1.046 | 1240.610 | 34.50 | 20.75 | 6.68 | 1247.29 | .05 | 1.92 | 2.00 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
22.868 | .0578 | | | | | | .0853 | 1.95 | 1.10 | 4.01 | 1.16 | .013 | .00 | .00 | PIPE
167.225 | 1240.886 | 1.007 | 1241.893 | 34.50 | 21.76 | 7.35 | 1249.24 | .06 | 1.92 | 2.00 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
17.877 | .0578 | | | | | | .0969 | 1.73 | 1.07 | 4.31 | 1.16 | .013 | .00 | .00 | PIPE
185.102 | 1241.919 | .970 | 1242.889 | 34.50 | 22.82 | 8.09 | 1250.98 | .07 | 1.92 | 2.00 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
14.807 | .0578 | | | | | | .1100 | 1.63 | 1.04 | 4.62 | 1.16 | .013 | .00 | .00 | PIPE
199.909 | 1242.775 | .935 | 1243.710 | 34.50 | 23.93 | 8.89 | 1252.60 | .07 | 1.92 | 2.00 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
12.711 | .0578 | | | | | | .1251 | 1.59 | 1.01 | 4.96 | 1.16 | .013 | .00 | .00 | PIPE
212.620 | 1243.510 | .901 | 1244.411 | 34.50 | 25.10 | 9.78 | 1254.20 | .08 | 1.92 | 1.99 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
11.199 | .0578 | | | | | | .1423 | 1.59 | .98 | 5.32 | 1.16 | .013 | .00 | .00 | PIPE
223.819 | 1244.157 | .869 | 1245.026 | 34.50 | 26.33 | 10.76 | 1255.79 | .09 | 1.92 | 1.98 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
10.034 | .0578 | | | | | | .1620 | 1.63 | .96 | 5.71 | 1.16 | .013 | .00 | .00 | PIPE
233.853 | 1244.737 | .838 | 1245.575 | 34.50 | 27.61 | 11.84 | 1257.41 | .09 | 1.92 | 1.97 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
9.116 | .0578 | | | | | | .1845 | 1.68 | .93 | 6.12 | 1.16 | .013 | .00 | .00 | PIPE
*****

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100 - YEAR HYDRAULIC ANALYSIS
 105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|------------|-------|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** |
| 242.969 | 1245.264 | .809 | 1246.073 | 34.50 | 28.96 | 13.02 | 1259.10 | .10 | 1.92 | 1.96 | 2.000 | .000 | .00 | 1 | .0 |
| 8.358 | .0578 | | | | | .2101 | 1.76 | .91 | 6.55 | 1.16 | .013 | .00 | .00 | PIPE | |
| 251.327 | 1245.747 | .780 | 1246.527 | 34.50 | 30.37 | 14.32 | 1260.85 | .11 | 1.92 | 1.95 | 2.000 | .000 | .00 | 1 | .0 |
| 7.738 | .0578 | | | | | .2394 | 1.85 | .89 | 7.02 | 1.16 | .013 | .00 | .00 | PIPE | |
| 259.065 | 1246.195 | .753 | 1246.948 | 34.50 | 31.86 | 15.76 | 1262.70 | .12 | 1.92 | 1.94 | 2.000 | .000 | .00 | 1 | .0 |
| 7.200 | .0578 | | | | | .2730 | 1.97 | .88 | 7.51 | 1.16 | .013 | .00 | .00 | PIPE | |
| 266.265 | 1246.611 | .727 | 1247.338 | 34.50 | 33.41 | 17.33 | 1264.67 | .13 | 1.92 | 1.92 | 2.000 | .000 | .00 | 1 | .0 |
| 6.735 | .0578 | | | | | .3115 | 2.10 | .86 | 8.04 | 1.16 | .013 | .00 | .00 | PIPE | |
| 273.000 | 1247.000 | .702 | 1247.702 | 34.50 | 35.04 | 19.07 | 1266.77 | .28 | 1.92 | 1.91 | 2.000 | .000 | .00 | 1 | .0 |
| 91.628 | .3320 | | | | | .3320 | 30.42 | .98 | 8.60 | .70 | .013 | .00 | .00 | PIPE | |
| 364.628 | 1277.420 | .702 | 1278.123 | 34.50 | 35.04 | 19.07 | 1297.19 | .28 | 1.92 | 1.91 | 2.000 | .000 | .00 | 1 | .0 |
| 83.318 | .3320 | | | | | .3115 | 25.95 | .98 | 8.60 | .70 | .013 | .00 | .00 | PIPE | |
| 447.945 | 1305.082 | .727 | 1305.809 | 34.50 | 33.41 | 17.33 | 1323.14 | .26 | 1.92 | 1.92 | 2.000 | .000 | .00 | 1 | .0 |
| 26.304 | .3320 | | | | | .2731 | 7.18 | .98 | 8.04 | .70 | .013 | .00 | .00 | PIPE | |
| 474.249 | 1313.815 | .753 | 1314.568 | 34.50 | 31.86 | 15.76 | 1330.33 | .23 | 1.92 | 1.94 | 2.000 | .000 | .00 | 1 | .0 |
| 15.193 | .3320 | | | | | .2395 | 3.64 | .99 | 7.51 | .70 | .013 | .00 | .00 | PIPE | |
| 489.442 | 1318.859 | .780 | 1319.639 | 34.50 | 30.37 | 14.33 | 1333.97 | .21 | 1.92 | 1.95 | 2.000 | .000 | .00 | 1 | .0 |
| 10.453 | .3320 | | | | | .2102 | 2.20 | .99 | 7.02 | .70 | .013 | .00 | .00 | PIPE | |

100 - YEAR HYDRAULIC ANALYSIS
105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
499.895 | 1322.329 | .809 | 1323.138 | 34.50 | 28.96 | 13.02 | 1336.16 | .20 | 1.92 | 1.96 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
7.831 | .3320 | | | | | .1845 | 1.44 | 1.01 | 6.55 | .70 | .013 | .00 | .00 | PIPE
507.726 | 1324.929 | .838 | 1325.767 | 34.50 | 27.61 | 11.84 | 1337.61 | .18 | 1.92 | 1.97 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
6.149 | .3320 | | | | | .1620 | 1.00 | 1.02 | 6.12 | .70 | .013 | .00 | .00 | PIPE
513.875 | 1326.970 | .869 | 1327.840 | 34.50 | 26.33 | 10.76 | 1338.60 | .16 | 1.92 | 1.98 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
4.990 | .3320 | | | | | .1423 | .71 | 1.03 | 5.71 | .70 | .013 | .00 | .00 | PIPE
518.865 | 1328.627 | .901 | 1329.528 | 34.50 | 25.10 | 9.78 | 1339.31 | .15 | 1.92 | 1.99 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
4.135 | .3320 | | | | | .1251 | .52 | 1.05 | 5.32 | .70 | .013 | .00 | .00 | PIPE
523.000 | 1330.000 | .935 | 1330.935 | 34.50 | 23.93 | 8.90 | 1339.83 | .00 | 1.92 | 2.00 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
JUNCT STR | .1250 | | | | | .1952 | .78 | 1.46 | 4.96 | | | .013 | .00 | .00 | PIPE
527.000 | 1330.500 | .628 | 1331.128 | 25.30 | 29.96 | 13.94 | 1345.06 | .76 | 1.77 | 1.86 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
3.329 | .3310 | | | | | .2703 | .90 | 1.39 | 7.83 | .60 | .013 | .00 | .00 | PIPE
530.329 | 1331.602 | .631 | 1332.233 | 25.30 | 29.72 | 13.72 | 1345.95 | .75 | 1.77 | 1.86 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
15.253 | .3310 | | | | | .2507 | 3.82 | 1.38 | 7.74 | .60 | .013 | .00 | .00 | PIPE
545.582 | 1336.650 | .653 | 1337.303 | 25.30 | 28.34 | 12.47 | 1349.78 | .69 | 1.77 | 1.88 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
9.969 | .3310 | | | | | .2197 | 2.19 | 1.34 | 7.24 | .60 | .013 | .00 | .00 | PIPE
555.551 | 1339.950 | .677 | 1340.627 | 25.30 | 27.02 | 11.34 | 1351.97 | .63 | 1.77 | 1.89 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
7.274 | .3310 | | | | | .1926 | 1.40 | 1.31 | 6.77 | .60 | .013 | .00 | .00 | PIPE

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100 - YEAR HYDRAULIC ANALYSIS
105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
562.824 | 1342.357 | .701 | 1343.058 | 25.30 | 25.76 | 10.31 | 1353.37 | .58 | 1.77 | 1.91 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
5.623 | .3310 | | | | | .1688 | .95 | 1.28 | 6.33 | .60 | .013 | .00 | .00 | PIPE
568.447 | 1344.218 | .726 | 1344.944 | 25.30 | 24.57 | 9.37 | 1354.32 | .53 | 1.77 | 1.92 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
4.513 | .3310 | | | | | .1480 | .67 | 1.26 | 5.92 | .60 | .013 | .00 | .00 | PIPE
572.960 | 1345.712 | .752 | 1346.464 | 25.30 | 23.42 | 8.52 | 1354.98 | .49 | 1.77 | 1.94 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
3.715 | .3310 | | | | | .1298 | .48 | 1.24 | 5.53 | .60 | .013 | .00 | .00 | PIPE
576.675 | 1346.942 | .779 | 1347.721 | 25.30 | 22.33 | 7.74 | 1355.47 | .45 | 1.77 | 1.95 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
3.113 | .3310 | | | | | .1138 | .35 | 1.22 | 5.16 | .60 | .013 | .00 | .00 | PIPE
579.788 | 1347.972 | .807 | 1348.779 | 25.30 | 21.29 | 7.04 | 1355.82 | .41 | 1.77 | 1.96 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
2.644 | .3310 | | | | | .0999 | .26 | 1.21 | 4.82 | .60 | .013 | .00 | .00 | PIPE
582.433 | 1348.847 | .836 | 1349.683 | 25.30 | 20.30 | 6.40 | 1356.08 | .37 | 1.77 | 1.97 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
2.264 | .3310 | | | | | .0877 | .20 | 1.21 | 4.50 | .60 | .013 | .00 | .00 | PIPE
584.697 | 1349.597 | .867 | 1350.464 | 25.30 | 19.36 | 5.82 | 1356.28 | .34 | 1.77 | 1.98 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
1.957 | .3310 | | | | | .0771 | .15 | 1.21 | 4.20 | .60 | .013 | .00 | .00 | PIPE
586.654 | 1350.245 | .899 | 1351.144 | 25.30 | 18.46 | 5.29 | 1356.43 | .31 | 1.77 | 1.99 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
1.698 | .3310 | | | | | .0678 | .12 | 1.21 | 3.92 | .60 | .013 | .00 | .00 | PIPE
588.352 | 1350.806 | .933 | 1351.740 | 25.30 | 17.60 | 4.81 | 1356.55 | .28 | 1.77 | 2.00 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
1.482 | .3310 | | | | | .0596 | .09 | 1.22 | 3.65 | .60 | .013 | .00 | .00 | PIPE

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100 - YEAR HYDRAULIC ANALYSIS
 105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|------------|-------|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** |
| 589.834 | 1351.297 | .968 | 1352.265 | 25.30 | 16.78 | 4.37 | 1356.64 | .26 | 1.77 | 2.00 | 2.000 | .000 | .00 | 1 | .0 |
| 1.294 | .3310 | | | | | .0525 | .07 | 1.23 | 3.40 | .60 | .013 | .00 | .00 | PIPE | |
| 591.128 | 1351.725 | 1.005 | 1352.730 | 25.30 | 16.00 | 3.97 | 1356.70 | .23 | 1.77 | 2.00 | 2.000 | .000 | .00 | 1 | .0 |
| 1.135 | .3310 | | | | | .0462 | .05 | 1.24 | 3.17 | .60 | .013 | .00 | .00 | PIPE | |
| 592.263 | 1352.101 | 1.043 | 1353.144 | 25.30 | 15.25 | 3.61 | 1356.76 | .21 | 1.77 | 2.00 | 2.000 | .000 | .00 | 1 | .0 |
| .990 | .3310 | | | | | .0407 | .04 | 1.26 | 2.95 | .60 | .013 | .00 | .00 | PIPE | |
| 593.253 | 1352.429 | 1.084 | 1353.513 | 25.30 | 14.54 | 3.28 | 1356.80 | .19 | 1.77 | 1.99 | 2.000 | .000 | .00 | 1 | .0 |
| .866 | .3310 | | | | | .0359 | .03 | 1.28 | 2.74 | .60 | .013 | .00 | .00 | PIPE | |
| 594.119 | 1352.715 | 1.127 | 1353.843 | 25.30 | 13.87 | 2.99 | 1356.83 | .17 | 1.77 | 1.98 | 2.000 | .000 | .00 | 1 | .0 |
| .757 | .3310 | | | | | .0317 | .02 | 1.30 | 2.55 | .60 | .013 | .00 | .00 | PIPE | |
| 594.876 | 1352.966 | 1.172 | 1354.138 | 25.30 | 13.22 | 2.71 | 1356.85 | .16 | 1.77 | 1.97 | 2.000 | .000 | .00 | 1 | .0 |
| .659 | .3310 | | | | | .0281 | .02 | 1.33 | 2.36 | .60 | .013 | .00 | .00 | PIPE | |
| 595.535 | 1353.184 | 1.219 | 1354.403 | 25.30 | 12.61 | 2.47 | 1356.87 | .14 | 1.77 | 1.95 | 2.000 | .000 | .00 | 1 | .0 |
| .566 | .3310 | | | | | .0249 | .01 | 1.36 | 2.19 | .60 | .013 | .00 | .00 | PIPE | |
| 596.102 | 1353.372 | 1.270 | 1354.642 | 25.30 | 12.02 | 2.24 | 1356.89 | .13 | 1.77 | 1.93 | 2.000 | .000 | .00 | 1 | .0 |
| .485 | .3310 | | | | | .0221 | .01 | 1.40 | 2.03 | .60 | .013 | .00 | .00 | PIPE | |
| 596.587 | 1353.532 | 1.324 | 1354.856 | 25.30 | 11.46 | 2.04 | 1356.90 | .11 | 1.77 | 1.89 | 2.000 | .000 | .00 | 1 | .0 |
| .412 | .3310 | | | | | .0196 | .01 | 1.44 | 1.87 | .60 | .013 | .00 | .00 | PIPE | |

100 - YEAR HYDRAULIC ANALYSIS
105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
596.999 | 1353.669 | 1.381 | 1355.050 | 25.30 | 10.93 | 1.85 | 1356.90 | .10 | 1.77 | 1.85 | 2.000 | .000 | .00 | 1 | .0
      | .340 | .3310 | | | | | .0175 | .01 | 1.48 | 1.72 | .60 | .013 | .00 | .00 | PIPE
597.339 | 1353.781 | 1.443 | 1355.224 | 25.30 | 10.42 | 1.69 | 1356.91 | .09 | 1.77 | 1.79 | 2.000 | .000 | .00 | 1 | .0
      | .270 | .3310 | | | | | .0156 | .00 | 1.53 | 1.58 | .60 | .013 | .00 | .00 | PIPE
597.609 | 1353.871 | 1.511 | 1355.382 | 25.30 | 9.93 | 1.53 | 1356.91 | .08 | 1.77 | 1.72 | 2.000 | .000 | .00 | 1 | .0
      | .206 | .3310 | | | | | .0141 | .00 | 1.59 | 1.44 | .60 | .013 | .00 | .00 | PIPE
597.815 | 1353.939 | 1.585 | 1355.524 | 25.30 | 9.47 | 1.39 | 1356.92 | .07 | 1.77 | 1.62 | 2.000 | .000 | .00 | 1 | .0
      | .134 | .3310 | | | | | .0127 | .00 | 1.65 | 1.30 | .60 | .013 | .00 | .00 | PIPE
597.949 | 1353.983 | 1.669 | 1355.652 | 25.30 | 9.03 | 1.27 | 1356.92 | .06 | 1.77 | 1.49 | 2.000 | .000 | .00 | 1 | .0
      | .051 | .3310 | | | | | .0117 | .00 | 1.72 | 1.16 | .60 | .013 | .00 | .00 | PIPE
598.000 | 1354.000 | 1.769 | 1355.769 | 25.30 | 8.61 | 1.15 | 1356.92 | .00 | 1.77 | 1.28 | 2.000 | .000 | .00 | 1 | .0
      | .1250 | | | | | | | | | | | | | | | |
JUNCT STR | .1250 | | | | | .0149 | .06 | 1.78 | 1.00 | | .013 | .00 | .00 | PIPE
602.000 | 1354.500 | 2.332 | 1356.832 | 14.30 | 8.09 | 1.02 | 1357.85 | .00 | 1.39 | .00 | 1.500 | .000 | .00 | 1 | .0
      | .0243 | | | | | .0185 | 2.14 | .00 | .00 | 1.08 | .013 | .00 | .00 | PIPE
717.365 | 1357.308 | 1.742 | 1359.050 | 14.30 | 8.09 | 1.02 | 1360.07 | .00 | 1.39 | .00 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | |
HYDRAULIC JUMP
717.365 | 1357.308 | 1.085 | 1358.392 | 14.30 | 10.45 | 1.70 | 1360.09 | .01 | 1.39 | 1.34 | 1.500 | .000 | .00 | 1 | .0
      | .0243 | | | | | .0256 | 1.45 | 1.10 | 1.82 | 1.08 | .013 | .00 | .00 | PIPE

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100 - YEAR HYDRAULIC ANALYSIS
 105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|------------|-------|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** |
| 773.891 | 1358.683 | 1.042 | 1359.725 | 14.30 | 10.91 | 1.85 | 1361.57 | .02 | 1.39 | 1.38 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 33.185 | .0243 | | | | | .0286 | .95 | 1.06 | 1.97 | 1.08 | .013 | .00 | .00 | PIPE | |
| 807.076 | 1359.491 | .998 | 1360.489 | 14.30 | 11.44 | 2.03 | 1362.52 | .02 | 1.39 | 1.42 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 20.924 | .0243 | | | | | .0321 | .67 | 1.02 | 2.15 | 1.08 | .013 | .00 | .00 | PIPE | |
| 828.000 | 1360.000 | .958 | 1360.958 | 14.30 | 12.00 | 2.24 | 1363.19 | .00 | 1.39 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| JUNCT STR | .1250 | | | | | .0694 | .28 | .96 | 2.33 | | .013 | .00 | .00 | PIPE | |
| 832.000 | 1360.500 | .352 | 1360.852 | 4.10 | 12.99 | 2.62 | 1363.47 | .00 | .78 | 1.27 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 2.796 | .1400 | | | | | .1017 | .28 | .35 | 4.60 | .33 | .013 | .00 | .00 | PIPE | |
| 834.796 | 1360.891 | .357 | 1361.249 | 4.10 | 12.71 | 2.51 | 1363.76 | .00 | .78 | 1.28 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 4.536 | .1400 | | | | | .0923 | .42 | .36 | 4.46 | .33 | .013 | .00 | .00 | PIPE | |
| 839.331 | 1361.526 | .369 | 1361.896 | 4.10 | 12.12 | 2.28 | 1364.18 | .00 | .78 | 1.29 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 3.282 | .1400 | | | | | .0808 | .27 | .37 | 4.18 | .33 | .013 | .00 | .00 | PIPE | |
| 842.613 | 1361.986 | .382 | 1362.368 | 4.10 | 11.56 | 2.07 | 1364.44 | .00 | .78 | 1.31 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 2.531 | .1400 | | | | | .0706 | .18 | .38 | 3.91 | .33 | .013 | .00 | .00 | PIPE | |
| 845.144 | 1362.340 | .395 | 1362.735 | 4.10 | 11.02 | 1.89 | 1364.62 | .00 | .78 | 1.32 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 2.025 | .1400 | | | | | .0618 | .13 | .40 | 3.66 | .33 | .013 | .00 | .00 | PIPE | |
| 847.169 | 1362.624 | .408 | 1363.032 | 4.10 | 10.51 | 1.71 | 1364.75 | .00 | .78 | 1.34 | 1.500 | .000 | .00 | 1 | .0 |
| | | | | | | | | | | | | | | | |
| 1.638 | .1400 | | | | | .0540 | .09 | .41 | 3.43 | .33 | .013 | .00 | .00 | PIPE | |

100 - YEAR HYDRAULIC ANALYSIS
 105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|------------|-------|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** |
| 848.808 | 1362.853 | .423 | 1363.276 | 4.10 | 10.02 | 1.56 | 1364.83 | .00 | .78 | 1.35 | 1.500 | .000 | .00 | 1 | .0 |
| 1.377 | .1400 | | | | | .0473 | .07 | .42 | 3.21 | .33 | .013 | .00 | .00 | PIPE | |
| 850.185 | 1363.046 | .437 | 1363.483 | 4.10 | 9.55 | 1.42 | 1364.90 | .00 | .78 | 1.36 | 1.500 | .000 | .00 | 1 | .0 |
| 1.144 | .1400 | | | | | .0414 | .05 | .44 | 3.00 | .33 | .013 | .00 | .00 | PIPE | |
| 851.329 | 1363.206 | .453 | 1363.659 | 4.10 | 9.11 | 1.29 | 1364.95 | .00 | .78 | 1.38 | 1.500 | .000 | .00 | 1 | .0 |
| .984 | .1400 | | | | | .0362 | .04 | .45 | 2.81 | .33 | .013 | .00 | .00 | PIPE | |
| 852.313 | 1363.344 | .468 | 1363.812 | 4.10 | 8.68 | 1.17 | 1364.98 | .00 | .78 | 1.39 | 1.500 | .000 | .00 | 1 | .0 |
| .826 | .1400 | | | | | .0317 | .03 | .47 | 2.63 | .33 | .013 | .00 | .00 | PIPE | |
| 853.139 | 1363.459 | .485 | 1363.945 | 4.10 | 8.28 | 1.06 | 1365.01 | .00 | .78 | 1.40 | 1.500 | .000 | .00 | 1 | .0 |
| .711 | .1400 | | | | | .0278 | .02 | .49 | 2.46 | .33 | .013 | .00 | .00 | PIPE | |
| 853.850 | 1363.559 | .502 | 1364.061 | 4.10 | 7.89 | .97 | 1365.03 | .00 | .78 | 1.42 | 1.500 | .000 | .00 | 1 | .0 |
| .605 | .1400 | | | | | .0244 | .01 | .50 | 2.30 | .33 | .013 | .00 | .00 | PIPE | |
| 854.455 | 1363.644 | .520 | 1364.164 | 4.10 | 7.53 | .88 | 1365.04 | .00 | .78 | 1.43 | 1.500 | .000 | .00 | 1 | .0 |
| .514 | .1400 | | | | | .0214 | .01 | .52 | 2.15 | .33 | .013 | .00 | .00 | PIPE | |
| 854.969 | 1363.716 | .539 | 1364.255 | 4.10 | 7.18 | .80 | 1365.05 | .00 | .78 | 1.44 | 1.500 | .000 | .00 | 1 | .0 |
| .443 | .1400 | | | | | .0187 | .01 | .54 | 2.01 | .33 | .013 | .00 | .00 | PIPE | |
| 855.412 | 1363.778 | .558 | 1364.336 | 4.10 | 6.84 | .73 | 1365.06 | .00 | .78 | 1.45 | 1.500 | .000 | .00 | 1 | .0 |
| .373 | .1400 | | | | | .0164 | .01 | .56 | 1.88 | .33 | .013 | .00 | .00 | PIPE | |

100 - YEAR HYDRAULIC ANALYSIS
105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
855.785 | 1363.830 | .578 | 1364.408 | 4.10 | 6.52 | .66 | 1365.07 | .00 | .78 | 1.46 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .311 | .1400 | | | | | | | | | | | | | | | |
856.096 | 1363.873 | .599 | 1364.473 | 4.10 | 6.22 | .60 | 1365.07 | .00 | .78 | 1.47 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .256 | .1400 | | | | | | | | | | | | | | | |
856.352 | 1363.909 | .621 | 1364.530 | 4.10 | 5.93 | .55 | 1365.08 | .00 | .78 | 1.48 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .215 | .1400 | | | | | | | | | | | | | | | |
856.567 | 1363.939 | .643 | 1364.582 | 4.10 | 5.66 | .50 | 1365.08 | .00 | .78 | 1.48 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .162 | .1400 | | | | | | | | | | | | | | | |
856.729 | 1363.962 | .667 | 1364.629 | 4.10 | 5.39 | .45 | 1365.08 | .00 | .78 | 1.49 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .122 | .1400 | | | | | | | | | | | | | | | |
856.851 | 1363.979 | .692 | 1364.671 | 4.10 | 5.14 | .41 | 1365.08 | .00 | .78 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .085 | .1400 | | | | | | | | | | | | | | | |
856.936 | 1363.991 | .718 | 1364.709 | 4.10 | 4.90 | .37 | 1365.08 | .00 | .78 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .052 | .1400 | | | | | | | | | | | | | | | |
856.988 | 1363.998 | .745 | 1364.743 | 4.10 | 4.67 | .34 | 1365.08 | .00 | .78 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | .012 | .1400 | | | | | | | | | | | | | | | |
857.000 | 1364.000 | .775 | 1364.775 | 4.10 | 4.45 | .31 | 1365.08 | .00 | .78 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
      | | | | | | | | | | | | | | | | |

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FILE: 105588linea.WSW
14.01

Date: 4-13-2009 Time: 1:43:49

W S P G W - EDIT LISTING - Version

WATER SURFACE PROFILE - CHANNEL DEFINITION

LISTING

PAGE 1

| CARD Y(3) | SECT Y(4) | CHN Y(5) | NO OF Y(6) | AVE Y(7) | PIER Y(8) | HEIGHT Y(9) | BASE Y(10) | ZL | ZR | INV | Y(1) | Y(2) |
|-----------|-----------|----------|------------|----------|-----------|-------------|------------|----|----|------|------|------|
| CODE | NO | TYPE | PIER/PIP | WIDTH | | DIAMETER | WIDTH | | | DROP | | |
| CD | 1 | 4 | 1 | | | 3.000 | | | | | | |
| CD | 2 | 4 | 1 | | | 2.000 | | | | | | |
| CD | 3 | 4 | 1 | | | 1.500 | | | | | | |
| CD | 5 | 4 | 1 | | | 4.000 | | | | | | |
| CD | 7 | 4 | 2 | | | 1.500 | | | | | | |
| CD | 9 | 4 | 1 | | | 6.000 | | | | | | |

W S P G W

PAGE NO 1

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

100 - YEAR HYDRAULIC ANALYSIS

HEADING LINE NO 2 IS -

105.588 "TRACT 34760" (LINE A -100% INTERCEPTION)

HEADING LINE NO 3 IS -

ARMSTRONG & BROOKS CONSULTING ENGINEERS

W S P G W

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

| ELEMENT NO | IS | A | SYSTEM | OUTLET | U/S DATA | STATION | INVERT | SECT | | | | | |
|------------|----|---|----------|----------|----------|---------|----------|------|---|---|------|-------|----|
| W S ELEV | | | | | | | | | | | | | |
| 1 | | | SYSTEM | OUTLET | | 100.000 | 1237.000 | 2 | | | | | |
| 1240.000 | | | | | | | | | | | | | |
| 2 | | | REACH | | | | | | | | | | |
| | | | U/S DATA | | | | | | | | | | |
| | | | RADIUS | ANGLE | | 273.000 | 1247.000 | 2 | | | | .013 | |
| 495.609 | | | | | | .000 | 0 | | | | | | |
| 3 | | | REACH | | | | | | | | | | |
| | | | U/S DATA | | | | | | | | | | |
| | | | RADIUS | ANGLE | | 523.000 | 1330.000 | 2 | | | | .013 | |
| 260.435 | | | | | | .000 | 0 | | | | | | |
| 4 | | | JUNCTION | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | U/S DATA | | | | | | | | | | |
| Q4 | | | INVERT-3 | INVERT-4 | PHI 3 | 527.000 | 1330.500 | 2 | 2 | 0 | .013 | 9.200 | Q3 |
| .000 | | | | | | 45.000 | .000 | | | | | | |
| | | | RADIUS | ANGLE | | | | | | | | | |
| .000 | | | | | | | | | | | | | |
| 5 | | | REACH | | | | | | | | | | |
| | | | U/S DATA | | | | | | | | | | |
| | | | RADIUS | ANGLE | | 598.000 | 1354.000 | 2 | | | | .013 | |
| 67.800 | | | | | | .000 | 0 | | | | | | |
| 6 | | | JUNCTION | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | U/S DATA | | | | | | | | | | |
| Q4 | | | INVERT-3 | INVERT-4 | PHI 3 | | | | | | | | Q3 |

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| | | | | | | | | | |
|------------|----------|----------|----------|---------|--------|----------|--------|------|--------|
| 7.000 | 1354.500 | 1354.500 | 45.000 | 45.000 | 3 | 3 | 3 | .013 | 4.000 |
| | RADIUS | ANGLE | | | | | | | |
| | .000 | .000 | | | | | | | |
| ELEMENT NO | 7 IS A | REACH | | | * | * | * | | |
| | RADIUS | ANGLE | U/S DATA | STATION | ANG PT | MAN H | INVERT | SECT | N |
| | 323.721 | 40.000 | | 828.000 | | 1360.000 | | 3 | .013 |
| ELEMENT NO | 8 IS A | JUNCTION | | .000 | 0 | | | | |
| | * | | * | | | | * | * | * |
| Q4 | INVERT-3 | INVERT-4 | U/S DATA | STATION | ANG PT | MAN H | INVERT | SECT | LAT-1 |
| | .000 | 1360.500 | PHI 3 | 832.000 | | 1360.500 | | 3 | 3 |
| | | .000 | PHI 4 | 45.000 | | .000 | | | 0 |
| | RADIUS | ANGLE | | | | | | | N |
| | .000 | .000 | | | | | | | Q3 |
| | | | | | | | | | .013 |
| | | | | | | | | | 10.200 |

W S P G W

PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

| | | | | | | | | | |
|------------|----------|------------------|----------|---------|--------|----------|--------|------|------|
| ELEMENT NO | 9 IS A | REACH | | | * | * | * | | |
| | RADIUS | ANGLE | U/S DATA | STATION | ANG PT | MAN H | INVERT | SECT | N |
| | .000 | .000 | | 857.000 | | 1364.000 | | 3 | .013 |
| ELEMENT NO | 10 IS A | SYSTEM HEADWORKS | | .000 | 0 | | | | |
| | W S ELEV | | U/S DATA | STATION | | INVERT | | SECT | * |
| | 1364.000 | | | 857.000 | | 1364.000 | | 3 | |

100 - YEAR HYDRAULIC STUDY
 105.588 TRACT 34760

LINE "B" (100% INTERCEPTION)

