City of Albuquerque

P.O. Box 1293 Albuquerque, NM 87103

Public Works Department

July 29, 2002

Certificate of Work Order Completion

City Engineer
600 Second St.
Plaza Del Sol
Albuquerque, NM 87102

Re: **Heritage Hills North Unit 2 Project No. 6085.81**
Map No. D-20

Dear Sir:

This is to certify that Project No. 6085.81 has been completed according to approved plans and construction specifications. Please be advised this Certificate of Work-Order Completion does not constitute acceptance of the city infrastructure until all requirements of the subdivision improvements agreement have been satisfied and a Certificate of Completion and Acceptance is issued by the City Engineer.

Project consisted of the following:

The North Heritage Hills Subdivision PHII project is a new residential development located north of east of Barstow St. and south of Paseo Del Norte Blvd. A total of 10 new lots were created and the following items constructed as part of infrastructure for the above-mentioned project.

Paving:
A 28'/F-F Residential paving road was constructed in Palomar Avenue from Lots 28 & 71 (existing pavement) to Lot 21A-1 with a 40' Temporary Turnaround Easement, curb and gutter and, 4' sidewalks on both sides are deferred.

Water:
An 8" PVC, C-900 water line was installed in Palomar Avenue from Lots 30 & 69, at the existing water line stub to 20' east of Lots 37 & 62.

Sewer:
An 8", SDR-35, gravity sewer line was installed in Palomar Avenue from Lots 30 & 69, at the existing sewer line stub to 20' east of Lots 37 & 62, to a MH.

Concrete Channel:
A 10 wide, concrete channel was constructed at the south property line from Lot 62 (existing concrete channel) to Lot 71.

Misc:
Temporary desilting ponds and berm with Agreement and Covenant and Temp Easement.
Water infrastructure included Valves, Fittings, Valve Boxes, and Fire Hydrants as required.
Sanitary Sewer included manholes and service connections as required.
Residential street lights were installed per the DPM.
Grading and drainage certified.
Internal sidewalks were deferred.
A 40' Radius cul-de-sac with curb and gutter and permanent paving was constructed at the east end of Palomar with barricades.

Centerline Mounumentation required and completed.

City of Albuquerque
P. O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103
PUBLIC WORKS DEPARTMENT

June 3, 1997

CERTIFICATE OF WORK ORDER COMPLETION

Ridgefield West, LLC
6480 Second St. NE Suite 241
Albuquerque, NM 87109

RE: North Heritage Hills Phase 1 PROJECT NO. 546881 MAP NO. (D-20)

Dear Sir:

This is to certify that the City of Albuquerque accepts Project No. 546881 as being completed according to approved plans and construction specifications. Please be advised this certificate of completion and acceptance shall only become effective upon final plat approval and filing in the office of the Bernalillo County Clerk's Office.

The project is described as follows:

- Installation of sanitary sewer mains and services, water mains and services,storm drainage appurtenances, sidewalk and asphalt concrete on Palomar, Barstow, and Rough Rider NE.

The contractors correction period began the date of this letter and is effective for a period of one (1) year.

CITY OF
Albuquerque
Public Works Department

February 18, 1997

Martin J. Chávez, Mayor

Robert E. Gurulé, Director

Ronald R. Bohannan
Tierra West Development
4421 McLeod Road NE
Suite D
Albuquerque, NM 87109

RE: NORTH HERITAGE HILLS SUBDIVISION PHASE 1 (D20-D9). ENGINEER'S CERTIFICATION FOR RELEASE OF FINANCIAL GUARANTEES. ENGINEER'S CERTIFICATION DATED FEBRUARY 7, 1997.

Dear Mr. Bohannan:

Based on the information provided on your January 29, 1997 submittal, City Hydrology accepts the Engineer's Certification of grading and drainage for release of financial guarantees.

If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,

Lisa Ann Manwill, P.E.
Engineering Assoc./Hyd.

c: Terri Martin
Andrew Garcia
File

DRAINAGE REPORT

for

North Heritage Hills Subdivision

Prepared by

Tierra West Development Management Sevices
4421 McLeod Road NE, Suite D
Albuquerque, New Mexico 87109

Prepared for

Steve Jackson
Jackson Maple Properties
6840 Second Street, NW Ste 241
Albuquerque, New Mexico 87107

March 1996
Revised July 1996

RONALD RAY BOHANNAN
NEW MEXICO
7868
REGISTERED PROFESSIONAL ENGINEER
7-2-96

Ronald R. Bohannan P.E. No. 7868

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Location

North Heritage Hills is a proposed 91 unit single family subdivision. It is located south of Paseo Del Norte between Barstow Street and Ventura Street, NE. The site is shown on the attached Zone Atlas Map D-20 and contains approximately 15.8 acres. The purpose of this report is to provide the drainage analysis and management plan for the subdivision. The project will be developed in two phases. Phase 1 consists of the area from Barstow Street to seven lots east of Rough Rider Road. Phase 2 will consist of the balance of the property.

Existing Drainage Conditions

The site is currently undeveloped. The natural slope is from east to west at approximately 3.3 percent. There are two existing basins on the site. The two basins drain to different points from the site (see undeveloped basin map shown on exhibit). Basin A has a runoff flow of 26.92 cfs. Basin A sheet flows south into an existing arroyo and flows west towards Barstow Street. Basin B has a runoff flow of 14.80 cfs and sheet flows north and west towards Paseo Del Norte and Barstow Street. The undeveloped flow enters Barstow and then continues west in the small arroyo and enters Paseo Del Norte and travels west in the alignment. Both Basin A and B eventually enter the Domingo Baca Arroyo near San Pedro and Paseo Del Norte. All upland flows from the east that would impact the site are collected in a storm sewer located in Ventura Street and directed south to the Domingo Baca Arroyo. All flow is diverted to the Domingo Baca Arroyo as referenced in the drainage report for Ridgefield North Subdivision (D-20/D8A).

FEMA Map and Soil Conditions

The site is located on FEMA Map section 350002 panel 10 as shown on the attached excerpt. The map shows that the site does not lie within any 100 year flood plains.

The site contains three different soils from the Soil Conservation Service Soil Survey of Bernalillo County. These are Tijeras and Embudo gravelly fine sandy loams, and an Embudo-Tijeras complex. All of the soils have a moderate hazard of water erosion and medium runoff.

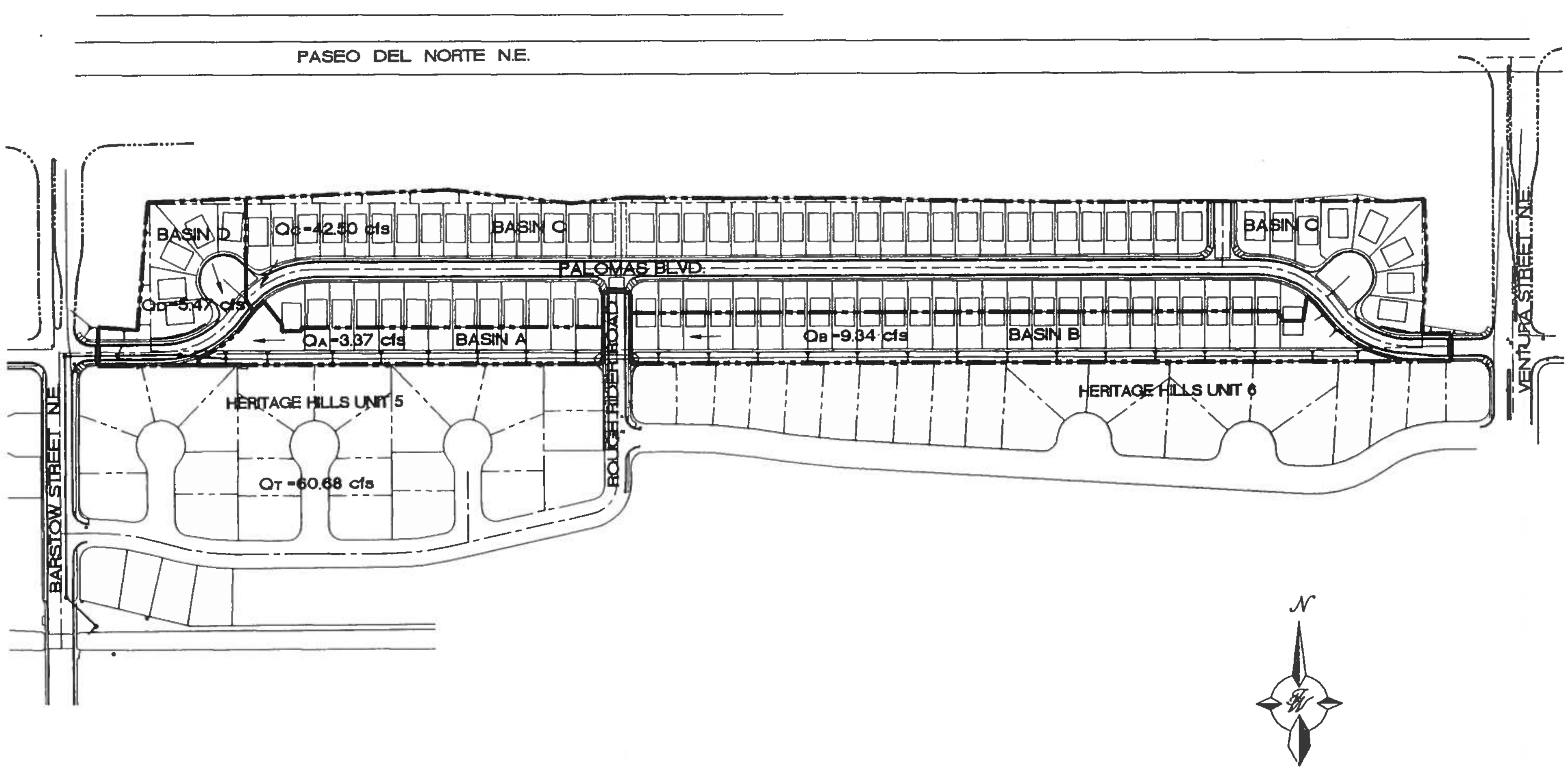
On-Site Drainage Management Plan

The proposed drainage management is to collect the developed flows in Palomas Street and a drainage channel then convey the flows to a new storm sewer in Barstow. The new storm sewer in Barstow (proposed with this project) will convey the flows south to the existing improved Domingo Baca channel. The site has been divided into four basins as shown on the Grading and Drainage Plan. All the basins will drain to the west side of the property. Basins A and B will drain to a drainage easement located on the south property line and from there will be picked up by the proposed 36" storm sewer system in Barstow. Basins C and D will drain to Palomas Boulevard and then into the same storm sewer system. The storm sewer will continue in Barstow Street and discharge into the existing Domingo Baca Arroyo.

The site is being developed in two phases. During Phase 1 of the project Basins C and B will be divided into developed and undeveloped portions. The undeveloped flows will be diverted into two desilting ponds. Clean water will overflow from the desilting ponds into Palomas Boulevard and the drainage channel at the south property line. The developed portion of Basin B and the clean runoff from the desilting pond in the undeveloped portion of Basin B will drain to a drainage channel near the southern property line. Basin C and the clean water from the undeveloped portion of Basin C will drain into Palomas Boulevard. There will be no changes to the runoff pattern of Basins A and D due to the phasing of the project. All the runoff will enter the proposed storm sewer system and be routed to the Domingo Baca Arroyo.

Summary

There are four basins proposed for the site. Basin A has a developed runoff flow of 3.37 cfs, Basin B has a developed runoff flow of 9.34 cfs, Basin C has a developed runoff flow of 42.50 cfs, and Basin D has a developed runoff flow of 5.47 cfs. All flows will eventually drain into the existing Domingo Baca Arroyo. During Phase 1 two desilting ponds will intercept the undeveloped flow from the Phase 2 portion of the site.



BASIN LAYOUT

RUNOFF CALCULATIONS --BASIN C

The site is @ Zone 3
Basin Area = 10.6190 acres

LAND TREATMENT

A= 0
B= 26 %
C= 26 %
D= 48 %

DEPTH (INCHES) @ 100-YEAR STORM

P_{60} = 2.14 inches

P_{360} = 2.60 inches

P_{1440} = 3.10 inches

DEPTH (INCHES) @ 10-YEAR STORM

P_{60} = 2.14 x 0.667
= 1.43 inches

P_{360} = 1.73

P_{1440} = 2.07

CALCULATED FLOWS (CFS) AND VOLUMES (AC-FT)

Q_{100} = 42.50 Q_{10} = 26.64
V_{100} = 1.502 V_{10} = .850

See the summary output from AHYMO calculations.

Also see the following summary tables.

DRAINAGE BASINS - EXISTING

SUB-BASIN	AREA (SF)	AREA (AC)	AREA (MI^2)
A	451639.66	10.3682	0.016200
B	248308.11	5.7004	0.008907

DRAINAGE BASINS - PROPOSED

SUB-BASIN	AREA (SF)	AREA (AC)	AREA (MI^2)
A	48189.32	1.1063	0.001729
B	118195.76	2.7134	0.004240
C	462562.09	10.6190	0.016592
D	59363.25	1.3628	0.002129

BASINS RUNOFF CALCULATION RESULTS - EXISTING

BASIN	Q-100 CFS	Q-10 CFS
A	26.92	12.21
B	14.8	6.71

BASINS RUNOFF CALCULATION RESULTS - PROPOSED

BASIN	Q-100 CFS	Q-10 CFS
A	3.37	1.72
B	9.34	5.19
C	42.50	26.64
D	5.47	3.30

SEE THE FOLLOWING SHEET FOR SAMPLE CALCULATION ON THE BASINS RUNOFF

FINDING STREET CAPACITY - 28 F-F CROSS-SECTION FOR 8" CURB

Q = 1.49/n A R^(2/3) S^½
n = 0.017
SLOPE = STREET SLOPE
R^2/3 = (A/P)^2/3
D2 = WATER DEPTH AFTER HYDRAULIC JUMP = D1/2 [SQRT (1 + 8Fr²) - 1]
E = V² / 2g

HALF STREET CALCULATIONS

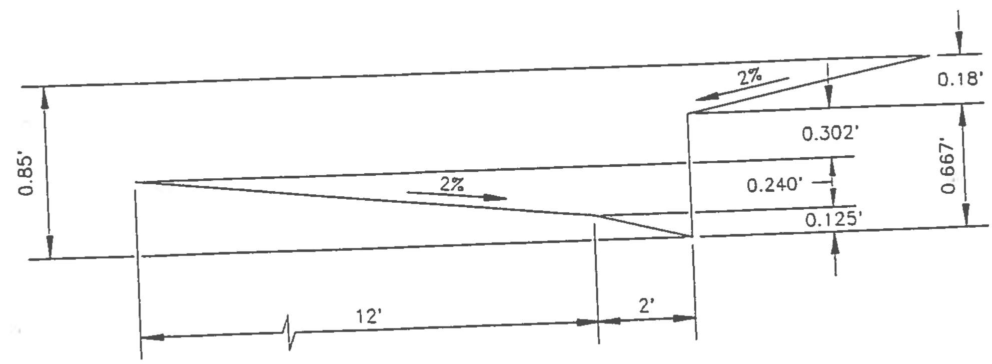
@Y < = 0.125
A1 = ½ Y (Y/0.0625) = 8Y²
P1 = SQRT[Y² + (Y/0.0625)²] + Y = SQRT(257 Y²) + Y

@ 0.125 < Y < = 0.365 & Y1 = Y - 0.125
A2 = A1 + ½Y1 (Y1/0.02) + 2Y1 = A1 + 25Y1² + 2Y1
P2 = P1 + SQRT[Y1² + (Y1/0.02)²] + Y1 = P1 + SQRT(2501 Y1²) + Y1

@ 0.365 < Y < = 0.667 & Y2 = Y - 0.365
A3 = A2 + 14Y2 + ½Y2[Y2/(0.02)] = A2 + 14 Y2
P3 = P2 + SQRT(Y2² + [Y2/(0.02)]²) = P2 + Y2

@ 0.667 < Y < = 0.847 & Y3 = Y - 0.667
A4 = A3 + 14Y3 + ½Y3[Y3/(0.02)] = A3 + 14 Y3 + 25 Y3²
P4 = P3 + SQRT(Y3² + [Y3/(0.02)]²) = P3 + SQRT(2501 Y3²)

SEE THE FOLLOWING SHEET FOR INPUT AND OUTPUT FILE FOR CALCULATION RESULTS FROM COMPUTER PROGRAM USING THE EQUATION SHOWN ABOVE



28' F-F
8" CURB
NOT TO SCALE

Street Capacity Calculations

28' F-F Street Section with 8" curb

For water depths less than 0.125 feet

Y=	Water depth
Area =	8*Y^2
P=	SQRT(257*Y^2) + Y
n=	0.017
Slope=	0.0352
Q =	42.5

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.01	0.0008	0.170312	0.004697	0.000368	0.000736	0.459978	0.0046	0.810605	0.007507
0.02	0.0032	0.340624	0.009395	0.002337	0.004673	0.73017	0.014603	0.909874	0.01761
0.04	0.0128	0.681249	0.018789	0.014836	0.029672	1.159073	0.046363	1.021299	0.041137
0.06	0.0288	1.021873	0.028184	0.043742	0.087484	1.518815	0.091129	1.092701	0.067451
0.08	0.0512	1.362498	0.037578	0.094204	0.188407	1.839913	0.147193	1.146369	0.095725
0.1	0.08	1.703122	0.046973	0.170802	0.341605	2.13503	0.213503	1.189806	0.125536
0.12	0.1152	2.043746	0.056367	0.277744	0.555487	2.410969	0.289316	1.226515	0.156622
0.125	0.125	2.128902	0.058716	0.309685	0.619371	2.477483	0.309685	1.234889	0.16457

For water depths greater than .125 ft but less than .365 ft

Y1=	Y-0.125
A2=	A1 + 2*Y1 + 25*Y1^2
P2=	P1 + SQRT(2501*Y1^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.13	0.135625	2.383952	0.056891	0.32901	0.65802	2.42588	0.315364	1.185686	0.16247
0.16	0.225625	3.914252	0.057642	0.552146	1.104292	2.447185	0.39155	1.078149	0.17674
0.2	0.415625	5.954652	0.069798	1.155508	2.311016	2.78017	0.556034	1.095541	0.225602
0.24	0.685625	7.995052	0.085756	2.18661	4.373221	3.189222	0.765413	1.147232	0.287455
0.28	1.035625	10.03545	0.103197	3.736693	7.473387	3.608153	1.010283	1.20165	0.355997
0.32	1.465625	12.07585	0.121368	5.892064	11.78413	4.020172	1.286455	1.252396	0.428921
0.36	1.975625	14.11625	0.139954	8.733784	17.46757	4.42077	1.591477	1.298431	0.505121
0.365	2.045	14.3713	0.142297	9.141118	18.28224	4.469984	1.631544	1.303862	0.514842

For water depths greater than .365 ft but less than .667 ft

Y2=	Y - 0.365
A3=	A2 + Y2*14
P3=	P2 + Y2

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.4	2.535	14.4063	0.175965	13.05478	26.10956	5.149814	2.059925	1.434939	0.636
0.45	3.235	14.4563	0.223778	19.55511	39.11022	6.044856	2.720185	1.588005	0.810344
0.4619	**3.4016**	**14.4682**	**0.235109**	**21.25055**	**42.50111**	**6.247223**	**2.885592**	**1.619888**	**0.852112**
0.55	4.635	14.5563	0.318419	35.44514	70.89029	7.64728	4.206004	1.817179	1.164937
0.6	5.335	14.6063	0.365253	44.70661	89.41322	8.379871	5.027922	1.906487	1.34529
0.65	6.035	14.6563	0.411768	54.7798	109.5596	9.077017	5.900061	1.984077	1.527571
0.667	6.273	14.6733	0.427511	58.38233	116.7647	9.306924	6.207718	2.008239	1.589965

For water depths greater than .667 ft but less than .85 ft

Y3=	Y - .667
A4=	A3 + 14 * Y3 + 25 * Y3^2
P4=	P3 + SQRT(2501 * Y3^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.7	6.762225	16.32363	0.41426	61.62819	123.2564	9.113596	6.379517	1.919609	1.582279
0.73	7.254225	17.82393	0.406994	65.33671	130.6734	9.006711	6.574899	1.857705	1.587274
0.75	7.607225	18.82413	0.404121	68.1933	136.3866	8.96428	6.72321	1.824134	1.595793
0.77	7.980225	19.82433	0.402547	71.35111	142.7022	8.94099	6.884562	1.795611	1.607863
0.8	8.577225	21.32463	0.402221	76.64754	153.2951	8.936169	7.148935	1.760672	1.631737
0.82	9.000225	22.32483	0.403149	80.55108	161.1022	8.949896	7.338915	1.741739	1.651009
0.85	9.672225	23.82513	0.405967	86.96844	173.9369	8.991565	7.64283	1.718691	1.684268

