TECHNICAL DRAINAGE STUDY
RESPONSE TO COMMENTS

TROPICAL PKWY/CENTENNIAL PKWY
ROADWAY IMPROVEMENTS

City of North Las Vegas, Clark County, Nevada

Job No.: MGL1101.000
Date: December 2011

Prepared By:
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HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Tropical Pkwy/Centennial Pkwy Roadway Improvements - Add 1 Date: December 12, 2011

Location of Development: a) Descriptive (Cross Streets) North/South: Centennial Parkway

East/West: Tropical Parkway

b) Section: 30 Township: 19 Range: 61

c) APN : 124-30-204-008

Name of Owner: M Grape LLC

Telephone No.: Fax No.: E-Mail Address:

Address: 2460 Professional Court, Suite 120

Contact Person-Name: Ray Fredericksen, P.E. **Telephone No.:** 702-284-5300

*** E-Mail Address:** rfredericksen@shg-inc.com **Fax No.:** 702-284-5399

Firm: Slater Hanifan Group

Address: 5740 S. Arville Street #216, Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivision Map	☐	Clearing and Grading Only
☐	Parcel Map	☐	Planned Unit Development	☒	Other (Please specify below)
☐	Large Parcel Map	☐	Building Permit		Roadway Improvements

1. Total Owned Land Area: At Site: 2.1 Ac Being Developed/Disturbed: 2.1 AC
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
4. Proposed type of development (Residential, Commercial, Etc.): Roadway Improvements
5. Approximate upstream land area which drains to the subject site: 10 acres
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Offsites - Twilight North
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: East in Tropical Parkway to existing storm water improvements
8. Briefly describe your proposed schedule for the subject project: As soon as possible

Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

*New Required Field

**Review and concurrence of the Clark County Regional Flood Control District is required.

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS

MGL1101.000

December 12, 2011

City of North Las Vegas
Land Development & Flood Control Division
2250 North Las Vegas Blvd, Suite 220
North Las Vegas, NV 89030

Re: **Technical Drainage Study for Tropical Pkwy./Centennial Pkwy. Roadway Improvements**
CNLV No. 43988

Land Development & Flood Control Division:

The purpose of this letter is to address comments contained in the November 30, 2011 review memorandum prepared for the above referenced project. The comments are addressed as follows:

1. **Comment**: *Concurrence must be obtained by the City of Las Vegas (CLV) due to the proposed improvement's proximity to the CLV jurisdiction. Please submit a copy of this study and all addenda to CLV upon acceptance from CNLV.*

   Response: Noted. A copy of the TDS and all addenda will be submitted to the CLV upon approval by CNLV.

2. **Comment**: *The Technical Drainage Study (TDS) is only for the proposed street improvements adjacent to the site, a separate drainage study and planning commission conditions must be submitted, in the future, for the undeveloped area within the same parcel.*

   Response: Noted. An on-site Technical Drainage Study will be submitted for all on-site improvements for the adjacent site.

3. **Comment**: *A quick review of the general topography in the area shows that the area surrounding the project site drains southeasterly direction. It appears that Decatur Boulevard, adjacent to the site, may intercept some offsite flows from upstream of the project site.*

   Section 1.5 of TDS states that "Improvements west of Decatur have effectively cut off flows and routed them into the existing storm drain in Decatur." Please provide approved reference materials to illustrate that all flows are being contained within the existing storm drain in Decatur Boulevard. Please note that all 10-year and 100-year street capacity calculations must be revised to reflect any flow changes. Also, 12' dry lane criterion must also be met for the future condition.

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Response: Based on reference studies provided by the City of Las Vegas for Winco Las Vegas (Thienes Engineering, 2011) which was an Update to the TDS for Decatur/215 (Southwest Engineering, 2008) there is an existing surface flow (section G in reference files) south in Decatur Blvd of 9 cfs during the 10-year storm event and 155 cfs during the 100-year storm event at the intersection of Decatur and Tropical, this flow proceeds remains in the Decatur right-of-way and heads south. At the Rice and Decatur intersection there is a surface flow of 0 cfs and 138 cfs during the 100-year storm event (Section E in the reference files). The existing 54" storm drain conveys 86 cfs. The street flow calculations show that the 10-year dry lane criteria is met. The 100-year storm event will produce a depth of flow 0.98 ft deep. The velocities however are non-erosive. Any developments proposed to fron on Decatur Blvd will provide flood protection to prevent flood water from inundating the property. Any future on-site developments will address this issue within their technical study. Copies of the reference material documenting these surface flows are included in Appendix A. All relevant Figures and calculations have been revised and included in the appendix. Based on review of the reference material it states that the storm water flow in Decatur Blvd will continue south and will not be picked up by any future storm drain. The downstream properties appear to have been designed to accommodate this storm water flow.

4. **Comment**: *Please note that the CNLV requires that all drop inlet sizing be performed with the HEC-22 software which can be acquired from the Federal Highway Administration's website.*

   Response: Please refer to Appendix B for all revised drop inlet sizing calculations using the HEC-22 software. The drop inlet on the west side of Centennial is now sized at 15-ft Modified Type C. The drop inlet along the east side of Centennial Pkwy is designed as a 7.5-ft Modified Type C.

5. **Comment**: *Please explain and demonstrate how the Q100=118 cfs and Q10=38 cfs (hydraulic Section D-D of the Existing Condition Street Flows) were obtained since the flows for the Interim and Future conditions at hydraulic section D-D are Q100=3 cfs and Q10=2 cfs.*

   Response: For the Existing Condition street flow calculations the CNLV North Neighborhood Study (CNLVNNS) was referenced. The Existing Condition, Figure E-9, in the CNLVNNS shows a surface flow of Q10=36 cfs and Q100=115 cfs heading east. This flow value was used for the existing condition. However, the current design of Rice Avenue with a highpoint just east of Decatur Blvd does not allow storm water to head east on Rice Ave. In addition, this flow was referenced from the City of Las Vegas NNS study and is no longer a valid quantity of water as discussed in the response to comment 3.

6. **Comment**: *Please explain/show how the Q100/Q10 in This Study and the Twilight Study were obtained in Tables 3 and 5 of TDS. The flow values in Tables 3 and 5 do not match with the flow values in the drainage basin maps and the reference materials for the Twilight Study.*

   Response: In compiling the first submittal of this TDS the NNS value at the intersection of Decatur Blvd. and Tropical Pkwy was used incorrectly in relation to

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the previous studies in the area. The following excerpt is from the TDS for Twilight at Riverwalk, by Slater Hanifan Group. This excerpt clarifies why the future condition value was used at the intersection from the NNS. The exhibits and street flow calculations have been revised to match.

Reference Material (from Twilight at Riverwalk):

"**Response:** Table 2 summarizes the existing condition peak 100-year flow rates to perimeter streets established by the CNLV Study. Note that both streets show no flow contained in storm drain. With completion of this project, the local facility in Tropical, south of the project, will be constructed to convey the 10-year storm flow and 100-year flow at the intersection of Valley & Tropical. Also, local facilities in Decatur and Tropical, west of Decatur, are complete and connect to the regional facility in Ann. The 10-year flow at Decatur is collected by this existing offsite storm drain. With these facilities, it is appropriate to utilize the CNLV Future Drainage conditions as existing condition in determining offsite flow for this project; therefore no street flow computations were performed based on the existing condition CNLV flow values. See Table 3 below regarding future drainage condition flow in the perimeter streets. Note that values in parenthesis represent flow conveyed in storm drain.

Table 2: Summary of Existing Condition Flows Established By CNLV Study		
Location	Q_{100} (cfs)	Q_{10} (cfs)
Tropical / Decatur	267 (0)	62 (0)
Tropical / Centennial	282 (0)	70 (0)

Table 3: Summary of Future Condition Flows Established By CNLV Study		
Location	Q_{100} (cfs)	Q_{10} (cfs)
Tropical / Decatur	223 (0)	0 (0)
Tropical / Centennial	229 (0)	19 (0)

(End insertion of reference material)

The HEC-1 analysis from the approved TDS for Twilight at Riverwalk was referenced and the hydrograph for the NNS quantity was added to the HEC-1 for this study. By incorporating this flow and hydrograph the flows became equal at the "intersection" of Centennial Parkway and Tropical Parkway as summarized in the revised Table 3 and 5 below:

Table 3: Interim Condition Comparison – This Study vs. Twilight Study				
Location	Concentration Point ID	$Q_{100/10}$ (cfs)	Concentration Point ID (Twilight Study)	$Q_{100/10}$ (cfs)
Intersection of Centennial Pkwy & Tropical Pkwy	CP.I5	233/21	CP.D6	241/16

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Table 5: Future Condition Comparison -- This Study vs. Twilight Study				
Location	Concentration Point ID	$Q_{100/10}$ (cfs)	Concentration Point ID (Twilight Study)	$Q_{100/10}$ (cfs)
Intersection of Centennial Pkwy & Tropical Pkwy	CP.D5	235/30	CP.D6	234/31

As you can see from the tables listed above the reference study and the proposed study are not the same incorporating the HEC-1 and hydrograph from the previously approved studies. Copies of the relevant reference material have been included in the Appendix.

7. **Comment**: *Please explain and demonstrate how the Qapproaching=26 cfs in Table 8 of the TDS was obtained. The Interim and Future Condition Basin Maps show that Q100=21 cfs instead of Q100=26 cfs at Section E-E.*

   Also, it appears that a portion of the Q100=302 cfs and Q10=78 cfs from Tropical Parkway will turn north adding to the flows in Centennial Parkway at the proposed drop inlets. Please evaluate and perform the necessary flow split calculations and revise all street and drop inlet capacity calculations to reflect the revision as necessary.

   Response: Please refer to the grading plans enclosed with this submittal. The grading concept for this intersection has been revised. The grading will no longer allow for storm water from Tropical Parkway to head north in Centennial Parkway. The drop inlets will remain to capture the 21 cfs conveyed south in Centennial Parkway. The west DI (15-ft) will capture the 17 cfs from the west half of the street while the 7.5-ft modified Type C will capture the ¾ cfs from the east half of Centennial. Please see the drop inlet sizing calculations in Appendix F as well as the revised grading plans. No additional calculations are required.

8. **Comment**: *Please discuss and show how soil type boundaries were determined as delineated on the drainage basin maps? Provide any pertinent soil type chart for the project area.*

   Response: Please refer to Appendix D for a Soils Map of the project vicinity. The majority of the soils associated with this project are soils type 305 which has is a hydrologic soils group 'C' the minor soils type used in compiling this report is 301 which is in hydrologic soils group 'D'. Also, note that both the onsite future project and the roadway basins are comprised of pavement and used a CN value of 98.

9. **Comment**: *It is unclear where is drainage basin DEC_5 as shown in the Soil and Curve Number Computation table of the TDS.*

   Response: This basin ID has been revised to call out basin DEC_3. The basin name was changed during composition of the analysis and not changed on this spreadsheet. Please refer to the revised Soil and Curve Number Computation spreadsheet in Appendix E.

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10. Comment: *Please revise the Flowmaster calculations for the interim and future conditions of Centennial Parkway and Tropical Parkway to show the proposed concrete median islands.*

Response: Noted. Please refer to Appendix F for the revised worksheets. All street flow calculations have been revised to the current values. Street sections have been revised to include the center median.

Perimeter Street Flow Summary
Interim Condition

Section	Slope (%)	Q_{100} (cfs)	Depth (ft)	Velocity (fps)	VxD	Q_{10} (cfs)	Dry Lane Width (ft)
SECTION A Tropical Pkwy (100' ROW) *(Q = CP.I2)*	0.70	224.0	1.12	4.76	5.3	3.0	36.50
SECTION B Tropical Pkwy (100' ROW) *(Q = CP.I3)*	0.60	230.0	1.03	4.25	4.4	12.0	21.50
SECTION C Decatur Blvd (100' ROW) *(Q = North of C-Store)*	0.40	144.0	0.98	3.14	3.1	3.0	24.0
SECTION D Rice Ave (60' ROW) *(Q = RIC1)*	0.61	3.0	0.32	1.62	0.5	2.0	n/a
SECTION E (West 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.70	17.0	0.52	2.57	1.3	8.0	36'
SECTION E (East 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.90	4.0	0.31	1.79	0.6	2.0	36'

Perimeter Street Flow Summary
Future Condition

Section	Slope (%)	Q_{100} (cfs)	Depth (ft)	Velocity (fps)	VxD	Q_{10} (cfs)	Dry Lane Width (ft)
SECTION A Tropical Pkwy (100' ROW) *(Q = CP.D2)*	0.70	224.0	1.13	4.81	5.4	3.0	36.50
SECTION B Tropical Pkwy (100' ROW) *(Q = CP.D3)*	0.60	232.0	1.03	4.26	4.4	21.0	17.50
SECTION C Decatur Blvd (100' ROW) *(Q = North of C-Store)*	0.40	144.0	0.98	3.14	3.1	3.0	24.0

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SECTION D Rice Ave (60' ROW) *(Q = RIC1)*	0.61	3.0	0.32	1.62	0.5	2.0	n/a
SECTION E (West 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.70	17.0	0.52	2.57	1.3	8.0	36'
SECTION E (East 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.90	4.0	0.31	1.79	0.6	2.0	36'

Based on the above table you can see that 10-year dry lane criteria is met under both scenarios. The depth of flow in many instances is above the top of curb however the velocities sre non-erosive. The on-site developer will be required to flood protect his development per requirements set forth in the HC&DDM manual.

11. Comment: *Below are comments pertaining to the Improvement Plans:*

a. *If the landscapes areas along the meandering sidewalks are to be installed with the street improvements, the Engineer must show grades and flow lines within all landscape areas. Flows from the landscape areas will not be allowed to sheet flow over the adjacent sidewalks. Drainage swales should be graded to direct flows to discharge into the sidewalk underdrains.*

   Response: Please refer to the grading plans. Swales within the landscape area have been added as well as sidewalk under drains where necessary.

b. *Since the 100-year depth of flows will overtop the curbs (i.e. Tropical Parkway), the proposed landscape berms used to protect future developed properties from flows in the adjacent streets must meet the criterium of being twice the depth of flow above the adjacent flowline up to 18-inches above adjacent water surface.*

   Also, for 100-year street flow with depths greater than 0.6' and velocities higher than 5 fps, erosion resistant landscaping or pony walls must be provided

   Response: A berm has been added along Decatur Blvd and Tropical Parkway to ensure that storm water flow remains in the adjacent right-of-way. The berms are designed to be a minimum of twice the depth of flow from the adjacent flow line. The depth of flow is above the curb however the velocities are below 5 fps. Therefore, no erosion protection was provided with this plan set. Please refer to the enclosed grading plans and detail sheet for the berm design.

c. *Please note that any proposed storm drains within the public right of way must be reinforced concrete pipe with diameter of 18" minimum. Please revise the portion of the proposed storm drain pipe on the east half of Centennial Parkway to reflect the above described requirements. Also, CNLV highly discourages the installation of storm drain under the curb and gutter. Please redesign the proposed storm drain lateral on the east side of Centennial Parkway to locate away from the curb and gutter.*

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Response: Noted. The storm drain in Centennial Pkwy has been redesigned to remove the storm drain from under the curb and gutter. Please refer to the plan and profile sheets.

d. *Please provide the Benchmark information.*

Response: Noted. The Benchmark has been added to all sheets.

e. *The size of the drop inlets on Sheet P-6 are different from the sizes shown in the drop-inlet calculations in the TDS. Please revise the drawing to reflect the correct size of the drop inlets.*

Response: Noted. Drop inlet sizes have been corrected. Please refer to profile sheets for Centennial Pkwy.

f. *Please provide two driveways per the conditions of the approved Site Plan Review (SPR 11-11). The first driveway should be located on Rice Ave. at approximate station 13+00 and second driveway should be on Tropical Pkwy. At approximate station 108+50.*

Response: Noted. All driveways have been added to the grading plans.

g. *Please note that tack-on curb is not allowed in the Public ROW. Please revise Sheets P-3 and P-4 to show "A" type curb per CCAUSD #219 for Tropical Pkwy.*

Response: Noted. "A" curb callout has been revised to the above mentioned design.

h. *The proposed meandering sidewalk on Tropical Pkwy. At approximate station 105+00, does not tie into the existing sidewalk at that location. Please revise drawing accordingly.*

Response: Noted. Meandering sidewalk has been revised to tie into existing C-store design.

i. *Since Rice Ave. is a new street (undeveloped on both sides), please submit a design for a new street without saw cutting and matching the existing asphalt pavement. All existing asphalt pavements on Rice Ave. are temporary and need to be removed and a half street improvements with 16' overpaved will be required as part of this development. In addition, a median island and a concrete valley gutter must be constructed within Rice Ave. at Decatur Blvd. intersection.*

Response: Noted. The revised street section shows the south half street to be removed and replaced with a full pavement section. The median conditioned in SPR-11-11 has been added to the plans. Please refer to the grading plans.

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j. Please remove approval signature line for CNLV Traffic Engineer from all Plan and Profile sheets.

Response: Noted. The Traffic Engineer's signature block has been removed from all profile sheets.

12. **Comment**: *Additional comments may be generated on the second review.*

Response: Noted.

13. **Comment**: *A copy of this letter must accompany the subsequent submittal to the City of North Las Vegas.*

Response: Noted. Please refer to Appendix G.

If you have any further comments, or questions, please feel free to contact me at (702) 284-5300.

Respectfully submitted,

SLATER HANIFAN GROUP

Ray Fredericksen, P.E.
Project Manager

5740 S. Arville Street #216, Las Vegas, NV 89118 ph (702) 284-5300 fax (702) 284-5399

APPENDIX

Appendix A – Response to Comment No. 3:
- a. Revised FlowMaster calcs for Decatur Blvd
- b. Reference material from Decatur/215

Appendix B – Response to Comment No.4:
- a. Drop Inlet Sizing calculations

Appendix C – Response to Comment No. 6
- a. 10-Year Interim Condition HEC-1
- b. 100-Year Interim Condition HEC-1
- c. 10-Year Developed Condition HEC-1
- d. 100-Year Developed Condition HEC-1
- e. 10-Year Existing Condition HEC-1
- f. 100-Year Existing Condition HEC-1
- g. Reference Material from Twilight at Riverwalk

Appendix D – Response to Comment No.8:
- a. Soils Map

Appendix E – Response to Comment No. 9
- a. Revised Soil and CN Table

Appendix F – Response to Comment No.10
- a. Revised Flowmaster calcs

Appendix G – Response to Comment No.14
- a. City of North Las Vegas comment letter

Appendix H – Exhibits
- a. Existing Condition Exhibit E
- b. Interim Condition Exhibit F
- c. Future Condition Exhibit G

APPENDIX A

Response to Comment 3

Reference Material from Adjacent Study
Revised Flowmaster Calcs for Decatur Blvd.

Rec'd 2/27/2008
DS 4261
A-25
Supp. Info
N/C.

SUPPLEMENT TO ADDENDUM #2 TO THE TECHNICAL DRAINAGE STUDY DECATUR / 215 SWE JOB # 070619

February 27, 2008

Prepared for:
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Prepared by:

SOUTHWEST ENGINEERING
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Las Vegas, Nevada 89130
Ph: (702) 648-9700 Fax (702) 648-9700

February 27, 2008

Oh Sang Kwon, P.E.
Flood Control Project Engineer
Department of Public Works
Land Development Services
City of Las Vegas, Nevada 89101

RE: Supplement to Addendum #2 to the Drainage Study for Decatur / 215- located at the northwest corner of Decatur Blvd. and Tropical Pkwy.

Dear Mr. Kwon:

This is in response to issues discussed in a February 20, 2008 meeting with Southwest Engineering and the City of Las Vegas (Robert Welch and Albert Sung). The City of Las Vegas is concerned about potential impacts to the existing flows downstream of the intersection of Tropical Parkway and Decatur Boulevard caused by the development of the project. It is important to add that the existing beltway, and existing improvements in Decatur Boulevard and Tropical Boulevard that were built with the Lodge III project have essentially established the drainage patterns at the intersection. The Lodge III site is located at the southwest corner of the intersection of Tropical Parkway and Decatur Boulevard.

The approved Lodge III Drainage Study (refer to attached excerpts) had established that the design flow for the 42-inch storm drain in Tropical Parkway is 52 cfs and the future design flow for the 54-inch storm drain in Decatur Boulevard is 149 cfs. The additional 97 cfs was assumed to enter the storm drain in Decatur Boulevard, north of Tropical Parkway, in the future. The Lodge III study also established that a total of 334 cfs would drain east in Tropical Parkway and a total of 444 cfs would drain south in Decatur Boulevard adjacent to the Lodge III site. Hence, the existing surface flow in Tropical Parkway is 282 cfs and the existing surface flow in Decatur Boulevard is 392 cfs at this location.

The Lodge III study essentially established the hydrologic design criteria in this area. The City of North Las Vegas had concurred with the conclusions of the Lodge III study. It is also important to note that the flows established in the Lodge III study somewhat deviate from the 1999 City of Las Vegas Northwest Neighborhood Study Update (see attached excerpt).

The following flows were established in the subject Decatur/215 drainage study:

Flows draining east in Tropical Parkway (west of Decatur):

Existing Q_{10}=59 cfs total (52 cfs in storm drain and 7 cfs surface flow)
Existing Q_{100}=350 cfs total (52 cfs in storm drain and 298 cfs surface flow)

Developed Q_{10}=58 cfs total (52 cfs in storm drain and 6 cfs surface flow)
Developed Q_{100}=346 cfs total (52 cfs in storm drain and 294 cfs surface flow)

Flows draining south in Decatur Boulevard (north of Tropical):

Existing Q_{10}=72 cfs total (72 cfs surface flow)
Existing Q_{100}=197 cfs total (197 cfs surface flow)

Developed Q_{10}=95 cfs total (86 cfs in storm drain and 9 cfs surface flow)

Developed Q_{100}=241 cfs total (86 cfs in storm drain and 155 cfs surface flow)

The flows draining to the intersection are not significantly impacted by the development of the Decatur/215 project. The existing and developed flows in Tropical Parkway (west of Decatur) are essentially the same. The flows in Decatur Boulevard (north of Tropical Parkway) have increased by 44 cfs in the 100-year storm, but the storm drain reduces the surface flow to 155 cfs. Hence, the development of the project will not cause significant negative impact the drainage patterns at the intersection of Tropical Parkway and Decatur Boulevard. The City of Las Vegas had requested that a flow split calculation be performed for this intersection. The previous drainage study did not provide a flow split calculation, but only provided calculations showing the maximum flow in Decatur if no split occurred.

The Pima County Method was utilized to estimate a flow split at the intersection for the developed condition. Since most of the flow in Decatur Boulevard (north of the intersection) is contained in the west side of the street-it was assumed that this flow would essentially continue south in Decatur. The flow draining east to the intersection in Tropical Parkway was assumed to split based on the Pima County Method. It was also assumed that no surface flow split would occur at the intersection for the 10-year storm. The flow split estimate (see attached calculations) yields the following flows downstream of the intersection:

Flows draining east in Tropical Parkway (east of Decatur):

Developed Q_{10}=0 cfs total (0 cfs surface flow)
Developed Q_{100}=193 cfs total (193 cfs surface flow)

Flows draining south in Decatur Boulevard (south of Tropical):

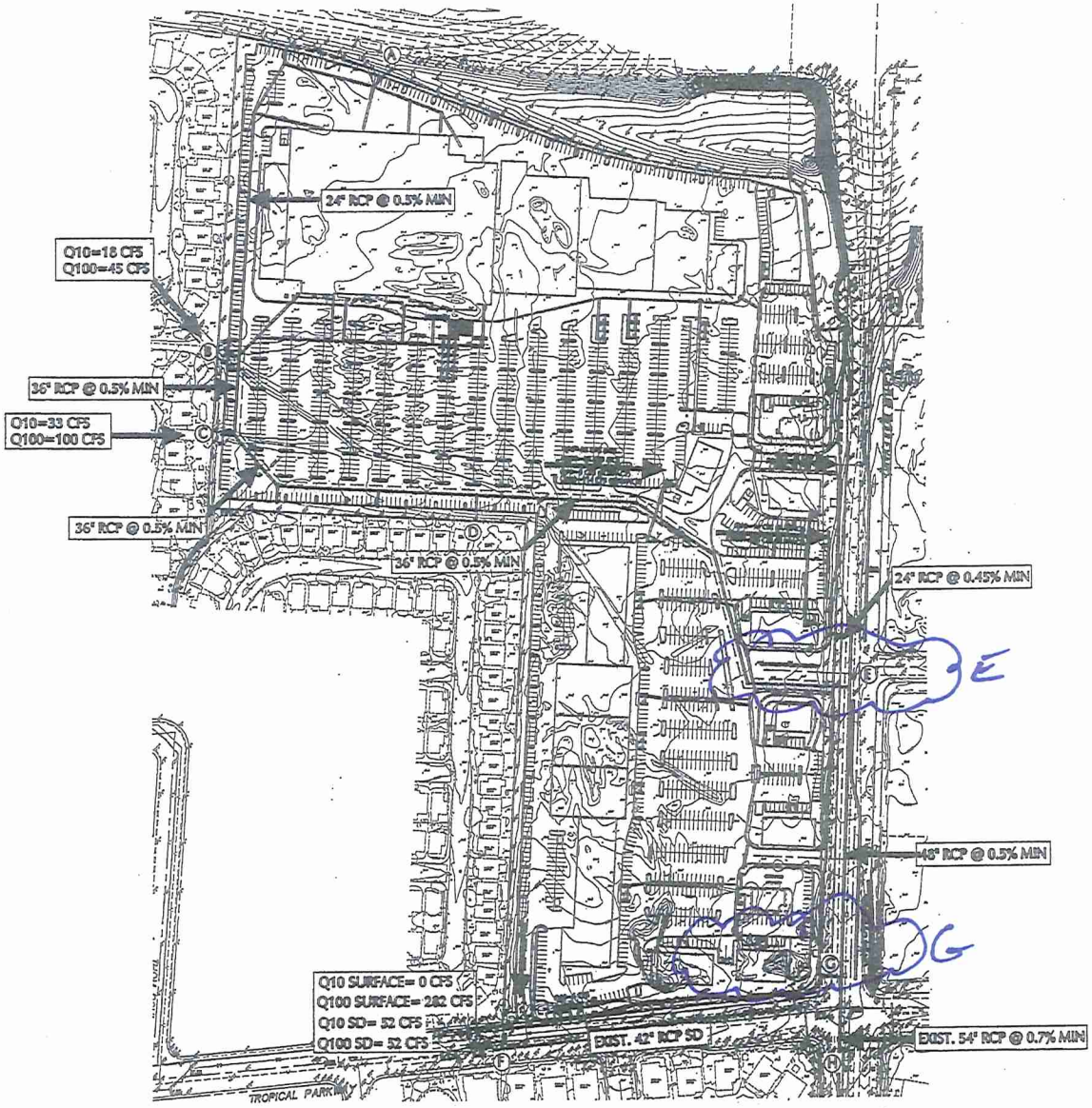
Developed Q_{10}=153 cfs total (138 cfs in storm drain and 15 cfs surface flow)
Developed Q_{100}=394 cfs total (138 cfs in storm drain and 256 cfs surface flow)

The resulting flow split estimate shows that the flows in Decatur, south of Tropical Parkway, are about the same as the previous surface flow of 392 cfs. Also, the storm drain design flow at this location (149 cfs) is not exceeded. For these reasons it is concluded that the development of the Decatur/215 project is consistent with established flows and drainage patterns in this vicinity.

If you have any questions or require additional information, please call me at Southwest Engineering at (702) 648-9700.