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-----|------------|-----|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| 100.000 | 1295.000 | .638 | 1295.638 | 21.50 | 24.92 | 9.64 | 1305.28 | .25 | 1.66 | 1.86 | 2.000 | .000 | .00 | 1 | .0 |
| 39.118 | .1905 | | | | | .1808 | 7.07 | .89 | 6.46 | .63 | .013 | .00 | .00 | PIPE | |
| 139.118 | 1302.451 | .647 | 1303.098 | 21.50 | 24.41 | 9.25 | 1312.35 | .24 | 1.66 | 1.87 | 2.000 | .000 | .00 | 1 | .0 |
| 31.736 | .1905 | | | | | .1647 | 5.23 | .89 | 6.27 | .63 | .013 | .00 | .00 | PIPE | |
| 170.855 | 1308.496 | .670 | 1309.166 | 21.50 | 23.28 | 8.41 | 1317.58 | .22 | 1.66 | 1.89 | 2.000 | .000 | .00 | 1 | .0 |
| 16.053 | .1905 | | | | | .1443 | 2.32 | .89 | 5.86 | .63 | .013 | .00 | .00 | PIPE | |
| 186.907 | 1311.554 | .694 | 1312.248 | 21.50 | 22.19 | 7.65 | 1319.90 | .20 | 1.66 | 1.90 | 2.000 | .000 | .00 | 1 | .0 |
| 10.486 | .1905 | | | | | .1265 | 1.33 | .90 | 5.48 | .63 | .013 | .00 | .00 | PIPE | |
| 197.394 | 1313.551 | .718 | 1314.269 | 21.50 | 21.16 | 6.95 | 1321.22 | .19 | 1.66 | 1.92 | 2.000 | .000 | .00 | 1 | .0 |
| 7.606 | .1905 | | | | | .1109 | .84 | .90 | 5.12 | .63 | .013 | .00 | .00 | PIPE | |
| 205.000 | 1315.000 | .745 | 1315.745 | 21.50 | 20.18 | 6.32 | 1322.07 | .19 | 1.66 | 1.93 | 2.000 | .000 | .00 | 1 | .0 |
| 72.363 | .1036 | | | | | .1033 | 7.48 | .93 | 4.79 | .74 | .013 | .00 | .00 | PIPE | |
| 277.363 | 1322.499 | .745 | 1323.244 | 21.50 | 20.14 | 6.30 | 1329.54 | .19 | 1.66 | 1.93 | 2.000 | .000 | .00 | 1 | .0 |
| 79.142 | .1036 | | | | | .0967 | 7.66 | .93 | 4.78 | .74 | .013 | .00 | .00 | PIPE | |
| 356.505 | 1330.700 | .772 | 1331.472 | 21.50 | 19.20 | 5.72 | 1337.20 | .17 | 1.66 | 1.95 | 2.000 | .000 | .00 | 1 | .0 |
| 26.262 | .1036 | | | | | .0849 | 2.23 | .94 | 4.46 | .74 | .013 | .00 | .00 | PIPE | |
| 382.767 | 1333.421 | .800 | 1334.221 | 21.50 | 18.31 | 5.20 | 1339.43 | .16 | 1.66 | 1.96 | 2.000 | .000 | .00 | 1 | .0 |
| 15.233 | .1036 | | | | | .0745 | 1.13 | .96 | 4.17 | .74 | .013 | .00 | .00 | PIPE | |

100 - YEAR HYDRAULIC STUDY
 105.588 TRACT 34760

LINE "B" (100% INTERCEPTION)

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
398.000 | 1335.000 | .830 | 1335.830 | 21.50 | 17.46 | 4.73 | 1340.56 | .03 | 1.66 | 1.97 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
84.036 | .0697 | | | | | .0697 | 5.86 | .86 | 3.89 | .83 | .013 | .00 | .00 | PIPE
482.036 | 1340.855 | .830 | 1341.685 | 21.50 | 17.46 | 4.73 | 1346.42 | .03 | 1.66 | 1.97 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
67.847 | .0697 | | | | | .0696 | 4.72 | .86 | 3.89 | .83 | .013 | .00 | .00 | PIPE
549.883 | 1345.582 | .829 | 1346.411 | 21.50 | 17.45 | 4.73 | 1351.14 | .03 | 1.66 | 1.97 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
92.117 | .0697 | | | | | .0653 | 6.02 | .86 | 3.89 | .83 | .013 | .00 | .00 | PIPE
642.000 | 1352.000 | .860 | 1352.860 | 21.50 | 16.64 | 4.30 | 1357.16 | .00 | 1.66 | 1.98 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
JUNCT STR | .1250 | | | | | .0923 | .37 | .95 | 3.63 | | | .013 | .00 | .00 | PIPE
646.000 | 1352.500 | .527 | 1353.027 | 12.10 | 18.28 | 5.19 | 1358.22 | .10 | 1.25 | 1.76 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
64.833 | .1235 | | | | | .1235 | 8.01 | .62 | 5.26 | .53 | .013 | .00 | .00 | PIPE
710.833 | 1360.506 | .527 | 1361.034 | 12.10 | 18.28 | 5.19 | 1366.22 | .10 | 1.25 | 1.76 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
58.547 | .1235 | | | | | .1177 | 6.89 | .62 | 5.26 | .53 | .013 | .00 | .00 | PIPE
769.380 | 1367.737 | .540 | 1368.277 | 12.10 | 17.65 | 4.84 | 1373.11 | .09 | 1.25 | 1.78 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
22.658 | .1235 | | | | | .1049 | 2.38 | .63 | 5.01 | .53 | .013 | .00 | .00 | PIPE
792.037 | 1370.535 | .559 | 1371.094 | 12.10 | 16.83 | 4.40 | 1375.49 | .08 | 1.25 | 1.80 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
12.019 | .1235 | | | | | .0918 | 1.10 | .64 | 4.69 | .53 | .013 | .00 | .00 | PIPE
804.057 | 1372.019 | .578 | 1372.597 | 12.10 | 16.05 | 4.00 | 1376.60 | .08 | 1.25 | 1.81 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
7.943 | .1235 | | | | | .0804 | .64 | .65 | 4.38 | .53 | .013 | .00 | .00 | PIPE
    
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100 - YEAR HYDRAULIC STUDY
105.588 TRACT 34760

LINE "B" (100% INTERCEPTION)

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
812.000 | 1373.000 | .599 | 1373.599 | 12.10 | 15.30 | 3.63 | 1377.23 | .05 | 1.25 | 1.83 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
57.104 | .0755 | | | | | .0730 | 4.17 | .65 | 4.10 | .60 | .013 | .00 | .00 | PIPE
869.104 | 1377.310 | .607 | 1377.917 | 12.10 | 15.00 | 3.49 | 1381.41 | .05 | 1.25 | 1.84 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
33.388 | .0755 | | | | | .0666 | 2.22 | .66 | 3.99 | .60 | .013 | .00 | .00 | PIPE
902.492 | 1379.830 | .628 | 1380.458 | 12.10 | 14.30 | 3.18 | 1383.63 | .05 | 1.25 | 1.86 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
15.508 | .0755 | | | | | .0583 | .90 | .67 | 3.73 | .60 | .013 | .00 | .00 | PIPE
918.000 | 1381.000 | .651 | 1381.651 | 12.10 | 13.64 | 2.89 | 1384.54 | .00 | 1.25 | 1.87 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
49.339 | .0556 | | | | | .0521 | 2.57 | .65 | 3.49 | .65 | .013 | .00 | .00 | PIPE
967.339 | 1383.741 | .667 | 1384.408 | 12.10 | 13.19 | 2.70 | 1387.11 | .00 | 1.25 | 1.89 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
24.691 | .0556 | | | | | .0465 | 1.15 | .67 | 3.33 | .65 | .013 | .00 | .00 | PIPE
992.030 | 1385.113 | .690 | 1385.803 | 12.10 | 12.57 | 2.45 | 1388.26 | .00 | 1.25 | 1.90 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
13.415 | .0556 | | | | | .0408 | .55 | .69 | 3.11 | .65 | .013 | .00 | .00 | PIPE
1005.445 | 1385.858 | .715 | 1386.573 | 12.10 | 11.99 | 2.23 | 1388.80 | .00 | 1.25 | 1.92 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
8.939 | .0556 | | | | | .0358 | .32 | .72 | 2.91 | .65 | .013 | .00 | .00 | PIPE
1014.384 | 1386.355 | .741 | 1387.096 | 12.10 | 11.43 | 2.03 | 1389.12 | .00 | 1.25 | 1.93 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
6.549 | .0556 | | | | | .0314 | .21 | .74 | 2.72 | .65 | .013 | .00 | .00 | PIPE
1020.932 | 1386.718 | .767 | 1387.485 | 12.10 | 10.90 | 1.84 | 1389.33 | .00 | 1.25 | 1.95 | 2.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
4.979 | .0556 | | | | | .0275 | .14 | .77 | 2.54 | .65 | .013 | .00 | .00 | PIPE
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100 - YEAR HYDRAULIC STUDY
105.588 TRACT 34760

LINE "B" (100% INTERCEPTION)

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
-|- -|- -|- -|- (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
1025.911 | 1386.995 | .795 | 1387.790 | 12.10 | 10.39 | 1.68 | 1389.47 | .00 | 1.25 | 1.96 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
3.929 | .0556 | | | | | .0241 | .09 | .80 | 2.37 | .65 | .013 | .00 | .00 | PIPE
1029.840 | 1387.213 | .824 | 1388.037 | 12.10 | 9.91 | 1.52 | 1389.56 | .00 | 1.25 | 1.97 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
3.159 | .0556 | | | | | .0212 | .07 | .82 | 2.22 | .65 | .013 | .00 | .00 | PIPE
1033.000 | 1387.389 | .854 | 1388.243 | 12.10 | 9.45 | 1.39 | 1389.63 | .00 | 1.25 | 1.98 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
2.544 | .0556 | | | | | .0186 | .05 | .85 | 2.07 | .65 | .013 | .00 | .00 | PIPE
1035.543 | 1387.530 | .886 | 1388.416 | 12.10 | 9.01 | 1.26 | 1389.68 | .00 | 1.25 | 1.99 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
2.080 | .0556 | | | | | .0164 | .03 | .89 | 1.93 | .65 | .013 | .00 | .00 | PIPE
1037.623 | 1387.646 | .919 | 1388.565 | 12.10 | 8.59 | 1.15 | 1389.71 | .00 | 1.25 | 1.99 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.703 | .0556 | | | | | .0144 | .02 | .92 | 1.80 | .65 | .013 | .00 | .00 | PIPE
1039.326 | 1387.740 | .953 | 1388.693 | 12.10 | 8.19 | 1.04 | 1389.73 | .00 | 1.25 | 2.00 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.367 | .0556 | | | | | .0127 | .02 | .95 | 1.68 | .65 | .013 | .00 | .00 | PIPE
1040.693 | 1387.816 | .989 | 1388.805 | 12.10 | 7.81 | .95 | 1389.75 | .00 | 1.25 | 2.00 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
1.081 | .0556 | | | | | .0111 | .01 | .99 | 1.56 | .65 | .013 | .00 | .00 | PIPE
1041.774 | 1387.876 | 1.027 | 1388.903 | 12.10 | 7.44 | .86 | 1389.76 | .00 | 1.25 | 2.00 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.835 | .0556 | | | | | .0098 | .01 | 1.03 | 1.45 | .65 | .013 | .00 | .00 | PIPE
1042.610 | 1387.923 | 1.067 | 1388.990 | 12.10 | 7.10 | .78 | 1389.77 | .00 | 1.25 | 2.00 | 2.000 | .000 | .00 | 1 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
.642 | .0556 | | | | | .0087 | .01 | 1.07 | 1.35 | .65 | .013 | .00 | .00 | PIPE

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WATER SURFACE PROFILE - CHANNEL DEFINITION

LISTING PAGE 1

| CARD Y(3) | SECT Y(4) | CHN Y(5) | NO Y(6) | OF Y(7) | AVE Y(8) | PIER Y(9) | HEIGHT Y(10) | BASE | ZL | ZR | INV | Y(1) | Y(2) |
|-----------|-----------|----------|----------|---------|----------|-----------|--------------|------|----|----|-----|------|------|
| CODE | NO | TYPE | PIER/PIP | WIDTH | DIAMETER | WIDTH | DROP | | | | | | |
| CD | 1 | 4 | 1 | | 3.000 | | | | | | | | |
| CD | 2 | 4 | 1 | | 1.500 | | | | | | | | |
| CD | 3 | 4 | 1 | | 2.000 | | | | | | | | |
| CD | 5 | 4 | 1 | | 1.500 | | | | | | | | |
| CD | 7 | 4 | 2 | | 1.500 | | | | | | | | |

W S P G W

PAGE NO 1

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -
 100 - YEAR HYDRAULIC STUDY

HEADING LINE NO 2 IS -
 105.588 TRACT 34760

HEADING LINE NO 3 IS -
 LINE "B" (100% INTERCEPTION)

W S P G W

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

| ELEMENT NO | IS | A | SYSTEM | OUTLET | U/S DATA | STATION | INVERT | SECT | | | | | |
|---|----|---|----------|----------|----------|---------|----------|----------|---|---|---|------|-------|
| 1 | | | | | | 100.000 | 1295.000 | 3 | | | | | |
| W S ELEV | | | | | | | | | | | | | |
| 1299.000 | | | | | | | | | | | | | |
| 2 | | | REACH | | | | | | | | | | |
| U/S DATA STATION INVERT SECT N | | | | | | | | | | | | | |
| RADIUS ANGLE ANG PT MAN H | | | | | | | | | | | | | |
| | | | 143.239 | 42.000 | | 205.000 | 1315.000 | 3 | | | | | .013 |
| 3 | | | REACH | | | | | | | | | | |
| U/S DATA STATION INVERT SECT N | | | | | | | | | | | | | |
| RADIUS ANGLE ANG PT MAN H | | | | | | | | | | | | | |
| | | | 130.095 | 85.000 | | 398.000 | 1335.000 | 3 | | | | | .013 |
| 4 | | | REACH | | | | | | | | | | |
| U/S DATA STATION INVERT SECT N | | | | | | | | | | | | | |
| RADIUS ANGLE ANG PT MAN H | | | | | | | | | | | | | |
| | | | 665.722 | 21.000 | | 642.000 | 1352.000 | 3 | | | | | .013 |
| 5 | | | JUNCTION | | | | | | | | | | |
| U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 | | | | | | | | | | | | | |
| Q4 | | | INVERT-3 | INVERT-4 | PHI 3 | PHI 4 | | | | | | | |
| | | | .000 | 1352.500 | .000 | 45.000 | 646.000 | 1352.500 | 3 | 2 | 0 | .013 | 9.400 |
| RADIUS ANGLE | | | | | | | | | | | | | |
| .000 .000 | | | | | | | | | | | | | |
| 6 | | | REACH | | | | | | | | | | |
| U/S DATA STATION INVERT SECT N | | | | | | | | | | | | | |
| RADIUS ANGLE ANG PT MAN H | | | | | | | | | | | | | |
| | | | 190.222 | 50.000 | | .000 | 812.000 | 1373.000 | 3 | | | | .013 |

| | | | | | | |
|------------|----------|------------------|-----------------|----------|------|------|
| | | | 105588LINEB.EDT | | | |
| ELEMENT NO | 7 IS A | REACH | * | * | * | |
| | | U/S DATA | STATION | INVERT | SECT | N |
| | RADIUS | ANGLE | ANG PT | MAN H | | |
| | 253.056 | 24.000 | 918.000 | 1381.000 | 3 | .013 |
| | | | .000 | 0 | | |
| ELEMENT NO | 8 IS A | REACH | * | * | * | |
| | | U/S DATA | STATION | INVERT | SECT | N |
| | RADIUS | ANGLE | ANG PT | MAN H | | |
| | .000 | .000 | 1044.000 | 1388.000 | 3 | .013 |
| | | | .000 | 0 | | |
| ELEMENT NO | 9 IS A | SYSTEM HEADWORKS | | | | * |
| | | U/S DATA | STATION | INVERT | SECT | |
| | W S ELEV | | 1044.000 | 1388.000 | 3 | |
| | 1388.000 | | | | | |

100 - YEAR HYDRUALIC STUDY
105.588 TRACT 34760 (LINE "C"0
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
100.000 | 1326.000 | 1.212 | 1327.212 | 69.60 | 21.66 | 7.28 | 1334.49 | .35 | 2.52 | 3.68 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
58.163 | .0621 | | | | | .0572 | 3.33 | 1.57 | 4.08 | 1.20 | .013 | .00 | .00 | PIPE
158.163 | 1329.613 | 1.230 | 1330.843 | 69.60 | 21.19 | 6.97 | 1337.82 | .34 | 2.52 | 3.69 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
58.349 | .0621 | | | | | .0520 | 3.03 | 1.57 | 3.96 | 1.20 | .013 | .00 | .00 | PIPE
216.513 | 1333.238 | 1.274 | 1334.512 | 69.60 | 20.20 | 6.34 | 1340.85 | .31 | 2.52 | 3.73 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
32.089 | .0621 | | | | | .0456 | 1.46 | 1.59 | 3.70 | 1.20 | .013 | .00 | .00 | PIPE
248.601 | 1335.231 | 1.319 | 1336.550 | 69.60 | 19.26 | 5.76 | 1342.31 | .29 | 2.52 | 3.76 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
21.516 | .0621 | | | | | .0399 | .86 | 1.61 | 3.46 | 1.20 | .013 | .00 | .00 | PIPE
270.117 | 1336.568 | 1.365 | 1337.933 | 69.60 | 18.37 | 5.24 | 1343.17 | .26 | 2.52 | 3.79 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
15.736 | .0621 | | | | | .0350 | .55 | 1.63 | 3.24 | 1.20 | .013 | .00 | .00 | PIPE
285.853 | 1337.545 | 1.414 | 1338.959 | 69.60 | 17.51 | 4.76 | 1343.72 | .24 | 2.52 | 3.82 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
12.147 | .0621 | | | | | .0307 | .37 | 1.65 | 3.03 | 1.20 | .013 | .00 | .00 | PIPE
298.000 | 1338.300 | 1.465 | 1339.765 | 69.60 | 16.70 | 4.33 | 1344.09 | .00 | 2.52 | 3.85 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
JUNCT STR | .0400 | | | | | .0474 | .24 | 1.54 | 2.83 | | | .013 | .00 | .00 | PIPE
303.000 | 1338.500 | 1.026 | 1339.526 | 53.20 | 20.89 | 6.78 | 1346.30 | .11 | 2.19 | 3.49 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
58.424 | .0682 | | | | | .0646 | 3.77 | 1.14 | 4.31 | 1.02 | .013 | .00 | .00 | PIPE
361.424 | 1342.483 | 1.038 | 1343.521 | 53.20 | 20.54 | 6.55 | 1350.08 | .11 | 2.19 | 3.51 | 4.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
61.704 | .0682 | | | | | .0591 | 3.65 | 1.14 | 4.21 | 1.02 | .013 | .00 | .00 | PIPE

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100 - YEAR HYDRUALIC STUDY
105.588 TRACT 34760 (LINE "C"0
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
423.128 | 1346.690 | 1.073 | 1347.764 | 53.20 | 19.59 | 5.96 | 1353.72 | .10 | 2.19 | 3.54 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
30.554 | .0682 | | | | | .0517 | 1.58 | 1.17 | 3.94 | 1.02 | .013 | .00 | .00 | PIPE
453.682 | 1348.774 | 1.111 | 1349.885 | 53.20 | 18.68 | 5.42 | 1355.30 | .09 | 2.19 | 3.58 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
19.811 | .0682 | | | | | .0452 | .90 | 1.20 | 3.69 | 1.02 | .013 | .00 | .00 | PIPE
473.493 | 1350.124 | 1.149 | 1351.273 | 53.20 | 17.81 | 4.92 | 1356.20 | .08 | 2.19 | 3.62 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
14.258 | .0682 | | | | | .0396 | .56 | 1.23 | 3.45 | 1.02 | .013 | .00 | .00 | PIPE
487.751 | 1351.097 | 1.189 | 1352.286 | 53.20 | 16.98 | 4.48 | 1356.76 | .08 | 2.19 | 3.66 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
10.888 | .0682 | | | | | .0347 | .38 | 1.26 | 3.23 | 1.02 | .013 | .00 | .00 | PIPE
498.639 | 1351.839 | 1.231 | 1353.070 | 53.20 | 16.19 | 4.07 | 1357.14 | .07 | 2.19 | 3.69 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
8.643 | .0682 | | | | | .0304 | .26 | 1.30 | 3.02 | 1.02 | .013 | .00 | .00 | PIPE
507.282 | 1352.428 | 1.274 | 1353.702 | 53.20 | 15.44 | 3.70 | 1357.40 | .06 | 2.19 | 3.73 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
7.003 | .0682 | | | | | .0266 | .19 | 1.34 | 2.83 | 1.02 | .013 | .00 | .00 | PIPE
514.286 | 1352.906 | 1.319 | 1354.225 | 53.20 | 14.72 | 3.36 | 1357.59 | .06 | 2.19 | 3.76 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
5.764 | .0682 | | | | | .0233 | .13 | 1.38 | 2.65 | 1.02 | .013 | .00 | .00 | PIPE
520.050 | 1353.299 | 1.366 | 1354.665 | 53.20 | 14.03 | 3.06 | 1357.72 | .05 | 2.19 | 3.79 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
4.814 | .0682 | | | | | .0204 | .10 | 1.42 | 2.47 | 1.02 | .013 | .00 | .00 | PIPE
524.863 | 1353.627 | 1.414 | 1355.041 | 53.20 | 13.38 | 2.78 | 1357.82 | .05 | 2.19 | 3.82 | 4.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
4.010 | .0682 | | | | | .0179 | .07 | 1.46 | 2.31 | 1.02 | .013 | .00 | .00 | PIPE
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100 - YEAR HYDRUALIC STUDY
105.588 TRACT 34760 (LINE "C"0
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
528.874 | 1353.901 | 1.465 | 1355.366 | 53.20 | 12.76 | 2.53 | 1357.89 | .04 | 2.19 | 3.85 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 3.385 | .0682 | | | | | .0157 | .05 | 1.51 | 2.16 | 1.02 | .013 | .00 | .00 | PIPE
532.259 | 1354.131 | 1.517 | 1355.648 | 53.20 | 12.16 | 2.30 | 1357.95 | .04 | 2.19 | 3.88 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 2.827 | .0682 | | | | | .0138 | .04 | 1.56 | 2.02 | 1.02 | .013 | .00 | .00 | PIPE
535.086 | 1354.324 | 1.572 | 1355.896 | 53.20 | 11.60 | 2.09 | 1357.98 | .04 | 2.19 | 3.91 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 2.368 | .0682 | | | | | .0121 | .03 | 1.61 | 1.89 | 1.02 | .013 | .00 | .00 | PIPE
537.453 | 1354.485 | 1.629 | 1356.115 | 53.20 | 11.06 | 1.90 | 1358.01 | .03 | 2.19 | 3.93 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 1.955 | .0682 | | | | | .0106 | .02 | 1.66 | 1.76 | 1.02 | .013 | .00 | .00 | PIPE
539.409 | 1354.619 | 1.689 | 1356.308 | 53.20 | 10.54 | 1.73 | 1358.03 | .03 | 2.19 | 3.95 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 1.612 | .0682 | | | | | .0093 | .02 | 1.72 | 1.64 | 1.02 | .013 | .00 | .00 | PIPE
541.021 | 1354.729 | 1.751 | 1356.480 | 53.20 | 10.05 | 1.57 | 1358.05 | .03 | 2.19 | 3.97 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 1.294 | .0682 | | | | | .0082 | .01 | 1.78 | 1.53 | 1.02 | .013 | .00 | .00 | PIPE
542.314 | 1354.817 | 1.816 | 1356.633 | 53.20 | 9.58 | 1.43 | 1358.06 | .03 | 2.19 | 3.98 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | 1.011 | .0682 | | | | | .0072 | .01 | 1.84 | 1.43 | 1.02 | .013 | .00 | .00 | PIPE
543.326 | 1354.886 | 1.884 | 1356.770 | 53.20 | 9.14 | 1.30 | 1358.07 | .02 | 2.19 | 3.99 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | .758 | .0682 | | | | | .0063 | .00 | 1.91 | 1.33 | 1.02 | .013 | .00 | .00 | PIPE
544.083 | 1354.938 | 1.955 | 1356.893 | 53.20 | 8.71 | 1.18 | 1358.07 | .02 | 2.19 | 4.00 | 4.000 | .000 | .00 | 1 | .0
        | | | | | | | | | | | | | | | | |
        | .514 | .0682 | | | | | .0056 | .00 | 1.98 | 1.24 | 1.02 | .013 | .00 | .00 | PIPE
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100 - YEAR HYDRAULIC STUDY
 105.588 "TRACT 34760" (LINE "D")
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|---------|--------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|------------|-------|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** |
| 100.000 | 1300.000 | .987 | 1300.987 | 229.60 | 38.76 | 23.33 | 1324.31 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | .469 .2500 | | | | | .1707 | .08 | .99 | 6.87 | .87 | .013 | .00 | .00 | RECTANG | |
| 100.469 | 1300.117 | .988 | 1301.105 | 229.60 | 38.73 | 23.29 | 1324.40 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 22.788 .2500 | | | | | .1592 | 3.63 | .99 | 6.87 | .87 | .013 | .00 | .00 | RECTANG | |
| 123.257 | 1305.814 | 1.036 | 1306.850 | 229.60 | 36.93 | 21.18 | 1328.03 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 16.743 .2500 | | | | | .1380 | 2.31 | 1.04 | 6.39 | .87 | .013 | .00 | .00 | RECTANG | |
| 140.000 | 1310.000 | 1.087 | 1311.087 | 229.60 | 35.21 | 19.25 | 1330.34 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 4.834 .2532 | | | | | .1251 | .60 | 1.09 | 5.95 | .87 | .013 | .00 | .00 | RECTANG | |
| 144.834 | 1311.224 | 1.105 | 1312.329 | 229.60 | 34.63 | 18.62 | 1330.95 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 11.770 .2532 | | | | | .1140 | 1.34 | 1.11 | 5.80 | .87 | .013 | .00 | .00 | RECTANG | |
| 156.604 | 1314.203 | 1.159 | 1315.362 | 229.60 | 33.01 | 16.92 | 1332.29 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 9.610 .2532 | | | | | .0990 | .95 | 1.16 | 5.40 | .87 | .013 | .00 | .00 | RECTANG | |
| 166.214 | 1316.636 | 1.216 | 1317.852 | 229.60 | 31.48 | 15.39 | 1333.24 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 8.011 .2532 | | | | | .0860 | .69 | 1.22 | 5.03 | .87 | .013 | .00 | .00 | RECTANG | |
| 174.225 | 1318.665 | 1.275 | 1319.940 | 229.60 | 30.01 | 13.99 | 1333.93 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 6.778 .2532 | | | | | .0748 | .51 | 1.28 | 4.68 | .87 | .013 | .00 | .00 | RECTANG | |
| 181.004 | 1320.381 | 1.337 | 1321.718 | 229.60 | 28.62 | 12.72 | 1334.43 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 | .0 |
| | 5.798 .2532 | | | | | .0650 | .38 | 1.34 | 4.36 | .87 | .013 | .00 | .00 | RECTANG | |

100 - YEAR HYDRAULIC STUDY
 105.588 "TRACT 34760" (LINE "D")
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Wth Prs/Pip |
|---------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-------|----------------|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch |
| ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** |
| 186.801 | 1321.848 | 1.403 | 1323.251 | 229.60 | 27.28 | 11.56 | 1334.81 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 4.998 | .2532 | | | | | .0566 | .28 | 1.40 | 4.06 | .87 | .013 | .00 | .00 | RECTANG |
| 191.800 | 1323.114 | 1.471 | 1324.585 | 229.60 | 26.01 | 10.51 | 1335.09 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 4.334 | .2532 | | | | | .0493 | .21 | 1.47 | 3.78 | .87 | .013 | .00 | .00 | RECTANG |
| 196.134 | 1324.211 | 1.543 | 1325.754 | 229.60 | 24.80 | 9.55 | 1335.31 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 3.774 | .2532 | | | | | .0430 | .16 | 1.54 | 3.52 | .87 | .013 | .00 | .00 | RECTANG |
| 199.908 | 1325.167 | 1.618 | 1326.785 | 229.60 | 23.65 | 8.68 | 1335.47 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 3.295 | .2532 | | | | | .0375 | .12 | 1.62 | 3.28 | .87 | .013 | .00 | .00 | RECTANG |
| 203.203 | 1326.001 | 1.697 | 1327.698 | 229.60 | 22.55 | 7.90 | 1335.59 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 2.880 | .2532 | | | | | .0327 | .09 | 1.70 | 3.05 | .87 | .013 | .00 | .00 | RECTANG |
| 206.083 | 1326.730 | 1.780 | 1328.510 | 229.60 | 21.50 | 7.18 | 1335.69 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 2.519 | .2532 | | | | | .0286 | .07 | 1.78 | 2.84 | .87 | .013 | .00 | .00 | RECTANG |
| 208.602 | 1327.368 | 1.867 | 1329.234 | 229.60 | 20.50 | 6.53 | 1335.76 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 2.201 | .2532 | | | | | .0250 | .06 | 1.87 | 2.64 | .87 | .013 | .00 | .00 | RECTANG |
| 210.803 | 1327.925 | 1.958 | 1329.883 | 229.60 | 19.55 | 5.93 | 1335.81 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 1.918 | .2532 | | | | | .0219 | .04 | 1.96 | 2.46 | .87 | .013 | .00 | .00 | RECTANG |
| 212.721 | 1328.410 | 2.053 | 1330.464 | 229.60 | 18.64 | 5.39 | 1335.86 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0 |
| 1.667 | .2532 | | | | | .0191 | .03 | 2.05 | 2.29 | .87 | .013 | .00 | .00 | RECTANG |

100 - YEAR HYDRAULIC STUDY
 105.588 "TRACT 34760" (LINE "D")
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope |      |      |      |      | SF Ave | HF   | SE Dpth | Froude N | Norm Dp | "N"    | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
214.388 | 1328.832 | 2.154 | 1330.986 | 229.60 | 17.77 | 4.90 | 1335.89 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 1.441 | .2532 |         |         |         |         | .0168 | .02 | 2.15 | 2.13 | .87 | .013 | .00 | .00 | RECTANG
215.828 | 1329.197 | 2.259 | 1331.456 | 229.60 | 16.94 | 4.46 | 1335.91 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 1.237 | .2532 |         |         |         |         | .0147 | .02 | 2.26 | 1.99 | .87 | .013 | .00 | .00 | RECTANG
217.065 | 1329.510 | 2.369 | 1331.879 | 229.60 | 16.15 | 4.05 | 1335.93 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 1.052 | .2532 |         |         |         |         | .0129 | .01 | 2.37 | 1.85 | .87 | .013 | .00 | .00 | RECTANG
218.117 | 1329.776 | 2.485 | 1332.261 | 229.60 | 15.40 | 3.68 | 1335.94 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | .883 | .2532 |         |         |         |         | .0113 | .01 | 2.48 | 1.72 | .87 | .013 | .00 | .00 | RECTANG
219.000 | 1330.000 | 2.606 | 1332.606 | 229.60 | 14.68 | 3.35 | 1335.95 | .00 | 3.57 | 6.00 | 4.000 | 6.000 | .00 | 0 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 20.000 | .0100 |         |         |         |         | .0106 | .21 | 2.61 | 1.60 | 2.66 | .013 | .00 | .00 | RECTANG
239.000 | 1330.200 | 2.598 | 1332.798 | 229.60 | 22.28 | 7.71 | 1340.51 | .00 | 4.28 | 5.00 | 5.000 | .000 | .00 | 1 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 16.272 | .0164 |         |         |         |         | .0278 | .45 | 2.60 | 2.73 | 3.05 | .013 | .00 | .00 | PIPE
255.272 | 1330.466 | 2.569 | 1333.035 | 229.60 | 22.58 | 7.92 | 1340.96 | .00 | 4.28 | 5.00 | 5.000 | .000 | .00 | 1 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 50.302 | .0164 |         |         |         |         | .0302 | 1.52 | 2.57 | 2.79 | 3.05 | .013 | .00 | .00 | PIPE
305.574 | 1331.289 | 2.475 | 1333.765 | 229.60 | 23.69 | 8.71 | 1342.48 | .00 | 4.28 | 5.00 | 5.000 | .000 | .00 | 1 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 43.426 | .0164 |         |         |         |         | .0343 | 1.49 | 2.48 | 3.00 | 3.05 | .013 | .00 | .00 | PIPE
349.000 | 1332.000 | 2.385 | 1334.385 | 229.60 | 24.84 | 9.58 | 1343.97 | .20 | 4.28 | 4.99 | 5.000 | .000 | .00 | 1 .0
        |         |      |         |         |         |         |         |         |         |         |         |         |         |         |         |
        | 164.633 | .0365 |         |         |         |         | .0365 | 6.02 | 2.58 | 3.22 | 2.38 | .013 | .00 | .00 | PIPE
    