Street Capacity Calculations

28' F-F Street Section with 8" curb

For water depths less than 0.125 feet

Y= Water depth
Area = 8*Y^2
P= SQRT(257*Y^2) + Y
n= 0.017
Slope= 0.0302
Q = 47.97

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.01	0.0008	0.170312	0.004697	0.000341	0.000682	0.426059	0.004261	0.75083	0.006737
0.02	0.0032	0.340624	0.009395	0.002164	0.004328	0.676326	0.013527	0.842778	0.01585
0.04	0.0128	0.681249	0.018789	0.013742	0.027484	1.073601	0.042944	0.945986	0.037128
0.06	0.0288	1.021873	0.028184	0.040516	0.081033	1.406815	0.084409	1.012123	0.060971
0.08	0.0512	1.362498	0.037578	0.087257	0.174514	1.704235	0.136339	1.061834	0.086617
0.1	0.08	1.703122	0.046973	0.158207	0.316414	1.97759	0.197759	1.102068	0.11368
0.12	0.1152	2.043746	0.056367	0.257262	0.514525	2.23318	0.267982	1.13607	0.141918
0.125	0.125	2.128902	0.058716	0.286849	0.573697	2.29479	0.286849	1.143826	0.149141

For water depths greater than .125 ft but less than .365 ft

Y1= Y-0.125
A2= A1 + 2*Y1 + 25*Y1^2
P2= P1 + SQRT(2501*Y1^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.13	0.135625	2.383952	0.056891	0.304748	0.609497	2.246992	0.292109	1.098252	0.147116
0.16	0.225625	3.914252	0.057642	0.51143	1.02286	2.266726	0.362676	0.998645	0.159711
0.2	0.415625	5.954652	0.069798	1.070299	2.140598	2.575156	0.515031	1.014754	0.203937
0.24	0.685625	7.995052	0.085756	2.025366	4.050732	2.954044	0.70897	1.062633	0.260109
0.28	1.035625	10.03545	0.103197	3.461143	6.922287	3.342082	0.935783	1.113038	0.322442
0.32	1.465625	12.07585	0.121368	5.457574	10.91515	3.723718	1.19159	1.160042	0.388816
0.36	1.975625	14.11625	0.139954	8.089741	16.17948	4.094775	1.474119	1.202682	0.458215
0.365	2.045	14.3713	0.142297	8.467037	16.93407	4.14036	1.511232	1.207713	0.467071

For water depths greater than .365 ft but less than .667 ft

Y2= Y - 0.365
A3= A2 + Y2*14
P3= P2 + Y2

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.4	2.535	14.4063	0.175965	12.0921	24.18419	4.770058	1.908023	1.329125	0.578012
0.45	3.235	14.4563	0.223778	18.11308	36.22616	5.599098	2.519594	1.470902	0.737738
0.49272	**3.83308**	**14.49902**	**0.264368**	**23.98432**	**47.96863**	**6.257192**	**3.083044**	**1.57091**	**0.875649**
0.55	4.635	14.5563	0.318419	32.83136	65.66272	7.083357	3.895846	1.683177	1.062775
0.6	5.335	14.6063	0.365253	41.40987	82.81974	7.761925	4.657155	1.765899	1.228152
0.65	6.035	14.6563	0.411768	50.74024	101.4805	8.407662	5.464981	1.837768	1.395326
0.667	6.273	14.6733	0.427511	54.07713	108.1543	8.620616	5.749951	1.860148	1.452554

For water depths greater than .667 ft but less than .85 ft

Y3= Y - .667
A4= A3 + 14 * Y3 + 25 * Y3^2
P4= P3 + SQRT(2501 * Y3^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.7	6.762225	16.32363	0.41426	57.08362	114.1672	8.441544	5.909081	1.778054	1.444644
0.73	7.254225	17.82393	0.406994	60.51867	121.0373	8.342541	6.090055	1.720715	1.448535
0.75	7.607225	18.82413	0.404121	63.16461	126.3292	8.303239	6.22743	1.68962	1.455927
0.77	7.980225	19.82433	0.402547	66.08956	132.1791	8.281667	6.376883	1.6632	1.466601
0.8	8.577225	21.32463	0.402221	70.99542	141.9908	8.277202	6.621761	1.630837	1.487942
0.82	9.000225	22.32483	0.403149	74.61111	149.2222	8.289916	6.797731	1.613301	1.505271
0.85	9.672225	23.82513	0.405967	80.55524	161.1105	8.328512	7.079235	1.591952	1.535282

FINDING STREET CAPACITY - 28 F-F CROSS-SECTION FOR 4" CURB

Q = 1.49/n A R^(2/3) S^½
n = 0.017
SLOPE = STREET SLOPE
R^2/3 = (A/P)^2/3
D2 = HYDRAULIC DEPTH AFTER HYDRAULIC JUMP = D1/2 [SQRT (1 + $8Fr^2$) - 1]
E = V^2 / 2g

HALF STREET CALCULATIONS

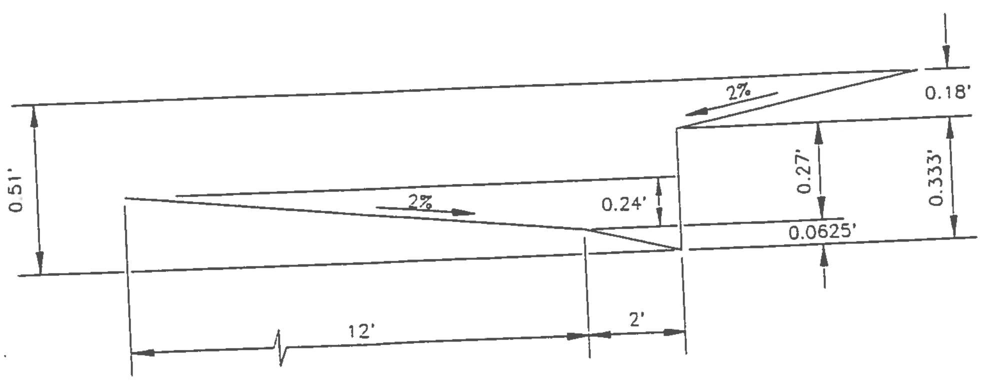
@Y < = 0.0625
A1 = ½ Y (Y/0.03125) = $16Y^2$
P1 = SQRT[Y^2 + $(Y/0.03125)^2$] + Y = SQRT(1025 Y^2) + Y

@ 0.0625 < Y < = 0.3025 & Y1 = Y - 0.0625
A2 = A1 + ½Y1 (Y1/0.02) + 2Y1 = A1 + $25Y1^2$ + 2Y1
P2 = P1 + SQRT[$Y1^2$ + $(Y1/0.02)^2$] + Y1 = P1 + SQRT(2501 Y^2) + Y1

@ 0.3025 < Y < = 0.333 & Y2 = Y - 0.3025
A3 = A2 + 14Y2
P3 = P2 + Y2

@ 0.333 < Y < = 0.513 & Y3 = Y - 0.333
A4 = A3 + 14Y3 + ½Y3[Y3/(0.02)] = A3 + 14 Y3 + 25 $Y3^2$
P4 = P3 + SQRT($Y3^2$ + $[Y3/(0.02)]^2$) = P3 + SQRT(2501 $Y3^2$)

SEE THE FOLLOWING SHEET FOR INPUT AND OUTPUT FILE FOR CALCULATION RESULTS FROM COMPUTER PROGRAM USING THE EQUATION SHOWN ABOVE



28' F-F
4" CURB
NOT TO SCALE

Street Capacity Calculations

28' F-F Street Section with 4" curb

For water depths less than 0.0625 feet

Y=	Water depth
Area =	16*Y^2
P=	SQRT(1025*Y^2) + Y
n=	0.017
Slope=	0.03216
Q=	21.75

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.015	0.0036	0.495234	0.007269	0.002118	0.004235	0.588242	0.008824	0.846413	0.011959
0.02	0.0064	0.660312	0.009692	0.004561	0.009121	0.712604	0.014252	0.887984	0.017034
0.025	0.01	0.825391	0.012115	0.008269	0.016538	0.826904	0.020673	0.921631	0.0224
0.03	0.0144	0.990469	0.014539	0.013446	0.026893	0.933775	0.028013	0.950066	0.028008
0.04	0.0256	1.320625	0.019385	0.028958	0.057917	1.131188	0.045248	0.996729	0.039826
0.05	0.04	1.650781	0.024231	0.052505	0.10501	1.312628	0.065631	1.034496	0.052304
0.06	0.0576	1.980937	0.029077	0.085379	0.170758	1.482276	0.088937	1.066413	0.065332
0.0625	0.0625	2.063476	0.030289	0.095198	0.190396	1.52317	0.095198	1.073693	0.068665

For water depths greater than .0625 ft but less than .3025 ft

Y1=	Y-0.0625
A2=	A1 + 2*Y1 + 25*Y1^2
P2=	P1 + SQRT(2501*Y1^2)+Y1

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.065	0.067656	2.191001	0.030879	0.104387	0.208774	1.542901	0.100289	1.066482	0.070782
0.07	0.078906	2.446051	0.032259	0.125344	0.250688	1.588517	0.111196	1.058071	0.075437
0.08	0.105156	2.956151	0.035572	0.178293	0.356587	1.695509	0.135641	1.056397	0.086034
0.09	0.136406	3.466251	0.039353	0.247388	0.494776	1.813611	0.163225	1.065356	0.09787
0.1	0.172656	3.976351	0.043421	0.334356	0.668711	1.936539	0.193654	1.079191	0.110602
0.2	0.810156	9.077351	0.08925	2.536315	5.072629	3.130649	0.62613	1.233648	0.262975
0.3	1.947656	14.17835	0.137368	8.128267	16.25653	4.173358	1.252007	1.342756	0.4391
0.3025	1.9825	14.30588	0.138579	8.322241	16.64448	4.197851	1.26985	1.345044	0.443706

For water depths greater than .3025 ft but less than .333 ft

Y2=	Y - 0.3025
A3=	A2 + Y2*14
P3=	P2 + Y2

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.305	2.0175	14.30838	0.141001	8.567555	17.13511	4.24662	1.295219	1.355082	0.451561
0.31	2.0875	14.31338	0.145843	9.06659	18.13318	4.343277	1.346416	1.374703	0.467291
0.315	2.1575	14.31838	0.15068	9.576719	19.15344	4.438804	1.398223	1.393743	0.483046
0.32	2.2275	14.32338	0.155515	10.09781	20.19562	4.533248	1.450639	1.412234	0.498828
0.3273	**2.3297**	**14.33068**	**0.162567**	**10.87803**	**21.75605**	**4.669282**	**1.528256**	**1.438299**	**0.521917**
0.33	2.3675	14.33338	0.165174	11.17238	22.34475	4.719061	1.55729	1.447674	0.530472
0.333	2.4095	14.33638	0.168069	11.50306	23.00611	4.774042	1.589756	1.457928	0.539987

For water depths greater than .333 ft but less than .51 ft

Y3=	Y - .333
A4=	A3 + 14 * Y3 + 25 * Y3^2
P4=	P3 + SQRT(2501 * Y3^2)

Depth (ft)	Area (ft^2)	P (ft)	R (A/P)	Q (cfs)	2Q (cfs)	Vel (ft/s)	D*V	Fr	D2 (ft)
0.335	2.4376	14.4364	0.168851	11.67328	23.34655	4.78884	1.604261	1.458075	0.543298
0.34	2.508725	14.68645	0.170819	12.10706	24.21411	4.825979	1.640833	1.458539	0.551623
0.35	2.654725	15.18655	0.174808	13.01031	26.02063	4.900814	1.715285	1.459844	0.568475
0.4	3.459725	17.68705	0.195608	18.27512	36.55025	5.282248	2.112899	1.471841	0.656283
0.4293	3.989542	19.15234	0.208306	21.97616	43.95232	5.508441	2.364774	1.481564	0.710097
0.5	5.444725	22.68805	0.239982	32.96019	65.92039	6.053601	3.026801	1.508693	0.845709
0.51	5.670725	23.18815	0.244553	34.76281	69.52562	6.130223	3.126414	1.512736	0.865462

Rectangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name:

Comment:

Solve For Depth

Given Input Data:

Bottom Width.....	19.50 ft
Manning's n......	0.025
Channel Slope....	0.0278 ft/ft
Discharge........	9.34 cfs

Computed Results:

Depth............	0.16 ft
Velocity.........	2.93 fps
Flow Area........	3.19 sf
Flow Top Width...	19.50 ft
Wetted Perimeter.	19.83 ft
Critical Depth...	0.19 ft
Critical Slope...	0.0162 ft/ft
Froude Number....	1.28 (flow is Supercritical)

$$D_2 = \frac{D_1}{2}\left(\sqrt{1+8Fr^2}-1\right)$$

$$= \frac{.16}{2}\left(\sqrt{1+8(1.28)^2}-1\right)$$

$$= 0.22$$

$0.22 < 0.50$ OK

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Rectangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name:

Comment:

Solve For Depth

Given Input Data:

Bottom Width.....	19.50 ft
Manning's n......	0.025
Channel Slope....	0.0375 ft/ft
Discharge........	12.71 cfs

Computed Results:

Depth............	0.18 ft
Velocity.........	3.62 fps
Flow Area........	3.51 sf
Flow Top Width...	19.50 ft
Wetted Perimeter.	19.86 ft
Critical Depth...	0.24 ft
Critical Slope...	0.0152 ft/ft
Froude Number....	1.51 (flow is Supercritical)

$$D_2 = \frac{D_1}{2}\left(\sqrt{1+8Fr^2} - 1\right)$$

$$= \frac{.18}{2}\left(\sqrt{1+8(1.51)^2} - 1\right)$$

$$= 0.30$$

$0.30 < 0.50$ ok

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STORM DROP INLET (EFFECTIVE AREA-IN PONDING SECTION)
(DBL-A @ the ponding section w/ sweepers on each side)

Area @ the Grate:

L = 88 ¾" - 2 (6"$_{\text{ENDS}}$) - 6"$_{\text{CENTER PIECE}}$ - 14 (½"$_{\text{MIDDLE BARS}}$)

= 63 ¾" = 5.3125'

W = 25 ½" - 13 (½"$_{\text{MIDDLE BARS}}$)

= 19" = 1.5833'

Area = 5.3125 x 8.41
= 8.41 SF

Effective area = 8.41 - .5 (8.41)$_{\text{Clogging Factor}}$

= 4.21 SF @ the Grate

Area @ the Throat:

L = 13.50'

H = 10 ¾" - 4 ½"
= 6 ¼" = 0.5208'

Area = 13.50 x 0.5208
= 7.03 SF @ the Throat

Total Area

Area = 4.21$_{\text{Grate}}$ + 7.03$_{\text{Throat}}$
= 11.24 SF

Using one Double A w/Sweepers on each side
(Checking the ponding depth at the inlet)

Q = 47.95 cfs

Solve for H:
$H = (Q/CA)^2/(2g)$

$H = (47.95/(0.60 \times 11.24))^2/(2 \times 32.2)$
= 0.78' < 0.87' (top of curb)

STORM DROP INLET-EFFECTIVE AREA
Single 'C'

<u>Area at the grate:</u>

L = 38.375" - 7(½" $_{\text{middle bars}}$)
= 34.875"
= 2.906'

W = 25.5" - 13(½" $_{\text{middle bars}}$)
= 19"
= 1.583'

Area = 1.583' x 2.906'
= 4.601 ft^2

Effective Area = 4.601- 4.601 (0.5 $_{\text{clogging factor}}$)
= 2.30 ft^2 at the grate

<u>Area at the throat:</u>

L = 47.375"
= 3.95'

H = 10¾" - 4½"
= 6¼"
= 0.5208'

Area = 3.95' x 0.5208'
= 2.06 ft^2 at the throat

<u>Total Area:</u>

Area = $2.30_{\text{grate}} + 2.06_{\text{throat}}$
= 4.36 ft^2

Head Requirements For Drainage Pipes At The Inlets

$Q = CA\sqrt{(2gH)}$

$C = 0.6$
$A = \pi r^2$ or area of the opening, r = radius of the pipe out of each drop inlet
$g = 32.2$
H = Water Depth (Measured from the center of the pipe)
Q = Flow

Solve for H:

$H = (Q/CA)^2/(2g)$

Pipe from DI-1 to MH-1

Using a 18" pipe
$A = 1.7671$

$H = (12.07/(0.6 \times 1.7671))^2/ (2 \times 32.2)$
$= 2.01'$

Therefor, the total water depth required from the invert of pipe = 0.75'+2.01' = 2.76'

Height provided from the invert to grate = 3.50'

Pipe from DI-2 to MH-2

Using a 36" pipe
A = 7.0686 SF

$H = (47.95/(0.6 \times 7.0686))^2/ (2 \times 32.2)$
$= 1.98'$

Therefor, the total water depth required from the invert of pipe = 1.50'+1.98' = 3.48'

Height provided from the invert to grate = 5.00'

Orifice Equation & Ponding Depth At The Inlets

$Q = CA\sqrt{(2gH)}$

C = 0.6
A = πr^2 or area of the opening, r = radius of the pipe out of each drop inlet
g = 32.2
H = Water Depth (Measured from the center of the pipe)
Q = Flow

Solve for H:

$H = (Q/CA)^2(2g)$

Pipe Crossing from Channel A to B

Using a 18" pipe
A = 1.7671

$H = (9.34/(0.6 \times 1.7671))^2 / (2 \times 32.2)$
= 1.2'

Therefore, the total water depth from the invert of pipe = 0.75'+1.2' = 1.95'

Drop inlet West end of channel B

$A_{(Single\ C)}$ = 4.36 (with 50% clogging factor)

$H = (12.71/(0.6 \times 4.36))^2 / (2 \times 32.2)$
= 0.37' (ponding depth from the top of grade)

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name:

Comment: Min. Pipe Slope From DI-1 To MH-1 TO MH-2

Solve For Actual Depth

Given Input Data:

Diameter..........	1.50 ft
Slope.............	0.0140 ft/ft
Manning's n.......	0.012
Discharge.........	12.71 cfs

Computed Results:

Depth.............	1.16 ft
Velocity..........	8.67 fps
Flow Area.........	1.47 sf
Critical Depth....	1.34 ft
Critical Slope....	0.0110 ft/ft
Percent Full......	77.34 %
Full Capacity.....	13.46 cfs
QMAX @.94D........	14.48 cfs
Froude Number.....	1.41 (flow is Supercritical)

Maintain Min. Slope of 1.40% For
18" RCP From DI-1 To MH-2 To MH-3

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name:

Comment: Min. Pipe Slope From DI-2 To MH-2

Solve For Actual Depth

Given Input Data:

Diameter..........	3.00 ft
Slope.............	0.0050 ft/ft
Manning's n.......	0.012
Discharge.........	47.95 cfs

Computed Results:

Depth.............	2.31 ft
Velocity..........	8.22 fps
Flow Area.........	5.84 sf
Critical Depth....	2.26 ft
Critical Slope....	0.0053 ft/ft
Percent Full......	76.93 %
Full Capacity.....	51.09 cfs
QMAX @.94D........	54.96 cfs
Froude Number.....	0.95 (flow is Subcritical)

Maintain a Min. Slope of 0.50% For
The 36" RCP From DI-2 To MH-2

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name:

Comment: Min. Pipe Slope From MH-2 To MH-3

Solve For Actual Depth

Given Input Data:

Diameter..........	3.00 ft
Slope.............	0.0080 ft/ft
Manning's n.......	0.012
Discharge.........	60.66 cfs

Computed Results:

Depth.............	2.31 ft
Velocity..........	10.39 fps
Flow Area.........	5.84 sf
Critical Depth....	2.51 ft
Critical Slope....	0.0068 ft/ft
Percent Full......	76.94 %
Full Capacity.....	64.63 cfs
QMAX @.94D........	69.52 cfs
Froude Number.....	1.21 (flow is Supercritical)

Maintain a Min. Slope of 0.8% For The
36" RCP From MH-2 To MH-3

Open Channel Flow Module, Version 3.12 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

AHYMO SUMMARY TABLE (AHYMO194) - AMAFCA Hydrologic Model - January, 1994   RUN DATE (MON/DAY/YR) =03/07/1996
INPUT FILE = A:D2EX.DAT   USER NO.= R_BOHANN.I01

PAGE = 1

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 2.600
COMPUTE NM HYD	100.10	-	1	.01620	26.92	.796	.92096	1.500	2.596	PER IMP= .00
COMPUTE NM HYD	100.20	-	1	.00891	14.80	.437	.92096	1.500	2.597	PER IMP= .00
START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 1.730
COMPUTE NM HYD	100.10	-	1	.01620	12.21	.307	.35586	1.532	1.177	PER IMP= .00
COMPUTE NM HYD	100.20	-	1	.00891	6.71	.169	.35586	1.532	1.178	PER IMP= .00
FINISH										

AHYMO SUMMARY TABLE (AHYMO194) - AMAFCA Hydrologic Model - January, 1994 RUN DATE (MON/DAY/YR) =03/05/1996
INPUT FILE = a:d2.dat USER NO.= R_BOHANN.I01

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 NOTATION
START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 2.600
COMPUTE NM HYD	100.10	-	1	.00173	3.37	.101	1.09055	1.510	3.042	PER IMP= .00
COMPUTE NM HYD	100.20	-	1	.00424	9.34	.304	1.34343	1.510	3.444	PER IMP= 20.00
COMPUTE NM HYD	100.30	-	1	.01659	42.50	1.502	1.69746	1.510	4.002	PER IMP= 48.00
COMPUTE NM HYD	100.40	-	1	.00213	5.47	.193	1.69746	1.510	4.015	PER IMP= 48.00
START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 1.730
COMPUTE NM HYD	110.10	-	1	.00173	1.72	.043	.46629	1.532	1.552	PER IMP= .00
COMPUTE NM HYD	110.20	-	1	.00424	5.19	.152	.67214	1.510	1.912	PER IMP= 20.00
COMPUTE NM HYD	110.30	-	1	.01659	25.64	.850	.96033	1.510	2.415	PER IMP= 48.00
COMPUTE NM HYD	110.40	-	1	.00213	3.30	.109	.96033	1.510	2.422	PER IMP= 48.00
FINISH										

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

12 February, 1999

Ronald R. Bohannan
Tierra West Development
4421 McLeod Road NE Suite D
Albuquerque, New Mexico 87109

RE: NORTH HERITAGE HILLS PHASE II (D20/D9). GRADING & DRAINAGE SUBMITTAL FOR PHASE II PRELIMINARY PLAT APPROVAL. ENGINEER'S STAMP DATED 11-22-98

Dear Mr. Bohannan:

Based upon the information provided in your 11/24/98 submittal the subject project (North heritage Hills Phase II) is approved for Preliminary Plat.

