PDP SWQMP

PRIORITY DEVELOPMENT PROJECT (PDP)
STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)

SUNBOW II, PHASE 3
Permit Application No. MPA20-0006
Drawing No. TBD

ENGINEER OF WORK:



[Alisa S. Vialpando, RCE #47945
Provide Wet Signature and Stamp above]

PREPARED FOR:
[Lennar Homes]
[16465 Via Esprillo, Suite 150]
[San Diego, CA 92127]

Jan 26, 2021

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

[9707 Waples Street]
[San Diego, CA 92121]
[(858)558-4500]

DATE:
January 26, 2021

Approved By: City of Chula Vista
(print Name & Sign)

Date:

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- ☒ **FORM I-3B Site Information Checklist for PDPs**
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- ☒ **ATTACHMENT 2: Backup for PDP Hydromodification Control Measures**
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ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

Project Name/ Sunbow II, Phase 3

Certification Page

Project Name: Sunbow II, Phase 3

Permit Application Number: MPA20-0006

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Chula Vista BMP Design Manual, which is based on the requirements of the San Diego Regional Water Quality Control Board Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

Alisa S. Vialpando, 6/19/20

Engineer of Work's Signature, Date

47945, 12/31/2021

PE #, Expiration Date

Alisa S. Vialpando

Print Name

Hunsaker & Associates San Diego, Inc.

Company



Project Name/ Sunbow II, Phase 3

SUBMITTAL RECORD

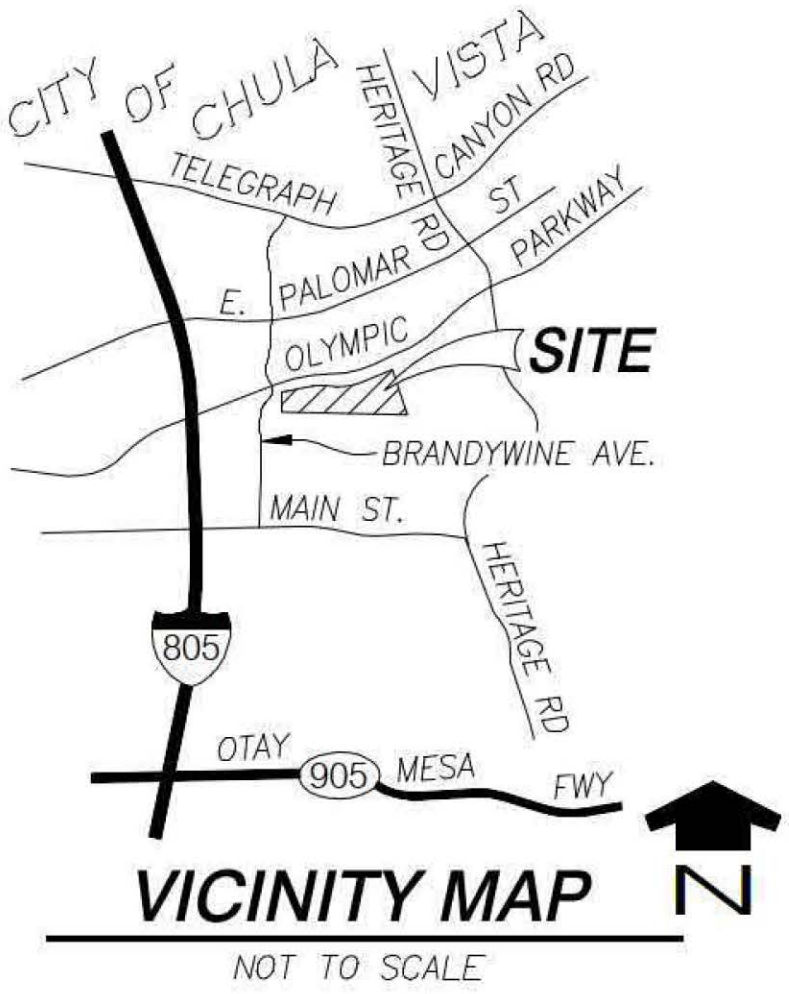
Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Summary of Changes
1	Feb 17, 2020	☑ Preliminary Design / Planning/ CEQA ☐ Final Desi n	Initial Submittal
2	Apr. 27, 2020	☑ Preliminary Design / Planning/ CEQA ☐ Final Desi n	Address plan check comments
3	June 23,2020	☑ Preliminary Design / Planning/ CEQA ☐ Final Desi n	Address plan check comments
4	Sep 30,2020	☑ Preliminary Design / Planning/ CEQA ☐ Final Desi n	Final Submittal
5	Jan 26, 2021	☑ Preliminary Design	Added offsite grading

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Project Name/ Sunbow II, Phase 3

Project Vicinity Map



Insert Completed Intake Form (Storm Water Requirements Applicability Checklist)

https://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports

Storm Water Requirements Applicability Checklist for All Permit Applications

Intake Form

March 2019 Update

Project Information

Project Address: South of Olympic Pkwy, North of Otay Landfill, 1.2 miles east of Freeway 805	Project Application # TBD
Project Name: SUNBOW PA-23	APN(s) 644-011-06-00, 644-020-11-00

Brief Description of Work Proposed: A land development project for multiple townhouse buildings with associated roads and landscapes.

The project is (select one):

☑ New Development Total Impervious Area 1,566,096 ft²

☐ Redevelopment Total new and/or replaced Impervious Area _____ ft²

(Redevelopment is the creation and/or replacement of impervious surface on an already developed site).

☐ *Others* _____

Name of Person Completing this Form: Alisa S. Vialpando

Role: ☐ Property Owner ☐ Contractor ☐ Architect ☑ Engineer ☐ Other _____

Email: AVialpando@hunsakersd.com Phone: (858)5584500

Signature: Alisa S. Vialpando Date Completed: 02/17/2020

Answer each section below, starting with Section 1 and progressing through each section. Additional information for determining the requirements is found in the Chula Vista BMP Design Manual available on the City's website at http://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports.

SECTION 1: Storm Water BMP Requirements

Does the project consist of **one or both** of the following: • Repair or improvements to an existing building or structure that don't alter the size such as: tenant improvements, interior remodeling, electrical work, fire alarm, fire sprinkler system, HVAC work, Gas, plumbing, etc. • Routine maintenance activities such as: roof or exterior structure surface replacement; resurfacing existing roadways and parking lots including dig outs, slurry seal, overlay and restriping; repair damaged sidewalks or pedestrian ramps on existing roads without expanding the impervious footprint; routine replacement of damaged pavement, trenching and resurfacing associated with utility work (i.e. sewer, water, gas or electrical laterals, etc.) and pot holing or geotechnical investigation borings.	☐ **Yes**	**Project is NOT Subject Permanent Storm Water E requirements.** **BUT IS** subject to Construc BMP requirements. Review & sign "Construction Storm Water BMP Certification Statement" on page 2.
	☑ **No**	**Continue to Section 2, page 3.**

1599328.2

Sunbow II, Phase

Construction Storm Water BMP Certification Statement

The following stormwater quality protection measures are required by City Chula Vista Municipal Code Chapter 14.20 and the City's Jurisdictional Runoff Management Program.

1. All applicable construction BMPs and non-stormwater discharge BMPs shall be installed and maintained for the duration of the project in accordance with the Appendix K "Construction BMP Standards" of the Chula Vista BMP Design Manual.
2. Erosion control BMPs shall be implemented for all portions of the project area in which no work has been done or is planned to be done over a period of 14 or more days. All onsite drainage pathways that convey concentrated flows shall be stabilized to prevent erosion.
3. Run-on from areas outside the project area shall be diverted around work areas to the extent feasible. Run-on that cannot be diverted shall be managed using appropriate erosion and sediment control BMPs.
4. Sediment control BMPs shall be implemented, including providing fiber rolls, gravel bags, or other equally effective BMPs around the perimeter of the project to prevent transport of soil and sediment offsite. Any sediment tracked onto offsite paved areas shall be removed via sweeping at least daily.
5. Trash and other construction wastes shall be placed in a designated area at least daily and shall be disposed of in accordance with applicable requirements.
6. Materials shall be stored to avoid being transported in storm water runoff and non-storm water discharges. Concrete washout shall be directed to a washout area and shall not be washed out to the ground.
7. Stockpiles and other sources of pollutants shall be covered when the chance of rain within the next 48 hours is at least 50%.

I certify that the stormwater quality protection measures listed above will be implemented at the project described on Intake Form. I understand that failure to implement these measures may result in monetary penalties or other enforcement actions. This certification is signed under penalty of perjury and does not require notarization.

Name: Alisa S. Vialpando Title: Vice President

Signature: Alisa S. Vialpl Date: 02/17/2020

Section 2: Determine if Project is a Standard Project or Priority Development Project

Is the project in any of the following categories, (a) through (j)?

(a) New development that **creates 10,000 square feet** or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. ☑ **Yes** ☐ **No**

(b) Redevelopment project that **creates and/or replaces 5,000 square feet** or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. ☐ **Yes** ☑ **No**

(c) New development or redevelopment projects that **creates and/or replaces a combined total of 5,000 square feet** or more of impervious surface (collectively over the entire project site) and support one or more of the following uses: ☐ **Yes** ☑ **No**

(i) **Restaurant.** This This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification Code 5812).

(ii) **Hillside development projects**. This category includes development on any natural slope that is twenty-five percent or greater.

(iii) **Parking Lots.** This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.

(iv) **Streets, roads, highways, freeways, and driveways**. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

(d) New development or redevelopment project that **creates and/or replaces 2,500 square feet** or more of impervious surface (collectively over the entire project site), discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). ☐ **Yes** ☑ **No**

(e) New development or redevelopment project that creates and/or replaces a combined total of 5,000 square feet or more of impervious surface, that support one or more of the following used: ☐ **Yes** ☑ **No**

(i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

(ii) Retail gasoline outlets. This category includes retail gasoline outlets that meet the meet one of the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.

(f) New development or redevelopment that result in the disturbance of **one or more acres** of land and are expected to generate pollutants post construction. This does not include projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces of if they sheet flow to surrounding pervious surfaces. ☐ **Yes** ☑ **No**

The project is (select one):

☐ If "No" is checked for every category in Section 2, **Project is "Standard Development Project".** Site design and source control BMP requirements apply. **Complete and submit Standard SWQMP** (refer to Chapter 4 & Appendix E of the BMP Design Manual for guidance). Continue to Section 4.

☑ If "Yes" is checked for ANY category in Section 2, **Project is "Priority Development Project (PDP)".** Complete below, if applicable, and continue to Section 3.

Complete for PDP Redevelopment Projects ONLY:

The total existing (pre-project) impervious area at the project site is: _____ ft^2 (A)

The total proposed newly created or replaced impervious area is _____ ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: _____%

The percent impervious surface created or replaced is (select one based on the above calculation):

☐ less than or equal to fifty percent (50%)—**only new impervious areas are considered a PDP**
OR

☐ greater than fifty percent (50%)—**the entire project site is considered a PDP**

☐ **Continue to Section 3**

Section 3: Determine if project is PDP Exempt

1. Does the project ONLY include new or retrofit sidewalk, bicycle lane or trails that:
   - Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   - Are designed and constructed to be hydraulically disconnected from paved streets or roads? Or;
   - Are designed and constructed with permeable pavements or surfaces in accordance with USEPA Green Streets guidance?

   ☐ **Yes. Project is PDP Exempt.**

   Complete and submit **Standard SWQMP** (refer to Chapter 4 of the BMP Design Manual for guidance). **Continue to Section 4.**

   ☑ **No. Next question**

2. Does the project ONLY include retrofitting or redevelopment of existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets standards?

   ☐ **Yes.**
   Project is PDP Exempt.
   Complete and submit Standard SWQMP (refer to Chapter 4 of the BMP Design Manual for guidance). **Continue to Section 4.**

   ☑ **No.**
   Project is PDP.
   Site design, source control and structural pollutant control BMPs apply. Complete and submit PDP SWQMP (refer to Chapters 4, 5 & 6 of the BMP Design Manual for guidance). **Continue to Section 4.**

SECTION 4: Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the BMP Design Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP), which is administered by the State Water Resource Control Board.

1. Does the project include Building/Grading/Construction permits proposing less than 5,000 square feet of ground disturbance and has less than 5-foot elevation change over the entire project area?

☐ Yes; review & sign Construction Storm Water Certification Statement, skip questions 2-4 ☑ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing grading, grubbing, excavation, or other activity that results in ground disturbance of less than one acre and more than 5,000 square feet?

☐ Yes. complete & submit Construction Storm Water Pollution Control Plan (CSWPCP), skip questions 3-4 ☑ No; next question

3. Does the project results in disturbance of an acre or more of total land area and are considered regular maintenance projects performed to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (Projects such as sewer/storm drain/utility replacement)

☐ Yes. complete & submit Construction Storm Water Pollution Control Plan (CSWPCP), skip question 4 ☑ No; next question

4. Is the project proposing land disturbance greater than or equal to one acre OR the project is part of a larger common plan of development disturbing 1 acre or more?

☑ Yes; Storm Water Pollution Prevention Plan (SWPPP) is required. Refer to online CASQA or Caltrans Template. Visit the SWRCB web site at http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

Note: for Projects that result in disturbance of one to five acres of total land area and can demonstrate that there will be no adverse water quality impacts by applying for a Construction Rainfall Erosivity Waiver, may be allowed to submit a CSWPCP in lieu of a SWPPP.

Project Name/ Sunbow II, Phase 3

HMP Exemption Exhibit

Attach this Exhibit (if Applicable) that shows direct storm water runoff discharge from the project site to HMP exempt area. Include project area, applicable underground storm drains line and/or concrete lined channels, outfall information and exempt waterbody. Reference applicable drawing number(s). **Exhibit must be provided on 11"x17" or larger paper.**

Project Name/ Sunbow II, Phase 3

Insert Completed Form I-3B: Site Information Checklist for PDPs

https://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports

Project Name: Sunbow II, Phase 3

Site Information Checklist	Form I-3B
Project Summary Information	
Project Name	SUNBOW PA-23 & PRESERVE
Project Address	Surrounded by Olympic Pkwy, Heritage Rd, Otay Landfill within the City of Chula Vista
Assessor's Parcel Number(s) (APN(s))	644-011-06-00, 644-020-11-00
Permit Application Number	MPA20-0006
Project Watershed	☒ San Diego Bay
Hydrologic Subarea name with Numeric Identifier up to two decimal places	Select One: ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☒ Otay 910
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	135.7 Acres (5911417.65 Square Feet)
Area to be Disturbed by the Project (Project Footprint)	58.83 Acres (2562983.6 Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	36.72 Acres (1599328.2 Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	22.11 Acres (963111.6 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition	61 %

Project Name: Sunbow II, Phase 3

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Description of Existing Site Condition and Drainage Patterns

Current Status of the Site (select all that apply):

- ☐ Existing development
- ☐ Previously graded but not built out
- ☐ Demolition completed without new construction
- ☐ Agricultural or other non-impervious use
- ☒ Vacant, undeveloped/natural

Description / Additional Information:

Project area is natural lands and open spaces covered with native vegetation and shrubs.

Existing Land Cover Includes (select all that apply):

- ☒ Vegetative Cover
- ☒ Non-Vegetated Pervious Areas
- ☐ Impervious Areas

Description / Additional Information:

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):

- ☐ NRCS Type A
- ☐ NRCS Type B
- ☒ NRCS Type C
- ☒ NRCS Type D

Approximate Depth to Groundwater (GW):

- ☐ GW Depth < 5 feet
- ☐ 5 feet < GW Depth < 10 feet
- ☐ 10 feet < GW Depth < 20 feet
- ☒ GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):

- ☒ Watercourses
- ☐ Seeps
- ☐ Springs
- ☐ Wetlands
- ☐ None

Description / Additional Information:

Poggi Canyon Creek runs along the north side of the project from east to west

Project Name: Sunbow II, Phase 3

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Description of Existing Site Drainage Patterns

How is storm water runoff conveyed from the site? At a minimum, this description should answer:

1. whether existing drainage conveyance is natural or urban;
2. Is runoff from offsite conveyed through the site? if yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
3. Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
4. Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:

The 117.3-acre hydrologic catchment primarily consist of natural grades and hills all covered by native vegetations and shrubs. The site is accessible from Olympic Pkwy through two separate bridges crossing Poggi Canyon creek in north side. The Poggi Canyon creek flows from northeast to southwest and accepts large amount of storm runoff from surrounding area. It is also the downstream of the onsite runoff from both our existing and proposed condition. The local high points are in southern boundary of the site adjacent to the Otay landfill and make the overall on site surface flow pattern simply south to north.

A small portion of the site in southwest corner was occupied by a water tank which is serving the nearby residential areas.

Based on the site topo, the existing condition catchment was divided into 7 subcatchments. All onsite runoff from sub-catchment under design event will flow from south via natural valley to north into Poggi Canyon creek and eventually confluence at the northwest corner of our catchment.

Project Name: Sunbow II, Phase 3

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Descri tion of Pro osed Site Develo ment and Draina e Patterns

Project Description / Proposed Land Use and/or Activities:

The Proposed Project's residential land use includes four unique multi-family attached residential product types with 15 unique floor plans, ranging in square footage from approximately 1,100 to 2,050 square feet in two- and three-story units. Each home includes a two-car garage and two to four bedrooms.
The development of the site will include adding the storm drains, curb inlets, cleanouts along the proposed onsite private roads and parking spaces to collect and convey the storm runoff to the two proposed detention and water quality control basins located at northeast and northwest part of development area.
The project also proposed bypassing storm drains running from south into Poggi Canyon creek in north to collect and bypass the offsite flow primarily from south and east side of the catchment.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):

Roadways, sidewalks, roofs

List/describe proposed pervious features of the project (e.g., landscape areas):

landscapes, wetlands

Does the project include grading and changes to site topography?

- ☒ Yes
- ☐ No

Description / Additional Information:

The grading is included to accommodate new constructed buildings.

Project Name: Sunbow II, Phase 3

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Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

- [x] Yes
- [ ] No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:

The Proposed Project's residential land use includes four unique multi-family attached residential product types with 15 unique floor plans, ranging in square footage from approximately 1,100 to 2,050 square feet in two- and three-story units. Each home includes a two-car garage and two to four bedrooms.

There is also a recreation facility in the central area. The development of the site will include adding the storm drains, curb inlets, cleanouts along the proposed onsite private roads and parking spaces to collect and convey the storm runoff to the two proposed detention and water quality control basins located at northeast and northwest part of the development area.

The project also proposed bypassing storm drains running from south into Poggi Canyon creek in north to collect and bypass the offsite flow primarily from south and east side of the catchment.

For more information please refer to 'DRAINAGE STUDY for SUNBOW II, PHASE 3 , Jan 26, 2021 prepared by Hunsaker & Associates San Diego, Inc

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Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

- ☒ On-site storm drain inlets
- ☒ Interior floor drains and elevator shaft sump pumps
- ☒ Interior parking garages
- ☒ Need for future indoor & structural pest control
- ☒ Landscape/Outdoor Pesticide Use
- ☒ Pools, spas, ponds, decorative fountains, and other water features
- ☐ Food service
- ☒ Refuse areas
- ☐ Industrial processes
- ☐ Outdoor storage of equipment or materials
- ☐ Vehicle and Equipment Cleaning
- ☐ Vehicle/Equipment Repair and Maintenance
- ☐ Fuel Dispensing Areas
- ☐ Loading Docks
- ☒ Fire Sprinkler Test Water
- ☒ Miscellaneous Drain or Wash Water
- ☒ Plazas, sidewalks, and parking lots

Description / Additional Information:

Project Name: Sunbow II, Phase 3

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Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):

The onsite runoff from the site will be collected by proposed curb inlets and storm drain systems which will convey the stormwater through the onsite Biofiltration and Modular Wetland BMPs for water quality control. The outflow of these BMPs discharges into Poggi Canyon Creek whose ultimate downstream destination is San Diego Bay.

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
Poggi Canyon Creek	Nitrogen, Toxicity	Not listed
Otay River	Not listed	Not listed
San Diego Bay	Mercury, PAH, PCB	Bacteria, Dissolved Copper, lead
		Zinc

Identification of Project Site Pollutants*

*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Expected from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☐	☐	☐
Nutrients	☐	☐	☐
Heavy Metals	☐	☐	☐
Organic Compounds	☐	☐	☐
Trash & Debris	☐	☐	☐
Oxygen Demanding Substances	☐	☐	☐
Oil & Grease	☐	☐	☐
Bacteria & Viruses	☐	☐	☐
Pesticides	☐	☐	☐

Project Name: Sunbow II, Phase 3

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Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6)?

- ☒ Yes, hydromodification management flow control structural BMPs required.
- ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):

Note: If "No" answer has been selected the SWQMP must include an exhibit that shows the storm water conveyance system from the project site to an exempt water body. The exhibit should include details about the conveyance system and the outfall to the exempt water body.

Critical Coarse Sediment Yield Areas*
***This Section only required if hydromodification management requirements apply**

Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint?

- ☒ Yes
- ☐ No

Description / Additional Information:

The CCSYA exists within the project site.

Project Name: Sunbow II, Phase 3

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Flow Control for Post-Project Runoff*

***This Section only required if hydromodification management requirements apply**

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project HMP Exhibit.

POC1 is located in northwest of the project site at where the basin 1 outflow confluences with existing culvert in Poggi Canyon Creek.

POC2 is located in northeast of the project site at where the basin 2 outflow confluences with existing culvert in Poggi Canyon Creek.

Has a geomorphic assessment been performed for the receiving channel(s)?

- ☐ No, the low flow threshold is 0.1Q2 (default low flow threshold)
- ☐ Yes, the result is the low flow threshold is 0.1Q2
- ☐ Yes, the result is the low flow threshold is 0.3Q2
- ☒ Yes, the result is the low flow threshold is 0.5Q2

If a geomorphic assessment has been performed, provide title, date, and preparer:

Susceptibility Analysis of Poggi Creek, Nov 7, 2012 (Revised 1/17/2013), Tory R. Walker Engineering, Inc.
Addendum to the Susceptibility Analysis of Poggi Creek (d50 Determination), March 14, 2013, Tory R. Walker Engineering, Inc.
Otay Ranch Village 2 North (Chula Vista Tract No. 06-05), Nov 17, 2011, ChangConsultants

Discussion / Additional Information: (optional)

Form I-3B Page 10 of 10

Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

Project Name/ Sunbow II, Phase 3

Insert Completed Form I-4: Source Control BMP Checklist for All Development Projects

https://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports

Project Name: Sunbow II, Phase 3

Source Control BMP Checklist for All Development Projects	Form I-4

All development projects must implement source control BMPs. Refer to **Chapter 4** and **Appendix E** of the BMP Design Manual for information to implement BMPs shown in this checklist.

Note: All selected BMPs must be shown on the site/construction plans.

Answer each category below pursuant to the following:

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.

Source Control Requirement	Applied?		
4.2.1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.1 not implemented:			
4.2.2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.2 not implemented:			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if 4.2.3 not implemented: No outdoor material storage area proposed in this project.			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if 4.2.4 not implemented: Not proposed			
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.5 not implemented:			

Project Name: Sunbow II, Phase 3

Source Control BMP Checklist for All Development Projects			Form I-4 (Page 2 of 2)
4.2.6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)	☐ Yes	☐ No	☐ N/A
SC-A Onsite storm drain inlets	☒ Yes	☐ No	☐ N/A
SC-B Interior floor drains and elevator shaft sump pumps	☒ Yes	☐ No	☐ N/A
SC-C Interior parking garages	☒ Yes	☐ No	☐ N/A
SC-D1 Need for future indoor & structural pest control	☒ Yes	☐ No	☐ N/A
SD-D2 Landscape/outdoor pesticide use	☒ Yes	☐ No	☐ N/A
SC-E Pools, spas, ponds, decorative fountains, and other water features	☒ Yes	☐ No	☐ N/A
SC-F Food Service	☐ Yes	☐ No	☒ N/A
SC-G Refuse areas	☒ Yes	☐ No	☐ N/A
SC-H Industrial processes	☐ Yes	☐ No	☒ N/A
SC-I Outdoor storage of equipment or materials	☐ Yes	☐ No	☒ N/A
SC-J Vehicle and equipment cleaning	☐ Yes	☐ No	☒ N/A
SC-K Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☒ N/A
SC-L Fuel dispensing areas	☐ Yes	☐ No	☒ N/A
SC-M Loading docks	☐ Yes	☐ No	☒ N/A
SC-N Fire sprinkler test water	☒ Yes	☐ No	☐ N/A
SC-O Miscellaneous drain or wash water	☒ Yes	☐ No	☐ N/A
SC-P Plazas, sidewalks, and parking lots	☒ Yes	☐ No	☐ N/A
SC-Q: Large Trash Generating Facilities	☐ Yes	☐ No	☒ N/A
SC-R: Animal Facilities	☐ Yes	☐ No	☒ N/A
SC-S: Plant Nurseries and Garden Centers	☐ Yes	☐ No	☒ N/A
SC-T: Automotive Facilities	☐ Yes	☐ No	☒ N/A

Discussion / justification if 4.2.6 not implemented. Justification must be provided for all "No" answers shown above.