Sincerely,
SOUTHWEST ENGINEERING

Ed Rajnovich
Project Manager



STORM DRAIN SUMMARY				
PT	Q10 IN SD	Q100 IN SD	Q10 INTO DI	Q100 INTO DI
A	4 CFS	9 CFS	4	9
B	22 CFS	34 CFS	18	25
C	55 CFS	55 CFS	33	21
D	55 CFS	55 CFS	0	0
E	86 CFS	86 CFS	31	31
F	52 CFS	52 CFS	0	0
G	86 CFS	86 CFS	0	0
H	138 CFS	138 CFS	0	0

SURFACE FLOW SUMMARY		
PT	Q10	Q100
A	0 CFS	0 CFS
B	0 CFS	20 CFS
C	0 CFS	99 CFS
D	8 CFS	114 CFS
E	0 CFS	138 CFS
F	0 CFS	282 CFS
G	9 CFS	155 CFS
H	15 CFS	439 CFS

DECATUR/TROPICAL

070619.00

FIGURE 8

STORM DRAIN

SYSTEM (REVISED 01/08)

1"=100'

This grading plan is a part of drainage study (126) which was received 1/29/2008 and rejected on 2/13/2008

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Decatur Blvd Q10 EX Sec C
Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	3.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.013	
Water Surface Elevation	79.17	ft
Elevation Range	78.82 to 80.11	
Flow Area	1.8	ft²
Wetted Perimeter	20.94	ft
Top Width	20.47	ft
Actual Depth	0.35	ft
Critical Elevation	79.17	ft
Critical Slope	0.59	%
Velocity	1.68	ft/s
Velocity Head	0.04	ft
Specific Energy	79.22	ft
Froude Number	1.00	
Flow Type	Supercritical	

Dry Lane

$\frac{79.41 - 79.17}{0.02} = 22$ ST

OK

Calculation Messages:
Water elevation exceeds lowest end station by 0.1015464 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.50	0.033
0+08.50	0+10.00	0.013
0+10.00	0+46.00	0.016
0+46.00	0+50.00	0.013
0+50.00	0+94.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	79.36
0+08.00	79.32
0+08.50	79.32
0+08.50	78.82
0+10.00	78.99

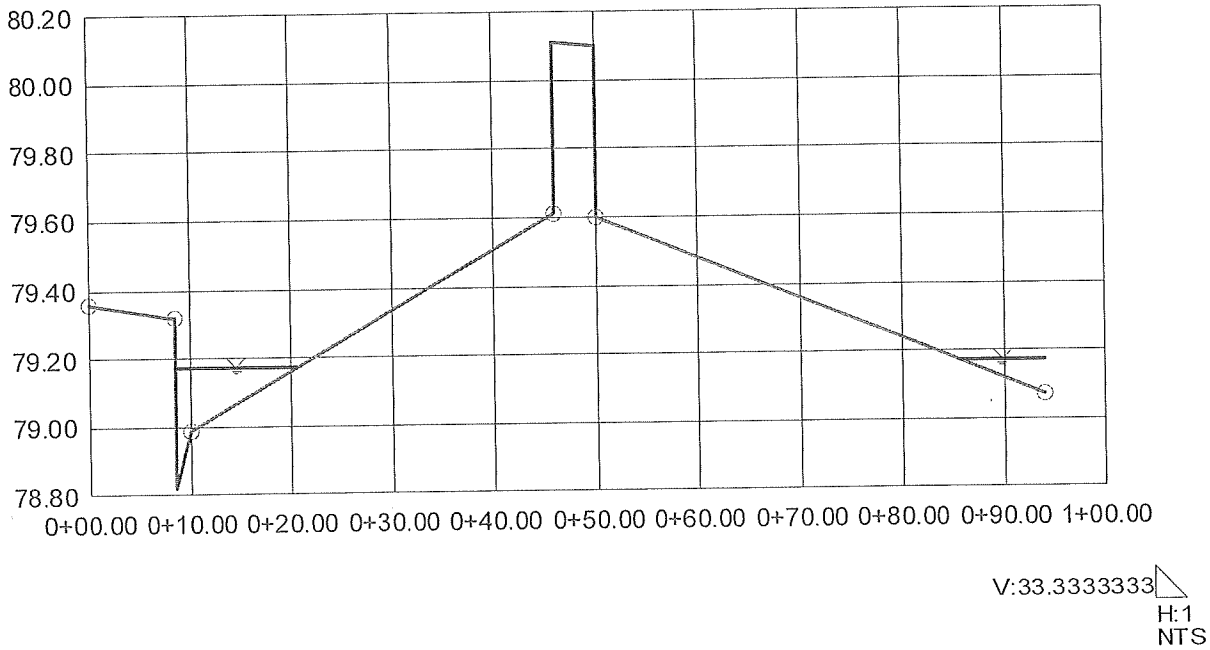
Decatur Blvd Q10 EX Sec C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+46.00	79.61
0+46.00	80.11
0+50.00	80.10
0+50.00	79.60
0+94.00	79.07

Decatur Blvd Q10 Ex Sec C
Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Channel Slope	0.60 %
Water Surface Elevation	79.17 ft
Elevation Range	78.82 to 80.11
Discharge	3.00 cfs



Decatur Blvd Q10 EX Sec C
Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	144.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	79.73	ft
Elevation Range	78.82 to 80.11	
Flow Area	37.5	ft²
Wetted Perimeter	91.80	ft
Top Width	90.00	ft
Actual Depth	0.91	ft
Critical Elevation	79.74	ft
Critical Slope	0.54	%
Velocity	3.84	ft/s
Velocity Head	0.23	ft
Specific Energy	79.96	ft
Froude Number	1.05	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.66057292 ft.
Flow is divided.

$$\frac{V \times D}{2}$$

$$3.84 \times 0.91 = 3.49$$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.50	0.033
0+08.50	0+10.00	0.013
0+10.00	0+46.00	0.016
0+46.00	0+50.00	0.013
0+50.00	0+94.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	79.36
0+08.00	79.32
0+08.50	79.32
0+08.50	78.82
0+10.00	78.99

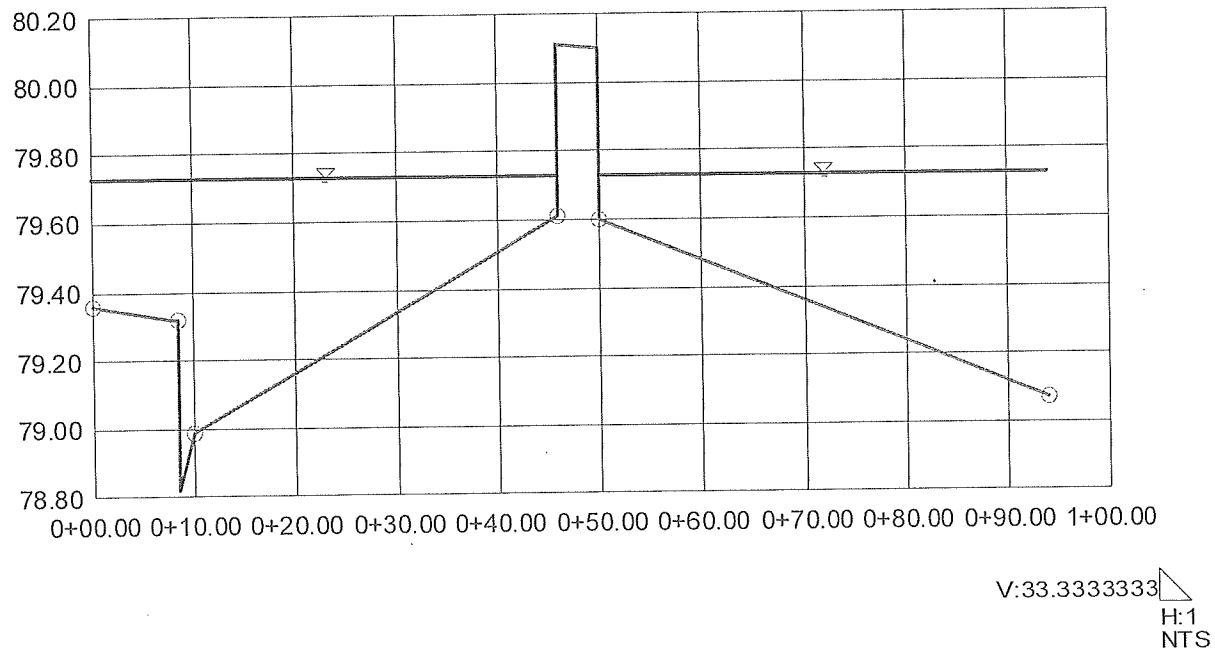
Decatur Blvd Q10 EX Sec C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+46.00	79.61
0+46.00	80.11
0+50.00	80.10
0+50.00	79.60
0+94.00	79.07

Decatur Blvd Q10 Ex Sec C
Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 EX Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.60	%
Water Surface Elevation	79.73	ft
Elevation Range	78.82 to 80.11	
Discharge	144.00	cfs



Decatur Blvd Q10 INT Sec C
Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.40 %
Discharge	3.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.013
Water Surface Elevation	79.13 ft
Elevation Range	78.74 to 80.11
Flow Area	2.0 ft²
Wetted Perimeter	21.77 ft
Top Width	21.35 ft
Actual Depth	0.39 ft
Critical Elevation	78.74 ft
Critical Slope	0.00 %
Velocity	1.47 ft/s
Velocity Head	0.03 ft
Specific Energy	79.16 ft
Froude Number	0.84
Flow Type	Subcritical

Calculation Messages:
Flow is divided.

Dry Lane

$\frac{79.61 - 79.13}{0.02} = 24\text{-}5t$

ok

2

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.50	0.033
0+08.50	0+10.00	0.013
0+10.00	0+46.00	0.016
0+46.00	0+50.00	0.013
0+50.00	1+00.00	0.016
1+00.00	1+02.00	0.013
1+02.00	1+12.00	0.033

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	79.36
0+08.00	79.32
0+08.50	79.32
0+10.00	78.99

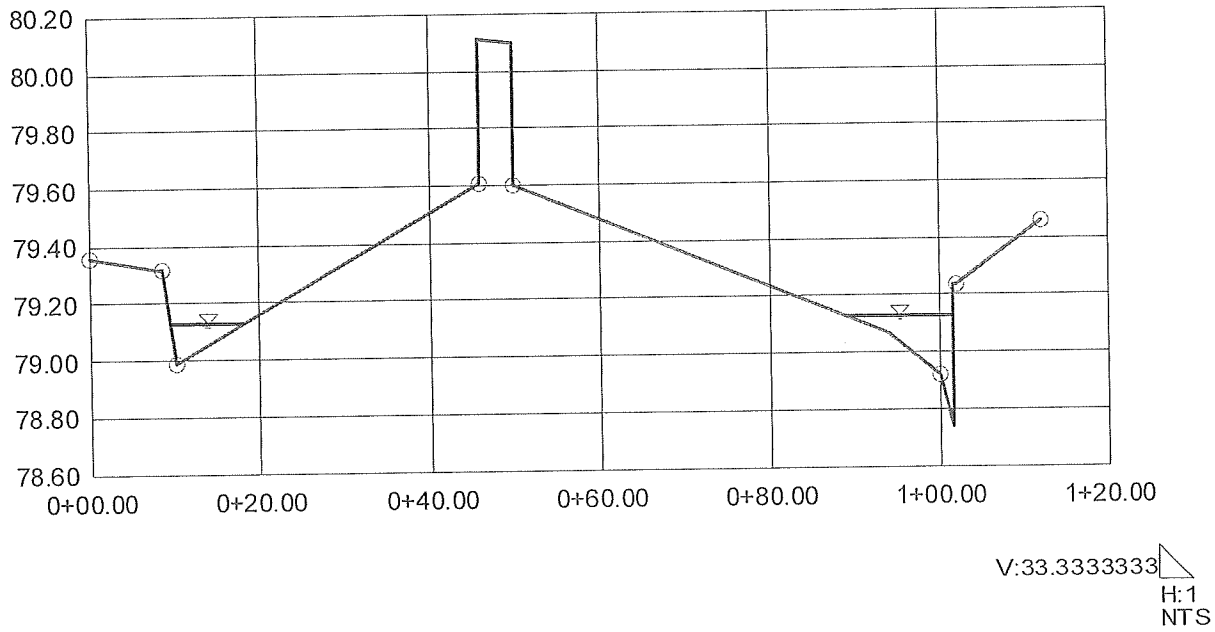
Decatur Blvd Q10 INT Sec C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+46.00	79.61
0+46.00	80.11
0+50.00	80.10
0+50.00	79.60
0+94.00	79.07
1+00.00	78.92
1+01.50	78.74
1+01.50	79.24
1+02.00	79.24
1+12.00	79.46

Decatur Blvd Q10 Int Sec C
Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.40	%
Water Surface Elevation	79.13	ft
Elevation Range	78.74 to 80.11	
Discharge	3.00	cfs



Decatur Blvd Q100 INTSec C
Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.40	%
Discharge	144.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	79.72	ft
Elevation Range	78.74 to 80.11	
Flow Area	45.9	ft²
Wetted Perimeter	109.41	ft
Top Width	108.00	ft
Actual Depth	0.98	ft
Critical Elevation	78.74	ft
Critical Slope	0.00	%
Velocity	3.14	ft/s
Velocity Head	0.15	ft
Specific Energy	79.87	ft
Froude Number	0.85	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.36115375 ft.
Flow is divided.

$V \times D$

$3.14 \times 0.98 = 3.1$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.00	0.033
0+08.00	0+10.00	0.013
0+10.00	0+46.00	0.016
0+46.00	0+50.00	0.013
0+50.00	1+00.00	0.016
1+00.00	1+02.00	0.013
1+02.00	1+12.00	0.033

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	79.36
0+08.00	79.32
0+08.50	79.32

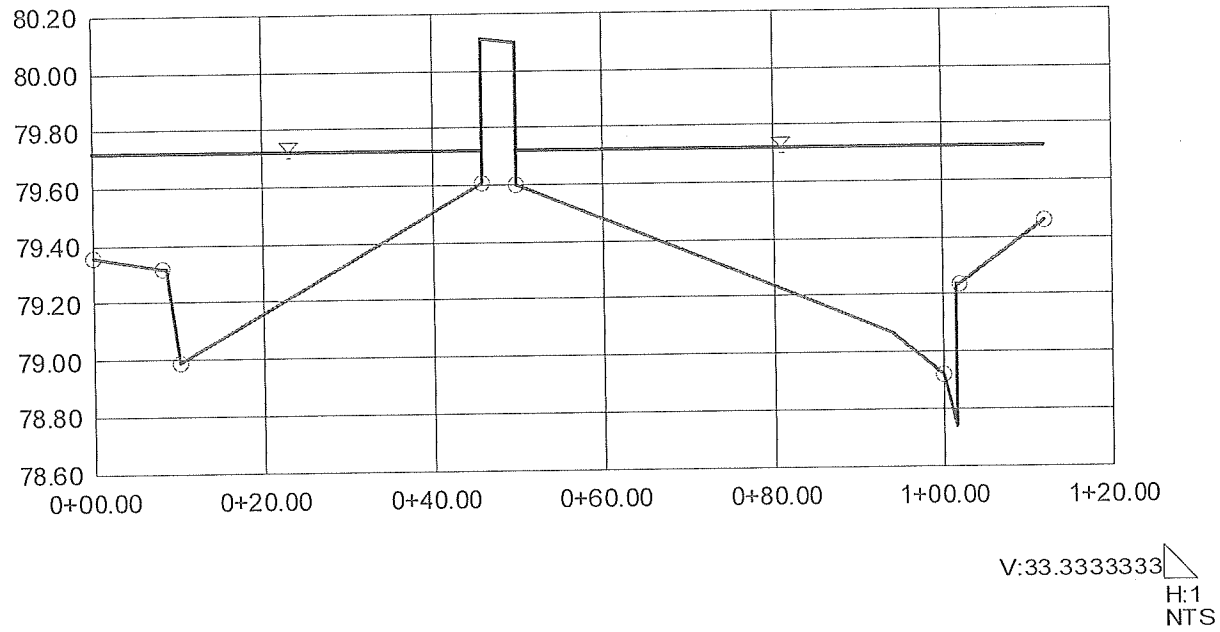
Decatur Blvd Q100 INTSec C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+10.00	78.99
0+46.00	79.61
0+46.00	80.11
0+50.00	80.10
0+50.00	79.60
0+94.00	79.07
1+00.00	78.92
1+01.50	78.74
1+01.50	79.24
1+02.00	79.24
1+12.00	79.46

Decatur Blvd Q100 Int Sec C
Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 INT Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.017
Channel Slope	0.40 %
Water Surface Elevation	79.72 ft
Elevation Range	78.74 to 80.11
Discharge	144.00 cfs



Decatur Blvd Q10 Dev Sec C
Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.40	%
Discharge	3.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.013	
Water Surface Elevation	79.13	ft
Elevation Range	78.74 to 80.11	
Flow Area	2.0	ft²
Wetted Perimeter	21.77	ft
Top Width	21.35	ft
Actual Depth	0.39	ft
Critical Elevation	78.74	ft
Critical Slope	0.00	%
Velocity	1.47	ft/s
Velocity Head	0.03	ft
Specific Energy	79.16	ft
Froude Number	0.84	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Dry Lane

$\frac{79.61 - 79.13}{0.02} = \frac{24'}{2}$

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.50	0.033
0+08.50	0+10.00	0.013
0+10.00	0+46.00	0.016
0+46.00	0+50.00	0.013
0+50.00	1+00.00	0.016
1+00.00	1+02.00	0.013
1+02.00	1+12.00	0.033

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	79.36
0+08.00	79.32
0+08.50	79.32
0+10.00	78.99

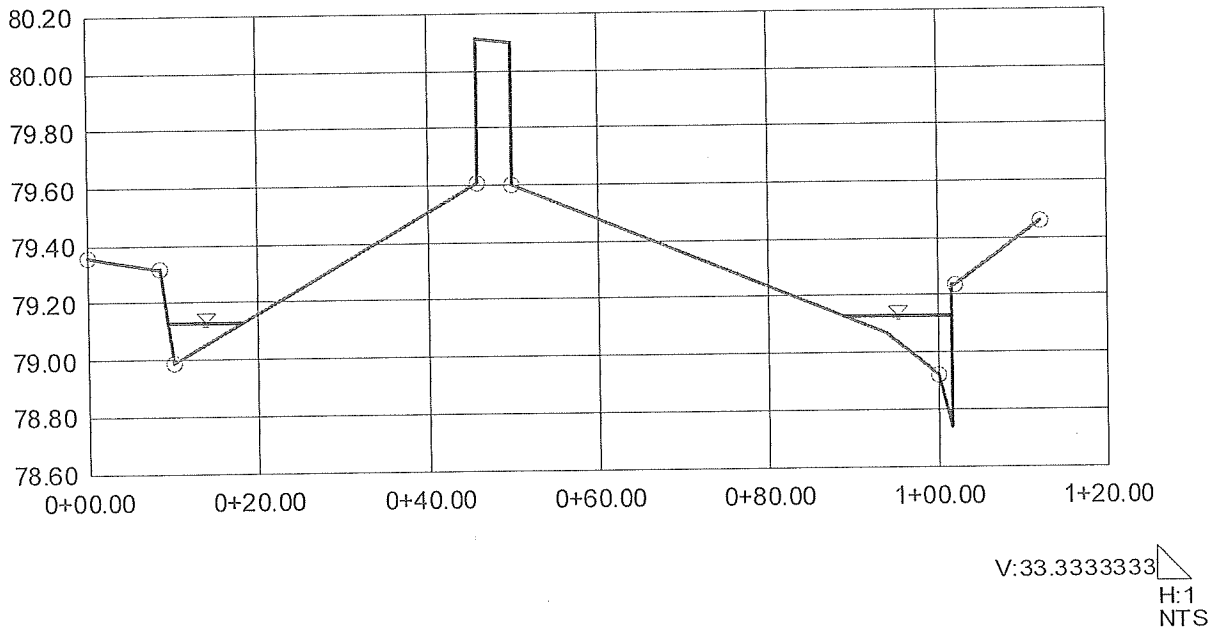
Decatur Blvd Q10 Dev Sec C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+46.00	79.61
0+46.00	80.11
0+50.00	80.10
0+50.00	79.60
0+94.00	79.07
1+00.00	78.92
1+01.50	78.74
1+01.50	79.24
1+02.00	79.24
1+12.00	79.46

Decatur Blvd Q10 Dev Sec C
Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q10 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Channel Slope	0.40 %
Water Surface Elevation	79.13 ft
Elevation Range	78.74 to 80.11
Discharge	3.00 cfs



Decatur Blvd Q100 Dev Sec C
Worksheet for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.40	%
Discharge	144.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	79.72	ft
Elevation Range	78.74 to 80.11	
Flow Area	45.9	ft²
Wetted Perimeter	109.41	ft
Top Width	108.00	ft
Actual Depth	0.98	ft
Critical Elevation	78.74	ft
Critical Slope	0.00	%
Velocity	3.14	ft/s
Velocity Head	0.15	ft
Specific Energy	79.87	ft
Froude Number	0.85	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.3618724 ft.
Flow is divided.

$V \times D$

$3.14 \times 0.98 = 3.1$

$\frac{3.1}{2}$

OK

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+08.00	0.033
0+08.00	0+10.00	0.013
0+10.00	0+46.00	0.016
0+46.00	0+50.00	0.013
0+50.00	1+00.00	0.016
1+00.00	1+02.00	0.013
1+02.00	1+12.00	0.033

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	79.36
0+08.00	79.32
0+08.50	79.32

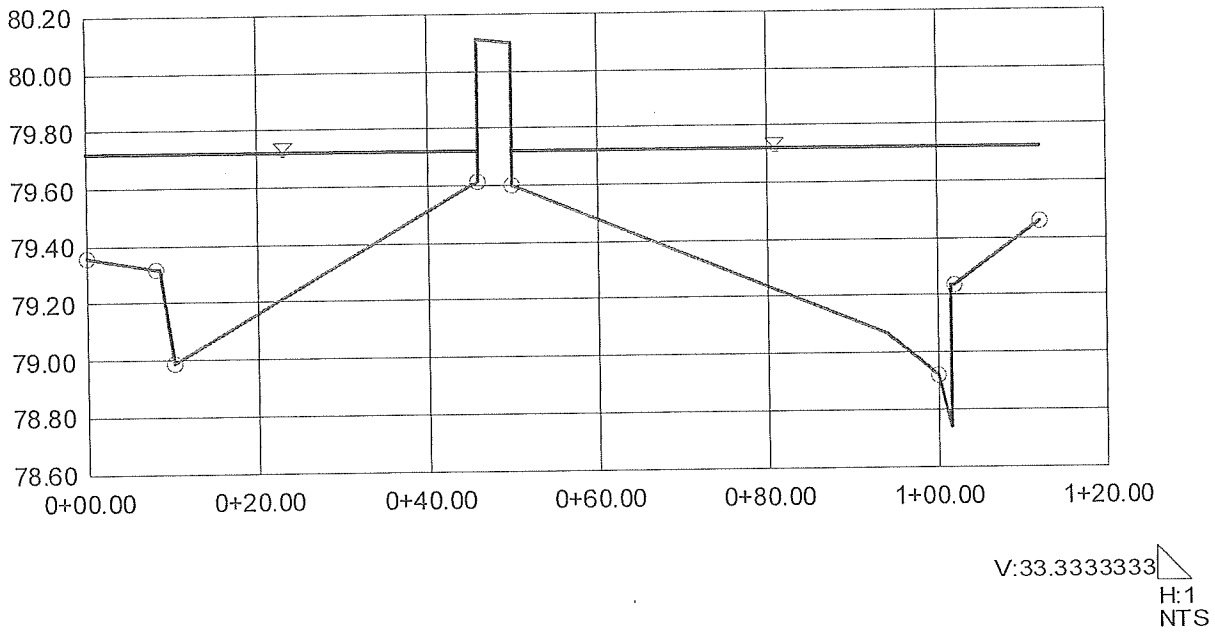
Decatur Blvd Q100 Dev Sec C
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+10.00	78.99
0+46.00	79.61
0+46.00	80.11
0+50.00	80.10
0+50.00	79.60
0+94.00	79.07
1+00.00	78.92
1+01.50	78.74
1+01.50	79.24
1+02.00	79.24
1+12.00	79.46

Decatur Blvd Q100 Dev Sec C
Cross Section for Irregular Channel

Project Description	
Worksheet	Decatur Boulevard Q100 Sec C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.017
Channel Slope	0.40 %
Water Surface Elevation	79.72 ft
Elevation Range	78.74 to 80.11
Discharge	144.00 cfs



APPENDIX B

Response to Comment 4

Drop inlet sizing HEC-22

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 12/12/2011

Project No. :Tropical & Centennial
Project Name.:
Computed by :Ray

Inlets on Grade: Curb Opening, Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0090
Sx	Pavement Cross Slope	(ft/ft)	0.0200
Sw	Gutter Cross Slope	(ft/ft)	0.1130
n	Manning's Coefficient		0.016
W	Gutter Width (ft)		1.50
a	Gutter Depression (inch)		0.67
Q	Discharge (cfs)		3.000
T	Width of Spread (ft)		10.22

Gutter Flow

Eo	Gutter Flow Ratio	0.475
d	Depth of Flow (ft)	0.34
V	Average Velocity (ft/sec)	2.61

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Curb Opening	12.43	7.50	0.00	0.004	2.996
Parallel Bar P-1-7/8	1.50	7.49	0.85	2.538	0.458
Combination			0.85	2.542	0.458

Note: The curb opening length in the input screen is the total length of the curb opening including its length along the grate.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Sag
Date: 12/06/2011

Project No. :MGL1101.000
Project Name.:TROPICAL PKWY
Computed by :

Inlets on Sag: Equal-Length Combination Inlet

Roadway and Discharge Data

		Composite/Dep
	Cross Slope	
Sx	Pavement Cross Slope (ft/ft)	0.0078
Sw	Gutter Cross Slope (ft/ft)	0.1130
n	Manning's Coefficient	0.016
W	Gutter Width (ft)	1.50
a	Gutter Depression (inch)	0.67

Inlet Interception

		Curb-Opening
	Inlet Type *Sag*	
L	Curb-Opening Length (ft)	15.00
H	Curb-Opening Height (in)	8.00
	Inlet Type *Sag*	Parallel Bar P-1-7/8
T	Width of Spread (ft)	79.88
WGR	Grate Width (ft)	1.50
L	Grate Length (ft)	15.00
	Inlet Type *Sag*	Equal Length Combination
d_ave	Depth of Flow (ft)	0.724
d_curb	Depth at Curb (ft)	0.837
Qi	Intercepted Flow (cfs)	25.000

APPENDIX C

Response to Comment 6

10-Year Interim Condition HEC-1
100-Year Interim Condition HEC-1
10-Year Developed Condition HEC-1
100-Year Developed Condition HEC-1
10-Year Existing Condition HEC-1
100-Year Existing Condition HEC-1
Reference Material Twilight at Riverwalk

10-Year Interim Condition

HEC-1

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1*****************************************
*****************************************
 *                                       *                                       *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                       *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998              *                                       *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1                *                                       *          609 SECOND STREET
*
 *                                       *                                       *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   09DEC11  TIME  10:51:30   *                                       *           (916) 756-1104
*
 *                                       *                                       *
*
 *****************************************
*****************************************
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

              *DIAGRAM
    1         ID     PROJECT NAME
    2         ID     TECHNICAL DRAINAGE STUDY
    3         ID     10-YR INTERIM CONDITION
    4         ID
    5         ID     RETURN PERIOD ------- 10- AND 100-YEAR
    6         ID     DISTRIBUTION -------- 6-HOUR SDN3
    7         ID     PROJECT NO. --------- MGL1101.000
    8         ID     FILENAME ------------ INTERIM.H1
    9         ID     DATE ---------------- SEPTEMBER 2011
   10         ID     MODELED BY ---------- SLATER HANIFAN GROUP
   11         ID
   12         ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
   13         ID        DRAINAGE AREA (MI^2)       DARF
   14         ID        100-YR                     0.990
   15         ID        10-YR                      0.570
   16         ID
   17         IT       5       0       0     300
   18         IO       5       0       0
   19         IN       5       0       0
   20         JR    PREC   0.570       0
              *

   21         KK    DEC4
   22         BA   .0034
   23         PB    2.77
   24         PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
   25         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
   26         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
   27         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   28         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   29         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
   30         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
   31         PC   0.998   0.999   1.000
   32         LS       0    98.0
   33         UD   0.136
              *