Also approved is the Infrastructure List accompanying your submittal, dated 10-15-98.

If I can be of further assistance, feel free to contact me at 924-3986.

Sincerely,

Scott Davis
PWD, Hydrology Div.

c: Andrew Garcia
file

DRAINAGE REPORT

for

North Heritage Hills Subdivision Phase II

Prepared by

Tierra West, LLC
4421 McLeod Road NE, Suite D
Albuquerque, New Mexico 87109

Prepared for

Steve Jackson
Jackson Maple Properties
6840 Second Street, NW Ste 241
Albuquerque, New Mexico 87107

May 1998

Ronald R. Bohannan P.E. No. 7868

Location

North Heritage Hills is a proposed 91 unit single family subdivision. It is located south of Paseo Del Norte between Barstow Street and Ventura Street, NE. The site is shown on the attached Zone Atlas Map D-20 and contains approximately 15.8 acres. The project is being developed in three phases. Phase 1 consists of the area from Barstow Street to seven lots east of Rough Rider Road, and has already been constructed. Phase 2 will consist of lots 28-35 and lots 64-71. These lots are located approximately 320' east of Rough Rider Road and extend to approximately 680' east of Rough Rider Road. Phase 3 will consist of the balance of the property and extend to Ventura Street. The purpose of this report is to provide the drainage analysis and management plan for Phase II of the subdivision.

Existing Drainage Conditions

The site has been previously approved under D20-D9, and Phase 1 has been completed. The site was divided into two phases in the original drainage report. Currently, Phase 2 of the site is being divided into Phase 2 and Phase 3. The drainage report and grading plan are being modified to reflect this change.

Phase 2 and 3 of the site are currently undeveloped. The natural slope is from east to west at approximately 3.3 percent. There are two existing basins on the site. The two basins drain to different points from the site (see undeveloped basin map shown on exhibit). Basin A has a runoff flow of 13.32 cfs. It sheet flows southeast to an existing temporary desilting pond. The pond is located east of the existing concrete channel located on the south side of the site. This pond captures flows from the undeveloped portion of the site before they enter the channel. Basin B has a runoff flow of 7.89 cfs and sheet flows northwest towards Phase I of the subdivision. A second temporary desilting pond is located east of the existing Palomar Avenue. This pond captures any undeveloped flows before they enter Palomar Avenue. When

Phase 2 is constructed these desilting ponds will be removed.

All upland flows from the east that would impact the site are collected in a storm sewer located in Ventura Street and directed south to the Domingo Baca Arroyo. All flow is diverted to the Domingo Baca Arroyo as referenced in the drainage report for Ridgefield North Subdivision (D-20/D8A).

FEMA Map and Soil Conditions

The site is located on FEMA Map section 350002 panel 10 as shown on the attached excerpt. The map shows that the site does not lie within any 100 year flood plains.

The site contains three different soils from the Soil Conservation Service Soil Survey of Bernalillo County. These are Tijeras and Embudo gravelly fine sandy loams, and an Embudo-Tijeras complex. All of the soils have a moderate hazard of water erosion and medium runoff.

On-Site Drainage Management Plan

The site is being developed in three phases. Phase 1 of the project has already been constructed. During Phase 1 of the project, Basins C and B were divided into developed and undeveloped portions. The undeveloped flows from Phase II and Phase III are being diverted into two desilting ponds. Clean water overflows from the desilting ponds into Palomar Avenue and the drainage channel at the south property line.

The proposed drainage management plan is to collect the developed flows in Palomar Avenue and a drainage channel and then convey the flows to an existing storm sewer (built with Phase I) in Barstow. The existing storm sewer in Barstow will convey the flows south to the existing improved Domingo Baca channel. The site was originally divided into four basins. These basins have been revised to account for the phasing of the subdivision as shown on the Developed Basin Layout exhibit. All the basins will drain to the west side of the property.

Basins B2 and B3 will drain to a drainage easement located on the south property line and from there drain to Phase I and be picked up by the 36" storm sewer system in Barstow. Basins C2 and C3 will drain to Palomar Avenue and to Phase I and into the same storm sewer system. The storm sewer continues in Barstow Street and discharges into the existing Domingo Baca Arroyo.

Phase 2 will follow the same drainage pattern as Phase 1. The desilting ponds will be relocated to the east boundary of Phase 2. The undeveloped flow from Phase 3 (basin C3 and B3) will drain to the desilting ponds which will overflow into Palomar Avenue and the southern drainage channel. The flow will be carried west to the existing drainage systems on the west side of Phase 1. The flows will then be conveyed to the South Domingo Baca Arroyo.

Phase 3, which consists of the balance of the property, will follow the approved drainage report. The developed flows will drain to Palomar Avenue and the southern drainage channel. When Phase III is developed the desilting ponds will be removed as they will no longer be necessary. At this point, all the flow will be developed and follow the drainage pattern approved in the original drainage report.

There will be no changes to the runoff pattern of Basins A and D due to the phasing of the project. All the runoff will enter the proposed storm sewer system and be routed to the Domingo Baca Arroyo.

Summary

There are four basins proposed for the site. Basin A has a developed runoff flow of 3.37 cfs, Basin B has a developed runoff flow of 9.34 cfs, Basin C has a developed runoff flow of 42.50 cfs, and Basin D has a developed runoff flow of 5.47 cfs. All flows will eventually drain into the existing Domingo Baca Arroyo. During Phase 2, two desilting ponds will intercept the undeveloped flow from the Phase 3 portion of the site. Phase 3 will be the last phase to be constructed and the desilting ponds will no longer be necessary.

RUNOFF CALCULATIONS

The site is @ Zone 3

LAND TREATMENT

Varies for each basin

DEPTH (INCHES) @ 100-YEAR STORM

P_{60} = 2.14 inches

P_{360} = 2.60 inches

P_{1440} = 3.10 inches

DEPTH (INCHES) @ 10-YEAR STORM

P_{60} = 2.14 x 0.667
= 1.43 inches

P_{360} = 1.73

P_{1440} = 2.07

See the summary output from AHYMO calculations.

Drainage Basins

Existing

BASIN	AREA (SF)	AREA (AC)	AREA (MI²)
A	223380.49	5.1281	0.008013
B	132269.75	3.0365	0.004745
TOTAL	355650.24	8.1646	0.012757

Developed

PHASE	BASIN	AREA (SF)	AREA (AC)	AREA (MI²)
1	A	48147.95	1.1053	0.001727
	B1	21211.50	0.4869	0.000761
	C1	233866.97	5.3688	0.008389
	D	57994.55	1.3314	0.002080
2	B2	30518.37	0.7006	0.001095
	C2	104097.39	2.3897	0.003734
3	B3	36457.08	0.8369	0.001308
	C3	157523.87	3.6163	0.005650
TOTAL		689817.68	15.8360	0.024744

Runoff Calculation Results

Existing

BASIN	Q-100 CFS	Q-10 CFS	V-100 AC-FT	V-10 AC-FT
A	13.32	5.98	0.394	0.152
B	7.89	3.55	0.233	0.090
TOTAL	21.21	9.53	0.627	0.242

Developed

PHASE	BASIN	Q-100 CFS	Q-10 CFS	V-100 AC-FT	V-10 AC-FT
1	A	3.34	1.69	0.100	0.043
	B1	1.68	0.93	0.055	0.027
	C1	21.36	12.86	0.760	0.430
	D	5.31	3.20	0.188	0.107
2	B2	2.41	1.33	0.078	0.039
	C2	9.52	5.73	0.338	0.191
3	B3	2.88	1.59	0.094	0.047
	C3	14.39	8.66	0.512	0.289
TOTAL		60.89	35.99	2.125	1.173

Concrete Channel

Manning's Equation:

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Q = Flow (cfs)
n = 0.013
A = Area
R = Hydraulic Radius
S = Slope

$$A = 1.5 * 10 = 15.00$$

$$WP = 2 * 1.50 + 10 = 13.00$$

$$R = \frac{A}{WP} = \frac{15.0}{13.00} = 1.1538$$

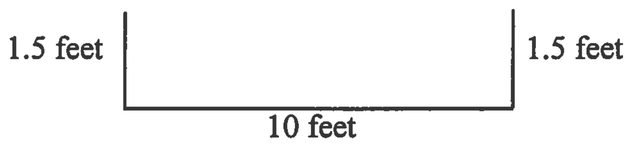
Manning's Equation:

$$Q = \frac{1.49}{0.013} * 15.00 * 1.1538^{2/3} * 0.006^{1/2}$$

$$Q = 146.50 \ cfs$$

Capacity of concrete channel = 146.50 cfs
Total developed flow in channel = 10.31 cfs

10.31 cfs < 146.50 cfs



VOLUME CALCULATIONS

PALOMAR DETENTION POND

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2

C = (At - Ab) / Dt

Ab	=	1,158.47
At	=	2,975.27
Dt	=	2.00
C	=	908.40

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
31	0	0	0.0000
31.50	0.5	0.0133	ERR
32.00	1	0.0292	ERR
32.50	1.5	0.0503	0.0000
32.75	1.75	0.0628	5.1625
33.00	2	0.0767	14.6018

<u>Weir Equation</u>
Q = CLH^(3/2)

C =	2.95
Length (ft)	14
H (ft) =	Height of weir
Q (CFS)=	Flow

VOLUME CALCULATIONS

CHANNEL DETENTION POND

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = $Ab * D + 0.5 * C * D^2$
C = (At - Ab) / Dt

Ab	=	702.33
At	=	2,204.68
Dt	=	2.00
C	=	751.18

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
22.5	0	0	0.0000
23.00	0.5	0.0102	ERR
23.50	1	0.0247	ERR
24.00	1.5	0.0436	0.0000
24.25	1.75	0.0546	2.9500
24.50	2	0.0667	8.3439

<u>Weir Equation</u>

Q = CLH^(3/2)

C =	2.95
Length (ft)	8
H (ft) =	Height of weir
Q (CFS)=	Flow

VOLUME CALCULATIONS

CHANNEL DETENTION POND

Ab - Bottom Of The Pond Surface Area
At - Top Of The Pond Surface Area
D - Water Depth
Dt - Total Pond Depth
C - Change In Surface Area / Water Depth

Volume = Ab * D + 0.5 * C * D^2
C = (At - Ab) / Dt

Ab = 702.33
At = 2,204.68
Dt = 2.00
C = 751.18

ACTUAL ELEV.	DEPTH (FT)	VOLUME (AC-FT)	Q (CFS)
22.5	0	0	0.0000
23.00	0.5	0.0102	ERR
23.50	1	0.0247	ERR
24.00	1.5	0.0436	0.0000
24.25	1.75	0.0546	2.9500
24.50	2	0.0667	8.3439

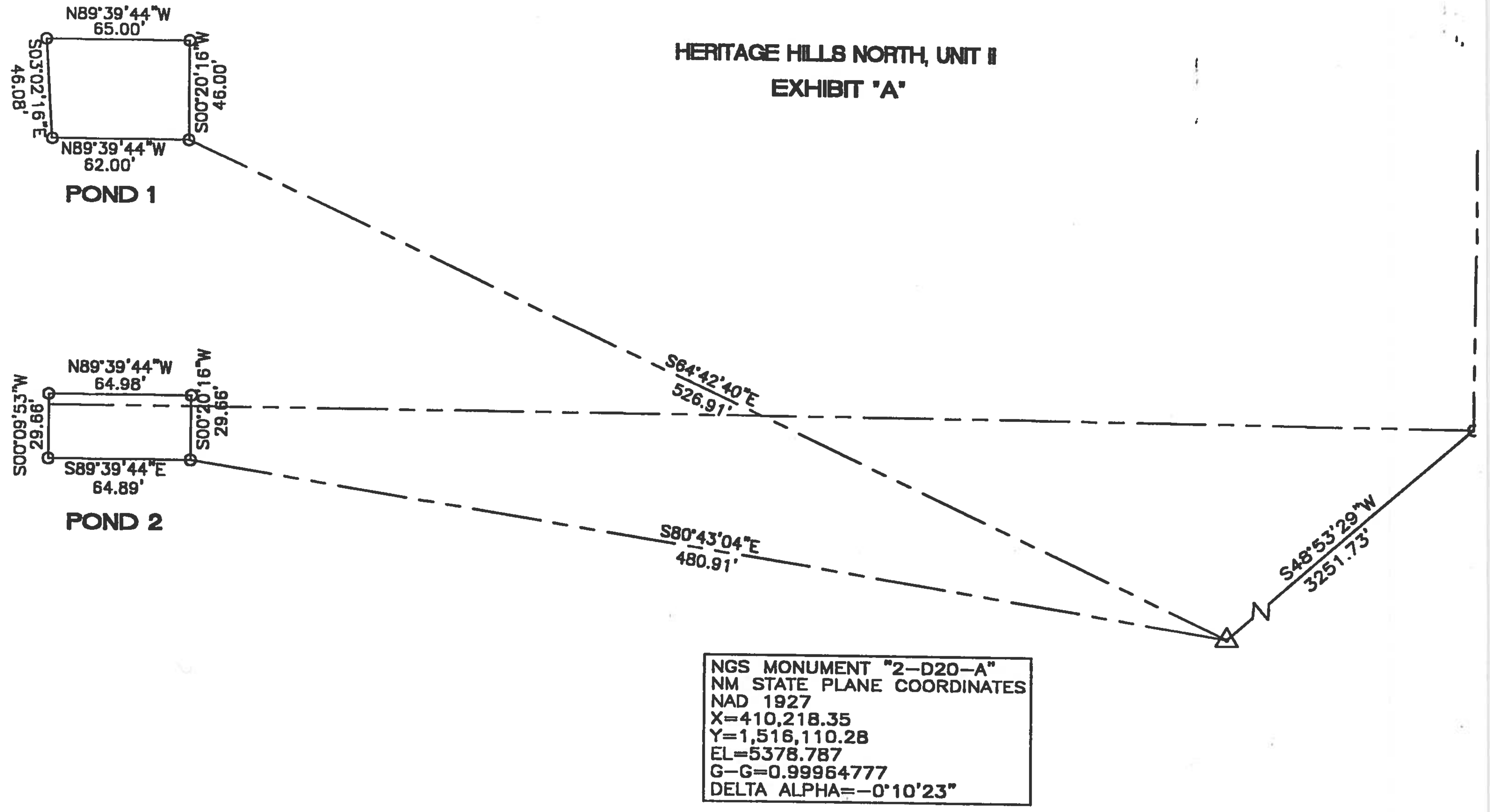
<u>Weir Equation</u>
Q = CLH^(3/2)
C = 2.95
Length (ft) 8
H (ft) = Height of weir
Q (CFS)= Flow

AHYMO SUMMARY TABLE (AHYMO194) - AMAFCA Hydrologic Model - January, 1994   RUN DATE (MON/DAY/YR) =10/30/1998
INPUT FILE = A:\9832\E.DAT   USER NO.= R_BOHANN.I01

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 NOTATION
START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 2.600
COMPUTE NM HYD	100.10	-	1	.00801	13.32	.394	.92096	1.500	2.597	PER IMP= .00
COMPUTE NM HYD	100.20	-	1	.00475	7.89	.233	.92096	1.500	2.598	PER IMP= .00
START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 1.730
COMPUTE NM HYD	100.10	-	1	.00801	5.98	.152	.35547	1.533	1.167	PER IMP= .00
COMPUTE NM HYD	100.20	-	1	.00475	3.55	.090	.35547	1.533	1.168	PER IMP= .00
FINISH										

HERITAGE HILLS NORTH, UNIT II

EXHIBIT "A"



LEGAL DESCRIPTION - HERITAGE HILLS NORTH, PHASE II

POND 1 DRAINAGE FACILITY

A TRACT OF LAND COMPRISING OF A PORTION OF LOT 21A AND LOTS 22A THROUGH 24A, BLOCK 31, AND THE SOUTHERLY PORTION OF THE VACATED PALOMAR AVENUE, NE ADJACENT TO THESE LOTS, NORTH ALBUQUERQUE ACRES TRACT "A" UNIT "A" AS THE SAME ARE SHOWN AND DESIGNATED ON THE PLAT THEREOF, FILES IN THE OFFICE OF THE COUNTY CLERK OF BERNALILLO COUNTY, NEW MEXICO ON OCTOBER 11, 1996 IN VOLUME 96C, FOLIO 431, LYING AND SITUATE WITHIN THE ELENA GALLEGOS GRANT PROJECTED SECTION 20, TOWNSHIP 11 NORTH, RANGE 4 EAST, NEW MEXICO PRINCIPAL MERIDIAN, CITY OF ALBUQUERQUE, BERNALILLO COUNTY, NEW MEXICO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF SAID PHASE II LYING ON THE EAST RIGHT OF WAY LINE OF PALOMAR AVENUE NE,

FROM WHENCE A TIE TO THE SOUTHEAST CORNER OF SAID DRAINAGE FACILITY BEARS S 64°42'40" E, A DISTANCE OF 526.91 FEET;

THENCE FROM SAID BEGINNING POINT, LEAVING SAID RIGHT OF WAY LINE, N 89°38'44" W, A DISTANCE OF 62.00 FEET TO THE SOUTHWEST CORNER OF SAID EASEMENT;

THENCE S 03°02'16" E, A DISTANCE OF 46.08 FEET TO THE NORTHWEST CORNER OF SAID EASEMENT;

THENCE N 89°39'44" W, A DISTANCE OF 65.00 FEET TO THE NORTHEAST CORNER OF SAID EASEMENT;

THENCE S 00°20'16" W, A DISTANCE OF 46.00 FEET TO THE POINT OF BEGINNING CONTAINING 0.067 ACRES (2927.58 SF) MORE OR LESS.