Insert Completed Form I-5: Site Design BMP Checklist for All Development Projects

https://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports

Project Name.: Sunbow II, Phase 3

Site Design BMP Checklist for All Development Projects	Form I-5

All development projects must implement site design BMPs where applicable and feasible. See **Chapter 4 and Appendix E** of the manual for information to implement site design BMPs shown in this checklist. **Note: All selected BMPs must be shown on the site/construction plans.**

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

Site Design Requirement	Applied?		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☒ No	☐ N/A
Due to grading of the site drainage pathways altered slightly such that some of the independent small sub-catchments in center portion of the site were combined into bigger sub-catchments. However, the designed flow is still within the capacity of WQ facilities.			
4.3.2 Conserve Natural Areas, Soils, and Vegetation	☒ Yes	☐ No	☐ N/A
4.3.3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
4.3.4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
4.3.5 Impervious Area Dispersion	☒ Yes	☐ No	☐ N/A

Project Name/Address/N Sunbow II, Phase 3

Site Design BMP Checklist for All Development Projects			Form I-5
Site Design Requirement	**Applied?**		
4.3.6 Runoff Collection	☒ Yes	☐ No	☐ N/A
4.3.7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
4.3.8 Harvesting and Using Precipitation	☐ Yes	☐ No	☒ N/A
Discussion / justification for all "No" answers shown above: Harvest and Use is not feasible.			

Insert Completed Form I-6: Summary of PDP Structural BMPs

https://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports

Project Name: Sunbow II, Phase 3

Summary of PDP Structural BMPs	Form I-6

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see **Chapter 5 of the manual**). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in **Chapter 5**. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see **Chapter 6 of the manual**). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by City at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity (**see Section 7 of the manual**).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page **3 of this form**) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

STEP 1:
1a: After delineating the DMAs, break down pervious and impervious area.
1b: DCV for all other DMAs were calculated using worksheet B.2-1
STEP 2:
2a: Harvest and use is infeasible according to Form I-7.
STEP 3:
3a: Using Form I-8 to conduct a prelimary feasibility screening determined that no infiltration to be feasible.
3b: Biofiltration BMP and Proprietary Biofiltration BMPs chosen.
3c: Worksheets B.5-1 were used to size the Biofiltration BMPs.
3d: Worksheets B.6-1 were used to calculate treatment flow rates and size the Proprietary Biofiltration BMPs.
STEP 4:
4a: Proposed BMPs fit minimum footprint required. Project meets pollutant control standards.
STEP 5:
5a: N/A
STEP 6: SWQMP prepared as step 6.
STEP 7:Maintenance agreements associated with this project are also attached in this SWQMP.

Project Name: Sunbow II, Phase 3

Form I-6 Page 2 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-1-1

Construction Plan Sheet No. CVT#20-0002, Sheet 3

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☒ Biofiltration (BF-1)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:

- ☐ Pollutant control only
- ☐ Hydromodification control only
- ☒ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Project Name: Sunbow II, Phase 3

Form I-6 Page 3 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-1-1

Construction Plan Sheet No. CVT#20-0002, Sheet 3

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

See attachment 1e for sizing calcs.

Project Name: Sunbow II, Phase 3

Form I-6 Page 2 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-1-2

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☒ Biofiltration (BF-1)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:

- ☐ Pollutant control only
- ☐ Hydromodification control only
- ☒ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Project Name: Sunbow II, Phase 3

Form I-6 Page 3 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-1-2

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

See attachment 1e for sizing calcs.

Project Name: Sunbow II, Phase 3

Form I-6 Page 4 **of** 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3-3

Construction Plan Sheet No. CVT#20-0002, Sheet 3

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☒ Biofiltration (BF-3)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:

- ☒ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Project Name: Sunbow II, Phase 3

Form I-6 Page 5 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3-3

Construction Plan Sheet No. CVT#20-0002, Sheet 3

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

The project proposes Compact Proprietary Biofiltration Unit, i.e. Modular Wetland Unit. See attachment 1e for sizing calcs and T.A.P.E. Certificates.

Project Name: Sunbow II, Phase 3

Form I-6 Page 4 **of** 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3-4

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☒ Biofiltration (BF-3)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:

- ☒ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Project Name: Sunbow II, Phase 3

Form I-6 Page 5 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3-4

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

The project proposes Compact Proprietary Biofiltration Unit, i.e. Modular Wetland Unit. See attachment 1e for sizing calcs and T.A.P.E. Certificates.

Project Name: Sunbow II, Phase 3

Form I-6 Page 4 **of** 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3 -5

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☒ Biofiltration (BF-3)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:

- ☒ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Project Name: Sunbow II, Phase 3

Form I-6 Page 5 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3 -5

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

The project proposes Compact Proprietary Biofiltration Unit, i.e. Modular Wetland Unit. See attachment 1e for sizing calcs and T.A.P.E. Certificates.

Project Name: Sunbow II, Phase 3

Form I-6 Page 4 **of** 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3 -6

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☐ Biofiltration (BF-1)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☒ Other (describe in discussion section below)

Purpose:

- ☒ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Form I-6 Page 5 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3 -6

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

The project proposes Compact Proprietary Biofiltration i.e. Curb Inlet Media Filter unit within existing storm drain inlet.

Project Name: Sunbow II, Phase 3

Form I-6 Page 4 **of** 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3 -7

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Type of structural BMP:

- ☐ Retention by harvest and use (e.g. HU-1, cistern)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☐ Biofiltration (BF-1)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☒ Other (describe in discussion section below)

Purpose:

- ☒ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	EOW for the project at the time of construction
Who will be the final owner of this BMP?	TBD
Who will maintain this BMP into perpetuity?	TBD
What is the funding mechanism for maintenance?	TBD

Project Name: Sunbow II, Phase 3

Form I-6 Page 5 of 9 *(Copy and attach as many as needed)*

Structural BMP ID No. BF-3 -7

Construction Plan Sheet No. CVT#20-0002, Sheet 4, 5

Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP):

The project proposes Compact Proprietary Biofiltration i.e. Curb Inlet Media Filter unit within existing storm drain inlet.

ATTACHMENT 1

Backup for PDP Pollutant Control BMPs

Project Name/ Sunbow II, Phase 3

Indicate which Items are Included:

Attachment Se uence	Contents	Checklist
Attachment 1A	**DMA Exhibit (Required)** See DMA Exhibit Checklist.	☑ Included
Attachment 1B	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☑ Included on DMA Exhibit in Attachment 1A ☑ Included as Attachment 1B, separate from DMA Exhibit
Attachment 1C	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☑ Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1D	Infiltration Feasibility Information. Contents of Attachment 1D depend on the infiltration condition: ☑ **No Infiltration Condition:** ☑ Infiltration Feasibility Condition ☐ Letter (***Note: must be stamped & signed by licensed geotechnical engineer***) ☐ Form I-8A (optional) ☐ Form I-8B (optional) ☐ **Partial Infiltration Condition:** ☐ Infiltration Feasibility Condition ☐ Letter (***Note: must be stamped & signed by licensed geotechnical engineer***) ☐ Form I-8A ☐ Form I-8B ☐ **Full Infiltration Condition:** ☐ Form I-8A ☐ Form I-8B ☐ Worksheet C.4-3 ☐ Form I-9 Refer to Appendices C and D of the BMP Design Manual for uidance.	☑ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1E	**Pollutant Control BMP Design Worksheets/ Calculations (Required)** Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design uidelines	☑ Included

Project Name/ Sunbow II, Phase 3

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify all the following:

- ☒ Underlying hydrologic soil group
- ☒ Approximate depth to groundwater
- ☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☒ Critical coarse sediment yield areas to be protected
- ☒ Existing topography and impervious areas
- ☒ Existing and proposed site drainage network and connections to drainage offsite
- ☒ Proposed grading
- ☒ Proposed impervious features
- ☒ Proposed design features and surface treatments used to minimize imperviousness
- ☒ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
- ☒ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
- ☒ Structural BMPs (identify location, type of BMP, and size/detail, and include cross-sections)

	Imp. RF	Pervious RF	% Imp	DMA 1 (DMA1-C + DMA1-D) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT	Summation RF x A	DMA 2 (DMA2-D) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT	Summation RF x A	DMA 3 (DMA3-C) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT	Summation RF x A
BASIN	0.90	0.10	0	25208	0.00	0	25208	2521	29906	0.00	0	29906.00	2990.60	0	0.00	0	0	0
INDUSTRIAL	0.90	0.30	90	0	0.00	0	0	0	0	0.00	0	0.00	0.00	0	0.00	0	0	0
MULTI/SF/COMMERCIAL	0.90	0.30	77	0	0.00	0	0	0	0	0.00	0	0.00	0.00	0	0.00	0	0	0
LANDSCAPE	0.90	0.30	0	636307	0.25	0	636307	190892	702665	0.22	0	702665	210800	12982	0.12	0	12982	3895
ROOF	0.90	0.30	100	301048	0.35	301048	0	270943	420958	0.39	420958	0	378863	0	0.00	0	0	0
ROAD	0.90	0.30	100	250516	0.29	250516	0	225465	348740	0.30	319146	29594	296110	23904	0.69	23904	0	21514
DRIVEWAY	0.90	0.30	100	15057	0.02	15057	0	13551	15654	0.01	15654	0	14088	0	0.00	0	0	0
SIDEWALK	0.90	0.30	100	69215	0.08	69215	0	62294	85931	0.08	85931	0	77338	6537	0.19	6537	0	5883
				1297351	1.00	635836	661515	765665	1603855	1.00	841689	762165	980189	43422.68	1.00	30441	12982	31291
			%perv	49.01			Weighted C =	0.59	54.32			Weighted C =	0.61	70.10			Weighted C =	0.72
														1.00				

	Imp. RF	Pervious RF	% Imp	DMA 4 (DMA4-D) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT	Summation RF x A	DMA 5 (DMA5-C) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT		DMA 6 (DMA7-D) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT	Summation RF x A
BASIN	0.90	0.10	0	0	0.00	0	0	0	0	0.00	0	0	0	0	0.00	0	0	0
INDUSTRIAL	0.90	0.30	90	0	0.00	0	0	0	0	0.00	0	0	0	0	0.00	0	0	0
MULTI/SF/COMMERCIAL	0.90	0.30	77	0	0.00	0	0	0	0	0.00	0	0	0	0	0.00	0	0	0
LANDSCAPE	0.90	0.30	0	8578	0.09	0	8578.36	2574	7489	0.08	0	7489	2247	3311	0.31	0	3311	993
ROOF	0.90	0.30	100	0	0.00	0	0	0	0	0.00	0	0	0	0	0.00	0	0	0
ROAD	0.90	0.30	100	22389	0.73	22389	0	20150	22496	0.73	22496	0	20246	1106	0.31	1106	0	995
DRIVEWAY	0.90	0.30	100	0	0.00	0	0	0	0	0.00	0	0	0	0	0.00	0	0	0
SIDEWALK	0.90	0.30	100	5597	0.18	5597	0	5038	5753	0.19	5753	0	5178	1347	0.38	1347	0	1212
				36564.89	1.00	27987	8578	27761	35738.24	1.00	28249	7489	27671	5764.00	1.00	2453	3311	3201
			%perv	76.54			Weighted C =	0.76	79.04			Weighted C =	0.77	42.56			Weighted C =	0.56

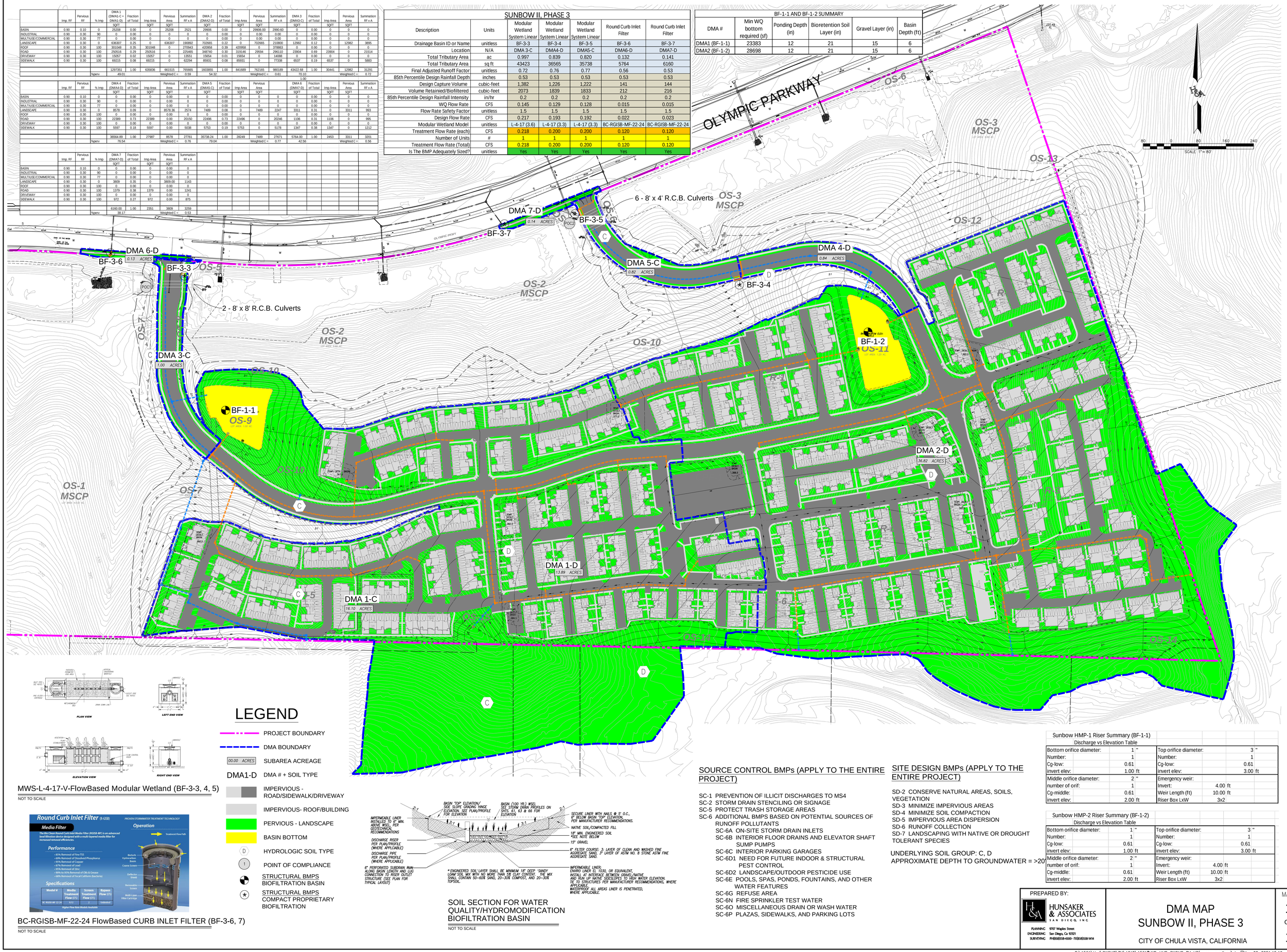
	Imp. RF	Pervious RF	% Imp	DMA 7 (DMA7-D) SQFT	Fraction of Total	Imp Area SQFT	Pervious Area SQFT	Summation RF x A
BASIN	0.90	0.10	0	0	0.00	0	0.00	0
INDUSTRIAL	0.90	0.30	90	0	0.00	0	0.00	0
MULTI/SF/COMMERCIAL	0.90	0.30	77	0	0.00	0	0.00	0
LANDSCAPE	0.90	0.30	0	3809	0.35	0	3809.00	1143
ROOF	0.90	0.30	100	0	0.00	0	0.00	0
ROAD	0.90	0.30	100	1379	0.38	1379	0.00	1241
DRIVEWAY	0.90	0.30	100	0	0.00	0	0.00	0
SIDEWALK	0.90	0.30	100	972	0.27	972	0.00	875
				6160.00	1.00	2351	3809	3259
			%perv	38.17			Weighted C =	0.53

SUNBOW II, PHASE 3

Description	Units	Modular Wetland System Linear	Modular Wetland System Linear	Modular Wetland System Linear	Round Curb Inlet Filter	Round Curb Inlet Filter
Drainage Basin ID or Name	unitless	BF-3-3	BF-3-4	BF-3-5	BF-3-6	BF-3-7
Location	N/A	DMA 3-C	DMA4-D	DMA5-C	DMA6-D	DMA7-D
Total Tributary Area	ac	0.997	0.839	0.820	0.132	0.141
Total Tributary Area	sq ft	43423	36565	35738	5764	6160
Final Adjusted Runoff Factor	unitless	0.72	0.76	0.77	0.56	0.53
85th Percentile Design Rainfall Depth	inches	0.53	0.53	0.53	0.53	0.53
Design Capture Volume	cubic-feet	1,382	1,226	1,222	141	144
Volume Retained/Biofiltered	cubic-feet	2073	1839	1833	212	216
85th Percentile Design Rainfall Intensity	in/hr	0.2	0.2	0.2	0.2	0.2
WQ Flow Rate	CFS	0.145	0.129	0.128	0.015	0.015
Flow Rate Safety Factor	unitless	1.5	1.5	1.5	1.5	1.5
Design Flow Rate	CFS	0.217	0.193	0.192	0.022	0.023
Modular Wetland Model	unitless	L-4-17 (3.6)	L-4-17 (3.3)	L-4-17 (3.3)	BC-RGISB-MF-22-24	BC-RGISB-MF-22-24
Treatment Flow Rate (each)	CFS	0.218	0.200	0.200	0.120	0.120
Number of Units	#	1	1	1	1	1
Treatment Flow Rate (Total)	CFS	0.218	0.200	0.200	0.120	0.120
Is The BMP Adequately Sized?	unitless	Yes	Yes	Yes	Yes	Yes

BF-1-1 AND BF-1-2 SUMMARY

DMA #	Min WQ bottom required (sf)	Ponding Depth (in)	Bioretention Soil Layer (in)	Gravel Layer (in)	Basin Depth (ft)
DMA1 (BF-1-1)	23383	12	21	15	6
DMA2 (BF-1-2)	28698	12	21	15	6



MWS-L-4-17-V-FlowBased Modular Wetland (BF-3-3, 4, 5)

NOT TO SCALE

BC-RGISB-MF-22-24 FlowBased CURB INLET FILTER (BF-3-6, 7)

NOT TO SCALE

LEGEND

- PROJECT BOUNDARY
- DMA BOUNDARY
- 00.00 ACRES — SUBAREA ACREAGE
- DMA1-D — DMA # + SOIL TYPE
- IMPERVIOUS - ROAD/SIDEWALK/DRIVEWAY
- IMPERVIOUS- ROOF/BUILDING
- PERVIOUS - LANDSCAPE
- BASIN BOTTOM
- D — HYDROLOGIC SOIL TYPE
- 1 — POINT OF COMPLIANCE

STRUCTURAL BMPS
BIOFILTRATION BASIN

STRUCTURAL BMPS
COMPACT PROPRIETARY BIOFILTRATION

SOIL SECTION FOR WATER QUALITY/HYDROMODIFICATION BIOFILTRATION BASIN

NOT TO SCALE

SOURCE CONTROL BMPs (APPLY TO THE ENTIRE PROJECT)

SC-1 PREVENTION OF ILLICIT DISCHARGES TO MS4
SC-2 STORM DRAIN STENCILING OR SIGNAGE
SC-5 PROTECT TRASH STORAGE AREAS
SC-6 ADDITIONAL BMPS BASED ON POTENTIAL SOURCES OF RUNOFF POLLUTANTS
- SC-6A ON-SITE STORM DRAIN INLETS
- SC-6B INTERIOR FLOOR DRAINS AND ELEVATOR SHAFT SUMP PUMPS
- SC-6C INTERIOR PARKING GARAGES
- SC-6D1 NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
- SC-6D2 LANDSCAPE/OUTDOOR PESTICIDE USE
- SC-6E POOLS, SPAS, PONDS, FOUNTAINS, AND OTHER WATER FEATURES
- SC-6G REFUSE AREA
- SC-6N FIRE SPRINKLER TEST WATER
- SC-6O MISCELLANEOUS DRAIN OR WASH WATER
- SC-6P PLAZAS, SIDEWALKS, AND PARKING LOTS

SITE DESIGN BMPs (APPLY TO THE ENTIRE PROJECT)

SD-2 CONSERVE NATURAL AREAS, SOILS, VEGETATION
SD-3 MINIMIZE IMPERVIOUS AREAS
SD-4 MINIMIZE SOIL COMPACTION
SD-5 IMPERVIOUS AREA DISPERSION
SD-6 RUNOFF COLLECTION
SD-7 LANDSCAPING WITH NATIVE OR DROUGHT TOLERANT SPECIES

UNDERLYING SOIL GROUP: C, D
APPROXIMATE DEPTH TO GROUNDWATER = >20

Sunbow HMP-1 Riser Summary (BF-1-1)			
Discharge vs Elevation Table			
Bottom orifice diameter:	1 "	Top orifice diameter:	3 "
Number:	1	Number:	1
Cg-low:	0.61	Cg-low:	0.61
invert elev:	1.00 ft	invert elev:	3.00 ft
Middle orifice diameter:	2 "	Emergency weir:	
number of orif:	1	Invert:	4.00 ft
Cg-middle:	0.61	Weir Length (ft)	10.00 ft
invert elev:	2.00 ft	Riser Box LxW	3x2

Sunbow HMP-2 Riser Summary (BF-1-2)			
Discharge vs Elevation Table			
Bottom orifice diameter:	1 "	Top orifice diameter:	3 "
Number:	1	Number:	1
Cg-low:	0.61	Cg-low:	0.61
invert elev:	1.00 ft	invert elev:	3.00 ft
Middle orifice diameter:	2 "	Emergency weir:	
number of orif:	1	Invert:	4.00 ft
Cg-middle:	0.61	Weir Length (ft)	10.00 ft
invert elev:	2.00 ft	Riser Box LxW	3x2

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DMA MAP
SUNBOW II, PHASE 3

CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 1

#4 F 21EF-1561

R:\1561\Hyd\SWQMP\TM\ACAD\1561$HYD_HMP_SWQMP_TM_V3(w_new gradings).dwg[]Mar-02-2021:15:19

Attachment 1c

Form I-7, Harvest and Use Feasibility Screening Checklist

Worksheet B.3-1: Harvest and Use Feasibility Screening

Harvest and Use Feasibility Screening	Worsksheet B.3-1
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☑ Toilet and urinal flushing ☑ Landscape irrigation ☐ Other:_____	
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. 36 hr toilet use per resident= 9.3 gal x 2.5 residents per unit x 709units x 1.5 days = 24726.4 gallons= 3305.4 cf, 36 hour landscape use/acre= 390 gls/ac x 22.89 ac= 8927 gals= 1193 cf Total anticipated 36 hr use = 4499 cf	
3. Calculate the DCV using worksheet B-2.1. DCV = 78,357 (cubic feet) 0.25DCV=19,589 cubic feet	

3a. Is the 36-hour demand greater than or equal to the DCV?	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36-hour demand less than 0.25DCV?
Yes / ☑ No ⇨ ⇩	Yes / ☑ No ⇨ ⇩	☑ Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

Note: 36-hour demand calculations are for feasibility analysis only. Once feasibility analysis is complete the applicant may be allowed to use a different drawdown time provided they meet the 80% of average annual (long term) runoff volume performance standard.

Attachment 1d

Form I-8, Categorization of Infiltration Feasibility Condition

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
BF-1-1	Planning

Criteria 1: Infiltration Rate Screening	
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[2]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☐ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☒ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☒ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☒ No; full infiltration is not required. Answer "No" to Criteria 1 Result.
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.

[1] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.
[2] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☒ No; full infiltration is not required. Skip to Part 1 Result.

Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.

Based on the USDA NCRS website, the mapped soil types beneath the proposed basin are classified as Hydrologic Soil Group C soils, with approximate Ksat values ranging between 0.06 to 0.2 inches per hour. The Ksat values are generally considered equivalent to the unfactored infiltration rate. If applying a feasibility FS of 2, the preliminary infiltration rates would range from 0.03 to 0.1 iph. The Websoil Survey report is attached. No additional infiltration testing has been performed. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.

Criteria 2: Geologic/Geotechnical Screening	
2A	**If all questions in Step 2A are answered "Yes," continue to Step 2B.** For any "No" answer in Step 2A answer "No" to Criteria 2 and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☒ Yes	☐ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☒ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☒ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☒ No

Summarize findings and basis; provide references to related reports or exhibits.

Based on the USDA NCRS website, the mapped soil types beneath the proposed basin are classified as Hydrologic Soil Group C soils, with approximate Ksat values ranging between 0.06 to 0.2 inches per hour. The Ksat values are generally considered equivalent to the unfactored infiltration rate. If applying a feasibility FS of 2, the preliminary infiltration rates would range from 0.03 to 0.1 iph. The Websoil Survey report is attached. No additional infiltration testing has been performed. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.

Part 1 Result – Full Infiltration Geotechnical Screening [3]	**Result**
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	☐ **Full infiltration Condition** ☒ **Complete Part 2**

[3] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
BF-1-1	Planning

Criteria 3 : Infiltration Rate Screening

3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ☒ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ☐ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ☐ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ☒ Yes; Continue to Criteria 4. ☐ No: Skip to Part 2 Result.