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100 - YEAR HYDRAULIC STUDY
 105.588 "TRACT 34760" (LINE "D")
 ARMSTRONG & BROOKS CONSULTING ENGINEERS

| Station | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL | No Prs/Pip | Wth |
|----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-----|------------|-----|
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type | Ch |
| 513.633 | 1338.015 | 2.385 | 1340.400 | 229.60 | 24.84 | 9.58 | 1349.98 | .20 | 4.28 | 4.99 | 5.000 | .000 | .00 | 1 | .0 |
| 355.367 | .0365 | | | | | .0351 | 12.48 | 2.58 | 3.22 | 2.38 | .013 | .00 | .00 | PIPE | |
| 869.000 | 1351.000 | 2.442 | 1353.442 | 229.60 | 24.10 | 9.02 | 1362.46 | .18 | 4.28 | 5.00 | 5.000 | .000 | .00 | 1 | .0 |
| 273.489 | .0338 | | | | | .0332 | 9.07 | 2.62 | 3.08 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1142.489 | 1360.253 | 2.463 | 1362.716 | 229.60 | 23.83 | 8.82 | 1371.54 | .17 | 4.28 | 5.00 | 5.000 | .000 | .00 | 1 | .0 |
| 228.758 | .0338 | | | | | .0307 | 7.03 | 2.64 | 3.03 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1371.247 | 1367.993 | 2.557 | 1370.550 | 229.60 | 22.72 | 8.02 | 1378.57 | .16 | 4.28 | 5.00 | 5.000 | .000 | .00 | 1 | .0 |
| 93.330 | .0338 | | | | | .0271 | 2.53 | 2.71 | 2.82 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1464.578 | 1371.151 | 2.656 | 1373.807 | 229.60 | 21.67 | 7.29 | 1381.10 | .14 | 4.28 | 4.99 | 5.000 | .000 | .00 | 1 | .0 |
| 56.236 | .0338 | | | | | .0239 | 1.34 | 2.80 | 2.62 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1520.814 | 1373.054 | 2.759 | 1375.813 | 229.60 | 20.66 | 6.63 | 1382.44 | .13 | 4.28 | 4.97 | 5.000 | .000 | .00 | 1 | .0 |
| 38.608 | .0338 | | | | | .0211 | .81 | 2.89 | 2.44 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1559.421 | 1374.360 | 2.869 | 1377.229 | 229.60 | 19.70 | 6.02 | 1383.25 | .12 | 4.28 | 4.95 | 5.000 | .000 | .00 | 1 | .0 |
| 28.454 | .0338 | | | | | .0186 | .53 | 2.99 | 2.26 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1587.875 | 1375.323 | 2.984 | 1378.307 | 229.60 | 18.78 | 5.48 | 1383.78 | .11 | 4.28 | 4.91 | 5.000 | .000 | .00 | 1 | .0 |
| 21.606 | .0338 | | | | | .0165 | .36 | 3.09 | 2.10 | 2.44 | .013 | .00 | .00 | PIPE | |
| 1609.481 | 1376.054 | 3.107 | 1379.161 | 229.60 | 17.91 | 4.98 | 1384.14 | .10 | 4.28 | 4.85 | 5.000 | .000 | .00 | 1 | .0 |
| 16.782 | .0338 | | | | | .0146 | .25 | 3.20 | 1.94 | 2.44 | .013 | .00 | .00 | PIPE | |

100 - YEAR HYDRAULIC STUDY
105.588 "TRACT 34760" (LINE "D")
ARMSTRONG & BROOKS CONSULTING ENGINEERS

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
1626.264 | 1376.622 | 3.237 | 1379.859 | 229.60 | 17.07 | 4.53 | 1384.38 | .09 | 4.28 | 4.78 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
13.108 | .0338 | | | | | .0130 | .17 | 3.32 | 1.79 | 2.44 | .013 | .00 | .00 | PIPE
1639.372 | 1377.065 | 3.375 | 1380.440 | 229.60 | 16.28 | 4.11 | 1384.55 | .08 | 4.28 | 4.68 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
10.097 | .0338 | | | | | .0115 | .12 | 3.45 | 1.65 | 2.44 | .013 | .00 | .00 | PIPE
1649.469 | 1377.407 | 3.524 | 1380.931 | 229.60 | 15.52 | 3.74 | 1384.67 | .07 | 4.28 | 4.56 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
7.610 | .0338 | | | | | .0103 | .08 | 3.59 | 1.52 | 2.44 | .013 | .00 | .00 | PIPE
1657.079 | 1377.664 | 3.685 | 1381.349 | 229.60 | 14.80 | 3.40 | 1384.75 | .06 | 4.28 | 4.40 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
5.413 | .0338 | | | | | .0092 | .05 | 3.74 | 1.39 | 2.44 | .013 | .00 | .00 | PIPE
1662.492 | 1377.847 | 3.861 | 1381.708 | 229.60 | 14.11 | 3.09 | 1384.80 | .05 | 4.28 | 4.19 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
3.333 | .0338 | | | | | .0083 | .03 | 3.91 | 1.26 | 2.44 | .013 | .00 | .00 | PIPE
1665.825 | 1377.960 | 4.057 | 1382.017 | 229.60 | 13.45 | 2.81 | 1384.83 | .04 | 4.28 | 3.91 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
1.175 | .0338 | | | | | .0076 | .01 | 4.10 | 1.13 | 2.44 | .013 | .00 | .00 | PIPE
1667.000 | 1378.000 | 4.283 | 1382.283 | 229.60 | 12.82 | 2.55 | 1384.84 | .04 | 4.28 | 3.51 | 5.000 | .000 | .00 | 1 | .0
      | | | | | | | | | | | | | | | | |
WALL ENTRANCE
1667.000 | 1378.000 | 8.858 | 1386.858 | 229.60 | 1.87 | .05 | 1386.91 | .00 | 2.11 | 14.00 | 8.000 | 14.000 | .00 | 0 | .0
      | | | | | | | | | | | | | | | | |

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WATER SURFACE PROFILE - CHANNEL DEFINITION

LISTING

PAGE 1

| CARD Y(3) | SECT Y(4) | CHN Y(5) | NO OF Y(6) | AVE Y(7) | PIER Y(8) | HEIGHT Y(9) | BASE Y(10) | ZL | ZR | INV | Y(1) | Y(2) |
|-----------|-----------|----------|------------|----------|-----------|-------------|------------|----|----|-------|------|------|
| CODE | NO | TYPE | PIER/PIP | WIDTH | | DIAMETER | WIDTH | | | DROP | | |
| CD | 1 | 4 | 1 | | | 5.000 | | | | | | |
| CD | 2 | 2 | 0 | .000 | | 8.000 | 14.000 | | | -2.00 | | |
| CD | 4 | 4 | 2 | | | 4.000 | | | | | | |
| CD | 6 | 2 | 0 | .000 | | 4.000 | 6.000 | | | .00 | | |
| CD | 8 | 2 | 0 | .000 | | 4.000 | 6.000 | | | .00 | | |
| CD | 10 | 4 | 1 | | | 5.000 | | | | | | |

W S P G W

PAGE NO 1

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

100 - YEAR HYDRAULIC STUDY

HEADING LINE NO 2 IS -

105.588 "TRACT 34760" (LINE "D")

HEADING LINE NO 3 IS -

ARMSTRONG & BROOKS CONSULTING ENGINEERS

W S P G W

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

| ELEMENT NO | IS | A | SYSTEM OUTLET | U/S DATA | STATION | INVERT | SECT | |
|------------|----|---|---------------|----------|----------|----------|------|------|
| 1 | | | | | 100.000 | 1300.000 | 6 | |
| | | | | | 1308.000 | | | |
| 2 | | | REACH | | | | | |
| | | | U/S DATA | | | | | N |
| | | | RADIUS | ANGLE | ANG PT | MAN H | | |
| | | | .000 | .000 | 140.000 | 1310.000 | 6 | .013 |
| | | | .000 | .000 | .000 | 0 | | |
| 3 | | | REACH | | | | | |
| | | | U/S DATA | | | | | N |
| | | | RADIUS | ANGLE | ANG PT | MAN H | | |
| | | | .000 | .000 | 219.000 | 1330.000 | 6 | .013 |
| | | | .000 | .000 | .000 | 0 | | |
| 4 | | | REACH | | | | | |
| | | | U/S DATA | | | | | N |
| | | | RADIUS | ANGLE | ANG PT | MAN H | | |
| | | | .000 | .000 | 239.000 | 1330.200 | 6 | .013 |
| | | | .000 | .000 | .000 | 0 | | |

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

| | | | | | | | | |
|---|--|--|----------|--------|---------|----------|---|------|
| 5 | | | REACH | | | | | |
| | | | U/S DATA | | | | | N |
| | | | RADIUS | ANGLE | ANG PT | MAN H | | |
| | | | .000 | .000 | 349.000 | 1332.000 | 1 | .013 |
| | | | .000 | .000 | .000 | 0 | | |
| 6 | | | REACH | | | | | |
| | | | U/S DATA | | | | | N |
| | | | RADIUS | ANGLE | ANG PT | MAN H | | |
| | | | 488.423 | 61.000 | 869.000 | 1351.000 | 1 | .013 |
| | | | .000 | .000 | .000 | 0 | | |
| 7 | | | REACH | | | | | |
| | | | U/S DATA | | | | | N |

105588lined.EDT

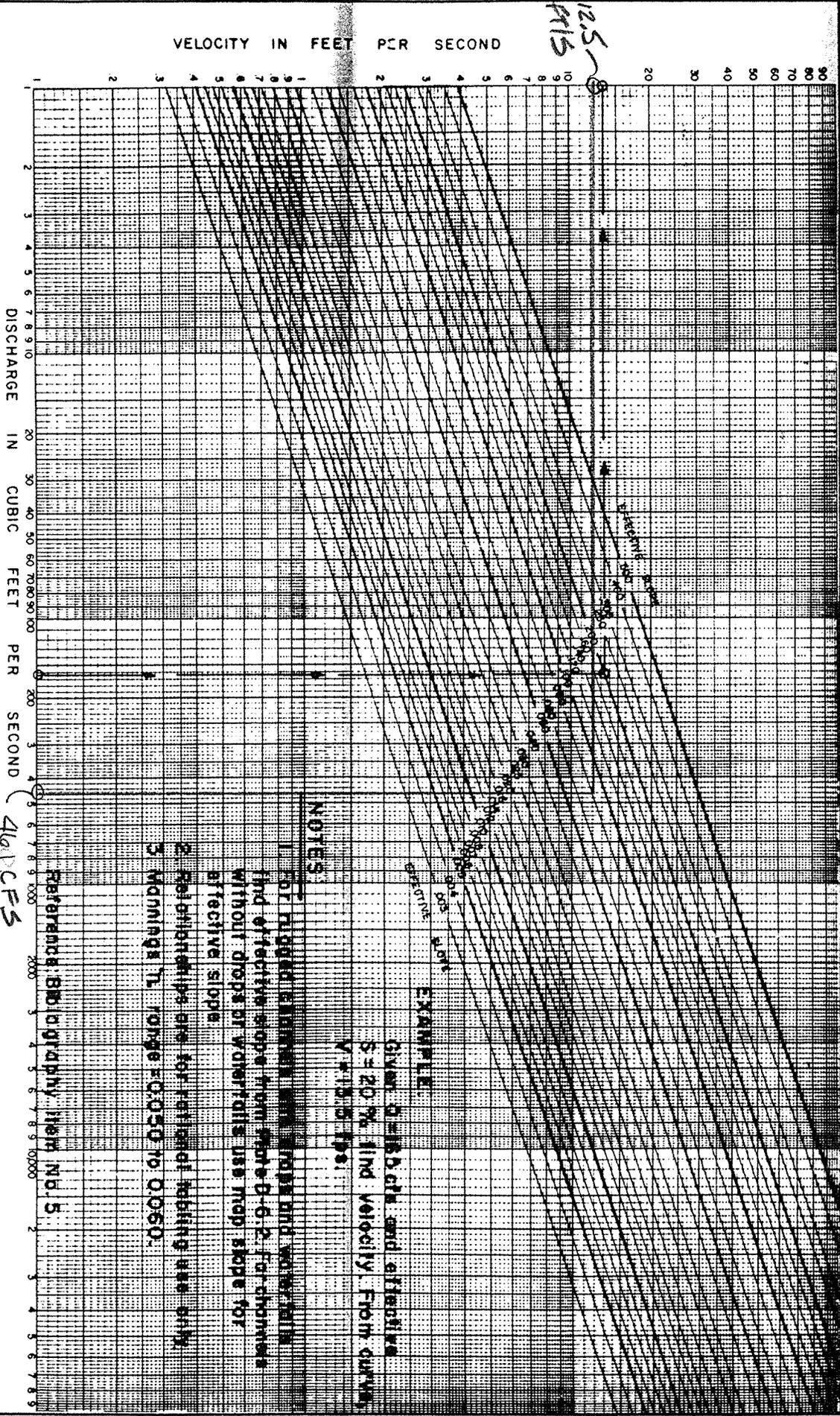
| RADIUS | ANGLE | ANG PT | MAN H | | |
|--------------|--------------------|----------|----------|------|------|
| 508.023 | 90.000 | 1667.000 | 1378.000 | 1 | .013 |
| ELEMENT NO 8 | IS A WALL ENTRANCE | .000 | 0 | | * |
| | U/S DATA | STATION | INVERT | SECT | FP |
| | | 1667.000 | 1378.000 | 2 | .500 |

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

| ELEMENT NO | IS A | SYSTEM HEADWORKS | | | |
|--------------|------|------------------|----------|----------|------|
| ELEMENT NO 9 | IS A | SYSTEM HEADWORKS | | | * |
| | | U/S DATA | STATION | INVERT | SECT |
| | | | 1667.000 | 1378.000 | 1 |
| | | W S ELEV | | | |
| | | 1378.000 | | | |

Appendix “E”

RCFC & WCD HYDROLOGY MANUAL



NOTES:

1. For rugged terrain and steep and waterfalls find effective slope from Table D-6.2. For channels without drops or waterfalls use trap slope for effective slope.
2. Relationships are for rational routing use only.
3. Manning's n range = 0.050 to 0.060.

Reference: BMO 101 dph, Item No. 5.

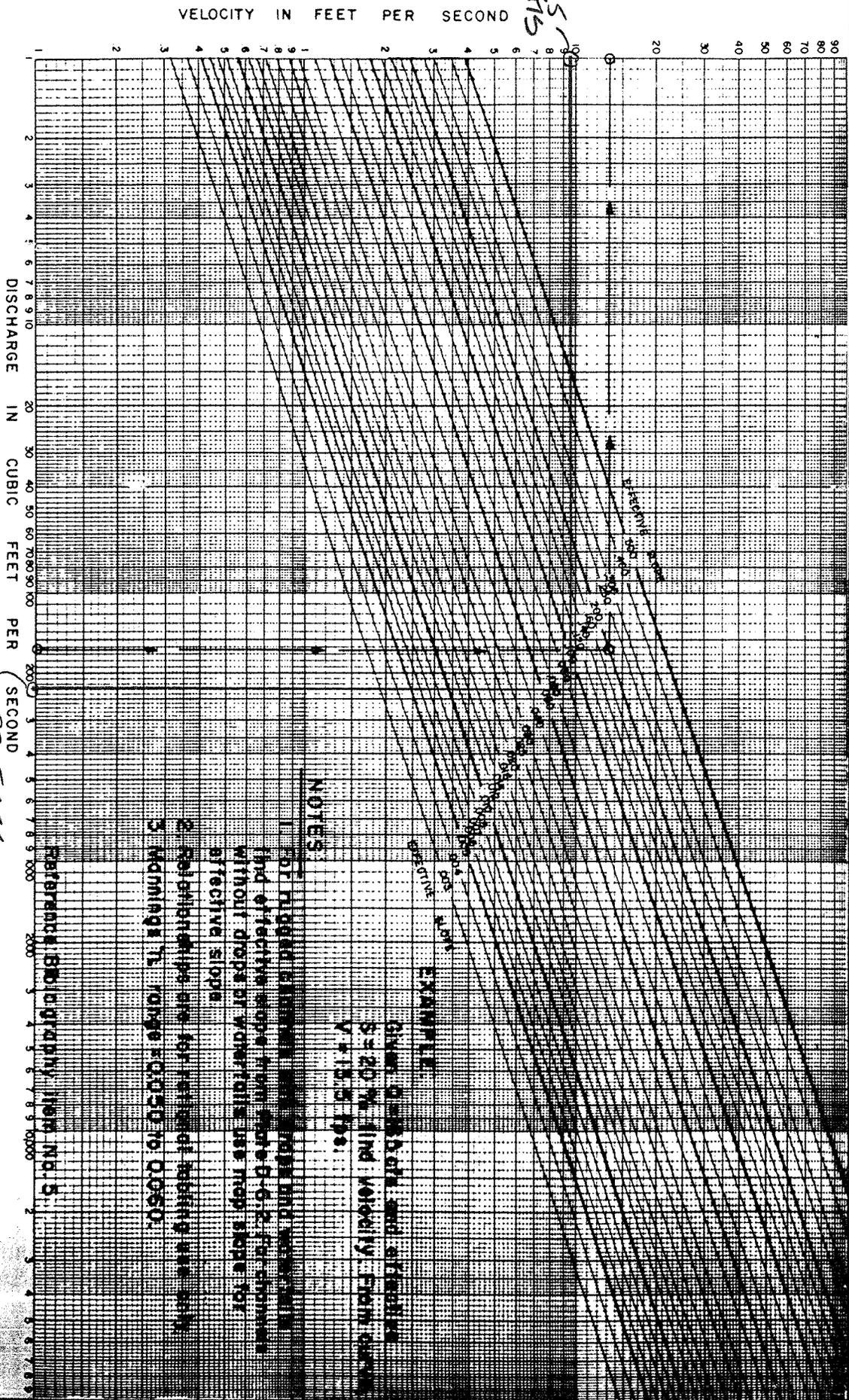
EXAMPLE:
 Given $Q = 400$ cfs and effective
 $S = 20\%$ find velocity from curves
 $V = 12.5$ fps.

VELOCITY - DISCHARGE - SLOPE
 RELATIONSHIPS
 NATURAL MOUNTAIN CHANNELS

(Butler)

Proposed Channels

RCFC & WCD HYDROLOGY MANUAL



NOTES

1. For rugged terrain use rough and smooth curves and effective slope from 0.01 to 0.2 for channels without drops or overfalls use top slope for effective slope.
2. Relationships are for natural channels only.
3. Manning's n range 0.050 to 0.060.

EXAMPLE

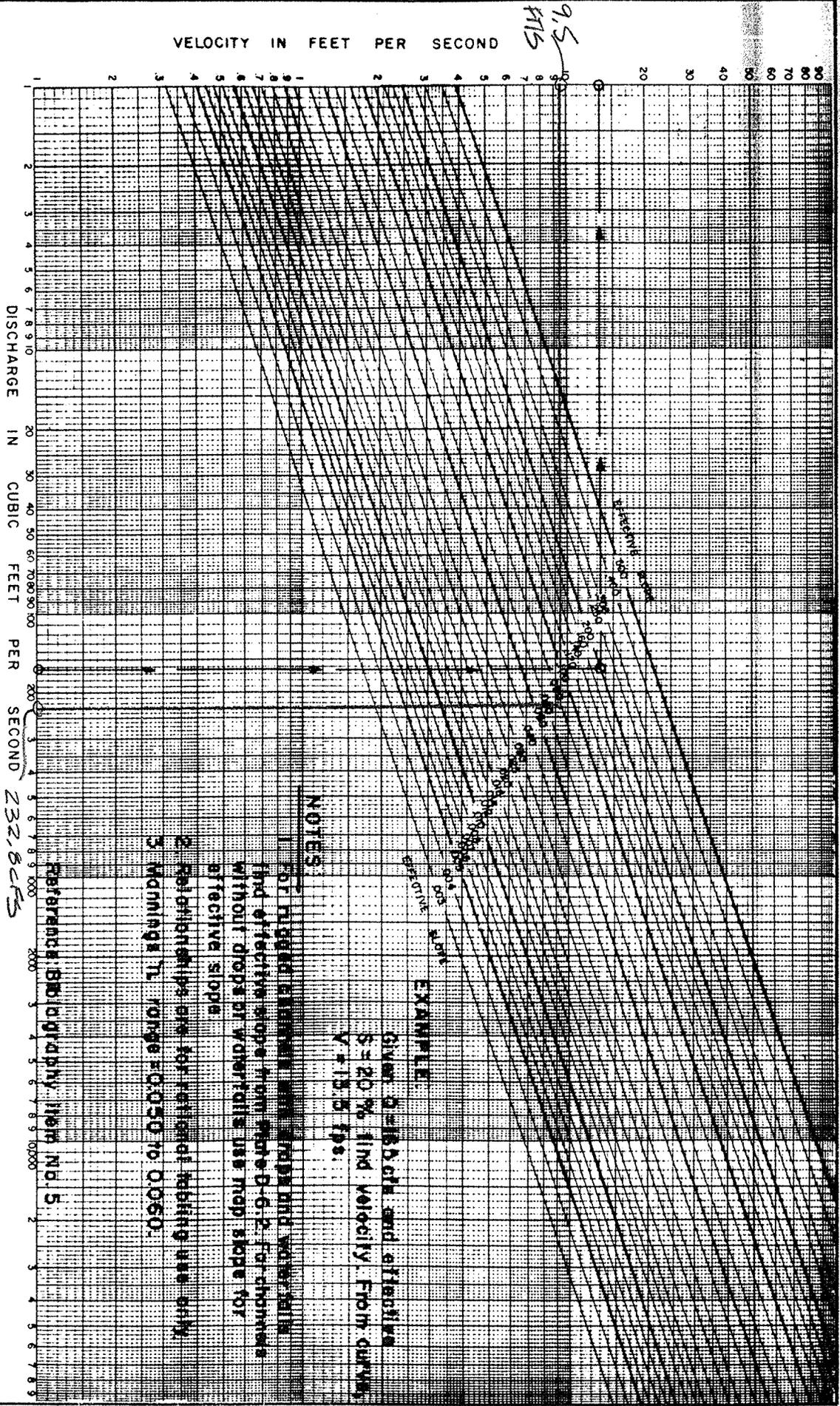
Given discharge and effective slope find velocity from curves.

VELOCITY - DISCHARGE - SLOPE
RELATIONSHIPS
NATURAL MOUNTAIN CHANNELS

(UN-Bulked)

Revised Conditions

RCFC & WCD HYDROLOGY MANUAL



NOTES:

1. FOR HYDRAULIC ESTIMATES AND CHANNEL AND WATERWAY find effective slope from plate D-6-2. For channels without drops or waterfalls use map slope for effective slope.
2. Relations ships are for natural and existing use only.
3. Manning's n ranges from 0.050 to 0.060.

EXAMPLE:

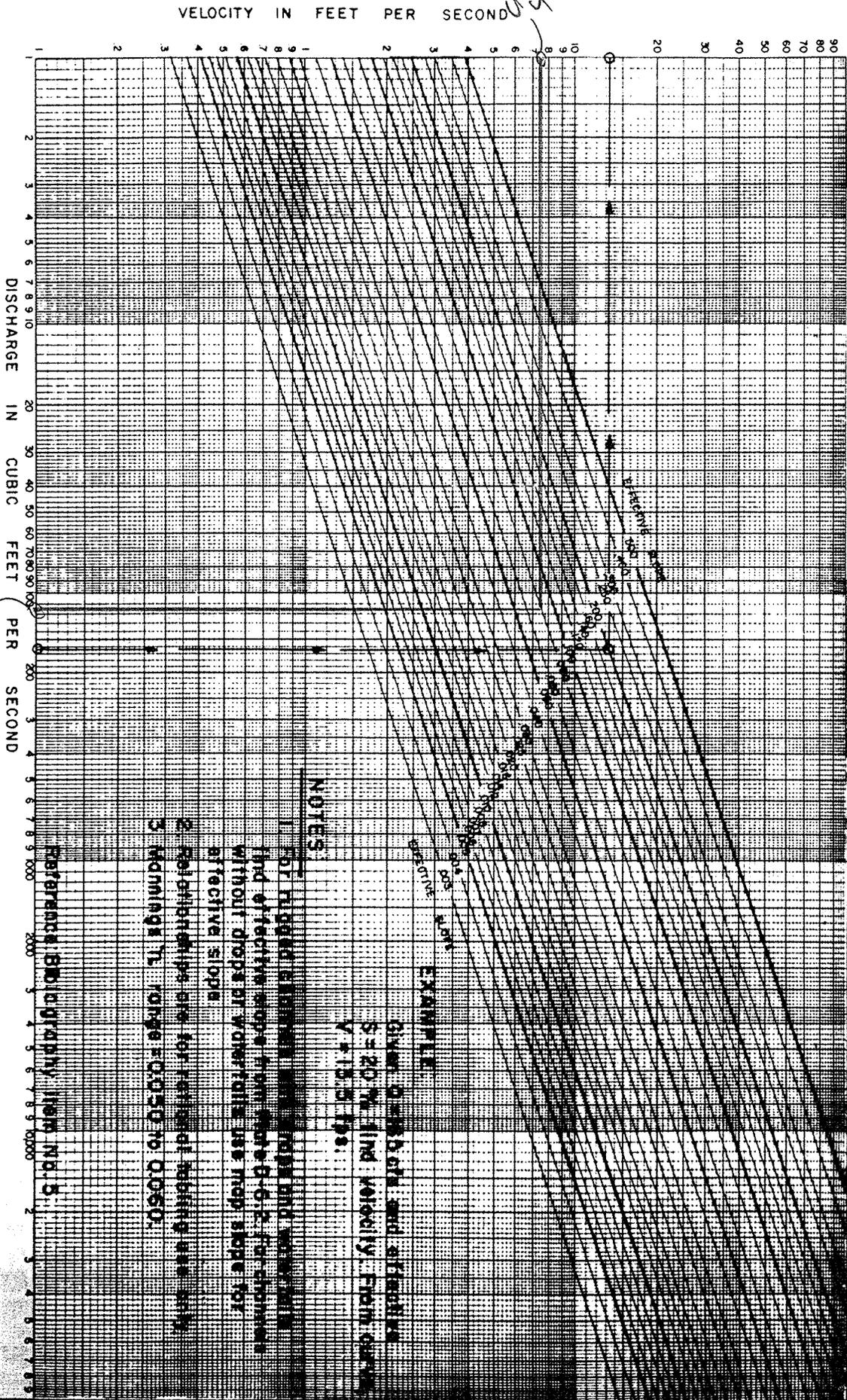
Given $S = 0.0024$ and effective $S = 20\%$ find velocity. From curves $V = 13.5$ fps.

Reference: BOD by Main No. 5

VELOCITY - DISCHARGE - SLOPE RELATIONSHIPS
NATURAL MOUNTAIN CHANNELS

"Bilrad" Eastern California

RCFC & WCD HYDROLOGY MANUAL



NOTES:

1. For rugged terrain use rough and porous bed and effective slope from Plate D-6, C, for channels without drops at waterfalls use top slope for effective slope.
2. Relationships are for normal bedding use only.
3. Manning's n range is 0.050 to 0.060.

Reference Bibliography Item No. 5

EXAMPLE:

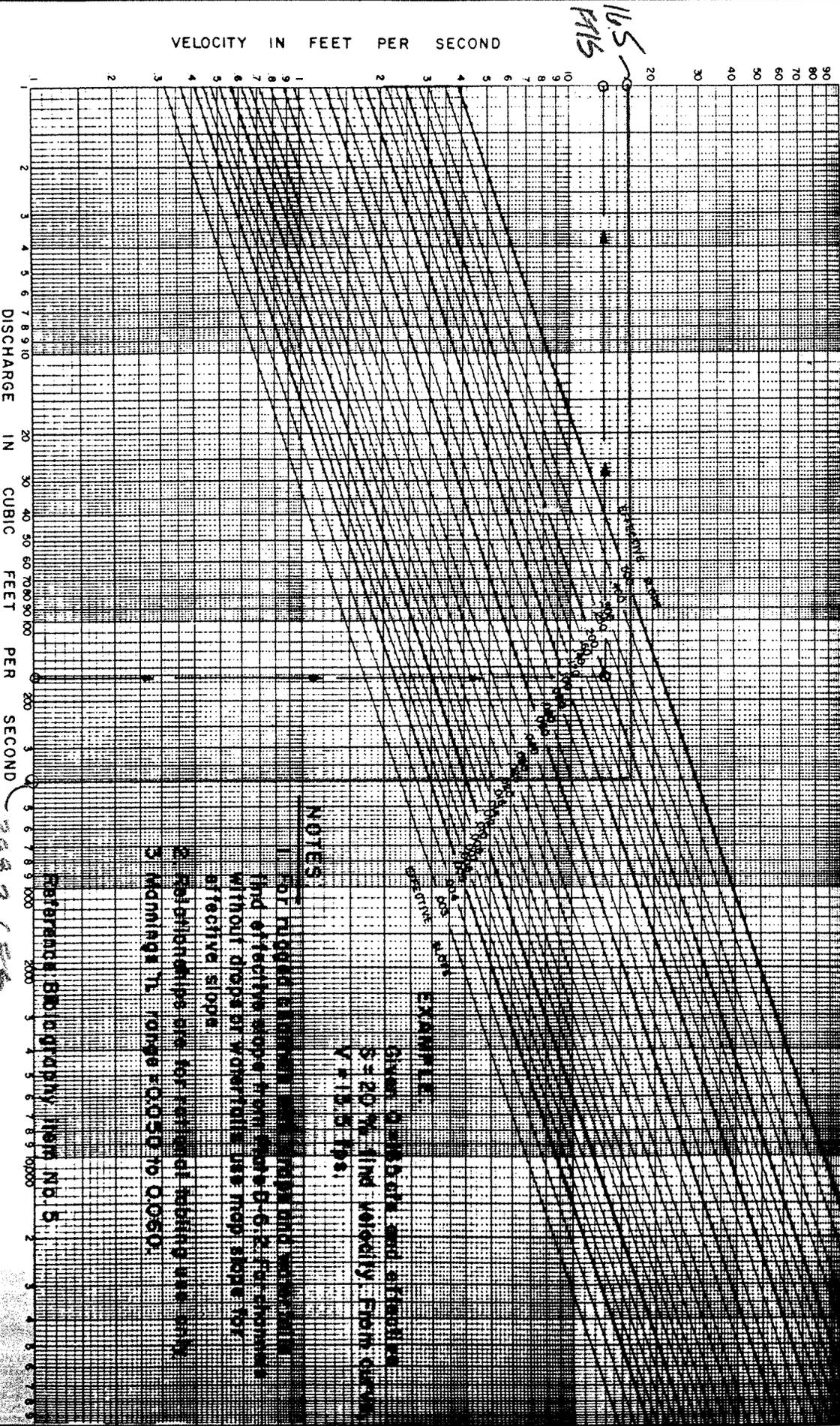
Given discharge and effective slope $S = 20\%$ find velocity from curve $V = 1.5$ f.p.s.

VELOCITY - DISCHARGE - SLOPE RELATIONSHIPS
NATURAL MOUNTAIN CHANNELS

(Un-Billed)

"Existing Conditions"

RCFC & WCD HYDROLOGY MANUAL



NOTES:

1. For rugged channels use roughness coefficient of 0.05 to 0.10 for channels without drops or waterfalls use rough slope for effective slope.
2. Relationship is for period of routing use only.
3. Manning's n range 0.050 to 0.080.

EXAMPLE:

Given channel and effective slope of 10% find velocity from curve $V = 15.5$ fpm.