   34         KK    DEC3
   35         BA   .0012
   36         LS       0    98.0
   37         UD   0.100
              *

   38         KK   CP.I1
   39         KM   COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
   40         HC       2
              *
```

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   41          KK     005
   42          BA   .0024
   43          LS       0    98.0
   44          UD   0.100
               *
1                                        HEC-1 INPUT                                                    PAGE  2

 LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   45          KK     NNS
   46          KM   REFERNCE FROM CNLV NN STUDY BASIN (DANN3A4)
   47          BA     .50
   48          QI       0       0       0       0       0       0       0       0       0       0
   49          QI       0       0       0       0       0       0       0       0       0       0
   50          QI       0       0       0       0       0       0       0       0       0       0
   51          QI       0       0       0       0       0       0       0       0       0       0
   52          QI       0       0       0       0       0       0       0       0       0       0
   53          QI       0       0       0       0       0       0       0       0       0       0
   54          QI       0       0       0       0       0       0       0       0       0       0
   55          QI       0       0       0       0       0       0       0       0       0       0
   56          QI       0       0       0       0       0       0       0       0       0       0
   57          QI       0       0       0       0       0       0       0       0       0       0
               *

   58          KK   CP.I2
   59          KM   COMBINATION POINT EAST OF C-STORE IN TROPICAL
   60          HC       2
               *

   61          KK   TROP1
   62          BA   .0042
   63          LS       0    98.0
   64          UD   0.140
               *

   65          KK    ON1I
   66          BA   .0024
   67          LS       0    83.3
   68          UD   0.100
               *

   69          KK    ON2I
   70          BA   .0135
   71          LS       0    83.3
   72          UD   0.212
               *

   73          KK   CP.I3
   74          KM   COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
   75          HC       4
               *

   76          KK   RH.5D
   77          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
   78          BA   .0032
   79          LS       0    91.0
   80          UD   0.098
               *
1                                        HEC-1 INPUT                                                    PAGE  3

 LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   81          KK   RH.6D
   82          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
   83          BA   .0050
   84          LS       0    91.0
   85          UD   0.107
               *

   86          KK   CP.D6
   87          KM   COMBINATION POINT AT INTERSECTION TWILIGHT
   88          KM   COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
   89          HC       2
               *

   90          KK   RH.4D
   91          BA   .0005
   92          LS       0    91.0
   93          UD   0.069
               *

   94          KK   CENT2
   95          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
   96          BA   .0026
   97          LS       0    98.0
   98          UD   0.082
               *

   99          KK   CENT4
  100          BA   .0006
  101          LS       0    98.0
  102          UD   0.100
```

```
                *
          103   KK   CP.D7
          104   KM   COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
          105   HC       4
                *
          106   KK   CP.I5
          107   KM   COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
          108   HC       2
                *
          109   KK   OF.2I
          110   KM   OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
          111   BA   .0135
          112   LS       0    83.4
          113   UD   0.166
                *
1                                        HEC-1 INPUT                                                    PAGE  4

          LINE  ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          114   KK    RIC1
          115   BA   .0014
          116   LS       0    98.0
          117   UD   0.100
                *
          118   KK   CP.I8
          119   KM   COMBINATION POINT IN RICE
          120   HC       2
                *
          121   ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

   21        DEC4
             .
             .
   34        .        DEC3
             .          .
             .          .
   38       CP.I1.............
             .
             .
   41        .         005
             .          .
             .          .
   45        .          .         NNS
             .          .          .
             .          .          .
   58        .       CP.I2.............
             .          .
             .          .
   61        .          .       TROP1
             .          .          .
             .          .          .
   65        .          .          .        ON1I
             .          .          .          .
             .          .          .          .
   69        .          .          .          .        ON2I
             .          .          .          .          .
             .          .          .          .          .
   73        .       CP.I3.....................................
             .          .
             .          .
   76        .          .       RH.5D
             .          .          .
             .          .          .
   81        .          .          .       RH.6D
             .          .          .          .
             .          .          .          .
   86        .          .       CP.D6.............
             .          .          .
             .          .          .
   90        .          .          .       RH.4D
             .          .          .          .
             .          .          .          .
   94        .          .          .          .       CENT2
             .          .          .          .          .
             .          .          .          .          .
   99        .          .          .          .          .       CENT4
             .          .          .          .          .         .
             .          .          .          .          .         .
  103        .          .       CP.D7.....................................
             .          .          .
             .          .          .
  106        .       CP.I5.............
             .          .
             .          .
```

```
  109          .           .       OF.2I
               .           .           .
               .           .           .
  114          .           .           .        RIC1
               .           .           .           .
               .           .           .           .
  118          .           .       CP.I8............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
****************************************
 *                                      *                                      *
*                                                                              *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *      *    U.S. ARMY CORPS OF ENGINEERS
*                                                                              *
 *               JUN   1998             *      *    HYDROLOGIC ENGINEERING CENTER
*                                                                              *
 *            VERSION 4.1               *      *         609 SECOND STREET
*                                                                              *
 *                                      *      *       DAVIS, CALIFORNIA 95616
*                                                                              *
 *  RUN DATE   09DEC11  TIME  10:51:30  *      *           (916) 756-1104
*                                                                              *
 *                                      *      *
*                                                                              *
 ****************************************
****************************************
```

PROJECT NAME
TECHNICAL DRAINAGE STUDY
10-YR INTERIM CONDITION

RETURN PERIOD ------- 10- AND 100-YEAR
DISTRIBUTION -------- 6-HOUR SDN3
PROJECT NO. --------- MGL1101.000
FILENAME ------------ INTERIM.H1
DATE ---------------- SEPTEMBER 2011
MODELED BY ---------- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS

DRAINAGE AREA (MI^2)	DARF
100-YR	0.990
10-YR	0.570

18 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION RATIO 1 .57
OPERATION	STATION	AREA	PLAN		
HYDROGRAPH AT					
+	DEC4	.00	1	FLOW	3.
				TIME	3.58

HYDROGRAPH AT +	DEC3	.00	1	FLOW TIME	1. 3.50
2 COMBINED AT +	CP.I1	.00	1	FLOW TIME	5. 3.58
HYDROGRAPH AT +	005	.00	1	FLOW TIME	3. 3.50
HYDROGRAPH AT +	NNS	.50	1	FLOW TIME	0. .00
2 COMBINED AT +	CP.I2	.50	1	FLOW TIME	3. 3.50
HYDROGRAPH AT +	TROP1	.00	1	FLOW TIME	4. 3.58
HYDROGRAPH AT +	ON1I	.00	1	FLOW TIME	1. 3.58
HYDROGRAPH AT +	ON2I	.01	1	FLOW TIME	4. 3.67
4 COMBINED AT +	CP.I3	.52	1	FLOW TIME	12. 3.58
HYDROGRAPH AT +	RH.5D	.00	1	FLOW TIME	2. 3.50
HYDROGRAPH AT +	RH.6D	.00	1	FLOW TIME	4. 3.50
2 COMBINED AT +	CP.D6	.01	1	FLOW TIME	6. 3.50
HYDROGRAPH AT +	RH.4D	.00	1	FLOW TIME	0. 3.50
HYDROGRAPH AT +	CENT2	.00	1	FLOW TIME	3. 3.50
HYDROGRAPH AT +	CENT4	.00	1	FLOW TIME	1. 3.50
4 COMBINED AT +	CP.D7	.01	1	FLOW TIME	10. 3.50
2 COMBINED AT +	CP.I5	.53	1	FLOW TIME	21. 3.58
HYDROGRAPH AT +	OF.2I	.01	1	FLOW TIME	5. 3.58
HYDROGRAPH AT +	RIC1	.00	1	FLOW TIME	2. 3.50
2 COMBINED AT +	CP.I8	.01	1	FLOW TIME	6. 3.58

+9 cfs surface

*** NORMAL END OF HEC-1 ***

100-Year Interim Condition

HEC-1

```
1*****************************************
*****************************************
 *                                       *                                       *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                       *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998              *                                       *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1                *                                       *         609 SECOND STREET
*
 *                                       *                                       *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   09DEC11  TIME  10:54:47   *                                       *           (916) 756-1104
*
 *                                       *                                       *
*
 *****************************************
*****************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

              *DIAGRAM
   1          ID     TROPICAL & CENTENNIAL ROADWAY IMPR
   2          ID     TECHNICAL DRAINAGE STUDY
   3          ID     100-YR INTERIM CONDITION
   4          ID
   5          ID     RETURN PERIOD ------- 10- AND 100-YEAR
   6          ID     DISTRIBUTION -------- 6-HOUR SDN3
   7          ID     PROJECT NO. --------- MGL1101.000
   8          ID     FILENAME ------------ INTERIM.H1
   9          ID     DATE ----------------- SEPTEMBER 2011
  10          ID     MODELED BY ---------- SLATER HANIFAN GROUP
  11          ID
  12          ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
  13          ID        DRAINAGE AREA (MI^2)        DARF
  14          ID        100-YR                      0.990
  15          ID        10-YR                       0.570
  16          ID
  17          IT      5       0       0     300
  18          IO      5       0       0
  19          IN      5       0       0
  20          JR    PREC   0.990       0
              *

  21          KK    DEC4
  22          BA   .0034
  23          PB    2.77
  24          PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
  25          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
  26          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
  27          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
  28          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
  29          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
  30          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
  31          PC   0.998   0.999   1.000
  32          LS       0    98.0
  33          UD   0.136
              *

  34          KK    DEC3
  35          BA   .0012
  36          LS       0    98.0
  37          UD   0.100
              *

  38          KK   CP.I1
  39          KM   COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
  40          HC       2
              *
```

```
41          KK     005
42          BA   .0024
43          LS      0    98.0
44          UD   0.100
            *
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

45          KK     NNS
46          KM   REFERNCE FROM CNLV NN STUDY BASIN (DANN3A4)
47          BA     .50
48          QI       0       0       0       0       0       0       0       0       0       0
49          QI       0       0       0       0       0       0       0       0       0       0
50          QI       0       0       0       1       1       1       0       0       1       1
51          QI       1       1       1       1       1       1       1       1       1       1
52          QI       1       1       5      45      89     121     151     186     219     223
53          QI     193     151     110      73      43      24      12       4       1       1
54          QI       1       1       1       1       1       1       1       1       1       1
55          QI       1       1       1       1       1       1       1       1       1       1
56          QI       1       0       0       0       0       0       0       0       0       0
57          QI       0       0       0       0       0       0       0       0       0       0
            *

58          KK   CP.I2
59          KM   COMBINATION POINT EAST OF C-STORE IN TROPICAL
60          HC       2
            *

61          KK   TROP1
62          BA   .0042
63          LS       0    98.0
64          UD   0.140
            *

65          KK    ON1I
66          BA   .0024
67          LS       0    83.3
68          UD   0.100
            *

69          KK    ON2I
70          BA   .0135
71          LS       0    83.3
72          UD   0.212
            *

73          KK   CP.I3
74          KM   COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
75          HC       4
            *

76          KK   RH.5D
77          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
78          BA   .0032
79          LS       0    91.0
80          UD   0.098
            *
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

81          KK   RH.6D
82          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
83          BA   .0050
84          LS       0    91.0
85          UD   0.107
            *

86          KK   CP.D6
87          KM   COMBINATION POINT AT INTERSECTION TWILIGHT
88          KM   COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
89          HC       2
            *

90          KK   RH.4D
91          BA   .0005
92          LS       0    91.0
93          UD   0.069
            *

94          KK   CENT2
95          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
96          BA   .0026
97          LS       0    98.0
98          UD   0.082
            *

99          KK   CENT4
100         BA   .0006
101         LS       0    98.0
102         UD   0.100
```

```
                    *
          103       KK   CP.D7
          104       KM   COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
          105       HC       4
                    *
          106       KK   CP.I5
          107       KM   COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
          108       HC       2
                    *
          109       KK   OF.2I
          110       KM   OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
          111       BA   .0135
          112       LS       0    83.4
          113       UD   0.166
                    *
1                                                HEC-1 INPUT                                                PAGE  4

          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          114       KK    RIC1
          115       BA   .0014
          116       LS       0    98.0
          117       UD   0.100
                    *
          118       KK   CP.I8
          119       KM   COMBINATION POINT IN RICE
          120       HC       2
                    *
          121       ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE       (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

   21          DEC4
                .
                .
   34           .        DEC3
                .          .
                .          .
   38        CP.I1.........
                .
                .
   41           .         005
                .          .
                .          .
   45           .          .        NNS
                .          .         .
                .          .         .
   58           .       CP.I2.........
                .          .
                .          .
   61           .          .       TROP1
                .          .         .
                .          .         .
   65           .          .          .       ON1I
                .          .          .         .
                .          .          .         .
   69           .          .          .         .       ON2I
                .          .          .         .         .
                .          .          .         .         .
   73           .       CP.I3.....................................
                .          .
                .          .
   76           .          .       RH.5D
                .          .         .
                .          .         .
   81           .          .          .       RH.6D
                .          .          .         .
                .          .          .         .
   86           .          .       CP.D6.........
                .          .         .
                .          .         .
   90           .          .          .       RH.4D
                .          .          .         .
                .          .          .         .
   94           .          .          .         .       CENT2
                .          .          .         .         .
                .          .          .         .         .
   99           .          .          .         .         .       CENT4
                .          .          .         .         .         .
                .          .          .         .         .         .
  103           .          .       CP.D7.....................................
                .          .         .
                .          .         .
  106           .       CP.I5.........
                .          .
                .          .
```

```
  109          .          .       OF.2I
               .          .          .
               .          .          .
  114          .          .          .        RIC1
               .          .          .          .
               .          .          .          .
  118          .          .       CP.I8.....
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*****************************************
 *                                       *
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *                                       *
 *               JUN   1998              *
 *                                       *
 *            VERSION 4.1                *
 *                                       *
 *                                       *
 *                                       *
 *  RUN DATE   09DEC11  TIME  10:54:47   *
 *                                       *
 *                                       *
 *                                       *
 *****************************************
*****************************************
```

```
*
*   U.S. ARMY CORPS OF ENGINEERS
*   HYDROLOGIC ENGINEERING CENTER
*        609 SECOND STREET
*      DAVIS, CALIFORNIA 95616
*          (916) 756-1104
*
```

TROPICAL & CENTENNIAL ROADWAY IMPR
TECHNICAL DRAINAGE STUDY
100-YR INTERIM CONDITION

RETURN PERIOD ------- 10- AND 100-YEAR
DISTRIBUTION -------- 6-HOUR SDN3
PROJECT NO. --------- MGL1101.000
FILENAME ------------ INTERIM.H1
DATE ---------------- SEPTEMBER 2011
MODELED BY ---------- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS

DRAINAGE AREA (MI^2)	DARF
100-YR	0.990
10-YR	0.570

```
  18 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE    2    0  ENDING DATE
                      NDTIME      0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

     JP           MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

     JR           MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                  .99
1
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .99
HYDROGRAPH AT					
+	DEC4	.00	1	FLOW	6.
				TIME	3.58

HYDROGRAPH AT					
+	DEC3	.00	1	FLOW	2.
				TIME	3.50
2 COMBINED AT					
+	CP.I1	.00	1	FLOW	8.
				TIME	3.58
HYDROGRAPH AT					
+	005	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	NNS	.50	1	FLOW	223.
				TIME	4.08
2 COMBINED AT					
+	CP.I2	.50	1	FLOW	224.
				TIME	4.08
HYDROGRAPH AT					
+	TROP1	.00	1	FLOW	8.
				TIME	3.58
HYDROGRAPH AT					
+	ON1I	.00	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	ON2I	.01	1	FLOW	13.
				TIME	3.67
4 COMBINED AT					
+	CP.I3	.52	1	FLOW	230.
				TIME	4.08
HYDROGRAPH AT					
+	RH.5D	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	RH.6D	.00	1	FLOW	8.
				TIME	3.50
2 COMBINED AT					
+	CP.D6	.01	1	FLOW	13.
				TIME	3.50
HYDROGRAPH AT					
+	RH.4D	.00	1	FLOW	1.
				TIME	3.50
HYDROGRAPH AT					
+	CENT2	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	CENT4	.00	1	FLOW	1.
				TIME	3.50
4 COMBINED AT					
+	CP.D7	.01	1	FLOW	21.
				TIME	3.50
2 COMBINED AT					
+	CP.I5	.53	1	FLOW	233.
				TIME	4.08
HYDROGRAPH AT					
+	OF.2I	.01	1	FLOW	14.
				TIME	3.58
HYDROGRAPH AT					
+	RIC1	.00	1	FLOW	3.
				TIME	3.50
2 COMBINED AT					
+	CP.I8	.01	1	FLOW	17.
				TIME	3.58

+ 155 surface from Ref.

*** NORMAL END OF HEC-1 ***

10-Year Developed Condition

HEC-1

```
1****************************************
****************************************
 *                                      *
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                                      *
 *               JUN   1998             *
 *                                      *
 *            VERSION 4.1               *
 *                                      *
 *                                      *
 *                                      *
 *  RUN DATE   09DEC11  TIME  10:16:38  *
 *                                      *
 *                                      *
 *                                      *
 ****************************************
****************************************
```

```
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

              *DIAGRAM
    1         ID     TROPICAL & CENTENNIAL ROADWAY
    2         ID     TECHNICAL DRAINAGE STUDY
    3         ID     10-YEAR DEVELOPED
    4         ID
    5         ID     RETURN PERIOD -------- 10-YR
    6         ID     DISTRIBUTION --------- 6-HOUR SDN3
    7         ID     PROJECT NO. ---------- MGL1101.000
    8         ID     FILENAME ------------- 10YRDEV.H1
    9         ID     DATE ----------------- DECEMBER 2011
   10         ID     MODELED BY ----------- SLATER HANIFAN GROUP
   11         ID
   12         ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
   13         ID        DRAINAGE AREA (MI^2)        DARF
   14         ID        100-YR                      0.990
   15         ID        10-YR                       0.570
   16         ID
   17         IT       5       0       0     300
   18         IO       5       0       0
   19         IN       5       0       0
   20         JR    PREC   0.570       0
              *

   21         KK    DEC4
   22         BA   .0034
   23         PB    2.77
   24         PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
   25         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
   26         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
   27         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   28         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   29         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
   30         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
   31         PC   0.998   0.999   1.000
   32         LS       0    98.0
   33         UD   0.136
              *

   34         KK    DEC3
   35         BA   .0012
   36         LS       0    98.0
   37         UD   0.100
              *

   38         KK   CP.D1
   39         KM   COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
   40         HC       2
              *
```

```
41          KK     005
42          BA   .0024
43          LS       0    98.0
44          UD   0.100
            *
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

45          KK     NNS
46          KM   REFERNCE FROM CNLV NN STUDY BASIN (DANN3A4)
47          BA     .50
48          QI       0       0       0       0       0       0       0       0       0       0
49          QI       0       0       0       0       0       0       0       0       0       0
50          QI       0       0       0       0       0       0       0       0       0       0
51          QI       0       0       0       0       0       0       0       0       0       0
52          QI       0       0       0       0       0       0       0       0       0       0
53          QI       0       0       0       0       0       0       0       0       0       0
54          QI       0       0       0       0       0       0       0       0       0       0
55          QI       0       0       0       0       0       0       0       0       0       0
56          QI       0       0       0       0       0       0       0       0       0       0
57          QI       0       0       0       0       0       0       0       0       0       0
58

59          KK   CP.D2
60          KM   COMBINATION POINT EAST OF C-STORE IN TROPICAL
61          HC       2
            *

62          KK   TROP1
63          BA   .0042
64          LS       0    98.0
65          UD   0.140
            *

66          KK    ON1D
67          BA   .0024
68          LS       0    98.0
69          UD   0.100
            *

70          KK    ON2D
71          BA   .0135
72          LS       0    98.0
73          UD   0.212
            *

74          KK   CP.D3
75          KM   COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
76          HC       4
            *

77          KK   RH.5D
78          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
79          BA   .0032
80          LS       0    91.0
81          UD   0.098
            *
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

82          KK   RH.6D
83          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
84          BA   .0050
85          LS       0    91.0
86          UD   0.107
            *

87          KK   CP.D6
88          KM   COMBINATION POINT AT INTERSECTION TWILIGHT
89          KM   COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
90          HC       2
            *

91          KK   RH.4D
92          BA   .0005
93          LS       0    91.0
94          UD   0.069
            *

95          KK   CENT2
96          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
97          BA   .0026
98          LS       0    98.0
99          UD   0.082
            *

100         KK   CENT4
101         BA   .0006
102         LS       0    98.0
103         UD   0.100
```

```
                  *
          104     KK   CP.D7
          105     KM   COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
          106     HC       4
                  *
          107     KK   CP.D5
          108     KM   COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
          109     HC       2
                  *
          110     KK   OF.2D
          111     KM   OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
          112     BA   .0135
          113     LS       0    98.0
          114     UD   0.166
                  *
1                                          HEC-1 INPUT                                                PAGE  4

        LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          115     KK    RIC1
          116     BA   .0014
          117     LS       0    98.0
          118     UD   0.100
                  *
          119     KK   CP.D8
          120     KM   COMBINATION POINT IN RICE
          121     HC       2
                  *
          122     ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

   21        DEC4
               .
               .
   34          .        DEC3
               .          .
               .          .
   38        CP.D1.............
               .
               .
   41          .         005
               .          .
               .          .
   45          .          .         NNS
               .          .          .
               .          .          .
   59          .       CP.D2.............
               .          .
               .          .
   62          .          .       TROP1
               .          .          .
               .          .          .
   66          .          .          .       ON1D
               .          .          .         .
               .          .          .         .
   70          .          .          .         .       ON2D
               .          .          .         .         .
               .          .          .         .         .
   74          .       CP.D3.....................................
               .          .
               .          .
   77          .          .       RH.5D
               .          .          .
               .          .          .
   82          .          .          .       RH.6D
               .          .          .         .
               .          .          .         .
   87          .          .       CP.D6.............
               .          .          .
               .          .          .
   91          .          .          .       RH.4D
               .          .          .         .
               .          .          .         .
   95          .          .          .         .       CENT2
               .          .          .         .         .
               .          .          .         .         .
  100          .          .          .         .         .       CENT4
               .          .          .         .         .         .
               .          .          .         .         .         .
  104          .          .       CP.D7.....................................
               .          .          .
               .          .          .
  107          .       CP.D5.............
               .          .
               .          .
```

```
  110          .           .       OF.2D
               .           .         .
               .           .         .
  115          .           .         .        RIC1
               .           .         .          .
               .           .         .          .
  119          .           .       CP.D8.............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                      *
 *                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *    U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                      *
 *               JUN   1998             *                                      *    HYDROLOGIC ENGINEERING CENTER
 *                                      *                                      *
 *            VERSION 4.1               *                                      *         609 SECOND STREET
 *                                      *                                      *
 *                                      *                                      *       DAVIS, CALIFORNIA 95616
 *                                      *                                      *
 *  RUN DATE   09DEC11   TIME  10:16:38  *                                      *           (916) 756-1104
 *                                      *                                      *
 *                                      *                                      *
 ****************************************
****************************************
```

TROPICAL & CENTENNIAL ROADWAY
TECHNICAL DRAINAGE STUDY
10-YEAR DEVELOPED

RETURN PERIOD ------- 10-YR
DISTRIBUTION -------- 6-HOUR SDN3
PROJECT NO. --------- MGL1101.000
FILENAME ------------ 10YRDEV.H1
DATE ---------------- DECEMBER 2011
MODELED BY ---------- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS

DRAINAGE AREA (MI^2)	DARF
100-YR	0.990
10-YR	0.570

```
  18 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      NDTIME        0055  ENDING TIME
                       ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                        TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

      JP           MULTI-PLAN OPTION
                        NPLAN          1  NUMBER OF PLANS

      JR           MULTI-RATIO OPTION
                       RATIOS OF PRECIPITATION
                       .57

 *** HEC-1 ERROR 1 *** INVALID CARD IDENTIFICATION CODE OR CARD OUT OF SEQUENCE
      CARD NO.   58
1
                PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                          TIME TO PEAK IN HOURS


                                                                RATIOS APPLIED TO PRECIPITATION
  OPERATION       STATION      AREA     PLAN                 RATIO 1
                                                               .57
```

HYDROGRAPH AT					
+	DEC4	.00	1	FLOW	3.
				TIME	3.58
HYDROGRAPH AT					
+	DEC3	.00	1	FLOW	1.
				TIME	3.50
2 COMBINED AT					
+	CP.D1	.00	1	FLOW	5.
				TIME	3.58
HYDROGRAPH AT					
+	005	.00	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	NNS	.50	1	FLOW	0.
				TIME	.00
2 COMBINED AT					
+	CP.D2	.50	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	TROP1	.00	1	FLOW	4.
				TIME	3.58
HYDROGRAPH AT					
+	ON1D	.00	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	ON2D	.01	1	FLOW	12.
				TIME	3.58
4 COMBINED AT					
+	CP.D3	.52	1	FLOW	21.
				TIME	3.58
HYDROGRAPH AT					
+	RH.5D	.00	1	FLOW	2.
				TIME	3.50
HYDROGRAPH AT					
+	RH.6D	.00	1	FLOW	4.
				TIME	3.50
2 COMBINED AT					
+	CP.D6	.01	1	FLOW	6.
				TIME	3.50
HYDROGRAPH AT					
+	RH.4D	.00	1	FLOW	0.
				TIME	3.50
HYDROGRAPH AT					
+	CENT2	.00	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	CENT4	.00	1	FLOW	1.
				TIME	3.50
4 COMBINED AT					
+	CP.D7	.01	1	FLOW	10.
				TIME	3.50
2 COMBINED AT					
+	CP.D5	.53	1	FLOW	30.
				TIME	3.58
HYDROGRAPH AT					
+	OF.2D	.01	1	FLOW	13.
				TIME	3.58
HYDROGRAPH AT					
+	RIC1	.00	1	FLOW	2.
				TIME	3.50
2 COMBINED AT					
+	CP.D8	.01	1	FLOW	15.
				TIME	3.58

+ 9 cfs surface flow

*** 1 ERROR(S) DETECTED BY HEC-1 ***
2

100-Year Developed Condition

HEC-1

```
1****************************************
****************************************
 *                                      *                                        *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                        *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                        *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                        *         609 SECOND STREET
*
 *                                      *                                        *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   09DEC11  TIME  10:19:28  *                                        *            (916) 756-1104
*
 *                                      *                                        *
*
 ****************************************
****************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

              *DIAGRAM
    1         ID     TROPICAL CENTENNIAL
    2         ID     TECHNICAL DRAINAGE STUDY
    3         ID     100-YR CONDITION
    4         ID
    5         ID     RETURN PERIOD ------- 10- AND 100-YEAR
    6         ID     DISTRIBUTION -------- 6-HOUR SDN3
    7         ID     PROJECT NO. ---------- MGL1101.000
    8         ID     FILENAME ------------ DEVELOPED.H1
    9         ID     DATE ---------------- SEPTEMBER 2011
   10         ID     MODELED BY ---------- SLATER HANIFAN GROUP
   11         ID
   12         ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
   13         ID        DRAINAGE AREA (MI^2)        DARF
   14         ID        100-YR                      0.990
   15         ID        10-YR                       0.570
   16         ID
   17         IT      5       0       0     300
   18         IO      5       0       0
   19         IN      5       0       0
   20         JR    PREC   0.990       0
              *

   21         KK    DEC4
   22         BA   .0034
   23         PB   2.77
   24         PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
   25         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
   26         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
   27         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   28         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   29         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
   30         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
   31         PC   0.998   0.999   1.000
   32         LS       0    98.0
   33         UD   0.136
              *

   34         KK    DEC3
   35         BA   .0012
   36         LS       0    98.0
   37         UD   0.100
              *

   38         KK   CP.D1
   39         KM   COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
   40         HC       2
              *
```

```
                41          KK     005
                42          BA   .0024
                43          LS       0    98.0
                44          UD   0.100
                            *
1                                                    HEC-1 INPUT                                                    PAGE  2

           LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                45          KK     NNS
                46          KM   REFERNCE FROM CNLV NN STUDY BASIN (DANN3A4)
                47          BA     .50
                48          QI       0       0       0       0       0       0       0       0       0       0
                49          QI       0       0       0       0       0       0       0       0       0       0
                50          QI       0       0       0       1       1       1       0       0       1       1
                51          QI       1       1       1       1       1       1       1       1       1       1
                52          QI       1       1       5      45      89     121     151     186     219     223
                53          QI     193     151     110      73      43      24      12       4       1       1
                54          QI       1       1       1       1       1       1       1       1       1       1
                55          QI       1       1       1       1       1       1       1       1       1       1
                56          QI       1       0       0       0       0       0       0       0       0       0
                57          QI       0       0       0       0       0       0       0       0       0       0
                58

                59          KK   CP.D2
                60          KM   COMBINATION POINT EAST OF C-STORE IN TROPICAL
                61          HC       2
                            *

                62          KK   TROP1
                63          BA   .0042
                64          LS       0    98.0
                65          UD   0.140
                            *

                66          KK    ON1D
                67          BA   .0024
                68          LS       0    98.0
                69          UD   0.100
                            *

                70          KK    ON2D
                71          BA   .0135
                72          LS       0    98.0
                73          UD   0.212
                            *

                74          KK   CP.D3
                75          KM   COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
                76          HC       4
                            *

                77          KK   RH.5D
                78          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                79          BA   .0032
                80          LS       0    91.0
                81          UD   0.098
                            *
1                                                    HEC-1 INPUT                                                    PAGE  3

           LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                82          KK   RH.6D
                83          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                84          BA   .0050
                85          LS       0    91.0
                86          UD   0.107
                            *

                87          KK   CP.D6
                88          KM   COMBINATION POINT AT INTERSECTION TWILIGHT
                89          KM   COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                90          HC       2
                            *

                91          KK   RH.4D
                92          BA   .0005
                93          LS       0    91.0
                94          UD   0.069
                            *

                95          KK   CENT2
                96          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                97          BA   .0026
                98          LS       0    98.0
                99          UD   0.082
                            *

               100          KK   CENT4
               101          BA   .0006
               102          LS       0    98.0
               103          UD   0.100
```

```
                *
          104   KK   CP.D7
          105   KM   COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
          106   HC       4
                *
          107   KK   CP.D5
          108   KM   COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
          109   HC       2
                *
          110   KK   OF.2D
          111   KM   OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
          112   BA   .0135
          113   LS       0    98.0
          114   UD   0.166
                *
1                                        HEC-1 INPUT                                                    PAGE  4

          LINE  ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          115   KK    RIC1
          116   BA   .0014
          117   LS       0    98.0
          118   UD   0.100
                *
          119   KK   CP.D8
          120   KM   COMBINATION POINT IN RICE
          121   HC       2
                *
          122   ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    21        DEC4
                .
                .
    34          .        DEC3
                .          .
                .          .
    38        CP.D1.............
                .
                .
    41          .          005
                .            .
                .            .
    45          .            .          NNS
                .            .           .
                .            .           .
    59          .          CP.D2.............
                .            .
                .            .
    62          .            .        TROP1
                .            .           .
                .            .           .
    66          .            .           .         ON1D
                .            .           .           .
                .            .           .           .
    70          .            .           .           .         ON2D
                .            .           .           .           .
                .            .           .           .           .
    74          .          CP.D3.....................................
                .            .
                .            .
    77          .            .        RH.5D
                .            .           .
                .            .           .
    82          .            .           .        RH.6D
                .            .           .           .
                .            .           .           .
    87          .            .        CP.D6.............
                .            .           .
                .            .           .
    91          .            .           .        RH.4D
                .            .           .           .
                .            .           .           .
    95          .            .           .           .        CENT2
                .            .           .           .          .
                .            .           .           .          .
   100          .            .           .           .          .        CENT4
                .            .           .           .          .          .
                .            .           .           .          .          .
   104          .            .        CP.D7.....................................
                .            .           .
                .            .           .
   107          .          CP.D5.............
                .            .
                .            .
```