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

Based on the USDA NCRS website, the mapped soil types beneath the proposed basin are classified as Hydrologic Soil Group C soils, with approximate Ksat values ranging between 0.06 to 0.2 inches per hour. The Ksat values are generally considered equivalent to the unfactored infiltration rate. If applying a feasibility FS of 2, the preliminary infiltration rates would range from 0.03 to 0.1 iph. The Websoil Survey report is attached. No additional infiltration testing has been performed. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☒ Yes	☐ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☒ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☒ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
4B-4	**Slope Stability.** If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☒ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☒ No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Summarize findings and basis; provide references to related reports or exhibits. Grading for the proposed basin will result in cuts ranging from approximately 14 to 48 feet into formational materials. A natural slope exists immediately adjacent to the proposed basin. A public roadway is planned immediately to the west of this basin and below the elevation of the basin bottom. The formational materials may exhibit highly expansive bentonitic layers. Full or partial infiltration is considered infeasible due to the expected very low infiltration rates, potential for daylight water seepage and slope instability, and potential to induce significant distress to surrounding public and private improvements if highly expansive soils are wetted. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.	

Part 2 – Partial Infiltration Geotechnical Screening Result[4]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ **Partial Infiltration Condition** ☒ **No Infiltration Condition**

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Diego County Area, California

Sunbow PA 23



February 14, 2020

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaF	Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	2.0	77.7%
LsE	Linne clay loam, 9 to 30 percent slopes	0.6	22.3%
Totals for Area of Interest		**2.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the

development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

DaF—Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20

Map Unit Setting

National map unit symbol: 2w638
Elevation: 20 to 2,530 feet
Mean annual precipitation: 1 to 30 inches
Mean annual air temperature: 60 to 65 degrees F
Frost-free period: 290 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Hillslopes, mountain slopes
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Residuum weathered from calcareous shale

Typical profile

A - 0 to 15 inches: clay
Bkss1 - 15 to 28 inches: clay
Bkss2 - 28 to 40 inches: clay loam
Cr - 40 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 39 to 79 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Altamont

Percent of map unit: 7 percent
Landform: Hillslopes
Down-slope shape: Convex

Across-slope shape: Convex
Hydric soil rating: No

Gazos
Percent of map unit: 2 percent
Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Linne
Percent of map unit: 2 percent
Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

San benito
Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Ecological site: Fine Loamy 9-13 (R015XE020CA)
Hydric soil rating: No

Oliventain
Percent of map unit: 2 percent
Landform: Terraces
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

LsE—Linne clay loam, 9 to 30 percent slopes

Map Unit Setting
National map unit symbol: hbdt
Elevation: 100 to 2,000 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition
Linne and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Linne

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous sandstone and shale

Typical profile

H1 - 0 to 15 inches: clay loam
H2 - 15 to 37 inches: clay loam, loam
H2 - 15 to 37 inches: weathered bedrock
H3 - 37 to 41 inches:

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Diablo

Percent of map unit: 5 percent
Hydric soil rating: No

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

Altamont

Percent of map unit: 5 percent
Hydric soil rating: No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
BF-1-2	Planning

Criteria 1: Infiltration Rate Screening	
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[2]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☐ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☒ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☒ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☒ No; full infiltration is not required. Answer "No" to Criteria 1 Result.
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.

[1] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.
[2] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☒ No; full infiltration is not required. Skip to Part 1 Result.

Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.

Based on the USDA NCRS website, the mapped soil types beneath the proposed basin are classified as Hydrologic Soil Group D soils, with approximate Ksat values ranging between 0.06 to 0.2 inches per hour. The Ksat values are generally considered equivalent to the unfactored infiltration rate. If applying a feasibility FS of 2, the preliminary infiltration rates would range from 0.03 to 0.1 iph. The Websoil Survey report is attached. No additional infiltration testing has been performed. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.

Criteria 2: Geologic/Geotechnical Screening	
2A	**If all questions in Step 2A are answered "Yes," continue to Step 2B.** For any "No" answer in Step 2A answer "No" to Criteria 2 and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☐ Yes	☒ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☒ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☒ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☒ No

Summarize findings and basis; provide references to related reports or exhibits.

Based on the USDA NCRS website, the mapped soil types beneath the proposed basin are classified as Hydrologic Soil Group D soils, with approximate Ksat values ranging between 0.06 to 0.2 inches per hour. The Ksat values are generally considered equivalent to the unfactored infiltration rate. If applying a feasibility FS of 2, the preliminary infiltration rates would range from 0.03 to 0.1 iph. The Websoil Survey report is attached. No additional infiltration testing has been performed. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.

Part 1 Result – Full Infiltration Geotechnical Screening [3]	**Result**
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	☐ **Full infiltration Condition** ☒ **Complete Part 2**

[3] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
BF-1-2	Planning

Criteria 3 : Infiltration Rate Screening

3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☒ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ☐ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ☐ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ☒ Yes; Continue to Criteria 4. ☐ No: Skip to Part 2 Result.

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

Based on the USDA NCRS website, the mapped soil types beneath the proposed basin are classified as Hydrologic Soil Group D soils, with approximate Ksat values ranging between 0.06 to 0.2 inches per hour. The Ksat values are generally considered equivalent to the unfactored infiltration rate. If applying a feasibility FS of 2, the preliminary infiltration rates would range from 0.03 to 0.1 iph. The Websoil Survey report is attached. No additional infiltration testing has been performed. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☐ Yes	☒ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☒ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☒ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
4B-4	**Slope Stability.** If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☒ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☒ No

Project Name: Sunbow II, Phase 3

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Summarize findings and basis; provide references to related reports or exhibits. Grading for the proposed basin will result in a cut/fill transition, with cuts ranging from approximately 0 to 8 feet into formational materials and fills greater than 20 feet thick beneath the basin. A public roadway is planned immediately to the east of this basin and below the elevation of the basin bottom. The formational materials may exhibit highly expansive bentonitic layers. Full or partial infiltration is considered infeasible due to the expected very low infiltration rates, potential for daylight water seepage and slope instability, and potential to induce significant distress to surrounding public and private improvements if highly expansive soils are wetted. Infiltration BMP's supported by compacted fill are not considered feasible due to the settlement potential. A geotechnical study of this property is currently being planned. This information is intended for preliminary planning purposes only and should be updated once the geotechnical investigation has been performed.	

Part 2 – Partial Infiltration Geotechnical Screening Result[4]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ **Partial Infiltration Condition** ☒ **No Infiltration Condition**

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Diego County Area, California

Sunbow PA 23 Eastern Basin



February 14, 2020

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,000 if printed on A portrait (8.5" x 11") sheet.

N

0 40 80 160 240 Meters

0 100 200 400 600 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaE	Diablo clay, 15 to 30 percent slopes	4.1	100.0%
Totals for Area of Interest		**4.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

DaE—Diablo clay, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: hbbb
Elevation: 200 to 3,250 feet
Mean annual precipitation: 9 to 25 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous sandstone and shale

Typical profile

H1 - 0 to 15 inches: clay
H2 - 15 to 32 inches: clay, silty clay loam
H2 - 15 to 32 inches: weathered bedrock
H3 - 32 to 36 inches:

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 24 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Altamont

Percent of map unit: 10 percent
Hydric soil rating: No

Linne

Percent of map unit: 3 percent
Hydric soil rating: No

Oliventain

Percent of map unit: 2 percent
Hydric soil rating: No

INFILTRATION FEASIBILITY CONDITION LETTER

SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

PREPARED FOR

LENNAR HOMES
SAN DIEGO, CALIFORNIA

JUNE 23, 2020
PROJECT NO. G2452-32-02

MATERIALS

Project No. G2452-32-02
June 23, 2020

Lennar Homes
16465 Via Esprillo, Suite 150
San Diego, California 92127

Attention: Mr. David Shepherd

Subject: INFILTRATION FEASIBILITY CONDITION LETTER
SUNBOW II
PHASE 3
CHULA VISTA, CALIFORNIA

References:
1. *Geotechnical Investigation, Sunbow Phase 3, Chula Vista, California*, prepared by Geocon Incorporated, dated April 10, 2020 (Project No. G2452-32-02).
2. *Tentative Map/SPA/GPA/Rezone CVT #20-0002, Sunbow II Phase 3, City of Chula Vista, California*, prepared by Hunsaker and Associates San Diego Inc., revision 3 dated June 23, 2020.

Dear Mr. Shepherd:

In accordance with your request, we have prepared this letter regarding storm water management for the subject project. Previous recommendations specific to storm water management, as well as a summary of expected soil conditions, was provided in Reference No. 1. Due to the "No Infiltration" condition identified in Reference No. 1, the City of Chula Vista is requesting an "Infiltration Feasibility Condition" letter in accordance with Appendix C.1.1 of the 2019 City Storm Water Manual.

The following information is provided to support storm water BMP design in accordance with the 2019 *City of Chula Vista Storm Water Standards Manual.*

SITE AND PROJECT DESCRIPTION

The proposed Sunbow II, Phase 3 development is located south of Olympic Parkway, north of the Otay Landfill, east of Brandywine Avenue and west of Heritage Road in Chula Vista, California. The property is essentially undeveloped except for the two existing embankments and box culvert structures that abut Olympic Parkway located along the northern property boundary.

Based on a review of the plans provided by Hunsaker and Associates, we understand the property will be developed to create 718 attached condominium units with associated infrastructure improvements,

a recreation area and two water quality basins. Ingress and egress to the site will be provided by two primary roadways that intersect with Olympic Parkway. The mass grading study indicates that approximately 1,200,000 cubic yards of cut and fill, respectively, will be required to develop the project.

PREVIOUS GEOTECHNICAL STUDIES

A preliminary geotechnical investigation was performed by Geocon Incorporated in 1986 as part of an overall study for the 600-acre Rancho Del Sur property and included advancing three large diameter borings on a portion of the property. In addition, several monitoring wells (gas, vadose, and groundwater) were installed on the property between 1989 and 1994 as part of an environmental study adjacent to the Otay Landfill. We also performed a geotechnical investigation in 2006 on the adjacent Otay Ranch Village 2 West project located along the eastern boundary of the site. The subsurface information and as-graded geologic mapping from these studies was reviewed and incorporated into a geologic reconnaissance report for Sunbow, Planning Area 23 in November 2019. The approximate location of the borings and trenches from these previous reports has been incorporated onto Figures 2 and 3 in current geotechnical investigation (Reference No. 1) and the logs of these previous studies have been included for reference in Appendix E (see Reference No. 1).

HYDROLOGIC SOIL GROUP

The United States Department of Agriculture (USDA), Natural Resources Conservation Services (NRCS), possesses general information regarding the existing soil conditions for areas within the United States. The USDA NRCS website also provides the Hydrologic Soil Group. Table 1 presents the descriptions of the hydrologic soil groups. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

TABLE 1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The subject site is underlain by surficial deposits consisting of previously-placed compacted fill, alluvium and colluvium. Formational units include San Diego, Otay and Sweetwater Formations. After completion of the proposed grading operations, the property would generally consist of formational units exposed at grade or compacted fill deposits overlying bedrock materials. The compacted fill and formational materials should be classified as Soil Group D. In addition, the USDA NRCS website also provides an estimated saturated hydraulic conductivity for the existing soils. Tables 2A and 2B present the information from the USDA NRCS website. The Hydrologic Soil Group Map presents output from the USDA NRCS website showing the limits of the soil units.

TABLE 2A
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP (BF-1-1)

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (Inches/ Hour)
Diablo Clay	DaF	78	C	0.06 – 0.20
Linne Clay Loam	LsE	22	C	0.2 – 0.57

TABLE 2B
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP (BF-1-2)

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (Inches/ Hour)
Diablo Clay	DaE	100	D	0.06 – 0.20

In-Situ Testing

We performed a constant-head borehole percolation test within the Otay Formation to evaluate the infiltration rate. The test boring was 4-inches in diameter. Table 3 presents the results of the estimated field saturated hydraulic conductivity and estimated infiltration rates obtained from the borehole percolation tests. We applied a feasibility factor of safety of 2 to the field results for use in preparation of Worksheet C.4-1. Based on a discussion in the County of Riverside *Design Handbook for Low Impact Development Best Management Practices*, the infiltration rate should be considered equal to the saturated hydraulic conductivity rate.

TABLE 3
FIELD INFILTRATION TEST RESULTS

Test No.	Geologic Unit	Test Depth (feet)	Field-Saturated Hydraulic Conductivity, k_{sat} (inch/hour)	Worksheet[1] Saturated Hydraulic Conductivity, k_{sat} (inch/hour)
I-1	To	1.5	0.1	0.05

[1] Using a factor of safety of 2 for Worksheet C.4-1.

GROUNDWATER ELEVATIONS

Groundwater was identified in the monitoring wells MW-1 and MW-2 (1989, 1994) on-site at depths of 165 and 275 feet, respectively, below the existing ground surface. Minor seepage was observed in Trench Nos. T-1 and T-2 along the alluvium and bedrock contact approximately 7 feet below existing grade. Subdrain systems will be required in the main drainages, along with proposed buttress, shear key and stability fill excavations, and possibly where impervious layers daylight near the ultimate graded surface.

The groundwater elevations and seepage conditions are expected to fluctuate seasonally and may affect remedial grading. In this regard, remedial grading may encounter wet soils and excavation and compaction difficulty, particularly if grading is planned during the winter months. It should also be noted that areas where perched water or seepage was not encountered may exhibit groundwater during rainy periods. Groundwater is not expected to occur within 10 feet from the bottom of the proposed basins.

GROUNDWATER MOUNDING

We do not expect groundwater mounding due to the depth of the groundwater elevation.

EXPANSION CLASSIFICATION

The soils encountered in the field investigation are considered to be “non-expansive” (expansion index [EI] of 20 or less) and “expansive” (expansion index [EI] of 130 or more) as defined by 2019 California Building Code (CBC) Section 1803.5.3. The soil materials collected and tested for expansion index indicate a “very low” to “very high” expansion. The Otay Formation siltstone and claystone is considered highly to very highly expansive. The alluvial/colluvial soils are generally moderately to highly expansive, and the San Diego and Sweetwater Formations are generally low expansive. BF-1-1 is supported on Sweetwater Formation. BF-1-2 is supported on a cut-fill transition exposing highly expansive bentonitic beds of the Otay Formation and greater than 25 feet of compacted fill.

HYDROCOMPRESSION/SETTLEMENT

We do not expect the formational materials to possess a hydrocompression potential due to the very dense nature of the materials. However, the existing and proposed fill materials possess a potential for hydrocompression/settlement when wetted. Infiltration BMP's supported on fill materials should be avoided due to the settlement potential.

EXISTING SLOPES

The SWS (Section C.2.1.3 and Worksheet C.4-1) states water infiltration should be setback from fill slopes a minimum distance of 1.5 times the slope height or 50 feet from natural slopes. Existing natural slopes and proposed fill slopes are located adjacent to the proposed storm water basins. BF-1-2 is supported on over 25 feet of compacted fill and is comprised as a fill slope on the north side. The north side of the western basin is a descending natural slope.

NEW OR EXISTING UTILITIES

Utilities are present on and adjacent to the property. We expect any on-site utilities to be removed during site grading. Full or partial infiltration should not be allowed in the areas of the existing or proposed utilities to help prevent potential damage/distress to improvements. The setback for infiltration devices should be at least 10 feet and a minimum of a 1:1 plane of 1 foot below the closest edge of the deepest adjacent utility.

EXISTING AND PLANNED STRUCTURES

Water should not be allowed to infiltrate within 10 feet of foundations.

SOIL TYPES

Compacted Fill – Compacted fill deposits will be placed during site grading. BF-1-2 is supported on greater than 25 feet of compacted fill on the north side.

The compacted fill will be comprised of mixtures of on-site sand, silt, and clay. The fill will be compacted to a dry density of at least 90 percent of the laboratory maximum dry density. In our experience, compacted fill does not possess infiltration rates appropriate for infiltration BMP's. Hazards that occur as a result of fill soil saturation include a potential for hydro-consolidation of the granular fill soils, long term fill settlement, differential fill settlement, lateral water migration, daylight water seepage and fill slope instability.

San Diego Formation – The San Diego Formation overlies the Otay Formation and typically consists of dense, fine to medium-grained sandstone with relatively low cohesion and moderate to high

permeability. In general, the San Diego Formation exhibits adequate shear strength and "very low" to "low" expansion characteristics in either an undisturbed or properly compacted condition. Due to the potentially friable and higher permeability characteristics of this unit, stability fills will be required where the San Diego Formation is exposed in cut slopes.

Otay Formation – The Otay Formation, which overlies the Sweetwater Formation and underlies the San Diego Formation, is the predominant geologic unit on the site. This formation consists of dense, silty to clayey, sandstone and hard, siltstone and claystone beds with continuous to discontinuous interbeds of weak, highly-plastic bentonitic claystone. In some instances, the bentonite beds contain bedding plane shears as observed in the majority of the exploratory borings during our study.

The sandy portions of the Otay Formation typically possess a "very low" to "low" expansion potential and adequate shear strength. The siltstone and claystone portions of the formation can exhibit a "medium" to "very high" expansion potential. With the possible exception of the bentonitic claystone, the Otay Formation is suitable for the support of compacted fill and structural loads.

The laterally extensive bentonitic claystone beds, which are well documented in the area, can vary in thickness from several inches up to 7 feet (see Boring No. LB-7-Reference No. 1). The beds are typically flat lying to gently dipping (0 to 3 degrees) and possess a very high expansion potential and very low shear strength. A laterally continuous bentonitic claystone bed is mapped across the site between elevations 341 feet and 371 feet above mean sea level. This unit will require important consideration with respect to slope stability and its expansion potential, and will require remedial grading measures.

The Otay Mesa Lateral Spread, commonly referred to as an ancient "intra-formational landslide" by geologists, is mapped within the site boundary. This ancient landslide, which is over 8-miles wide and approximately 2½-miles long, is entirely contained within the Otay Formation and terminates along the La Nación Fault to the west. We have also observed and mapped this feature during the grading operations for Olympic Parkway and other neighboring residential developments.

The basal surface of the ancient "intra-formational landslide" occurred along a single, continuous, bentonitic clay bed that coincides with the bentonitic clay bed mapped on Figures 2 and 3 (Reference No. 1). The slide mass consists of relatively undisturbed consolidated blocks of the Otay Formation that have low to very low compressibility characteristics. Some areas exhibit plastically deformed bentonite which has been squeezed into the overlying mass creating unpredictable diapirs and flame structures that vary in dimension and orientation. If present, these features can create problems for site improvements due to their expansion potential. Although not observed within the exploratory borings

and trenches, the potential for these conditions will be evaluated during the grading phase of project development.

BF-1-2 is underlain by the highly expansive bentonitic clay beds of the Otay Formation.

Sweetwater Formation – The Sweetwater Formation, commonly referred to as the "gritstone layer" of the Otay Formation, underlies the Otay Formation and is characterized as dense to very dense, gravelly, fine to coarse sandstone that is locally cemented. The Sweetwater Formation generally has a high shear strength and a low expansive potential.

BF-1-1 is supported on this unit.

Soil or Groundwater Contamination

Based on review of the Geotracker website, no active cleanup sites exist on or adjacent to the subject basin locations. In addition, we are not aware of any contaminated soils or shallow groundwater on the site that would preclude storm water infiltration. An environmental assessment was not part of our scope of work.

Slopes and Other Geologic Hazards

Infiltration of storm water adjacent to cut or fill slopes should be avoided. Fill slopes will exhibit instability if water is allowed to saturate the compacted fill. Cut slopes may exhibit daylight seepage.

Based on standard setback guidelines provided by the City of Chula Vista, the proposed basins are situated within the setback zones for natural and fill slopes.

STORM WATER DESIGN NARRATIVE

The locations of the proposed basins (BF-1-1 and BF-1-2) were provided by the Project Civil Engineer considering site topography, proposed grading, and ultimate development. Based on the information provided, each of the basin locations was chosen based on the future ultimate development including; raising the finish grade, constructing roadways, curb and gutters, sidewalks, and associated utilities to mitigate peak flow runoff and satisfy hydromodification requirements for each DMA area.

We performed our site reconnaissance and background research for the subject property to evaluate potential areas of infiltration. We expect the onsite soil and geologic units to exhibit very slow infiltration rates that do not meet the minimum thresholds for full or partial infiltration. Infiltration of storm water should be avoided due to the soil and geologic conditions described herein and in Reference No. 1. In addition, the formational materials exhibit features that would potentially allow

for lateral water migration, slope instability, daylight water seepage and excessive volume change due to the moderately to very highly expansive soils beneath the property.

Table 4 presents a summary of the anticipated soil/geologic conditions beneath each of the proposed BMP locations.

TABLE 4
ANTICIPATED SOIL/GEOLOGIC CONDITIONS BENEATH BMP LOCATIONS

BMP ID	Anticipated Geologic Conditions	Adverse Geologic Conditions
Western Basin (BF-1-1)	Sweetwater Formation	Low hydraulic conductivity; adjacent to a descending natural slope
Eastern Basin (BF-1-2)	Cut-fill transition exposing highly expansive Otay Formation or greater than 25 feet of compacted fill	Fill soil > 5 feet thick; settlement, volume change.

CONCLUSIONS AND RECOMMENDATIONS

Our results indicate that each storm water basin exhibits adverse soil and geologic conditions, will be supported on greater than 5 feet of fill, or located within slope setback zones. In addition, we expect these units to exhibit very slow infiltration characteristics unsuitable for infiltration BMP's. Considering the site and geologic conditions, it is our opinion that full and partial infiltration is infeasible on this site. Liners and subdrains should be installed within BMP areas. If water is allowed to infiltrate the soil, water could migrate away from the basins and into public and private improvements, or induce adverse soil movement.