LEGAL DESCRIPTION - HERITAGE HILLS NORTH, PHASE II

POND 2 DRAINAGE FACILITY

A TRACT OF LAND COMPRISING OF A PORTION OF LOT 21A AND LOTS 22A THROUGH 24A, BLOCK 31, AND THE SOUTHERLY PORTION OF THE VACATED PALOMAR AVENUE, NE ADJACENT TO THESE LOTS, NORTH ALBUQUERQUE ACRES TRACT "A" UNIT "A" AS THE SAME ARE SHOWN AND DESIGNATED ON THE PLAT THEREOF, FILES IN THE OFFICE OF THE COUNTY CLERK OF BERNALILLO COUNTY, NEW MEXICO ON OCTOBER 11, 1996 IN VOLUME 96C, FOLIO 431, LYING AND SITUATE WITHIN THE ELENA GALLEGOS GRANT PROJECTED SECTION 20, TOWNSHIP 11 NORTH, RANGE 4 EAST, NEW MEXICO PRINCIPAL MERIDIAN, CITY OF ALBUQUERQUE, BERNALILLO COUNTY, NEW MEXICO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF SAID PHASE II LYING ON THE EAST RIGHT OF WAY LINE OF PALOMAR AVENUE NE, FROM WHENCE A TIE TO THE SOUTHEAST CORNER OF SAID DRAINAGE FACILITY BEARS S 80°43'04" E, A DISTANCE OF 480.91 FEET;

THENCE FROM SAID BEGINNING POINT, LEAVING SAID RIGHT OF WAY LINE, S 89°39'44" E, A DISTANCE OF 64.89 FEET TO THE SOUTHWEST CORNER OF SAID EASEMENT;

THENCE S 00°09'53" E, A DISTANCE OF 29.66 FEET TO THE NORTHWEST CORNER OF SAID EASEMENT;

THENCE S 89°39'44" E, A DISTANCE OF 64.98 FEET TO THE NORTHEAST CORNER OF SAID EASEMENT;

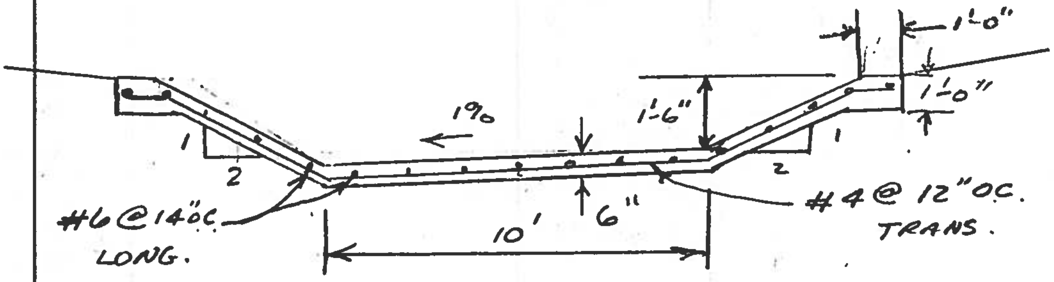
THENCE S 00°20'16" W, A DISTANCE OF 29.66 FEET TO THE POINT OF BEGINNING CONTAINING 0.044 ACRES (1926.03 SF) MORE OR LESS.

D-20/D009

NORTH PINO CHANNEL
AT
HERITAGE HILLS PARK
DESIGN CALCULATIONS

CONCRETE CHANNEL

USE 6" THICK BTM AND SIDE SLOPES BECAUSE CHANNEL IS SHALLOW



FIND TEMP. OR MIN STEEL FROM SEC. 22.8 P. 168 DPM

LONG $A_s/A_c \geq .005$

TRY # 6 @ 14" O.C.

$$A_s/A_c = \frac{.44 \times \frac{1}{144}}{\frac{14}{12} \times 0.5} = .00524$$

TRANS. $A_s/A_c \geq .0025$

TRY # 4 @ 12" O.C.

$$A_s/A_c = \frac{.20 \times \frac{1}{144}}{1 \times 0.5} = .00278$$

CLEAR COVER 3" ON BOTTOM

MAKE POUR CONTINUOUS WITH NO EXPANSION JOINTS EXCEPT @ BRIDGE.

USE 18" SPLICE FOR # 6 (MIN.) FOR CONSTRUCTION JOINTS

HYDROLOGY

FLOW @ GETTYSBURG LOOP

COMBINE BASIN @ HERITAGE HILLS EAST AND HERITAGE HILLS UNIT 2

$$S = \frac{4,050}{144.83} = .0358$$

FROM PLATE 22.2 B-2 V= 5.0 FPS

$$T_c = \frac{4,050}{5.0} = 13.50 \text{ MIN.}$$

WEIGHTED AREA

$$\frac{39}{97} \times 25.96 = 10.44 \text{ AC}$$

TOTAL AREA = 10.44 + 7.90 = 18.34 AC

$$\text{AVG } C = \frac{10.44(.75) + 7.90(.55)}{18.34} = .66$$

USING VOL = 2.51 IN 22.2 D-1

$$i = 2.51(1.85) = 4.64 \text{ IN/HR}$$

$$Q_{100} = CiA = .66(4.64)(18.34)$$

$$= 56.16 \text{ CFS}$$

ONSITE FLOW = 19 CFS (HERITAGE HILLS UNIT 2)
OFFSITE " = 39 CFS (HERITAGE HILLS EAST)
58 CFS

USE Q_{100} = 58 CFS

HYDROLOGY

FLOW @ YORKTOWN CUL-DE-SAC

COMBINE BASIN @ HERITAGE HILLS EAST AND HERITAGE HILLS UNIT 2

$$S = \frac{113.83}{3700} = .0308$$

FROM PLATE 22.2 B-2 V= 4.65 FPS

WEIGHTED AREA

$\frac{39}{97} \times 25.96 = 10.44 AC$

$$T_c = \frac{3700}{4.65} = 13.26 \text{ MIN}$$

TOTAL AREA = 10.44 + 6.1 = 16.54 AC

$$\text{AVE } C = \frac{10.44(.75) + 6.1(.54)}{16.54} = .67$$

USING VOL = 2.51 IN. PLATE 22.2 D-1

$$i = 2.51(1.85) = 4.64 \text{ IN/HR}$$

$$Q_{100} = CiA = .67(4.64)(16.54) = 51.42 \text{ CFS}$$

ONSITE FLOW = 15 CFS (HERITAGE HILLS UNIT 2)
OFFSITE " = 39 CFS (HERITAGE HILLS EAST)
54 CFS

USE Q_{100} = 54 CFS

HYDROLOGY

FLOW @ VALLEYFORGE

COMBINE BASIN @ HERITAGE HILLS EAST AND HERITAGE HILLS UNIT 2

$$S = \frac{106.47}{3850} = .0277$$

FROM PLATE 22.2 B-2 V = 4.45 FPS

$$T_c = \frac{3850}{4.45} = 14.42 \text{ MIN.}$$

TOTAL AREA = 5.35 + 8.1 = 13.45

WEIGHTED AREA

$\frac{20}{97} \times 25.96 = 5.35$ AVE. C = $\frac{5.35(.75) + 8.1(.51)}{13.45} = .61$

USING VOL = 2.51 IN

$i - 1.8(2.51) = 4.52$

$Q_{100} = .61(4.52)\,13.45 = 37.08$ CFS

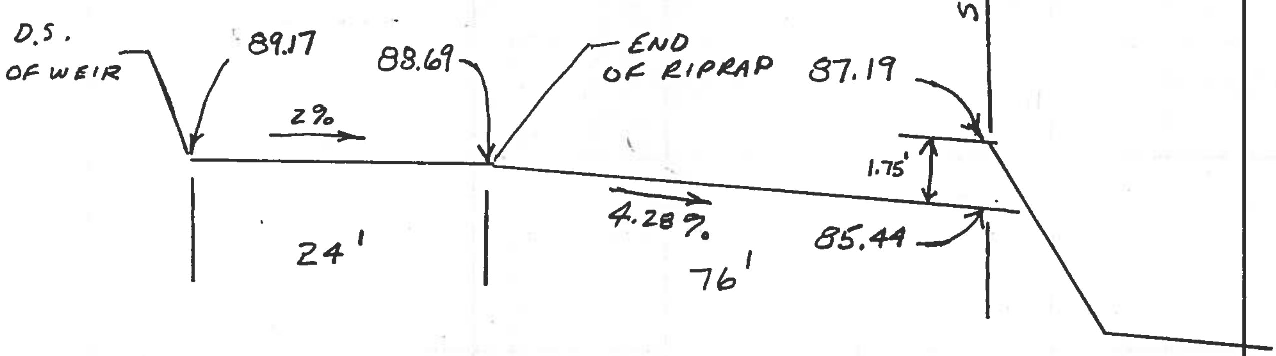
ONSITE FLOW = 21 CFS (HERITAGE HILLS UNIT 2)
OFFSITE " = 20 " (HERITAGE HILLS EAST)
41 "

USE $Q_{100} = 41$ CFS

RUNDOWNS INTO CHANNEL

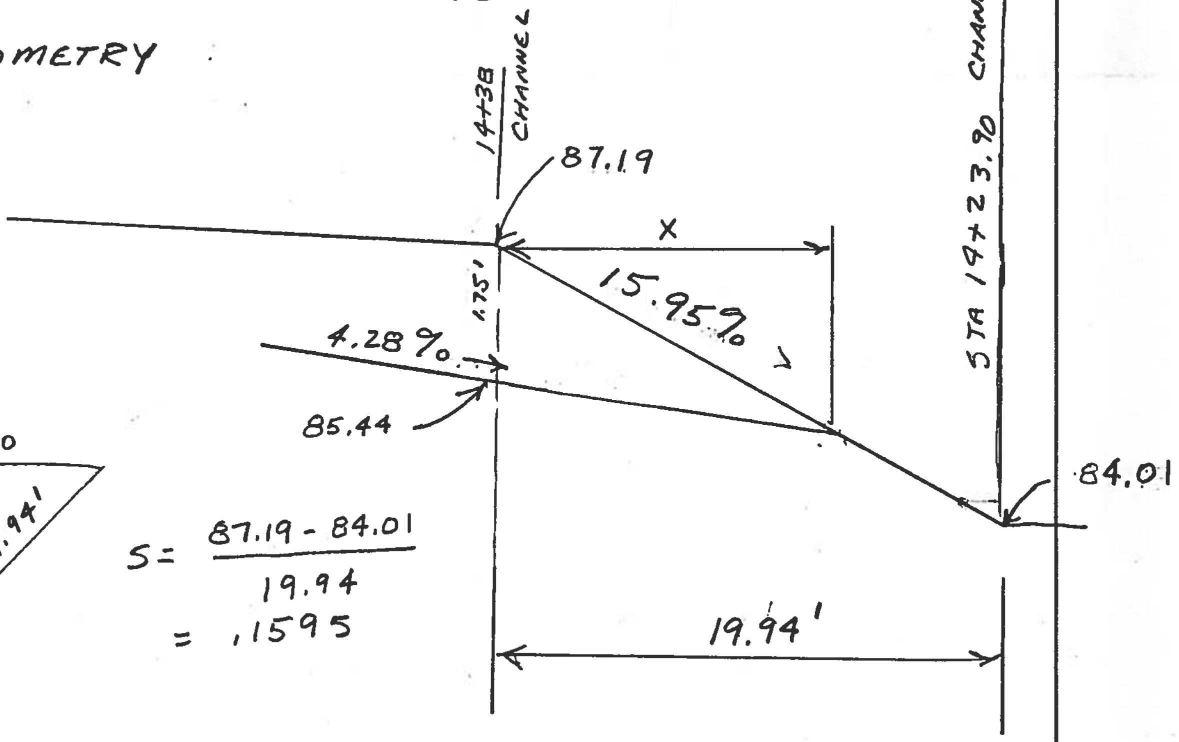
CAPITOL HILL

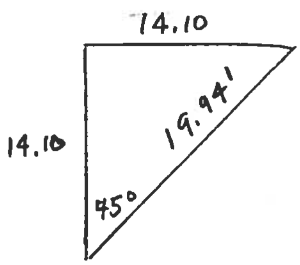
$Q_{100} = 32$ CFS



$$S = \frac{88.69 - 85.44}{76'} = 4.28\%$$

GEOMETRY





$$S = \frac{87.19 - 84.01}{19.94} = .1595$$

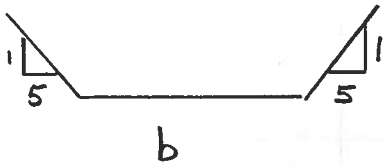
$$.1595X = 1.75 - .0428$$

$$X = 15.00'$$

CAPITOL HILL (CON'T)

$V_{100} < 6.00$ FPS W. GRASS

$d_N < .75'$



TRY $b = 5'$

$n = .030$

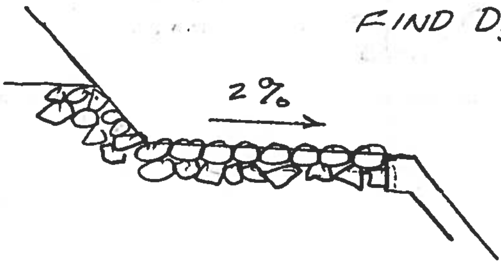
$d_N = 0.65'$

$V = 5.97$ FPS

$F = 1.54$

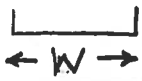
SIZE GROUTED APRON

USING 8" GROUTED RIP RAP



FIND $D_{50} = d_N$

S = .02



$n = .045$

TRY $W = 15'$

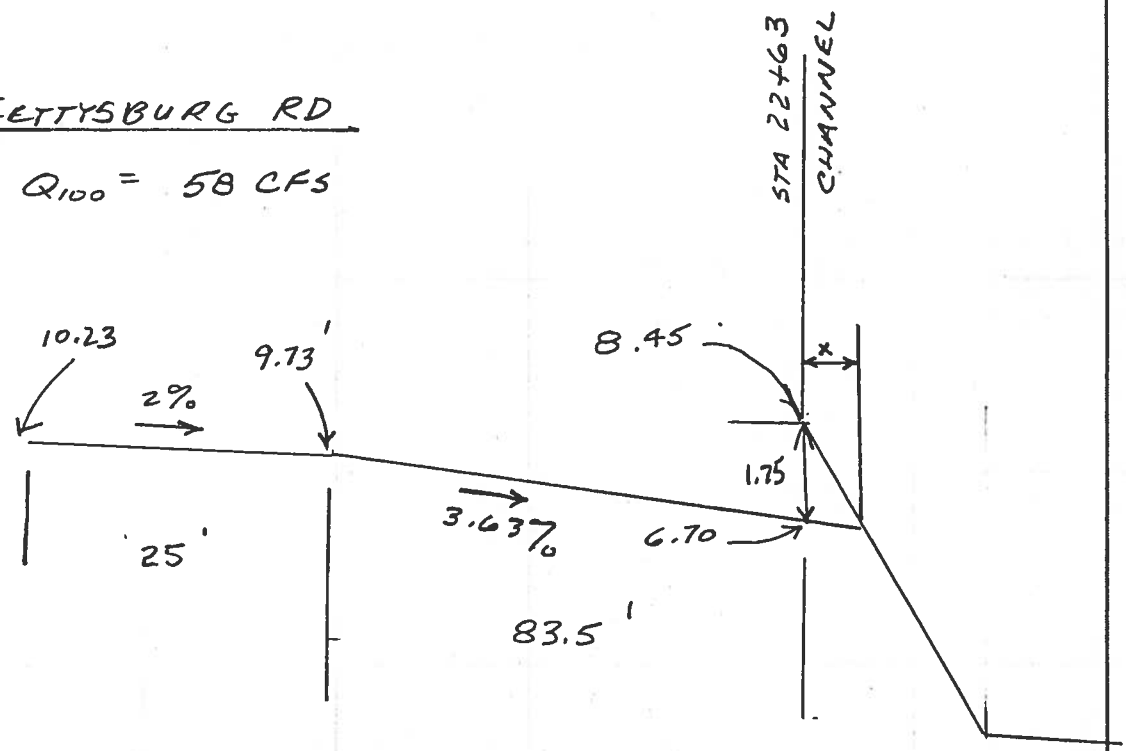
$d_N = .66 \approx 8''$

$V = 3.28$ FPS

∴ DOUBLE W TO 30'

GETTYSBURG RD

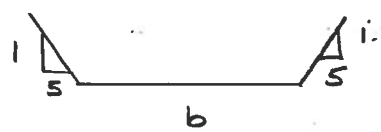
Q_{100} = 58 CFS



$$S = \frac{9.73 - 6.70}{83.5} = 3.63\%$$

$$.1595X = 1.75 - 0.0363X$$

$$X = 14.20'$$



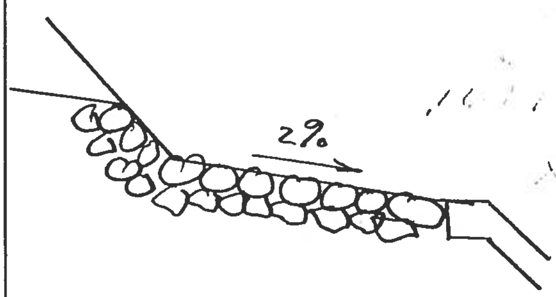
TRY b = 10'

$n = .030$

$d_N = 0.70$

$V = 6.14$ FPS

$F = 1.45$



$d_N = D_{50}$

TRY W = 25'

$n = .045$

$d_N = .68 \approx 8''$

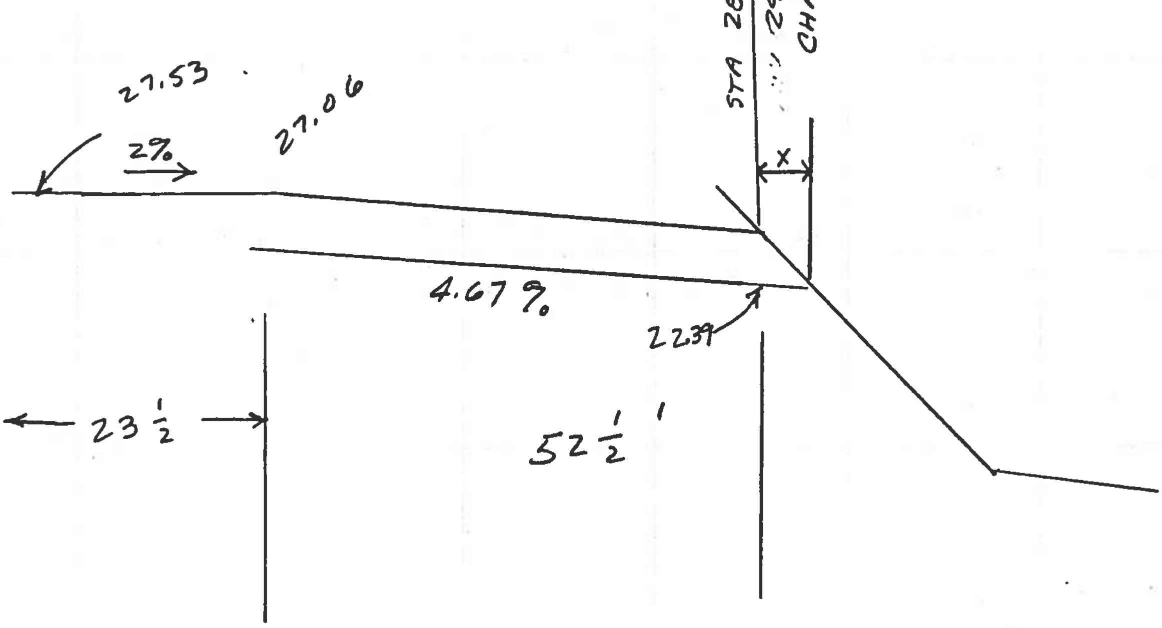
$V = 3.42$ FPS

$F = 0.73$

DOUBLE TO 50'