Reference hydrograph from No. 5

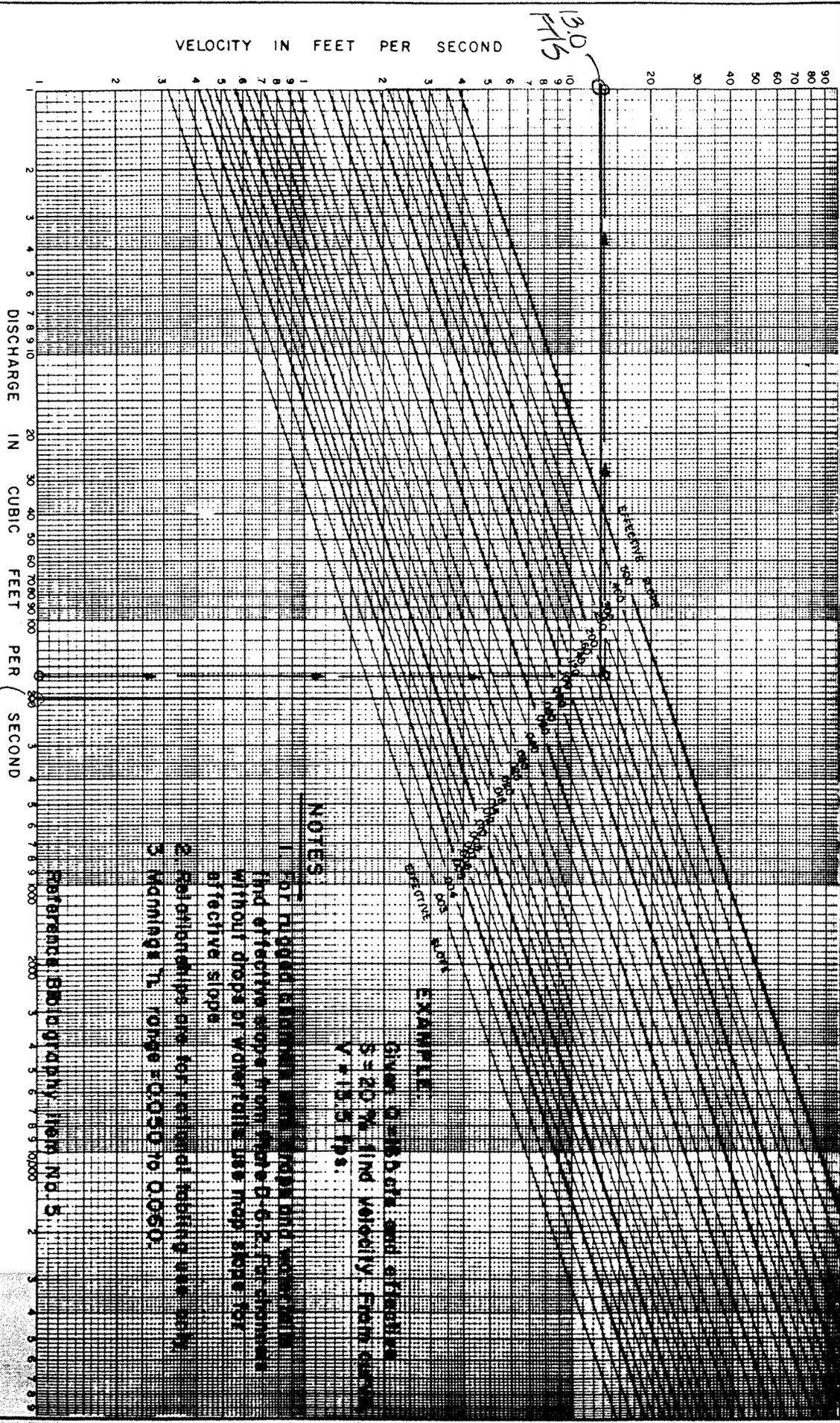
VELOCITY - DISCHARGE - SLOPE
RELATIONSHIPS
NATURAL MOUNTAIN CHANNELS

(Bulked)

Dr. Prasad Chandra

RCFC & WCD HYDROLOGY MANUAL

199.1.CFS



NOTES:

1. For flooded channels, use rough and irregular bed effective slope from plate D-6-2 for stones without drops or overfalls. Use steep slope for effective slope.
2. Relationships are for normal flowing water only.
3. Manning's n range is 0.050 to 0.060.

EXAMPLE:

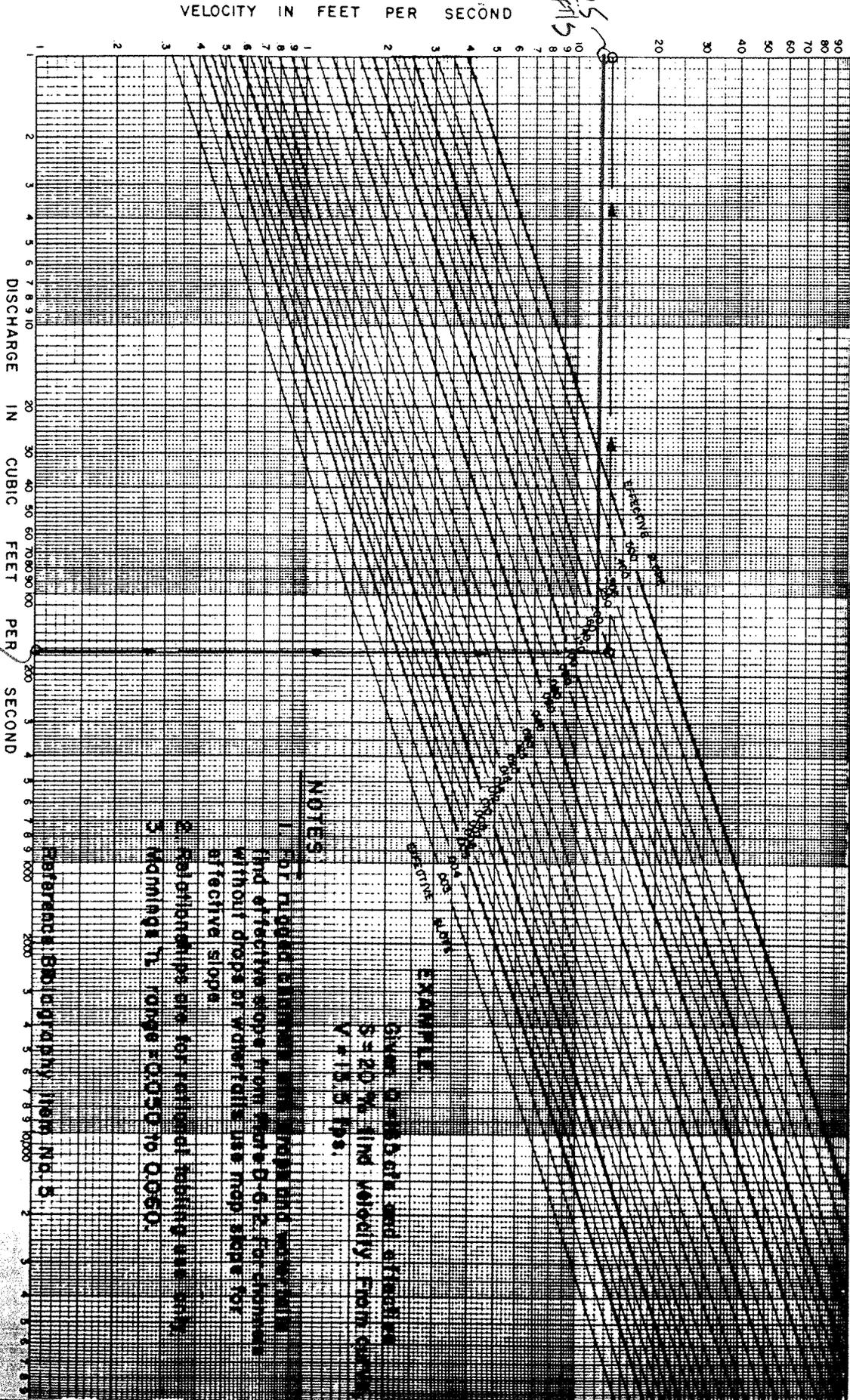
Given $S = 0.001$ and effective slope $S_e = 20\%$ find velocity. From curve $V = 15.5$ f/s.

Reference: BOLDING, Item No. 5.

VELOCITY - DISCHARGE - SLOPE
RELATIONSHIPS
NATURAL MOUNTAIN CHANNELS

(Un-B. Mod) "Froese's Conditions"

RCFC & WCD HYDROLOGY MANUAL



NOTES

- 1. If rigid channel and roughness coefficients are known, find effective slope from Table D-6. If channels without drops or waterfalls use rough slope for effective slope.
- 2. Relationships are for range of bedding and slope.
- 3. Manning's n range is 0.050 to 0.060.

EXAMPLE

Given discharge and effective slope. Find velocity from curves.

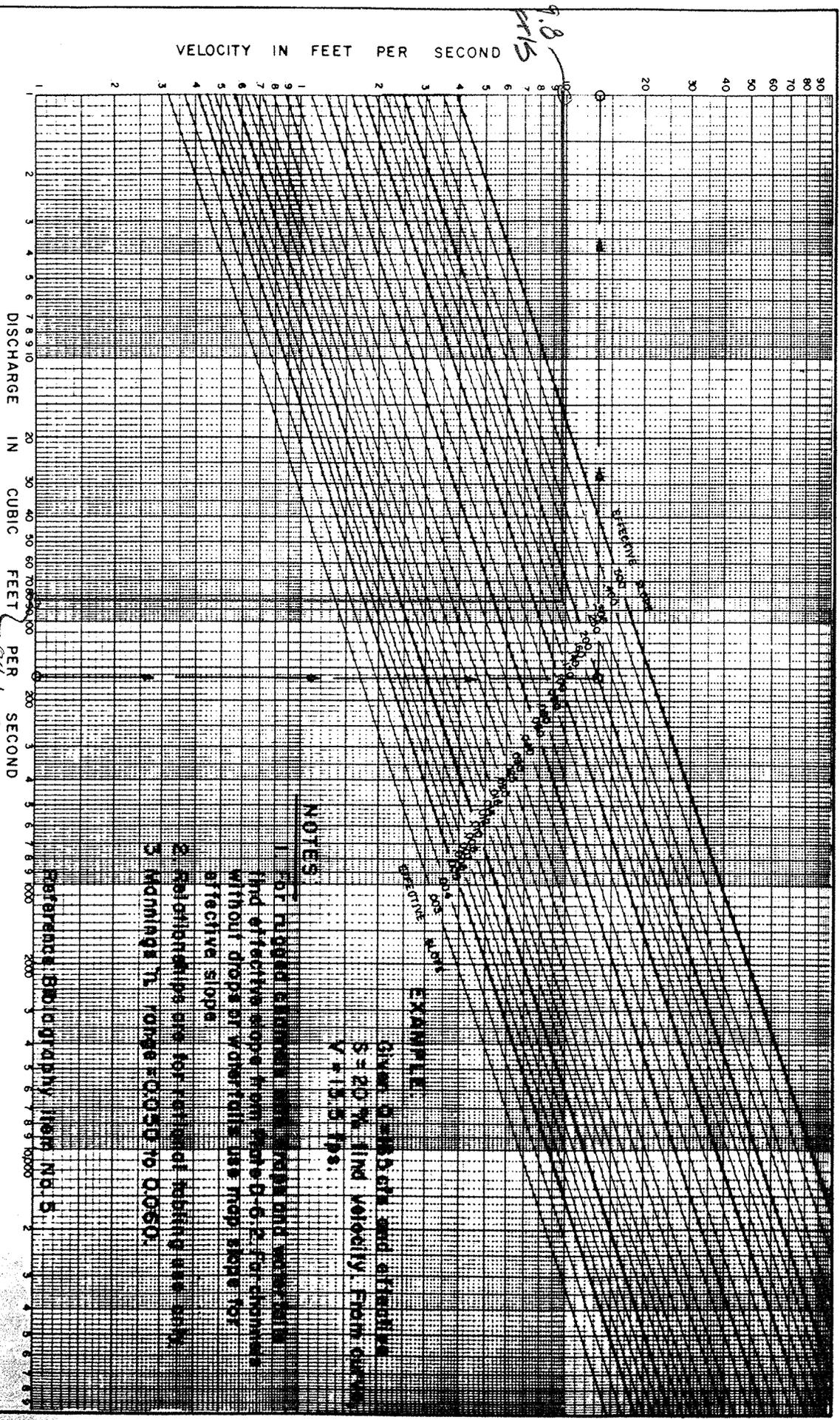
Reference: Bibliography Item No. 5

VELOCITY - DISCHARGE - SLOPE
RELATIONSHIPS
NATURAL MOUNTAIN CHANNELS

(B. Wood)

"Existing Conditions"

RCFC & WCD HYDROLOGY MANUAL



VELOCITY - DISCHARGE - SLOPE
 RELATIONSHIPS
 NATURAL MOUNTAIN CHANNELS

(UN-Bullock) Existing Conditions

Appendix “F”

HEC-RAS Plan: Plan 03 River: RIVER-1 Reach: Reach-1 Profile: PF 1

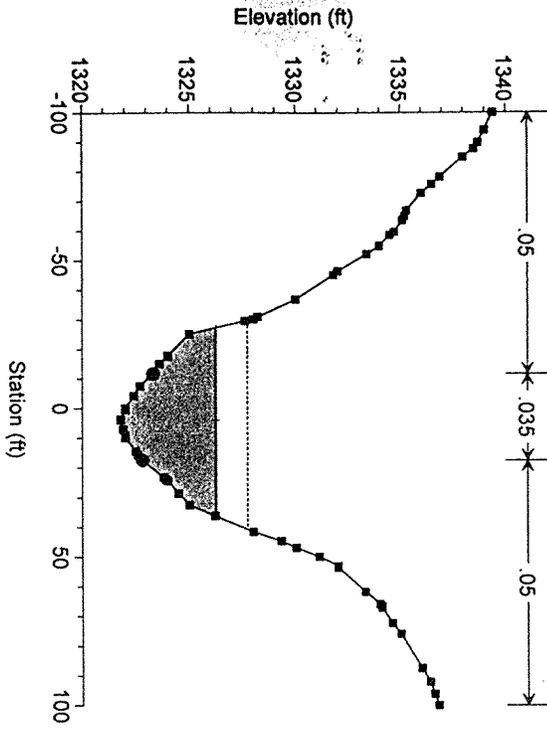
| Reach | River Sta | Profile | Q Total (cfs) | Min Chl EI (ft) | W/S. Elev (ft) | Chl W/S. (ft) | E. G. Elev (ft) | E. G. Slope (ft/ft) | Vel Chnl (ft/s) | Flow Area (sq ft) | Top Width (ft) | Froude # Chl |
|---------|-----------|---------|------------------|--------------------|-------------------|------------------|--------------------|------------------------|--------------------|----------------------|-------------------|--------------|
| Reach-1 | 1600 | PF 1 | 1532.80 | 1321.80 | 1326.26 | 1326.26 | 1327.72 | 0.010003 | 10.59 | 183.09 | 63.82 | 0.94 |
| Reach-1 | 1550 | PF 1 | 1532.80 | 1318.00 | 1321.77 | 1321.77 | 1323.21 | 0.010624 | 10.24 | 180.62 | 67.81 | 0.95 |
| Reach-1 | 1500 | PF 1 | 1532.80 | 1315.30 | 1318.06 | 1318.06 | 1319.12 | 0.012727 | 9.20 | 209.94 | 101.16 | 0.99 |
| Reach-1 | 1450 | PF 1 | 1532.80 | 1312.40 | 1314.91 | 1314.91 | 1315.92 | 0.013251 | 8.76 | 212.51 | 109.36 | 1.00 |
| Reach-1 | 1400 | PF 1 | 1532.80 | 1308.60 | 1311.02 | 1311.02 | 1311.94 | 0.014933 | 9.10 | 227.92 | 126.31 | 1.05 |
| Reach-1 | 1350 | PF 1 | 1532.80 | 1303.40 | 1305.94 | 1305.94 | 1306.91 | 0.013104 | 8.49 | 213.74 | 113.74 | 0.98 |
| Reach-1 | 1300 | PF 1 | 1532.80 | 1299.70 | 1302.91 | 1302.91 | 1303.83 | 0.011641 | 9.21 | 237.46 | 124.76 | 0.96 |
| Reach-1 | 1250 | PF 1 | 1532.80 | 1296.30 | 1299.81 | 1299.81 | 1300.87 | 0.011104 | 9.42 | 222.74 | 113.21 | 0.95 |
| Reach-1 | 1200 | PF 1 | 1532.80 | 1294.10 | 1297.31 | 1297.31 | 1298.41 | 0.012101 | 9.46 | 211.74 | 99.36 | 0.98 |
| Reach-1 | 1150 | PF 1 | 1532.80 | 1289.60 | 1293.74 | 1293.74 | 1294.83 | 0.009177 | 8.92 | 217.15 | 108.15 | 0.87 |
| Reach-1 | 1100 | PF 1 | 1532.80 | 1283.60 | 1286.64 | 1286.64 | 1287.93 | 0.012458 | 9.66 | 182.85 | 73.16 | 1.00 |
| Reach-1 | 1050 | PF 1 | 1532.80 | 1277.80 | 1281.53 | 1281.53 | 1282.98 | 0.011075 | 10.40 | 178.96 | 65.83 | 0.97 |
| Reach-1 | 1000 | PF 1 | 1532.80 | 1272.20 | 1276.50 | 1276.50 | 1278.07 | 0.010608 | 10.54 | 169.83 | 59.20 | 0.96 |
| Reach-1 | 950 | PF 1 | 1532.80 | 1270.00 | 1273.85 | 1273.85 | 1275.10 | 0.013310 | 9.25 | 180.26 | 77.07 | 1.01 |
| Reach-1 | 900 | PF 1 | 1532.80 | 1269.30 | 1271.92 | 1271.92 | 1273.03 | 0.013687 | 8.56 | 186.17 | 86.78 | 1.00 |
| Reach-1 | 850 | PF 1 | 1532.80 | 1265.40 | 1268.45 | 1268.45 | 1269.65 | 0.011743 | 9.25 | 191.00 | 84.22 | 0.97 |
| Reach-1 | 800 | PF 1 | 1532.80 | 1262.00 | 1265.50 | 1265.50 | 1266.72 | 0.011846 | 9.39 | 191.24 | 82.22 | 0.97 |
| Reach-1 | 750 | PF 1 | 1532.80 | 1258.00 | 1261.99 | 1261.99 | 1263.24 | 0.010610 | 9.61 | 196.95 | 89.49 | 0.94 |
| Reach-1 | 700 | PF 1 | 1532.80 | 1255.80 | 1258.70 | 1258.70 | 1259.64 | 0.014250 | 7.90 | 202.50 | 110.07 | 1.00 |
| Reach-1 | 650 | PF 1 | 1532.80 | 1251.70 | 1254.83 | 1254.83 | 1255.75 | 0.014795 | 7.81 | 203.16 | 113.34 | 1.01 |
| Reach-1 | 600 | PF 1 | 1532.80 | 1249.30 | 1252.01 | 1252.01 | 1252.93 | 0.014602 | 7.77 | 204.00 | 115.34 | 1.00 |
| Reach-1 | 550 | PF 1 | 1532.80 | 1246.00 | 1249.29 | 1249.29 | 1250.25 | 0.013829 | 8.05 | 203.64 | 111.51 | 0.99 |
| Reach-1 | 500 | PF 1 | 1532.80 | 1242.50 | 1246.46 | 1246.46 | 1247.58 | 0.013619 | 8.73 | 187.98 | 90.13 | 1.00 |
| Reach-1 | 450 | PF 1 | 1532.80 | 1238.70 | 1243.33 | 1243.33 | 1244.34 | 0.014102 | 8.17 | 196.02 | 102.17 | 1.00 |
| Reach-1 | 400 | PF 1 | 1532.80 | 1236.00 | 1240.93 | 1240.93 | 1241.80 | 0.016424 | 7.68 | 208.89 | 122.66 | 1.04 |
| Reach-1 | 350 | PF 1 | 1532.80 | 1234.00 | 1237.26 | 1237.26 | 1238.13 | 0.015164 | 7.71 | 210.95 | 122.21 | 1.01 |
| Reach-1 | 300 | PF 1 | 1532.80 | 1230.80 | 1234.11 | 1234.11 | 1235.07 | 0.014267 | 8.11 | 205.59 | 111.25 | 1.00 |
| Reach-1 | 250 | PF 1 | 1532.80 | 1227.60 | 1230.41 | 1230.41 | 1231.56 | 0.012333 | 8.96 | 191.93 | 87.40 | 0.98 |
| Reach-1 | 200 | PF 1 | 1532.80 | 1224.60 | 1227.17 | 1227.17 | 1228.17 | 0.013099 | 8.64 | 210.03 | 106.99 | 0.99 |
| Reach-1 | 150 | PF 1 | 1532.80 | 1213.60 | 1217.10 | 1217.10 | 1218.46 | 0.012123 | 9.58 | 172.14 | 65.91 | 0.98 |
| Reach-1 | 100 | PF 1 | 1532.80 | 1199.50 | 1206.00 | 1203.24 | 1206.35 | 0.001309 | 5.05 | 357.62 | 75.20 | 0.36 |

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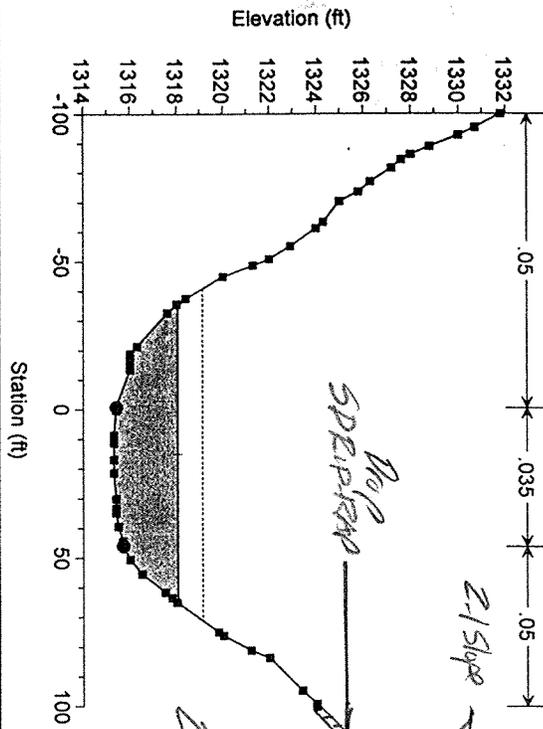
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1600 Q(100) = 1532.8 (100% Bulking Factor)



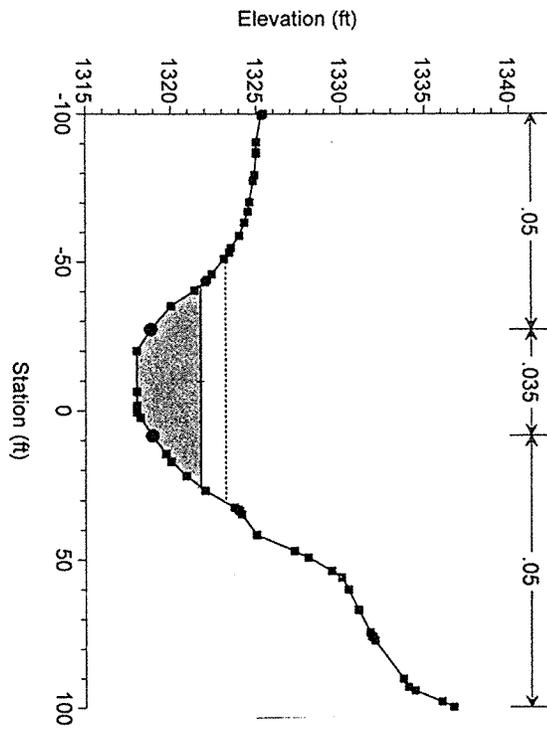
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1500 Q(100) = 1532.8 (100% Bulking Factor)



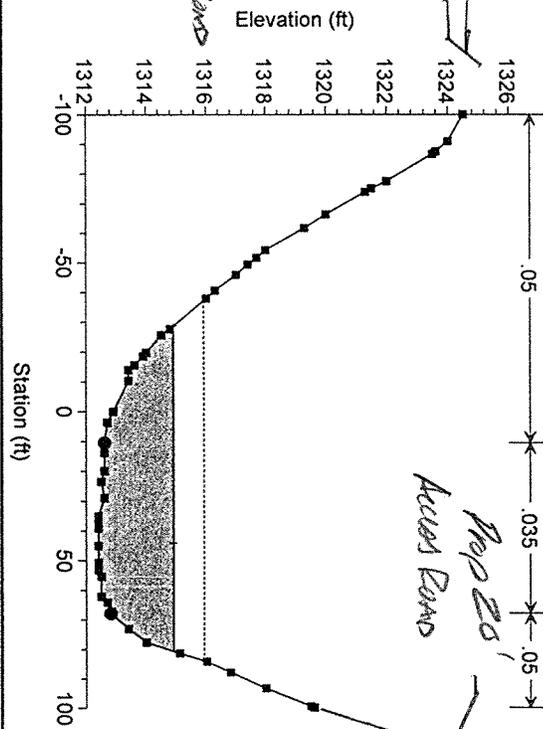
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1550 Q(100) = 1532.8 (100% Bulking Factor)

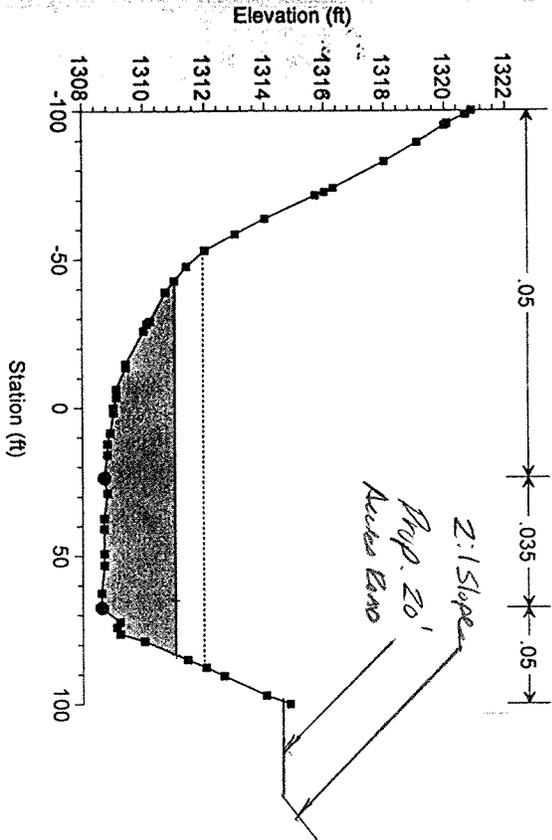


HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

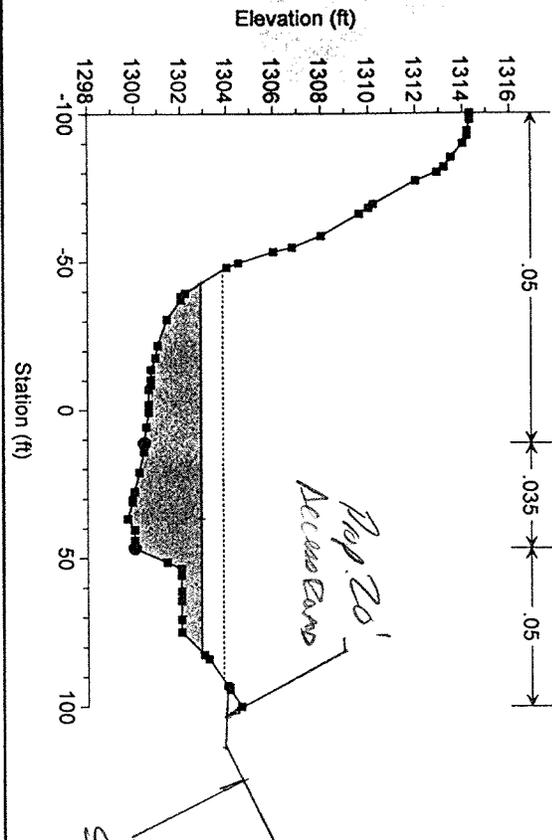
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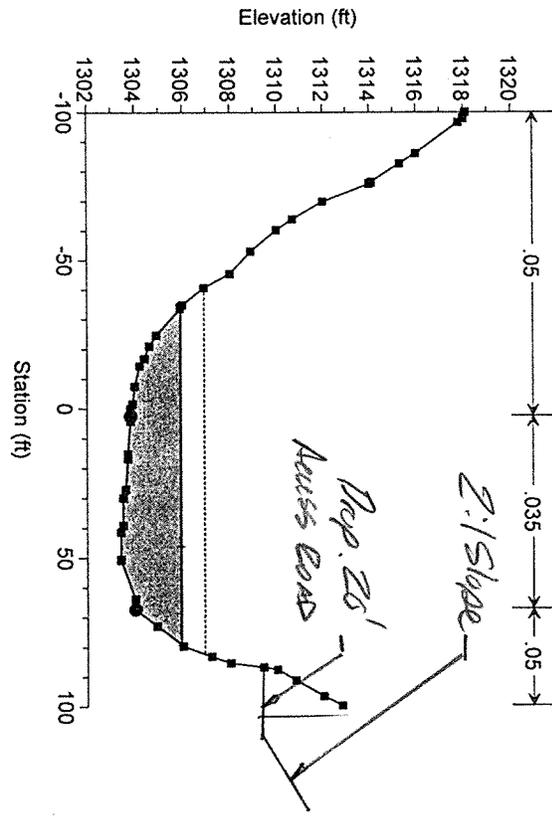
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 1400 Q(100) = 1532.8 (100% Bulking Factor)



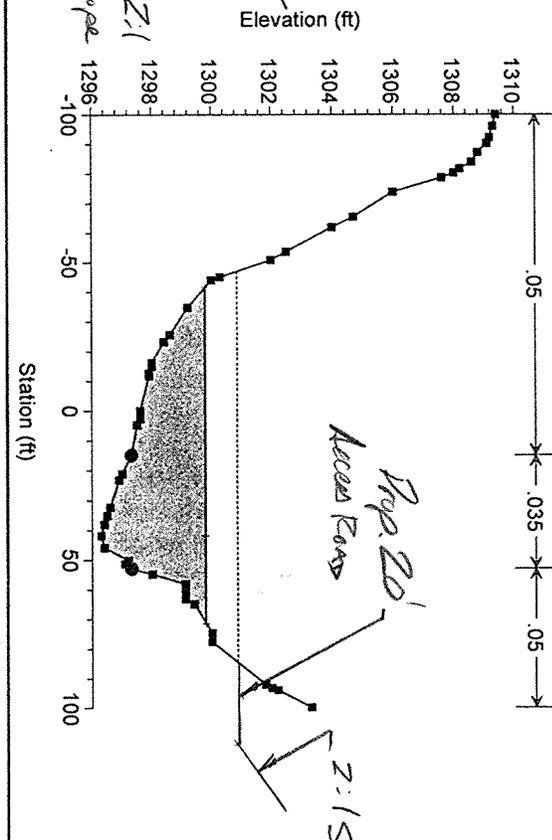
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 1300 Q(100) = 1532.8 (100% Bulking Factor)