Based on the results of our research and the existing geologic units on the property, it does not appear that the site conditions possess an opportunity for full and partial infiltration based on the underlying geologic conditions. *Therefore, the property should be considered to possess a "No Infiltration" condition in accordance with Appendix C of SWS.*

STORM WATER MANAGEMENT DEVICES

Storm water management devices should be properly constructed in accordance with the project plans. Liners and subdrains should be incorporated into the design and construction of the planned storm water BMP's. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride**,** PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 4 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. The penetration of the liners at the subdrains should be properly

waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

If you have any questions regarding this letter, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

David B. Evans
CEG 1860

TEM:DBE:dmc

(e-mail) Addressee
(e-mail) Hunsaker and Associates San Diego, Inc.
Attention: Mr. John Rivera

Attachment 1e

Pollutant Control BMP Design Worksheets/Calculations

SUNBOW

BIOFILTRATION BMP DMA CALCULATIONS

	Imp. RF	Pervious RF	% Imp	DMA 1 (DMA1-C + DMA1-D)	Fraction of Total	Imp Area	Pervious Area	Summation RF x A	DMA 2 (DMA2-D)	Fraction of Total	Imp Area	Pervious Area	Summation RF x A	DMA 3 (DMA3-C)	Fraction of Total	Imp Area	Pervious Area	Summation RF x A
				SQFT		SQFT	SQFT		SQFT		SQFT	SQFT		SQFT		SQFT	SQFT	
BASIN	0.90	0.10	0	25208	0.00	0	25208	2521	29906	0.00	0	29906.00	2990.60	0	0.00	0	0	0
INDUSTRIAL	0.90	0.30	90	0	0.00	0	0	0	0	0.00	0	0.00	0.00	0	0.00	0	0	0
MULTIUSE/COMMERCIAL	0.90	0.30	77	0	0.00	0	0	0	0	0.00	0	0.00	0.00	0	0.00	0	0	0
LANDSCAPE	0.90	0.30	0	636307	0.25	0	636307	190892	702665	0.22	0	702665	210800	12982	0.12	0	12982	3895
ROOF	0.90	0.30	100	301048	0.35	301048	0	270943	420958	0.39	420958	0	378863	0	0.00	0	0	0
ROAD	0.90	0.30	100	250516	0.29	250516	0	225465	348740	0.30	319146	29594	296110	23904	0.69	23904	0	21514
DRIVEWAY	0.90	0.30	100	15057	0.02	15057	0	13551	15654	0.01	15654	0	14088	0	0.00	0	0	0
SIDEWALK	0.90	0.30	100	69215	0.08	69215	0	62294	85931	0.08	85931	0	77338	6537	0.19	6537	0	5883
				1297351	1.00	635836	661515	765665	1603855	1.00	841689	762165	980189	43422.68	1.00	30441	12982	31291
			%perv	49.01			Weighted C =	0.59	54.32			Weighted C =	0.61	70.10			Weighted C =	0.72

1.00

	Imp. RF	Pervious RF	% Imp	DMA 4 (DMA4-D)	Fraction of Total	Imp Area	Pervious Area	Summation RF x A	DMA 5 (DMA5-C)	Fraction of Total	Imp Area	Pervious Area		DMA 6 (DMA7-D)	Fraction of Total	Imp Area	Pervious Area	Summation RF x A
				SQFT		SQFT	SQFT		SQFT		SQFT	SQFT		SQFT		SQFT	SQFT	
BASIN	0.90	0.10	0	0	0.00	0	0.00	0	0	0.00	0	0	0	0	0.00	0	0	0
INDUSTRIAL	0.90	0.30	90	0	0.00	0	0.00	0	0	0.00	0	0	0	0	0.00	0	0	0
MULTIUSE/COMMERCIAL	0.90	0.30	77	0	0.00	0	0.00	0	0	0.00	0	0	0	0	0.00	0	0	0
LANDSCAPE	0.90	0.30	0	8578	0.09	0	8578.36	2574	7489	0.08	0	7489	2247	3311	0.31	0	3311	993
ROOF	0.90	0.30	100	0	0.00	0	0.00	0	0	0.00	0	0	0	0	0.00	0	0	0
ROAD	0.90	0.30	100	22389	0.73	22389	0.00	20150	22496	0.73	22496	0	20246	1106	0.31	1106	0	995
DRIVEWAY	0.90	0.30	100	0	0.00	0	0.00	0	0	0.00	0	0	0	0	0.00	0	0	0
SIDEWALK	0.90	0.30	100	5597	0.18	5597	0.00	5038	5753	0.19	5753	0	5178	1347	0.38	1347	0	1212
				36564.89	1.00	27987	8578	27761	35738.24	1.00	28249	7489	27671	5764.00	1.00	2453	3311	3201
			%perv	76.54			Weighted C =	0.76	79.04			Weighted C =	0.77	42.56			Weighted C =	0.56

	Imp. RF	Pervious RF	% Imp	DMA 7 (DMA7-D)	Fraction of Total	Imp Area	Pervious Area	Summation RF x A
				SQFT		SQFT	SQFT	
BASIN	0.90	0.10	0	0	0.00	0	0.00	0
INDUSTRIAL	0.90	0.30	90	0	0.00	0	0.00	0
MULTIUSE/COMMERCIAL	0.90	0.30	77	0	0.00	0	0.00	0
LANDSCAPE	0.90	0.30	0	3809	0.35	0	3809.00	1143
ROOF	0.90	0.30	100	0	0.00	0	0.00	0
ROAD	0.90	0.30	100	1379	0.38	1379	0.00	1241
DRIVEWAY	0.90	0.30	100	0	0.00	0	0.00	0
SIDEWALK	0.90	0.30	100	972	0.27	972	0.00	875
				6160.00	1.00	2351	3809	3259
			%perv	38.17			Weighted C =	0.53

SUNBOW II, PHASE 3
DCV CALCULATION

DMA 1: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	29.78	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.59	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	33,817	cubic-feet

DMA 2: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	36.82	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.61	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	43,292	cubic-feet

DMA 3: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	1.00	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.72	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,382	cubic-feet

DMA 4: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	0.84	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.76	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,226	cubic-feet

DMA #5: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	0.82	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.77	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,222	cubic-feet

DMA #6: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	0.13	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.56	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	141	cubic-feet

DMA #7: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.53	inches
2	Area tributary to BMP (s)	A=	0.14	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.53	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	144	cubic-feet

CITY OF CHULA VISTA	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-1-1	
Sizing Method for Pollutant Removal Criteria		**Worksheet B.5-1**	
1	Area draining to the BMP	**1297351.15**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.59**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**33817**	**cu. ft.**
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	**12**	**inches**
6	Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	**21**	**inches**
7	Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	**12**	**inches**
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	**3**	**inches**
9	Freely drained pore storage of the media	**0.2**	**in/in**
10	Porosity of aggregate storage	**0.4**	**in/in**
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	**3.525**	**in/hr.**
Baseline Calculations			
12	Allowable routing time for sizing	**6**	**hours**
13	Depth filtered during storm [Line 11 x Line 12]	**21.15**	**inches**
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	**22.2**	**inches**
15	Total Depth Treated [Line 13 + Line 14]	**43.35**	**inches**
Option 1 – Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	**50725**	**cu. ft.**
17	Required Footprint [Line 16/ Line 15] x 12	**14042**	**sq. ft.**
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	**25363**	**cu. ft.**
19	Required Footprint [Line 18/ Line 14] x 12	**13710**	**sq. ft.**
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4)	**0.03**	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	**22970**	**sq. ft.**
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	**22970**	**sq. ft.**
23	Provided BMP Footprint	**25208**	**sq. ft.**
24	Is Line 23 ≥ Line 22?	**Yes, Performance Standard is Met**	

CITY OF CHULA VISTA	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-1-2	
Sizing Method for Pollutant Removal Criteria		**Worksheet B.5-1**	
1	Area draining to the BMP	**1603854.55**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.61**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**43292**	**cu. ft.**
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	**12**	**inches**
6	Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	**21**	**inches**
7	Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	**12**	**inches**
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	**3**	**inches**
9	Freely drained pore storage of the media	**0.2**	**in/in**
10	Porosity of aggregate storage	**0.4**	**in/in**
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	**2.962**	**in/hr.**
Baseline Calculations			
12	Allowable routing time for sizing	**6**	**hours**
13	Depth filtered during storm [Line 11 x Line 12]	**17.772**	**inches**
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	**22.2**	**inches**
15	Total Depth Treated [Line 13 + Line 14]	**39.972**	**inches**
Option 1 – Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	**64937**	**cu. ft.**
17	Required Footprint [Line 16/ Line 15] x 12	**19495**	**sq. ft.**
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	**32469**	**cu. ft.**
19	Required Footprint [Line 18/ Line 14] x 12	**17551**	**sq. ft.**
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4)	**0.03**	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	**29406**	**sq. ft.**
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	**29406**	**sq. ft.**
23	Provided BMP Footprint	**29906**	**sq. ft.**
24	Is Line 23 ≥ Line 22?	**Yes, Performance Standard is Met**	

DMA 3: Compact Biofiltration Design Flows		Worksheet B.6-1		
1	DCV	DCV	1,382	cubic-feet
2	DCV Retained	DCV Retained	0.00	cubic-feet
3	DCV Biofiltered	DCV Biofiltered	0.00	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	DCV flow-thru	1,382	cubic-feet
5	Adjustment Factor (Line 4 / Line1)	AF=	1.00	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP(s)	A=	1.00	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.72	unitless
9	Calculate Flow Rate = AF x (C x i x A) x1.5	Q=	0.217	cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located
2) Volume based (e.g., dry extended detention basin) Compact Biofiltration treatment control
3) Propietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the
4) Compact Biofiltration treatment control BMPs shall be sized to filter or treat the maximum flow

	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-3-3	
	hod for Volume Retention	**Worksheet B.5-2**	
1	Area draining to the BMP	**43422.68**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.72**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**1382**	**cu. ft.**
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30 When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05	**0**	**in/hr.**
6	Factor of safety	**2**	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6]	**0**	**in/hr.**
8	Average annual volume reduction target (Figure B.5-2) When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 ≤ 0.01 in/hr. = 3.5%	**3.5**	**%**
9	Fraction of DCV to be retained (Figure B.5-3) When Line 8 > 8% = 0.0000013 x Line 8^3 - 0.000057 x Line 8^2 + 0.0086 x Line 8 - 0.014 When Line 8 ≤ 8% = 0.023	**0.023**	
10	Target volume retention [Line 9 x Line 4]	**32**	**cu. ft.**

CITY OF CHULA VISTA		Project Name	SUNBOW II, PHASE 3					
		BMP ID	BF-3-3					
Volume Retention for No Infiltration Condition						**Worksheet B.5-6**		
1	Area draining to the biofiltration BMP					**43422.68**	**sq. ft.**	
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)					**0.72**		
3	Effective impervious area draining to the BMP [Line 1 x Line 2]					**31291**	**sq. ft.**	
4	Required area for Evapotranspiration [Line 3 x 0.03]					**939**	**sq. ft.**	
5	Biofiltration BMP Footprint						**sq. ft.**	
Landscape Area (must be identified on DS-3247)								
		Identification	**1**	**2**	**3**	**4**	**5**	
6	Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.)		4327.23					
7	Impervious area draining to the landscape area (sq. ft.)		2179					
8	Impervious to Pervious Area ratio [Line 7/Line 6]		**0.50**	**0.00**	**0.00**	**0.00**	**0.00**	
9	Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5]		**1453**	**0**	**0**	**0**	**0**	
10	Sum of Landscape area [sum of Line 9 Id's 1 to 5]					**1453**	**sq. ft.**	
11	Provided footprint for evapotranspiration [Line 5 + Line 10]					**1453**	**sq. ft.**	
Volume Retention Performance Standard								
12	Is Line 11 ≥ Line 4?				Volume Retention Performance Standard is Met			
13	Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4]					**1.55**		
14	Target Volume Retention [Line 10 from Worksheet B.5.2]					**32**	**cu. ft.**	
15	Volume retention required from other site design BMPs [(1-Line 13) x Line 14]					**-17.48276818**	**cu. ft.**	
Site Design BMP								
	Identification	**Site Design Type**				**Credit**		
16	**1**						**cu. ft.**	
	2						**cu. ft.**	
	3						**cu. ft.**	
	4						**cu. ft.**	
	5						**cu. ft.**	
	Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP.					**0**	**cu. ft.**	
17	Is Line 16 ≥ Line 15?				Volume Retention Performance Standard is Met			

DMA 4: Compact Biofiltration Design Flows		Worksheet B.6-1		
1	DCV	DCV	1,234	cubic-feet
2	DCV Retained	DCV Retained	0.00	cubic-feet
3	DCV Biofiltered	DCV Biofiltered	0.00	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	DCV flow-thru	1,234	cubic-feet
5	Adjustment Factor (Line 4 / Line1)	AF=	1.00	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP(s)	A=	0.84	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.76	unitless
9	Calculate Flow Rate = AF x (C x i x A) x1.5	Q=	0.194	cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located
2) Volume based (e.g., dry extended detention basin) Compact Biofiltration treatment control
3) Propietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the
4) Compact Biofiltration treatment control BMPs shall be sized to filter or treat the maximum flow

	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-3-4	
	hod for Volume Retention	**Worksheet B.5-2**	
1	Area draining to the BMP	**36564.89**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.76**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**1226**	**cu. ft.**
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30 When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05	**0**	**in/hr.**
6	Factor of safety	**2**	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6]	**0**	**in/hr.**
8	Average annual volume reduction target (Figure B.5-2) When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 ≤ 0.01 in/hr. = 3.5%	**3.5**	**%**
9	Fraction of DCV to be retained (Figure B.5-3) When Line 8 > 8% = 0.0000013 x Line 8^3 - 0.000057 x Line 8^2 + 0.0086 x Line 8 - 0.014 When Line 8 ≤ 8% = 0.023	**0.023**	
10	Target volume retention [Line 9 x Line 4]	**28**	**cu. ft.**

CITY OF CHULA VISTA		Project Name	SUNBOW II, PHASE 3					
		BMP ID	BF-3-4					
Volume Retention for No Infiltration Condition						**Worksheet B.5-6**		
1	Area draining to the biofiltration BMP					**36564.89**	**sq. ft.**	
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)					**0.76**		
3	Effective impervious area draining to the BMP [Line 1 x Line 2]					**27761**	**sq. ft.**	
4	Required area for Evapotranspiration [Line 3 x 0.03]					**833**	**sq. ft.**	
5	Biofiltration BMP Footprint						**sq. ft.**	
Landscape Area (must be identified on DS-3247)								
		Identification	**1**	**2**	**3**	**4**	**5**	
6	Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.)		2859.45					
7	Impervious area draining to the landscape area (sq. ft.)		1865.77					
8	Impervious to Pervious Area ratio [Line 7/Line 6]		**0.65**	**0.00**	**0.00**	**0.00**	**0.00**	
9	Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5]		**1244**	**0**	**0**	**0**	**0**	
10	Sum of Landscape area [sum of Line 9 Id's 1 to 5]					**1244**	**sq. ft.**	
11	Provided footprint for evapotranspiration [Line 5 + Line 10]					**1244**	**sq. ft.**	
Volume Retention Performance Standard								
12	Is Line 11 ≥ Line 4?				Volume Retention Performance Standard is Met			
13	Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4]					**1.49**		
14	Target Volume Retention [Line 10 from Worksheet B.5.2]					**28**	**cu. ft.**	
15	Volume retention required from other site design BMPs [(1-Line 13) x Line 14]					**-13.81846073**	**cu. ft.**	
Site Design BMP								
	Identification	**Site Design Type**				**Credit**		
16	**1**						**cu. ft.**	
	2						**cu. ft.**	
	3						**cu. ft.**	
	4						**cu. ft.**	
	5						**cu. ft.**	
	Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP.					**0**	**cu. ft.**	
17	Is Line 16 ≥ Line 15?				Volume Retention Performance Standard is Met			

DMA 5: Compact Biofiltration Design Flows		Worksheet B.6-1		
1	DCV	DCV	1,227	cubic-feet
2	DCV Retained	DCV Retained	0.00	cubic-feet
3	DCV Biofiltered	DCV Biofiltered	0.00	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	DCV flow-thru	1,227	cubic-feet
5	Adjustment Factor (Line 4 / Line1)	AF=	1.00	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP(s)	A=	0.82	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.78	unitless
9	Calculate Flow Rate = AF x (C x i x A) x1.5	Q=	0.193	cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located
2) Volume based (e.g., dry extended detention basin) Compact Biofiltration treatment control
3) Propietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the
4) Compact Biofiltration treatment control BMPs shall be sized to filter or treat the maximum flow

	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-3-5	
	hod for Volume Retention	**Worksheet B.5-2**	
1	Area draining to the BMP	**35738.24**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.77**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**1222**	**cu. ft.**
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30 When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05	**0**	**in/hr.**
6	Factor of safety	**2**	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6]	**0**	**in/hr.**
8	Average annual volume reduction target (Figure B.5-2) When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 ≤ 0.01 in/hr. = 3.5%	**3.5**	**%**
9	Fraction of DCV to be retained (Figure B.5-3) When Line 8 > 8% = 0.0000013 x Line 8^3 - 0.000057 x Line 8^2 + 0.0086 x Line 8 - 0.014 When Line 8 ≤ 8% = 0.023	**0.023**	
10	Target volume retention [Line 9 x Line 4]	**28**	**cu. ft.**

CITY OF CHULA VISTA		Project Name	SUNBOW II, PHASE 3					
		BMP ID	BF-3-5					
Volume Retention for No Infiltration Condition						**Worksheet B.5-6**		
1	Area draining to the biofiltration BMP					**35738.24**	**sq. ft.**	
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)					**0.77**		
3	Effective impervious area draining to the BMP [Line 1 x Line 2]					**27671**	**sq. ft.**	
4	Required area for Evapotranspiration [Line 3 x 0.03]					**830**	**sq. ft.**	
5	Biofiltration BMP Footprint						**sq. ft.**	
Landscape Area (must be identified on DS-3247)								
		Identification	**1**	**2**	**3**	**4**	**5**	
6	Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.)		2496.35					
7	Impervious area draining to the landscape area (sq. ft.)		1917.82					
8	Impervious to Pervious Area ratio [Line 7/Line 6]		**0.77**	**0.00**	**0.00**	**0.00**	**0.00**	
9	Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5]		**1279**	**0**	**0**	**0**	**0**	
10	Sum of Landscape area [sum of Line 9 Id's 1 to 5]					**1279**	**sq. ft.**	
11	Provided footprint for evapotranspiration [Line 5 + Line 10]					**1279**	**sq. ft.**	
Volume Retention Performance Standard								
12	Is Line 11 ≥ Line 4?				Volume Retention Performance Standard is Met			
13	Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4]					**1.54**		
14	Target Volume Retention [Line 10 from Worksheet B.5.2]					**28**	**cu. ft.**	
15	Volume retention required from other site design BMPs [(1-Line 13) x Line 14]					**-15.17891937**	**cu. ft.**	
Site Design BMP								
	Identification	**Site Design Type**				**Credit**		
16	**1**						**cu. ft.**	
	2						**cu. ft.**	
	3						**cu. ft.**	
	4						**cu. ft.**	
	5						**cu. ft.**	
	Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP.					**0**	**cu. ft.**	
17	Is Line 16 ≥ Line 15?				Volume Retention Performance Standard is Met			

DMA 6: Compact Biofiltration Design Flows		Worksheet B.6-1		
1	DCV	DCV	141	cubic-feet
2	DCV Retained	DCV Retained	0.00	cubic-feet
3	DCV Biofiltered	DCV Biofiltered	0.00	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	DCV flow-thru	141	cubic-feet
5	Adjustment Factor (Line 4 / Line1)	AF=	1.00	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP(s)	A=	0.13	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.56	unitless
9	Calculate Flow Rate = AF x (C x i x A) x1.5	Q=	0.022	cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located
2) Volume based (e.g., dry extended detention basin) Compact Biofiltration treatment control
3) Propietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the
4) Compact Biofiltration treatment control BMPs shall be sized to filter or treat the maximum flow

	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-3-6	
	hod for Volume Retention	**Worksheet B.5-2**	
1	Area draining to the BMP	**5764.00**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.56**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**141**	**cu. ft.**
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30 When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05	**0**	**in/hr.**
6	Factor of safety	**2**	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6]	**0**	**in/hr.**
8	Average annual volume reduction target (Figure B.5-2) When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 ≤ 0.01 in/hr. = 3.5%	**3.5**	**%**
9	Fraction of DCV to be retained (Figure B.5-3) When Line 8 > 8% = 0.0000013 x Line 8^3 - 0.000057 x Line 8^2 + 0.0086 x Line 8 - 0.014 When Line 8 ≤ 8% = 0.023	**0.023**	
10	Target volume retention [Line 9 x Line 4]	**3**	**cu. ft.**

CITY OF CHULA VISTA		Project Name	SUNBOW II, PHASE 3					
		BMP ID	BF-3-6					
Volume Retention for No Infiltration Condition					**Worksheet B.5-6**			
1	Area draining to the biofiltration BMP					**5764.00**	**sq. ft.**	
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)					**0.56**		
3	Effective impervious area draining to the BMP [Line 1 x Line 2]					**3201**	**sq. ft.**	
4	Required area for Evapotranspiration [Line 3 x 0.03]					**96**	**sq. ft.**	
5	Biofiltration BMP Footprint						**sq. ft.**	
Landscape Area (must be identified on DS-3247)								
		Identification	**1**	**2**	**3**	**4**	**5**	
6	Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.)		1103.67					
7	Impervious area draining to the landscape area (sq. ft.)		449					
8	Impervious to Pervious Area ratio [Line 7/Line 6]		**0.41**	**0.00**	**0.00**	**0.00**	**0.00**	
9	Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5]		**299**	**0**	**0**	**0**	**0**	
10	Sum of Landscape area [sum of Line 9 Id's 1 to 5]					**299**	**sq. ft.**	
11	Provided footprint for evapotranspiration [Line 5 + Line 10]					**299**	**sq. ft.**	
Volume Retention Performance Standard								
12	Is Line 11 ≥ Line 4?				Volume Retention Performance Standard is Met			
13	Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4]					**3.11**		
14	Target Volume Retention [Line 10 from Worksheet B.5.2]					**3**	**cu. ft.**	
15	Volume retention required from other site design BMPs [(1-Line 13) x Line 14]					**-6.861050075**	**cu. ft.**	
Site Design BMP								
	Identification	**Site Design Type**				**Credit**		
16	**1**						**cu. ft.**	
	2						**cu. ft.**	
	3						**cu. ft.**	
	4						**cu. ft.**	
	5						**cu. ft.**	
	Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP.					**0**	**cu. ft.**	
17	Is Line 16 ≥ Line 15?				Volume Retention Performance Standard is Met			

DMA 7: Compact Biofiltration Design Flows		Worksheet B.6-1		
1	DCV	DCV	144	cubic-feet
2	DCV Retained	DCV Retained	0.00	cubic-feet
3	DCV Biofiltered	DCV Biofiltered	0.00	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	DCV flow-thru	144	cubic-feet
5	Adjustment Factor (Line 4 / Line1)	AF=	1.00	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP(s)	A=	0.14	acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=	0.53	unitless
9	Calculate Flow Rate = AF x (C x i x A) x1.5	Q=	0.023	cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located
2) Volume based (e.g., dry extended detention basin) Compact Biofiltration treatment control
3) Propietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the
4) Compact Biofiltration treatment control BMPs shall be sized to filter or treat the maximum flow

	Project Name	SUNBOW II, PHASE 3	
	BMP ID	BF-3-7	
	hod for Volume Retention	**Worksheet B.5-2**	
1	Area draining to the BMP	**6160.00**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.53**	
3	85th percentile 24-hour rainfall depth	**0.53**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**144**	**cu. ft.**
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30 When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05	**0**	**in/hr.**
6	Factor of safety	**2**	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6]	**0**	**in/hr.**
8	Average annual volume reduction target (Figure B.5-2) When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 ≤ 0.01 in/hr. = 3.5%	**3.5**	**%**
9	Fraction of DCV to be retained (Figure B.5-3) When Line 8 > 8% = 0.0000013 x Line 8^3 - 0.000057 x Line 8^2 + 0.0086 x Line 8 - 0.014 When Line 8 ≤ 8% = 0.023	**0.023**	
10	Target volume retention [Line 9 x Line 4]	**3**	**cu. ft.**

CITY OF CHULA VISTA		Project Name	SUNBOW II, PHASE 3					
		BMP ID	BF-3-7					
Volume Retention for No Infiltration Condition					**Worksheet B.5-6**			
1	Area draining to the biofiltration BMP					**6160.00**	**sq. ft.**	
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)					**0.53**		
3	Effective impervious area draining to the BMP [Line 1 x Line 2]					**3259**	**sq. ft.**	
4	Required area for Evapotranspiration [Line 3 x 0.03]					**98**	**sq. ft.**	
5	Biofiltration BMP Footprint						**sq. ft.**	
Landscape Area (must be identified on DS-3247)								
		Identification	**1**	**2**	**3**	**4**	**5**	
6	Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.)		1269.67					
7	Impervious area draining to the landscape area (sq. ft.)		324					
8	Impervious to Pervious Area ratio [Line 7/Line 6]		**0.26**	**0.00**	**0.00**	**0.00**	**0.00**	
9	Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5]		**216**	**0**	**0**	**0**	**0**	
10	Sum of Landscape area [sum of Line 9 Id's 1 to 5]					**216**	**sq. ft.**	
11	Provided footprint for evapotranspiration [Line 5 + Line 10]					**216**	**sq. ft.**	
Volume Retention Performance Standard								
12	Is Line 11 ≥ Line 4?				Volume Retention Performance Standard is Met			
13	Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4]					**2.21**		
14	Target Volume Retention [Line 10 from Worksheet B.5.2]					**3**	**cu. ft.**	
15	Volume retention required from other site design BMPs [(1-Line 13) x Line 14]					**-4.005335345**	**cu. ft.**	
Site Design BMP								
	Identification	**Site Design Type**				**Credit**		
16	**1**						**cu. ft.**	
	2						**cu. ft.**	
	3						**cu. ft.**	
	4						**cu. ft.**	
	5						**cu. ft.**	
	Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP.					**0**	**cu. ft.**	
17	Is Line 16 ≥ Line 15?				Volume Retention Performance Standard is Met			

SUNBOW II, PHASE 3

Description	Units	Modular Wetland System Linear	Modular Wetland System Linear	Modular Wetland System Linear	Round Curb Inlet Filter	Round Curb Inlet Filter
Drainage Basin ID or Name	unitless	BF-3-3	BF-3-4	BF-3-5	BF-3-6	BF-3-7
Location	N/A	DMA 3-C	DMA4-D	DMA5-C	DMA6-D	DMA7-D
Total Tributary Area	ac	0.997	0.839	0.820	0.132	0.141
Total Tributary Area	sq ft	43423	36565	35738	5764	6160
Final Adjusted Runoff Factor	unitless	0.72	0.76	0.77	0.56	0.53
85th Percentile Design Rainfall Depth	inches	0.53	0.53	0.53	0.53	0.53
Design Capture Volume	cubic-feet	1,382	1,226	1,222	141	144
Volume Retainied/Biofiltered	cubic-feet	2073	1839	1833	212	216
85th Percentile Design Rainfall Intensity	in/hr	0.2	0.2	0.2	0.2	0.2
WQ Flow Rate	CFS	0.145	0.129	0.128	0.015	0.015
Flow Rate Safety Factor	unitless	1.5	1.5	1.5	1.5	1.5
Design Flow Rate	CFS	0.217	0.193	0.192	0.022	0.023
Modular Wetland Model	unitless	L-4-17 (3.6)	L-4-17 (3.3)	L-4-17 (3.3)	BC-RGISB-MF-22-24	BC-RGISB-MF-22-24
Treatment Flow Rate (each)	CFS	0.218	0.200	0.200	0.120	0.120
Number of Units	#	1	1	1	1	1
Treatment Flow Rate (Total)	CFS	0.218	0.200	0.200	0.120	0.120
Is The BMP Adequately Sized?	unitless	Yes	Yes	Yes	Yes	Yes

WASHINGTON STATE DEPARTMENT OF ECOLOGY

July 2017

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, AND PHOSPHORUS TREATMENT

For the

MWS-Linear Modular Wetland

Ecology's Decision:

Based on Modular Wetland Systems, Inc. application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Basic treatment

   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

2. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Phosphorus treatment

   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

3. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Enhanced treatment

   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

4. Ecology approves the MWS - Linear Modular Wetland Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:

    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
    - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
    - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

5. These use level designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use:

Applicants shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the MWS – Linear Modular Wetland Stormwater Treatment System units, in accordance with Modular Wetland Systems, Inc. applicable manuals and documents and the Ecology Decision.
2. Each site plan must undergo Modular Wetland Systems, Inc. review and approval before site installation. This ensures that site grading and slope are appropriate for use of a MWS – Linear Modular Wetland Stormwater Treatment System unit.
3. MWS – Linear Modular Wetland Stormwater Treatment System media shall conform to the specifications submitted to, and approved by, Ecology.
4. The applicant tested the MWS – Linear Modular Wetland Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to MWS – Linear Modular Wetland Stormwater Treatment Systems whether plants are included in the final product or not.
5. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

    - Typically, Modular Wetland Systems, Inc. designs MWS - Linear Modular Wetland systems for a target prefilter media life of 6 to 12 months.
    - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
    - Owners/operators must inspect MWS - Linear Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific

maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
    - Standing water remains in the vault between rain events, or
    - Bypass occurs during storms smaller than the design storm.
    - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
    - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6. Discharges from the MWS - Linear Modular Wetland Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant:	Modular Wetland Systems, Inc.
Applicant's Address:	*PO. Box 869* *Oceanside, CA 92054*

Application Documents:

- *Original Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011
- *Quality Assurance Project Plan*: Modular Wetland system – Linear Treatment System performance Monitoring Project, draft, January 2011.
- *Revised Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011
- *Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014*
- *Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014.*

Applicant's Use Level Request:

General use level designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The MWS – Linear Modular wetland is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 50-percent of Total Phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 30-percent of dissolved Copper from stormwater with influent concentrations between 0.005 and 0.020 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 60-percent of dissolved Zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/l.