```
  110          .           .       OF.2D
               .           .          .
               .           .          .
  115          .           .          .        RIC1
               .           .          .          .
               .           .          .          .
  119          .           .       CP.D8.....
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
**************************************
 *                                    *                                    *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                    *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                    *         609 SECOND STREET
*
 *                                      *                                    *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   09DEC11  TIME  10:19:28  *                                    *           (916) 756-1104
*
 *                                      *                                    *
*
 ****************************************
**************************************
```

TROPICAL CENTENNIAL
TECHNICAL DRAINAGE STUDY
100-YR CONDITION

RETURN PERIOD ------- 10- AND 100-YEAR
DISTRIBUTION -------- 6-HOUR SDN3
PROJECT NO. --------- MGL1101.000
FILENAME ------------ DEVELOPED.H1
DATE ---------------- SEPTEMBER 2011
MODELED BY ---------- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS

DRAINAGE AREA (MI^2)	DARF
100-YR	0.990
10-YR	0.570

```
  18 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                      NMIN            5  MINUTES IN COMPUTATION INTERVAL
                      IDATE       1   0  STARTING DATE
                      ITIME         0000  STARTING TIME
                         NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2   0  ENDING DATE
                      NDTIME        0055  ENDING TIME
                      ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

     JP           MULTI-PLAN OPTION
                      NPLAN           1  NUMBER OF PLANS

     JR           MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                  .99

*** HEC-1 ERROR 1 *** INVALID CARD IDENTIFICATION CODE OR CARD OUT OF SEQUENCE
    CARD NO.   58
1

               PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                          TIME TO PEAK IN HOURS


                                                                RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN            RATIO 1
                                                          .99
```

HYDROGRAPH AT					
+	DEC4	.00	1	FLOW	6.
				TIME	3.58
HYDROGRAPH AT					
+	DEC3	.00	1	FLOW	2.
				TIME	3.50
2 COMBINED AT					
+	CP.D1	.00	1	FLOW	8.
				TIME	3.58
HYDROGRAPH AT					
+	005	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	NNS	.50	1	FLOW	223.
				TIME	4.08
2 COMBINED AT					
+	CP.D2	.50	1	FLOW	224.
				TIME	4.08
HYDROGRAPH AT					
+	TROP1	.00	1	FLOW	8.
				TIME	3.58
HYDROGRAPH AT					
+	ON1D	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	ON2D	.01	1	FLOW	22.
				TIME	3.58
4 COMBINED AT					
+	CP.D3	.52	1	FLOW	232.
				TIME	4.08
HYDROGRAPH AT					
+	RH.5D	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	RH.6D	.00	1	FLOW	8.
				TIME	3.50
2 COMBINED AT					
+	CP.D6	.01	1	FLOW	13.
				TIME	3.50
HYDROGRAPH AT					
+	RH.4D	.00	1	FLOW	1.
				TIME	3.50
HYDROGRAPH AT					
+	CENT2	.00	1	FLOW	5.
				TIME	3.50
HYDROGRAPH AT					
+	CENT4	.00	1	FLOW	1.
				TIME	3.50
4 COMBINED AT					
+	CP.D7	.01	1	FLOW	21.
				TIME	3.50
2 COMBINED AT					
+	CP.D5	.53	1	FLOW	235.
				TIME	4.08
HYDROGRAPH AT					
+	OF.2D	.01	1	FLOW	24.
				TIME	3.58
HYDROGRAPH AT					
+	RIC1	.00	1	FLOW	3.
				TIME	3.50
2 COMBINED AT					
+	CP.D8	.01	1	FLOW	26.
				TIME	3.58

+ 155 cfs surface flow

*** 1 ERROR(S) DETECTED BY HEC-1 ***

10-Year Existing Condition

HEC-1

```
1****************************************
****************************************
 *                                      *
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                                      *
 *               JUN   1998             *
 *                                      *
 *            VERSION 4.1               *
 *                                      *
 *                                      *
 *                                      *
 *  RUN DATE   09DEC11  TIME  13:20:57  *
 *                                      *
 *                                      *
 *                                      *
 ****************************************
****************************************
```

```
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

              *DIAGRAM
    1         ID     PROJECT NAME
    2         ID     TECHNICAL DRAINAGE STUDY
    3         ID     10-YEAR EXISTING CONDITION
    4         ID
    5         ID     RETURN PERIOD ------- 10- AND 100-YEAR
    6         ID     DISTRIBUTION -------- 6-HOUR SDN3
    7         ID     PROJECT NO. --------- MGL1101.000
    8         ID     FILENAME ------------ EXISTING.H1
    9         ID     DATE ---------------- SEPTEMBER 2011
   10         ID     MODELED BY ---------- SLATER HANIFAN GROUP
   11         ID
   12         ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
   13         ID        DRAINAGE AREA (MI^2)       DARF
   14         ID        100-YR                     0.990
   15         ID        10-YR                      0.570
   16         ID
   17         IT       5       0       0     300
   18         IO       5       0       0
   19         IN       5       0       0
   20         JR    PREC   0.570       0
              *
   21         KK    DEC4
   22         BA    .0034
   23         PB    2.77
   24         PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
   25         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
   26         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
   27         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   28         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   29         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
   30         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
   31         PC   0.998   0.999   1.000
   32         LS       0    98.0
   33         UD   0.136
              *
   34         KK    DEC3
   35         BA    .0012
   36         LS       0    98.0
   37         UD   0.100
              *
   38         KK    CP.E1
   39         KM    COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
   40         HC       2
              *
```

```
                KK     005
                BA   .0024
                LS       0    98.0
                UD   0.100
                *
1                                                HEC-1 INPUT                                                PAGE  2

LINE            ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

                KK     NNS
                KM   REFERNCE FROM CNLV NN STUDY BASIN (DANN3A4)
                BA     .50
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                QI       0       0       0       0       0       0       0       0       0       0
                *

                KK   CP.E2
                KM   COMBINATION POINT EAST OF C-STORE IN TROPICAL
                HC       2
                *

                KK   TROP1
                BA   .0032
                LS       0    98.0
                UD   0.139
                *

                KK    ON1E
                BA   .0024
                LS       0    83.3
                UD   0.100
                *

                KK    ON2E
                BA   .0152
                LS       0    83.3
                UD   0.212
                *

                KK   CP.E3
                KM   COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
                HC       4
                *

                KK   RH.5D
                KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                BA   .0032
                LS       0    91.0
                UD   0.098
                *
1                                                HEC-1 INPUT                                                PAGE  3

LINE            ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

                KK   RH.6D
                KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                BA   .0050
                LS       0    91.0
                UD   0.107
                *

                KK   CP.D6
                KM   COMBINATION POINT AT INTERSECTION TWILIGHT
                KM   COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                HC       2
                *

                KK   RH.4D
                BA   .0005
                LS       0    91.0
                UD   0.069
                *

                KK   CENT2
                KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
                BA   .0026
                LS       0    98.0
                UD   0.082
                *

                KK   CENT4
                BA   .0002
                LS       0    98.0
                UD   0.100
```

```
                *
          103   KK   CP.D7
          104   KM   COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
          105   HC       4
                *
          106   KK   CP.E5
          107   KM   COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
          108   HC       2
                *
          109   KK   OF.2E
          110   KM   OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
          111   BA   .0135
          112   LS       0    83.4
          113   UD   0.166
                *
1                                          HEC-1 INPUT                                                    PAGE  4

          LINE  ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          114   KK    RIC1
          115   BA   .0014
          116   LS       0    98.0
          117   UD   0.100
                *
          118   KK   CP.E8
          119   KM   COMBINATION POINT IN RICE
          120   HC       2
                *
          121   ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE       (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

   21         DEC4
                .
                .
   34           .        DEC3
                .          .
                .          .
   38         CP.E1.............
                .
                .
   41           .          005
                .            .
                .            .
   45           .            .         NNS
                .            .          .
                .            .          .
   58           .        CP.E2.............
                .            .
                .            .
   61           .            .       TROP1
                .            .          .
                .            .          .
   65           .            .          .       ON1E
                .            .          .         .
                .            .          .         .
   69           .            .          .       ON2E
                .            .          .         .
                .            .          .         .
   73           .        CP.E3.....................................
                .            .
                .            .
   76           .            .       RH.5D
                .            .          .
                .            .          .
   81           .            .          .      RH.6D
                .            .          .        .
                .            .          .        .
   86           .            .       CP.D6.............
                .            .          .
                .            .          .
   90           .            .          .      RH.4D
                .            .          .        .
                .            .          .        .
   94           .            .          .        .      CENT2
                .            .          .        .        .
                .            .          .        .        .
   99           .            .          .        .        .      CENT4
                .            .          .        .        .        .
                .            .          .        .        .        .
  103           .            .       CP.D7.....................................
                .            .          .
                .            .          .
  106           .        CP.E5.............
                .            .
                .            .
```

```
  109          .          .       OF.2E
               .          .         .
               .          .         .
  114          .          .         .       RIC1
               .          .         .         .
               .          .         .         .
  118          .          .       CP.E8.............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                      *
 *                                      *    U.S. ARMY CORPS OF ENGINEERS      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *
 *                                      *    HYDROLOGIC ENGINEERING CENTER     *
 *               JUN  1998              *                                      *
 *                                      *         609 SECOND STREET            *
 *            VERSION 4.1               *                                      *
 *                                      *       DAVIS, CALIFORNIA 95616        *
 *                                      *                                      *
 *  RUN DATE   09DEC11  TIME  13:20:57  *           (916) 756-1104             *
 *                                      *                                      *
 ****************************************
****************************************
```

PROJECT NAME
TECHNICAL DRAINAGE STUDY
10-YEAR EXISTING CONDITION

RETURN PERIOD ------- 10- AND 100-YEAR
DISTRIBUTION -------- 6-HOUR SDN3
PROJECT NO. --------- MGL1101.000
FILENAME ------------ EXISTING.H1
DATE ---------------- SEPTEMBER 2011
MODELED BY ---------- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS

DRAINAGE AREA (MI^2)	DARF
100-YR	0.990
10-YR	0.570

18 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION RATIO 1 .57
OPERATION	STATION	AREA	PLAN		
HYDROGRAPH AT					
+	DEC4	.00	1	FLOW	3.
				TIME	3.58

HYDROGRAPH AT					
+	DEC3	.00	1	FLOW	1.
				TIME	3.50
2 COMBINED AT					
+	CP.E1	.00	1	FLOW	5.
				TIME	3.58
HYDROGRAPH AT					
+	005	.00	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	NNS	.50	1	FLOW	0.
				TIME	.00
2 COMBINED AT					
+	CP.E2	.50	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	TROP1	.00	1	FLOW	3.
				TIME	3.58
HYDROGRAPH AT					
+	ON1E	.00	1	FLOW	1.
				TIME	3.58
HYDROGRAPH AT					
+	ON2E	.02	1	FLOW	5.
				TIME	3.67
4 COMBINED AT					
+	CP.E3	.52	1	FLOW	11.
				TIME	3.58
HYDROGRAPH AT					
+	RH.5D	.00	1	FLOW	2.
				TIME	3.50
HYDROGRAPH AT					
+	RH.6D	.00	1	FLOW	4.
				TIME	3.50
2 COMBINED AT					
+	CP.D6	.01	1	FLOW	6.
				TIME	3.50
HYDROGRAPH AT					
+	RH.4D	.00	1	FLOW	0.
				TIME	3.50
HYDROGRAPH AT					
+	CENT2	.00	1	FLOW	3.
				TIME	3.50
HYDROGRAPH AT					
+	CENT4	.00	1	FLOW	0.
				TIME	3.50
4 COMBINED AT					
+	CP.D7	.01	1	FLOW	10.
				TIME	3.50
2 COMBINED AT					
+	CP.E5	.53	1	FLOW	20.
				TIME	3.58
HYDROGRAPH AT					
+	OF.2E	.01	1	FLOW	5.
				TIME	3.58
HYDROGRAPH AT					
+	RIC1	.00	1	FLOW	2.
				TIME	3.50
2 COMBINED AT					
+	CP.E8	.01	1	FLOW	6.
				TIME	3.58

+ offsite 9 cfs flow

*** NORMAL END OF HEC-1 ***

100-Year Existing Condition

HEC-1

```
1****************************************
****************************************
 *                                      *                                      *
*                                                                              *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *    U.S. ARMY CORPS OF ENGINEERS
*                                                                              *
 *              JUN   1998              *                                      *    HYDROLOGIC ENGINEERING CENTER
*                                                                              *
 *           VERSION 4.1                *                                      *         609 SECOND STREET
*                                                                              *
 *                                      *                                      *      DAVIS, CALIFORNIA 95616
*                                                                              *
 *  RUN DATE   09DEC11  TIME  13:21:51  *                                      *           (916) 756-1104
*                                                                              *
 *                                      *                                      *
*                                                                              *
 ****************************************
****************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

              *DIAGRAM
    1         ID     PROJECT NAME
    2         ID     TECHNICAL DRAINAGE STUDY
    3         ID     100-YEAR EXISTING CONDITION
    4         ID
    5         ID     RETURN PERIOD -------- 10- AND 100-YEAR
    6         ID     DISTRIBUTION -------- 6-HOUR SDN3
    7         ID     PROJECT NO. ---------- MGL1101.000
    8         ID     FILENAME ------------ EXISTING.H1
    9         ID     DATE ---------------- SEPTEMBER 2011
   10         ID     MODELED BY ---------- SLATER HANIFAN GROUP
   11         ID
   12         ID        SIX HOUR DEPTH-AREA REDUCTION FACTORS
   13         ID        DRAINAGE AREA (MI^2)       DARF
   14         ID        100-YR                     0.990
   15         ID        10-YR                      0.570
   16         ID
   17         IT      5       0       0     300
   18         IO      5       0       0
   19         IN      5       0       0
   20         JR   PREC   0.990       0
              *
   21         KK    DEC4
   22         BA   .0034
   23         PB    2.77
   24         PC       0   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
   25         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
   26         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
   27         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   28         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   29         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
   30         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
   31         PC   0.998   0.999   1.000
   32         LS       0    98.0
   33         UD   0.136
              *
   34         KK    DEC3
   35         BA   .0012
   36         LS       0    98.0
   37         UD   0.100
              *
   38         KK   CP.E1
   39         KM   COMBINATION POINT AT INTERSECTION DECATUR & TROPICAL
   40         HC       2
              *
```

```
 41          KK     005
 42          BA   .0024
 43          LS       0    98.0
 44          UD   0.100
             *
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 45          KK     NNS
 46          KM   REFERNCE FROM CNLV NN STUDY BASIN (DANN3A4)
 47          BA     .50
 48          QI       0       0       0       0       0       0       0       0       0       0
 49          QI       0       0       0       0       0       0       0       0       0       0
 50          QI       0       0       0       1       1       1       0       0       1       1
 51          QI       1       1       1       1       1       1       1       1       1       1
 52          QI       1       1       5      45      89     121     151     186     219     223
 53          QI     193     151     110      73      43      24      12       4       1       1
 54          QI       1       1       1       1       1       1       1       1       1       1
 55          QI       1       1       1       1       1       1       1       1       1       1
 56          QI       1       0       0       0       0       0       0       0       0       0
 57          QI       0       0       0       0       0       0       0       0       0       0
             *

 58          KK   CP.E2
 59          KM   COMBINATION POINT EAST OF C-STORE IN TROPICAL
 60          HC       2
             *

 61          KK   TROP1
 62          BA   .0032
 63          LS       0    98.0
 64          UD   0.139
             *

 65          KK    ON1E
 66          BA   .0024
 67          LS       0    83.3
 68          UD   0.100
             *

 69          KK    ON2E
 70          BA   .0152
 71          LS       0    83.3
 72          UD   0.212
             *

 73          KK   CP.E3
 74          KM   COMBINATION POINT JUST W OF CENT PKWY IN TROPICAL
 75          HC       4
             *

 76          KK   RH.5D
 77          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
 78          BA   .0032
 79          LS       0    91.0
 80          UD   0.098
             *
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 81          KK   RH.6D
 82          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
 83          BA   .0050
 84          LS       0    91.0
 85          UD   0.107
             *

 86          KK   CP.D6
 87          KM   COMBINATION POINT AT INTERSECTION TWILIGHT
 88          KM   COMBINATION POINT REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
 89          HC       2
             *

 90          KK   RH.4D
 91          BA   .0005
 92          LS       0    91.0
 93          UD   0.069
             *

 94          KK   CENT2
 95          KM   BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
 96          BA   .0026
 97          LS       0    98.0
 98          UD   0.082
             *

 99          KK   CENT4
100          BA   .0002
101          LS       0    98.0
102          UD   0.100
```

```
                *
          103   KK   CP.D7
          104   KM   COMBINATION POINT NORTH OF INTERSECTION OF CENT PKWY IN TROPICAL
          105   HC       4
                *
          106   KK   CP.E5
          107   KM   COMBINATION POINT AT INTERSECTION OF CENT PKWY IN TROPICAL
          108   HC       2
                *
          109   KK   OF.2E
          110   KM   OFFSITE BASIN REFERENCED FROM TWILIGHT AT RIVERWALK RANCH
          111   BA   .0135
          112   LS       0    83.4
          113   UD   0.166
                *
1                                        HEC-1 INPUT                                        PAGE  4

          LINE  ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          114   KK    RIC1
          115   BA   .0014
          116   LS       0    98.0
          117   UD   0.100
                *
          118   KK   CP.E8
          119   KM   COMBINATION POINT IN RICE
          120   HC       2
                *
          121   ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

   21        DEC4
               .
               .
   34          .        DEC3
               .          .
               .          .
   38        CP.E1.............
               .
               .
   41          .         005
               .          .
               .          .
   45          .          .         NNS
               .          .          .
               .          .          .
   58          .       CP.E2.............
               .          .
               .          .
   61          .          .       TROP1
               .          .          .
               .          .          .
   65          .          .          .        ON1E
               .          .          .          .
               .          .          .          .
   69          .          .          .          .        ON2E
               .          .          .          .          .
               .          .          .          .          .
   73          .       CP.E3.....................................
               .          .
               .          .
   76          .          .       RH.5D
               .          .          .
               .          .          .
   81          .          .          .       RH.6D
               .          .          .         .
               .          .          .         .
   86          .          .       CP.D6.............
               .          .          .
               .          .          .
   90          .          .          .       RH.4D
               .          .          .         .
               .          .          .         .
   94          .          .          .         .       CENT2
               .          .          .         .         .
               .          .          .         .         .
   99          .          .          .         .         .       CENT4
               .          .          .         .         .         .
               .          .          .         .         .         .
  103          .          .       CP.D7.....................................
               .          .          .
               .          .          .
  106          .       CP.E5.............
               .          .
               .          .
```

```
  109          .          .       OF.2E
               .          .          .
               .          .          .
  114          .          .          .        RIC1
               .          .          .          .
               .          .          .          .
  118          .          .       CP.E8.....
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
****************************************
 *                                      *
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                                      *
 *               JUN   1998             *
 *                                      *
 *            VERSION 4.1               *
 *                                      *
 *                                      *
 *                                      *
 *  RUN DATE   09DEC11  TIME  13:21:51  *
 *                                      *
 *                                      *
 *                                      *
 ****************************************
****************************************
```

```
*                                                    *
*    U.S. ARMY CORPS OF ENGINEERS                    *
*    HYDROLOGIC ENGINEERING CENTER                   *
*         609 SECOND STREET                          *
*       DAVIS, CALIFORNIA 95616                      *
*            (916) 756-1104                          *
*                                                    *
```

PROJECT NAME
TECHNICAL DRAINAGE STUDY
100-YEAR EXISTING CONDITION

RETURN PERIOD ------- 10- AND 100-YEAR
DISTRIBUTION -------- 6-HOUR SDN3
PROJECT NO. --------- MGL1101.000
FILENAME ------------ EXISTING.H1
DATE ---------------- SEPTEMBER 2011
MODELED BY ---------- SLATER HANIFAN GROUP

SIX HOUR DEPTH-AREA REDUCTION FACTORS

DRAINAGE AREA (MI^2)	DARF
100-YR	0.990
10-YR	0.570

18 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.99

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION RATIO 1 .99
OPERATION	STATION	AREA	PLAN		
HYDROGRAPH AT					
+	DEC4	.00	1	FLOW	6.
				TIME	3.58

HYDROGRAPH AT	DEC3	.00	1	FLOW	2.
+				TIME	3.50
2 COMBINED AT	CP.E1	.00	1	FLOW	8.
+				TIME	3.58
HYDROGRAPH AT	005	.00	1	FLOW	5.
+				TIME	3.50
HYDROGRAPH AT	NNS	.50	1	FLOW	223.
+				TIME	4.08
2 COMBINED AT	CP.E2	.50	1	FLOW	224.
+				TIME	4.08
HYDROGRAPH AT	TROP1	.00	1	FLOW	6.
+				TIME	3.58
HYDROGRAPH AT	ON1E	.00	1	FLOW	3.
+				TIME	3.50
HYDROGRAPH AT	ON2E	.02	1	FLOW	14.
+				TIME	3.67
4 COMBINED AT	CP.E3	.52	1	FLOW	230.
+				TIME	4.08
HYDROGRAPH AT	RH.5D	.00	1	FLOW	5.
+				TIME	3.50
HYDROGRAPH AT	RH.6D	.00	1	FLOW	8.
+				TIME	3.50
2 COMBINED AT	CP.D6	.01	1	FLOW	13.
+				TIME	3.50
HYDROGRAPH AT	RH.4D	.00	1	FLOW	1.
+				TIME	3.50
HYDROGRAPH AT	CENT2	.00	1	FLOW	5.
+				TIME	3.50
HYDROGRAPH AT	CENT4	.00	1	FLOW	0.
+				TIME	3.50
4 COMBINED AT	CP.D7	.01	1	FLOW	20.
+				TIME	3.50
2 COMBINED AT	CP.E5	.53	1	FLOW	233.
+				TIME	4.08
HYDROGRAPH AT	OF.2E	.01	1	FLOW	14.
+				TIME	3.58
HYDROGRAPH AT	RIC1	.00	1	FLOW	3.
+				TIME	3.50
2 COMBINED AT	CP.E8	.01	1	FLOW	17.
+				TIME	3.58

+ 155 surface flow

*** NORMAL END OF HEC-1 ***

Reference Material

Twilight at Riverwalk, SHG

HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\~vbh0901.TMP

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               MAY   1991              *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/15/2005  TIME  15:19:16 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
*****************************************
```

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

```
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
:::                                       :::
:::  Full Microcomputer Implementation    :::
:::                 by                    :::
:::        Haestad Methods, Inc.          :::
:::                                       :::
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID  10-YR ULTIMATE CONDITION - RIVERWALK TWILIGHT
   2          IT       5                    300
   3          IO       5       0

   4          KK  RT.1D
   5          KM
   6          KO                                       22
   7          BA    .0051
   8          PB    1.58
   9          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
  10          PC    .130    .130    .133    .140    .142    .148    .158    .172    .181
  11          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
  12          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
  13          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
  14          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
  15          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
  16          PC    .998    .999   1.000
  17          LS             95
  18          UD    .109

  19          KK  RT.2D
  20          KM
  21          KO                                       22
  22          BA    .0049
  23          LS             95
  24          UD    .110

  25          KK  CP.D1
  26          KM
  27          KO                                       22
  28          HC       2

  29          KK  DI6
  30          KM  WATER CAPTURED BY DROP INLET 6
  31          KO                                       22
  32          DT  RDI6              18
```

```
 33          DI        0        9       18
 34          DQ        0        8       11

 35          KK  RT.3D
 36          KM
 37          KO                                22
 38          BA    .0065
 39          LS                95
 40          UD       .1

 41          KK  RT.4D
 42          KM
 43          KO                                22
 44          BA    .0088
 45          LS                95
 46          UD     .114
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 47          KK  CP.D2
 48          KM
 49          KO                                22
 50          HC        3

 51          KK  RT.5D
 52          KM
 53          KO                                22
 54          BA    .0126
 55          LS                95
 56          UD     .158

 57          KK  RT.6D
 58          KM
 59          KO                                22
 60          BA     .002
 61          LS                95
 62          UD     .069

 63          KK  CP.D3
 64          KM
 65          KO                                22
 66          HC        3

 67          KK  CEN1
 68          KM
 69          KO                                22
 70          BA    .0050
 71          LS                98
 72          UD     .100

 73          KK  OF.1D
 74          KM
 75          KO                                22
 76          BA    .0172
 77          LS                94
 78          UD     .137

 79          KK  DEC3
 80          KM
 81          KO                                22
 82          BA    .0014
 83          LS                98
 84          UD     .073

 85          KK  CP.D5
 86          KM
 87          KO                                22
 88          HC        3
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 89          KK  RH.2P
 90          KM
 91          KO                                22
 92          BA    .0105
 93          LS                91
 94          UD     .138

 95          KK  CEN2
 96          KM
 97          KO                                22
 98          BA    .0026
 99          LS                98
100          UD     .082

101          KK  CP.D4
102          KM
103          KO                                22
104          HC        2
```

```
105          KK  CP.D6
106          KM
107          KO                                    22
108          HC       2

109          KK  RT.7D
110          KM
111          KO                                    22
112          BA   .0035
113          LS                95
114          UD    .085

115          KK  TROP1
116          KM
117          KO                                    22
118          BA   .0053
119          LS                98
120          UD    .104

121          KK  OF.4D
122          KM
123          KO                                    22
124          BA   .0014
125          LS                96
126          UD    .082

127          KK  CP.D7
128          KM
129          KO                                    22
130          HC       4
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

131          KK  RDI6
132          KM  RUNOFF CAPUTRED BY DI6 ADDED BACK INTO TOTAL CAPTURED
133          KO                                    22
134          DR  RDI6

135          KK  CP.D8
136          KM
137          KO                                    22
138          HC       3

139          KK  DEC4
140          KM
141          KO                                    22
142          BA   .0033
143          LS                98
144          UD     .05

145          KK  RDEC4
146          KM  ROUTE DEC4 TO CENTENNIAL PKWY
147          KO                                    22
148          RK    1400    .005    .015           TRAP      49       2

149          KK  RMRH
150          KM  RICE - MONTGOMERY - RANCH HOUSE
151          KO                                    22
152          BA   .0054
153          LS                98
154          UD    .139

155          KK  OF.2D
156          KM
157          KO                                    22
158          BA   .0135
159          LS                94
160          UD    .132

161          KK  OF.3D
162          KM
163          KO                                    22
164          BA   .0188
165          LS                95
166          UD    .129

167          KK  RH.1P
168          KM
169          KO                                    22
170          BA   .0108
171          LS                92
172          UD    .140
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

173          KK  CEN3
174          KM
175          KO                                    22
```

```
176          BA   .0034
177          LS              98
178          UD    .066

179          KK  CP.D9
180          KM
181          KO                                   22
182          HC       6

183          KK  DUMMY
184          KM
185          KO                                   22
186          HC       2
187          ZZ
```

HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\~vbh0901.TMP

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY  1991                 *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  03/15/2005  TIME  15:19:16 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