VALLEY FORGE PL

$Q_{100} = 41$ CFS



$$S = \frac{27.06 - 22.39}{52.5'} = 4.67\%$$

$$.1595x = 1.75 - .0467x$$

$$x = 15.51'$$

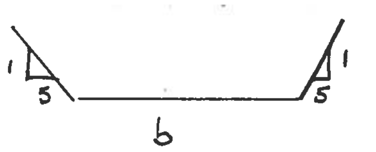
TRY $b = 10'$

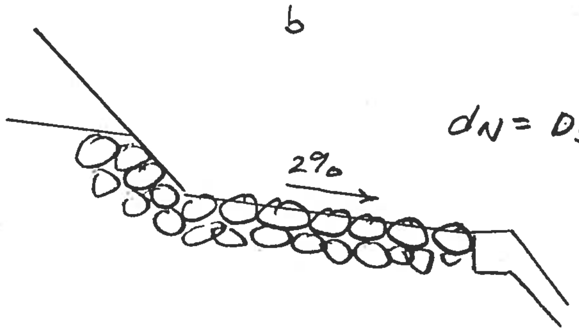
$n = .030$

$d_N = 0.55$

$V = 5.85$ FPS

$F = 1.53$





$d_N = D_{50}$

TRY $W = 20'$

$n = .045$

$d_N = 0.65 \approx 8''$

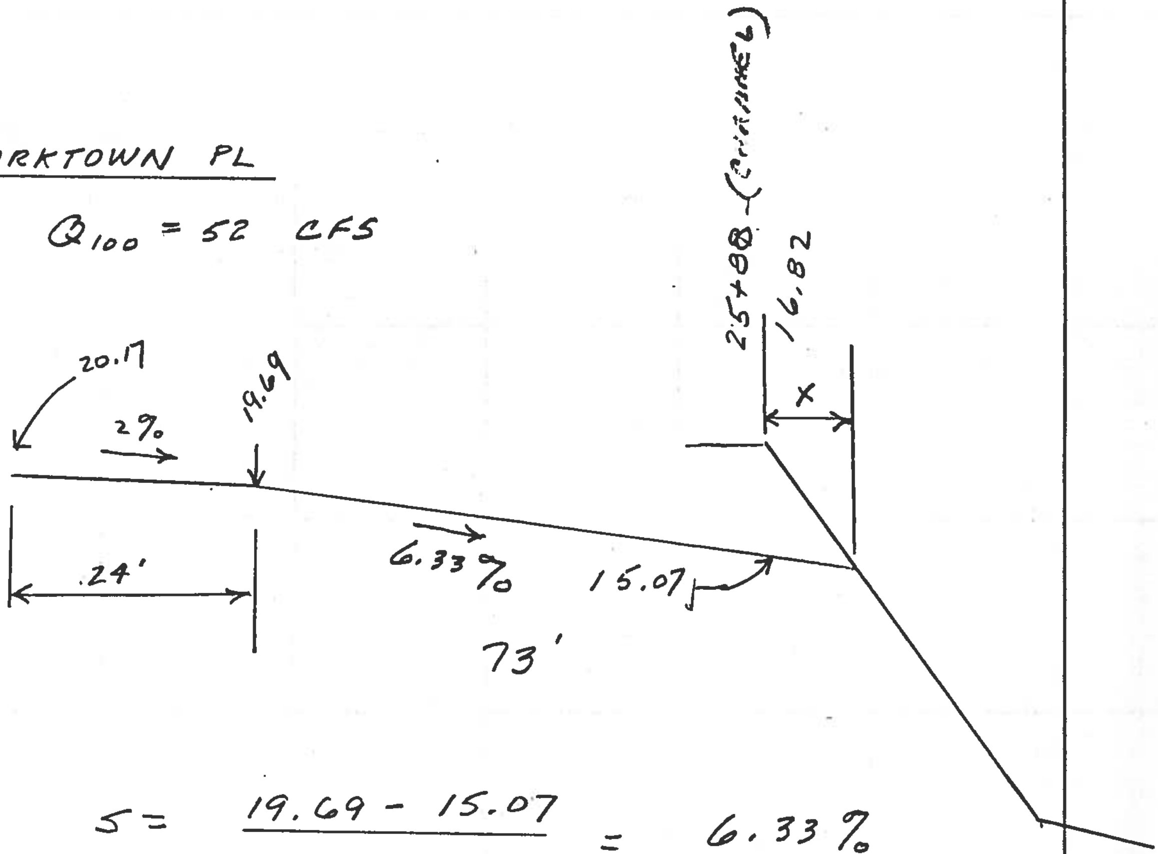
$V = 3.15$

$F = .69$

DOUBLE TO 40'

YORKTOWN PL

$Q_{100} = 52$ CFS

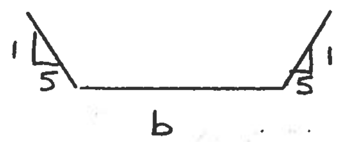


$$S = \frac{19.69 - 15.07}{73} = 6.33\%$$

$$.1595X = 1.75 - .0633X$$

$$X = 18.19'$$

$$y = 2.90'$$



$d_N = D_{50}$

TRY $b = 18'$

$n = .030$

$d_N = .45'$

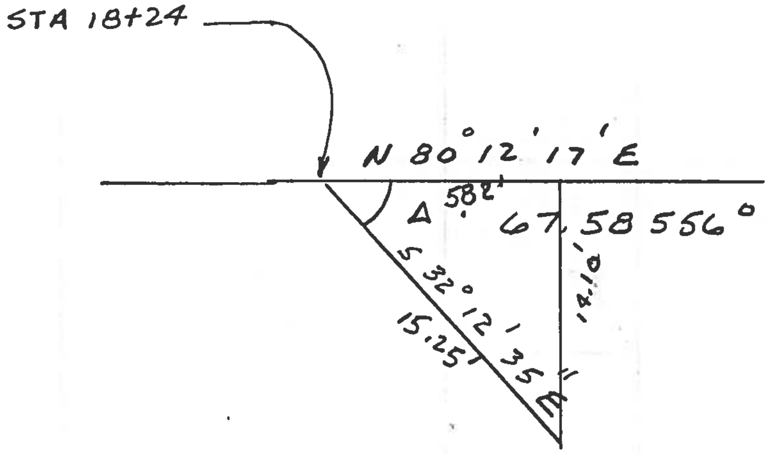
$V = 5.71$ FPS

$F = 1.58$

USE $W = 50'$

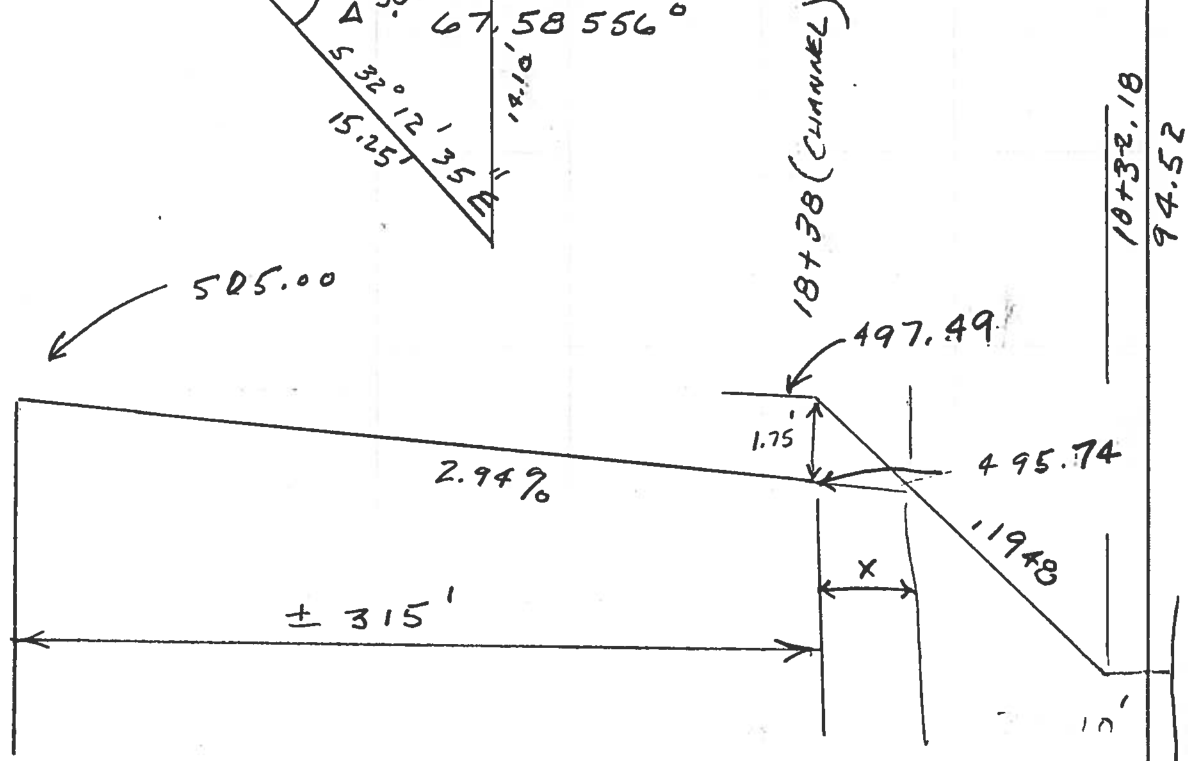
CHERRY HILLS E.

$Q_{100} = 43.6$ CFS



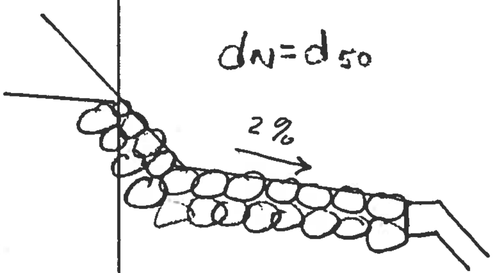
$S = \frac{97.49 - 94.52}{15.25}$

$= .1948$



$.1948x = 1.75 - .0294x$ $\quad S = \frac{505.00 - 495.74}{315} = 2.94\%$

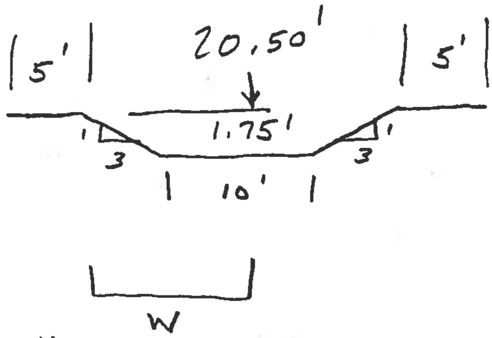
$x = 10.58'$



$d_N = .65$

$V = 5.61$ FPS

$F = 1.32$



$n = .045$

$W = 20'$

$d_N = .65 \approx 8"$ DOUBLE TO 40'

$V = 3.35$ FPS

$d_c = 0.85'$

$F = 0.73$

18" RCP STORM DRAIN AND INLET

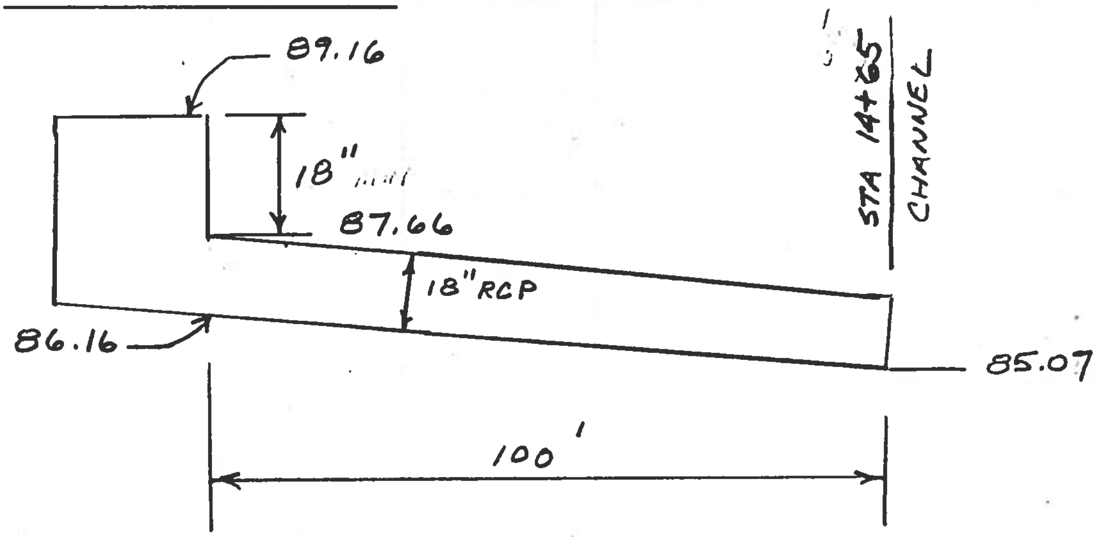
FIND GRATING CAPACITY FOR ALL CATCH BASINS

DEPTH OF FLOW $2\frac{1}{2}''$ $.21'$

ASSUME $S = .02$

FROM PLATE 22.3 D-5 $Q = 1.4$ CFS

CAPITOL DR



$$S = \frac{86.16 - 85.07}{98.5} = 1.11\ \%$$

$$\frac{Qn}{D^{8/3}\ S^{1/2}} = \frac{1.4\,(.013)}{1.5^{8/3}\ .011^{1/2}} = .05851$$

$$\frac{d}{D} = .09 \qquad d = .24'$$

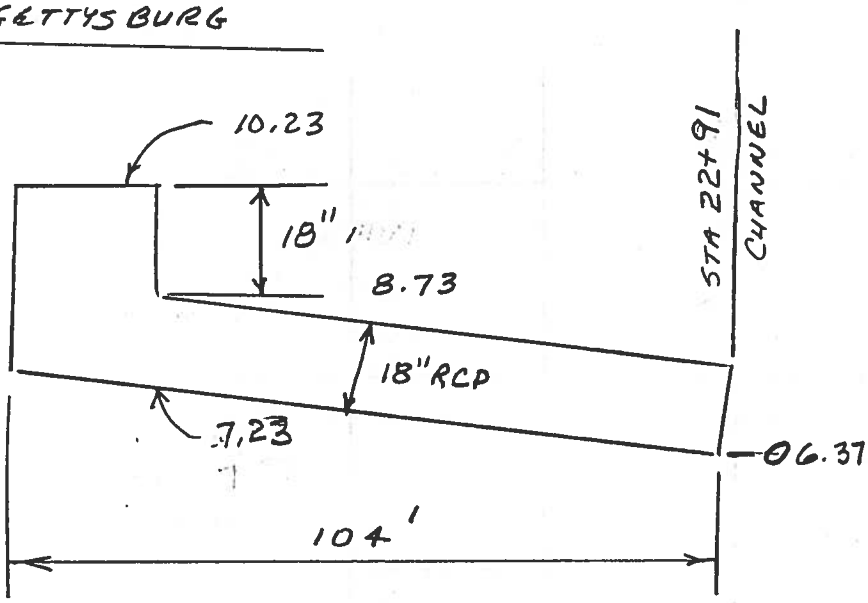
$$V = \frac{1.4}{.33} = 4.24\ \text{FPS} > 2.0\ \text{O.K.}$$

$$V = 0.5 + 1.2\,\frac{(2.67)^2}{2g} + \frac{1.5}{\cos .05851}$$

$$= 2.13' < 89.16 - 86.16 = 3.00'$$

O.K.

GETTYSBURG



$$S = \frac{7.23 - 6.35}{104} = 0.85\%$$

CHECK V

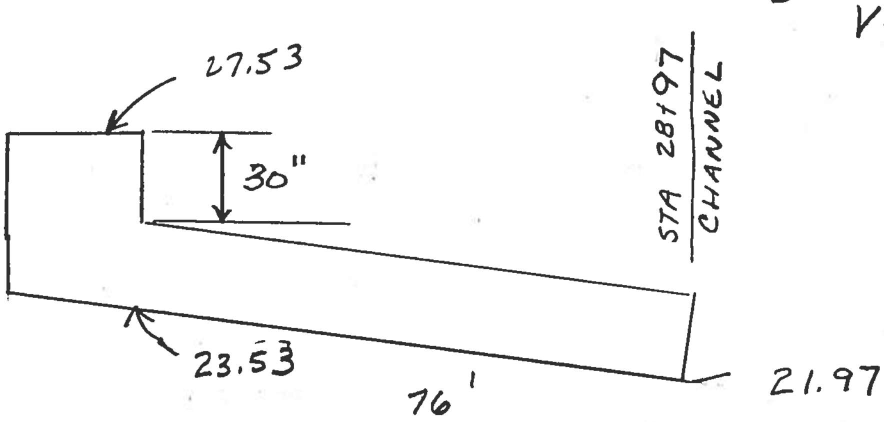
$$\frac{1.4(.013)}{1.5^{8/3}(.0085)^{1/2}} = .0668$$

$$\frac{d}{D} = .26 \quad d = .39'$$

$$V = \frac{1.4}{.37} = 3.78 \text{ FP}$$

72.0

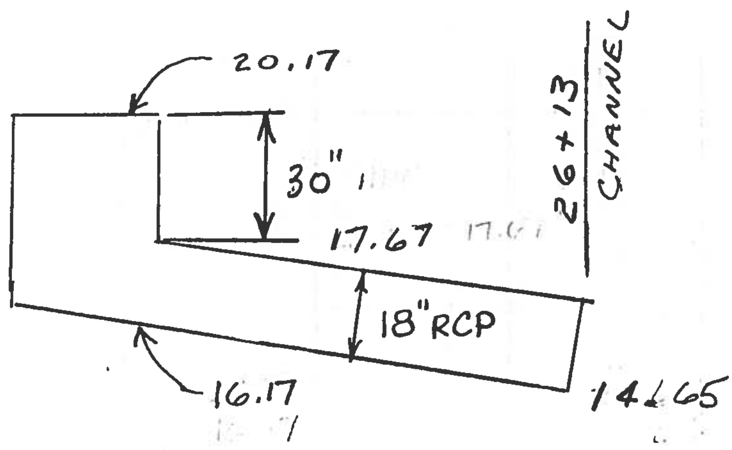
VALLEY FORGE



$$S = \frac{23.53 - 21.97}{76} = 2.05\%$$

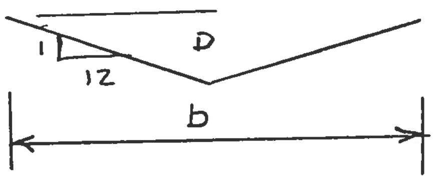
1.76

YORKTOWN PL.



TRY $S = \frac{16.17 - 14.65}{97.7} = 1.57\%$

OUTLET STRUCTURES



$d_N = .20'$

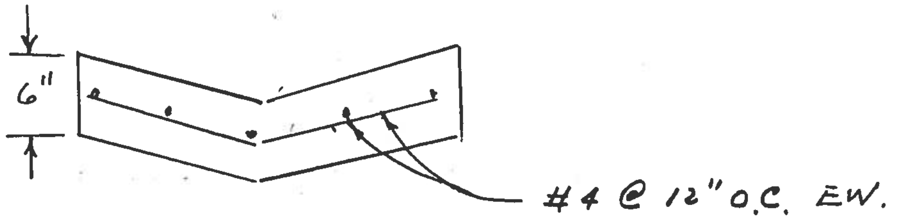
$V = 2.91$ FPS

$F = 1.63$

USE $D = 3''$

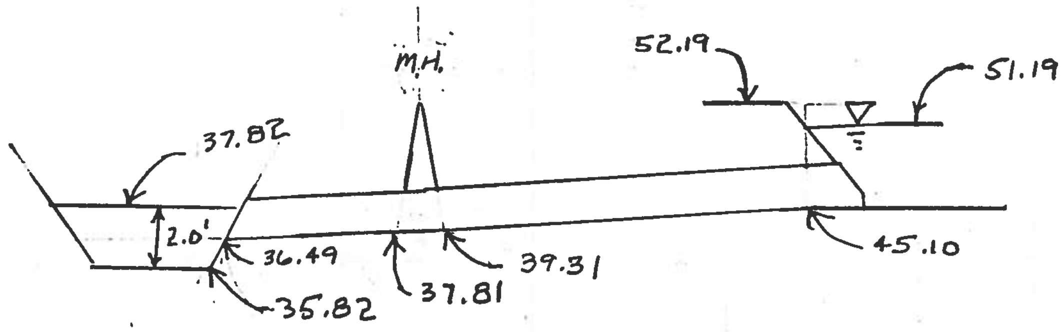
$b = 6'$

USE MIM. TEMP. STL FROM CITY STD K-12-4



VENTURA ST. STORM DRAIN

$Q_{100} = 104$ CFS



CHECK INLET CONTROL

D = 42" USE CHART 2 FHA

TYPE 2 INLET SEE NOTE P. 5-49

$\frac{HW}{D} = 1.74$ $HW = 6.09'$

PIPE HYDRAULICS

USE PLATE 22.3 B-3 P. 33 DPM

FOR 3.75° BEND $K_b = .041$

DEPTH OF FLOW IN 1.80% SLOPE

$\frac{104(.013)}{3.5^{8/3}(.018)^{1/2}} = .355$ $\frac{d}{D} = .66$

D = 2.31'

$V = \frac{104}{6.74} = 15.43$ FPS

$h_v = \frac{15.43^2}{64.4} = 3.70'$

BEVELED PIPE LOSS = 8 X .041(3.70')

= 1.21' OR 0.15' EA

MH LOSS USING $K_b = 0.35$ FROM DPM

0.35 (3.70) = 1.30'

AVE INCOMING & OUTGOING

SAY 1.90% × 6' = .12'

TOTAL DROP THRU MH = 1.30 + .12 = 1.42'

CHECK OUTLET CONTROL

$HW = H + h_o - LS_o + h_b$

$d_c = 3.12'$

$h_o = \frac{3.12' + 3.50'}{2} = 3.31'$

$h_b = 1.42' + 1.21' = 2.63'$

$LS_o = 8.61'$

H FROM CHART 9 = 6.5'

HW = 6.5 + 3.31 − 8.61' + 2.63'
= 3.83 ≤ 6.09 O.K.