Ecology Recommendations:

- Modular Wetland Systems, Inc. has shown Ecology, through laboratory and field-testing, that the MWS - Linear Modular Wetland Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Total phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The MWS-Linear Modular wetland has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Modular Wetland Systems, Inc. should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Modular Wetland Systems, Inc. should use these data to establish required maintenance cycles.
2. Modular Wetland Systems, Inc. should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Modular Wetland Systems, Inc. will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at http://www.modularwetlands.com/

Contact Information:

Applicant: Zach Kent
BioClean A Forterra Company.
398 Vi9a El Centro
Oceanside, CA 92058
zach.kent@forterrabp.com

Applicant website: http://www.modularwetlands.com/

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Revision History

Date	**Revision**
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS-Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)

ATTACHMENT 2

Backup for PDP Hydromodification Control Measures

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Indicate which Items are Included

Attachment Sequence	Contents	Checklist
Attachment 2A	Hydromodification Management Exhibit (Required)	☑ Included See Hydromodification Management Exhibit Checklist.
Attachment 2B	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☑ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map **(Required)** Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☑ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2C	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☐ Not performed ☑ Included ☐ Submitted as separate stand-alone document
Attachment 2D	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each Structural BMP See Chapter 6 and Appendix G of the BMP Design Manual	☑ Included ☐ Submitted as separate stand-alone document

Attachment 2A

HMP EXHIBIT

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

- ☑ Underlying hydrologic soil group
- ☑ Approximate depth to groundwater
- ☑ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☑ Critical coarse sediment yield areas to be protected
- ☑ Existing topography
- ☑ Existing and proposed site drainage network and connections to drainage offsite
- ☑ Proposed grading
- ☑ Proposed impervious features
- ☑ Proposed design features and surface treatments used to minimize imperviousness
- ☑ Point(s) of Compliance (POC) for Hydromodification Management Hydromodification Management, with a POC at each point of discharge
- ☑ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
- ☑ Structural BMPs for hydromodification management (identify location, type of BMP, cross-section and size/detail)

DMA 7-D
0.14 ACRES

6 - 8' x 4' R.C.B. Culverts

DMA 6-D
0.13 ACRES

POC1

POC2

2 - 8' x 8' R.C.B. Culverts

DMA 5-C
0.82 ACRES

DMA 4-D
0.84 ACRES

DMA 3-C
1.00 ACRES

DMA 2-D
36.82 ACRES

DMA 1-D
13.89 ACRES

DMA 1-C
16.10 ACRES

C

D

LEGEND

- PROJECT BOUNDARY
- DMA 1 BOUNDARY
- XX.XX ACRES — SUBAREA ACREAGE
- DMA1-D — DMA # + SOIL TYPE
- PERVIOUS - LANDSCAPE / SELF TREATING AREAS
- D — HYDROLOGIC SOIL TYPE
- POC — POINT OF COMPLIANCE
- COARSE SEDIMENT YIELDING AREA

UNDERLYING SOIL GROUP: C, D
APPROXIMATE DEPTH TO GROUNDWATER = >20'

100 0 100 200 300
SCALE 1"= 100'

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PREDEVELOPED CONDITION
HYDROMODIFICATION MAP

SUNBOW II, PHASE 3

CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 1

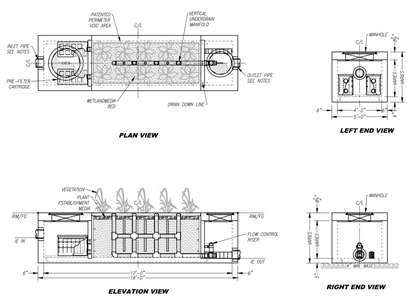
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BF-1-1 AND BF-1-2 SUMMARY					
DMA #	Min WQ bottom required (sf)	Ponding Depth (in)	Bioretention Soil Layer (in)	Gravel Layer (in)	Basin Depth (ft)
DMA1 (BF-1-1)	23383	12	21	15	6
DMA2 (BF-1-2)	28698	12	21	15	6

DMA 7-D 0.14 ACRES
6 - 8' x 4' R.C.B. Culverts
BF-3-5
BF-3-7
DMA 6-D 0.13 ACRES
BF-3-6
BF-3-3
2 - 8' x 8' R.C.B. Culverts
DMA 5-C 0.82 ACRES
DMA 4-D 0.84 ACRES
BF-3-4
DMA 3-C 1.00 ACRES
BF-1-1 0.58 ACRES
BF-1-2 0.68 ACRES
DMA 2-D 36.14 ACRES
DMA 1-D 13.89 ACRES
DMA 1-C 15.52 ACRES
OS-2 MSCP
OS-3 MSCP
OS-10
OS-12
OS-14
OS-7
R-1
SCALE 1" = 100'

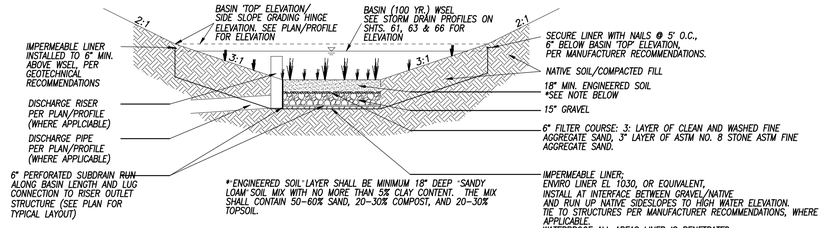
UNDERLYING SOIL GROUP: C, D
APPROXIMATE DEPTH TO GROUNDWATER = >20'



MWS-L-4-17-V-FlowBased Modular Wetland
NOT TO SCALE

LEGEND

- PROJECT BOUNDARY
- DMA BOUNDARY
- 00.00 ACRES — SUBAREA ACREAGE
- DMA1-D — DMA # + SOIL TYPE
- IMPERVIOUS - ROAD/SIDEWALK/ DRIVEWAY
- IMPERVIOUS- ROOF/BUILDING
- PERVIOUS - LANDSCAPE
- BASIN BOTTOM
- POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREA
- D — HYDROLOGIC SOIL TYPE
- POC — POINT OF COMPLIANCE
- STRUCTURAL BMPS — BIOFILTRATION BASIN
- STRUCTURAL BMPS — COMPACT PROPRIETARY BIOFILTRATION



SOIL SECTION FOR WATER QUALITY/HYDROMODIFICATION BIOFILTRATION BASIN
NOT TO SCALE

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DEVELOPED CONDITION HYDROMODIFICATION MAP
SUNBOW II, PHASE 3
CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 1

W.O.# 2167-0161

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Attachment 2B

CCSYA MAP

Downstream System Sensitivity to Coarse Sediment
(Preliminary Threshold Channel Analysis for Poggi Creek)


CCSYA MAP
Legend
Yes
Google Earth
© 2019 Google
© 2019 INEGI
N
1000 ft

Downstream System Sensitivity to Coarse Sediment

Preliminary Threshold Channel Analysis for Poggi Creek (per City of Chula Vista BMP Design Manual Appendix H.7)

INTRODUCTION

The purpose of this analysis is, by referencing TRWE Susceptibility Analysis of Poggi Creek (TRWE Susceptibility Analysis) and performing the Threshold Channel determination methodology listed in City of Chula Vista BMP Design Manual Appendix H.7 (Manual), to demonstrate that the existing Poggi Creek which is receiving our Sunbow II, Phase 3 project POC discharges satisfies the classification of Threshold Channel. As a result, the Sunbow project (PDP) can be exempt from MS4 Permit requirement for the Critical Coarse Sediment supply.

The following statements are interpreted from the City of Chula Vista BMP Design Manual Appendix H.7.

METHODOLOGY

In general, a threshold channel is a stream channel in which channel boundary material has no significant movement during the design flow. Once the study channel is classified as Threshold Channel, changes in sediment supply are not considered a geomorphic condition of concern, therefore the PDP project can be exempt from the coarse sediment supply requirements.

To demonstrate whether the channel is classified as a threshold channel, one must follow the steps shown below:

Step1, determine the domain of analysis of the channel. This term refers to the channel reaches which are receiving the project discharge or hydraulicly affected by the project (please see attached Worksheet H.7-1 for the details of domain determination). All supporting calculations will be conducted within this domain as well.
Step2, document photographs of the domain and determine the d50(in mm)of the bed material (available from the attached TRWE Susceptibility Analysis).
Step3, calculate the Q10 and Specific Stream Power (SSP) using the Equation H.7-5 (page H-35) and H.7-2 (page H-34) in Manual's Appendix H.7. Regarding the Equation H.7-5, select a 50% overall imperviousness for study drainage area to determine the Adjustment Factor. All other terms are directly available from the attached TRWE Susceptibility Analysis.
Step4, Plot the calculated Specific Stream Power results against d50(in mm) in Figure H.7-1 in Manual's Appendix H.7, page H-34. If the plotted points are below the solid line in Figure H.7-1, the

study channel reaches are classified as threshold channel.

Step5, Thus the **CONCULSION** can be made that the PDP is exempted from the MS4 Coarse Sediment Supply requirement despite the Sunbow PDP is in Critical Coarse Sediment Yielding Area.

The calculations and supporting data are all included in this analysis below.

H.7 Downstream System Sensitivity to Coarse Sediment

If an applicant has identified onsite and/or upstream PCCSYAs and elects to perform additional optional analyses to refine the PCCSYA designation, the guidance presented below should be followed. Protection of critical coarse sediment yield areas is a necessary element of hydromodification management because coarse sediment supply is as much an issue for causing erosive conditions to receiving streams as are accelerated flows. However, not all downstream systems warrant preservation of coarse sediment supply nor all source areas need to be protected. The following guidance shall be used to refine PCCSYA designations:

- Depositional Analysis (**Appendix H.7.1**)
- Threshold Channel Analysis (**Appendix H.7.2**)
- Coarse Sediment Source Area Verification (**Appendix H.7.3**)

H.7.1 Depositional Analysis

Areas identified as PCCSYAs may be removed from consideration if it is demonstrated that these sources are deposited into existing systems prior to reaching the first downstream unlined water of the state. Systems resulting in deposition may include existing natural sinks, existing structural BMPs, existing hardened MS4 systems, or other existing similar features. Applicants electing to perform depositional analysis to refine PCCSYA mapping must meet the following criteria to qualify for exemption from CCSYA designation:

- The existing hardened MS4 system that is being analyzed should be upstream of the first downstream unlined waters of the state; **and**
- The peak velocity from the discrete 2-year, 24-hour runoff event for the existing hardened MS4 system that is being analyzed is less than three feet per second.

The three feet per second criteria is consistent with the recommended minimum velocity for storm and sanitary sewers in ASCE Manual of Engineering Practice No. 37 (ASCE, 1970).

In limited scenarios, applicant may have the option to establish site specific minimum self-cleansing velocity using Equation H.7-1 or other appropriate equations instead of using the default three feet per second criteria. This site specific analysis must be documented in the SWQMP and the [City Engineer] has the discretion to request additional analysis prior to approving a site specific minimum self-cleansing velocity. If an applicant chooses to establish a site specific minimum self-cleansing velocity for refinement, then the applicant must design any new bypass hardened conveyance systems proposed by the project to meet the site specific criteria.

Equation H.7-1: Minimum Self Cleansing Velocity

$$V = \frac{1.486}{n} R^{1/6} \left[B(s_g - 1) D_g \right]^{1/2}$$

Where:

V = minimum self-cleansing velocity (ft/sec)
R = hydraulic radius (ft)
n = Manning's roughness coefficient (unitless)
B = constant equal to 0.04 for clean granular particles (unitless)
sg = specific gravity of sediment particle (unitless): **Use 2.65**
Dg = sediment particle diameter (inches): **Use 0.20 in**

H.7.2 Threshold Channel Analysis

A threshold channel is a stream channel in which channel boundary material has no significant movement during the design flow. If there is no movement of bed load in the stream channel, then it is not anticipated that reductions in sediment supply will be detrimental to stream stability because the channel bed consists of the parent material and not coarse sediment supplied from upstream. In such a situation, changes in sediment supply are not considered a geomorphic condition of concern. SCCWRP Technical Report 562 (2008) states the following in regards to sand vs. gravel bed behavior/threshold vs. live-bed contrasts:

> "Sand and gravel systems are quite varied in their transport of sediment and their sensitivity to sediment supply. On the former, sand-bed channels typically have live beds, which transport sediment continuously even at relatively low flows. Conversely, gravel/cobble-bed channels generally transport the bulk of their bed sediment load more episodically, requiring higher flow events for bed mobility (i.e., threshold behavior)."

> "Sand-bed streams without vertical control are much more sensitive to perturbations in flow and sediment regimes than coarse-grain (gravel/cobble) threshold channels. This has clear implications in their respective management regarding hydromodification (i.e., sand systems being relatively more susceptible than coarser systems). This also has direct implications for the issue of sediment trapping by storm water practices in watersheds draining to sand-bed streams, as well as general loss of sediment supply following the conversion from undeveloped sparsely-vegetated to developed well-vegetated via irrigation."

The following provides guidance for evaluating whether a stream channel is a threshold channel or not. This determination is important because while accounting for changes in bed sediment supply is appropriate for quantifying geomorphic impacts in non-threshold stream channels, it is not considered appropriate for threshold channels. The domain of analysis for this evaluation shall be the same as that used to evaluate susceptibility, per SCCWRP Technical Report 606, Field Manual for Assessing Channel Susceptibility (2010). This domain is defined by the following upstream and downstream boundaries:

- From the point of compliance proceed downstream until reaching one of the following:
    - At least one reach downstream of the first grade-control point (preferably second downstream grade control location);
    - Tidal backwater/lentic (still water) waterbody;
    - Equal order tributary (Strahler 1952);
    - A 2-fold increase in drainage area.

OR demonstrate sufficient flow attenuation through existing hydrologic modeling.

- From the point of compliance proceed upstream for 20 channel top widths OR to the first grade control in good condition, whichever comes first.

Satisfied! see calcs. below

Applicant must complete **Worksheet H.7-1** to document selection of the domain of analysis. If the entire domain of analysis is classified as a threshold channel, then the PDP can be exempt from the MS4 Permit requirement for sediment supply. The following definitions from the Natural Resources Conservation Service's (NRCS) National Engineering Handbook Part 654 - Stream Restoration Design (2007) are helpful in understanding what a threshold channel is.

- **Alluvial Channel**: Streams and channels that have bed and banks formed of material transported by the stream. There is an exchange of material between the inflowing sediment load and the bed and banks of an alluvial channel (NRCS, 2007).
- **Threshold Channel**: A channel in which channel boundary material has no significant movement during the design flow (NRCS, 2007).

The key factor for determining whether a channel is a threshold channel is the composition of its bed material. Larger bed sediment consisting primarily of cobbles and boulders are typically immobile, unless the channel is a large river with sufficient discharge to regularly transport such grain sizes as bed load. As a rule-of-thumb, channels with bed material that can withstand a 10-year peak discharge without incipient motion are considered threshold channels and not live-bed alluvial channels. Threshold channel beds typically consist of cobbles, boulders, bedrock, or very dense vegetation (e.g., a thicket). Threshold channels also includes channels that have existing grade control structures that protect the stream channels from hydromodification impacts.

For a project to be exempt from coarse sediment supply requirements, the applicant must submit the following for approval to the City Engineer:

- Photographic documentation and grain size analysis used to determine the d_{50} of the bed material; **and**
- Calculations that show that the receiving water of concern meets the specific stream power criteria defined below or a finding from a geomorphologist that the stream channel has existing grade control structures that protect the stream channel from hydromodification impacts.

Specific Stream Power

Specific (i.e., unit) stream power is the rate at which the energy of flowing water is expended on the bed and banks of a channel (refer to Equation H.7-1). SCCWRP studies have found that locating channels on a plot of Specific Stream Power at Q_{10} (as calculated by the Hawley et al. method

optimized for Southern California watersheds – Figure H.7-1) versus median channel grain size is a good predictor of channel stability. The Q_{10} equation from SCCWRP TR 606 is presented as Equation H.7-2.

Equation H.7-2: Calculation of Specific Stream Power

$$Specific\ Stream\ Power = \frac{Total\ Stream\ Power}{Channel\ Width} = \frac{\gamma QS}{w}$$

Where:

γ: Specific Weight of Water (9810 N/m^3)
Q: Flow Rate (dominant discharge in many cases, m^3/sec)
S: Slope of Channel
w: Channel Width (meters)

Equation H.7-3: Calculation of Q_{10} using the Hawley et al. method

$$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$$

Where:

Q_{10cfs}: 10 year Flow Rate in cubic feet per second
A: Drainage Area in sq. miles
P: Mean Annual Precipitation in inches

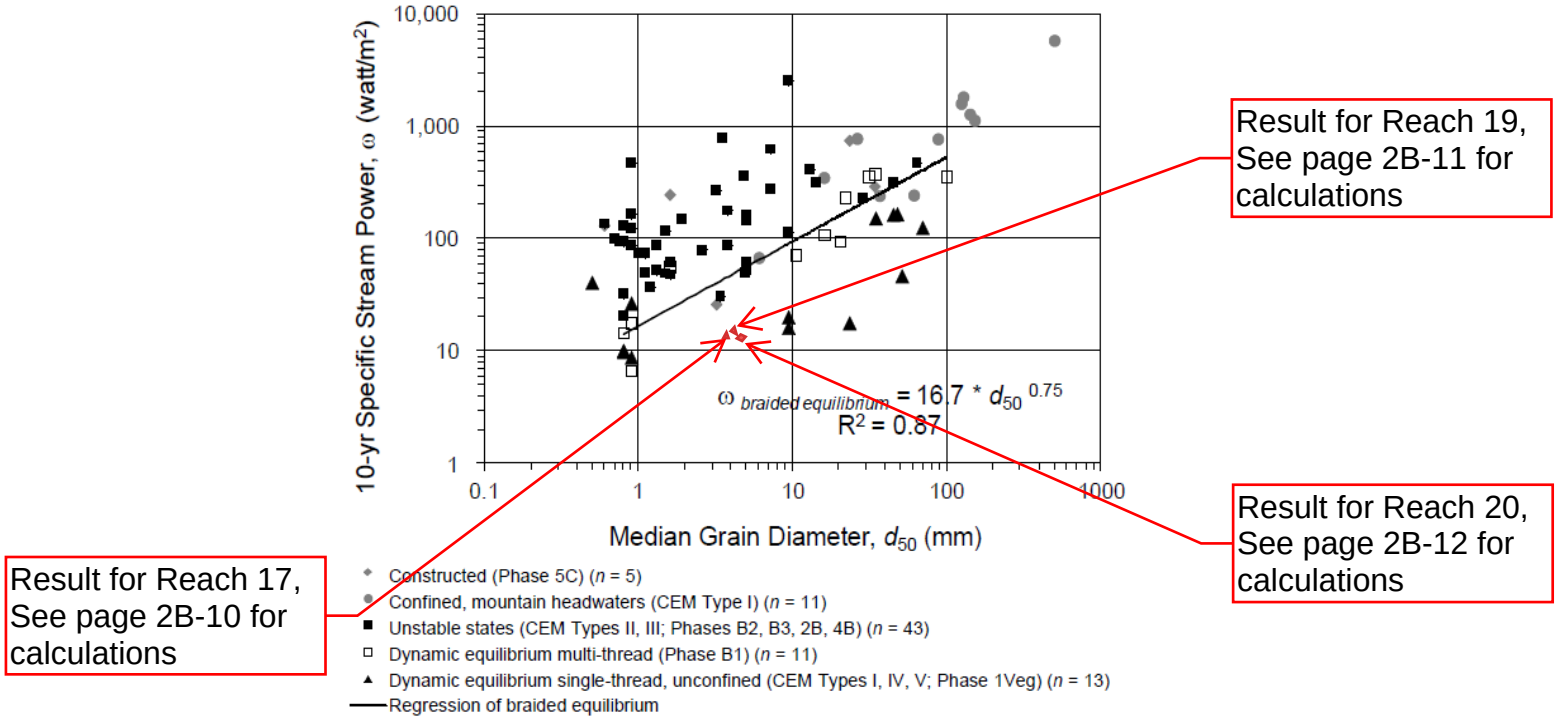


Figure H.7-1: Threshold of stream instability based on specific stream power and channel sediment diameter

Since the SCCWRP TR 606 Q_{10} (Equation H.7-3) does not explicitly consider watershed imperviousness, adjustment factors (AF) shown in Figure H.7-2 were developed using the following Equation H.7-4 for Q_{10} from SCCWRP TR 654 to account for imperviousness while estimating Q_{10}.

Equation H.7-4: Calculation of Q_{10} using equation from SCCWRP TR 654

$$Q_{10} = e^{3.61} * A^{0.865} * DD^{0.804} * P_{224}^{0.778} * IMP^{0.096}$$

Where:

Q_{10}: 10 year Flow Rate
A: Drainage Area in sq. miles
DD: Drainage Density
P_{224}: 2-Year 24-Hour Precipitation in inches
IMP: Watershed Imperviousness

Adjustment factors were developed as part of this methodology by changing the watershed imperviousness in Equation H.7-4 and keeping the remaining terms constant. Adjustment factor for imperviousness of 3.6% was set to 1; since it is the mean imperviousness of the dataset used to develop the stability curve in Figure H.7-1. Updated Q_{10} equation with adjustment factor is presented as Equation H.7-5 below:

Equation H.7-5: Calculation of Q_{10} with Adjustment Factor for Watershed Imperviousness

$$Q_{10cfs} = AF * 18.2 * A^{0.87} * P^{0.77}$$

Where:

Q_{10cfs}: 10 year Flow Rate in cubic feet per second
AF: Adjustment Factor
A: Drainage Area in sq. miles
P: Mean Annual Precipitation in inches

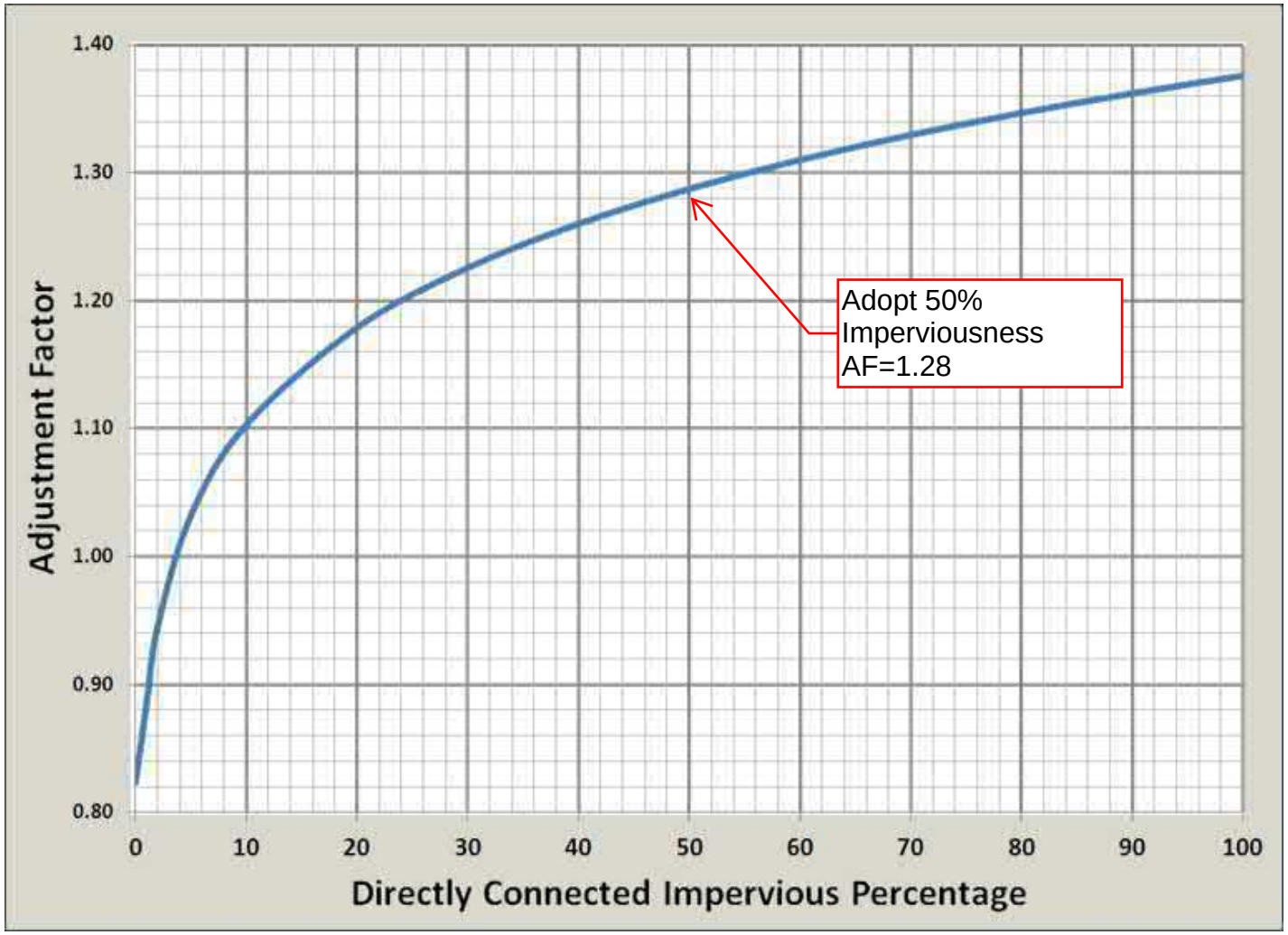


Figure H.7-2: Adjustment factor to account for imperviousness while estimating Q_{10}

Steps for evaluating the specific stream power criteria are presented below:

- **Step 1**: Calculate the specific stream power for the receiving water. Use Equation H.7-2, H.7-5 and Figure H.7-2. Directly connected imperviousness shall be estimated using guidance provided in the Water Quality Equivalency guidance document.
- **Step 2**: Determine the d_{50} of representative cross section within the domain of analysis.
- **Step 3**: Use results from Step 1 and Step 2; and Figure H.7-1 to determine if the receiving water meets the specific stream power criteria. Receiving water shall be considered meeting the specific stream power criteria when the point plotted based on results from Step 1 and Step 2 is below the solid line in Figure H.7-1.