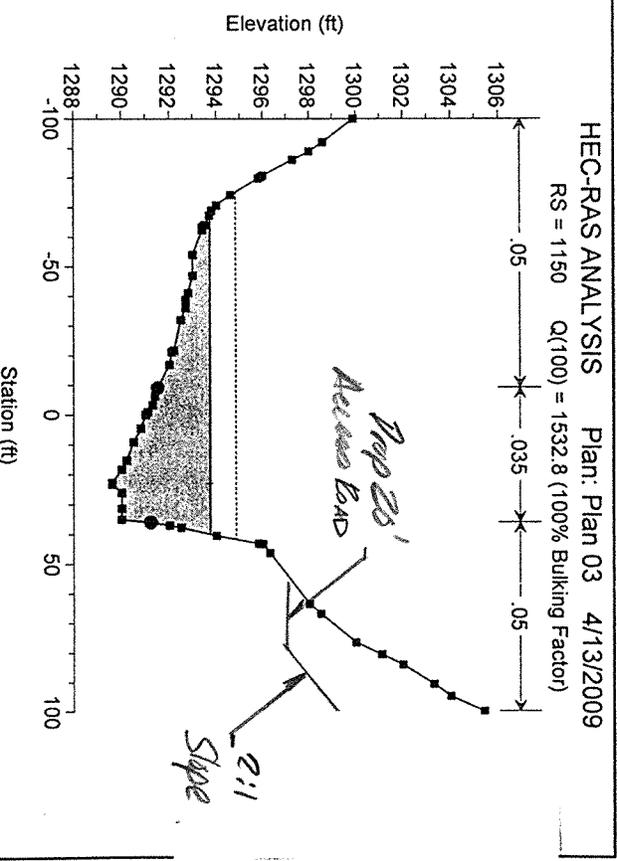
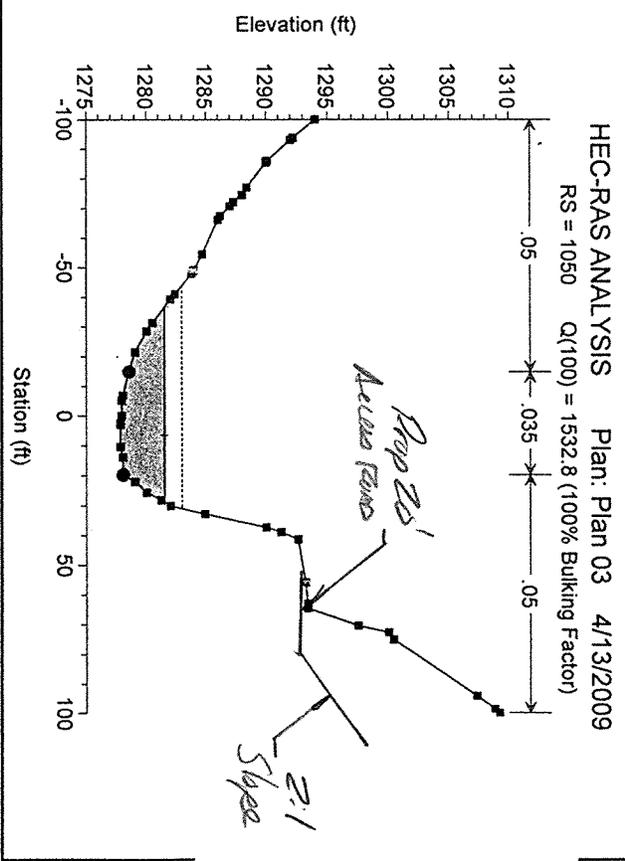
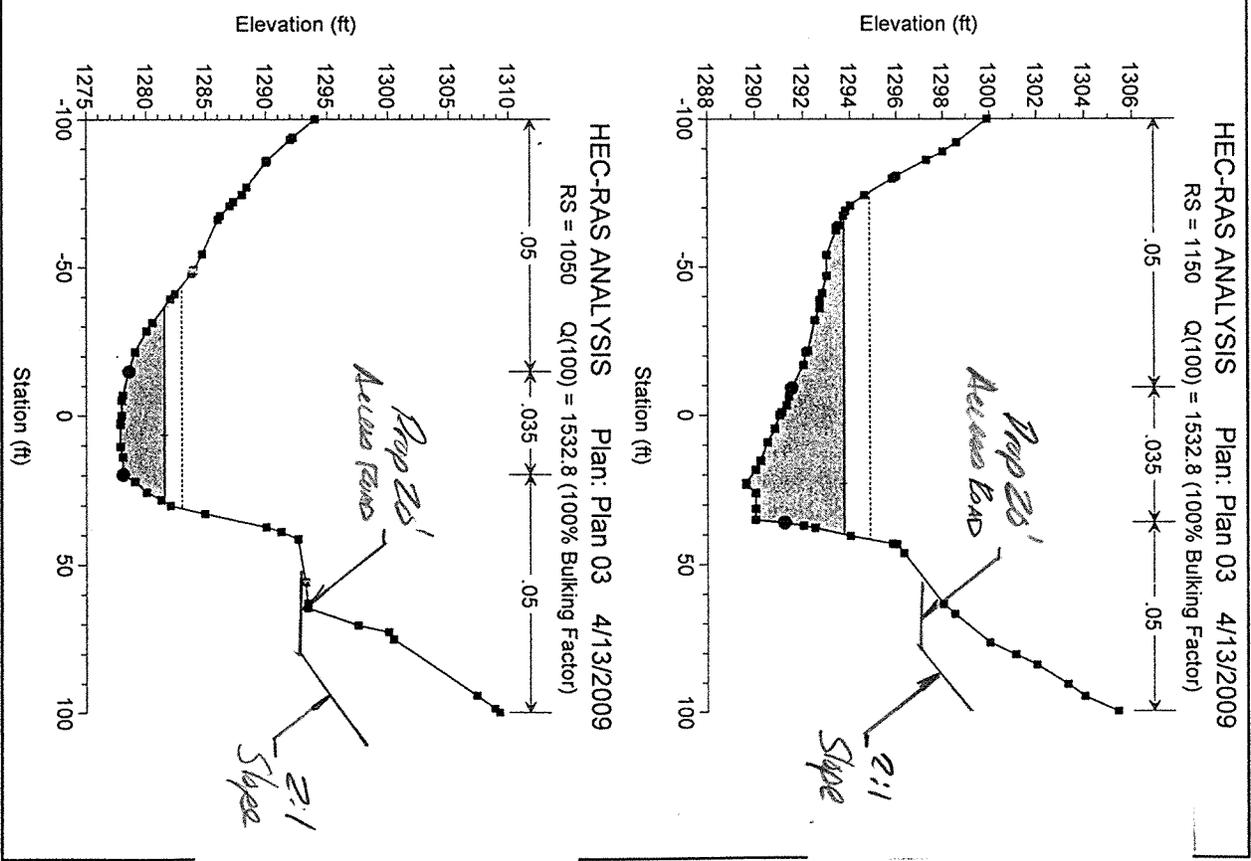
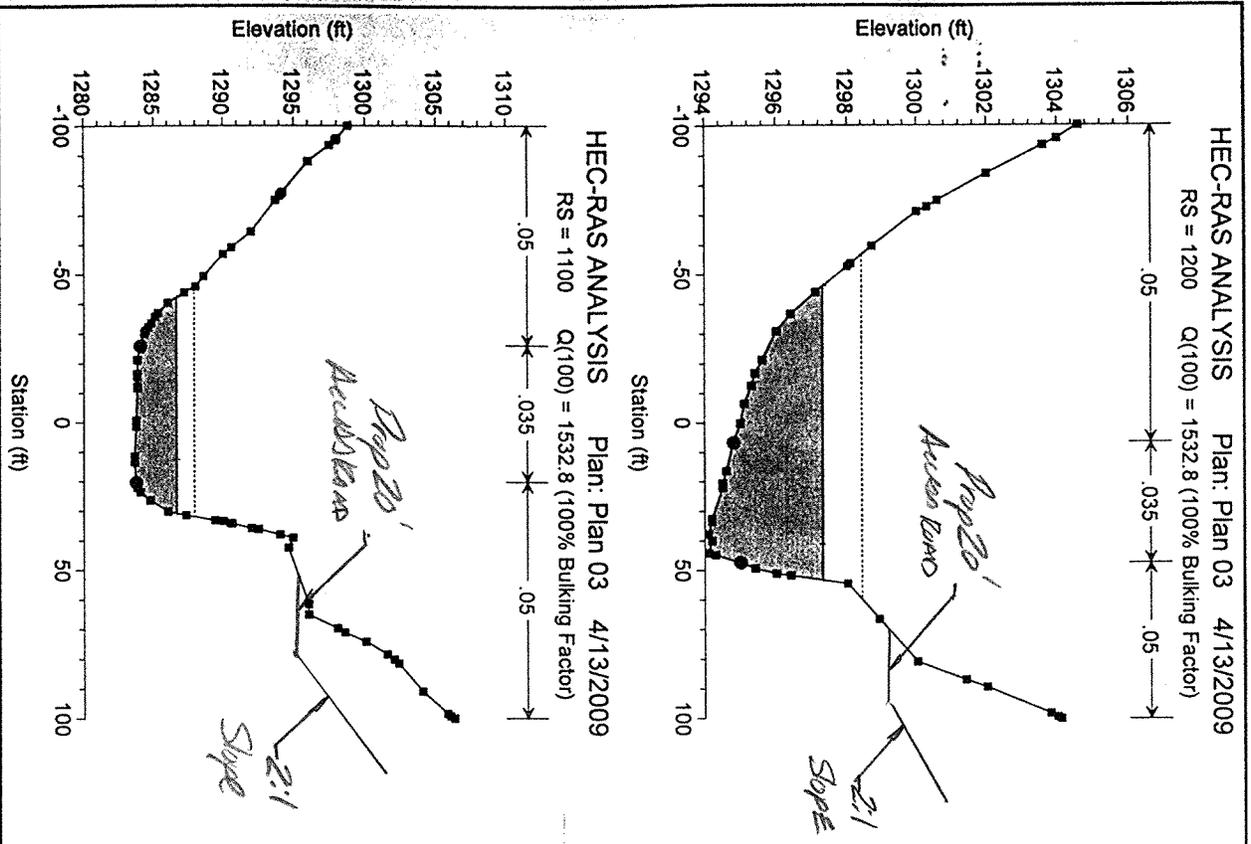


HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 1350 Q(100) = 1532.8 (100% Bulking Factor)

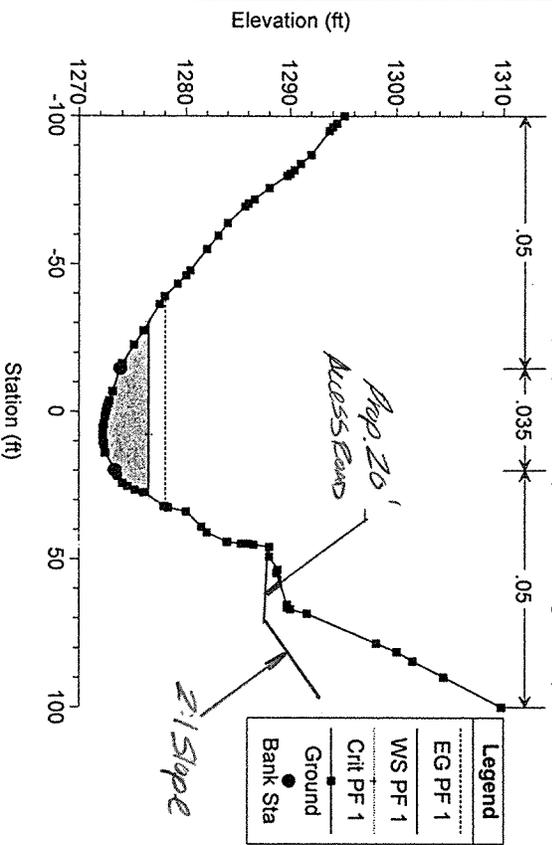


HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
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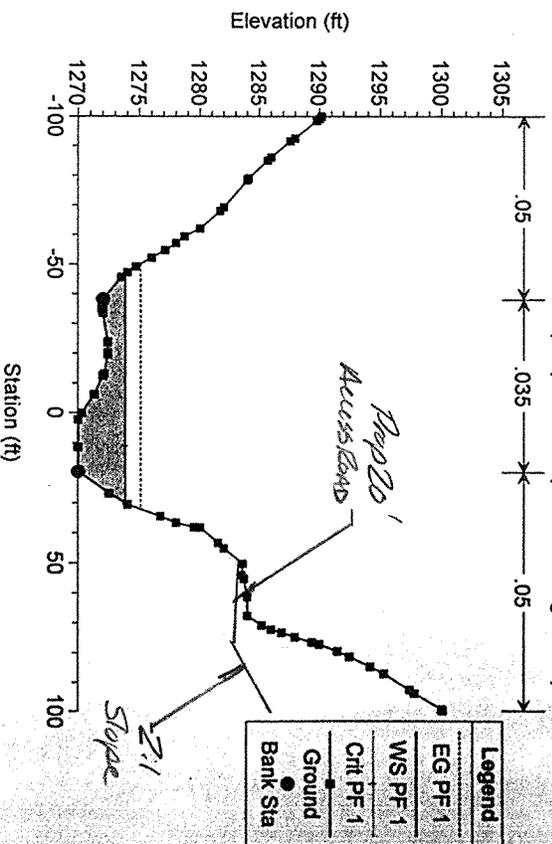




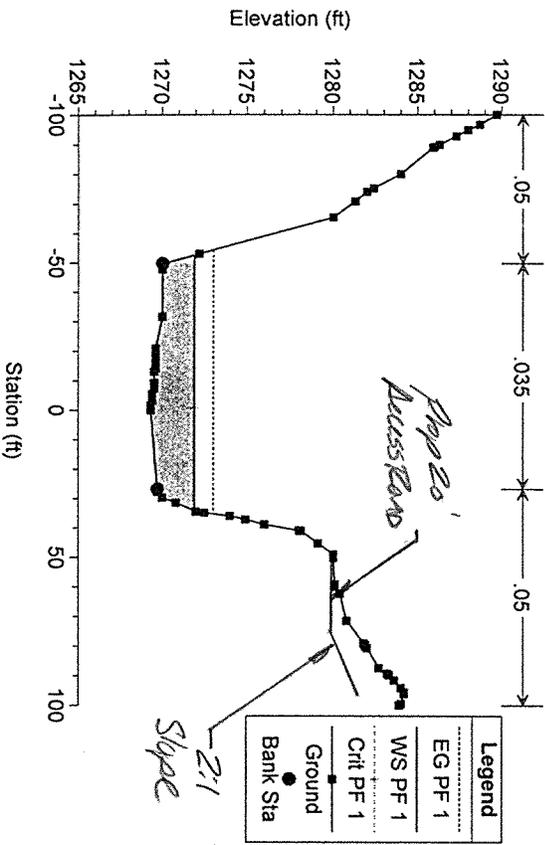
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
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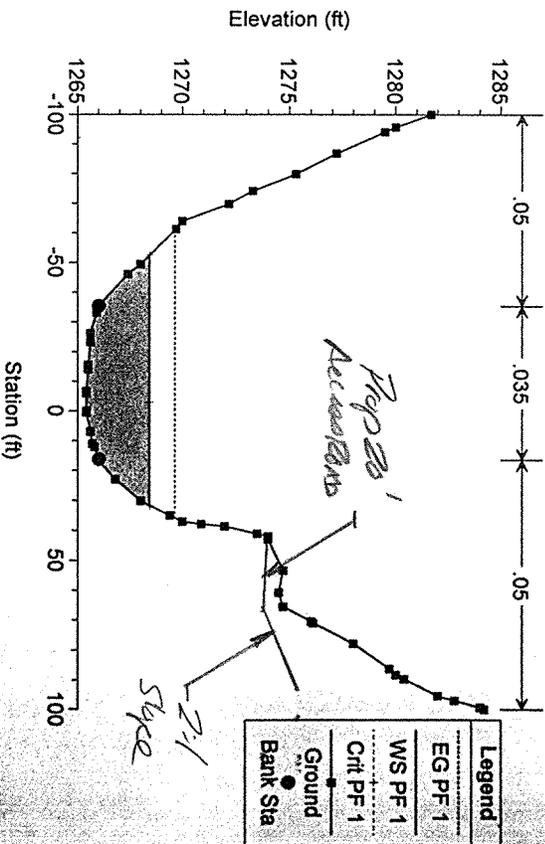
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
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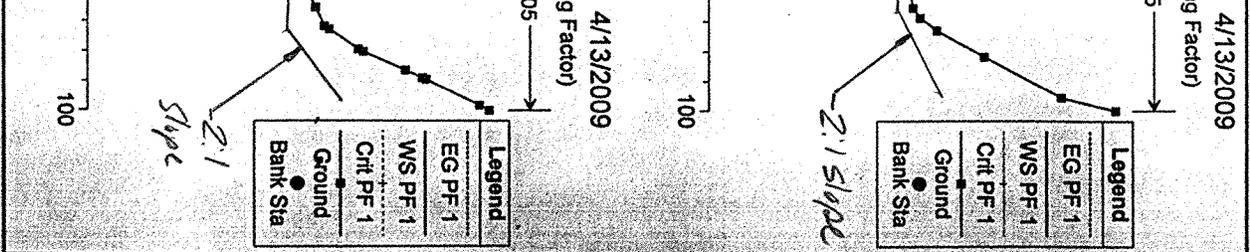
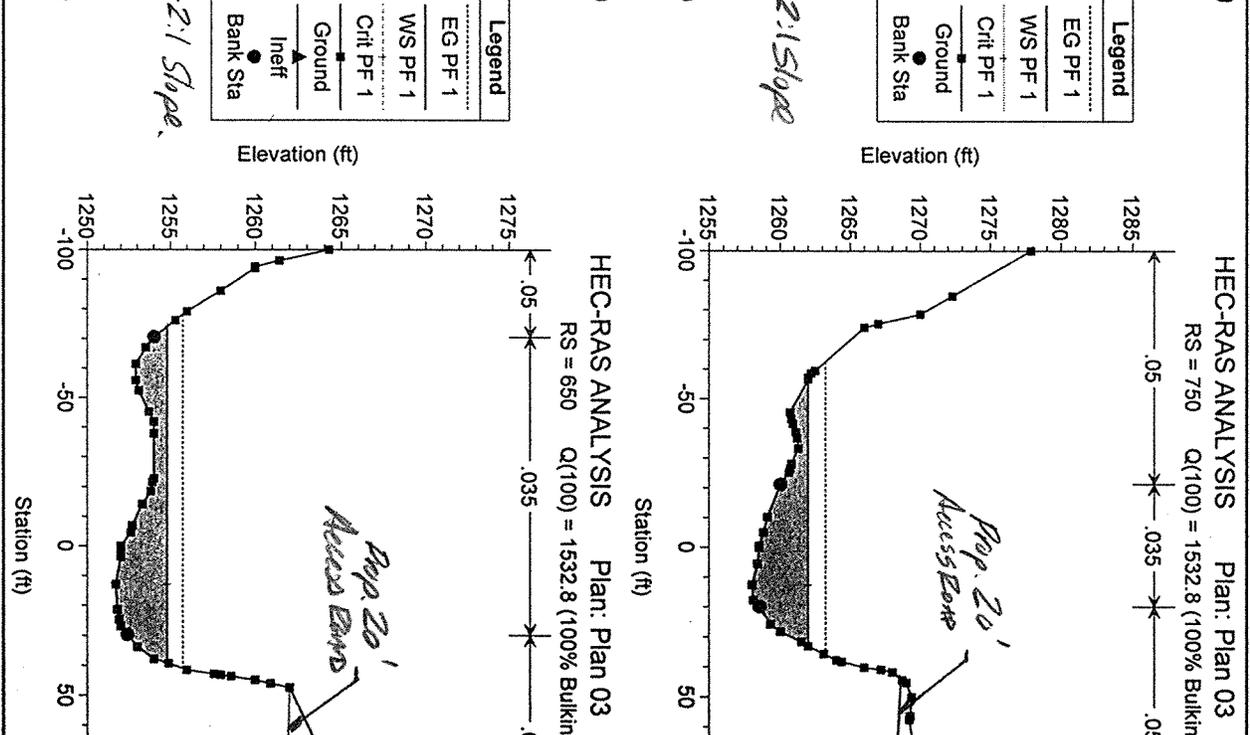
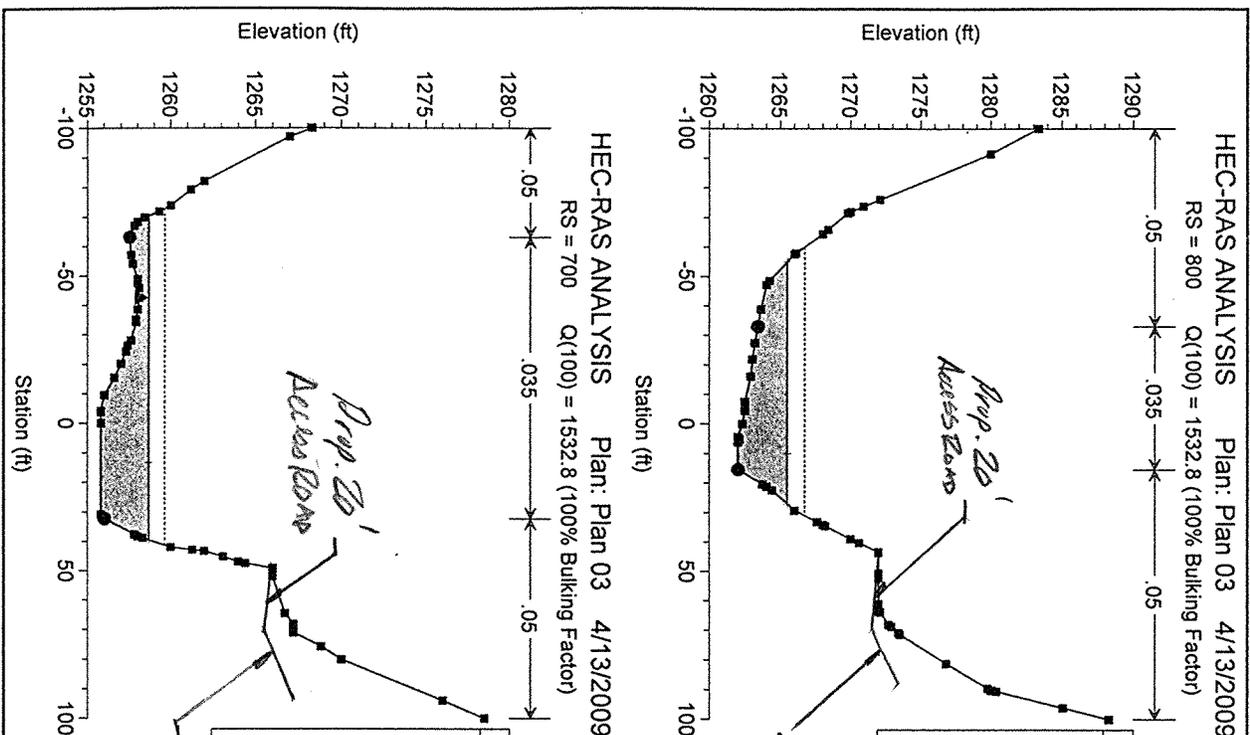


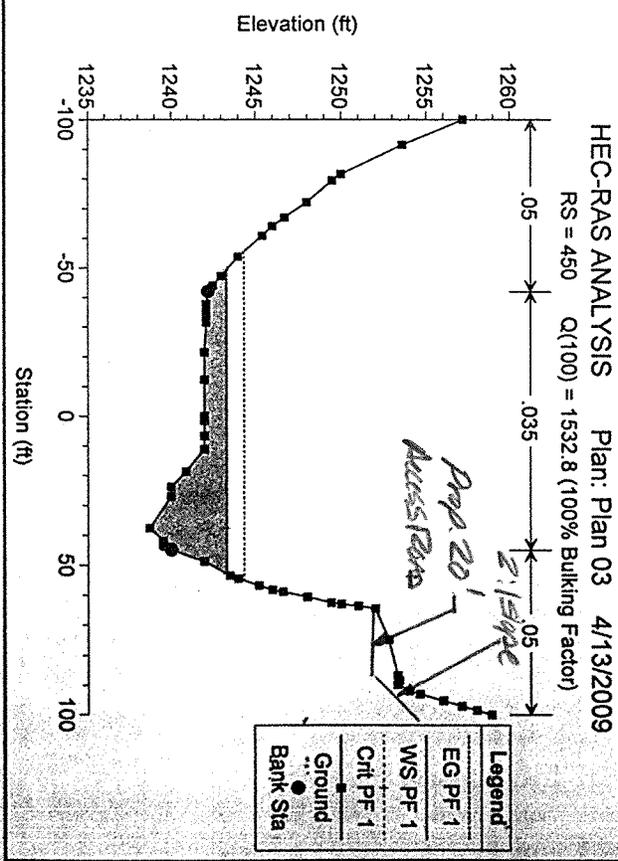
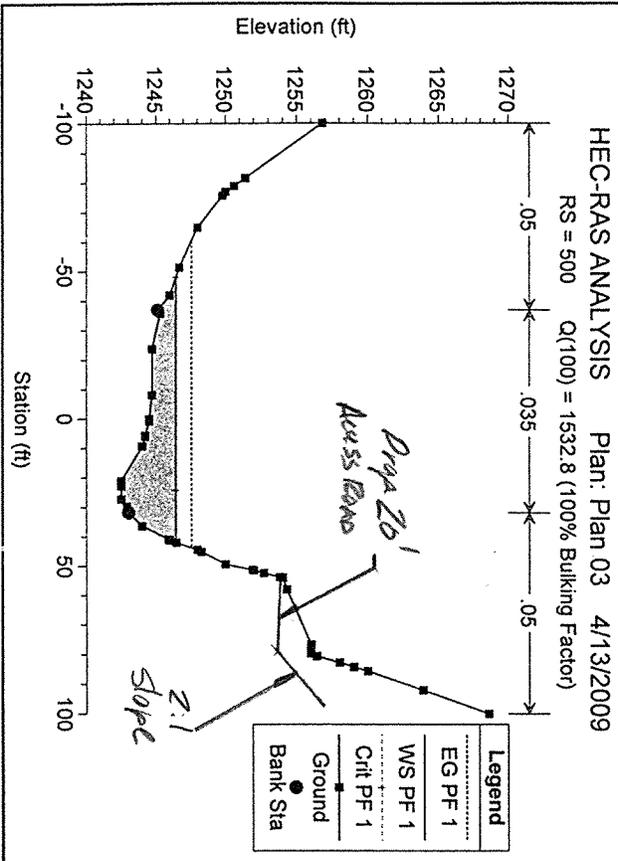
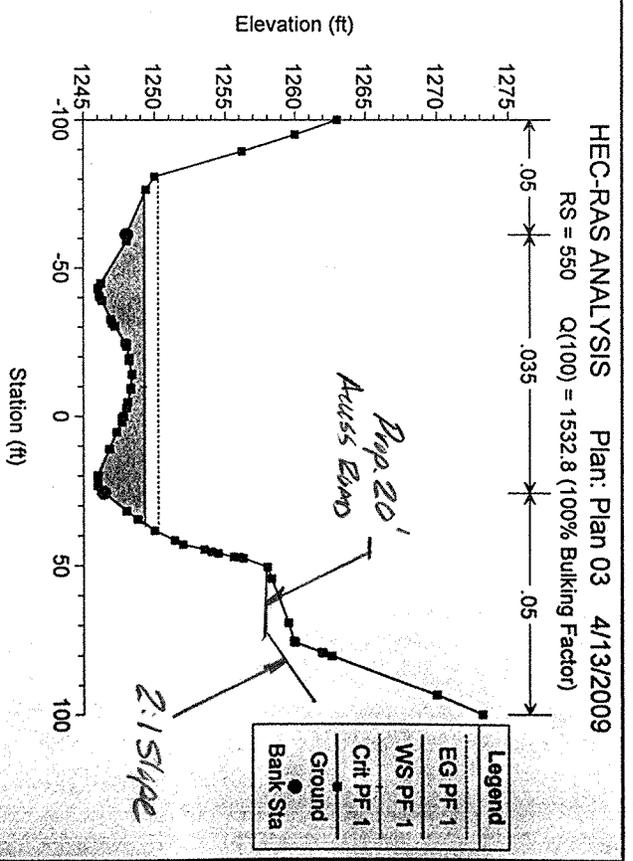
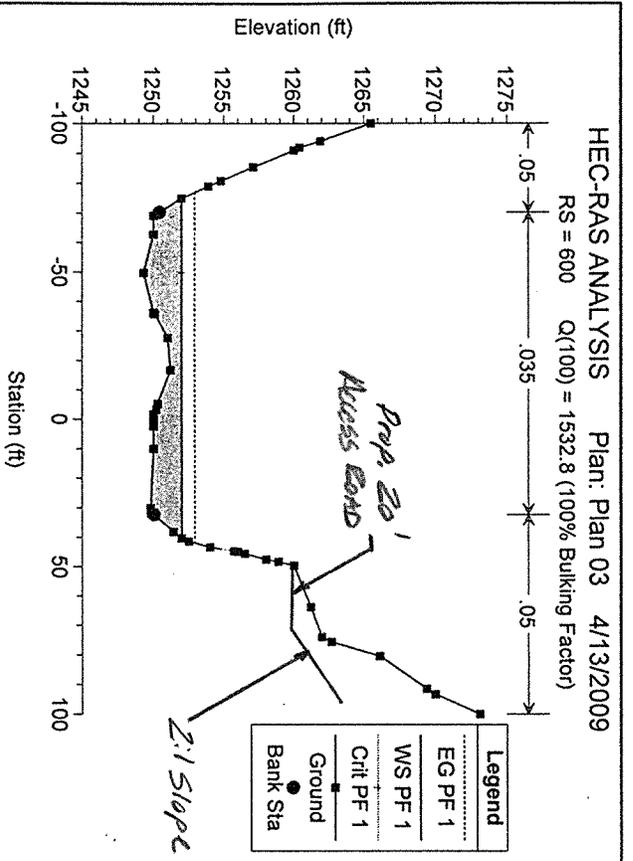
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 900 Q(100) = 1532.8 (100% Bulking Factor)



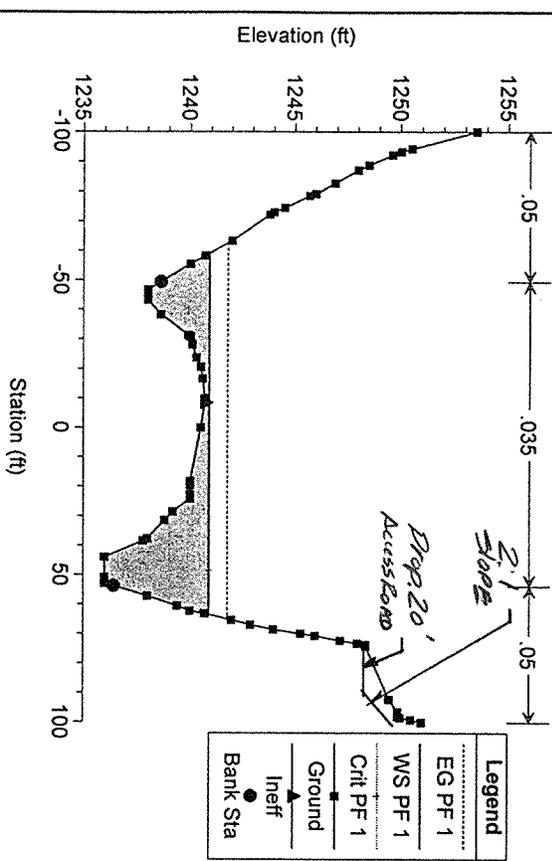
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 850 Q(100) = 1532.8 (100% Bulking Factor)



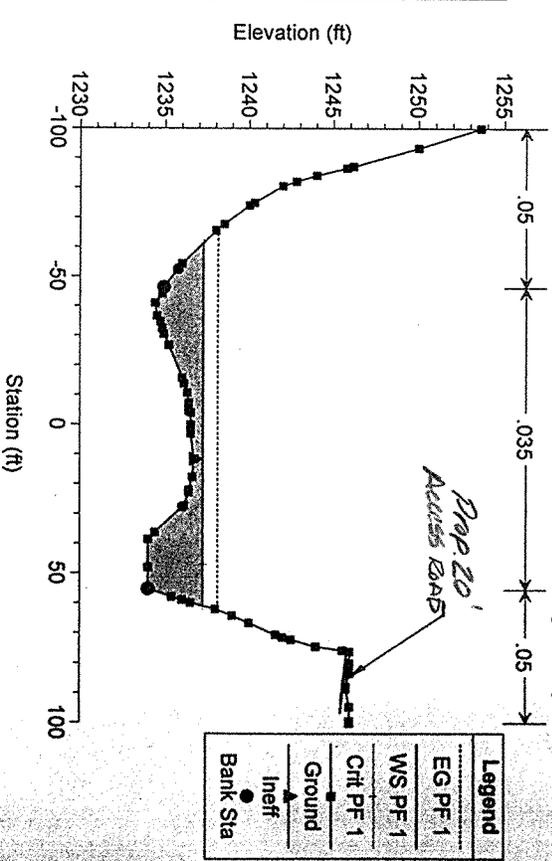




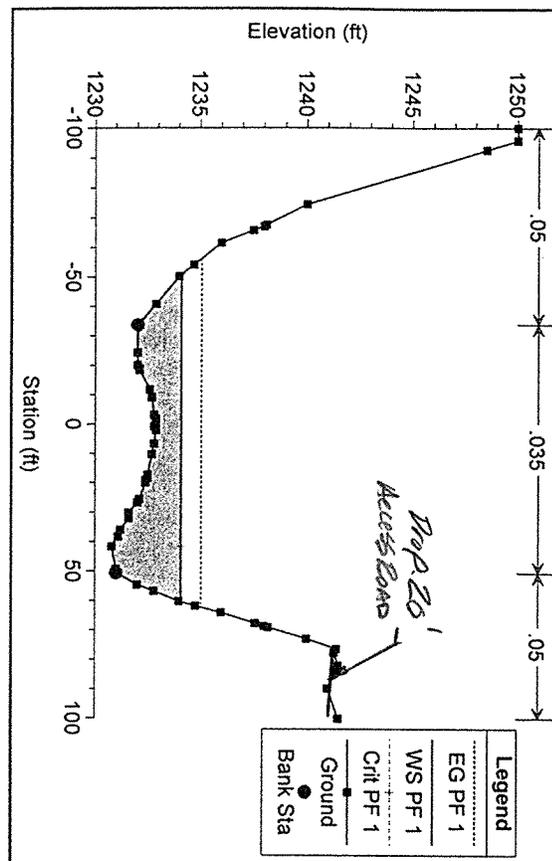
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 400 Q(100) = 1532.8 (100% Bulking Factor)