CHECK FROM MH U.S.

$h_o = 3.31$ ✓

$h_b = 1.21'$ ✓

$LS_o = 5.79'$

H = 5.75 FROM CHART 9

HW = 5.75 + 3.31 − 5.79 + 1.21
= 4.48' < 6.09 OK.

N. PINO RIP RAP FILTER

USE SCS SOIL SURVEY

EMBUDO SERIES 20"-60" DEEP

	% PASSING		
No. 4 SIEVE	80-95	87.5	4.75
No 10 "	50-70	60	2.00 } 1.44 mm
No. 40 "	20-45	32.5	0.42 }
No 200 "	10-25	17.5	.074 mm

USE $d_{15} \simeq .074$ mm

$d_{50} \simeq 1.44$ mm

$d_{85} \simeq 4.75$ mm

CHECK UPPER LIMIT D_{15}

$D_{15} = 5 \times (4.75) = 23.75$ mm

$D_{15} = 20 \times (.074) = 1.48$ mm

USE $D_{15} = 1.48$ mm. USE 1.48

CHECK LOWER LIMIT D_{15}

$D_{15} = 4 \times .074$ mm $= 0.296$ mm

UPPER LIMIT D50

$D_{50} = 25 \times 1.44$ mm $= 36$ mm

($1\frac{3}{8}$" DIA)

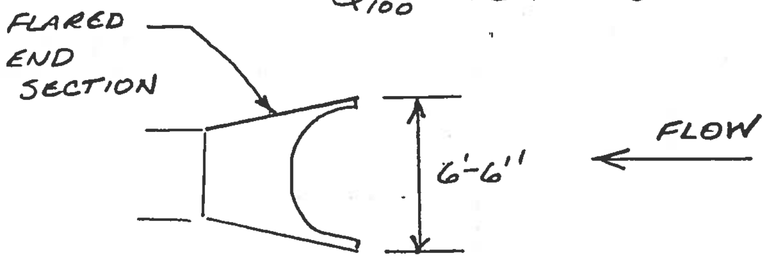
USE $D_{50} = 3/4$"

USE $D_{15} = 0.89$ OR #40 0.42 mm

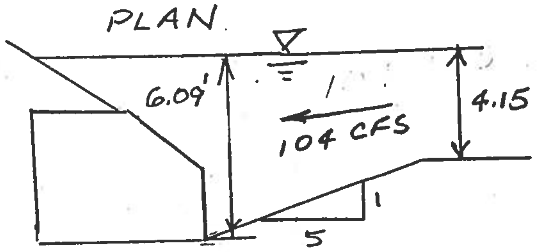
SIZE GROUTED RIP RAP

@ ENTRANCE TO VENTURA S.D.

$Q_{100} = 104$ CFS

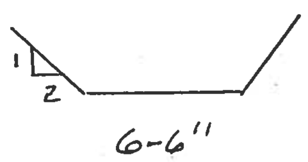


PLAN



$$V = \frac{104}{(4.15 \times 6.5)} = 3.86 \text{ FPS}$$

TRY $Q = 20$ CFS



$d_N = 0.40'$

$V = 6.85$ FPS

$F = 2.01$

USING DENVER DRAINAGE CRITERIA MANUAL

$$\frac{V\,S^{0.17}}{(S_c - 1)^{.66}} = \frac{6.85(0.20)^{.17}}{(2.5-1)^{.66}} = 3.98$$

USING TABLE 5-5 $D_{50} = 8"$

REDUCE ONE SIZE FOR GROUTED TO

$D_{50} = 6"$ THICKNESS 1'-0"

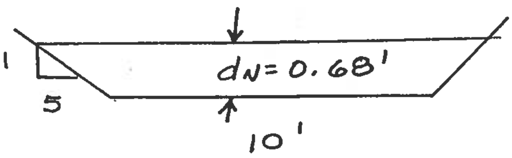
USE 6" FILTER

SIZE GROUTED RIP RAP

@ BOTTOM OF RUNDOWNS

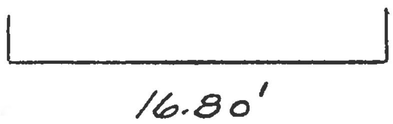
USE Q_{100} = 54 CFS @ GETTYBURG (WORST CASE)

RUNDOWN SWALE



TOP WIDTH = 16.80'

TRANSLATE TO RECT. CHANNEL



USE 5:1 OR 0.20

GIVES → V = 7.14 FPS

F = 1.87

USING DENVER DRAINAGE CRITERIA MANUAL

$$\frac{V S^{0.17}}{(S_s - 1)^{.66}} = \frac{7.14\,(0.20)^{.17}}{(2.5-1)^{.66}} = 4.16$$

USING TABLE 5-5 D_{50} = 12"

REDUCE ONE TYPE FOR GROUTED

TO D_{50} = 8"

THICKNESS 2X FOR SANDY SOIL

USE 18"

USE 6" FILTER

RIP RAP @ TRANSITION

FROM HEC 2

STA 10+97.80 (SEC 18) V= 7.71 FPS

TO STA 11+70.00 (SEC 17.2+13) V= 10.05 FPS

USE DENVER DRAINAGE MANUAL

INCREASE VEL 20% TO 12.06

$$\frac{V S^{0.17}}{(2.5-1)^{.66}} = \frac{12.06 (.015)^{0.17}}{1.5^{.66}} = 4.5$$

TABLE 5-5 USE D_{50} = 12"

W/ 6" FILTER

STA 11+70 V= 10.05 FPS

TO STA 12+14 V = 15.04 FPS

INCREASE VEL 20% TO 18.05 FPS

$$\frac{18.05 (.015)}{(2.5-1)^{.66}} = 5.5$$

USE D_{50} = 18" W 8" FILTER

STA 12+14 V = 15.04 FPS

STA 12+42 V = 20.14 FPS

$$\frac{20.14 (.015)^{0.17}}{1.5^{.66}} = 6.4$$

USE D_{50} = 24" W 8" FILTER

GROUT 24" TO END W 8" FILTER

NORTH PINO ARROYO

THRU HERITAGE HILLS PARK

HEC-2 RUNS

JUNE 1985

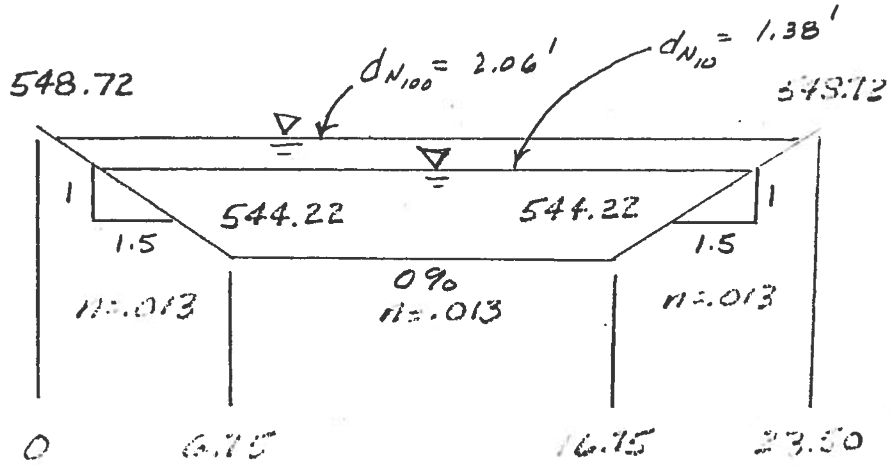
FLOW (CFS) ALONG CHANNEL

INFLOW LOCATION	CHANNEL STA	INV. EL @ ℄	Q_{100} INFLOW	ADJUST. Q_{100} INFLOW	Q_{100} CUM. TOTAL	Q_{10} INFLOW	AJUST. Q_{10} INFLOW	Q_{10} CUM. TOTAL
VENTURA BR.	35+30.25	5536.6	642	642	642	322	322	322
VENTURA S.D.	35+00.39	5535.78	104	72	714	—	33	355
VALLEY FORGE	28+58	5519.23	41	28	742	—	13	368
YORKTOWN	25+76	5511.96	54	37	779	—	17	385
GETTYSBURG	22+49	5503.54	58	40	819	—	17	402
CHERRY H. E	18+32	5492.79	43.6	30	849	—	14	416
MINUTEMAN	18+16	5492.38	9	6	855	—	3	419
CAPITOL	14+26	5482.33	32	22	877	—	10	429
CHERRY H. W	—	—	11.4	8	885	—	4	433
BARSTOW DIP XING					885			433

HEC-2 X-SECTION

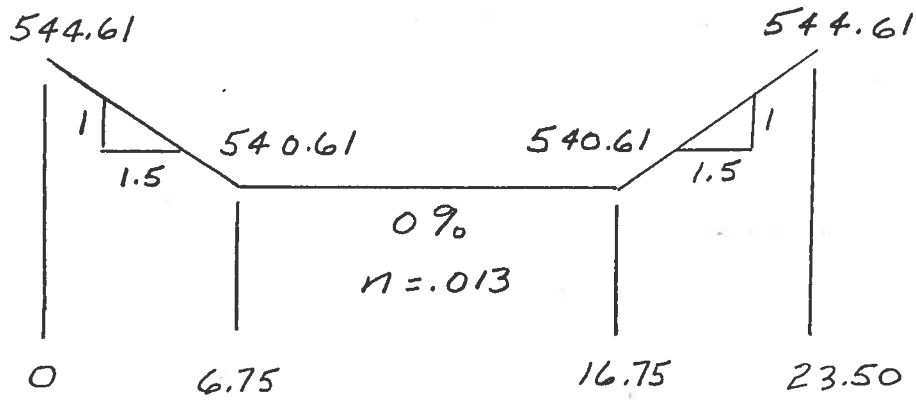
SEC. 1

STA. 36+50.75



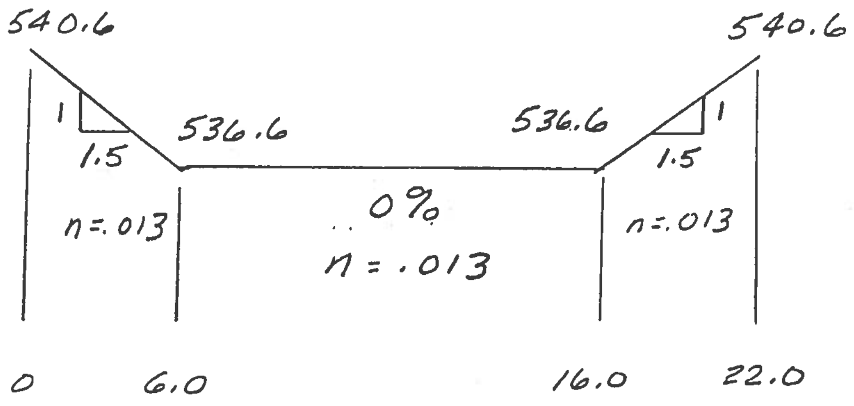
SEC. 2

STA 36+16.25
(U.S. FACE VENTURA BR.)



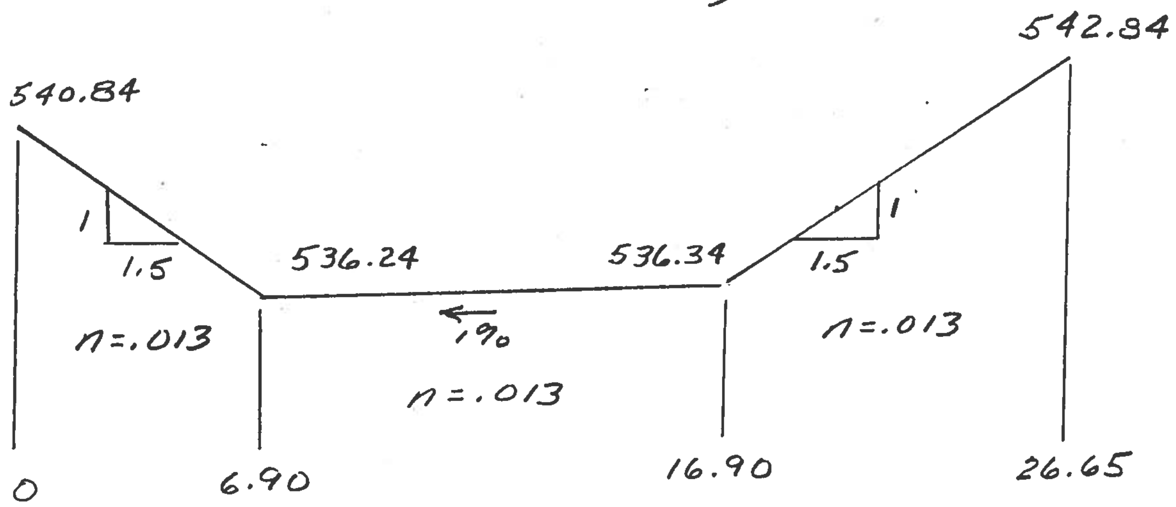
SEC. 3

STA 35+30.25
(D.S. FACE VENTURA BR.)



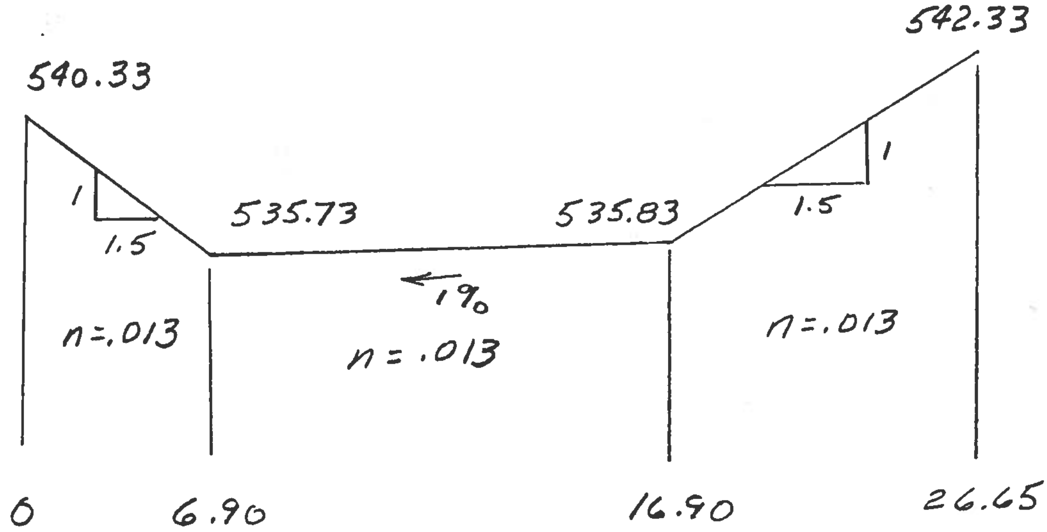
SEC. 4

STA 35+20.25
(BEG. BTM TRANS.)



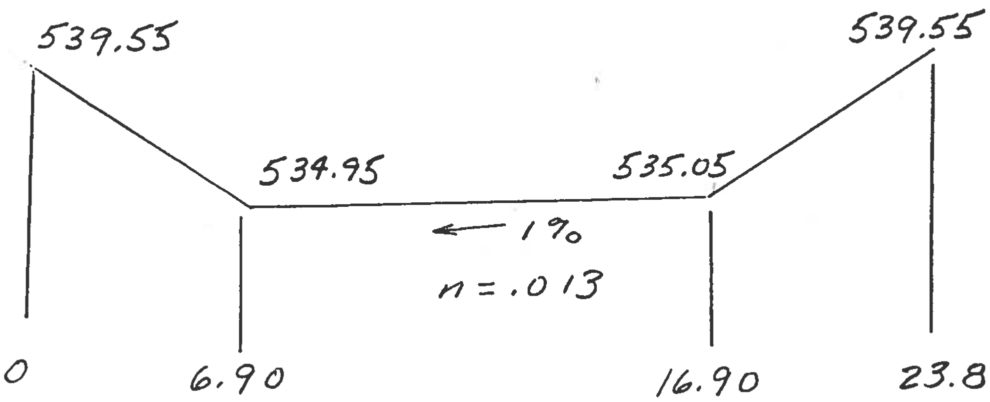
SEC. 5

STA 35+00.39
(42" RCP)



SEC. 6

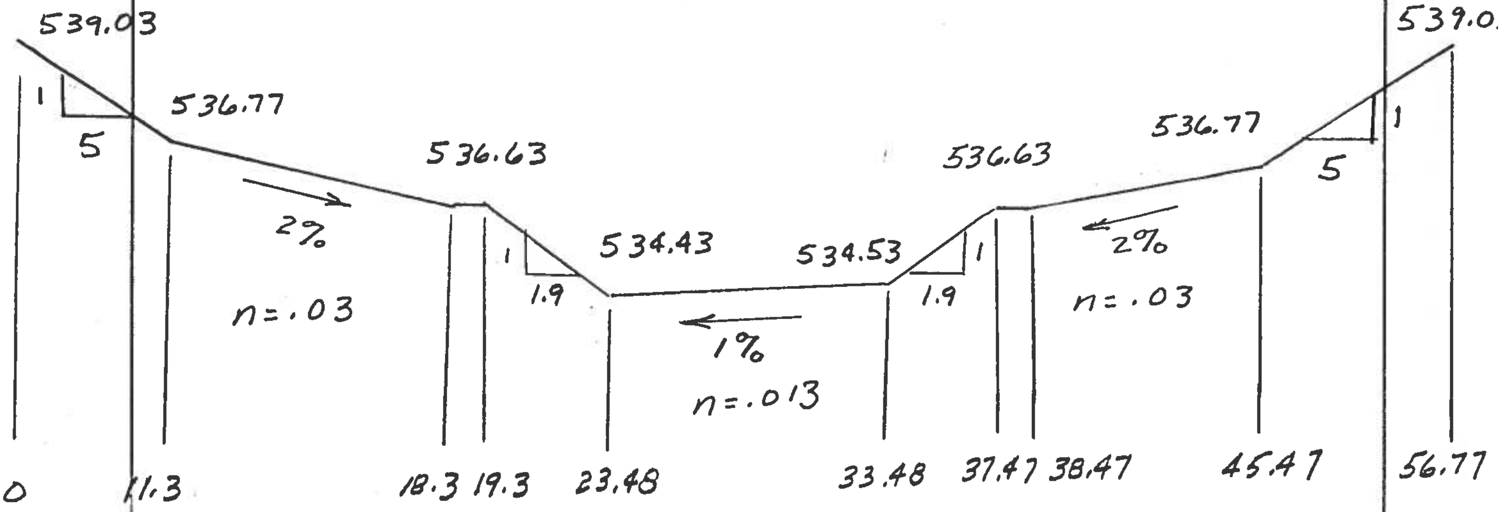
STA 34+70.25
(END OF S.S. TRANS.)



SEC. 7

STA 34+50.25

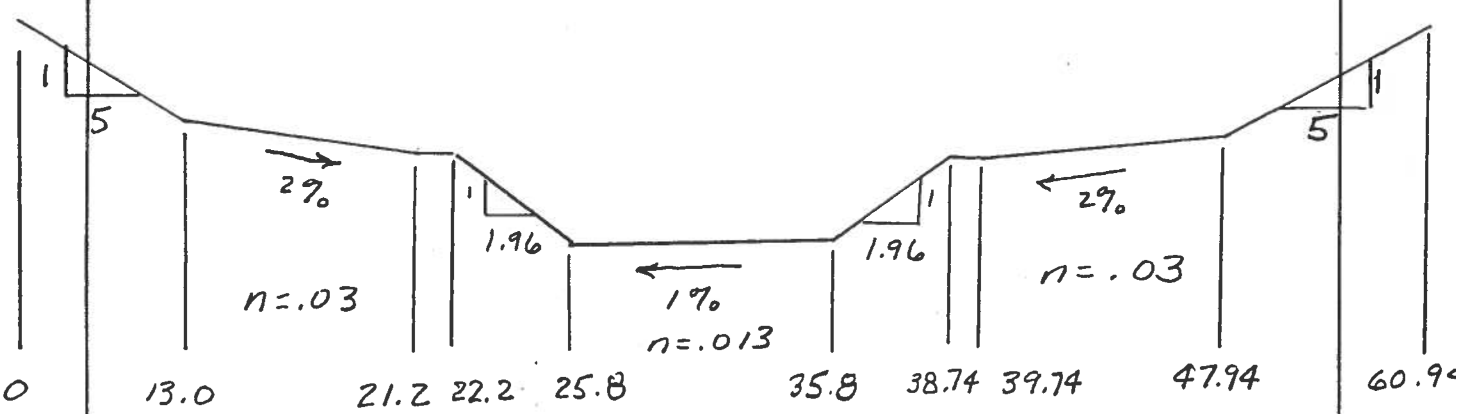
(IN S.S. TRANS.)