H.7.3 Coarse Sediment Source Area Verification

When it has been determined that PCCSYAs are present, and it has been determined that downstream systems require protection, additional analysis may be performed that may refine the extents of actual CCSYAs to be protected onsite. The following analysis shall be performed to determine if the mapped PCCSYAs are a significant source of bed sediment supply to the receiving water, based on the coarse sediment proportion of the soil onsite

- Obtain a grain size distribution per ASTM D422 for the project's PCCSYA that is being evaluated.
- Identify whether the source material is a coarse grained or fine grained soil. Coarse grained is defined as over 50% by weight coarse than no. 200 sieve (i.e., $d_{50} > 0.074$ mm).
- By performing this analysis, the applicant can exclude PCCSYAs that are determined to be fine grained (i.e., $d_{50} < 0.074$ mm). Fine grained soils are not considered significant sources of bed sediment supply.
- Applicant shall include the following information in the SWQMP when this refinement option is performed:
    - Map with locations on where the grain size distribution analysis was performed;
    - Photographic documentation; and
    - Grain size distribution.
- Additional grain size distribution analysis may be requested at specific locations by the County prior to approval of this refinement.

Areas that are not expected to be a significant source of bed sediment supply (i.e. fine grained soils) to the receiving stream do not require protection and are not considered CCSYAs.

If it is determined that the PCCSYAs are producing sediment that is critical to receiving streams, or if the optional additional analysis presented above has not been performed, the project must provide management measures for protection of critical coarse sediment yield (refer to **Appendix H.2, H.3 and H.4**).

Worksheet H.7-1: Domain of Analysis

Domain of Analysis		Worksheet H.7-1
Use this form to document the domain of analysis		
Project Name: Sunbow PA-23 & Preserve		
Project Tracking Number / Permit Application Number: CVT # 20-0002		
Part 1: Identify Domain of Analysis		
Project Location (at proposed storm water discharge point)		
1	Address:	South of Olympic Pkwy, North of Otay Landfill, 1.2 miles east of Freeway 805
2	Latitude (decimal degrees):	32.609 N
3	Longitude (decimal degrees):	117.017 W
4	Watershed:	Otay 910
Basis for determining downstream limit: Per City's BMP Manual page H-32, the domain of analysis for Threshold Channel shall be the same as that used to evaluate susceptibility. We will define the downstream limit of Susceptibility Analysis (the end of Reach 20 in attached Susceptibility Analysis) as that of our Threshold Channel Analysis despite the downstream limit of Susceptibility Analysis is immediately upstream of our POC1. This decision is supported by the fact that the Poggi Canyon Creek accepting our POC1 and POC2 maintains very consistent channel condition per onsite visual investigation, we anticipated a similar channel susceptibility in downstream of study Reach 20.		
Channel length from discharge point to downstream limit:	0	
Basis for determining upstream limit: Per City's BMP Manual requirement, select the end of Reach 16 in Susceptibility Analysis as our upstream limit. It is approximately 720 ft upstream of POC 2.		
Channel length from discharge point to upstream limit:	720 ft	

Worksheet H.7-1; Page 2 of 2

Photo(s)

Map or aerial photo of site. Include channel alignment and tributaries, project discharge point, upstream and downstream limits of analysis, ID number and boundaries of geomorphic channel units, and any other features used to determine limits (e.g. exempt water body, grade control)

see following pages

Data for Specific Stream Power Calculation for Reach 17

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek - REACH 17. Natural channel (50% of conservation area).

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	3.031
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.004
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	29.0

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2), P (in)	276
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.8
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m), Q_{10} (m^3/s)	0.011
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.2
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m), W_{ref} (m)	1.68

Calculation:
Q10cfs = AF * 18.2 * $A^{0.87}$ * $P^{0.77}$ = 1.28*18.2*$3.031^{0.87}$*$9.76^{0.77}$ = 353.29cfs = 10m^3/s
Specific Stream Power (SSP) = rQS/w = 9810*10*0.004/29 = 13.5 Watt/m^2
d50 (inch) for Threshold Channel Analysis = 3.7 mm

Then plot SSP against d50 in Figure H.7-1, it is below the solid line, see previous page

Data for Specific Stream Power Calculation for Reach 19

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 19

Natural channel (upper half of second conservation area)

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	3.119
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.0044
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	30.5

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2), P (in)	283
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	8.0
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	S_v (m/m), Q_{10} (m^3/s)	0.012
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.4
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m), W_{ref} (m)	1.75

Calculation:

$Q10cfs = AF * 18.2 * A^{0.87} * P^{0.77} = 1.28*18.2*3.119^{0.87}*9.76^{0.77} = 362.24cfs = 10.25m^3/s$

Specific Stream Power (SSP) = $rQS/w = 9810*10.25*0.0044/30.5 = 14.5$ Watt/m^2

d50 (inch) for Threshold Channel Analysis = 3.9mm

Then plot SSP against d50 in Figure H.7-1, it is below the solid line, see previous page

Data for Specific Stream Power Calculation for Reach 20

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 20. Natural channel (lower half of second conservation area).

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	3.172
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.0044
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	33.5

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	287
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	8.1
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.013
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.5
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	1.92

Calculation:

Q10cfs = AF * 18.2 * $A^{0.87}$ * $P^{0.77}$ = 1.28*18.2*$3.172^{0.87}$*$9.76^{0.77}$ = 367.36cfs = 10.4m^3/s

Specific Stream Power (SSP) = rQS/w = 9810*10.4*0.0044/33.5 = 13.4 Watt/m^2

d50 (inch) for Threshold Channel Analysis = 4.4mm

Then plot SSP against d50 in Figure H.7-1, it is below the solid line, see previous page

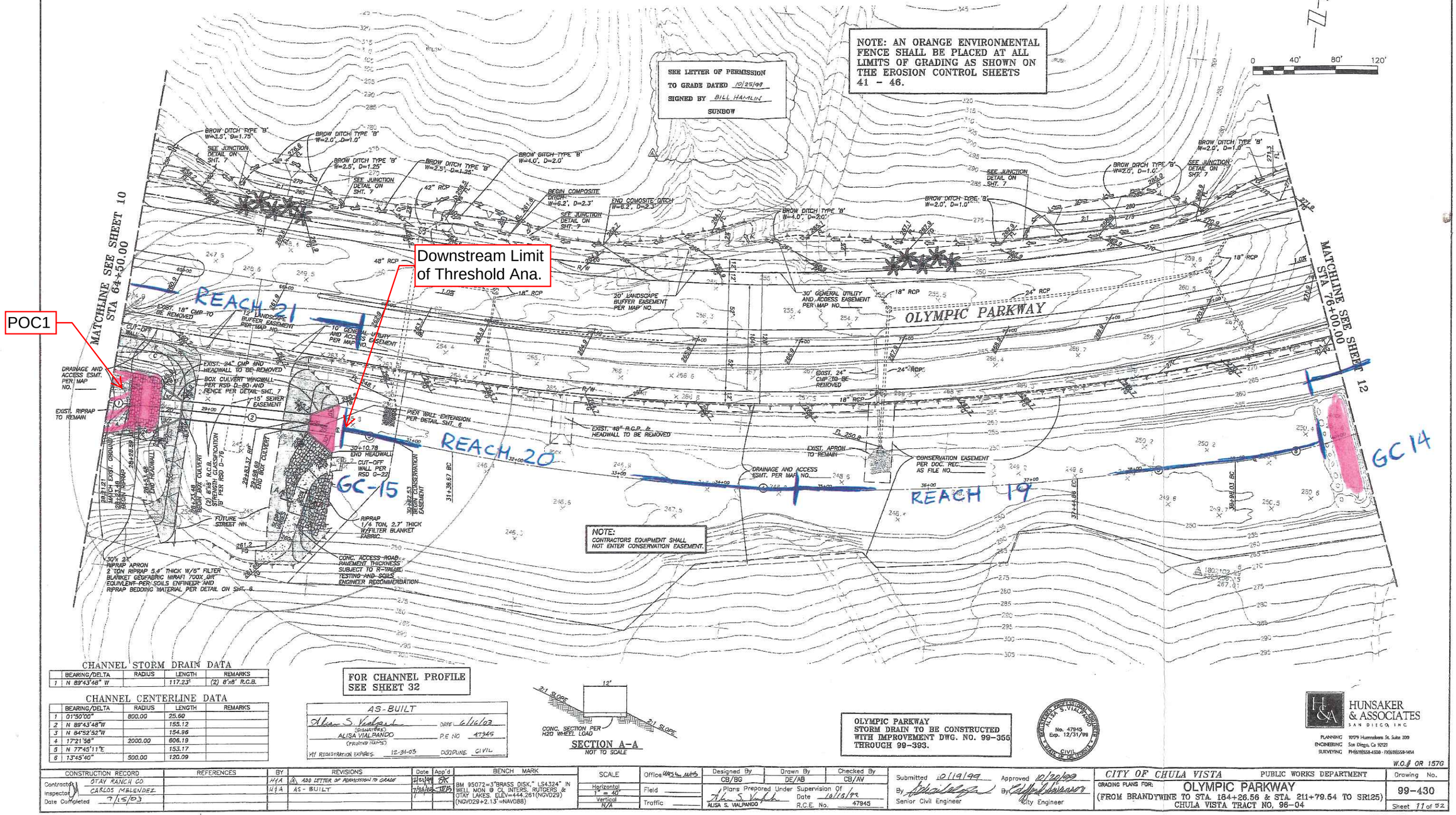
TABLE 1. Values of d_{50}

REACH #	d_{50}	REACH #	d_{50}	REACH #	d_{50}	REACH #	d_{50}
Reach 2	2.9	Reach 6	4.0	Reach 11	4.0	Reach 16	3.7
Reach 3	2.9	Reach 8	4.0	Reach 12	3.4	Reach 17	3.7
Reach 4	2.9	Reach 9	4.0	Reach 15	3.4	Reach 19	3.9
Reach 5	4.0	Reach 10	4.0			Reach 20	4.4

d50 in mm

CONCLUSIONS

- The value of d_{50} was determined for 8 different sections and average results are shown in Table 1.
- The combination d_{50} – INDEX determines a point below the 50% Risk of incising/braiding.
- The Score A already assigned in the 1/17/2013 "Susceptibility Analysis of Poggi Creek" document stands.
- No changes in assessment occurred as a consequence of the d_{50} determination, and consequently, the low susceptibility evaluation of Poggi Creek remains.



CHANNEL STORM DRAIN DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 89°43'48" W		117.23'	(2) 8'x8' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	01°50'00"	800.00	25.60	
2	N 89°43'48"W		155.12	
3	N 84°52'52"W		154.96	
4	17°21'58"	2000.00	606.19	
5	N 77°45'11"E		153.17	
6	13°45'40"	500.00	120.09	

FOR CHANNEL PROFILE SEE SHEET 32

AS-BUILT
Alisa S. Vialpando (SIGNATURE)
ALISA VIALPANDO (PRINTED NAME) P.E. NO. 47945
RX REGISTRATION EXPIRES: 12-31-03 DISCIPLINE: CIVIL

SECTION A-A
NOT TO SCALE

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-356 THROUGH 99-393.

REGISTERED PROFESSIONAL ENGINEER ALISA S. VIALPANDO No. 47945 Exp. 12/31/'99 CIVIL STATE OF CALIFORNIA

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 209 San Diego, Ca 92121
ENGINEERING PH(619)558-4500 · FX(619)558-1414
SURVEYING

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd	BENCH MARK	SCALE	Office	Designed By	Drawn By	Checked By	Submitted	Approved	CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT	Drawing No.
Contractor STAY RANCH CO.		H1A	⚠ ADD LETTER OF PERMISSION TO GRADE	2/21/00	BK	BM 95072=3"BRASS DISK," LS4,324" IN WELL NON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)	Horizontal 1" = 40'	Field	CB/BG	DE/AB	CB/AV	10/19/99	10/20/99	GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.64 TO SR125) CHULA VISTA TRACT NO. 96-04	99-430
Inspector CARLOS MELENDEZ		4/4A	AS-BUILT	7/28/03	MDS		Vertical N/A	Traffic	Plans Prepared Under Supervision Of: ALISA S. VIALPANDO	Date 10/18/99	R.C.E. No. 47945	By Senior Civil Engineer	By City Engineer		Sheet 11 of 52
Date Completed 7/15/03															

AS BUILT

O.W.D. W.O.
File name: R:\0131\01.31CH11

BN NO. 4001A
W.O. NO. 025-271

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 – 46.

SEE LETTER OF PERMISSION TO GRADE DATED 10/25/99
SIGNED BY BILL HAMLIN
SUNBOW

SUPERCEDED BY SUNBOW CV DWG NO. 00039

SCALE: 1" = 40'
0 40' 80' 120'

POC2

Uptream Limit of Threshold Ana.

REACH 18
REACH 17
REACH 16
GC 13
GC-12

OLYMPIC PARKWAY
200'VC

MATCHLINE SEE SHEET 11 STA 76+00.00

MATCHLINE SEE SHEET 13 STA 87+00.00

OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+23.56 AND STA. 211+79.54 TO SR125)

FOR CHANNEL PROFILE SEE SHEET 32 & 33

CHANNEL STORM DRAIN DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 63°13'47" E		53.16	(6) 8'x4' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	09°14'05"	500.00	80.59	
2	N 54°45'26"E		57.61	
3	N 63°13'47"E		157.19	
4	12°54'11"	500.00	112.60	
5	N 76°07'58"E		57.56	
6	08°54'52"	1000.00	155.58	
7	N 67°26'30"E		486.96	

AS-BUILT
(SIGNATURE) Alisa S. Vialpando DATE 6/16/03
ALISA VIALPANDO
(PRINTED NAME) P.E. NO: 47945
MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE CIVIL

OLYMPIC PARKWAY
STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

REGISTERED PROFESSIONAL ENGINEER ALISA S. VIALPANDO No. 47945 Exp. 12/31/99 CIVIL STATE OF CALIFORNIA

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200 San Diego, Ca 92121
ENGINEERING SURVEYING Ph(619)558-4500 · Fx(619)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd
Contractor OTAY RANCH CO		HA	A ADD LETTER OF PERMISSION TO GRADE	12/31/99	BG
Inspector CARLOS MELENDEZ		HA	B REVISE NOTE FOR BOX CULVERT	2/11/00	BG
Date Completed 7/15/03		HA	AS-BUILT	7/16/03	CTD

BENCH MARK: BM 95072-3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.26'(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE: Horizontal 1" = 40' Vertical N/A
Office M.B.S. by M.A.S.
Field
Traffic
Designed By CB/BG
Drawn By DE/AB
Checked By CB/AV
Plans Prepared Under Supervision Of ALISA S. VIALPANDO Date 10/18/99 R.C.E. No. 47945

Submitted 10/19/99 By Alisa S. Vialpando Senior Civil Engineer
Approved 10/20/99 By Clifford Swanson City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT
GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125)
CHULA VISTA TRACT NO. 96-04

Drawing No. 99-429
Sheet 12 of 52

AS BUILT

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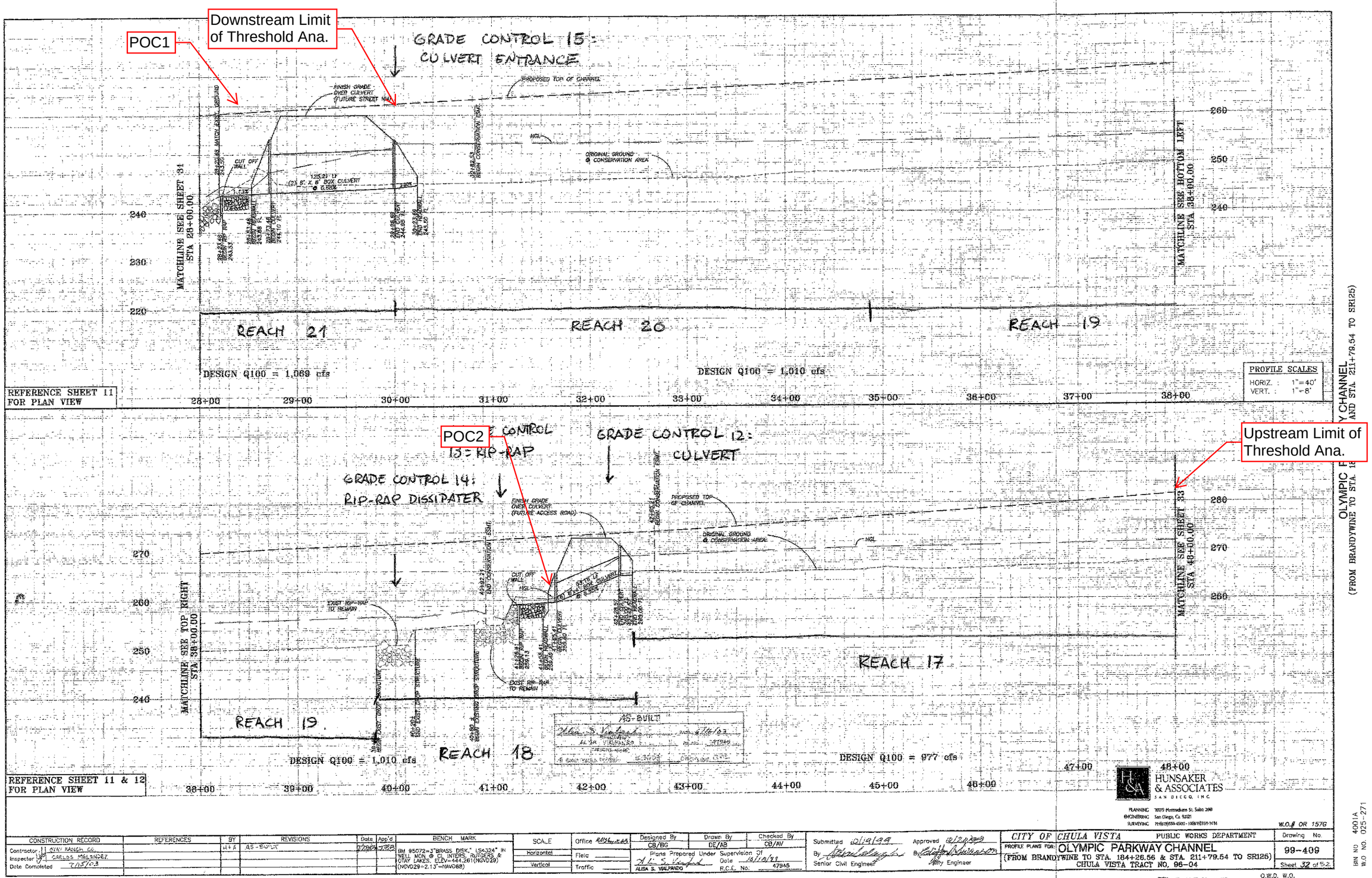
BIN NO. 4001A
W.O. NO. 025-271

POC1

Downstream Limit of Threshold Ana.

POC2

Upstream Limit of Threshold Ana.



CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd	BENCH MARK	SCALE	Designed By	Drawn By	Checked By	Submitted	Approved
Contractor STAY RANCH CO.		H&A	AS-BUILT	7/2003		BM 95072=3"BRASS DISK," LS4324" IN WELL MON.@ CL INTERS. RUTGERS & STAY LAKES. ELEV=444.261(NGVD29) (NGVD29-2.13'=NAVD88)	Horizontal	Office	CB/BG	DE/AB	CB/AV	10/19/99	10/29/99
Inspector CARLOS MELENDEZ							Vertical	Field	Plans Prepared Under Supervision Of			By	By
Date Completed 7/15/03								Traffic	ALISA S. VALPANDO	Date 10/19/99	R.C.E. No. 47945	Senior Civil Engineer	City Engineer

CITY OF CHULA VISTA — PUBLIC WORKS DEPARTMENT

PROFILE PLANS FOR: OLYMPIC PARKWAY CHANNEL (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

Drawing No. 99-409 Sheet 32 of 52

HUNSAKER & ASSOCIATES SAN DIEGO, INC

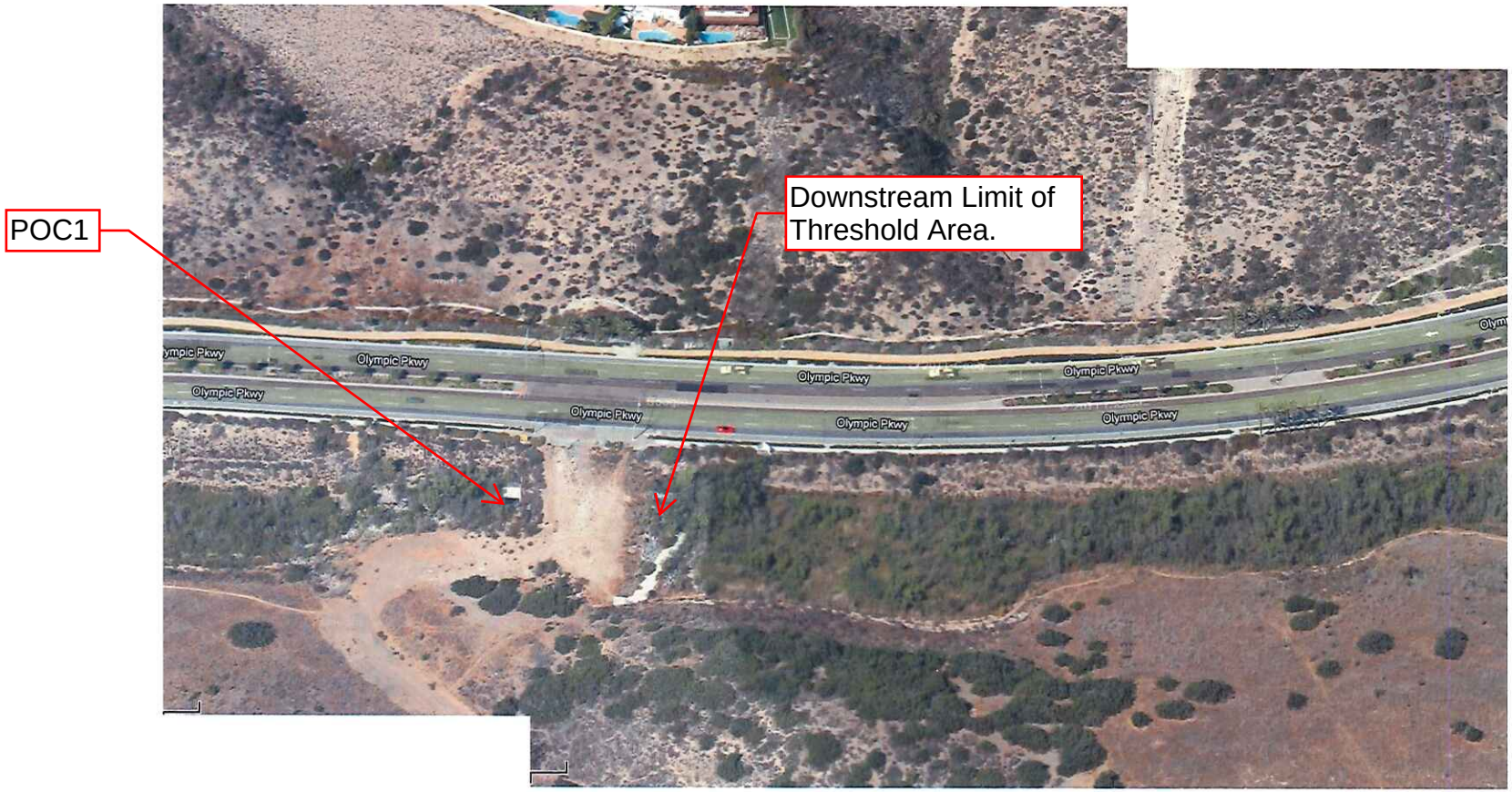
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca. 92121
SURVEYING PH(619)558-4500 - FX(619)558-1414