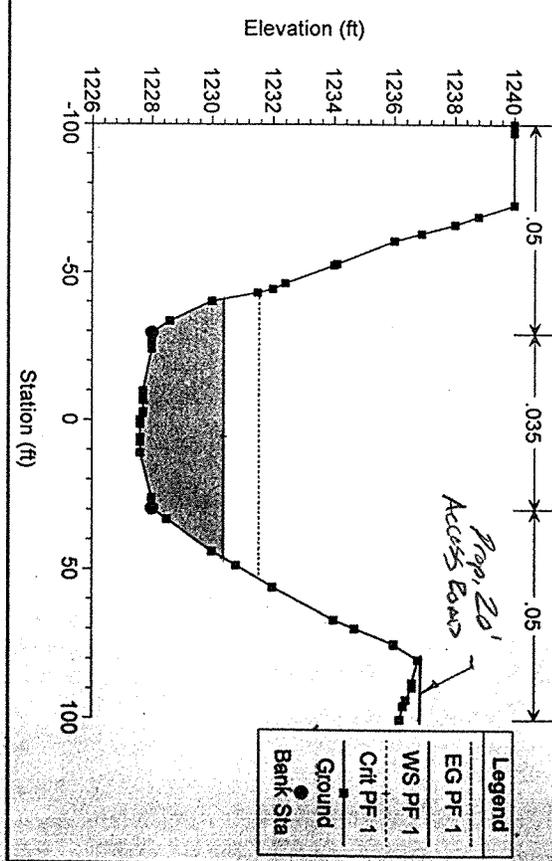
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 350 Q(100) = 1532.8 (100% Bulking Factor)



HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 300 Q(100) = 1532.8 (100% Bulking Factor)

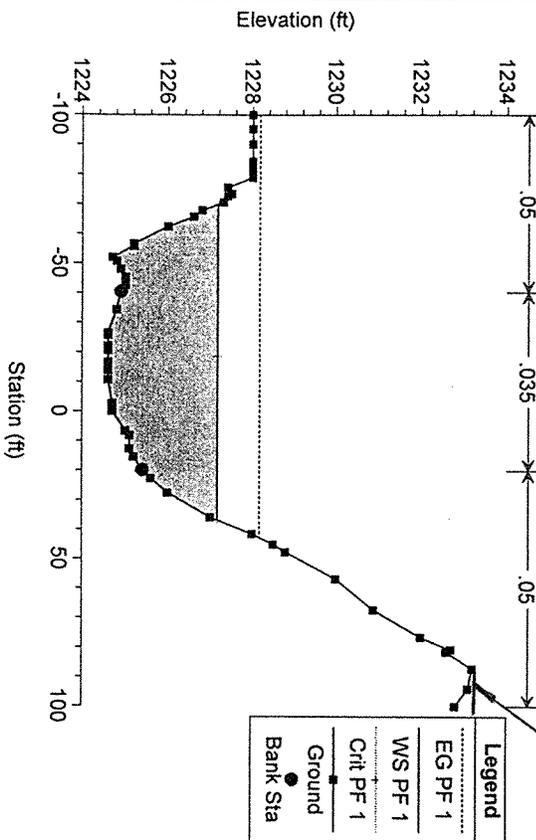


HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 250 Q(100) = 1532.8 (100% Bulking Factor)

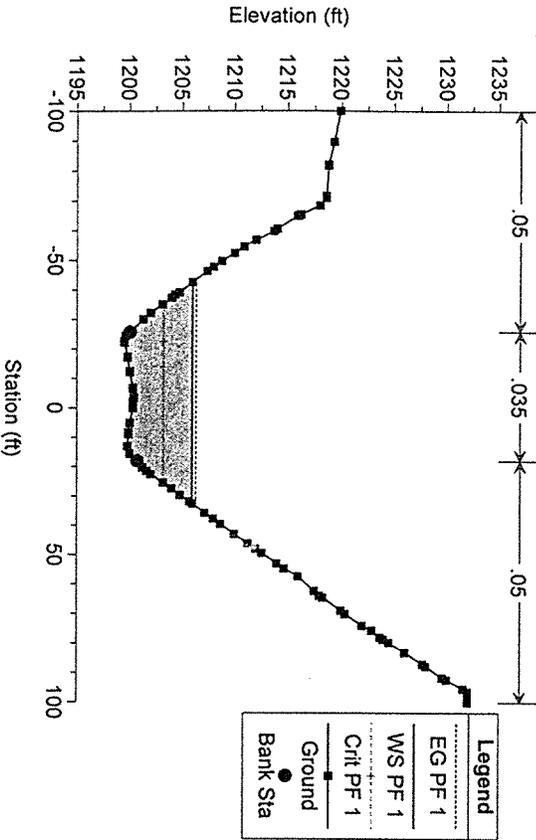


HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 200 Q(100) = 1532.8 (100% Bulking Factor)

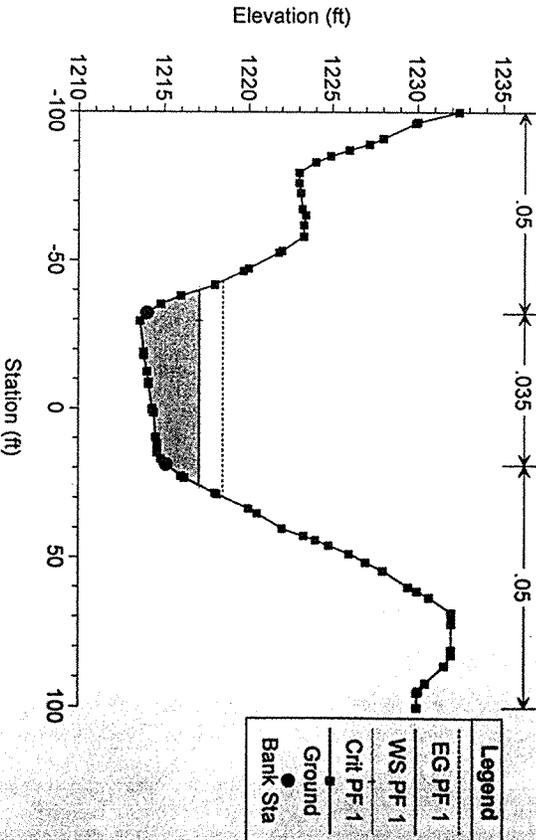
Prop. Zo' Access Bank



HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 100 Q(100) = 1532.8 (100% Bulking Factor)

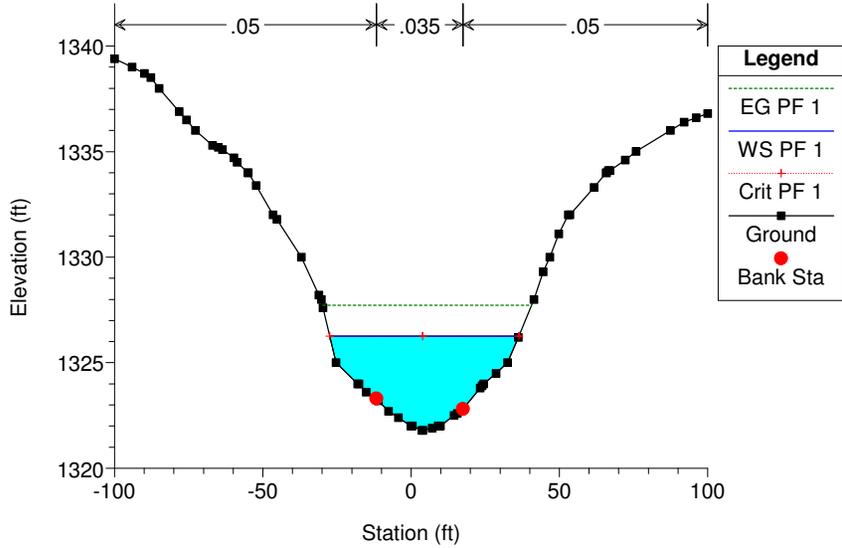


HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009
 RS = 150 Q(100) = 1532.8 (100% Bulking Factor)



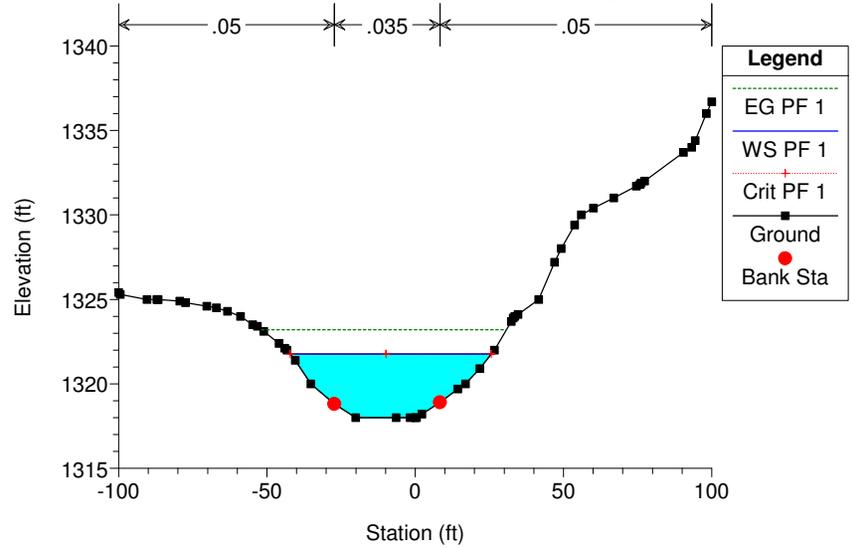
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1600 Q(100) = 1532.8 (100% Bulking Factor)



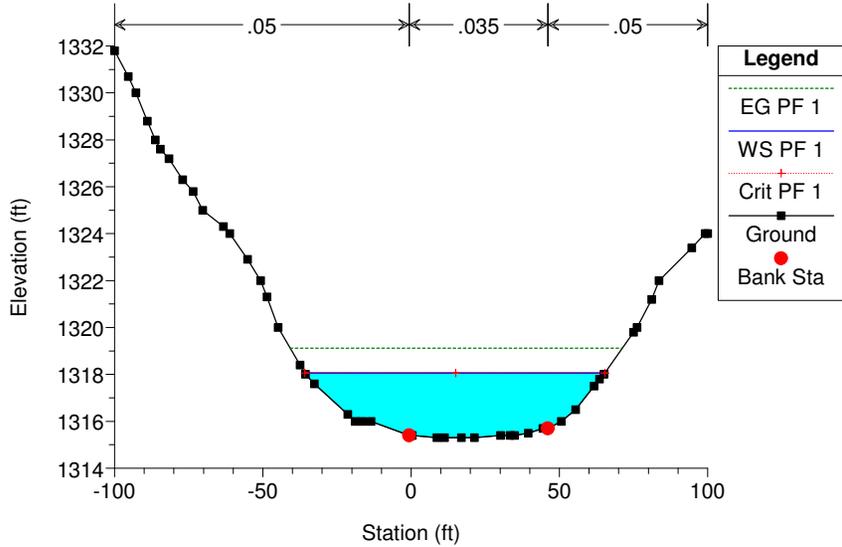
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1550 Q(100) = 1532.8 (100% Bulking Factor)



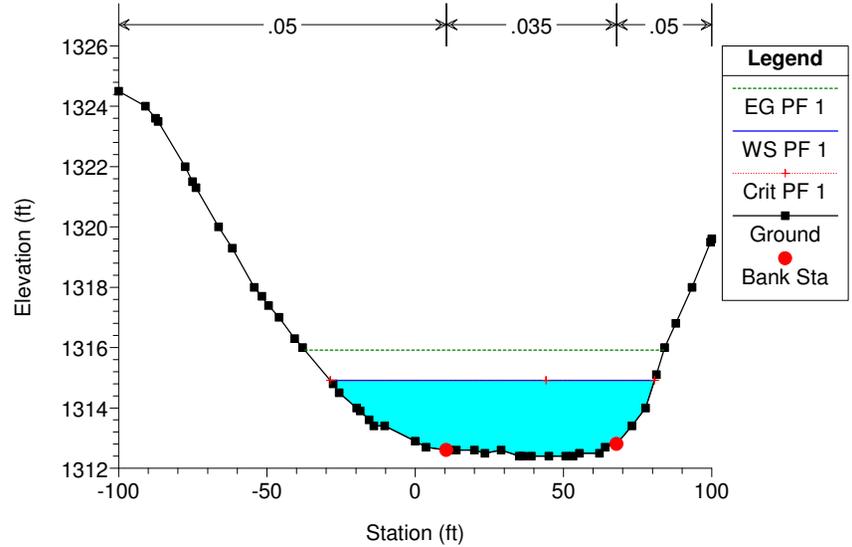
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1500 Q(100) = 1532.8 (100% Bulking Factor)



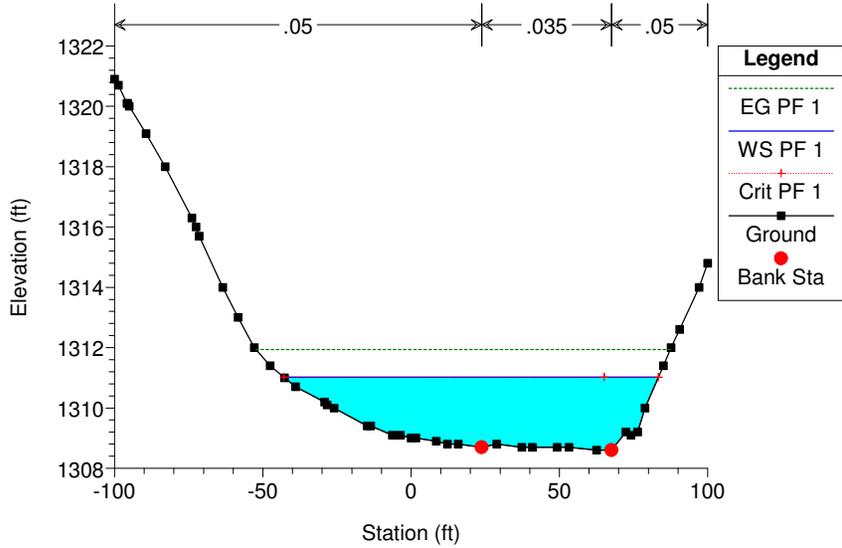
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1450 Q(100) = 1532.8 (100% Bulking Factor)



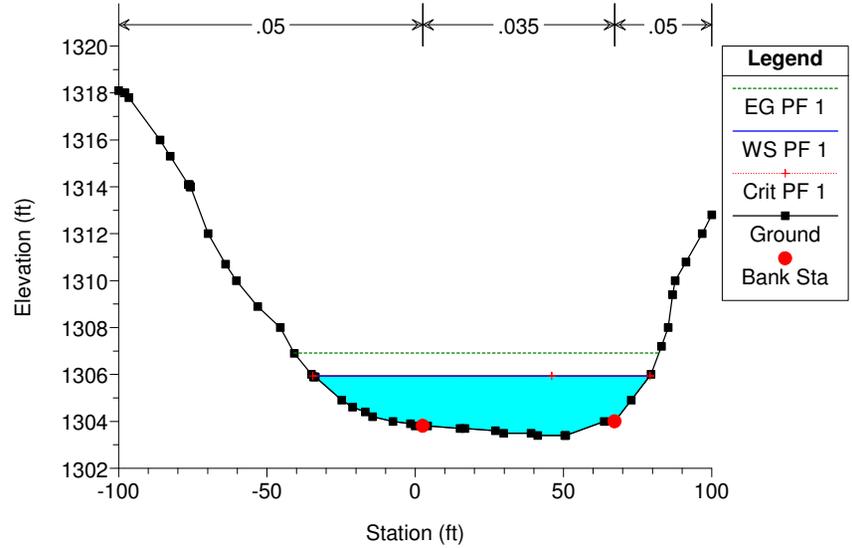
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

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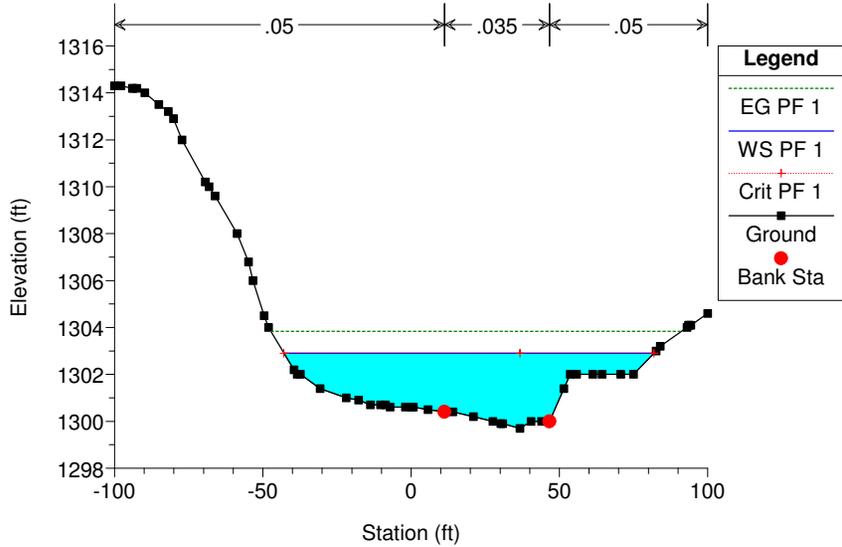
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1350 Q(100) = 1532.8 (100% Bulking Factor)



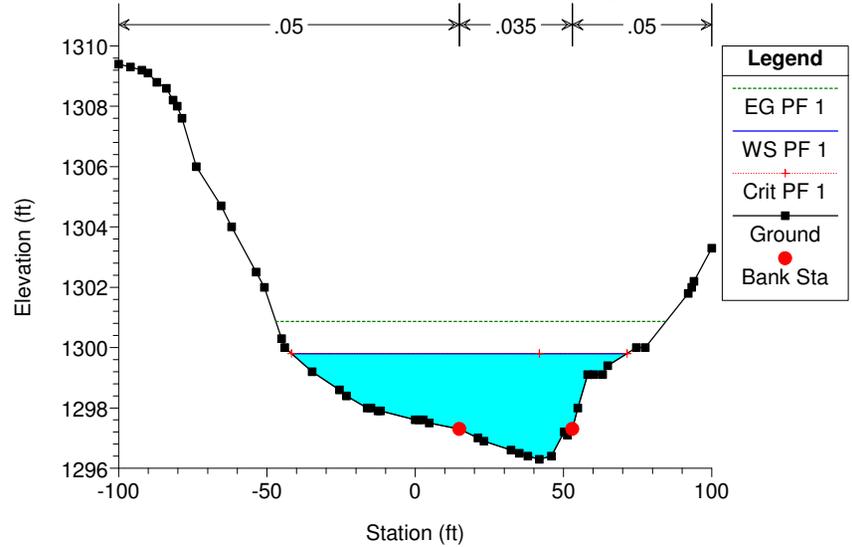
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1300 Q(100) = 1532.8 (100% Bulking Factor)



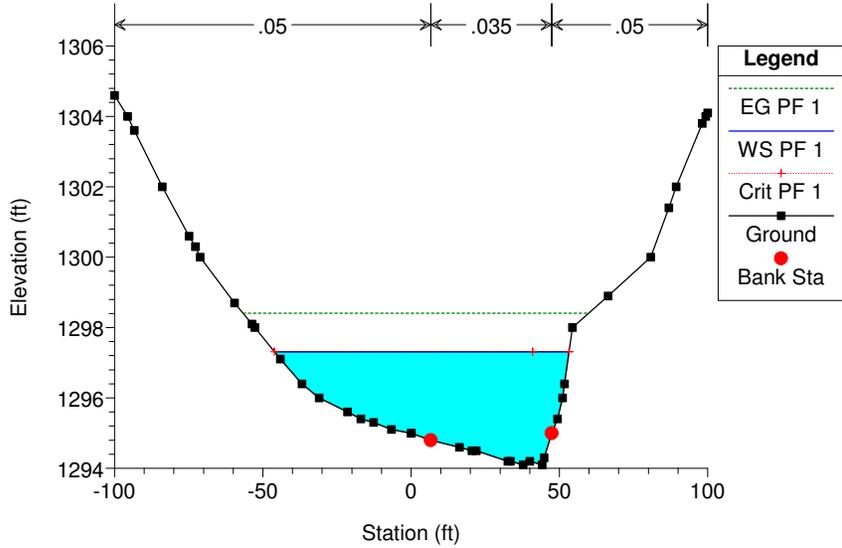
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1250 Q(100) = 1532.8 (100% Bulking Factor)



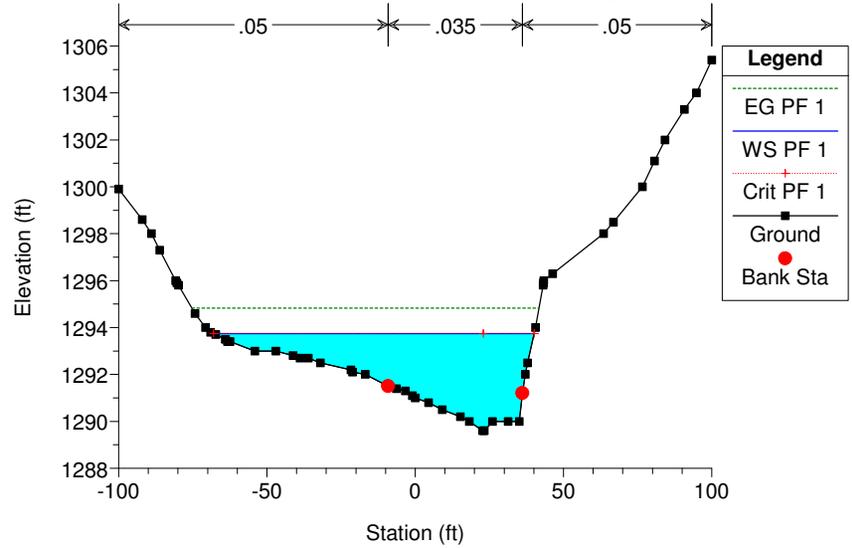
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1200 Q(100) = 1532.8 (100% Bulking Factor)



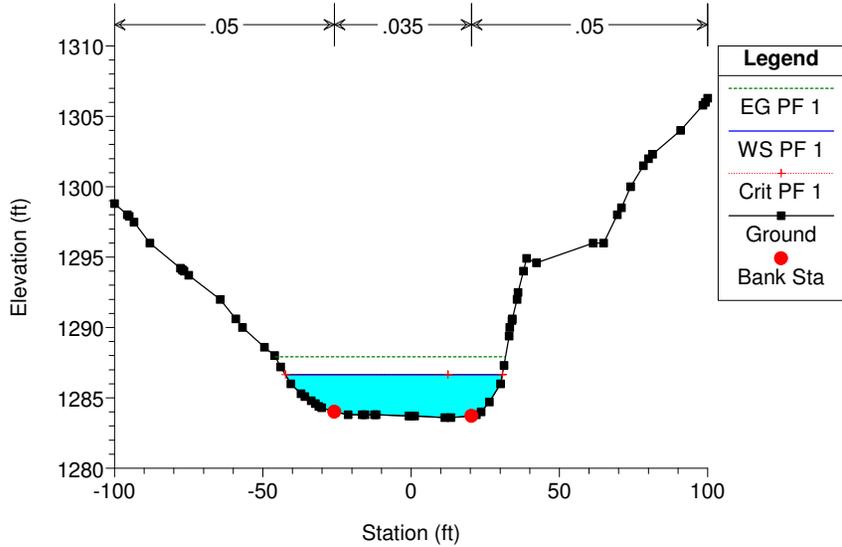
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1150 Q(100) = 1532.8 (100% Bulking Factor)



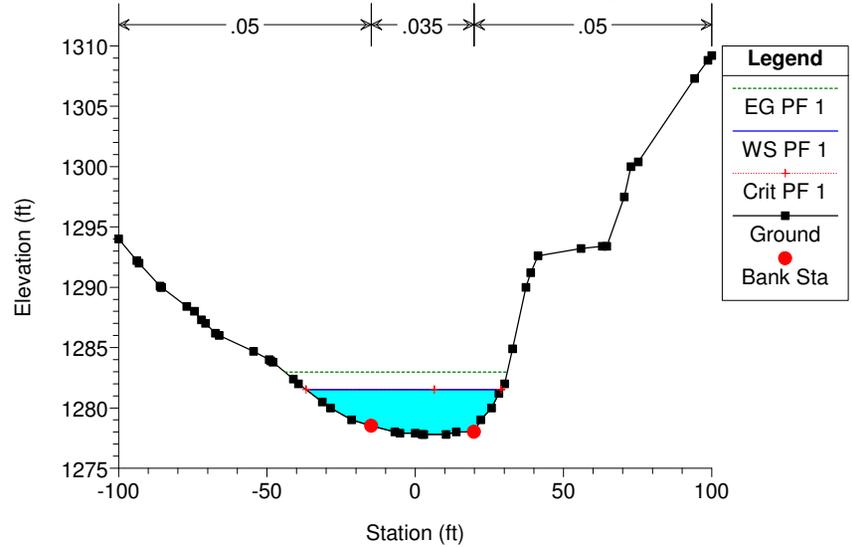
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1100 Q(100) = 1532.8 (100% Bulking Factor)



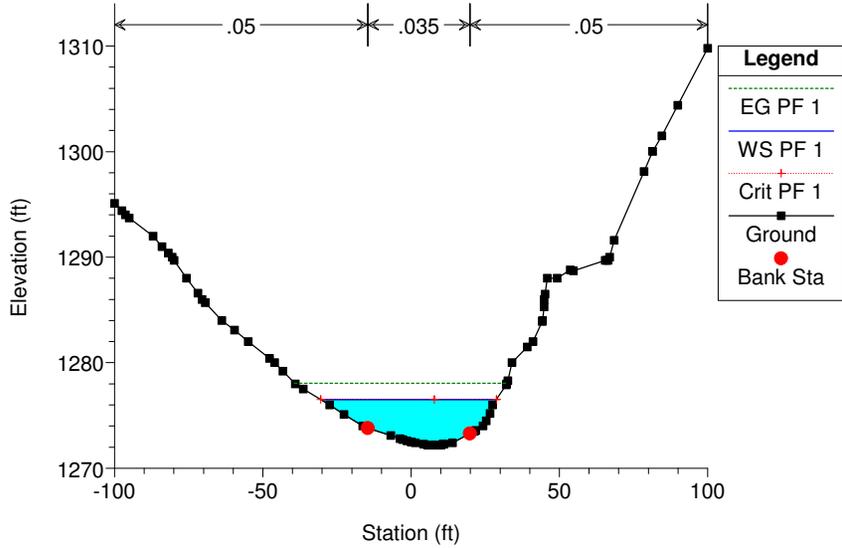
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1050 Q(100) = 1532.8 (100% Bulking Factor)



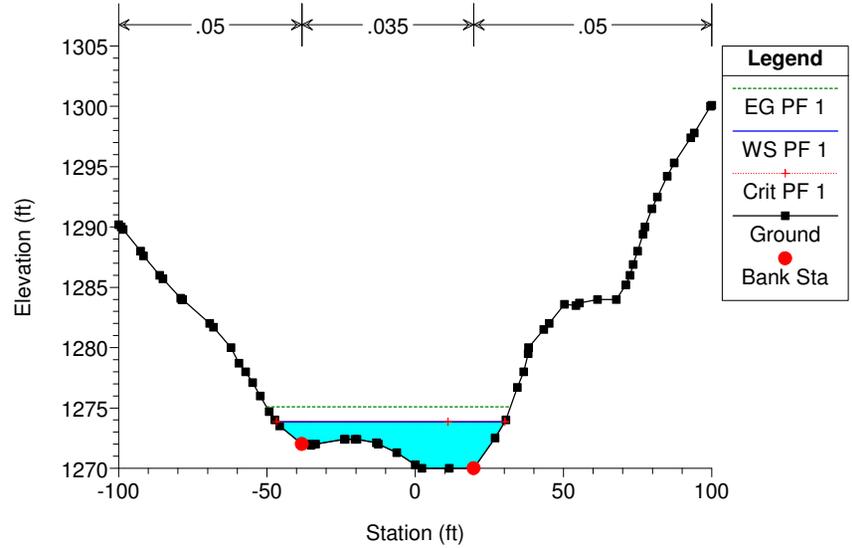
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 1000 Q(100) = 1532.8 (100% Bulking Factor)



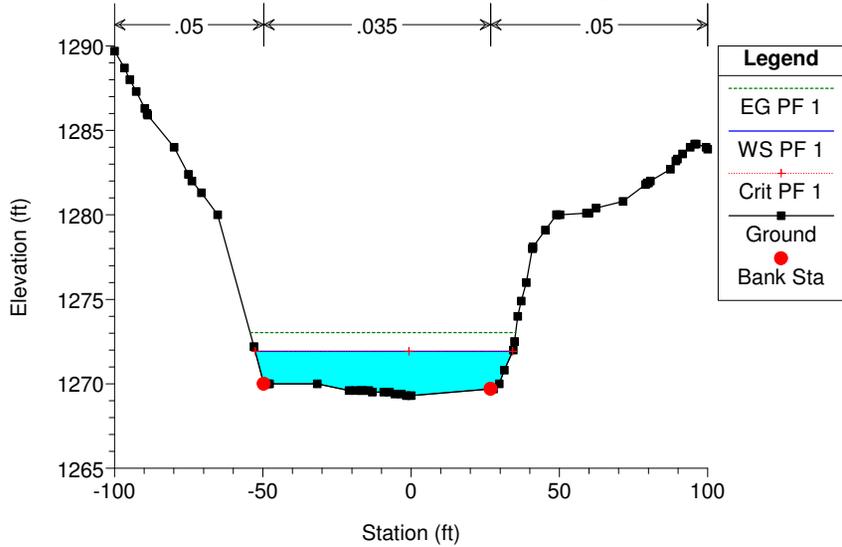
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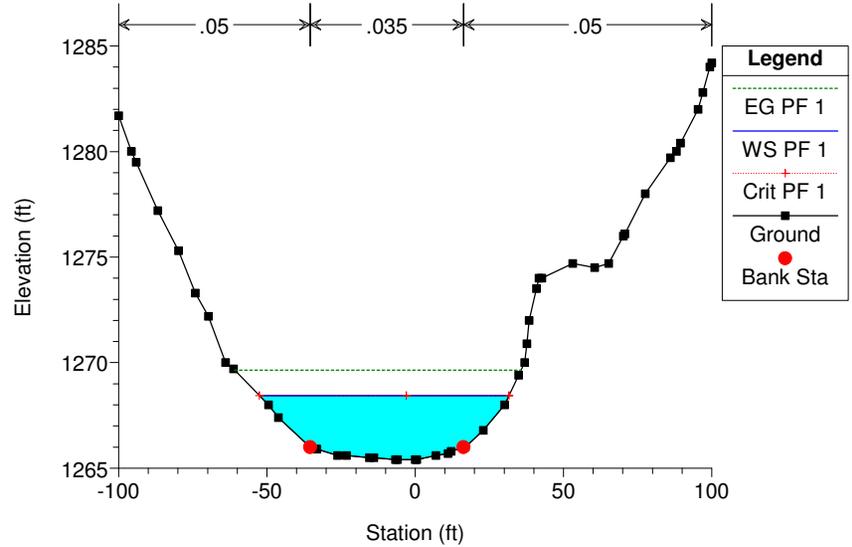
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 900 Q(100) = 1532.8 (100% Bulking Factor)