SEC. 7.5

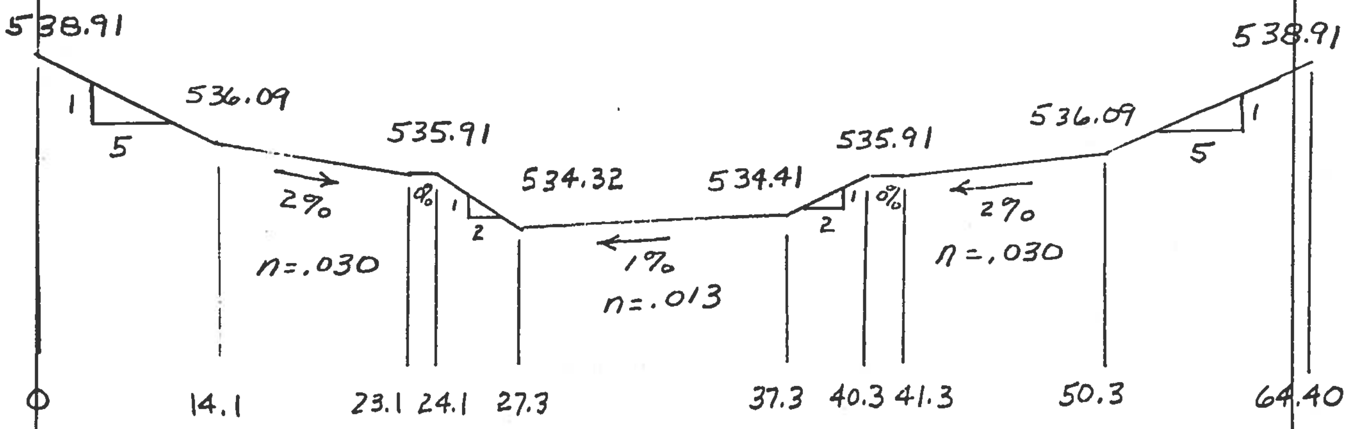
STA 34+47.25

(IN S.S. TRANS.)



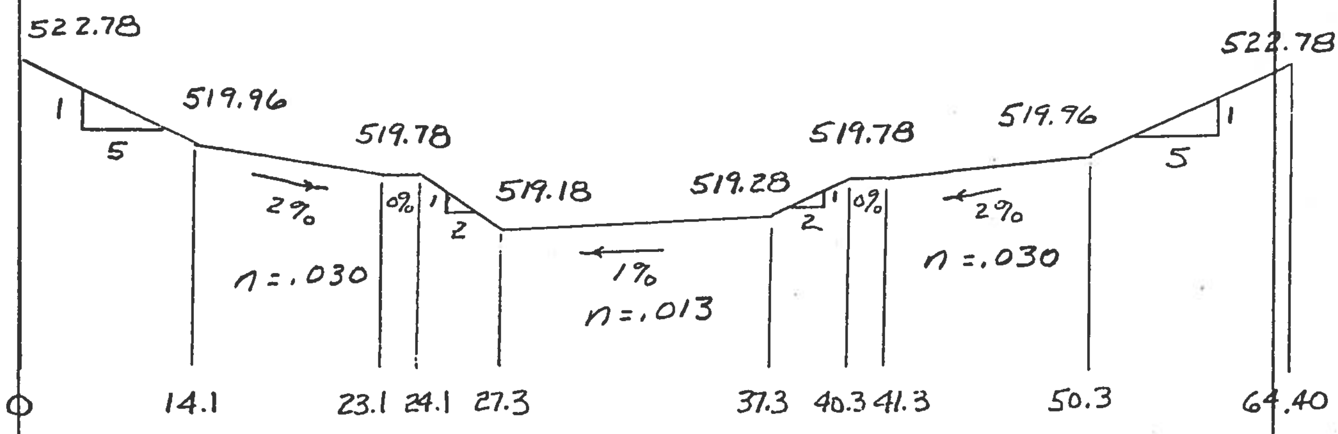
SEC. 8

STA. 34+45.25
BEG. SS TRANS.



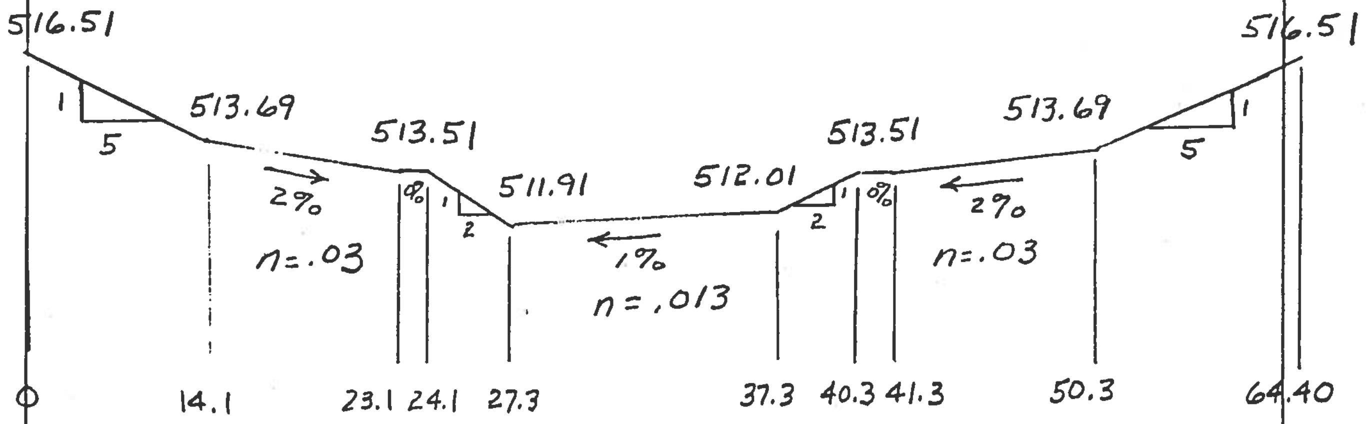
SEC. 9

STA 28+58
(VALLEY FORGE)



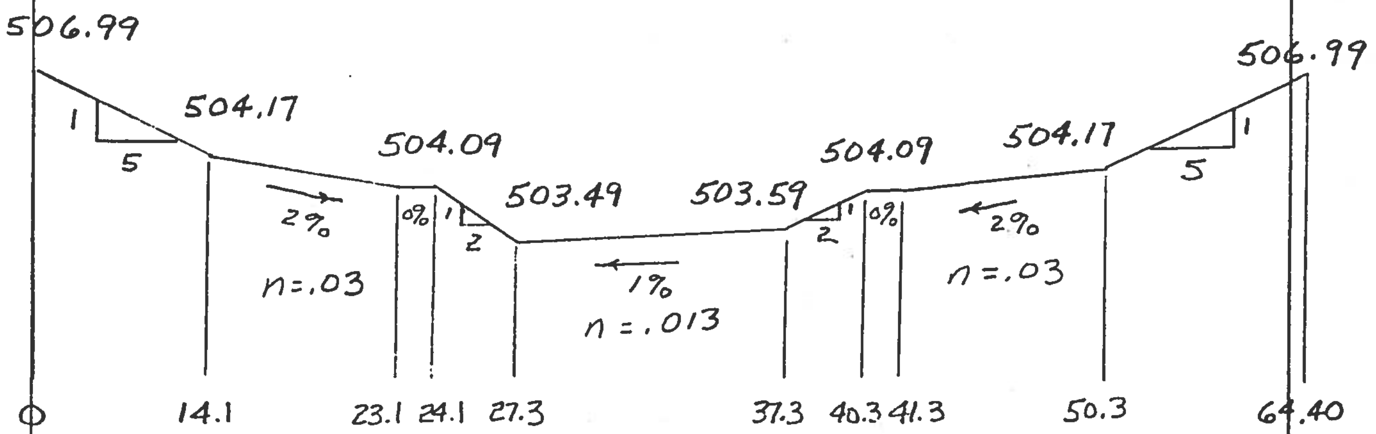
SEC. 10

STA. 25+76
(YORKTOWN)



SEC. 11

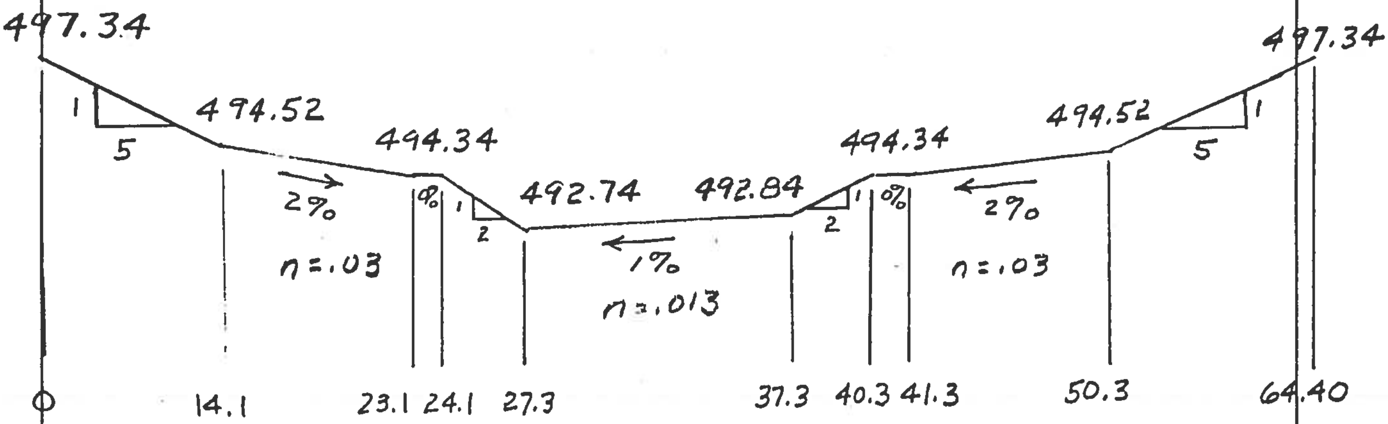
STA 22+49
(GETTYSBURG)



SEC. 12

STA. 18+32

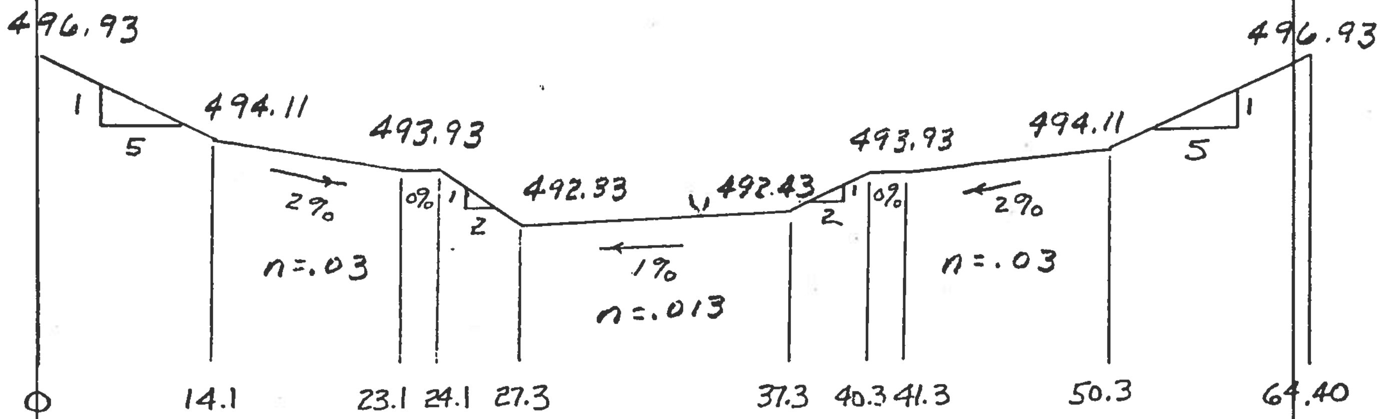
(CHERRY H. E.)



SEC. 13

STA 18+16

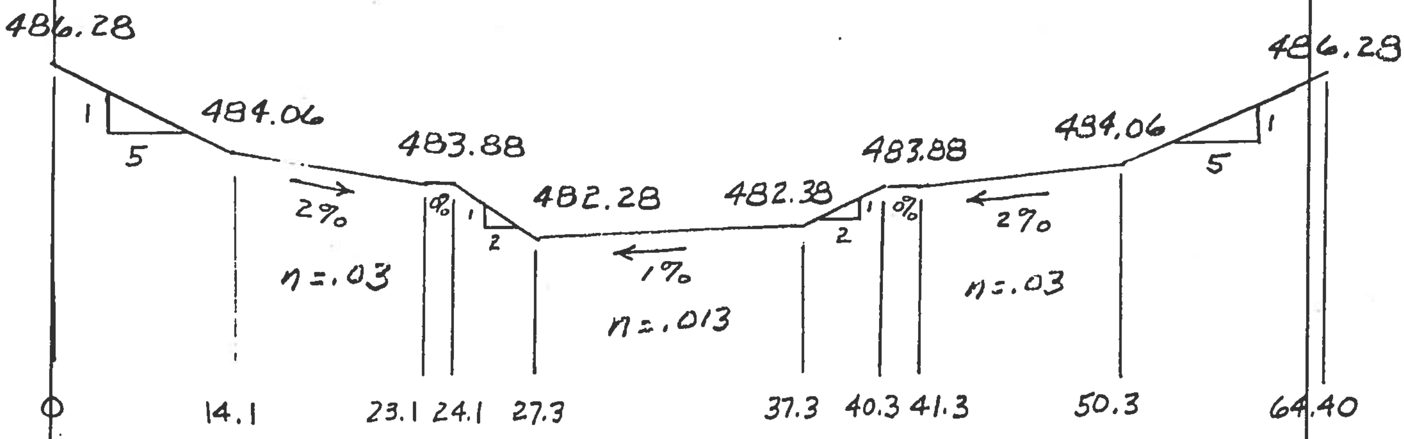
(MINUTEMAN)



SEC. 14

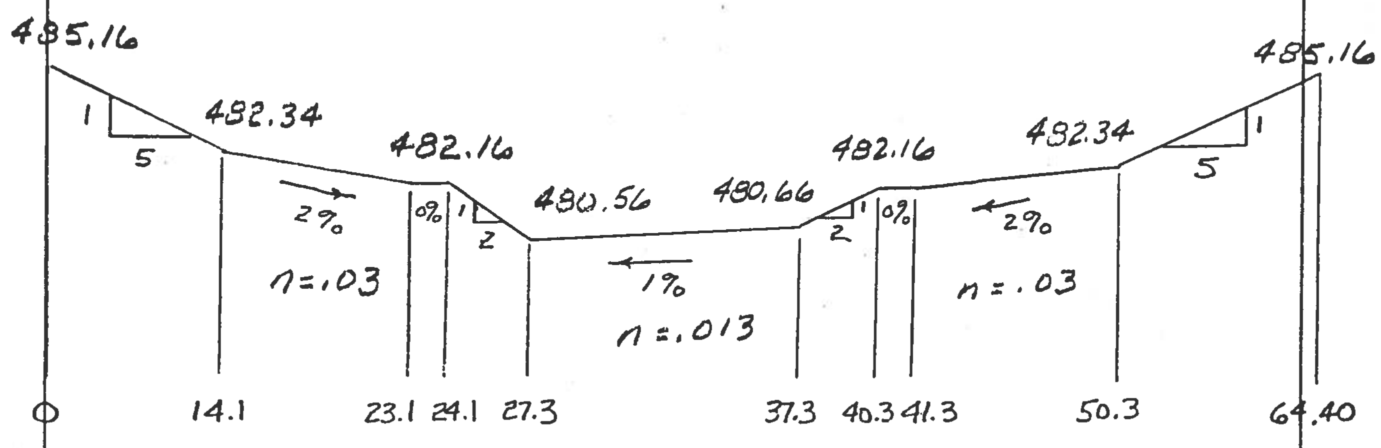
STA. 14+26

(CAPITOL)



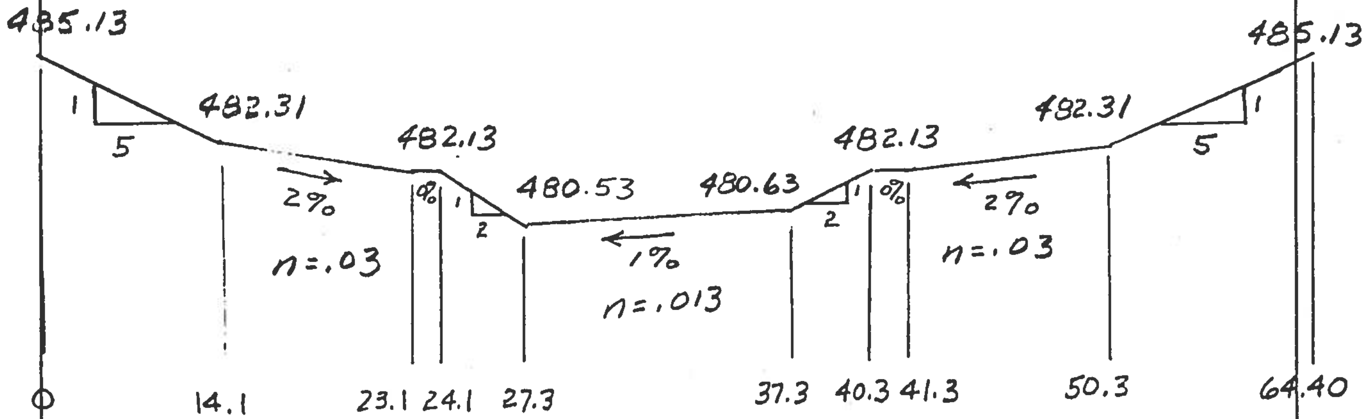
SEC. 14.4

STA 13+58.80



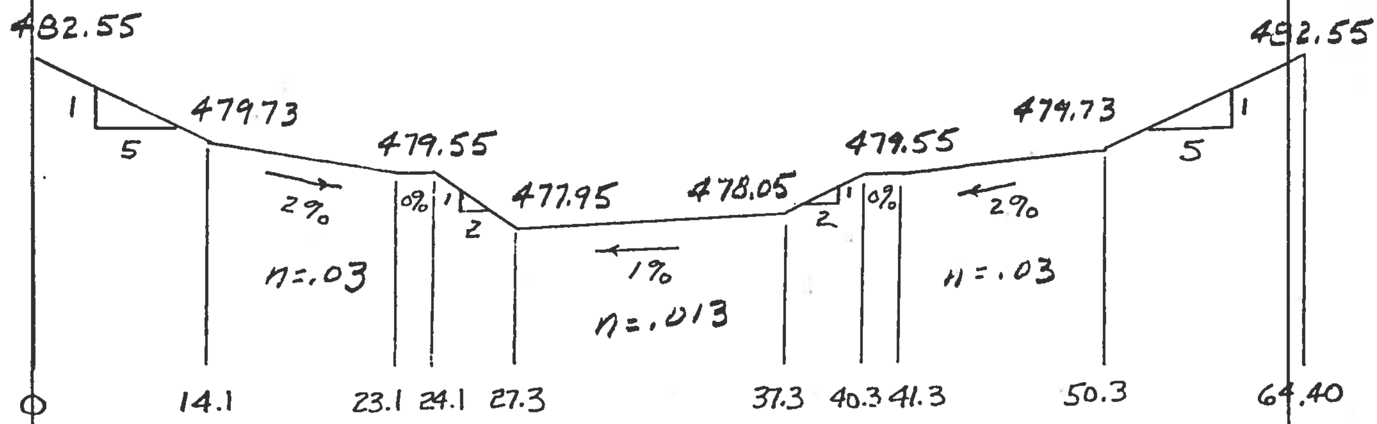
SEC. 14.5

STA. 13+57.80



SEC. 15

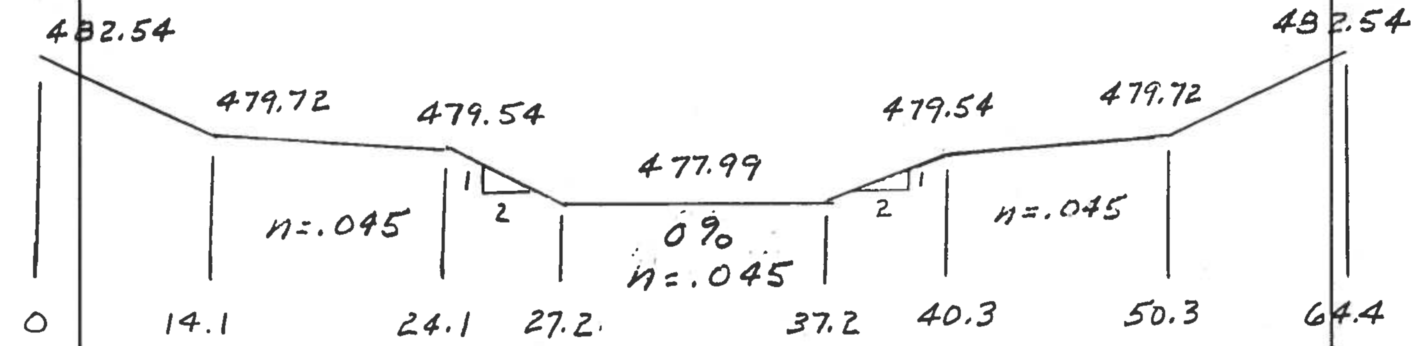
STA 12+57.80
(END OF RIPRAP TRANS.)