W.O.# OR 157G

O.W.D. W.O.
File name: R:\0131\0131CH32

AS BUILT

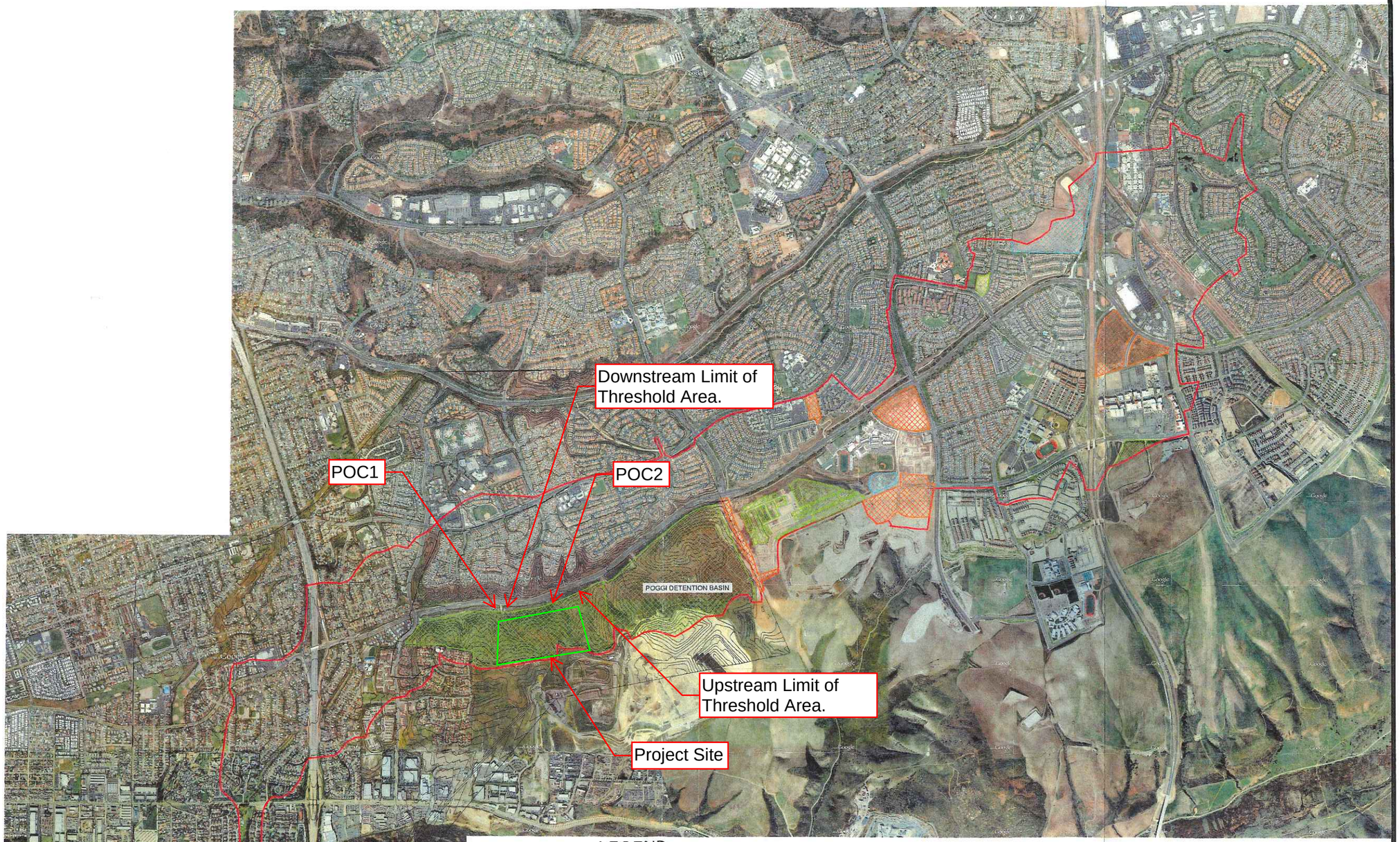
WM NO 4001A
W.O NO. 025-271



Aerial View of Poggi Creek (continuation). Reaches 19 to 21.



Aerial View of Poggi Creek (continuation). Reaches 16 to 19.



LEGEND

- POGGI BASIN MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED (GRADED AND/OR FUTURE MEDIUM DENSITY DEVELOPMENT)
- MINOR WATERSHED (GRADED AND/OR FUTURE HIGH DENSITY DEVELOPMENT)
- MINOR WATERSHED (OPEN SPACE TO REMAIN)

NOTE:
AREAS NOT HATCHED REPRESENT EXISTING DEVELOPED AREAS OR AREAS THAT WILL NOT BE DEVELOPED.

800 0 800 1600 2400
SCALE 1"=800'

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

POGGI BASIN WATERSHED ANALYSIS



Photo 25. Entrance of Reach18 from above, GC13



Photo 26. Wing-wall at the beginning of Reach 18, GC-13



Photos 27 & 28. Entrance of Reach 21. Flow measurements were also performed in this section.

Attachment 2C

GEOMORPHIC ASSESSMENT

TECHNICAL MEMORANDUM:

Susceptibility Analysis of Poggi Creek

Otay Ranch Village 2 North, Chula Vista, CA.

Prepared for:

Hunsaker & Associates San Diego Inc.
November 7, 2012. Revised: 1/17/2013.

TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING
122 Civic Center Drive, Suite 206, Vista, CA 92084 760.414.9212 www.trwengineering.com

TECHNICAL MEMORANDUM:

Susceptibility Analysis of Poggi Creek

Otay Ranch Village 2 North, Chula Vista, CA.

Prepared for:

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November 7, 2012. Revised: 1/17/2013.



Luis Parra, PhD, CPSWQ, ToR, D.WRE.
R.C.E. 66377

Senior Project Manager

TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING
122 Civic Center Drive, Suite 206, Vista, CA 92084 760.414.9212 www.trwengineering.com

SUSCEPTIBILITY ANALYSIS OF POGGI CREEK

This study will determine the level of susceptibility to erosion for a large segment of Poggi Creek in Chula Vista, CA, starting at the entrance of the double rectangular culvert crossing Olympic Pkwy from north to south, in front of the entrance to Otay Ranch High School football field parking lot, and ending 10,200 ft downstream, about 1,800 ft upstream of the intersection of Brandywine Avenue with Olympic Pkwy. The length of analysis is considerable enough to include multiple grade controls. Depending on the discharge point of the specific project studied, it may occur that the length analyzed will satisfy domain of analysis criteria as established in the HMP methodology [1,2]. As a matter of fact, the length analyzed for Poggi Creek in this document is large enough to satisfy domain of analysis criteria for the following projects (refer to the Exemption Document of each project): Expansion of Neighborhood R-8A, Otay Ranch Village 2; Re-Entitlement of Neighborhoods R-6, R-7, R-8A, R-8B, R-9A & R-9B, Otay Ranch Village 2 North Project; and Otay Ranch Village 2 West. This study could be used for other projects as well, but the insurance that the length established here is enough to satisfy domain of analysis for a given project must be established by the proponent of such project

1. GENERAL CHARACTERISTICS OF THE AREA

Poggi Creek is a highly geomorphologically controlled creek at the analyzed length. As a matter of fact, from the intersection of Olympic Pkwy with Hwy 125 (more than 6000 ft upstream of the analyzed segment), to the entrance of the 12 ft circular pipe at the intersection of Brandywine Ave with Olympic Pkwy (about 2000 ft downstream of the analyzed segment), Poggi Creek can be described as a designed vegetated channel with multiple hydraulic controls, established vegetation and fixed alignment, with an overall slope of 0.8%, multiple riprap control structures and high slope culverts to adjust the vegetated channel to the topographic characteristics of the area.

The portion of the creek analyzed can be divided in 21 reaches following the definitions of the SCCWRP approach [1], due to the presence of multiple grade control points, culverts, and due to the length of the creek analyzed.

From upstream to downstream, the description of the reaches is as follows (see Appendices 1: Profile; 2: Plan View; and 3: Aerial View of Poggi Creek):

Reach 1: From the entrance of the double rectangular culvert crossing Olympic Pkwy (Grade Control 1, GC-1) to the discharge of such concrete culvert to the south side of Olympic Pkwy.

Reach 2: Discharge of culvert, to riprap control structure with significant vertical drop (GC-2).

Reach 3: From the downstream end of GC-2 to an arbitrary point selected such that the reach length does not exceeds the maximum length of 200 m.

Reach 4: From the downstream end of Reach 3, to an arbitrary point located 200 m (656 ft) downstream.

Reach 5: From the end of Reach 4, to the upstream end of GC-3, a riprap dissipater with significant vertical drop (GC-3).

Reach 6: From the upstream end of the riprap, to the next grade control point (GC-4), in this case corresponding to the entrance of a concrete culvert.

Reach 7: From the entrance of the double rectangular culvert to its discharge, so that the reach only includes a hardened system.

Reach 8: From the discharge of the culvert (a flat riprap pad not considered as a grade control in this analysis) to the downstream end of the next riprap structure (GC-5), which is considered as a grade control due to its 6 ft vertical drop.

Reach 9: From the downstream end of GC-5 to an arbitrary point about 200 m downstream.

Reach 10: From the downstream end of Reach 9, to the upstream end of a riprap grade control (GC-6).

Reach 11: From the upstream end of GC-6 to the upstream end of GC-7, corresponding to another riprap energy dissipater.

Reach 12: From the upstream end of GC-7, to the entrance of a double rectangular box culvert, including a vertical riprap grade control (GC-8). The riprap structure and the entrance of the culvert (being the former immediately upstream from the latter) were considered as a single Grade Control (GC-8).

Reach 13: From the entrance of the double rectangular culvert to the downstream end of GC-9, which corresponds to the riprap facility immediately downstream of the outlet of the culvert. This reach also only includes a hardened system, and the end of it corresponds to the entrance to the Poggi Creek Detention Basin (PCDB).

Reach 14: Poggi Creek Detention Basin (PCDB). This reach in itself is a grade control point, as it corresponds to a pond with controlled discharge and velocities. Reach 14 is not included in the analysis of the creek, as it resembles an approximately lentil water body for large storms.

Reach 15: From the upstream end of the outlet structure of Poggi Creek Detention Basin (which is considered in this analysis GC-10), to the upstream end of a riprap pad that existed before the channel design (GC-11). GC-11 corresponds to the first grade control downstream of PCDB.

Reach 16: From the upstream end of GC-11 to an arbitrary point of a natural reach without grade controls. The end of the reach is chosen at station 48+00 for convenience, and is selected to approximately divide the natural segment (conservation area) in two equal segments.

Reach 17: From station 48+00 to the upstream end of a multiple box culvert. The entrance of the culvert (GC-12) is the second grade control downstream of PCDB. Reaches 16 and 17 are conservation areas with natural slope.

Reach 18: Includes the box culvert, and two consecutive riprap/grade control structures (corresponding with GC-13 and GC-14). For practical purposes, this is a hardened/stable reach. GC-13 and GC-14 are the third and fourth Grade Controls downstream of Poggi Creek Detention Basin (PCDB).

Reach 19: From the downstream end of GC-14 to the middle point of the long segment that connects GC-14 to the entrance of the double box culvert (GC-15).

Reach 20: From the end of Reach 19, to the entrance of the double box culvert (GC-15). Reaches 19 and 20 are also part of the conservation area.

Reach 21: Culvert and downstream riprap. Reach 21 is the last reach analyzed, and it is a hardened/stable reach.

Although for the purpose of this analysis the study could have concluded at the downstream end of Reach 17, it was extended to the end of Reach 21, because it fits better with the profile and plan view plans of the channels; it is also conservative in the validation of the results.

The reader is referred to the Appendix 1: Profile; Appendix 2: Plan View; and Appendix 3: Aerial View, for a more detailed understanding of all reaches analyzed.

1.1 Runoff Measurement

The day of the visit (10/12/2012) was selected because it corresponded with the first day after the first significant storm of the 2012-13 Season, in order to observe runoff and the response of the vegetated channel to it. During the day of the visit, the creek displayed a relatively significant flow due to the previous storm event occurring from the afternoon of 10/11/2012 to the early morning of 10/12/2012.

To demonstrate the sensitivity of the Poggi Creek to runoff, and to demonstrate the special variability of runoff in a relatively large study area, runoff was measured at two points: the entrance of Culvert 1, at the upstream end of the study area (GC-1), and the entrance of Reach 21 (GC-15). The method used to measure runoff is by measuring the flow area A_{flow} (which in a rectangular section is the product of the width W by the total depth H), the surface velocity v_{top}, and indirectly obtaining the mean velocity v_{avg}.

The flow area is associated with the depth of the water and the width of the rectangular culvert. The surface velocity was measured with floating tracers (key limes used to avoid water contamination), by establishing a distance in the culvert between two points were the depth was uniform, and the time a floating tracer took to travel between those two points, using a stop watch. Results of the measurements are summarized in Table A.

Once the velocity and the flow area are known, then using the definition of peak flow, Q:

$$Q = v_{avg} \cdot A_{flow} = k \cdot v_{top} \cdot A_{flow} \qquad (1)$$

The relationship between the average velocity v_{avg} and top velocity v_{top} can be obtained from the velocity distribution equation [3]:

$$v_{avg} = \frac{1}{H-y_0}\int_{y_0}^{H}\left(2.5 \cdot v^* ln\frac{y}{y_0}\right)dy \quad (2)$$

$$\frac{v_{avg}}{v_{top}} = k = 1 - \left[ln\left(\frac{D}{y_0}\right)\right]^{-1} \quad (3)$$

In the previous equations v* is the shear velocity, D the total depth, and y_0 the constant of integration related to the bottom surface roughness. The constant k, associated with the double integral of the velocity profile (integration in the x-y plane and more importantly in a vertical section) is usually determined experimentally, but for rough surfaces (like concrete) is about 0.7 to 0.75. As the error of the flow determination is about 10%, the lowest recommended value is used and the peak flow is conservatively determined with equation (1), where k=0.7.

Table A. Dimensions and Top Velocity for Determination of Peak Flow in a Rectangular Culvert

GC-1: Double rectangular culvert control				**GC-15: Double rectangular culvert control**			
W, Left (ft)	12	W, right (ft)	12	W, Left (ft)	8	W, right (ft)	8
H, left (in)	4.0	H, right (in)	3.75	H, left (in)	5.0	H, right (in)	2.3
A_{flow}, left (ft^2)	4.00	A_{flow}, right (ft^2)	3.75	A_{flow}, left (ft^2)	3.33	A_{flow}, right (ft^2)	1.50
v_{top}, left (ft/s)	5.6	v_{top}, right (ft/s)	5.7	v_{top}, left (ft/s)	6.4	v_{top}, right (ft/s)	3.6
k factor, left	0.7	k factor, fight	0.7	k factor, left	0.7	k factor, left	0.7
Q, left (cfs)	15.7	Q, left (cfs)	15.0	Q, left (cfs)	14.9	Q, left (cfs)	3.8
Qtotal, (cfs)		**30.6**		**Qtotal, (cfs)**		**18.7**	

The peak flow measured at GC-1 is 31 cfs (9:00 am). The peak flow measured at GC-15 is 19 cfs (3:00 pm). Although GC-15 is downstream of GC-1, and has a larger contributing area, the measured peak flow is 40% smaller.

There are many reasons for this to happen. The factors that have a tendency to reduce the peak moving downstream were larger than the factors that have a tendency to increase the peak flow. Among the reducing factors, we can mention: (1) infiltration and ponding between GC-1 and GC-15; (2) the routing process (Muskingum-like attenuation in the channel and Modified-Puls-like attenuation in Poggi Creek Detention Basin) reduce the peak flow as we move downstream; and (3) the time of measurement downstream was 6 hours after the time of measurement downstream, and we were measuring the receding arm of a hydrograph produced by a storm event that finished early that day (5:00 am or so). The only increasing factor is the contributing area that increases as the creek flows downstream.

In any case, the flow measurements indicate that a relatively large flow was occurring during the day of the visit between GC-1 at 9:00 am (31 cfs) and GC-15 at 3:00 pm (19 cfs).

1.2 Comparison Between the Measured Peak Flows and the USGS 2-Year Peak Flows.

In the HMP document [2], the justification of using $0.1Q_2$ as a low threshold for erosion was performed using the USGS Regression Equation to determine Q_2. This report will use this regression to have an idea what type of flow was in occurrence during our site visit (as a function of Q_2).

The USGS Q_2 Regression Equation [4] (in cfs) can be expressed as:

$$Q_2 = 0.14 \cdot A^{0.72} P^{1.62} \quad (4)$$

In equation (4), A represents the contributing area in square miles, and P the annual precipitation (9.76 inches in the Poggi Creek area [5]). The contributing area at GC-1 was estimated as 2.166 sq-miles. The contributing area at GC-15 was estimated at 3.225 sq-miles (see Appendix 4, Poggi Creek Watershed).

The peak flows obtained with equation (4) are:

$Q_{2,GC\text{-}1}$: 9.8 cfs.

$Q_{2,GC\text{-}15}$: 13.0 cfs.

The measured peak represents 316% of the USGS Q_2 value at GC-1 (6 times larger than the low susceptibility threshold of 50% of Q_2). At this peak flow, no indication of erosion was observed, and the vegetation in the creek was holding in a vertical position, without even bending by the action of the flow observed.

Regarding the downstream end, the measured value represents 146% of the USGS Q_2 value at GC-15 (almost three times larger than the low susceptibility threshold of 50% of Q_2).

The findings of this section are of extreme importance: there is physical and photographic evidence (see Appendix 5, Site Visit Photos) that the occurrence of a peak flow larger than the USGS regression estimate of the 2-year peak flow does not cause erosion in the analyzed reaches of Poggi Creek, as there was no physical indication of (1) bed load transport (movement of sand or fine gravel could not be seen nor felt in the sections were the personnel entered the creek); (2) bank erosion (TRWE personnel could not find a bank who had failed, or was close to failure, or in danger of being eroded); and (3) floating vegetation (usually, in vegetated channels, floating vegetation indicates that the flow has dislodged some vegetation and some erosion is expected; no floating vegetation was observed). Consequently, there is strong physical evidence of the creek having a low susceptibility to erosion. This conclusion is in addition to the same finding obtained by using the more conservative SCCWRP approach [1], which will be discussed in the following sections.

2. SCCWRP APPROACH

The approved SCCWRP approach [1] will be used in almost all reaches to determine the susceptibility to erosion based on standard forms and methodologies published by the Regional Water Quality Control Board in its web page. This approach is not required in the following reaches: Reach 1 (concrete culvert); Reach 7 (concrete culvert); Reach 13 (concrete culvert and riprap); Reach 14 (Poggi Creek Detention Basin); Reach 18 (concrete culvert and two consecutive riprap structures), and Reach 21 (concrete culvert and downstream riprap). Therefore, of the 21 analyzed reaches, 6 are excluded and 15 will be performed in a detailed way by filling forms and calculations. It should be evident to the reader that analyzing the susceptibility to erosion of riprap or a concrete culvert is unnecessary, as by definition those hardened systems are not susceptible to erosion at the low threshold value.

2.1 Basic Information

The contributing area to each reach is variable, as it increases moving downstream. The contributing area of GC-1 is 2.166 square miles, while the contributing area of CG-15 (Reach 21) is 3.225 square miles (see Appendix 4). A linear interpolation of the area as a function of the station at the entrance of each reach was performed to determine the variable contributing area per reach.

The mean annual precipitation from records published by the Western Regional Climate Center for Chula Vista, from 10/1/1918 to 9/30/2012 is 9.73 inches [5]. The valley slope S_V (obtained from the profiles and plan view of the channel) is mostly 0.8% for all reaches, except the Poggi Basin and the natural reaches with a smaller slope. The valley width W_v corresponds to the width of the channel, determined from the plan view sheets (Appendix 2), and confirmed in the field.

3. INITIAL DESKTOP ANALYSIS

Form 1 was completed with desktop information, and with field information for the valley width. The Valley Width Index (VWI) was determined for all reaches. VWI values were as low as 0.769 for Reach 6, and as high as 1.92 for Reach 20. Table 1 shows the results of the analysis for all reaches, while Appendix 6 shows Form 1 corresponding to all reaches requiring it.

TABLE 1. INITIAL DESKTOP ANALYSIS SUMMARY.

Reach	Progressive	L (ft)	L (m)	Area (mi^2)	S_v	W_v (m)	Q_{10} (cfs)	Q_{10} (m^3/s)	INDEX	W_{ref} (m)	WVI	Description
1	12856	496	151.2	2.166	N/R	N/R	206	5.8	N/R	N/R	N/R	Concrete Culverts
2	12360	188	57.3	2.219	0.008	12.2	210	6.0	0.020	15.3	0.798	Discharge of culvert to discharge of riprap dissipater
3	12172	656.1	200.0	2.239	0.008	12.2	212	6.0	0.020	15.3	0.795	New 0.8% channel
4	11515.9	656.1	200.0	2.310	0.008	12.2	218	6.2	0.020	15.5	0.786	Continuation of 0.8% channel
5	10859.8	641.8	195.6	2.380	0.008	12.2	224	6.3	0.020	15.7	0.777	0.8% channel to beginning of riprap
6	10218	562	171.3	2.449	0.008	12.2	229	6.5	0.020	15.9	0.769	Rip - rap, 0.8% channel to start of box culverts
7	9656	239	72.8	2.510	N/R	N/R	234	6.6	N/R	N/R	N/R	Culvert and head walls
8	9417	379	115.5	2.535	0.008	15.2	236	6.7	0.021	16.1	0.948	0.8% channel to end of riprap structure
9	9038	694	211.5	2.576	0.008	15.2	240	6.8	0.021	16.2	0.943	new 0.8% channel
10	8344	694	211.5	2.651	0.008	15.2	246	7.0	0.021	16.4	0.932	Continuation of 0.8% channel
11	7650	532	162.2	2.725	0.008	15.2	252	7.1	0.021	16.5	0.923	Upstream end of 2 consecutive riprap dissipaters.
12	7118	378	115.2	2.782	0.0079	15.2	256	7.3	0.022	16.6	0.915	2 riprap structures (upstream to downstream end)
13	6740	218	66.4	2.823	N/R	N/R	259	7.3	N/R	N/R	N/R	Culvert and riprap discharging into Poggi basin
14	6522	795	242.3	2.846	N/R	N/R	261	7.4	N/R	N/R	N/R	Poggi basin
15	5727	452	137.8	2.932	0.008	9.1	268	7.6	0.022	17.0	0.538	Outlet structure to upstream end of existing riprap
16	5275	475	144.8	2.980	0.004	33.5	272	7.7	0.011	17.1	1.96	From start to middle of conservation area. Natural channel.
17	4800	515	157.0	3.031	0.004	29.0	276	7.8	0.011	17.2	1.68	From middle to end of conservation area. Natural channel.
18	4285	305	93.0	3.086	N/R	N/R	280	7.9	N/R	N/R	N/R	Box culvert to the end of second riprap drop structure
19	3980	492	150.0	3.119	0.0044	30.5	283	8.0	0.012	17.4	1.75	50% of Conservation Area
20	3488	492	150.0	3.172	0.0044	33.5	287	8.1	0.013	17.5	1.92	50% of Conservation Area
21	2996	350	106.7	3.225	N/R	N/R	291	8.2	N/R	N/R	N/R	Culvert and riprap discharging into conservation area

4. PEBBLE COUNT AND EQUIVALENT d_{50}

Form 2 could not be completed in the field, as there are no pebbles, cobbles, or gravel at the surface of a vegetated stream such as Poggi Creek in the Domain of Analysis (other than the rocks belonging to the multiple existing riprap structures). Consequently, Form 2 is shown empty in Appendix 7.