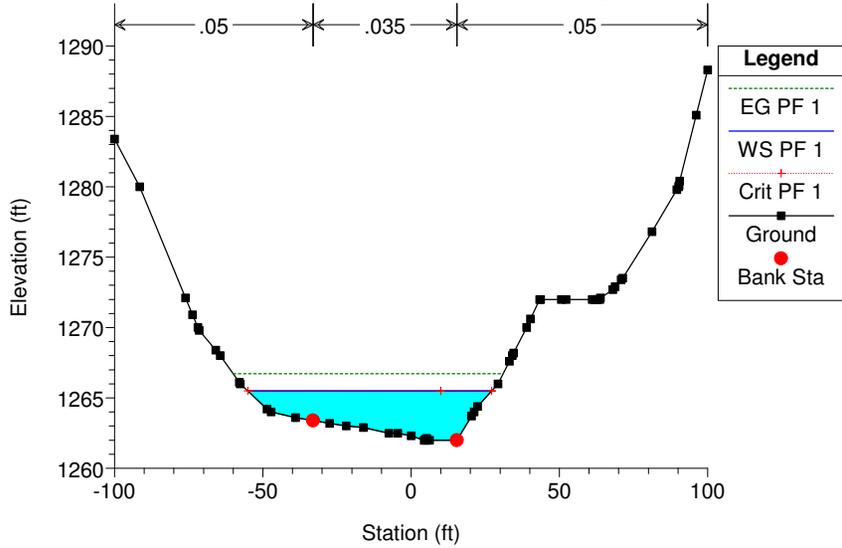
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

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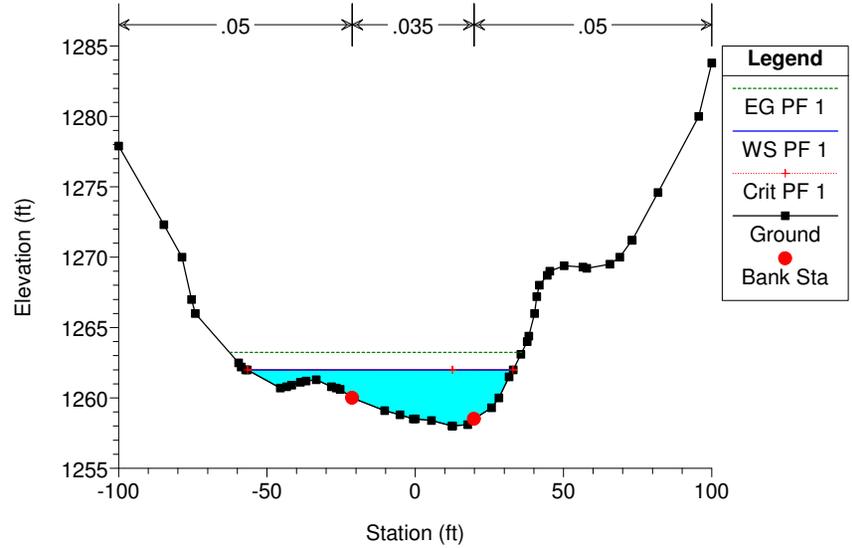
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 800 Q(100) = 1532.8 (100% Bulking Factor)



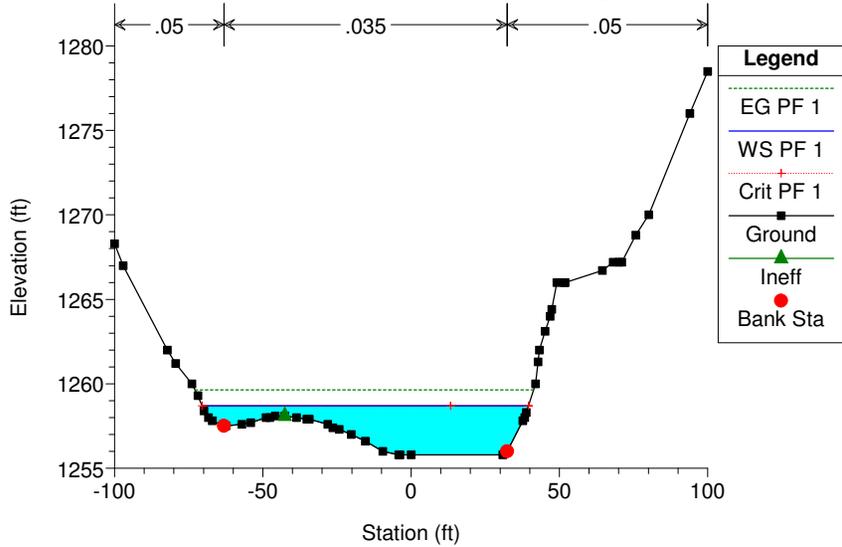
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 750 Q(100) = 1532.8 (100% Bulking Factor)



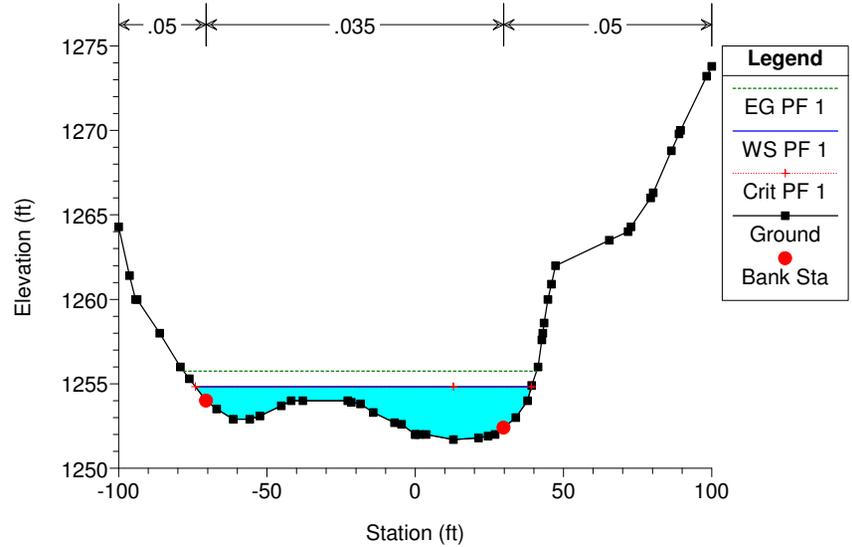
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 700 Q(100) = 1532.8 (100% Bulking Factor)



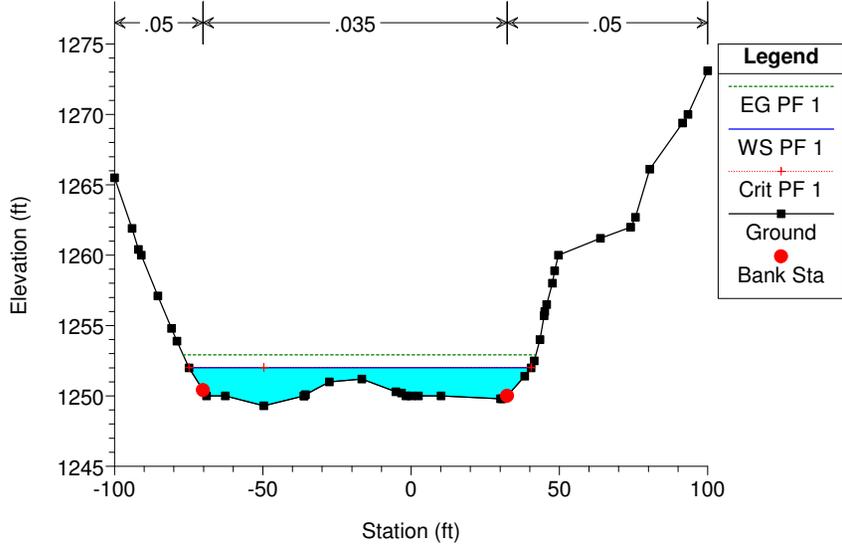
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 650 Q(100) = 1532.8 (100% Bulking Factor)



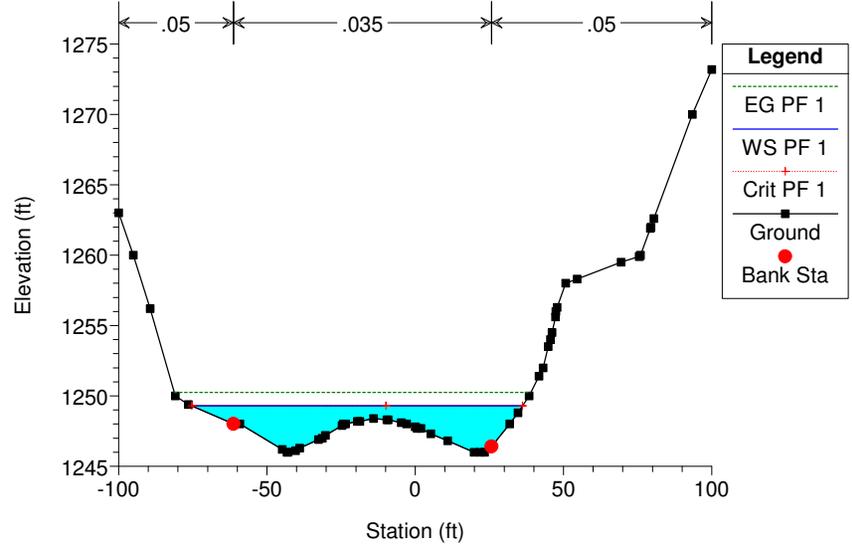
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 600 Q(100) = 1532.8 (100% Bulking Factor)



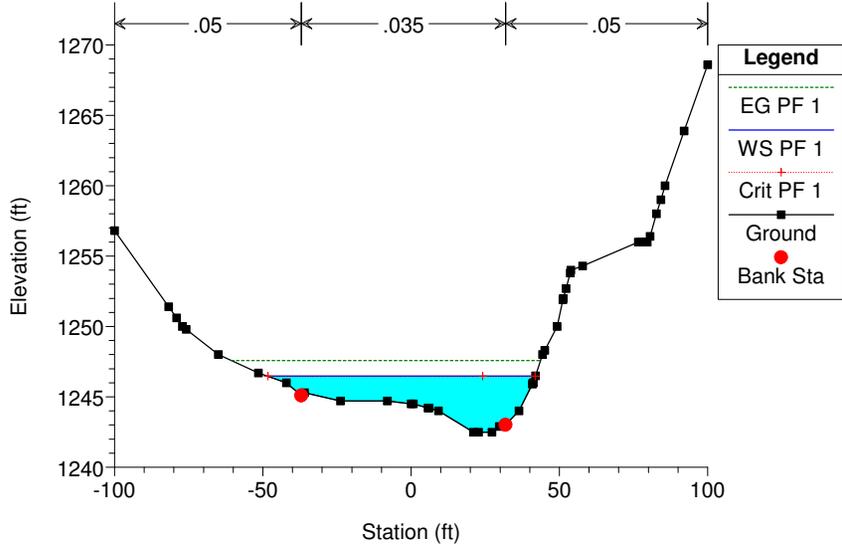
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 550 Q(100) = 1532.8 (100% Bulking Factor)



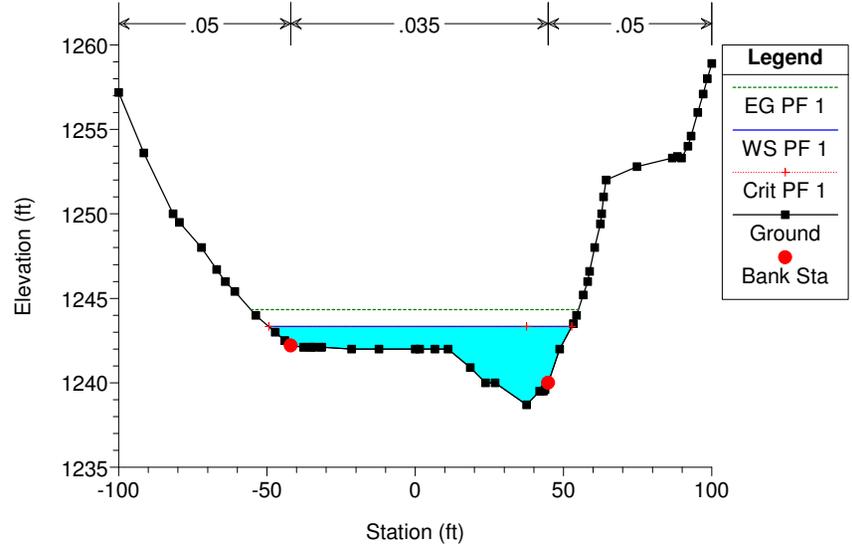
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 500 Q(100) = 1532.8 (100% Bulking Factor)



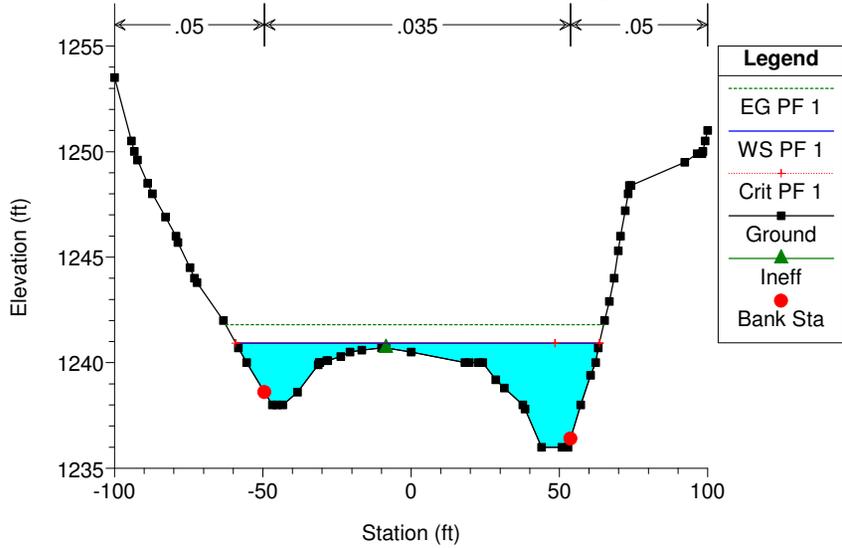
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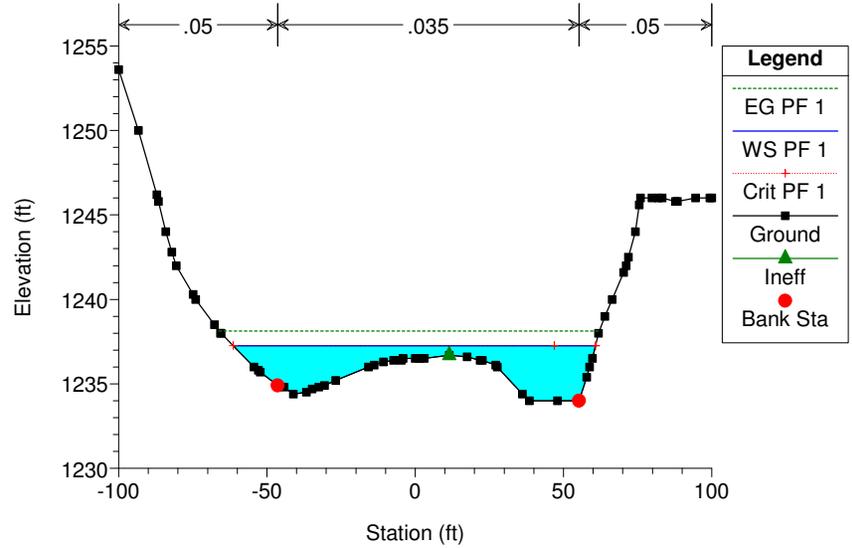
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 400 Q(100) = 1532.8 (100% Bulking Factor)



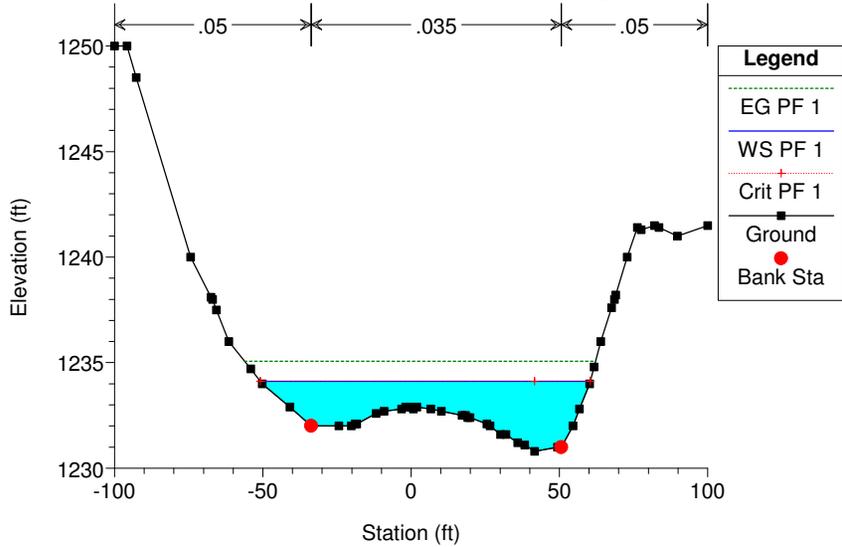
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 350 Q(100) = 1532.8 (100% Bulking Factor)



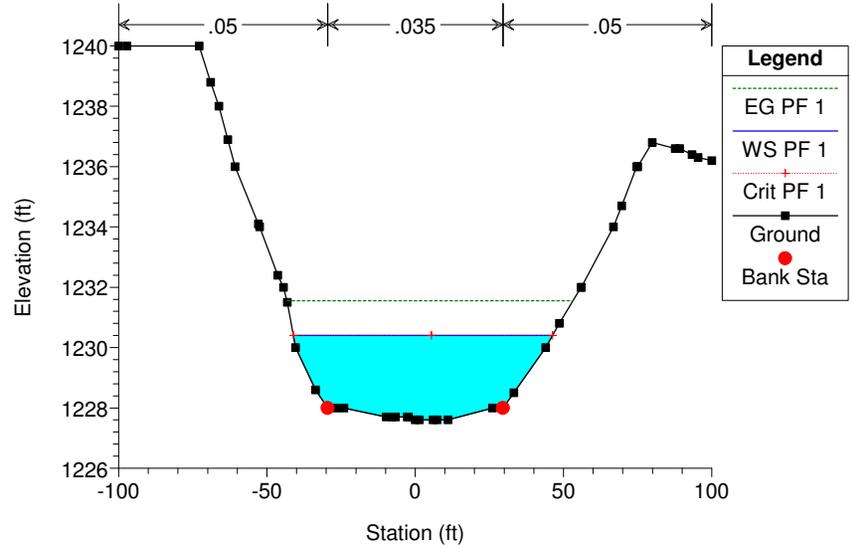
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 300 Q(100) = 1532.8 (100% Bulking Factor)



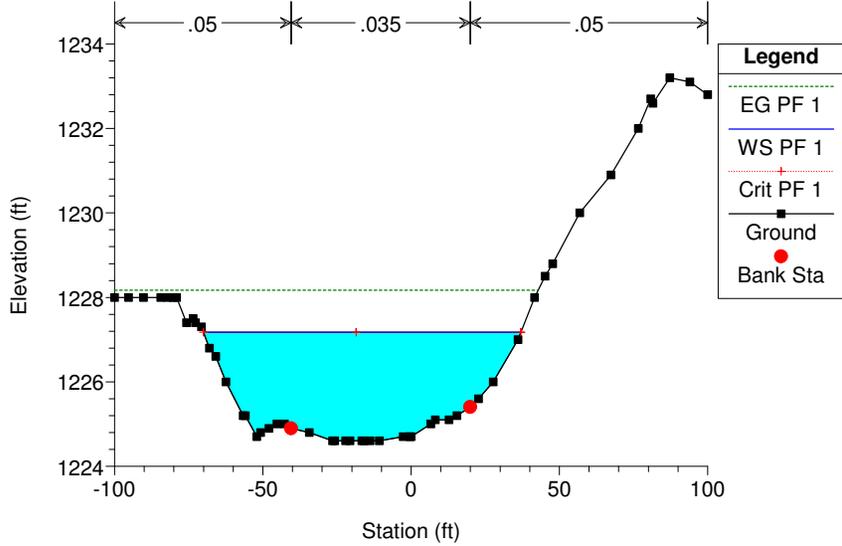
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 250 Q(100) = 1532.8 (100% Bulking Factor)



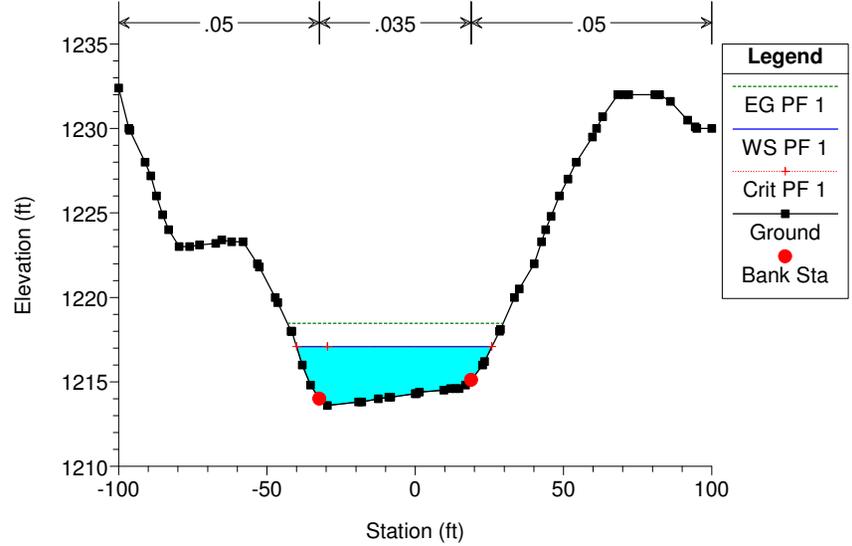
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 200 Q(100) = 1532.8 (100% Bulking Factor)



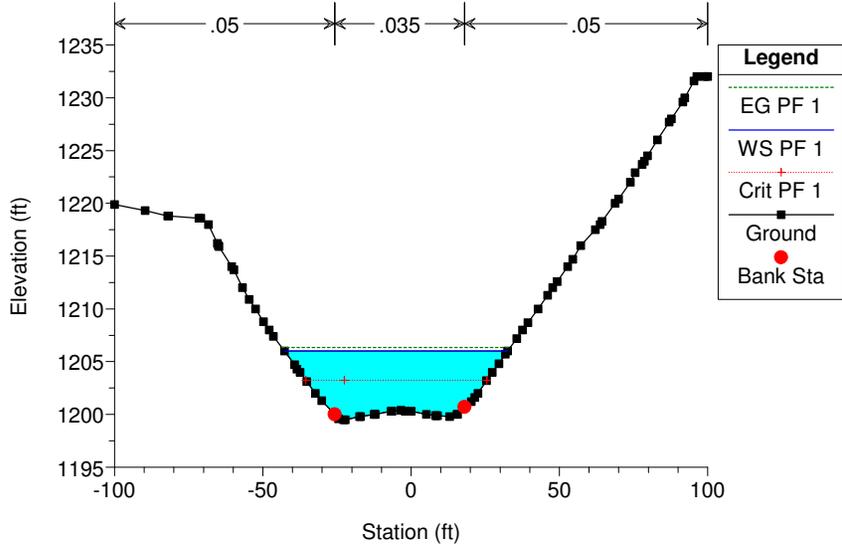
HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 150 Q(100) = 1532.8 (100% Bulking Factor)



HEC-RAS ANALYSIS Plan: Plan 03 4/13/2009

RS = 100 Q(100) = 1532.8 (100% Bulking Factor)



Appendix “G”

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2001
Study date: 04/13/09

100-YEAR "ROUTING ANALYSIS"
105.588 "TRACT 34760"
BASIN "E-1" (Q=56.7 cfs) (36" RISER)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

--
Armstrong & Brooks Consulting Engineers - S/N 785

***** HYDROGRAPH INFORMATION

From study/file name: 105588uha6100.rte

*****HYDROGRAPH

DATA*****

Number of intervals = 37
Time interval = 10.0 (Min.)
Maximum/Peak flow rate = 56.616 (CFS)
Total volume = 5.543 (Ac.Ft)

Status of hydrographs being held in storage

Stream 1 Stream 2 Stream 3 Stream 4 Stream 5

Peak (CFS) 0.000 0.000 0.000 0.000

0.000

Vol (Ac.Ft) 0.000 0.000 0.000 0.000

0.000

+++++

++++

Process from Point/Station 5.000 to Point/Station

10.000

**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

--
Total number of inflow hydrograph intervals = 37
Hydrograph time unit = 10.000 (Min.)
Initial depth in storage basin = 1235.00 (Ft.)

--

Initial basin depth = 1235.00 (Ft.)
Initial basin storage = 0.17 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

| | | | | | | | | |
|---------|-------|-------|-------|-----|--|--|--|--|
| 2.833 | 5.09 | 4.08 | 0.306 | O | | | | |
| 1236.72 | | | | | | | | |
| 3.000 | 5.58 | 4.51 | 0.320 | OI | | | | |
| 1236.79 | | | | | | | | |
| 3.167 | 6.02 | 4.95 | 0.335 | OI | | | | |
| 1236.87 | | | | | | | | |
| 3.333 | 6.70 | 5.43 | 0.351 | O | | | | |
| 1236.95 | | | | | | | | |
| 3.500 | 8.25 | 6.27 | 0.373 | OI | | | | |
| 1237.06 | | | | | | | | |
| 3.667 | 10.29 | 7.63 | 0.405 | OI | | | | |
| 1237.21 | | | | | | | | |
| 3.833 | 11.89 | 9.20 | 0.442 | OI | | | | |
| 1237.37 | | | | | | | | |
| 4.000 | 13.25 | 11.41 | 0.473 | OI | | | | |
| 1237.51 | | | | | | | | |
| 4.167 | 15.05 | 15.16 | 0.485 | O | | | | |
| 1237.56 | | | | | | | | |
| 4.333 | 17.52 | 16.70 | 0.490 | O | | | | |
| 1237.58 | | | | | | | | |
| 4.500 | 19.81 | 19.39 | 0.499 | OI | | | | |
| 1237.62 | | | | | | | | |
| 4.667 | 21.85 | 21.36 | 0.505 | O | | | | |
| 1237.65 | | | | | | | | |
| 4.833 | 23.89 | 23.42 | 0.511 | O | | | | |
| 1237.67 | | | | | | | | |
| 5.000 | 25.92 | 25.45 | 0.518 | O | | | | |
| 1237.70 | | | | | | | | |
| 5.167 | 33.61 | 31.36 | 0.537 | OI | | | | |
| 1237.78 | | | | | | | | |
| 5.333 | 43.62 | 41.29 | 0.568 | OI | | | | |
| 1237.91 | | | | | | | | |
| 5.500 | 56.62 | 49.90 | 0.631 | O I | | | | |
| 1238.16 | | | | | | | | |
| 5.667 | 29.44 | 43.98 | 0.577 | I O | | | | |
| 1237.95 | | | | | | | | |
| 5.833 | 5.37 | 9.48 | 0.448 | I O | | | | |
| 1237.40 | | | | | | | | |
| 6.000 | 1.41 | 6.71 | 0.384 | I O | | | | |
| 1237.11 | | | | | | | | |
| 6.167 | 0.36 | 4.47 | 0.319 | I O | | | | |
| 1236.78 | | | | | | | | |
| 6.333 | 0.00 | 3.00 | 0.270 | IO | | | | |
| 1236.53 | | | | | | | | |
| 6.500 | 0.00 | 1.97 | 0.236 | IO | | | | |
| 1236.35 | | | | | | | | |
| 6.667 | 0.00 | 1.30 | 0.213 | O | | | | |
| 1236.23 | | | | | | | | |
| 6.833 | 0.00 | 0.85 | 0.198 | O | | | | |
| 1236.15 | | | | | | | | |
| 7.000 | 0.00 | 0.56 | 0.189 | O | | | | |
| 1236.10 | | | | | | | | |
| 7.167 | 0.00 | 0.37 | 0.182 | O | | | | |
| 1236.06 | | | | | | | | |
| 7.333 | 0.00 | 0.24 | 0.178 | O | | | | |
| 1236.04 | | | | | | | | |
| 7.500 | 0.00 | 0.16 | 0.175 | O | | | | |
| 1236.03 | | | | | | | | |
| 7.667 | 0.00 | 0.10 | 0.173 | O | | | | |
| 1236.02 | | | | | | | | |
| 7.833 | 0.00 | 0.07 | 0.172 | O | | | | |

1236.01

Remaining water in basin = 0.00 (Ac.Ft)

```
*****HYDROGRAPH
DATA*****
      Number of intervals = 47
      Time interval = 10.0 (Min.)
      Maximum/Peak flow rate = 49.895 (CFS)
      Total volume = 5.541 (Ac.Ft)
      Status of hydrographs being held in storage
      Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
Peak (CFS)    0.000    0.000    0.000    0.000
0.000
Vol (Ac.Ft)   0.000    0.000    0.000    0.000
0.000
*****
*****
```

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Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2002, Version

6.1

Study date 04/13/09 File: 105588UHA6100.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Armstrong & Brooks Consulting Engineers - S/N 785

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

UNIT HYDROGRAPH STUDY
105.588 "TRACT 34760"
REDUCED PEAK TRIBUTARY FLOW RATE (Q=45.3 CFS)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

--
Drainage Area = 22.40(Ac.) = 0.035 Sq. Mi.
0.035 Drainage Area for Depth-Area Areal Adjustment = 22.40(Ac.) =
Sq. Mi.
Length along longest watercourse = 1740.00(Ft.)
(Ft.) Length along longest watercourse measured to centroid = 690.00
Length along longest watercourse = 0.330 Mi.
Mi. Length along longest watercourse measured to centroid = 0.131

Difference in elevation = 134.00(Ft.)
Slope along watercourse = 406.6207 Ft./Mi.
Average Manning's 'N' = 0.020
Lag time = 0.046 Hr.
Lag time = 2.78 Min.
25% of lag time = 0.70 Min.
40% of lag time = 1.11 Min.
Unit time = 10.00 Min.
Duration of storm = 6 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

| Area(Ac.) [1] | Rainfall(In) [2] | Weighting[1*2] |
|---------------|------------------|----------------|
| 22.40 | 1.70 | 38.08 |

100 YEAR Area rainfall data:

| | | |
|---------------|------------------|----------------|
| Area(Ac.) [1] | Rainfall(In) [2] | Weighting[1*2] |
| 22.40 | 4.00 | 89.60 |

STORM EVENT (YEAR) = 100.00
 Area Averaged 2-Year Rainfall = 1.700(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 4.000(In)
 Areal adjustment factor = 99.99 %
 Adjusted average point rain = 4.000(In)

Sub-Area Data:

| | | |
|----------------------|--------------|--------------|
| Area(Ac.) | Runoff Index | Impervious % |
| 18.700 | 75.00 | 0.000 |
| 2.700 | 75.00 | 0.400 |
| 0.400 | 75.00 | 0.900 |
| 0.600 | 87.00 | 1.000 |
| Total Area Entered = | | 22.40(Ac.) |

| RI (In/Hr) | RI AMC2 AMC-2 | Infil. Rate (In/Hr) | Impervious (Dec.%) | Adj. Infil. Rate (In/Hr) | Area% (Dec.) | F |
|---------------|------------------|------------------------|-----------------------|-----------------------------|-----------------|-----------|
| 0.253 | 75.0 | 75.0 | 0.303 | 0.000 | 0.303 | 0.835 |
| 0.023 | 75.0 | 75.0 | 0.303 | 0.400 | 0.194 | 0.121 |
| 0.001 | 75.0 | 75.0 | 0.303 | 0.900 | 0.058 | 0.018 |
| 0.000 | 87.0 | 87.0 | 0.164 | 1.000 | 0.016 | 0.027 |
| 0.278 | | | | | | Sum (F) = |