10-YR ULTIMATE CONDITION - RIVERWALK TWILIGHT

```
3 IO          OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL          0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                   NMIN           5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1   0  STARTING DATE
                   ITIME       0000  STARTING TIME
                     NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2   0  ENDING DATE
                  NDTIME       0055  ENDING TIME
                   ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     0.08 HOURS
                  TOTAL TIME BASE     24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	RT.1D	5.	3.50	1.	0.	0.	0.01		
HYDROGRAPH AT	RT.2D	4.	3.50	1.	0.	0.	0.00		
2 COMBINED AT	CP.D1	9.	3.50	1.	0.	0.	0.01		
DIVERSION TO	RDI6	8.	3.50	1.	0.	0.	0.01		
HYDROGRAPH AT	DI6	1.	3.50	0.	0.	0.	0.01		
HYDROGRAPH AT	RT.3D	6.	3.50	1.	0.	0.	0.01		
HYDROGRAPH AT	RT.4D	8.	3.58	1.	0.	0.	0.01		
3 COMBINED AT	CP.D2	15.	3.50	2.	0.	0.	0.03		
HYDROGRAPH AT									

	RT.5D	11.	3.58	1.	0.	0.	0.01
HYDROGRAPH AT	RT.6D	2.	3.50	0.	0.	0.	0.00
3 COMBINED AT	CP.D3	27.	3.58	4.	1.	1.	0.04
HYDROGRAPH AT	CEN1	6.	3.50	1.	0.	0.	0.00
HYDROGRAPH AT	OF.1D	15.	3.58	2.	0.	0.	0.02
HYDROGRAPH AT	DEC3	2.	3.50	0.	0.	0.	0.00
3 COMBINED AT	CP.D5	21.	3.58	3.	1.	1.	0.02
HYDROGRAPH AT	RH.2P	7.	3.58	1.	0.	0.	0.01
HYDROGRAPH AT	CEN2	3.	3.50	0.	0.	0.	0.00
2 COMBINED AT	CP.D4	10.	3.58	1.	0.	0.	0.01
2 COMBINED AT	CP.D6	31.	3.58	4.	1.	1.	0.04
HYDROGRAPH AT	RT.7D	4.	3.50	0.	0.	0.	0.00
HYDROGRAPH AT	TROP1	6.	3.50	1.	0.	0.	0.01
HYDROGRAPH AT	OF.4D	2.	3.50	0.	0.	0.	0.00
4 COMBINED AT	CP.D7	41.	3.50	5.	1.	1.	0.05
HYDROGRAPH AT	RDI6	8.	3.50	1.	0.	0.	0.00
3 COMBINED AT	CP.D8	76.	3.50	10.	3.	2.	0.09
HYDROGRAPH AT	DEC4	4.	3.50	0.	0.	0.	0.00
ROUTED TO	RDEC4	4.	3.58	0.	0.	0.	0.00
HYDROGRAPH AT	RMRH	6.	3.58	1.	0.	0.	0.01
HYDROGRAPH AT	OF.2D	12.	3.58	1.	0.	0.	0.01
HYDROGRAPH AT	OF.3D	17.	3.58	2.	1.	1.	0.02
HYDROGRAPH AT	RH.1P	8.	3.58	1.	0.	0.	0.01
HYDROGRAPH AT	CEN3	4.	3.50	0.	0.	0.	0.00
6 COMBINED AT	CP.D9	49.	3.58	6.	2.	2.	0.06
2 COMBINED AT	DUMMY	124.	3.58	17.	4.	4.	0.14

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
RDEC4	MANE	3.74	4.11	218.20	1.42	5.00	3.70	215.00	1.42

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2392E+00 EXCESS=0.0000E+00 OUTFLOW=0.2494E+00 BASIN STORAGE=0.2241E-04 PERCENT ERROR= -4.3

*** NORMAL END OF HEC-1 ***

HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\~vbh1D75.TMP

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               MAY  1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/2005  TIME  13:53:35 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
*****************************************
```

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

```
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
:::                                     :::
:::  Full Microcomputer Implementation  :::
:::              by                     :::
:::        Haestad Methods, Inc.        :::
:::                                     :::
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID  100-YR ULTIMATE CONDITION - RIVERWALK TWILIGHT
   2          IT       5                     300
   3          IO       5       0

   4          KK  RT.1D
   5          KM
   6          KO                                      22
   7          BA   .0051
   8          PB    2.77
   9          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
  10          PC    .130    .130    .133    .140    .142    .148    .158    .172    .181
  11          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
  12          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
  13          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
  14          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
  15          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
  16          PC    .998    .999   1.000
  17          LS              95
  18          UD    .109

  19          KK  RT.2D
  20          KM
  21          KO                                      22
  22          BA   .0049
  23          LS              95
  24          UD    .110

  25          KK  CP.D1
  26          KM
  27          KO                                      22
  28          HC       2

  29          KK  DI6
  30          KM  WATER CAPTURED BY DROP INLET 6
  31          KO                                      22
  32          DT  RDI6              18
```

```
33          DI        0        9       18
34          DQ        0        8       11

35          KK  RT.3D
36          KM
37          KO                                      22
38          BA    .0065
39          LS                 95
40          UD       .1

41          KK  RT.4D
42          KM
43          KO                                      22
44          BA    .0088
45          LS                 95
46          UD     .114
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

47          KK  CP.D2
48          KM
49          KO                                      22
50          HC        3

51          KK  RT.5D
52          KM
53          KO                                      22
54          BA    .0126
55          LS                 95
56          UD     .158

57          KK  RT.6D
58          KM
59          KO                                      22
60          BA     .002
61          LS                 95
62          UD     .069

63          KK  CP.D3
64          KM
65          KO                                      22
66          HC        3

67          KK  CEN1
68          KM
69          KO                                      22
70          BA    .0050
71          LS                 98
72          UD     .100

73          KK  OF.1D
74          KM
75          KO                                      22
76          BA    .0172
77          LS                 85
78          UD     .137

79          KK  DEC3
80          KM
81          KO                                      22
82          BA    .0014
83          LS                 98
84          UD     .073

85          KK  NNS
86          KM  REFERENCE FROM CNLV NN STUDY BASIN (DANN3A4)
87          KO                                      22
88          BA      .50
89          QI        0        0        0        0        0        0        0        0        0        0
90          QI        0        0        0        0        0        0        0        0        0        0
91          QI        0        0        0        1        1        1        0        0        1        1
92          QI        1        1        1        1        1        1        1        1        1        1
93          QI        1        1        5       45       89      121      151      186      219      223
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

94          QI      193      151      110       73       43       24       12        4        1        1
95          QI        1        1        1        1        1        1        1        1        1        1
96          QI        1        1        1        1        1        1        1        1        1        1
97          QI        1        0        0        0        0        0        0        0        0        0
98          QI        0        0        0        0        0        0        0        0        0        0

99          KK  CP.D5
100         KM
101         KO                                      22
102         HC        4

103         KK  RH.2P
104         KM
105         KO                                      22
```

```
106          BA   .0105
107          LS              91
108          UD    .138

109          KK  CEN2
110          KM
111          KO                                    22
112          BA   .0026
113          LS              98
114          UD    .082

115          KK  CP.D4
116          KM
117          KO                                    22
118          HC       2

119          KK  CP.D6
120          KM
121          KO                                    22
122          HC       2

123          KK  RT.7D
124          KM
125          KO                                    22
126          BA   .0035
127          LS              95
128          UD    .085

129          KK  TROP1
130          KM
131          KO                                    22
132          BA   .0053
133          LS              98
134          UD    .104

135          KK  OF.4D
136          KM
137          KO                                    22
138          BA   .0014
139          LS              96
140          UD    .082
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

141          KK  CP.D7
142          KM
143          KO                                    22
144          HC       4

145          KK  RDI6
146          KM  RUNOFF CAPUTRED BY DI6 ADDED BACK INTO TOTAL CAPTURED
147          KO                                    22
148          DR  RDI6

149          KK  CP.D8
150          KM
151          KO                                    22
152          HC       3

153          KK  DEC4
154          KM
155          KO                                    22
156          BA   .0033
157          LS              98
158          UD     .05

159          KK  RDEC4
160          KM  ROUTE DEC4 TO CENTENNIAL PKWY
161          KO                                    22
162          RK    1400    .005    .015           TRAP      49       2

163          KK  RMRH
164          KM  RICE - MONTGOMERY - RANCH HOUSE
165          KO                                    22
166          BA   .0054
167          LS              98
168          UD    .139

169          KK  OF.2D
170          KM
171          KO                                    22
172          BA   .0135
173          LS              94
174          UD    .132

175          KK  OF.3D
176          KM
177          KO                                    22
178          BA   .0188
179          LS              95
180          UD    .129
```

```
181          KK  RH.1P
182          KM
183          KO                                    22
184          BA   .0108
185          LS              92
186          UD    .140
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

187          KK  CEN3
188          KM
189          KO                                    22
190          BA   .0034
191          LS              98
192          UD    .066

193          KK  CP.D9
194          KM
195          KO                                    22
196          HC       6

197          KK  DUMMY
198          KM
199          KO                                    22
200          HC       2
201          ZZ
```

HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\~vbh1D75.TMP

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               MAY   1991              *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/2005  TIME  13:53:35 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*            (916) 756-1104             *
*                                       *
*****************************************
```

100-YR ULTIMATE CONDITION - RIVERWALK TWILIGHT

```
  3 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                     NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                       NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2   0  ENDING DATE
                    NDTIME       0055  ENDING TIME
                     ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     0.08 HOURS
                      TOTAL TIME BASE    24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	RT.1D	9.	3.50	1.	0.	0.	0.01		
HYDROGRAPH AT	RT.2D	9.	3.50	1.	0.	0.	0.00		
2 COMBINED AT	CP.D1	18.	3.50	2.	1.	1.	0.01		
DIVERSION TO	RDI6	11.	3.50	2.	0.	0.	0.01		
HYDROGRAPH AT	DI6	7.	3.50	0.	0.	0.	0.01		
HYDROGRAPH AT									

	RT.3D	12.	3.50	2.	0.	0.	0.01
HYDROGRAPH AT	RT.4D	16.	3.50	2.	1.	1.	0.01
3 COMBINED AT	CP.D2	35.	3.50	4.	1.	1.	0.03
HYDROGRAPH AT	RT.5D	21.	3.58	3.	1.	1.	0.01
HYDROGRAPH AT	RT.6D	4.	3.50	0.	0.	0.	0.00
3 COMBINED AT	CP.D3	58.	3.50	8.	2.	2.	0.04
HYDROGRAPH AT	CEN1	10.	3.50	1.	0.	0.	0.00
HYDROGRAPH AT	OF.1D	21.	3.58	3.	1.	1.	0.02
HYDROGRAPH AT	DEC3	3.	3.50	0.	0.	0.	0.00
HYDROGRAPH AT	NNS	223.	4.08	23.	6.	6.	0.50
4 COMBINED AT	CP.D5	229.	4.08	28.	7.	7.	0.52
HYDROGRAPH AT	RH.2P	16.	3.58	2.	1.	1.	0.01
HYDROGRAPH AT	CEN2	5.	3.50	1.	0.	0.	0.00
2 COMBINED AT	CP.D4	21.	3.58	3.	1.	1.	0.01
2 COMBINED AT	CP.D6	233.	4.08	30.	8.	7.	0.54
HYDROGRAPH AT	RT.7D	7.	3.50	1.	0.	0.	0.00
HYDROGRAPH AT	TROP1	10.	3.50	1.	0.	0.	0.01
HYDROGRAPH AT	OF.4D	3.	3.50	0.	0.	0.	0.00
4 COMBINED AT	CP.D7	236.	4.08	33.	8.	8.	0.55
HYDROGRAPH AT	RDI6	11.	3.50	2.	0.	0.	0.00
3 COMBINED AT	CP.D8	250.	4.00	43.	11.	10.	0.59
HYDROGRAPH AT	DEC4	8.	3.50	1.	0.	0.	0.00
ROUTED TO	RDEC4	7.	3.58	1.	0.	0.	0.00
HYDROGRAPH AT	RMRH	10.	3.58	1.	0.	0.	0.01
HYDROGRAPH AT	OF.2D	23.	3.58	3.	1.	1.	0.01
HYDROGRAPH AT	OF.3D	33.	3.58	4.	1.	1.	0.02
HYDROGRAPH AT	RH.1P	17.	3.58	2.	1.	1.	0.01
HYDROGRAPH AT	CEN3	8.	3.50	1.	0.	0.	0.00
6 COMBINED AT	CP.D9	95.	3.58	13.	3.	3.	0.06
2 COMBINED AT	DUMMY	279.	3.58	56.	14.	13.	0.64

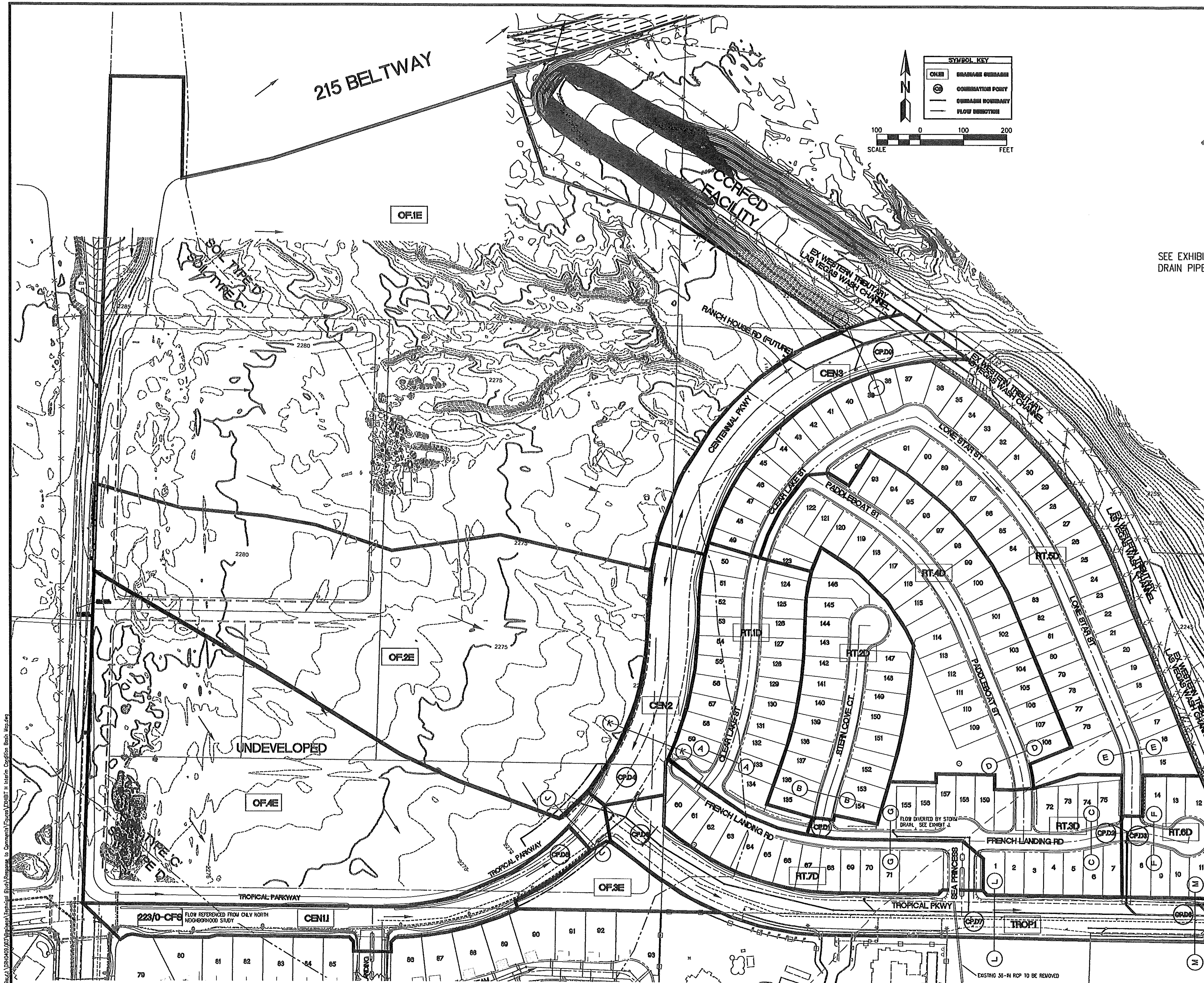
SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

						INTERPOLATED TO COMPUTATION INTERVAL			
ISTAQ	ELEMENT	DT	PEAK	TIME TO	VOLUME	DT	PEAK	TIME TO	VOLUME

				PEAK				PEAK	
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
RDEC4	MANE	3.05	7.32	214.88	2.60	5.00	7.29	215.00	2.61

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4469E+00 EXCESS=0.0000E+00 OUTFLOW=0.4577E+00 BASIN STORAGE=0.2321E-04 PERCENT ERROR= -2.4

*** NORMAL END OF HEC-1 ***



SUMMARY OF OFFSITE FLOWRATES			
SUBBASIN	Q100 (CFS)	Q10 (CFS)	AREA (ACRES)
RT.1D	9	5	3.29
RT.2D	9	4	3.13
RT.3D	12	6	4.14
RT.4D	16	8	5.60
RT.5D	21	11	8.06
RT.6D	4	2	1.28
RT.7D	7	4	2.23
CP.D1	16	9	----
CP.D2	35	15	----
CP.D3	56	27	----
CP.D4	23	9	----
CP.D5	233	8	----
CP.D6	241	16	----
CP.D7	245	25	----
CP.D8	260	61	----
CP.D9	57	23	----
CEN1.I	6	4	2.00
CEN2	6	3	1.65
CEN3	8	4	2.15
TROP1	10	6	3.36
OF.1E	52	21	29.62
OF.2E	20	7	12.43
OF.3E	2	1	0.87
OF.4E	17	6	12.45

SEE EXHIBIT J FOR DROP INLET AND STORM DRAIN PIPE SIZES

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

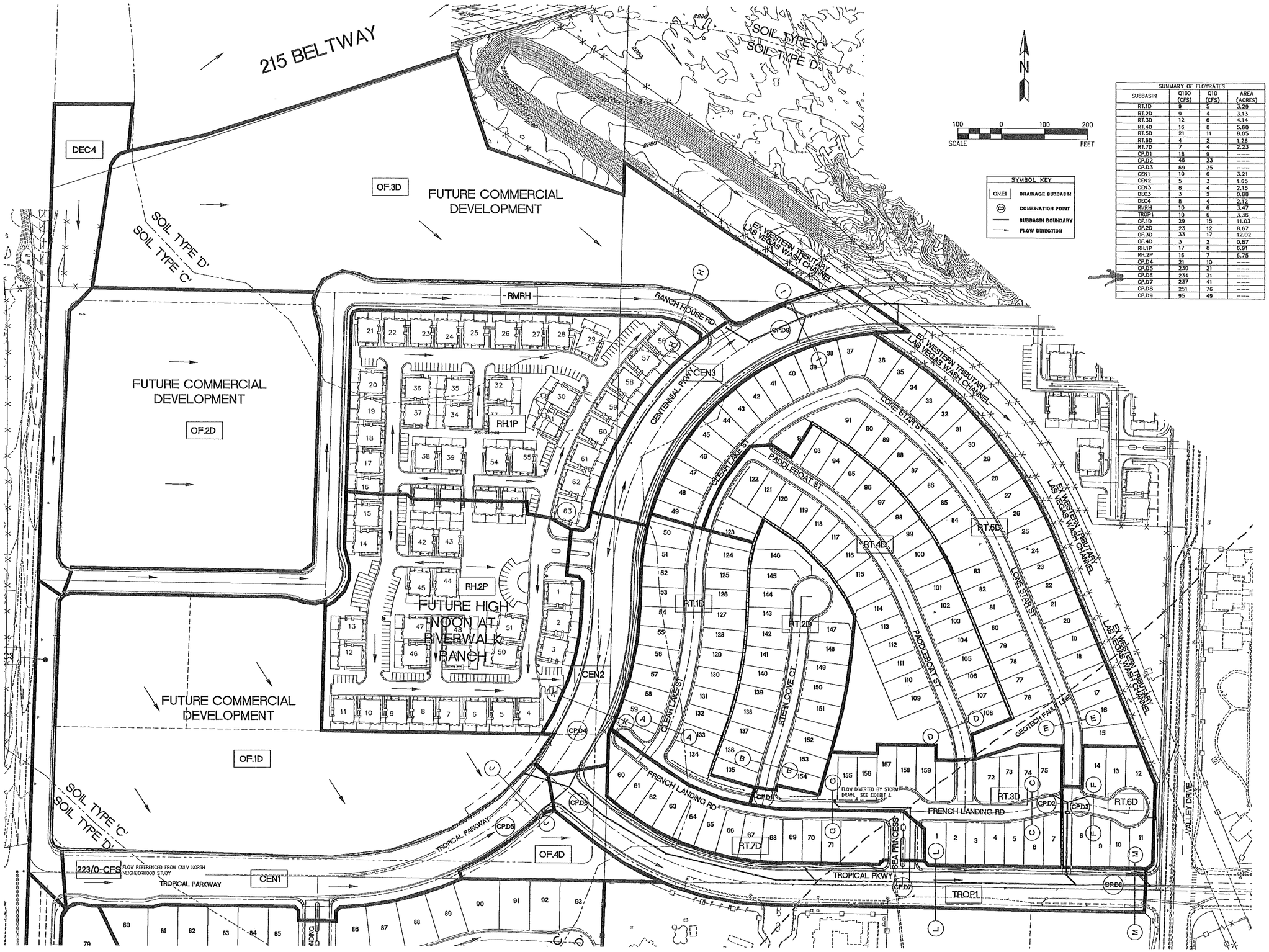
NO.	DESCRIPTION	DATE	BY	APP.

DR HORTON

TWILIGHT AT RIVERWALK RANCH
DRAINAGE BASIN MAP - INTERIM CONDITIONS

DATE:
DRAFTER: JDS
DESIGNER: JDS
CHECKED: MJF
PROJECT NO.

EXHIBIT H
SHEET X OF



SYMBOL KEY

ONE1	DRAINAGE SUBBASIN
C2	CONFLUENCE POINT
	SUBBASIN BOUNDARY
	FLOW DIRECTION

SUMMARY OF FLOWRATES

SUBBASIN	Q100 (CFS)	Q10 (CFS)	AREA (ACRES)
RT.1D	9	5	3.29
RT.2D	9	4	3.13
RT.3D	12	6	4.14
RT.4D	16	8	5.60
RT.5D	21	11	8.05
RT.6D	4	2	1.26
RT.7D	7	4	2.23
CP.D1	18	9	----
CP.D2	46	23	----
CP.D3	69	35	----
CEN1	10	6	3.21
CEN2	5	3	1.65
CEN3	8	4	2.15
DEC3	3	2	0.88
DEC4	8	4	2.12
RMRH	10	6	3.47
TROP1	10	6	3.35
OF.1D	29	15	11.03
OF.2D	23	12	8.67
OF.3D	33	17	12.02
OF.4D	3	2	0.87
RH.1P	17	8	6.91
RH.2P	16	7	6.75
CP.D4	21	10	----
CP.D5	230	21	----
CP.D6	234	31	----
CP.D7	237	41	----
CP.D8	251	76	----
CP.D9	95	49	----

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV. 89118
PHONE: (702) 284-5300 FAX: (702) 284-5399

NO.	DESCRIPTION	DATE	BY	APP.

DR HORTON

TWILIGHT AT RIVERWALK RANCH
DRAINAGE BASIN MAP - ULTIMATE CONDITIONS

DATE: 03/18/05
DRAFTER: JDS
DESIGNER: JDS
CHECKED: MJF
PROJECT NO. DRH0409.003

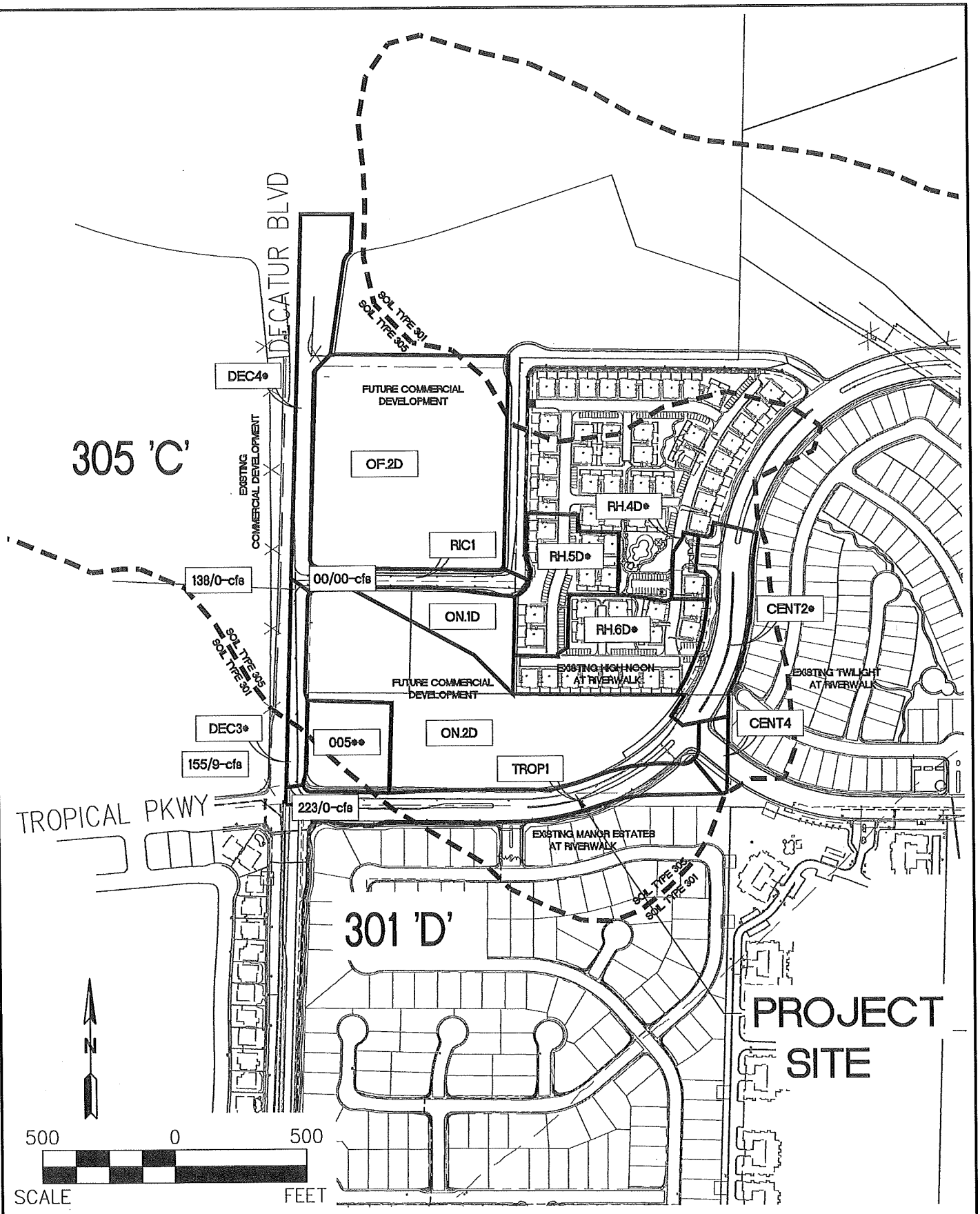
EXHIBIT I
SHEET 1 OF 1

File: J:\DRH0409.003\Wordcad\Technical Study\Responses to Comments\Figures\EXHIBIT I Ultimate Condition Basin Map_rvcover.dwg

APPENDIX D

Response to Comment 8

Soils Map



SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

SOILS MAP

CENTENNIAL/TROPICAL REALIGNMENT

DATE: 12/06/11	PROJECT NO. MGL1101.000
DRAFTER: RFF	
DESIGNER: RFF	EXHIBIT D
CHECKED: RFF	SHEET 1 OF 1

File: J:\MGL1101-000\Drainage\Technical Study\Addendum\Addendum 1\New folder\EXHIBIT D Soils Map.dwg

APPENDIX E

Response to Comment 9

Revised Soil and CN Table

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS

Soil & Curve Number Computation

Project Name: Tropical Pkwy
Date: 9/22/2011
File Name: MGL1101-000
By: RFF

Data:

Reference: Exhibit G SCS Soil Data

Soil Type & Description		A	B	C	D
301	Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes	0%	5%	0%	95%
305	Las Vegas-Destazo complex, 0 to 2 percent slopes	5%	30%	5%	60%

Land Use	A	B	C	D
Desert Shrub (poor)	63	77	85	88
Commercial	89	92	94	95
Roadway	98	98	98	98

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
OF.2E	301	3.5%	Desert Shrub (poor)	0%	5%	0%	95%	63	77	85	88	0.30	3.03
	305	96.5%	Desert Shrub (poor)	5%	30%	5%	60%	63	77	85	88	8.35	80.41
TOTAL PERCENT		100.0%									TOTAL AREA	8.65	**83.44**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
ON.1E	305	100.0%	Desert Shrub (poor)	5%	30%	5%	60%	63	77	85	88	1.54	83.30
TOTAL PERCENT		100.0%									TOTAL AREA	1.54	**83.30**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
ON.2E	305	100.0%	Desert Shrub (poor)	5%	30%	5%	60%	63	77	85	88	10.00	83.30
TOTAL PERCENT		100.0%									TOTAL AREA	10.00	**83.30**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
DEC_3	305	30.3%	Roadway	5%	30%	5%	60%	98	98	98	98	0.23	29.66
	301	69.7%	Roadway	0%	5%	0%	95%	98	98	98	98	0.53	68.34
TOTAL PERCENT		30.3%									TOTAL AREA	0.76	**98.00**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
TROP_1	301	28.8%	Roadway	0%	5%	0%	95%	98	98	98	98	0.59	28.20
	305	71.2%	Roadway	5%	30%	5%	60%	98	98	98	98	1.46	69.80
TOTAL PERCENT		100.0%									TOTAL AREA	2.05	**98.00**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
CENT_2	305	100.0%	Roadway	5%	30%	5%	60%	98	98	98	98	0.14	98.00
TOTAL PERCENT		100.0%									TOTAL AREA	0.14	**98.00**

BASIN ID	SOIL TYPE	SUBAREA PERCENT	LAND USE	HYDROLOGIC SOIL GROUP A	B	C	D	LAND USE CN A	B	C	D	SUBAREA ACRES	CALCULATED CN
RICE-1	305	100.0%	Roadway	5%	30%	5%	60%	98	98	98	98	0.90	98.00
TOTAL PERCENT		100.0%									TOTAL AREA	0.90	**98.00**