SEC. 15.1

STA 12+56.80

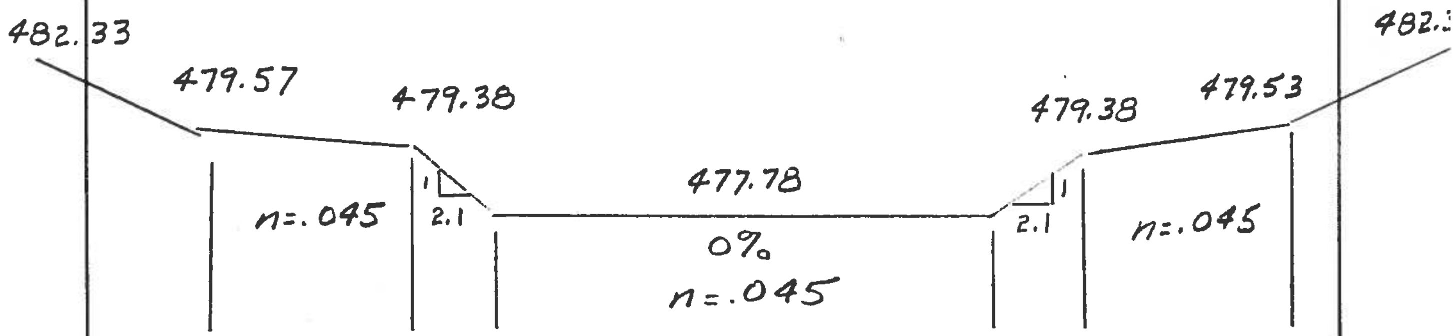
(RIP RAP TRANS.)



SEC. 16.0

STA 12+42.80

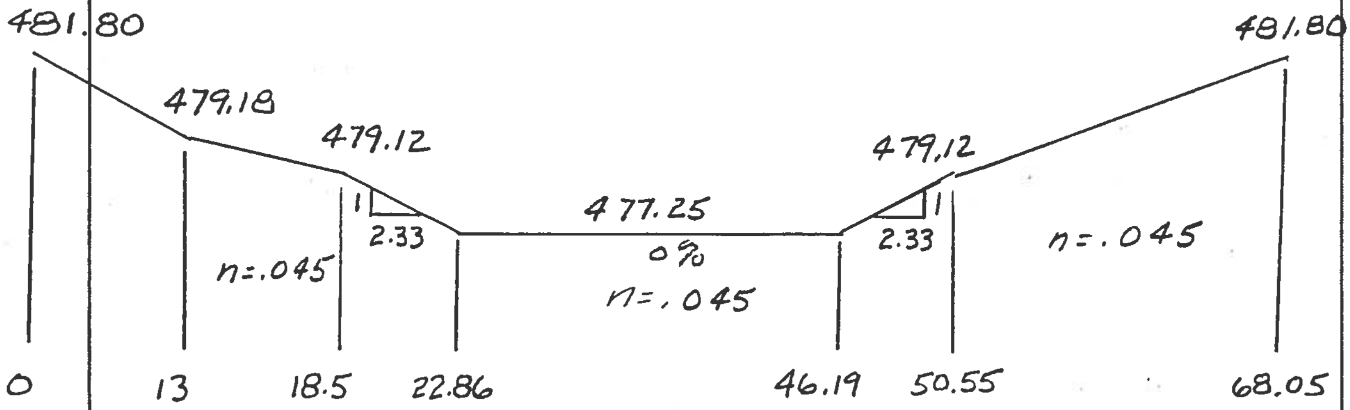
(RIP RAP TRANS.)



SEC. 16.5

STA 12+07.80

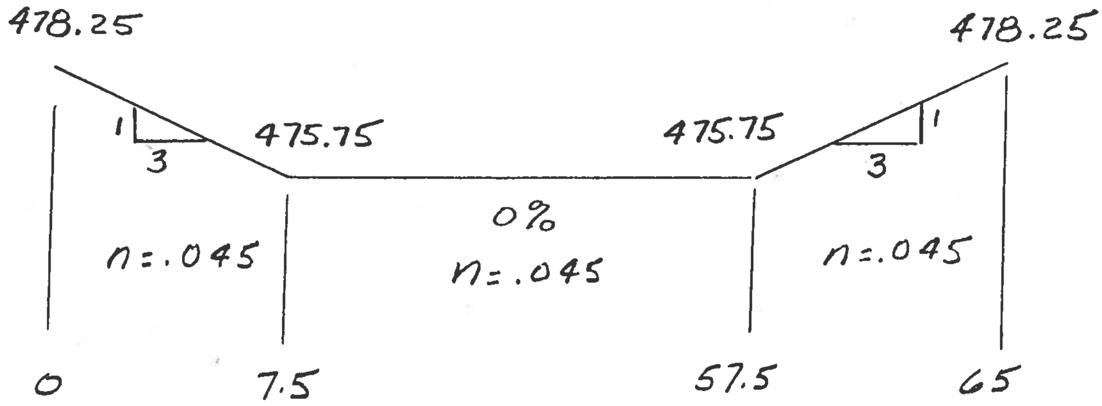
(RIPRAP TRANS.)



SEC. 17

STA 11+07.80

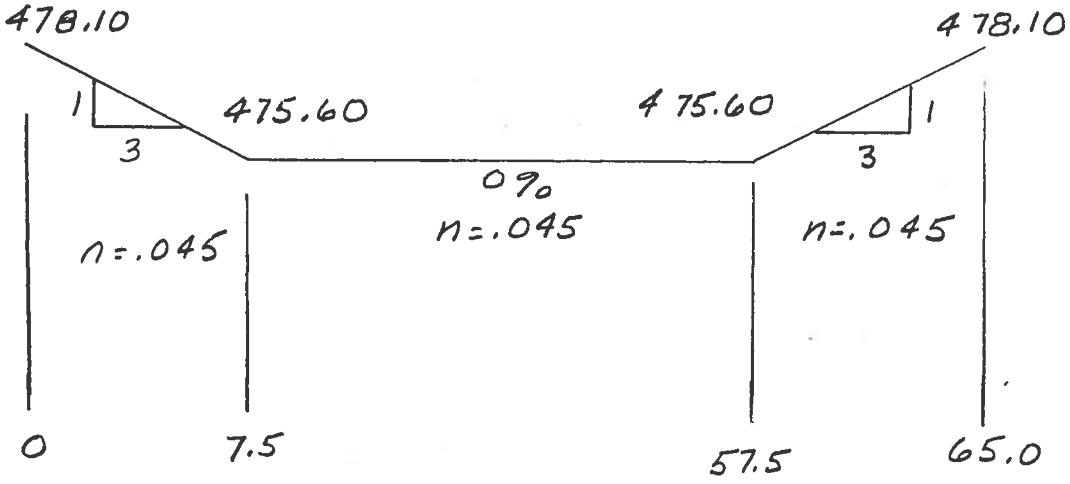
(BEG RIPRAP TRANS.)



SEC. 18

STA 10+97.80

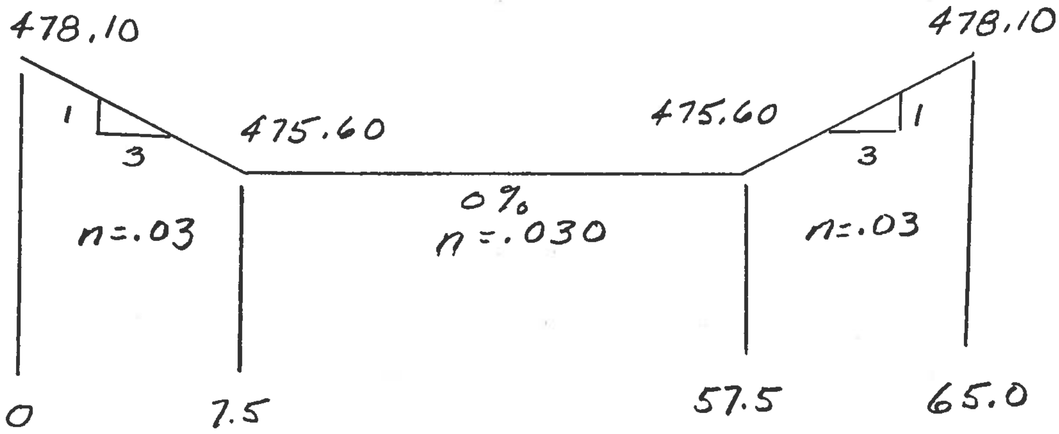
(BEGI RIPRAP)



SEC. 18.1

STA 10+96.80

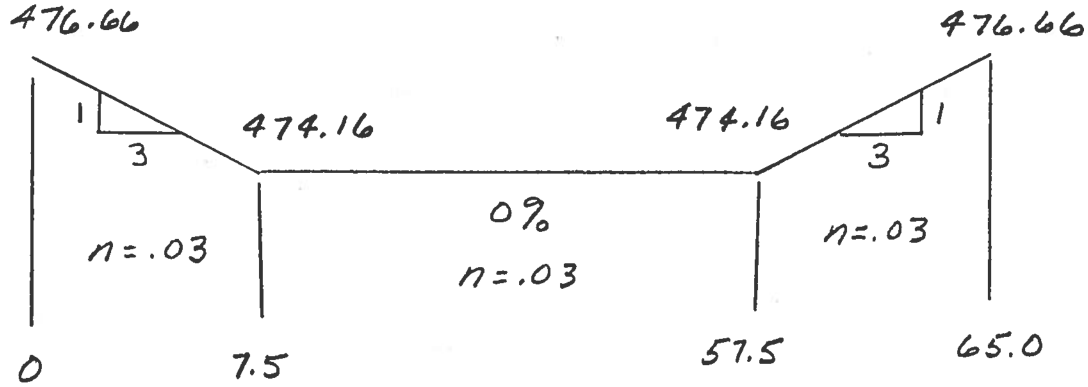
(END EARTH CHANNEL)



SEC. 19

STA 10+02

(BEG. EARTH CHANNEL)



THIS RUN EXECUTED 15-JUN-85 16:29:30

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APR. 1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
**************************************************
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

100-YR. FLOW

SUMMARY PRINTOUT

	SECNO	XLCH	ELMIN	Q	CWSEL	DIFWSX	DEPTH	EG	HV	HL	TOPWID	VCH	QCH
	1.000	0.00	544.22	642.00	546.28	0.00	2.06	555.08	8.80	0.00	16.18	23.81	642.00
	2.000	34.50	540.61	642.00	542.45	-3.83	1.84	554.07	11.62	1.01	15.52	27.35	642.00
*	3.000	43.00	536.60	642.00	538.39	-2.03	1.79	550.80	12.41	1.68	15.37	28.27	642.00
	4.000	10.00	536.24	642.00	538.08	-0.31	1.84	550.40	12.32	0.40	15.39	28.17	642.00
	5.000	19.86	535.73	714.00	537.77	-0.32	2.04	549.68	11.91	0.72	15.96	27.70	714.00
	6.000	30.14	534.95	714.00	537.00	-0.77	2.05	548.66	11.66	1.01	16.06	27.41	714.00
	7.000	20.00	534.43	714.00	536.40	-0.60	1.97	547.98	11.58	0.68	17.28	27.31	714.00
	7.500	3.00	534.36	714.00	536.33	-0.07	1.97	547.87	11.54	0.11	31.54	27.29	712.73
	8.000	2.00	534.32	714.00	536.20	-0.13	1.88	547.79	11.59	0.08	37.28	27.55	702.13
*	9.000	146.81	519.18	742.00	521.25	-3.76	2.07	530.24	8.99	3.90	39.19	24.56	711.15
	10.000	280.88	511.91	779.00	514.04	-7.21	2.13	523.03	8.99	7.21	39.77	24.66	740.43
	11.000	326.35	503.49	819.00	505.66	-8.37	2.17	514.86	9.19	8.17	40.26	25.02	773.13
	12.000	417.00	492.74	849.00	494.94	-10.72	2.20	504.41	9.46	10.45	40.53	25.43	798.37
	13.000	16.00	492.33	855.00	494.54	-0.40	2.21	504.00	9.46	0.40	40.62	25.44	802.98
	14.000	390.34	482.28	877.00	484.51	-10.03	2.23	494.18	9.67	9.83	40.81	25.75	821.45
	14.400	67.20	480.56	877.00	482.79	-1.72	2.23	492.48	9.69	1.70	40.79	25.77	821.60
	14.500	1.00	480.53	877.00	482.76	-0.03	2.23	492.45	9.69	0.03	40.79	25.77	821.60

15-JUN-85 16:29:22 PAGE 12

	SECNO	XLCH	ELMIN	Q	CWSEL	DIFWSX	DEPTH	EG	HV	HL	TOPWID	VCH	QCH
	15.000	100.00	477.95	877.00	480.17	-2.60	2.22	489.91	9.74	2.55	40.76	25.83	822.00
*	15.100	1.00	477.99	877.00	480.26	0.10	2.27	489.84	9.58	0.07	41.68	27.26	663.67
	16.000	14.00	477.78	877.00	479.93	-0.33	2.15	486.22	6.29	3.62	40.24	20.78	813.59
	16.500	35.00	477.25	877.00	479.46	-0.47	2.21	482.40	2.94	3.82	41.21	13.82	868.29
*	17.000	25.00	475.75	877.00	477.78	-0.52	2.03	478.70	0.92	0.62	62.16	7.72	877.00
*	18.000	10.00	475.60	877.00	477.63	-0.15	2.03	478.55	0.92	0.25	62.17	7.71	877.00
*	18.100	1.00	475.59	877.00	477.59	-0.04	2.00	478.54	0.94	0.02	62.05	7.80	877.00
	19.000	94.80	474.16	877.00	475.92	-1.67	1.76	477.19	1.28	1.34	60.51	9.07	877.00

15-JUN-85 16:29:22 PAGE 13

SUMMARY OF ERRORS

CAUTION SECNO= 3.000 PROFILE= 1 INTERPOLATED XSECTIONS USED

CAUTION SECNO= 9.000 PROFILE= 1 INTERPOLATED XSECTIONS USED

CAUTION SECNO= 15.100 PROFILE= 1 SLOPE TOO STEEP

CAUTION SECNO= 17.000 PROFILE= 1 INTERPOLATED XSECTIONS USED

CAUTION SECNO= 18.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 18.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 18.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO= 18.100 PROFILE= 1 MINIMUM SPECIFIC ENERGY

15-JUN-85 16:29:32 PAGE 1

THIS RUN EXECUTED 15-JUN-85 16:29:32

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**************************************************
 HEC2 RELEASE DATED NOV 76 UPDATED APR. 1980
 ERROR CORR -  01,02,03,04
 MODIFICATION -  50,51,52,53,54
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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APR. 1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
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THIS RUN EXECUTED 15-JUN-85 17:34:02

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

10-YR. FLOW

SUMMARY PRINTOUT

	SECNO	XLCH	ELMIN	Q	CWSEL	DIFWSX	DEPTH	EG	HV	HL	TOPWID	VCH	QCH
	1.000	0.00	544.22	322.00	545.60	0.00	1.38	551.40	5.80	0.00	14.14	19.33	322.00
	2.000	34.50	540.61	322.00	541.79	-3.81	1.18	550.29	8.50	1.11	13.51	23.40	322.00
	3.000	86.00	536.60	322.00	537.76	-4.03	1.16	546.46	8.70	3.83	13.48	23.67	322.00
	4.000	10.00	536.24	322.00	537.46	-0.30	1.22	546.01	8.56	0.45	13.50	23.47	322.00
	5.000	19.86	535.73	355.00	537.08	-0.38	1.35	545.21	8.13	0.80	13.89	22.89	355.00
	6.000	30.14	534.95	355.00	536.32	-0.76	1.37	544.12	7.80	1.09	14.00	22.42	355.00
	7.000	20.00	534.43	355.00	535.77	-0.55	1.34	543.41	7.64	0.71	14.89	22.18	355.00
	7.500	3.00	534.36	355.00	535.71	-0.06	1.35	543.30	7.60	0.11	14.74	22.12	355.00
	8.000	2.00	534.32	355.00	535.64	-0.06	1.32	543.23	7.59	0.07	15.13	22.10	355.00
*	9.000	146.81	519.18	368.00	520.66	-3.77	1.48	526.76	6.11	3.78	15.78	19.83	368.00
	10.000	280.88	511.91	385.00	513.44	-7.22	1.53	519.63	6.20	7.13	15.96	19.98	385.00
	11.000	326.35	503.49	402.00	505.05	-8.38	1.56	511.42	6.37	8.21	16.10	20.25	402.00
*	12.000	417.00	492.74	416.00	494.33	-10.73	1.59	500.90	6.57	10.57	16.20	20.56	416.00
	13.000	16.00	492.33	419.00	493.93	-0.40	1.60	500.46	6.53	0.44	19.26	20.50	419.00
	14.000	390.34	482.28	429.00	483.95	-9.98	1.67	490.00	6.05	10.46	26.26	19.75	428.70
	14.400	67.20	480.56	429.00	482.23	-1.72	1.67	488.32	6.09	1.68	25.85	19.82	428.74
	14.500	1.00	480.53	429.00	482.19	-0.03	1.66	488.29	6.10	0.03	25.79	19.83	428.74

	SECNO	XLCH	ELMIN	Q	CWSEL	DIFWSX	DEPTH	EG	HV	HL	TOPWID	VCH	QCH
	15.000	100.00	477.95	429.00	479.61	-2.58	1.66	485.76	6.15	2.54	25.33	19.90	428.78
	15.100	1.00	477.99	429.00	479.92	0.31	1.93	485.70	5.78	0.06	38.22	20.29	380.09
	16.000	14.00	477.78	429.00	479.43	-0.49	1.65	482.88	3.45	2.82	25.21	14.90	428.98
	16.500	35.00	477.25	429.00	478.95	-0.48	1.70	480.26	1.31	2.62	31.30	9.19	429.00
*	17.000	50.00	475.75	429.00	477.03	-0.90	1.28	477.63	0.60	1.39	57.67	6.23	429.00
*	18.000	10.00	475.60	429.00	476.88	-0.15	1.28	477.48	0.60	0.28	57.68	6.23	429.00
*	18.100	1.00	475.59	429.00	476.85	-0.03	1.26	477.46	0.62	0.02	57.60	6.30	429.00
	19.000	94.80	474.16	429.00	475.34	-1.51	1.18	476.06	0.72	1.40	57.04	6.83	429.00

SUMMARY OF ERRORS

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CAUTION  SECNO=    9.000  PROFILE= 1  INTERPOLATED XSECTIONS USED

CAUTION  SECNO=   12.000  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION  SECNO=   12.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=   17.000  PROFILE= 1  INTERPOLATED XSECTIONS USED

CAUTION  SECNO=   18.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   18.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=   18.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=   18.100  PROFILE= 1  MINIMUM SPECIFIC ENERGY
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