Area averaged mean soil loss (F) (In/Hr) = 0.278
 Minimum soil loss rate ((In/Hr)) = 0.139
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.710

 Unit Hydrograph
 FOOTHILL S-Curve

--
 Unit Hydrograph Data

| Unit time period (hrs) | Time % of lag | Distribution Graph % | Unit Hydrograph (CFS) |
|---------------------------|---------------|-------------------------|--------------------------|
| 1 | 0.167 | 359.239 | 63.882 |
| 2 | 0.333 | 718.479 | 36.118 |
| | | Sum = 100.000 | Sum= 22.575 |

| | | | | |
|-----------|---------|------------|-------------------|-----------|
| Unit Time | Pattern | Storm Rain | Loss rate(In./Hr) | Effective |
|-----------|---------|------------|-------------------|-----------|

50.0

| | | | | | | |
|------|--------|-------|-----|--|--|--|
| 0+10 | 0.0152 | 1.10 | Q | | | |
| 0+20 | 0.0258 | 0.77 | Q | | | |
| 0+30 | 0.0338 | 0.58 | Q | | | |
| 0+40 | 0.0492 | 1.12 | Q | | | |
| 0+50 | 0.0673 | 1.31 | VQ | | | |
| 1+ 0 | 0.0902 | 1.66 | VQ | | | |
| 1+10 | 0.1205 | 2.20 | Q | | | |
| 1+20 | 0.1535 | 2.40 | Q | | | |
| 1+30 | 0.1866 | 2.40 | Q | | | |
| 1+40 | 0.2196 | 2.40 | Q | | | |
| 1+50 | 0.2526 | 2.40 | QV | | | |
| 2+ 0 | 0.2904 | 2.74 | Q | | | |
| 2+10 | 0.3309 | 2.94 | Q | | | |
| 2+20 | 0.3762 | 3.29 | QV | | | |
| 2+30 | 0.4242 | 3.48 | QV | | | |
| 2+40 | 0.4721 | 3.48 | Q V | | | |
| 2+50 | 0.5296 | 4.17 | QV | | | |
| 3+ 0 | 0.5925 | 4.57 | Q V | | | |
| 3+10 | 0.6602 | 4.91 | Q V | | | |
| 3+20 | 0.7353 | 5.45 | Q V | | | |
| 3+30 | 0.8275 | 6.69 | Q V | | | |
| 3+40 | 0.9420 | 8.32 | Q V | | | |
| 3+50 | 1.0742 | 9.60 | Q V | | | |
| 4+ 0 | 1.2213 | 10.68 | Q V | | | |
| 4+10 | 1.3881 | 12.11 | Q V | | | |
| 4+20 | 1.5820 | 14.08 | Q V | | | |
| 4+30 | 1.8011 | 15.90 | Q V | | | |
| 4+40 | 2.0425 | 17.53 | Q V | | | |
| 4+50 | 2.3064 | 19.16 | Q V | | | |

| | | | | | | | | | |
|---|------|--------|-------|---|---|---|---|---|---|
| | 5+ 0 | 2.5927 | 20.78 | | | Q | | V | |
| | 5+10 | 2.9633 | 26.91 | | | | Q | V | |
| | 5+20 | 3.4439 | 34.89 | | | | | Q | V |
| | 5+30 | 4.0672 | 45.25 | | | | | | Q |
| | 5+40 | 4.3920 | 23.59 | | | Q | | | |
| V | 5+50 | 4.4515 | 4.32 | | Q | | | | |
| V | 6+ 0 | 4.4670 | 1.13 | Q | | | | | |
| V | 6+10 | 4.4710 | 0.28 | Q | | | | | |
| V | | | | | | | | | |

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2001
Study date: 04/13/09

100-YEAR "ROUTING ANALYSIS"
105.588 "TRACT 34760"
BASIN "E-1" (Q=45.3 cfs) (36" RISER)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

Armstrong & Brooks Consulting Engineers - S/N 785

***** HYDROGRAPH INFORMATION

From study/file name: 105588uha6100.rte

*****HYDROGRAPH

DATA*****

Number of intervals = 37
Time interval = 10.0 (Min.)
Maximum/Peak flow rate = 45.248 (CFS)
Total volume = 4.471 (Ac.Ft)

Status of hydrographs being held in storage

| | Stream 1 | Stream 2 | Stream 3 | Stream 4 | Stream 5 |
|-------------|----------|----------|----------|----------|----------|
| Peak (CFS) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Vol (Ac.Ft) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

0.000

0.000

+++++

++++

Process from Point/Station 5.000 to Point/Station

10.000

**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 37
Hydrograph time unit = 10.000 (Min.)
Initial depth in storage basin = 1235.00 (Ft.)

Initial basin depth = 1235.00 (Ft.)
Initial basin storage = 0.17 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Remaining water in basin = 0.00 (Ac.Ft)

*****HYDROGRAPH
DATA*****
Number of intervals = 46
Time interval = 10.0 (Min.)
Maximum/Peak flow rate = 42.660 (CFS)
Total volume = 4.468 (Ac.Ft)
Status of hydrographs being held in storage
Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
Peak (CFS) 0.000 0.000 0.000 0.000
0.000
Vol (Ac.Ft) 0.000 0.000 0.000 0.000
0.000

--

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2001
Study date: 04/13/09

100-YEAR "ROUTING ANALYSIS"
105.588 "TRACT 34760"
BASIN "E-1" (Q=45.3 cfs) (24" RISER)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

--
Armstrong & Brooks Consulting Engineers - S/N 785

***** HYDROGRAPH INFORMATION

From study/file name: 105588uha6100.rte
*****HYDROGRAPH

DATA*****

| | | | | | | |
|-------|---|---------------|----------|----------|----------|----------|
| | Number of intervals = | 37 | | | | |
| | Time interval = | 10.0 (Min.) | | | | |
| | Maximum/Peak flow rate = | 45.248 (CFS) | | | | |
| | Total volume = | 4.471 (Ac.Ft) | | | | |
| | Status of hydrographs being held in storage | | | | | |
| | | Stream 1 | Stream 2 | Stream 3 | Stream 4 | Stream 5 |
| 0.000 | Peak (CFS) | 0.000 | 0.000 | 0.000 | 0.000 | |
| 0.000 | Vol (Ac.Ft) | 0.000 | 0.000 | 0.000 | 0.000 | |

++++
Process from Point/Station 5.000 to Point/Station
10.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

--
Total number of inflow hydrograph intervals = 37
Hydrograph time unit = 10.000 (Min.)
Initial depth in storage basin = 1235.00 (Ft.)

--
Initial basin depth = 1235.00 (Ft.)
Initial basin storage = 0.17 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

| | | | | | | | | |
|---------|-------|-------|-------|-----|--|---|--|--|
| 2.833 | 4.17 | 3.12 | 0.326 | O | | | | |
| 1236.82 | | | | | | | | |
| 3.000 | 4.57 | 3.42 | 0.341 | OI | | | | |
| 1236.90 | | | | | | | | |
| 3.167 | 4.91 | 3.74 | 0.357 | OI | | | | |
| 1236.98 | | | | | | | | |
| 3.333 | 5.45 | 4.19 | 0.374 | OI | | | | |
| 1237.06 | | | | | | | | |
| 3.500 | 6.69 | 4.80 | 0.396 | OI | | | | |
| 1237.16 | | | | | | | | |
| 3.667 | 8.32 | 5.68 | 0.427 | OI | | | | |
| 1237.30 | | | | | | | | |
| 3.833 | 9.60 | 6.74 | 0.464 | O I | | | | |
| 1237.47 | | | | | | | | |
| 4.000 | 10.68 | 9.55 | 0.492 | OI | | | | |
| 1237.59 | | | | | | | | |
| 4.167 | 12.11 | 11.23 | 0.506 | OI | | | | |
| 1237.65 | | | | | | | | |
| 4.333 | 14.08 | 12.92 | 0.520 | O | | | | |
| 1237.71 | | | | | | | | |
| 4.500 | 15.90 | 14.80 | 0.535 | OI | | | | |
| 1237.77 | | | | | | | | |
| 4.667 | 17.53 | 16.54 | 0.550 | OI | | | | |
| 1237.83 | | | | | | | | |
| 4.833 | 19.16 | 18.18 | 0.563 | OI | | | | |
| 1237.89 | | | | | | | | |
| 5.000 | 20.78 | 19.81 | 0.577 | O | | | | |
| 1237.95 | | | | | | | | |
| 5.167 | 26.91 | 21.93 | 0.618 | O I | | | | |
| 1238.11 | | | | | | | | |
| 5.333 | 34.89 | 24.01 | 0.727 | O | | I | | |
| 1238.52 | | | | | | | | |

Warning: Basin depth limit exceeded, the data here is an estimation

| | | | | | | | | |
|---------|-------|-------|-------|---|--|--|--|---|
| 5.500 | 45.25 | 27.28 | 0.926 | O | | | | I |
| 1239.23 | | | | | | | | |

Warning: Basin depth limit exceeded, the data here is an estimation

| | | | | | | | | |
|---------|-------|-------|-------|-----|--|--|--|--|
| 5.667 | 23.59 | 28.73 | 1.014 | I O | | | | |
| 1239.55 | | | | | | | | |
| 5.833 | 4.32 | 25.73 | 0.831 | I O | | | | |
| 1238.90 | | | | | | | | |
| 6.000 | 1.13 | 18.37 | 0.565 | I O | | | | |
| 1237.90 | | | | | | | | |
| 6.167 | 0.28 | 5.26 | 0.412 | I O | | | | |
| 1237.24 | | | | | | | | |
| 6.333 | 0.00 | 3.65 | 0.352 | I O | | | | |
| 1236.96 | | | | | | | | |
| 6.500 | 0.00 | 2.77 | 0.308 | IO | | | | |
| 1236.73 | | | | | | | | |
| 6.667 | 0.00 | 2.10 | 0.275 | IO | | | | |
| 1236.55 | | | | | | | | |
| 6.833 | 0.00 | 1.59 | 0.249 | IO | | | | |
| 1236.42 | | | | | | | | |
| 7.000 | 0.00 | 1.20 | 0.230 | O | | | | |
| 1236.32 | | | | | | | | |
| 7.167 | 0.00 | 0.91 | 0.216 | O | | | | |
| 1236.24 | | | | | | | | |
| 7.333 | 0.00 | 0.69 | 0.205 | O | | | | |
| 1236.18 | | | | | | | | |
| 7.500 | 0.00 | 0.52 | 0.196 | O | | | | |

| | | | | | | | | |
|---------|------|------|-------|---|--|--|--|--|
| 1236.14 | | | | | | | | |
| 7.667 | 0.00 | 0.40 | 0.190 | O | | | | |
| 1236.10 | | | | | | | | |
| 7.833 | 0.00 | 0.30 | 0.185 | O | | | | |
| 1236.08 | | | | | | | | |
| 8.000 | 0.00 | 0.23 | 0.181 | O | | | | |
| 1236.06 | | | | | | | | |
| 8.167 | 0.00 | 0.17 | 0.179 | O | | | | |
| 1236.05 | | | | | | | | |
| 8.333 | 0.00 | 0.13 | 0.177 | O | | | | |
| 1236.03 | | | | | | | | |
| 8.500 | 0.00 | 0.10 | 0.175 | O | | | | |
| 1236.03 | | | | | | | | |

Remaining water in basin = 0.00 (Ac.Ft)

*****HYDROGRAPH
 DATA*****
 Number of intervals = 51
 Time interval = 10.0 (Min.)
 Maximum/Peak flow rate = 28.729 (CFS)
 Total volume = 4.467 (Ac.Ft)
 Status of hydrographs being held in storage
 Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
 Peak (CFS) 0.000 0.000 0.000 0.000
 Vol (Ac.Ft) 0.000 0.000 0.000 0.000

 --

Unit Hydrograph Analysis

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Study date 04/13/09 File: 105588UHA6100.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Armstrong & Brooks Consulting Engineers - S/N 785

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

UNIT HYDROGRAPH STUDY
105.588 "TRACT 34760"
100% PEAK FLOW TRIBUTARY RATE (56.7 CFS)
ARMSTRONG & BROOKS CONSULTING ENGINEERS

Drainage Area = 22.40(Ac.) = 0.035 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 22.40(Ac.) =
0.035 Sq. Mi.
Length along longest watercourse = 1740.00(Ft.)
Length along longest watercourse measured to centroid = 690.00(Ft.)
Length along longest watercourse = 0.330 Mi.
Length along longest watercourse measured to centroid = 0.131 Mi.
Difference in elevation = 134.00(Ft.)
Slope along watercourse = 406.6207 Ft./Mi.
Average Manning's 'N' = 0.020
Lag time = 0.046 Hr.
Lag time = 2.78 Min.
25% of lag time = 0.70 Min.
40% of lag time = 1.11 Min.
Unit time = 10.00 Min.
Duration of storm = 6 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

| Area(Ac.) [1] | Rainfall(In) [2] | Weighting[1*2] |
|---------------|------------------|----------------|
| 22.40 | 1.70 | 38.08 |

100 YEAR Area rainfall data:

| Area(Ac.) [1] | Rainfall(In) [2] | Weighting[1*2] |
|---------------|------------------|----------------|
|---------------|------------------|----------------|

22.40

4.00

89.60

STORM EVENT (YEAR) = 100.00
 Area Averaged 2-Year Rainfall = 1.700(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 4.000(In)
 Areal adjustment factor = 99.99 %
 Adjusted average point rain = 4.000(In)

Sub-Area Data:

| Area(Ac.) | Runoff Index | Impervious % |
|---------------------------------|--------------|--------------|
| 18.700 | 75.00 | 0.000 |
| 2.700 | 75.00 | 0.400 |
| 0.400 | 75.00 | 0.900 |
| 0.600 | 87.00 | 1.000 |
| Total Area Entered = 22.40(Ac.) | | |

| RI | RI | Infil. Rate | Impervious | Adj. Infil. Rate | Area% | F |
|-----------|-------|-------------|------------|------------------|--------|---------|
| AMC2 | AMC-2 | (In/Hr) | (Dec.%) | (In/Hr) | (Dec.) | (In/Hr) |
| 75.0 | 75.0 | 0.303 | 0.000 | 0.303 | 0.835 | 0.253 |
| 75.0 | 75.0 | 0.303 | 0.400 | 0.194 | 0.121 | 0.023 |
| 75.0 | 75.0 | 0.303 | 0.900 | 0.058 | 0.018 | 0.001 |
| 87.0 | 87.0 | 0.164 | 1.000 | 0.016 | 0.027 | 0.000 |
| Sum (F) = | | | | | | 0.278 |

Area averaged mean soil loss (F) (In/Hr) = 0.278
 Minimum soil loss rate ((In/Hr)) = 0.139
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.710

 U n i t H y d r o g r a p h
 FOOTHILL S-Curve

Unit Hydrograph Data

| Unit time period | Time % of lag | Distribution | Unit Hydrograph |
|------------------|---------------|---------------|-----------------|
| (hrs) | | Graph % | (CFS) |
| 1 | 0.167 | 359.239 | 14.421 |
| 2 | 0.333 | 718.479 | 8.154 |
| | | Sum = 100.000 | Sum= 22.575 |

| Unit Time | Pattern | Storm Rain | Loss rate(In./Hr) | | Effective |
|-----------|---------|------------|-------------------|-------|-----------|
| (Hr.) | Percent | (In/Hr) | Max | Low | (In/Hr) |
| 1 | 0.17 | 1.10 | 0.278 | 0.187 | 0.08 |
| 2 | 0.33 | 1.20 | 0.278 | --- | 0.01 |
| 3 | 0.50 | 1.30 | 0.278 | --- | 0.03 |
| 4 | 0.67 | 1.40 | 0.278 | --- | 0.06 |
| 5 | 0.83 | 1.40 | 0.278 | --- | 0.06 |
| 6 | 1.00 | 1.50 | 0.278 | --- | 0.08 |
| 7 | 1.17 | 1.60 | 0.278 | --- | 0.11 |
| 8 | 1.33 | 1.60 | 0.278 | --- | 0.11 |
| 9 | 1.50 | 1.60 | 0.278 | --- | 0.11 |

| | | | | | | |
|-------|-------|-------|-------|-------|-------|------|
| 10 | 1.67 | 1.60 | 0.384 | 0.278 | --- | 0.11 |
| 11 | 1.83 | 1.60 | 0.384 | 0.278 | --- | 0.11 |
| 12 | 2.00 | 1.70 | 0.408 | 0.278 | --- | 0.13 |
| 13 | 2.17 | 1.70 | 0.408 | 0.278 | --- | 0.13 |
| 14 | 2.33 | 1.80 | 0.432 | 0.278 | --- | 0.15 |
| 15 | 2.50 | 1.80 | 0.432 | 0.278 | --- | 0.15 |
| 16 | 2.67 | 1.80 | 0.432 | 0.278 | --- | 0.15 |
| 17 | 2.83 | 2.00 | 0.480 | 0.278 | --- | 0.20 |
| 18 | 3.00 | 2.00 | 0.480 | 0.278 | --- | 0.20 |
| 19 | 3.17 | 2.10 | 0.504 | 0.278 | --- | 0.23 |
| 20 | 3.33 | 2.20 | 0.528 | 0.278 | --- | 0.25 |
| 21 | 3.50 | 2.50 | 0.600 | 0.278 | --- | 0.32 |
| 22 | 3.67 | 2.80 | 0.672 | 0.278 | --- | 0.39 |
| 23 | 3.83 | 3.00 | 0.720 | 0.278 | --- | 0.44 |
| 24 | 4.00 | 3.20 | 0.768 | 0.278 | --- | 0.49 |
| 25 | 4.17 | 3.50 | 0.840 | 0.278 | --- | 0.56 |
| 26 | 4.33 | 3.90 | 0.936 | 0.278 | --- | 0.66 |
| 27 | 4.50 | 4.20 | 1.008 | 0.278 | --- | 0.73 |
| 28 | 4.67 | 4.50 | 1.080 | 0.278 | --- | 0.80 |
| 29 | 4.83 | 4.80 | 1.152 | 0.278 | --- | 0.87 |
| 30 | 5.00 | 5.10 | 1.224 | 0.278 | --- | 0.95 |
| 31 | 5.17 | 6.70 | 1.608 | 0.278 | --- | 1.33 |
| 32 | 5.33 | 8.10 | 1.944 | 0.278 | --- | 1.67 |
| 33 | 5.50 | 10.30 | 2.472 | 0.278 | --- | 2.19 |
| 34 | 5.67 | 2.80 | 0.672 | 0.278 | --- | 0.39 |
| 35 | 5.83 | 1.10 | 0.264 | 0.278 | 0.187 | 0.08 |
| 36 | 6.00 | 0.50 | 0.120 | 0.278 | 0.085 | 0.03 |
| Sum = | 100.0 | | | | Sum = | 14.4 |

Flood volume = Effective rainfall 2.40(In)
times area 22.4(Ac.)/[((In)/(Ft.))] = 4.5(Ac.Ft)
Total soil loss = 1.60(In)
Total soil loss = 2.995(Ac.Ft)
Total rainfall = 4.00(In)
Flood volume = 194754.9 Cubic Feet
Total soil loss = 130468.0 Cubic Feet

Peak flow rate of this hydrograph = 45.248(CFS)

+++++

6 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 10 Minute intervals ((CFS))

| Time(h+m) | Volume Ac.Ft | Q(CFS) | 0 | 12.5 | 25.0 | 37.5 | 50.0 |
|-----------|--------------|--------|----|------|------|------|------|
| 0+10 | 0.0152 | 1.10 | Q | | | | |
| 0+20 | 0.0258 | 0.77 | Q | | | | |
| 0+30 | 0.0338 | 0.58 | Q | | | | |
| 0+40 | 0.0492 | 1.12 | Q | | | | |
| 0+50 | 0.0673 | 1.31 | VQ | | | | |
| 1+ 0 | 0.0902 | 1.66 | VQ | | | | |
| 1+10 | 0.1205 | 2.20 | Q | | | | |
| 1+20 | 0.1535 | 2.40 | Q | | | | |
| 1+30 | 0.1866 | 2.40 | Q | | | | |
| 1+40 | 0.2196 | 2.40 | Q | | | | |

| | | | | | | | | | |
|------|--------|-------|-----|--|--|--|--|--|--|
| 1+50 | 0.2526 | 2.40 | QV | | | | | | |
| 2+ 0 | 0.2904 | 2.74 | Q | | | | | | |
| 2+10 | 0.3309 | 2.94 | Q | | | | | | |
| 2+20 | 0.3762 | 3.29 | QV | | | | | | |
| 2+30 | 0.4242 | 3.48 | QV | | | | | | |
| 2+40 | 0.4721 | 3.48 | Q V | | | | | | |
| 2+50 | 0.5296 | 4.17 | QV | | | | | | |
| 3+ 0 | 0.5925 | 4.57 | Q V | | | | | | |
| 3+10 | 0.6602 | 4.91 | Q V | | | | | | |
| 3+20 | 0.7353 | 5.45 | Q V | | | | | | |
| 3+30 | 0.8275 | 6.69 | Q V | | | | | | |
| 3+40 | 0.9420 | 8.32 | Q V | | | | | | |
| 3+50 | 1.0742 | 9.60 | Q V | | | | | | |
| 4+ 0 | 1.2213 | 10.68 | Q V | | | | | | |
| 4+10 | 1.3881 | 12.11 | Q V | | | | | | |
| 4+20 | 1.5820 | 14.08 | Q V | | | | | | |
| 4+30 | 1.8011 | 15.90 | Q V | | | | | | |
| 4+40 | 2.0425 | 17.53 | Q V | | | | | | |
| 4+50 | 2.3064 | 19.16 | Q V | | | | | | |
| 5+ 0 | 2.5927 | 20.78 | Q V | | | | | | |
| 5+10 | 2.9633 | 26.91 | Q V | | | | | | |
| 5+20 | 3.4439 | 34.89 | Q V | | | | | | |
| 5+30 | 4.0672 | 45.25 | Q V | | | | | | |
| 5+40 | 4.3920 | 23.59 | Q | | | | | | |
| 5+50 | 4.4515 | 4.32 | Q | | | | | | |
| 6+ 0 | 4.4670 | 1.13 | Q | | | | | | |
| 6+10 | 4.4710 | 0.28 | Q | | | | | | |

Appendix “H”

RAINFALL INTENSITY - INCHES PER HOUR

RCFC & WCD
HYDROLOGY MANUAL

STANDARD
INTENSITY - DURATION
CURVES DATA

| CATHEDRAL CITY | | | | CHERRY VALLEY | | | | CORONA | | | | DESERT HOT SPRINGS | | | | ELSINORE - WILDOMAR | | | |
|---------------------|------------|-------------|---------------------|---------------|-------------|---------------------|------------|-------------|---------------------|------------|-------------|---------------------|------------|-------------|---------------------|---------------------|-------------|--|--|
| DURATION MINUTES | FREQUENCY | | DURATION MINUTES | FREQUENCY | | DURATION MINUTES | FREQUENCY | | DURATION MINUTES | FREQUENCY | | DURATION MINUTES | FREQUENCY | | DURATION MINUTES | FREQUENCY | | | |
| | 10 YEAR | 100 YEAR | | 10 YEAR | 100 YEAR | | 10 YEAR | 100 YEAR | | 10 YEAR | 100 YEAR | | 10 YEAR | 100 YEAR | | 10 YEAR | 100 YEAR | | |
| 5 | 4.14 | 6.76 | 5 | 3.65 | 5.49 | 5 | 3.10 | 4.78 | 5 | 4.39 | 6.76 | 5 | 3.23 | 4.94 | 5 | 3.23 | 4.94 | | |
| 6 | 3.73 | 6.08 | 6 | 3.30 | 4.97 | 6 | 2.84 | 4.38 | 6 | 3.95 | 6.08 | 6 | 2.96 | 4.53 | 6 | 2.96 | 4.53 | | |
| 7 | 3.41 | 5.56 | 7 | 3.03 | 4.56 | 7 | 2.64 | 4.07 | 7 | 3.62 | 5.56 | 7 | 2.75 | 4.21 | 7 | 2.75 | 4.21 | | |
| 8 | 3.15 | 5.15 | 8 | 2.82 | 4.24 | 8 | 2.47 | 3.81 | 8 | 3.35 | 5.15 | 8 | 2.58 | 3.95 | 8 | 2.58 | 3.95 | | |
| 9 | 2.95 | 4.81 | 9 | 2.64 | 3.97 | 9 | 2.34 | 3.60 | 9 | 3.13 | 4.81 | 9 | 2.44 | 3.73 | 9 | 2.44 | 3.73 | | |
| 10 | 2.77 | 4.52 | 10 | 2.49 | 3.75 | 10 | 2.22 | 3.43 | 10 | 2.94 | 4.52 | 10 | 2.32 | 3.54 | 10 | 2.32 | 3.54 | | |
| 11 | 2.62 | 4.28 | 11 | 2.36 | 3.56 | 11 | 2.12 | 3.27 | 11 | 2.78 | 4.28 | 11 | 2.21 | 3.39 | 11 | 2.21 | 3.39 | | |
| 12 | 2.49 | 4.07 | 12 | 2.25 | 3.39 | 12 | 2.04 | 3.14 | 12 | 2.65 | 4.07 | 12 | 2.12 | 3.25 | 12 | 2.12 | 3.25 | | |
| 13 | 2.38 | 3.88 | 13 | 2.16 | 3.25 | 13 | 1.96 | 3.02 | 13 | 2.53 | 3.88 | 13 | 2.04 | 3.13 | 13 | 2.04 | 3.13 | | |
| 14 | 2.28 | 3.72 | 14 | 2.07 | 3.12 | 14 | 1.89 | 2.92 | 14 | 2.42 | 3.72 | 14 | 1.97 | 3.02 | 14 | 1.97 | 3.02 | | |
| 15 | 2.19 | 3.58 | 15 | 1.99 | 3.00 | 15 | 1.83 | 2.82 | 15 | 2.32 | 3.58 | 15 | 1.91 | 2.92 | 15 | 1.91 | 2.92 | | |
| 16 | 2.11 | 3.44 | 16 | 1.92 | 2.90 | 16 | 1.77 | 2.73 | 16 | 2.24 | 3.44 | 16 | 1.85 | 2.83 | 16 | 1.85 | 2.83 | | |
| 17 | 2.04 | 3.32 | 17 | 1.86 | 2.80 | 17 | 1.72 | 2.66 | 17 | 2.16 | 3.32 | 17 | 1.80 | 2.75 | 17 | 1.80 | 2.75 | | |
| 18 | 1.97 | 3.22 | 18 | 1.80 | 2.71 | 18 | 1.68 | 2.58 | 18 | 2.09 | 3.22 | 18 | 1.75 | 2.67 | 18 | 1.75 | 2.67 | | |
| 19 | 1.91 | 3.12 | 19 | 1.75 | 2.64 | 19 | 1.63 | 2.52 | 19 | 2.03 | 3.12 | 19 | 1.70 | 2.60 | 19 | 1.70 | 2.60 | | |
| 20 | 1.85 | 3.03 | 20 | 1.70 | 2.56 | 20 | 1.59 | 2.46 | 20 | 1.97 | 3.03 | 20 | 1.66 | 2.54 | 20 | 1.66 | 2.54 | | |
| 22 | 1.75 | 2.86 | 22 | 1.61 | 2.43 | 22 | 1.52 | 2.35 | 22 | 1.86 | 2.86 | 22 | 1.59 | 2.43 | 22 | 1.59 | 2.43 | | |
| 24 | 1.67 | 2.72 | 24 | 1.54 | 2.32 | 24 | 1.46 | 2.25 | 24 | 1.77 | 2.72 | 24 | 1.52 | 2.33 | 24 | 1.52 | 2.33 | | |
| 26 | 1.59 | 2.60 | 26 | 1.47 | 2.22 | 26 | 1.40 | 2.17 | 26 | 1.69 | 2.60 | 26 | 1.46 | 2.24 | 26 | 1.46 | 2.24 | | |
| 28 | 1.52 | 2.49 | 28 | 1.41 | 2.13 | 28 | 1.36 | 2.09 | 28 | 1.62 | 2.49 | 28 | 1.41 | 2.16 | 28 | 1.41 | 2.16 | | |
| 30 | 1.46 | 2.39 | 30 | 1.36 | 2.05 | 30 | 1.31 | 2.02 | 30 | 1.55 | 2.39 | 30 | 1.37 | 2.09 | 30 | 1.37 | 2.09 | | |
| 32 | 1.41 | 2.30 | 32 | 1.31 | 1.98 | 32 | 1.27 | 1.96 | 32 | 1.50 | 2.30 | 32 | 1.33 | 2.03 | 32 | 1.33 | 2.03 | | |
| 34 | 1.36 | 2.22 | 34 | 1.27 | 1.91 | 34 | 1.23 | 1.90 | 34 | 1.45 | 2.22 | 34 | 1.29 | 1.97 | 34 | 1.29 | 1.97 | | |
| 36 | 1.32 | 2.15 | 36 | 1.23 | 1.85 | 36 | 1.20 | 1.85 | 36 | 1.40 | 2.15 | 36 | 1.25 | 1.92 | 36 | 1.25 | 1.92 | | |
| 38 | 1.28 | 2.09 | 38 | 1.20 | 1.80 | 38 | 1.17 | 1.81 | 38 | 1.36 | 2.09 | 38 | 1.22 | 1.87 | 38 | 1.22 | 1.87 | | |
| 40 | 1.24 | 2.02 | 40 | 1.16 | 1.75 | 40 | 1.14 | 1.76 | 40 | 1.32 | 2.02 | 40 | 1.19 | 1.82 | 40 | 1.19 | 1.82 | | |
| 45 | 1.16 | 1.89 | 45 | 1.09 | 1.64 | 45 | 1.08 | 1.66 | 45 | 1.23 | 1.89 | 45 | 1.13 | 1.72 | 45 | 1.13 | 1.72 | | |
| 50 | 1.09 | 1.78 | 50 | 1.03 | 1.55 | 50 | 1.03 | 1.58 | 50 | 1.16 | 1.78 | 50 | 1.07 | 1.64 | 50 | 1.07 | 1.64 | | |
| 55 | 1.03 | 1.68 | 55 | .98 | 1.47 | 55 | .98 | 1.51 | 55 | 1.09 | 1.68 | 55 | 1.02 | 1.56 | 55 | 1.02 | 1.56 | | |
| 60 | .98 | 1.60 | 60 | .93 | 1.40 | 60 | .94 | 1.45 | 60 | 1.04 | 1.60 | 60 | .98 | 1.50 | 60 | .98 | 1.50 | | |
| 65 | .94 | 1.53 | 65 | .89 | 1.34 | 65 | .90 | 1.40 | 65 | .99 | 1.53 | 65 | .94 | 1.44 | 65 | .94 | 1.44 | | |
| 70 | .90 | 1.46 | 70 | .85 | 1.29 | 70 | .87 | 1.35 | 70 | .95 | 1.46 | 70 | .91 | 1.39 | 70 | .91 | 1.39 | | |
| 75 | .86 | 1.41 | 75 | .82 | 1.24 | 75 | .84 | 1.30 | 75 | .91 | 1.41 | 75 | .88 | 1.35 | 75 | .88 | 1.35 | | |
| 80 | .83 | 1.35 | 80 | .79 | 1.20 | 80 | .82 | 1.26 | 80 | .88 | 1.35 | 80 | .85 | 1.31 | 80 | .85 | 1.31 | | |
| 85 | .80 | 1.31 | 85 | .77 | 1.16 | 85 | .80 | 1.23 | 85 | .85 | 1.31 | 85 | .83 | 1.27 | 85 | .83 | 1.27 | | |

SLOPE = .580

SLOPE = .550

SLOPE = .480

SLOPE = .580

SLOPE = .480

Appendix “I”

Appendix “J”

Appendix “K”