5740 S. Arville St., Suite 216 - Las Vegas, NV 89118
Ph. 702-284-5300 - Fx. 702-284-5399

APPENDIX F

Response to Comment 10

Revised FlowMaster Calcs

Centennial Pkwy Q10 Int/Dev Sec E East 1/2
Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q10 Int/Dev Sec E E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.90	%
Discharge	2.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.013	
Water Surface Elevation	67.01	ft
Elevation Range	66.74 to 67.75	
Flow Area	1.2	ft²
Wetted Perimeter	21.43	ft
Top Width	21.15	ft
Actual Depth	0.27	ft
Critical Elevation	67.02	ft
Critical Slope	0.64	%
Velocity	1.61	ft/s
Velocity Head	0.04	ft
Specific Energy	67.05	ft
Froude Number	1.17	
Flow Type	Supercritical	

Dry Lane

$\frac{67.09 - 67.01}{0.02} = \frac{4'}{2}$

All flow goes into 7.5' DI then Dry Lane is not

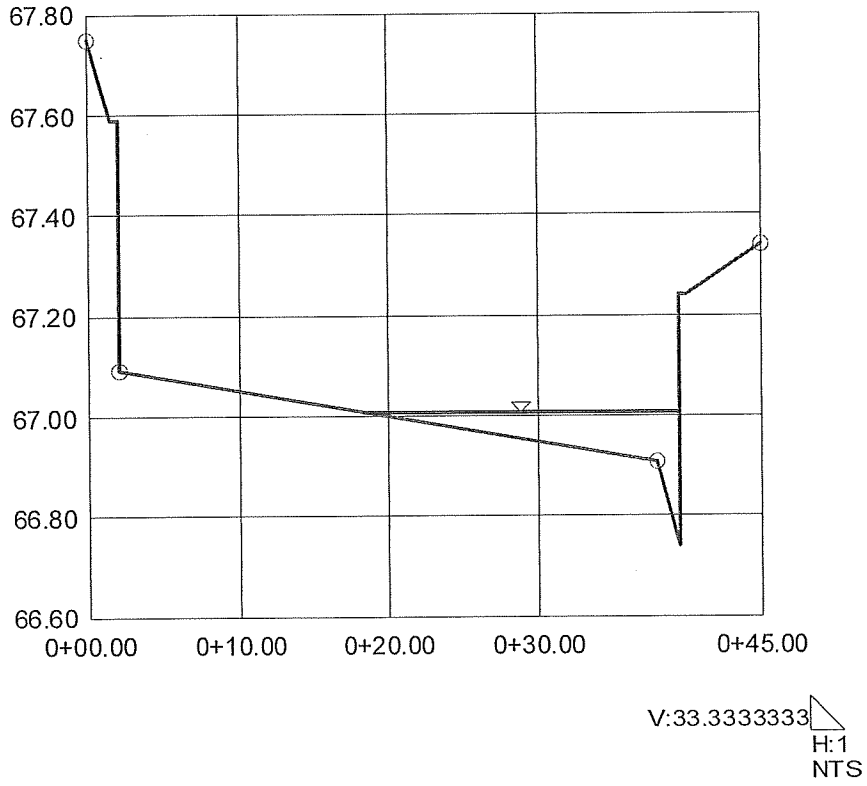
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+38.00	0.016
0+38.00	0+45.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.75
0+01.50	67.59
0+02.00	67.59
0+02.00	67.09
0+38.00	66.91
0+39.50	66.74
0+39.50	67.24
0+40.00	67.24
0+45.00	67.34

Centennial Pkwy Q10 Int/Dev Sec E
Cross Section for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q10 Int/Dev Sec E E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.90	%
Water Surface Elevation	67.01	ft
Elevation Range	66.74 to 67.75	
Discharge	2.00	cfs



Centennial Pkwy Q100 Int/Dev Sec E East 1/2
Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q100 Int/Dev Sec E E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.90	%
Discharge	4.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	67.05	ft
Elevation Range	66.74 to 67.75	
Flow Area	2.2	ft²
Wetted Perimeter	29.43	ft
Top Width	29.11	ft
Actual Depth	0.31	ft
Critical Elevation	67.06	ft
Critical Slope	0.69	%
Velocity	1.79	ft/s
Velocity Head	0.05	ft
Specific Energy	67.10	ft
Froude Number	1.13	
Flow Type	Supercritical	

$V \times D$

$1.79 \times 0.31 = 0.55$

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+38.00	0.016
0+38.00	0+45.00	0.013

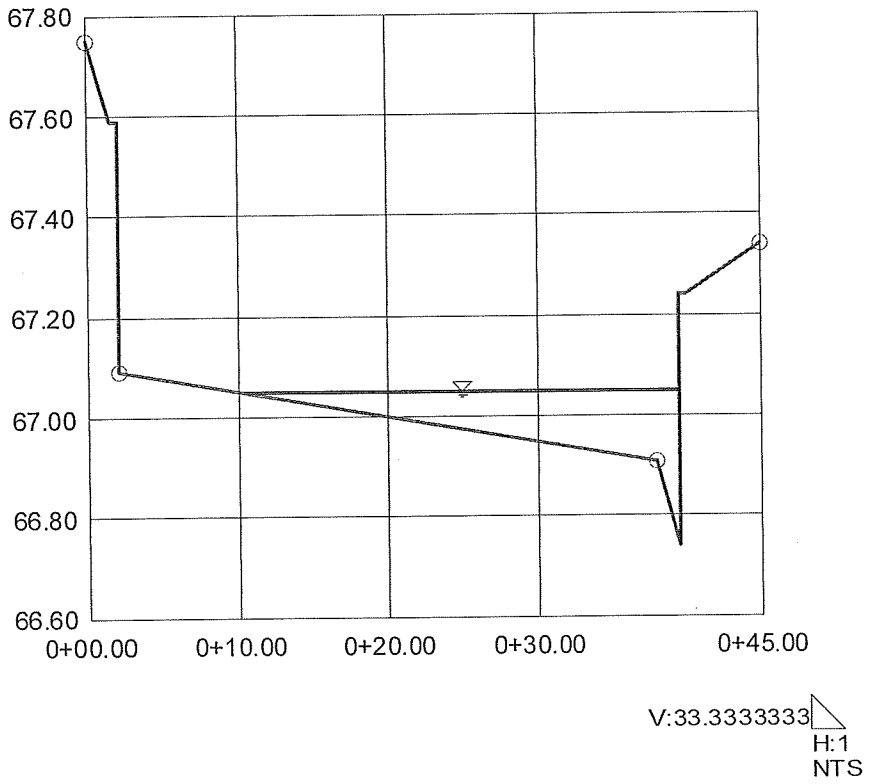
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	67.75
0+01.50	67.59
0+02.00	67.59
0+02.00	67.09
0+38.00	66.91
0+39.50	66.74
0+39.50	67.24
0+40.00	67.24
0+45.00	67.34

Centennial Pkwy Q100 Int/Dev Sec E
Cross Section for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q100 Int/Dev Sec E E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.90 %
Water Surface Elevation	67.05 ft
Elevation Range	66.74 to 67.75
Discharge	4.00 cfs



Centennial Pkwy Q10 Int/Dev Sec E West1/2
Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q10 Int/Dev Sec W E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	8.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	66.55	ft
Elevation Range	66.13 to 67.45	
Flow Area	3.6	ft²
Wetted Perimeter	26.44	ft
Top Width	26.00	ft
Actual Depth	0.42	ft
Critical Elevation	66.56	ft
Critical Slope	0.62	%
Velocity	2.23	ft/s
Velocity Head	0.08	ft
Specific Energy	66.63	ft
Froude Number	1.06	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+38.00	0.016
0+38.00	0+40.00	0.013
0+40.00	0+53.20	0.022

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	67.45
0+01.50	67.17
0+02.00	67.17
0+02.00	66.67
0+38.00	66.30
0+39.50	66.13
0+39.50	66.63
0+40.00	66.63
0+53.20	66.89

Dry Lane

$\frac{66.67 - 66.55}{0.02} = 6'$

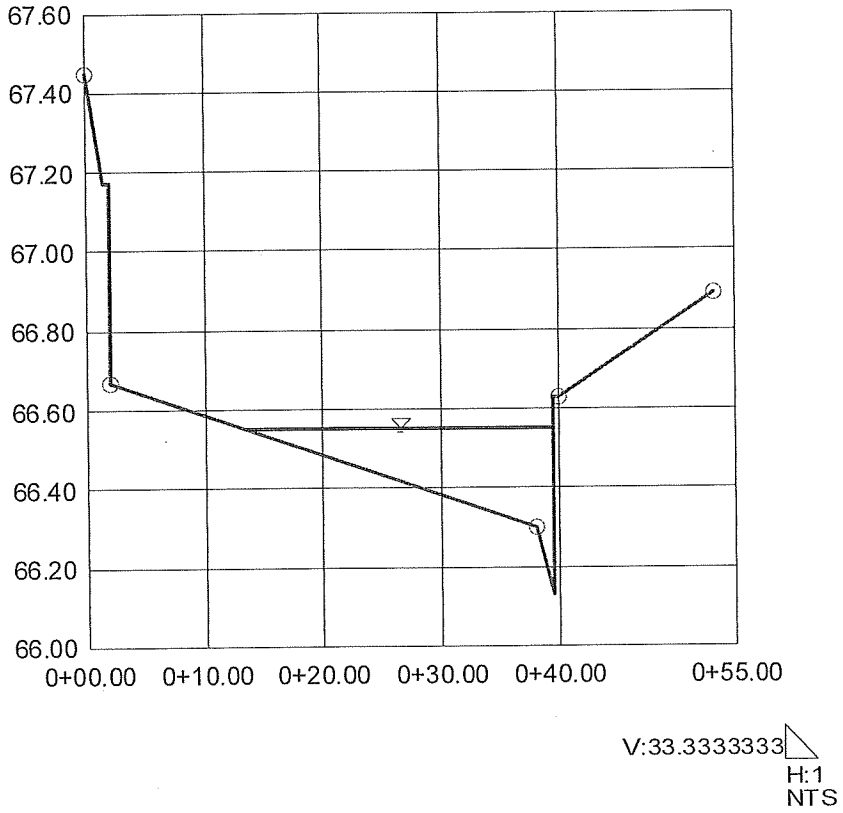
All Flow is captured by 15-5t DI in West Hmlf of Cent sta: 11+08.

So Dry lane = 36'

Centennial Pkwy Q10 Int/Dev Sec E West 1/2
Cross Section for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q10 Int/Dev Sec W E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Channel Slope	0.70	%
Water Surface Elevation	66.55	ft
Elevation Range	66.13 to 67.45	
Discharge	8.00	cfs



Centennial Pkwy Q100 Int/Dev Sec E West1/2
Worksheet for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q100 Int/Dev Sec W E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	17.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	66.65	ft
Elevation Range	66.13 to 67.45	
Flow Area	6.6	ft²
Wetted Perimeter	37.47	ft
Top Width	36.95	ft
Actual Depth	0.52	ft
Critical Elevation	66.66	ft
Critical Slope	0.60	%
Velocity	2.57	ft/s
Velocity Head	0.10	ft
Specific Energy	66.75	ft
Froude Number	1.07	
Flow Type	Supercritical	

V x D

2.57 x 0.52 = 1.3

OK

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+38.00	0.016
0+38.00	0+40.00	0.013
0+40.00	0+53.20	0.022

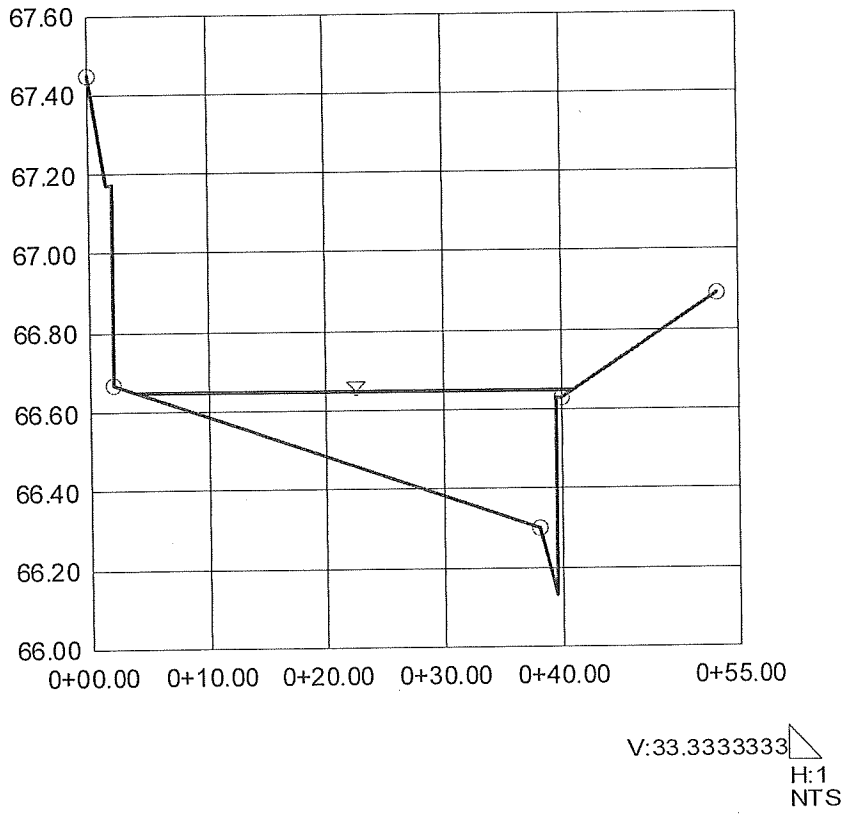
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	67.45
0+01.50	67.17
0+02.00	67.17
0+02.00	66.67
0+38.00	66.30
0+39.50	66.13
0+39.50	66.63
0+40.00	66.63
0+53.20	66.89

Centennial Pkwy Q100 Int/Dev Sec E West 1/2
Cross Section for Irregular Channel

Project Description	
Worksheet	Centennial Parkway Q100 Int/Dev Sec W E1/2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Channel Slope	0.70	%
Water Surface Elevation	66.65	ft
Elevation Range	66.13 to 67.45	
Discharge	17.00	cfs



Tropical Pkwy Q10 EX Sec A
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	3.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.013	
Water Surface Elevation	71.62	ft
Elevation Range	71.34 to 73.95	
Flow Area	1.3	ft²
Wetted Perimeter	10.46	ft
Top Width	10.18	ft
Actual Depth	0.28	ft
Critical Elevation	71.64	ft
Critical Slope	0.50	%
Velocity	2.35	ft/s
Velocity Head	0.09	ft
Specific Energy	71.71	ft
Froude Number	1.17	
Flow Type	Supercritical	

Dry Lane

$\frac{72.40 - 71.62}{0.02} = 39'$

OK

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+13.00	0.034
0+13.00	0+26.00	0.016
0+26.00	0+39.50	0.013
0+39.50	0+40.00	0.016
0+40.00	0+83.00	0.013
0+83.00	0+95.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.95
0+08.00	71.72
0+13.00	72.09
0+26.00	72.44
0+26.00	72.78
0+26.50	72.78
0+39.50	72.78
0+40.00	72.78

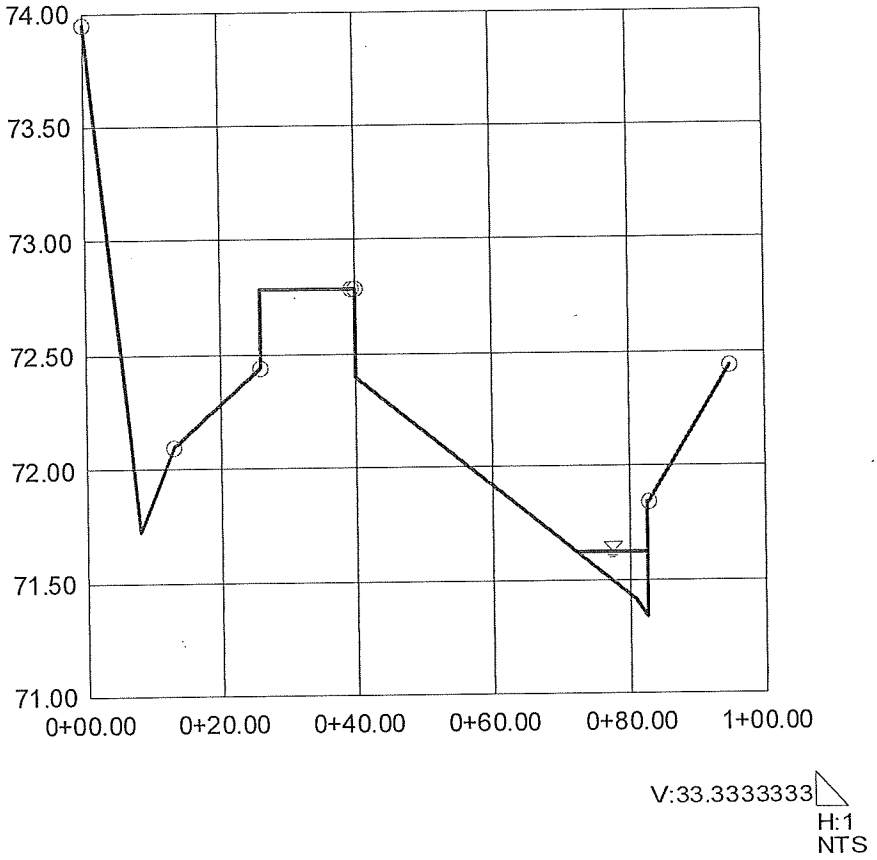
Tropical Pkwy Q10 EX Sec A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+40.00	72.40
0+81.00	71.41
0+82.50	71.34
0+82.50	71.84
0+83.00	71.84
0+95.00	72.44

Tropical Pkwy Q10 Ex Sec A
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Channel Slope	0.70 %
Water Surface Elevation	71.62 ft
Elevation Range	71.34 to 73.95
Discharge	3.00 cfs



Tropical Pkwy Q100 EX Sec A
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O0 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	224.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	72.52	ft
Elevation Range	71.34 to 73.95	
Flow Area	39.3	ft²
Wetted Perimeter	76.80	ft
Top Width	75.87	ft
Actual Depth	1.18	ft
Critical Elevation	72.65	ft
Critical Slope	0.34	%
Velocity	5.70	ft/s
Velocity Head	0.50	ft
Specific Energy	73.02	ft
Froude Number	1.40	
Flow Type	Supercritical	

$$\frac{V \times D}{5.70 \times 1.18 = 6.7}$$

Calculation Messages:
Water elevation exceeds lowest end station by 0.79194188e-1 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+13.00	0.034
0+13.00	0+26.00	0.016
0+26.00	0+39.50	0.013
0+39.50	0+40.00	0.016
0+40.00	0+83.00	0.013
0+83.00	0+95.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.95
0+08.00	71.72
0+13.00	72.09
0+26.00	72.44

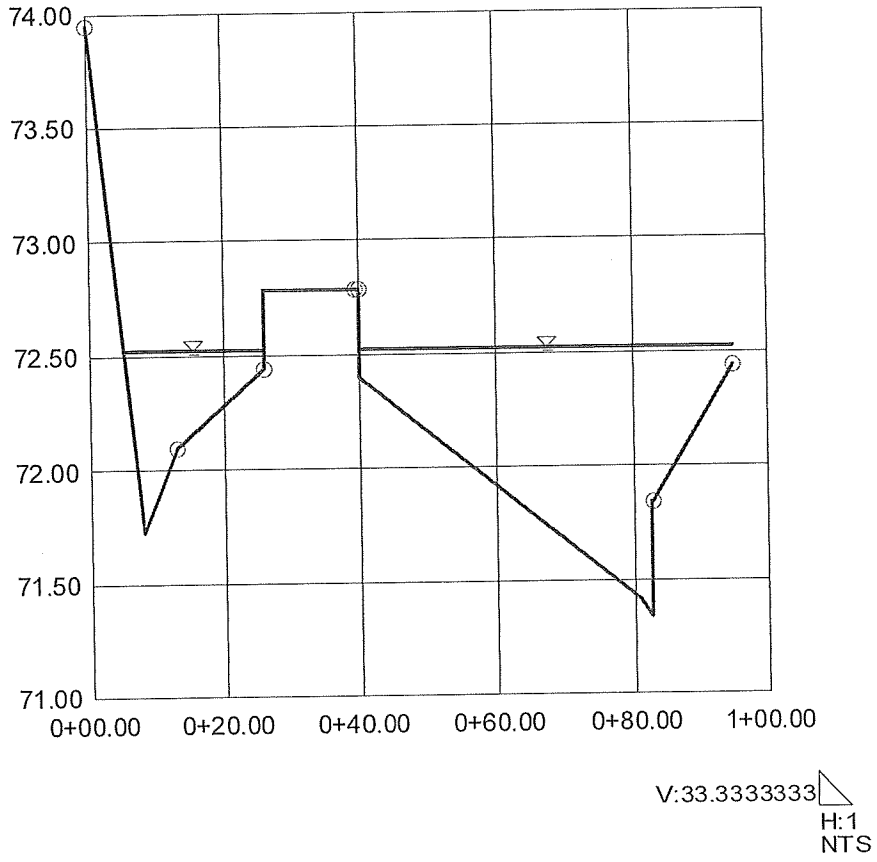
Tropical Pkwy Q100 EX Sec A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+26.00	72.78
0+26.50	72.78
0+39.50	72.78
0+40.00	72.78
0+40.00	72.40
0+81.00	71.41
0+82.50	71.34
0+82.50	71.84
0+83.00	71.84
0+95.00	72.44

Tropical Pkwy Q100 Ex Sec A
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O0 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.70 %
Water Surface Elevation	72.52 ft
Elevation Range	71.34 to 73.95
Discharge	224.00 cfs



Tropical Pkwy Sec B Q10 EX
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	11.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	66.43	ft
Elevation Range	66.21 to 67.02	
Flow Area	4.8	ft²
Wetted Perimeter	26.42	ft
Top Width	26.22	ft
Actual Depth	0.22	ft
Critical Elevation	66.21	ft
Critical Slope	0.00	%
Velocity	2.29	ft/s
Velocity Head	0.08	ft
Specific Energy	66.51	ft
Froude Number	0.94	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+04.00	0.022
0+04.00	0+29.50	0.016
0+29.50	0+30.00	0.013
0+30.00	0+40.00	0.022

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	67.02
0+04.00	66.30
0+18.00	66.21
0+29.50	66.25
0+29.50	66.74
0+30.00	66.74
0+40.00	67.00

Dry Lane

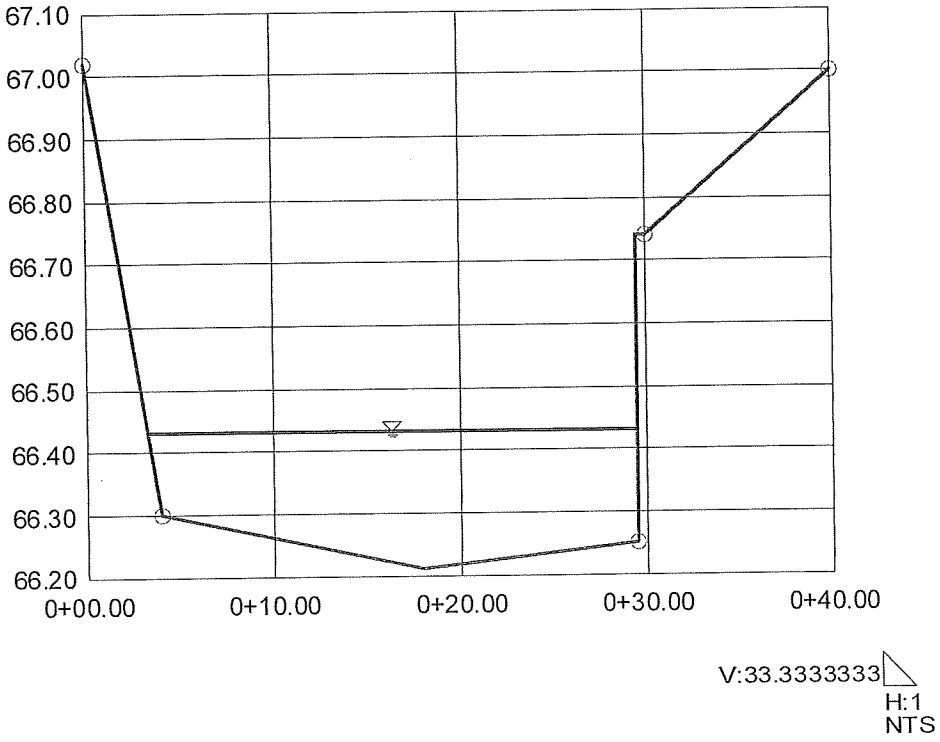
$\frac{66.25 - 66.43}{0.02} = 6$

2

Tropical Pkwy Sec B Q10 EX
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.60 %
Water Surface Elevation	66.43 ft
Elevation Range	66.21 to 67.02
Discharge	11.00 cfs



Tropical Pkwy Sec B Q100 EX
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O0 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	230.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	67.35	ft
Elevation Range	66.21 to 67.02	
Flow Area	36.0	ft²
Wetted Perimeter	41.23	ft
Top Width	40.00	ft
Actual Depth	1.14	ft
Critical Elevation	67.46	ft
Critical Slope	0.41	%
Velocity	6.40	ft/s
Velocity Head	0.64	ft
Specific Energy	67.98	ft
Froude Number	1.19	
Flow Type	Supercritical	

$$\frac{V \times \Delta}{6.4 \times 1.14 = 7.3}$$

Calculation Messages:
Water elevation exceeds lowest end station by 0.34720672 ft.

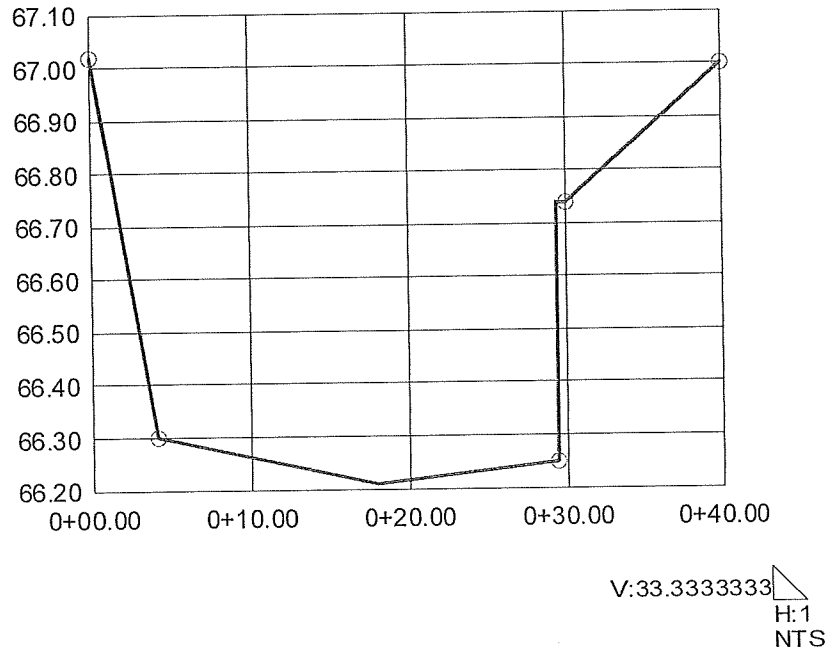
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+04.00	0.022
0+04.00	0+29.50	0.016
0+29.50	0+30.00	0.013
0+30.00	0+40.00	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.02
0+04.00	66.30
0+18.00	66.21
0+29.50	66.25
0+29.50	66.74
0+30.00	66.74
0+40.00	67.00

Tropical Pkwy Sec B Q100 EX
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O0 EX
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.60 %
Water Surface Elevation	67.35 ft
Elevation Range	66.21 to 67.02
Discharge	230.00 cfs



Tropical Pkwy Q10 INT Sec B
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	12.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	67.51	ft
Elevation Range	67.05 to 70.44	
Flow Area	5.3	ft²
Wetted Perimeter	35.40	ft
Top Width	34.50	ft
Actual Depth	0.46	ft
Critical Elevation	67.51	ft
Critical Slope	0.58	%
Velocity	2.26	ft/s
Velocity Head	0.08	ft
Specific Energy	67.59	ft
Froude Number	1.02	
Flow Type	Supercritical	

Dry Lane

$\frac{67.94 - 67.51}{0.02} = \frac{21.5'}{2}$

OK

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+14.00	0.022
0+14.00	0+16.00	0.013
0+16.00	0+52.00	0.016
0+52.00	0+55.00	0.013
0+55.00	1+01.50	0.016
1+01.50	1+03.50	0.013
1+03.50	1+28.50	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.79
0+14.00	67.55
0+14.50	67.55
0+14.50	67.05

Slater Hanifan Group
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

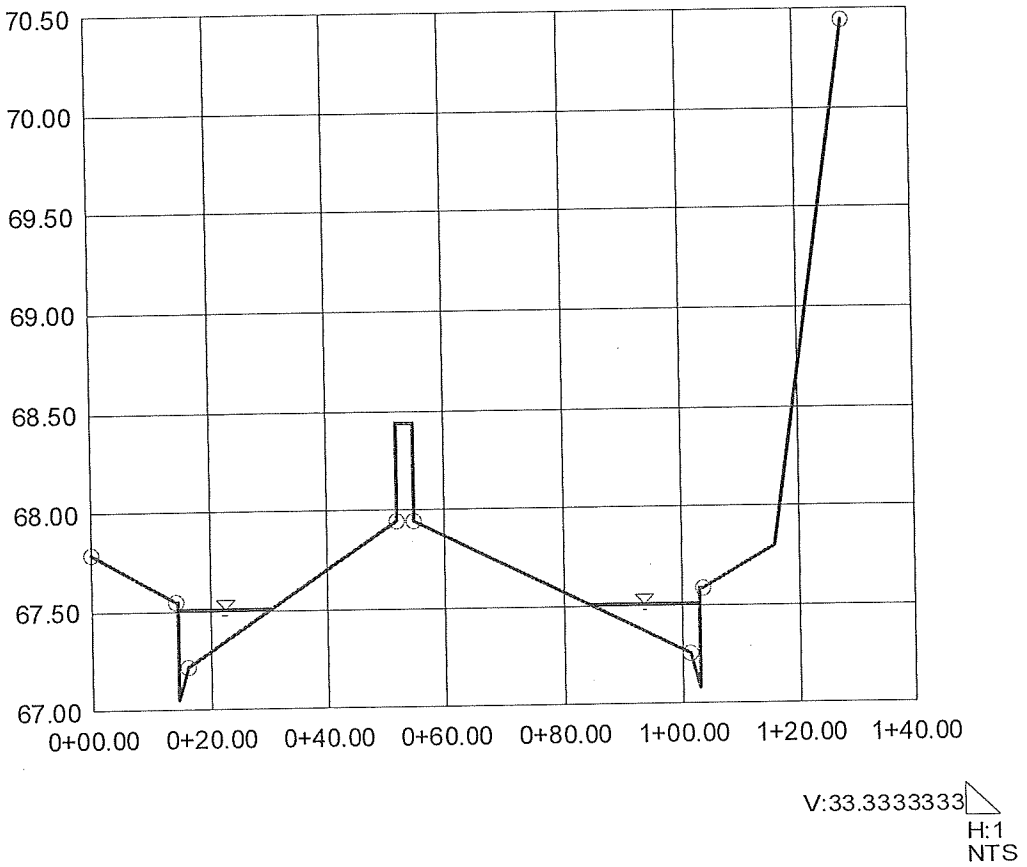
Tropical Pkwy Q10 INT Sec B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+16.00	67.22
0+52.00	67.94
0+52.00	68.44
0+55.00	68.44
0+55.00	67.94
1+01.50	67.25
1+03.00	67.08
1+03.00	67.58
1+03.50	67.58
1+16.00	67.80
1+28.50	70.44

Tropical Pkwy Q10 INT Sec B
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.014
Channel Slope	0.60 %
Water Surface Elevation	67.51 ft
Elevation Range	67.05 to 70.44
Discharge	12.00 cfs



Tropical Pkwy Q100 INT Sec B
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O0 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	230.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	68.08	ft
Elevation Range	67.05 to 70.44	
Flow Area	54.2	ft²
Wetted Perimeter	115.93	ft
Top Width	114.31	ft
Actual Depth	1.03	ft
Critical Elevation	68.10	ft
Critical Slope	0.50	%
Velocity	4.25	ft/s
Velocity Head	0.28	ft
Specific Energy	68.36	ft
Froude Number	1.09	
Flow Type	Supercritical	

$\sqrt{x}\,\Delta$

$4.25 \times 1.03 = 4.4$

2

OK

Calculation Messages:
Water elevation exceeds lowest end station by 0.28563381 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+14.00	0.022
0+14.00	0+16.00	0.013
0+16.00	0+52.00	0.016
0+52.00	0+55.00	0.013
0+55.00	1+01.50	0.016
1+01.50	1+03.50	0.013
1+03.50	1+28.50	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.79
0+14.00	67.55
0+14.50	67.55

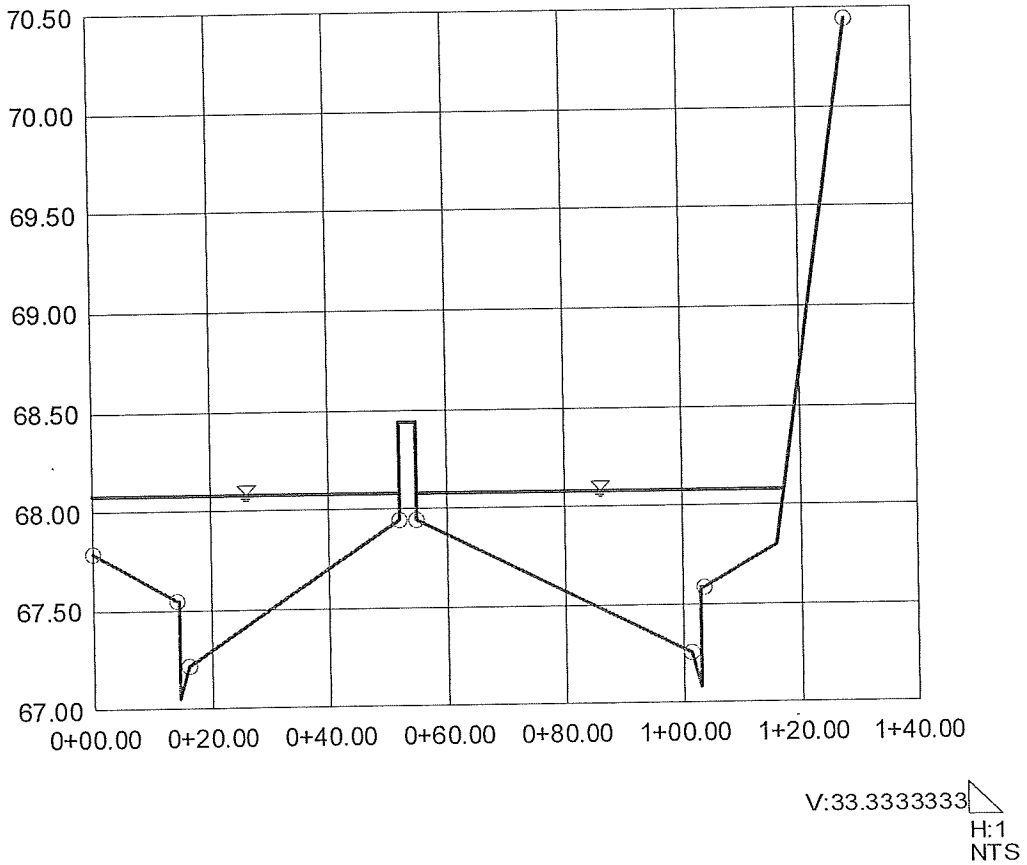
Tropical Pkwy Q100 INT Sec B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+14.50	67.05
0+16.00	67.22
0+52.00	67.94
0+52.00	68.44
0+55.00	68.44
0+55.00	67.94
1+01.50	67.25
1+03.00	67.08
1+03.00	67.58
1+03.50	67.58
1+16.00	67.80
1+28.50	70.44

Tropical Pkwy Q100 INT Sec B
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O0 INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Channel Slope	0.60 %
Water Surface Elevation	68.08 ft
Elevation Range	67.05 to 70.44
Discharge	230.00 cfs



Tropical Pkwy Q10 Dev Sec B
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	21.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	67.59	ft
Elevation Range	67.05 to 70.44	
Flow Area	8.5	ft²
Wetted Perimeter	48.46	ft
Top Width	47.44	ft
Actual Depth	0.54	ft
Critical Elevation	67.59	ft
Critical Slope	0.57	%
Velocity	2.46	ft/s
Velocity Head	0.09	ft
Specific Energy	67.68	ft
Froude Number	1.02	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Dry Lane

$\frac{67.94 - 67.59}{0.02} = 17.5'$

2 OK

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+14.00	0.022
0+14.00	0+16.00	0.013
0+16.00	0+52.00	0.016
0+52.00	0+55.00	0.013
0+55.00	1+01.50	0.016
1+01.50	1+03.50	0.013
1+03.50	1+28.50	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.79
0+14.00	67.55
0+14.50	67.55
0+14.50	67.05

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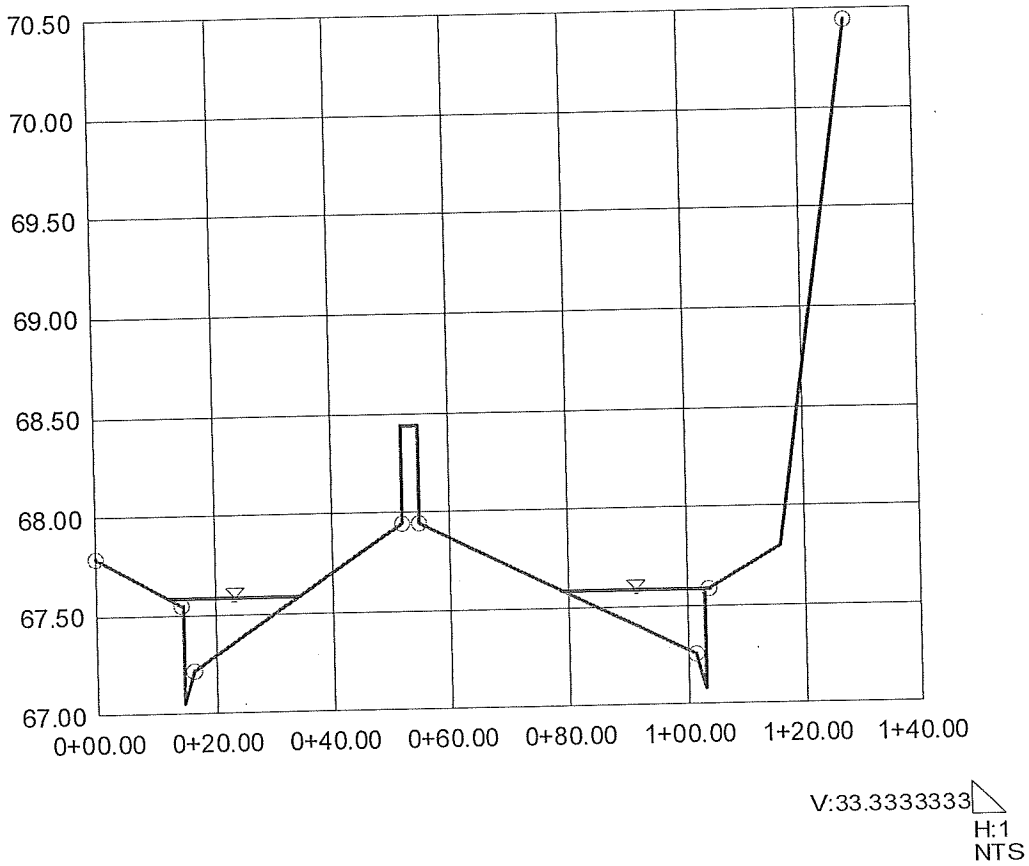
Tropical Pkwy Q10 Dev Sec B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+16.00	67.22
0+52.00	67.94
0+52.00	68.44
0+55.00	68.44
0+55.00	67.94
1+01.50	67.25
1+03.00	67.08
1+03.00	67.58
1+03.50	67.58
1+16.00	67.80
1+28.50	70.44

Tropical Pkwy Q10 Dev Sec B
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1O DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.60 %
Water Surface Elevation	67.59 ft
Elevation Range	67.05 to 70.44
Discharge	21.00 cfs



Tropical Pkwy Q100 Dev Sec B
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1OO DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.60	%
Discharge	232.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.016
Water Surface Elevation	68.08 ft
Elevation Range	67.05 to 70.44
Flow Area	54.5 ft²
Wetted Perimeter	115.95 ft
Top Width	114.32 ft
Actual Depth	1.03 ft
Critical Elevation	68.11 ft
Critical Slope	0.50 %
Velocity	4.26 ft/s
Velocity Head	0.28 ft
Specific Energy	68.36 ft
Froude Number	1.09
Flow Type	Supercritical

$V \times D$

$4.26 \times 1.03 = 4.4$

Calculation Messages:
Water elevation exceeds lowest end station by 0.28820327 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+14.00	0.022
0+14.00	0+16.00	0.013
0+16.00	0+52.00	0.016
0+52.00	0+55.00	0.013
0+55.00	1+01.50	0.016
1+01.50	1+03.50	0.013
1+03.50	1+28.50	0.022

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.79
0+14.00	67.55
0+14.50	67.55

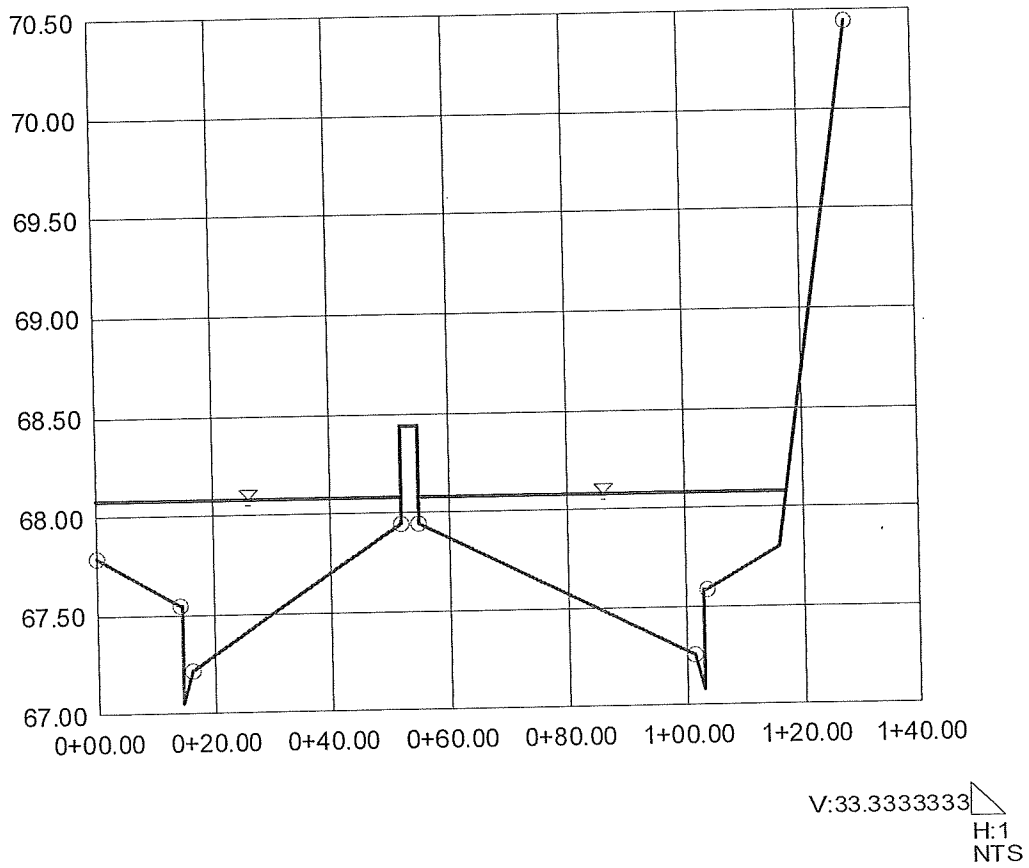
Tropical Pkwy Q100 Dev Sec B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+14.50	67.05
0+16.00	67.22
0+52.00	67.94
0+52.00	68.44
0+55.00	68.44
0+55.00	67.94
1+01.50	67.25
1+03.00	67.08
1+03.00	67.58
1+03.50	67.58
1+16.00	67.80
1+28.50	70.44

Tropical Pkwy Q100 Dev Sec B
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec B Q1OO DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.60	%
Water Surface Elevation	68.08	ft
Elevation Range	67.05 to 70.44	
Discharge	232.00	cfs



Tropical Pkwy Q10 Dev
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Channel Slope	0.70 %
Discharge	3.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.013
Water Surface Elevation	71.78 ft
Elevation Range	71.42 to 73.01
Flow Area	1.4 ft²
Wetted Perimeter	12.75 ft
Top Width	12.20 ft
Actual Depth	0.36 ft
Critical Elevation	71.79 ft
Critical Slope	0.55 %
Velocity	2.15 ft/s
Velocity Head	0.07 ft
Specific Energy	71.85 ft
Froude Number	1.12
Flow Type	Supercritical

Dry Lane

$\frac{72.51 - 71.78}{0.02} = 36.51$

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+12.00	0.022
0+12.00	0+14.00	0.013
0+14.00	0+50.00	0.016
0+50.00	0+53.00	0.013
0+53.00	0+96.00	0.016
0+96.00	1+03.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	72.44
0+12.00	72.11
0+12.50	72.11
0+12.50	71.61
0+14.00	71.78

Tropical Pkwy Q10 Dev
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+50.00	72.51
0+50.00	73.01
0+53.00	72.96
0+53.00	72.46
0+96.00	71.59
0+97.50	71.42
0+97.50	71.92
0+98.00	71.92
1+03.00	72.02

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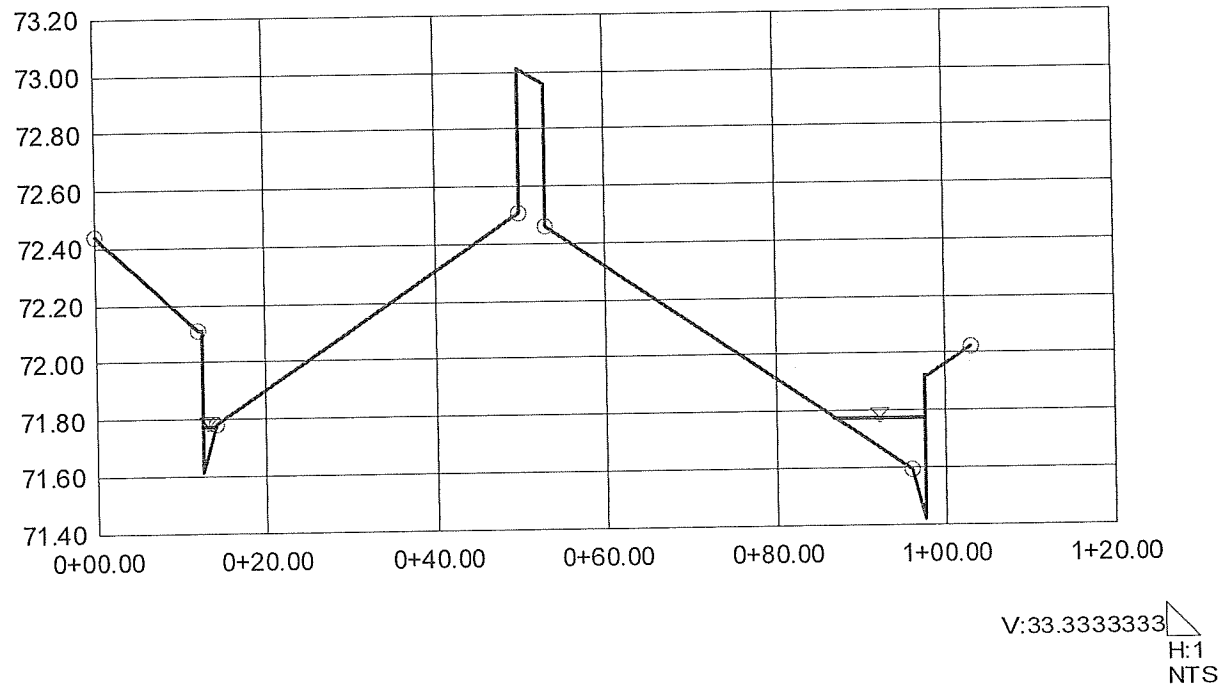
Tropical Pkwy Q10 Dev
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Channel Slope	0.70 %
Water Surface Elevation	71.78 ft
Elevation Range	71.42 to 73.01
Discharge	3.00 cfs



SEC A

Tropical Pkwy Q100 Dev
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1OO DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	224.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	72.55	ft
Elevation Range	71.42 to 73.01	
Flow Area	46.6	ft²
Wetted Perimeter	101.80	ft
Top Width	100.00	ft
Actual Depth	1.13	ft
Critical Elevation	72.62	ft
Critical Slope	0.43	%
Velocity	4.81	ft/s
Velocity Head	0.36	ft
Specific Energy	72.91	ft
Froude Number	1.24	
Flow Type	Supercritical	

$V \times D$

$4.81 \times 1.13 = 5.4$ C

Calculation Messages:
Water elevation exceeds lowest end station by 0.52819847 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+12.00	0.022
0+12.00	0+14.00	0.013
0+14.00	0+50.00	0.016
0+50.00	0+53.00	0.013
0+53.00	0+96.00	0.016
0+96.00	1+03.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	72.44
0+12.00	72.11
0+12.50	72.11
0+12.50	71.61

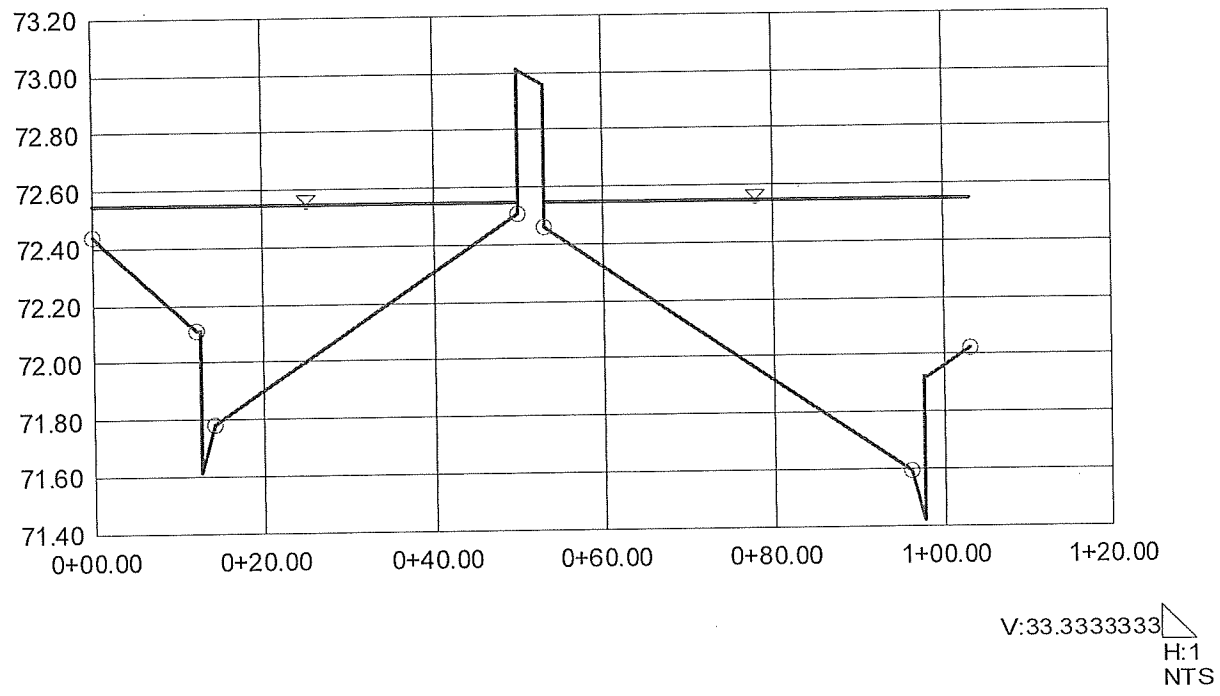
Tropical Pkwy Q100 Dev
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+14.00	71.78
0+50.00	72.51
0+50.00	73.01
0+53.00	72.96
0+53.00	72.46
0+96.00	71.59
0+97.50	71.42
0+97.50	71.92
0+98.00	71.92
1+03.00	72.02

Tropical Pkwy Q100 Dev
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1OO DEV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Channel Slope	0.70 %
Water Surface Elevation	72.55 ft
Elevation Range	71.42 to 73.01
Discharge	224.00 cfs



SEC A

Tropical Pkwy Q10 INT
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	3.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.013	
Water Surface Elevation	71.78	ft
Elevation Range	71.42 to 73.01	
Flow Area	1.4	ft²
Wetted Perimeter	12.75	ft
Top Width	12.20	ft
Actual Depth	0.36	ft
Critical Elevation	71.79	ft
Critical Slope	0.55	%
Velocity	2.15	ft/s
Velocity Head	0.07	ft
Specific Energy	71.85	ft
Froude Number	1.12	
Flow Type	Supercritical	

Dry Lane

$\frac{72.51 - 71.78}{0.02} = 36.5'$

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+12.00	0.022
0+12.00	0+14.00	0.013
0+14.00	0+50.00	0.016
0+50.00	0+53.00	0.013
0+53.00	0+96.00	0.016
0+96.00	1+03.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	72.44
0+12.00	72.11
0+12.50	72.11
0+12.50	71.61
0+14.00	71.78

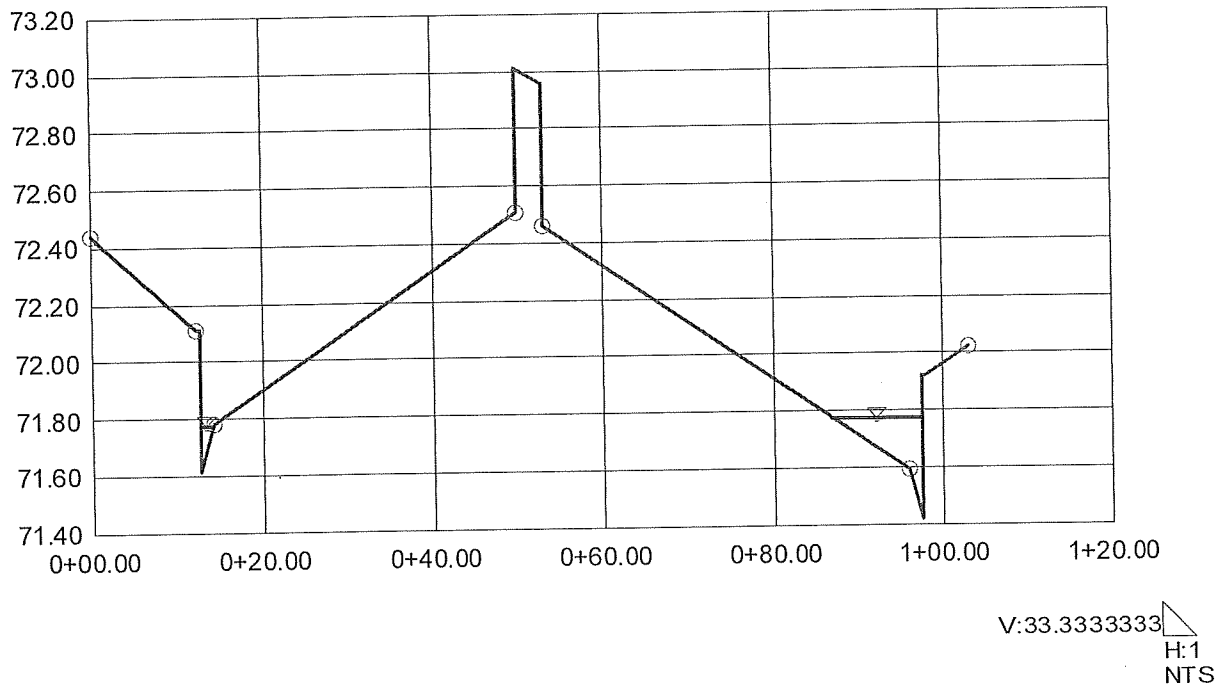
Tropical Pkwy Q10 INT
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+50.00	72.51
0+50.00	73.01
0+53.00	72.96
0+53.00	72.46
0+96.00	71.59
0+97.50	71.42
0+97.50	71.92
0+98.00	71.92
1+03.00	72.02

Tropical Pkwy Q10 INT
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q1O INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.70	%
Water Surface Elevation	71.78	ft
Elevation Range	71.42 to 73.01	
Discharge	3.00	cfs



SEC A

Tropical Pkwy Q100 INT
Worksheet for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10O INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.70	%
Discharge	224.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	72.54	ft
Elevation Range	71.42 to 73.01	
Flow Area	47.1	ft²
Wetted Perimeter	101.97	ft
Top Width	100.00	ft
Actual Depth	1.12	ft
Critical Elevation	72.61	ft
Critical Slope	0.45	%
Velocity	4.76	ft/s
Velocity Head	0.35	ft
Specific Energy	72.89	ft
Froude Number	1.22	
Flow Type	Supercritical	

V x d

~~Depth~~

4.76 x 1.12 = 5.3 > 2 OK

Calculation Messages:
Water elevation exceeds lowest end station by 0.52148249 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+12.00	0.022
0+12.00	0+14.00	0.013
0+14.00	0+50.00	0.016
0+50.00	0+53.00	0.013
0+53.00	0+96.00	0.016
0+96.00	1+03.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	72.24
0+12.00	72.11
0+12.50	72.11
0+12.50	71.61

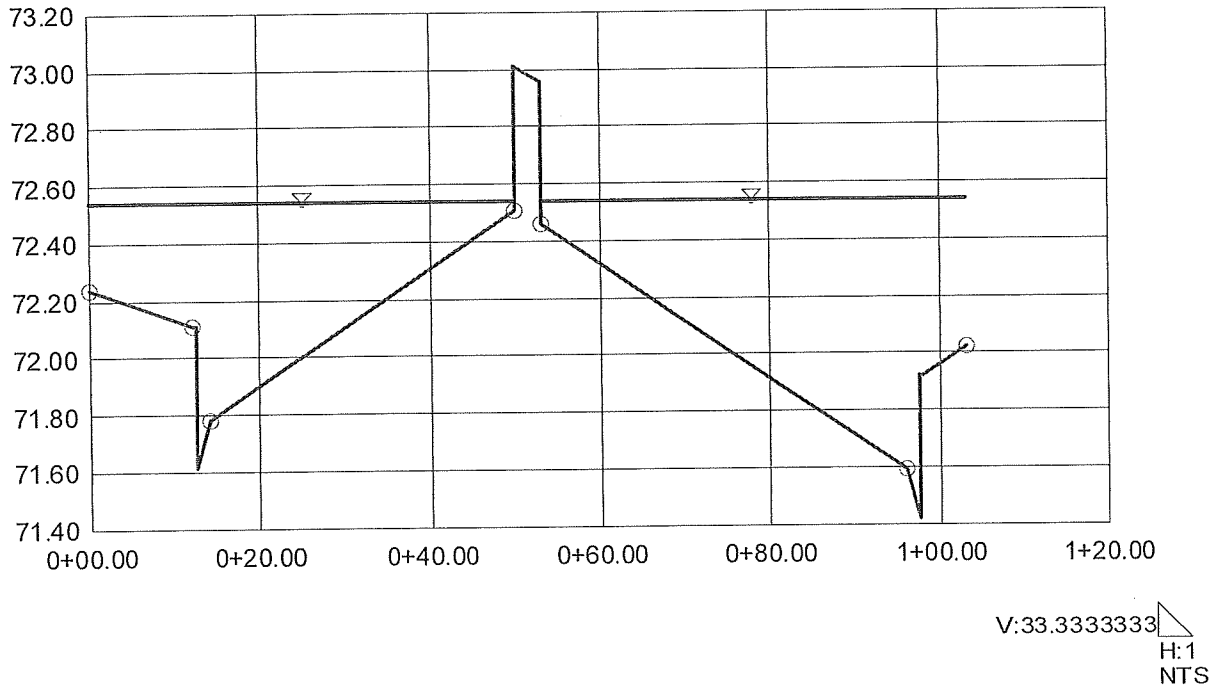
Tropical Pkwy Q100 INT
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+14.00	71.78
0+50.00	72.51
0+50.00	73.01
0+53.00	72.96
0+53.00	72.46
0+96.00	71.59
0+97.50	71.42
0+97.50	71.92
0+98.00	71.92
1+03.00	72.02

Tropical Pkwy Q100 INT
Cross Section for Irregular Channel

Project Description	
Worksheet	Tropical Parkway Sec A Q10O INT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.70	%
Water Surface Elevation	72.54	ft
Elevation Range	71.42 to 73.01	
Discharge	224.00	cfs



APPENDIX G

Response to Comment 14

City of North Las Vegas Comment Letter

CITY OF
NORTH LAS VEGAS

Your Community of Choice

PUBLIC WORKS – DEVELOPMENT AND FLOOD CONTROL
2250 N. Las Vegas Blvd., Suite 220 • North Las Vegas, Nevada 89030
Telephone: (702) 633-1200 • Fax: (702) 649-4696 • TDD: (800) 326-6868
www.cityofnorthlasvegas.com

November 30, 2011 Mailed via: E-mail

Ray Fredericksen, P.E.

Slater Hanifan Group
5740 S Arville Street. Suite #216
Las Vegas, Nevada 89118

Re: Technical Drainage Study for Tropical Pkwy./Centennial Pkwy. Roadway Improvements.
CNLV No. 43988

Dear Mr. Fredericksen :

CNLV staff has reviewed the above referenced study, dated November 7, 2011, and offers the following comments:

1. Concurrence must be obtained by the City of Las Vegas (CLV) due to the proposed improvements's proximity to the CLV jurisdiction. Please submit a copy of this study and all addenda to CLV upon acceptance from CNLV.

2. This Technical Drainage Study (TDS) is only for the proposed street improvements adjacent to the site, a separate drainage study and planning commission conditions must be submitted, in the future, for the undeveloped area within the same parcel.

3. A quick review of the general topography in the area shows that the area surrounding the project site drains southeasterly direction. It appears that Decatur Boulevard, adjacent to the site, may intercept some offsite flows from upstream of the project site.

   Section 1.5 of TDS states that "Improvements west pf Decatur have effectively cut off flows and routed them into the existing storm drain in Decatur." Please provide approved reference materials to illustrate that all flows are being contained within the existing storm drain in Decatur Boulevard. Please note that all 10-year and 100-year street capacity calculations must be revised to reflect any flow changes. Also, 12' dry lane criterion must also be met for the future condition.

4. Please note that the CNLV requires that all drop inlet sizing be performed with the HEC-22 software which can be acquired from the Federal Highway Administration's website.

5. Please explain and demonstrate how the Q100=118 cfs and Q10=38 cfs (hydraulic Section D-D of the Existing Condition Street Flows) were obtained since the flows for the Interim and Future conditions at hydraulic Section D-D are Q100=3 cfs and Q10= 2 cfs.

6. Please explain/show how the Q100/10 in This Study and the Twilight Study were obtained in Tables 3 and 5 of the TDS. The flow values in Tables 3 and 5 do not match with the flow values in the drainage basin maps and the reference materials for the Twilight Study.

7. Please explain and demonstrate how the Qapproaching=26 cfs in Table 8 of the TDS was obtained. The Interim and Future Condition Basin Maps show that Q100=21 cfs instead of Q100=26 cfs at Section E-E.

   Also, it appears that a portion of the Q100=302 cfs and Q10=78 cfs from Tropical Parkway will turn north adding to the flows in Centennial Parkway at the proposed drop inlets. Please evaluate and perform the necessary flow split calculations and revise all street and drop inlet capacity calculations to reflect the revision as necessary.

8. Please discuss and show how soil type boundaries were determined as delineated on the drainage basin maps? Provide any pertinent soil type chart for the project area.

9. It is unclear where is drainage basin DEC-5 as shown in the Soil and Curve Number Computation table of the TDS.

10. Please revised the Flowmaster calculations for the interim and future conditions of Centennial Parkway and Tropical Parkway to show the proposed concrete median islands.

11. Below are comments pertaining the Improvement Plans:

    a. If the landscapes areas along the meandering sidewalks are to be installed with the street improvements, the Engineer must show grades and flow lines within all landscape areas. Flows from the landscape areas will not be allowed to sheet flow over the adjacent sidewalks. Drainage swales should be graded to direct flows to discharge into the sidewalk underdrains.

    b. Since the 100-year depth of flows will overtop the curbs (i.e. Tropical Parkway), the proposed landscape berms used to protect future developed properties from flows in the adjacent streets must meet the criterium of being twice the depth of flow above the adjacent flowline up to 18" above adjacent water surface.

       Also, for 100-year street flow with depths greater than 0.6' and velocities higher than 5 fps, erosion resistant landscaping or pony walls must be provided.

    c. Please note that any proposed storm drains within the public right-of-way must be reinforced concrete pipe with diameter of 18" minimum. Please revise the portion of the proposed storm drain pipe on the east half of Centennial Parkway to reflect the above described requirements. Also, CNLV highly discourages the installation of storm drain under the curb and gutter. Please redesign the proposed storm drain lateral on the east side of Centennial Parkway to locate away from the curb and gutter.

    d. Please provide the Benchmark information.

e. The size of the drop inlets on Sheet P-6 are different from the sizes shown in the drop-inlet calculations in the TDS. Please revise the drawing to reflect the correct size of the drop inlets.

f. Please provide two driveways per the conditions of the approved Site Plan Review (SPR 11-11). The first driveway should be located on Rice Ave. at approximate station 13+00 and second driveway should be on Tropical Pkwy. at approximate station 108+50.

g. Please note that tack-on curb is not allowed in the public ROW. Please revise Sheets P-3 and P-4 to show "A" type curb per CCAUSD #219 for Tropical Pkwy.

h. The proposed meandering sidewalk on Tropical Pkwy., at approximate station 105+00, does not tie into the existing sidewalk at that location. Please revise drawing accordingly.

i. Since Rice Ave. is a new street (undeveloped on both sides), please submit a design for a new street without saw cutting and matching the existing asphalt pavement. All existing asphalt pavements on Rice Ave. are temporary and need to be removed and a half street improvements with 16' overpaved will be required as part of this development. In addition, a median island and a concrete valley gutter must be constructed within Rice Ave. at Decatur Blvd. intersection.

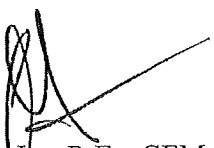
j. Please remove approval signature line for CNLV Traffic Engineer from all Plan and Profile sheets.

12. Additional comments may be generated on the second review.

13. A copy of this letter must accompany the subsequent submittal to the City of North Las Vegas.

It is recommended that the Engineer review the Drainage Study Checklist before resubmitting the drainage study addendum to the City. The City, its officials, or employees assume no liability for information, data, calculations and conclusions presented by the consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review. If you have any questions concerning this matter, please contact me at (702)633-1932.

Sincerely,



Dan Le, P.E., CFM
Senior Engineer
Development and Flood Control Division

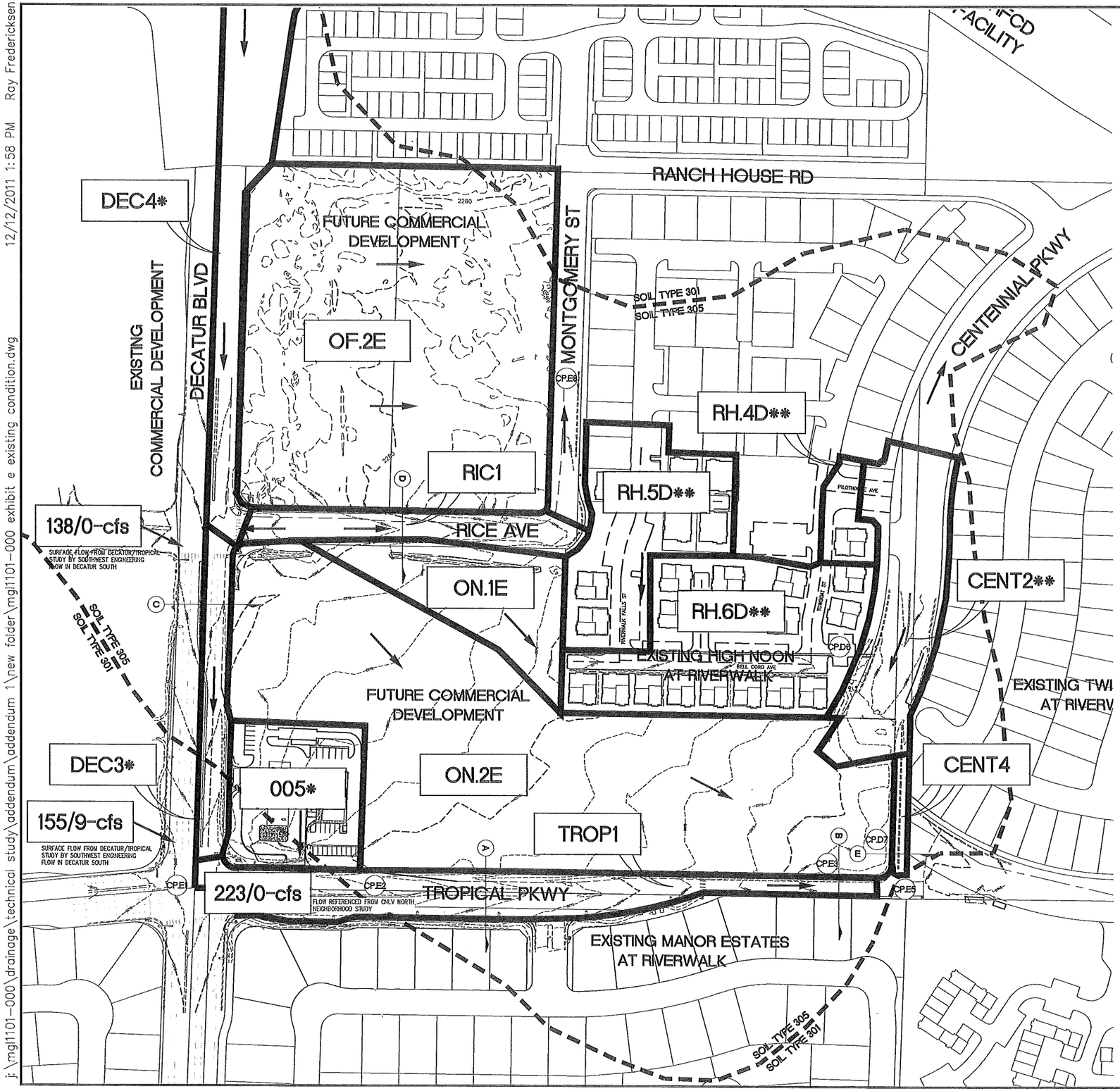
APPENDIX H

Figures

Existing

Interim

Future



Flow Summary
Existing Condition

Subbasin ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	
DEC.4	2.19	3	6	
DEC.3	0.76	1	2	
CP.E1	N/A	13	163	INCLUDES flows from west of Decatur
005*	1.55	3	5	
CP.E2	N/A	3	224	INCLUDES North Neighborhood flows
TROP1	2.05	3	6	0/223 cfs
ON.1E	1.54	1	3	
ON.2E	9.7	5	14	
CP.E3	N/A	11	230	INCLUDES North Neighborhood flows
RH.5D**	2.07	2	5	0/223 cfs
RH.6D**	3.17	4	8	
CP.D6**	N/A	6	13	
RH.4D**	0.34	<0.5	1	
CENT2**	1.65	3	5	
CENT4	0.14	<1	<1	
CP.D7	N/A	10	20	
CP.E5	N/A	20	233	INCLUDES North Neighborhood flows
OF.2E	8.64	5	14	0/223 cfs
RIC1	0.9	2	3	
CP.E8	N/A	6	17	

*Referenced from the Tropical/Decatur Convenience Store Proposed Condition Analysis, by Kimley Horn
**Referenced from the Twilight at Riverwalk Ranch Ultimate Condition Analysis, by SHS

Perimeter Street Flow Summary
Existing Condition

Section	Slope (%)	Q_{100} (cfs)	Depth (ft)	Velocity (fps)	VxD	Q_{10} (cfs)	Dry Lane Width (ft)
SECTION A Tropical Pkwy (100' ROW) *(Q = CP.E2)*	0.70	224.0	1.18	5.70	6.7	3.0	39.00
SECTION B Tropical Pkwy (100' ROW) *(Q = CP.E3)*	0.60	230.0	1.14	6.40	7.3	11.0	0.00
SECTION C Decatur Blvd (100' ROW) *(North of C-Store)*	0.60	144.0	0.91	3.84	3.5	3.0	22.0
SECTION D Rice Ave (60' ROW) *(Q = RIC1)*	0.61	118.0	1.03	3.94	4.1	38.0	n/a
SECTION E Centennial Pkwy (100' ROW) *(Q = CP.D7)*	0.43	20.0	0.63	3.37	2.1	10.0	0.0

N

0 200 400
SCALE – 1"=200' FEET

LEGEND

- BASIN BOUNDARY
- ON-D1 — BASIN ID
- FLOW DIRECTION
- PT1 — CONCENTRATION POINT
- SOIL BOUNDARY
- 000 — FLOWMASTER SECTION

SLATER HANIFAN GROUP
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5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
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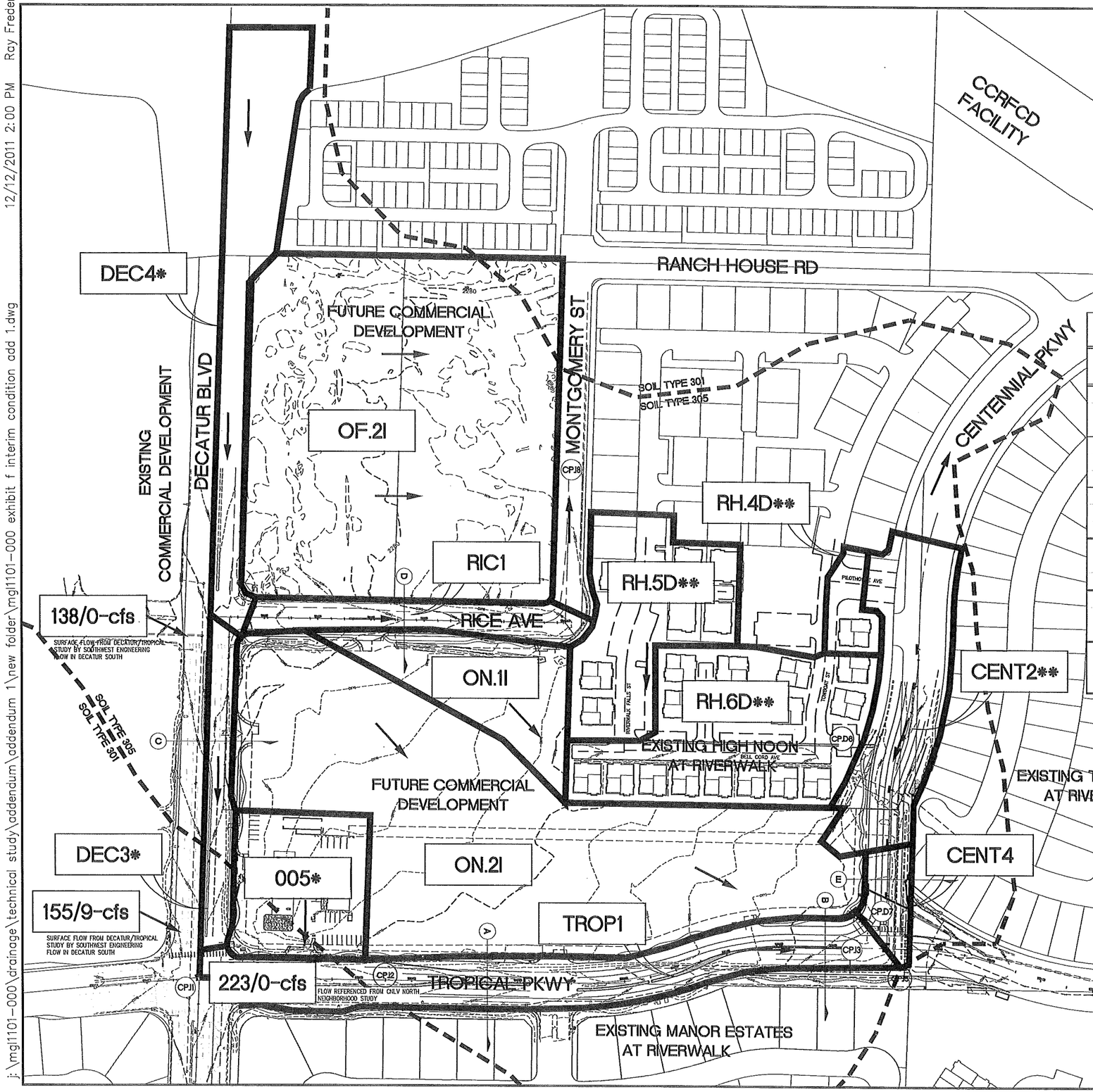
NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

M GRAPE LLC

TROPICAL PARKWAY REALIGNMENT
EXISTING CONDITION BASIN MAP

DATE: 9/23/11
DRAFTER: RFF
DESIGNER: RFF
CHECKED: RFF
PROJECT NO.
MGL1101.000

EXHIBIT E
SHEET 1 OF 3



Flow Summary
Interim Condition

Subbasin ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	
DEC.4	2.19	3	6	
DEC.3	0.76	1	2	
CP.I1 (SOUTH IN DECATUR)	N/A	13	163	INCLUDES flow
005*	1.55	3	5	
CP.I2	N/A	3	224	INCLUDES North Neighborhood flows
TROP1	2.69	4	8	0/223 cfs
ON.1I	1.54	1	3	
ON.2I	8.64	4	13	
CP.I3	N/A	12	230	INCLUDES North Neighborhood flows
RH.5D**	2.07	2	5	0/223 cfs
RH.6D**	3.17	4	8	
CP.D6**	N/A	6	13	
RH.4D**	0.34	<0.5	1	
CENT2**	1.65	3	5	
CENT4	0.38	<1	<1	
CP.D7	N/A	10	21	
CP.I5	N/A	21	233	INCLUDES North Neighborhood flows
OF.2I	8.64	5	14	0/223 cfs
RIC1	0.9	2	3	
CP.I8	N/A	6	17	

*Referenced from the Tropical/Decatur Convenience Store Proposed Condition Analysis, by Kimley Horn
**Referenced from the Twilight at Riverwalk Ranch Ultimate Condition Analysis, by SHG

Perimeter Street Flow Summary
Interim Condition

Section	Slope (%)	Q_{100} (cfs)	Depth (ft)	Velocity (fps)	VxD	Q_{10} (cfs)	Dry Lane Width (ft)
SECTION A Tropical Pkwy (100' ROW) *(Q = CP.I2)*	0.70	224.0	1.12	4.76	5.3	3.0	36.50
SECTION B Tropical Pkwy (100' ROW) *(Q = CP.I3)*	0.60	230.0	1.03	4.25	4.4	12.0	21.50
SECTION C Decatur Blvd (100' ROW) *(Q = North of C-Store)*	0.40	144.0	0.98	3.14	3.1	3.0	24.0
SECTION D Rice Ave (60' ROW) *(Q = RIC1)*	0.61	3.0	0.32	1.62	0.5	2.0	n/a
SECTION E (West 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.70	17.0	0.52	2.57	1.3	8.0	36'
SECTION E (East 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.90	4.0	0.31	1.79	0.6	2.0	36'

LEGEND

- BASIN BOUNDARY
- ON-D1 — BASIN ID
- FLOW DIRECTION
- PT1 — CONCENTRATION POINT
- SOIL BOUNDARY
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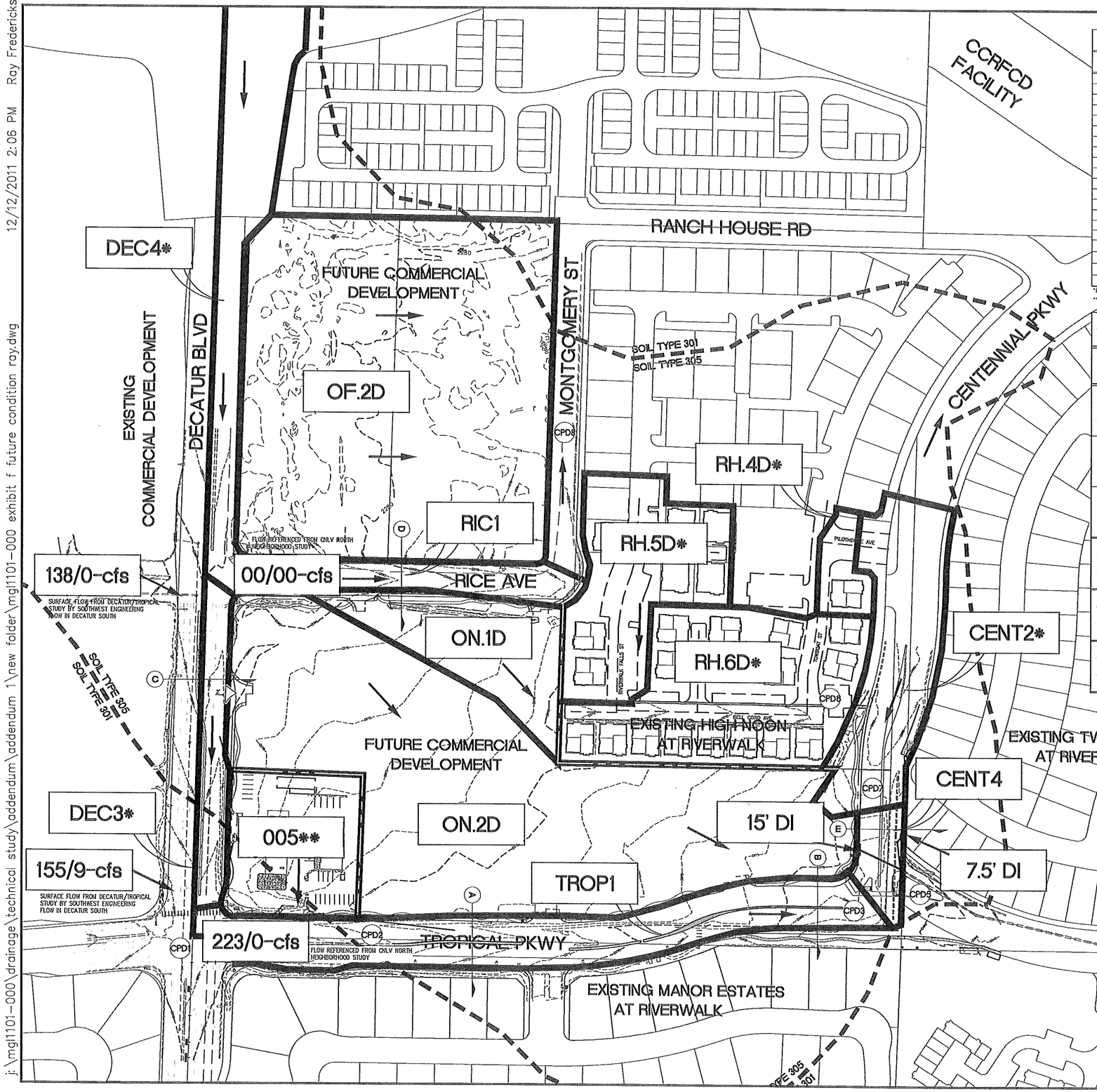
NO.	DESCRIPTION	DATE	BY	APP. DATE	APP

M GRAPE LLC

TROPICAL PARKWAY REALIGNMENT
INTERIM CONDITION BASIN MAP

DATE: 9/23/11
DRAFTER: RFF
DESIGNER: RFF
CHECKED: RFF
PROJECT NO. MGL1101.000

EXHIBIT F
SHEET 2 OF 3



Flow Summary
Proposed Condition

Subbasin ID	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)	
DEC.4	2.19	3	6	
DEC.3	0.76	1	2	
CP.D1	N/A	13	163	INCLUDES North Neighborhood flows
005*	1.55	3	5	
CP.D2	N/A	3	224	INCLUDES North Neighborhood flows
TROP1	2.69	4	8	
ON.1D	1.54	3	5	
ON.2D	8.64	12	22	
CP.D3	N/A	21	232	INCLUDES North Neighborhood flows
RH.5D**	2.07	2	5	
RH.6D**	3.17	4	8	
CP.D6**	N/A	6	13	
RH.4D**	0.34	<0.5	1	
CENT2**	1.65	3	5	
CENT4	0.38	<1	<1	
CP.D7	N/A	10	21	
CP.D5	N/A	30	235	INCLUDES North Neighborhood flows
RIC1	0.9	2	3	
OF.2D	8.64	13	24	
CP.D8	N/A	15	26	

*Referenced from the Tropical/Decatur Convenience Store Proposed Condition Analysis, by Kimley Horn
**Referenced from the Twilight at Riverwalk Ranch Ultimate Condition Analysis, by SHG

Perimeter Street Flow Summary
Future Condition

Section	Slope (%)	Q_{100} (cfs)	Depth (ft)	Velocity (fps)	VxD	Q_{10} (cfs)	Dry Lane Width (ft)
SECTION A Tropical Pkwy (100' ROW) *(Q = CP.D2)*	0.70	224.0	1.13	4.81	5.4	3.0	36.50
SECTION B Tropical Pkwy (100' ROW) *(Q = CP.D3)*	0.60	232.0	1.03	4.26	4.4	21.0	17.50
SECTION C Decatur Blvd (100' ROW) *(Q = North of C-Store)*	0.40	144.0	0.98	3.14	3.1	3.0	24.0
SECTION D Rice Ave (60' ROW) *(Q = RIC1)*	0.61	3.0	0.32	1.62	0.5	2.0	n/a
SECTION E (West 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.70	17.0	0.52	2.57	1.3	8.0	36'
SECTION E (East 1/2 St) Centennial Pkwy (90' ROW) *(Q = CP.D7)*	0.90	4.0	0.31	1.79	0.6	2.0	36'

LEGEND

- BASIN BOUNDARY
- ON-D1 — BASIN ID
- FLOW DIRECTION
- PT1 — CONCENTRATION POINT
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NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

M GRAPE, LLC.

TROPICAL PARKWAY REALIGNMENT
FUTURE CONDITION BASIN MAP

DATE: 9/23/11
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CHECKED: RFF
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EXHIBIT G
SHEET 3 OF 3