Poggi Creek is heavily vegetated, with abundance of cattails, riffles, pools, and very dense vegetation (see pictures in Appendix 5). Following the shear stress recommendation of Figure 5-1 of the HMP document (shown in this document as Figure 1 in next page), an equivalent rock size will be determined for the dense vegetation observed. This same methodology was also approved in San Marcos Creek by the Water Board [6]. Information regarding the applicability and approval of the equivalent d_{50} Methodology is also shown in Appendix 12. It can be seen that the permissible shear stress τ_P in Figure 5-1, expressed in lb/ft^2, is numerically equal to 1/3 of the diameter d_{50} of the gravel/cobble equivalent, expressed in inches (in other words, 1-inch gravel has a permissible shear stress of 0.33 lb/ft^2; 2-inch gravel-cobble has a permissible shear stress of 0.67 lb/ft^2; a 6-inch cobble has a permissible shear stress of 2 lb/ft^2, and a 12-inch cobble has a permissible shear stress of 4 lb/ft^2; see Figure 5-1 attached in this document). Mathematically, this observation can be written as:

$$\tau_P = \frac{1}{3} d_{50} \qquad (5)$$

Consequently, as the permissible shear stress for long native grasses is 1.2 to 1.7 lb/ft^2 (and probably even larger for very dense vegetation conglomerates), the conservative equivalent diameter will be assumed equal to 3.6 to 5.1 inches (90 to 130 mm).

Boundary Category	Boundary Type	Permissible Shear Stress (lb/sq ft)
Soils	Fine colloidal sand	0.02 - 0.03
	Sandy loam (noncolloidal)	0.03 - 0.04
	Alluvial silt (noncolloidal)	0.045 - 0.05
	Silty loam (noncolloidal)	0.045 - 0.05
	Firm loam	0.075
	Fine gravels	0.075
	Stiff clay	0.26
	Alluvial silt (colloidal)	0.26
	Graded loam to cobbles	0.38
	Graded silts to cobbles	0.43
	Shales and hardpan	0.67
Gravel/Cobble	1-in.	0.33
	2-in.	0.67
	6-in.	2.0
	12-in.	4.0
Vegetation	Class A turf	3.7
	Class B turf	2.1
	Class C turf	1.0
	Long native grasses	1.2 – 1.7
	Short native and bunch grass	0.7 - 0.95
	Reed plantings	0.1-0.6
	Hardwood tree plantings	0.41-2.5
Temporary Degradable RECPs	Jute net	0.45
	Straw with net	1.5 – 1.65
	Coconut fiber with net	2.25
	Fiberglass roving	2.00
Non-Degradable RECPs	Unvegetated	3.00
	Partially established	4.0-6.0
	Fully vegetated	8.00
Riprap	6 – in. d_{50}	2.5
	9 – in. d_{50}	3.8
	12 – in. d_{50}	5.1
	18 – in. d_{50}	7.6
	24 – in. d_{50}	10.1
Soil Bioengineering	Wattles	0.2 – 1.0
	Reed fascine	0.6-1.25
	Coir roll	3 - 5
	Vegetated coir mat	4 - 8
	Live brush mattress (initial)	0.4 – 4.1
	Live brush mattress (grown)	3.90-8.2
	Brush layering (initial/grown)	0.4 – 6.25
	Live fascine	1.25-3.10
	Live willow stakes	2.10-3.10
Hard Surfacing	Gabions	10
	Concrete	12.5

[1] Ranges of values generally reflect multiple sources of data or different t

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J. Schoklitsch, A. (1937).

Figure 5-1. Range of Critical Shear Stresses (τ_{cr}) for Different Materials (from Fischenich)

Figure 1. Permissible Shear Stress per the HMP Document.

TABLE 2. VERTICAL, LATERAL AND TOTAL SUSCEPTIBILITY SUMMARY

Reach	Bed	Armoring (1)	$2/S_v$	Distance to GC	Grade control (1)	Incising & SI (1)	Vertical Rating[2]	VERTICAL	Adjustable?	Occurring? Well consolid.?	Bank slope	LATERAL RESULTS	TOTAL
1	C/C[3]	Low	N/A	N/A	N/A	N/A	N/A	Low	No, Low	N/A	N/A	Concrete or riprap. Stable. Low lateral risk.	Low
2	Intermediate	B	250	29	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
3	Intermediate	B	250	298	B	A	4.24	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
4	Intermediate	B	250	298	B	A	4.24	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
5	Intermediate	B	250	298	B	A	4.24	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
6	Intermediate	B	250	86	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
7	C/C[3]	Low	N/A	N/A	N/A	N/A	N/A	Low	No, Low	N/A	N/A	Concrete or riprap. Stable. Low lateral risk.	Low
8	Intermediate	B	250	58	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
9	Intermediate	B	250	212	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
10	Intermediate	B	250	212	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
11	Intermediate	B	250	81	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
12	Intermediate	B	253	58	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
13	C/C[3]	Low	N/A	N/A	N/A	N/A	N/A	Low	No, Low	N/A	N/A	Concrete or riprap. Stable. Low lateral risk.	Low
14	Ponding area	Low	N/A	N/A	N/A	N/A	N/A	Low	No, Low	N/A	N/A	Concrete or riprap. Stable. Low lateral risk.	Low
15	Intermediate	B	250	69	A	A	3.57	Low	yes	No, yes	3:1(18.4°)R, 2:1 L	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
16	Intermediate	B	500	151	A	A	3.57	Low	yes	No, yes	2 : 1 (26.6°)	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
17	Intermediate	B	500	151	A	A	3.57	Low	yes	No, yes	2 : 1 (26.6°)	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
18	C/C[3]	Low	N/A	N/A	N/A	N/A	N/A	Low	No, Low	N/A	N/A	Concrete or riprap. Stable. Low lateral risk.	Low
19	Intermediate	B	455	150	A	A	3.57	Low	yes	No, yes	2 : 1 (26.6°)	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
20	Intermediate	B	455	150	A	A	3.57	Low	yes	No, yes	2 : 1 (26.6°)	NMW[4]. Risk < 10% per angle. VMI <2. Low.	Low
21	C/C[3]	Low	N/A	N/A	N/A	N/A	N/A	Low	No, Low	N/A	N/A	Concrete or riprap. Stable. Low lateral risk.	Low

Notes: (1): Armoring, Grade Control, Incising & SI (Screening Index) have a valuation of A, B, or C in the SCCWRP Approach

(2): Vertical rating is dimensionless; Vertical rating = $(\text{Incising \& SI} \cdot (\text{Armoring} \cdot \text{Grade control})^{0.5})^{0.5}$, with A =3; B = 6; C = 9.

(3): Coarse/Concrete. (4): NMW: no mass wasting.

5. VERTICAL SUSCEPTIBILITY FIELD SHEET

The appropriate pathway for each reach is shown in Form 3, Appendix 8. As in this case the conservative equivalent diameter cannot be unequivocally assigned as larger than 128 mm, and as the hardpan is of uncertain strength, then as a conservative approach the intermediate bed path is chosen for all reaches except those not analyzed (Reaches 1, 7, 13, 14, 18, and 21, see Form 3, Appendix 8). Vertical Susceptibility overall results for all reaches can be seen in Table 2 in the previous page.

5.1 Armoring Potential, Grade Control and Screening Index Score

The armoring potential (Form 3, checklist 1), is assigned as B (hardpan of unknown resistance).

Regarding the grade control, it is assigned as B when the average distance to control grade is larger than $2/S_v$ (see Summary on Table 2). The grade control is B for Reaches 3, 4, and 5. The grade control is A for Reaches 2, 6, 8 to 12, 15, 16, 17, 19 and 20. The Screen Index Score is also A, as the combination of variable $S_v Q_{10}^{0.5}$ (INDEX in Table 1) and the equivalent d_{50} always generates a less than 50% probability of incision in Form 3 (see Appendix 8). The vertical rating is then calculated as:

$$Vertical\ rating = \sqrt{screening\ index \cdot \sqrt{armoring\ .\ grade\ control}} \qquad (6)$$

In equation (6) the screening index, the armoring index and the grade control index can be assigned a valuation of A, B, or C. Using the SCCWRP equivalence of A = 3, B = 6 and C = 9, the vertical rating can be obtained. The vertical rating is either 3.57 for Reaches 2, 6, 8 to 12, 15, 16, 17, 19 and 20, or 4.24 for Reaches 3, 4 and 5. For all cases the vertical susceptibility based on the vertical rating is less than 4.5, and therefore, considered LOW.

6. LATERAL SUSCEPTIBILITY FIELD SHEET

There are two appropriate paths, the first shown in Form 4, Appendix 9 and the second shown in Form 5, Appendix 10. The first option for Form 4 assumes that Poggi Creek is laterally adjustable, but lateral adjustments are not occurring, and all bank strata are consolidated. Then, following Form 6, Appendix 11, bank height has a less than 10% risk of failure according to the existing bank angles, and as the vertical rating is less than high, the lateral susceptibility is low for all reaches (see Form 4, Appendix 9, for all reaches). Using Form 5, the same conclusion is reached (see Appendix 10), as there is no mass wasting or extensive fluvial erosion, both banks are consolidated and no risk factors are present. As both potential paths generate a lateral LOW susceptibility, the lateral susceptibility of the Creek is considered LOW. We should add that Form 6 has been evaluated for the most conservative scenario, as it evaluates the probability of mass wasting in moderately to well-consolidated banks, which is less than 10% when the bank angle is less than 30°, regardless of bank height. Lateral Susceptibility overall results for all reaches can be seen in Table 2.

From the field observations and taking into account the design of Poggi Creek as a vegetated channel, there is strong indication that Poggi Creek is not laterally adjustable in the domain of analysis. Vegetation is established and healthy, pools and riffles are controlled by multiple riprap controls, plus dense vegetation and cattails dissipate the creek's energy. Additionally, no indication of avulsion or chute formation can be seen, banks are stable, and properties adjacent to the creek do not display evidence of backyard loss to erosion.

7. FINAL EVALUATION

Poggi Creek has a low vertical susceptibility and a low lateral susceptibility to erosion at the 21 Reaches analyzed, from the entrance of the double rectangular culvert crossing Olympic Pkwy north to south, in front of the entrance to the parking lot of football field of the Otay Ranch High School, to the discharge of the culvert ending 10,200 ft downstream, about 1,800 ft upstream of the intersection of Brandywine Avenue with Olympic Pkwy. Therefore, the overall susceptibility of the Creek is considered LOW. Overall results are displayed in Table 2.

8. CONCLUSION

Poggi Creek has a LOW SUSCEPTIBILTY to erosion, according to the SCCWRP methodology approved by the HMP Document.

The LOW susceptibility is also corroborated by the peak flow analysis in Section 1.2. A measured flow 316% to 146% of the USGS Regression Q_2 (from upstream to downstream) did not generate any visible erosion failure or vegetation transport in the creek.

Hydromodification design for projects draining directly into this section of Poggi Creek (specifically between GC-2 and GC-14) can be accomplished using a low-susceptibility rating; therefore, the lower threshold recommended for hydromodification analysis is $0.50 \cdot Q_2$.

9. LIST OF APPENDICES

Appendix 1: Profile of Poggi Creek.

Appendix 2: Plan View of Poggi Creek.

Appendix 3: Aerial View of Poggi Creek.

Appendix 4: Poggi Creek Watershed.

Appendix 5: Site Visit Photos.

Appendix 6: Form 1: Initial Desktop Analysis

Appendix 7: Form 2: Pebble Count (Empty)

Appendix 8: Form 3: Vertical Susceptibility Field Sheet

Appendix 9: Form 4: Lateral Susceptibility Field Sheet

Appendix 10: Form 5: Sequence of Lateral Susceptibility Questions Option

Appendix 11: Form 6: Probability of Mass Wasting Bank Failure

Appendix 12: Example of the Approval of the Equivalent d_{50} Methodology by the SDRWQCB

Appendix 13: Response to Rick Engineering Comments

10. REFERENCES

[1] SCCWRP Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility: http://www.waterboards.ca.gov/academy/courses/riverrat/606_hydromodscrntool_fldmanl.pdf

[2] Final Hydromodification Management Plan. County of San Diego, CA, March 2011. Available at: http://www.projectcleanwater.org/html/wg_susmp.html

[3] Open Channel Hydraulics. Richard H. French. Editors: McGraw-Hill Inc., 1985.

[4] USGS Water Resources Investigation Report 94-4002: Nationwide Summary of USGS Regional Regression Equations for Estimating Magnitude and Frequency of Floods for Ungaged Sites, 1993. Equations available at: http://water.usgs.gov/software/NFF/manual/ca/

[5] Western Regional Climate Center: Southern California Summary. Available under Chula Vista at: http://www.wrcc.dri.edu/summary/Climsmsca.html

[6] City of San Marcos. Final San Marcos Creek Specific Plan: Master Water Quality and Hydromodification Management Plan. December 15, 2011. Document is publicly available at: http://www.ci.san-marcos.ca.us/Modules/ShowDocument.aspx?documentid=5531

APPENDIX 1: PROFILE OF POGGI CREEK

POC1

Downstream Limit of Threshold Ana.

GRADE CONTROL 15:
CULVERT ENTRANCE

FINISH GRADE OVER CULVERT (FUTURE STREET)

PROPOSED TOP OF CHANNEL

HGL

ORIGINAL GROUND & CONSERVATION AREA

CUT OFF WALL

(2) 5' x 8' BOX CULVERT @ 6.88%

MATCHLINE SEE SHEET 31 STA 28+00.00

MATCHLINE SEE BOTTOM LEFT STA 38+00.00

REACH 21

REACH 20

REACH 19

DESIGN Q100 = 1,069 cfs

DESIGN Q100 = 1,010 cfs

PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=8'

REFERENCE SHEET 11 FOR PLAN VIEW

28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00

POC2

GRADE CONTROL 13:
RIP-RAP

GRADE CONTROL 14:
RIP-RAP DISSIPATER

CULVERT

FINISH GRADE OVER CULVERT (FUTURE ACCESS ROAD)

PROPOSED TOP OF CHANNEL

ORIGINAL GROUND & CONSERVATION AREA

HGL

CUT OFF WALL

EXIST RIP-RAP TO REMAIN

EXIST RIP-RAP TO REMAIN

MATCHLINE SEE TOP RIGHT STA 38+00.00

MATCHLINE SEE SHEET 33 STA 48+00.00

REACH 19

REACH 18

REACH 17

AS-BUILT

DESIGN Q100 = 1,010 cfs

DESIGN Q100 = 977 cfs

REFERENCE SHEET 11 & 12 FOR PLAN VIEW

38+00 39+00 40+00 41+00 42+00 43+00 44+00 45+00 46+00 47+00 48+00

Upstream Limit of Threshold Ana.

OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA. 211+79.54 TO SR125)

HUNSAKER & ASSOCIATES
SAN DIEGO, INC

PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca. 92121
SURVEYING PH(619)558-4500 - FAX(619)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd	BENCH MARK
Contractor STAY RANCH CO.		HSA	AS-BUILT	7/2003		BM 95072="J" BRASS DISK," LSA-324" IN WELL MON. @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29-2.13)=NAVD88)
Inspector CARLOS MELSINDEZ						
Date Completed 7/15/03						

SCALE: Horizontal ____ Vertical ____

Office ESCONDIDO | Field ____ | Traffic ____

Designed By CB/BG | Drawn By DE/AB | Checked By CB/AV

Plans Prepared Under Supervision Of: ALISA S. VIALPANDO | Date 10/10/02 | R.C.E. No. 47945

Submitted 10/19/99 By Senior Civil Engineer

Approved 12/22/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

PROFILE PLANS FOR: OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125)
CHULA VISTA TRACT NO. 96-04

Drawing No. 99-409

Sheet 32 of 52

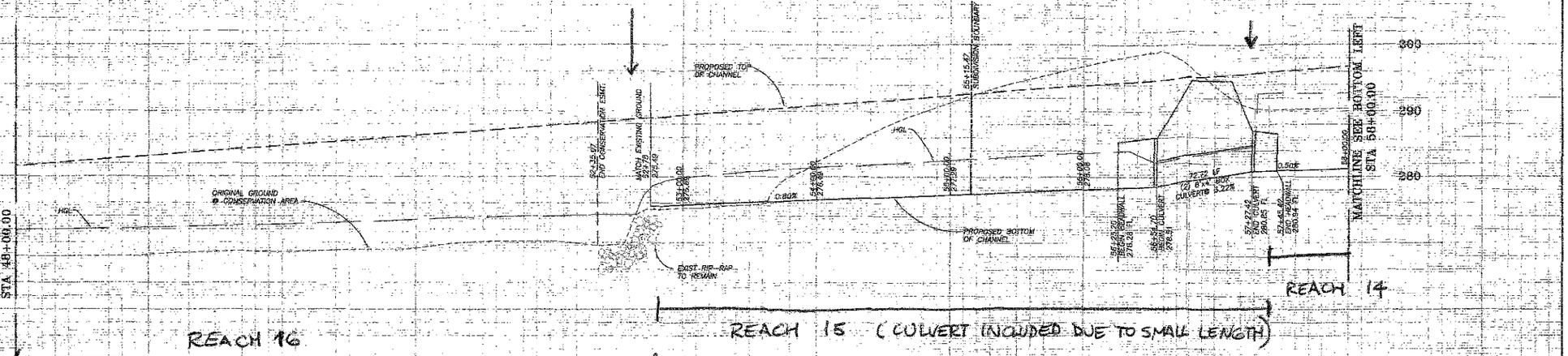
IRN NO. 4001A
W.O. NO. 025-271

O.W.D. W.O.
File name: R:\0131\0131CH32

AS BUILT

GRADE CONTROL 11:
EXISTING RIP-RAP.

GRADE CONTROL 10:
OUTLET OF POGGI BASIN

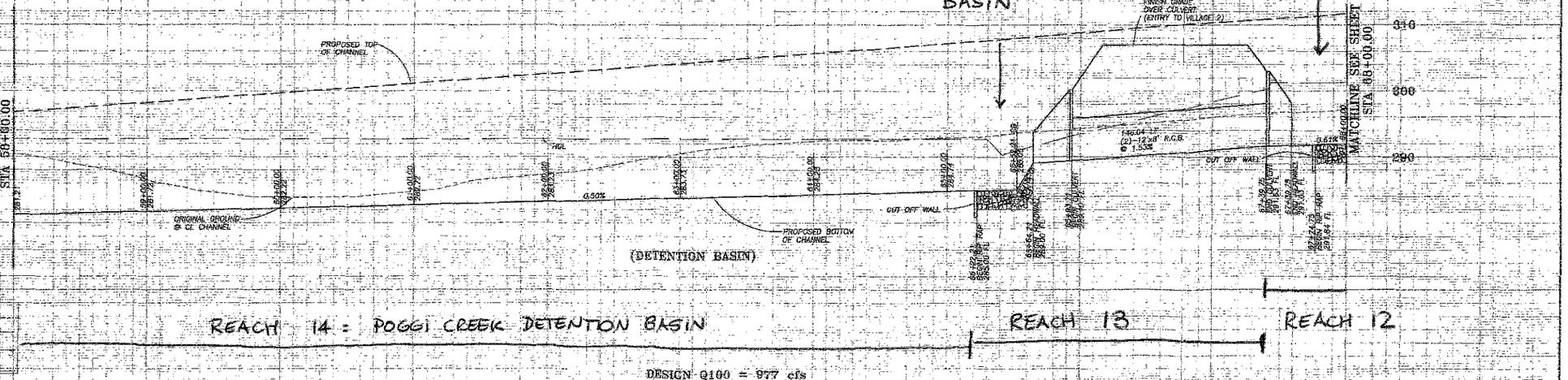


PROFILE SCALES
HORIZ. : 1"=40'
VERT. : 1"=6'

REFERENCE SHEET 12 & 15
FOR PLAN VIEW

GRADE CONTROL 9:
CULVERT, RIP-RAP &
ENTRANCE TO DETENTION
BASIN

GRADE CONTROL 8:
RIP-RAP & CONCRETE CULVERT



AS-BUILT
Alisa S. Vialpando
ALISA VIALPANDO
R.C.E. 47945
EXPIRATION DATE: 12-31-03

REFERENCE SHEET 13 & 14
FOR PLAN VIEW

HUNSAKER & ASSOCIATES
SAN DIEGO, INC.
PLANNING 10179 Huennekens St, Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING (619)558-4500 - FAX(619)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	Apv'd	BENCH MARK	SCALE	Office	Designed By	Drawn By	Checked By
Contractor OTAY RANCH CO.						BM 95072="3"BRASS DISK " LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)	Horizontal		CB/BG	DE/AB	CB/AV
Inspector CARLOS MELENDEZ							Field		Plans Prepared Under Supervision Of		
Date Completed 7/15/03							Traffic		ALISA S. VIALPANDO	Date 10/18/99	
							Vertical			R.C.E. No. 47945	

Submitted 10/19/99 By Senior Civil Engineer
Approved 12/22/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

PROFILE PLANS FOR: OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125)
CHULA VISTA TRACT NO. 96-04

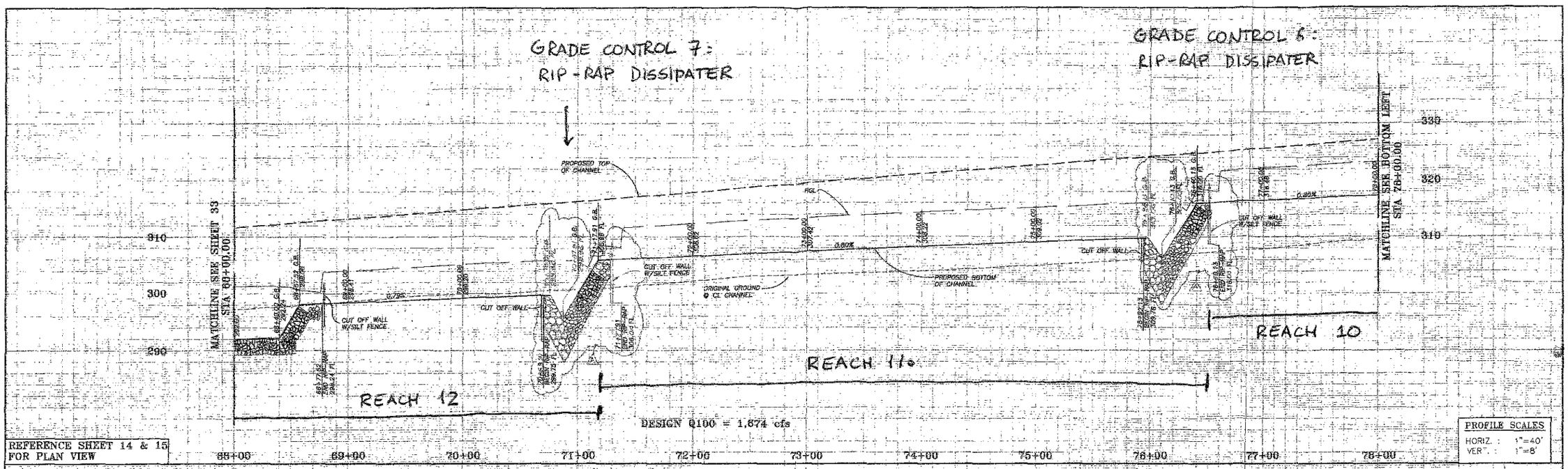
Drawing No. 99-408
Sheet 33 of 52

AS BUILT

O.W.D. W.O.
File name: R:\0131\0131CH33

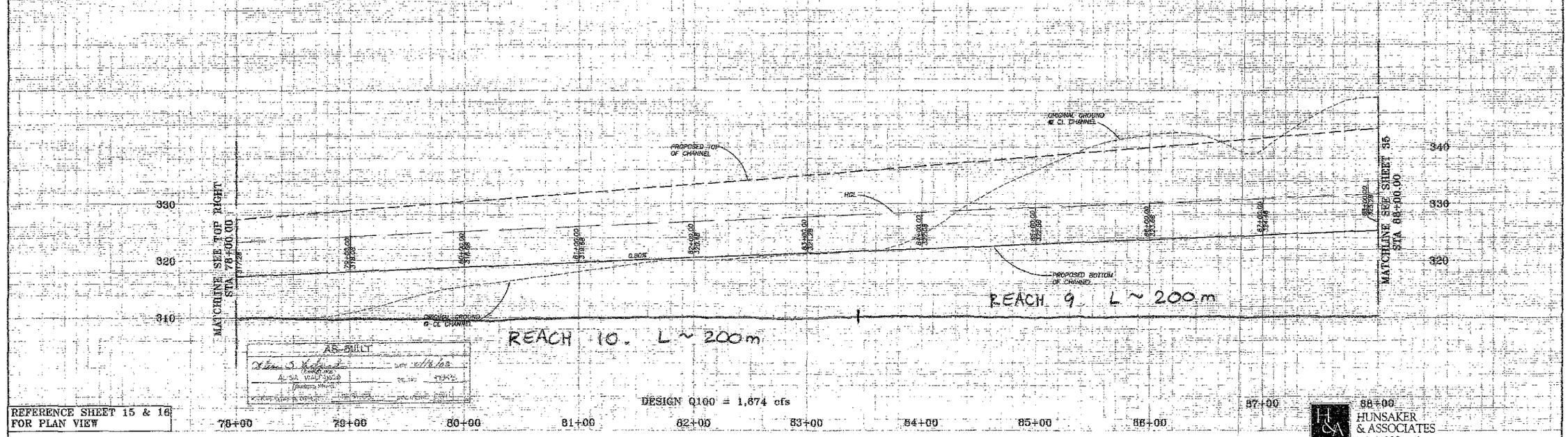
BIN NO. 4001A
W.O. NO. 025-271

OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA. 184+23.56 AND STA. 211+79.54 TO SR125)



REFERENCE SHEET 14 & 15
FOR PLAN VIEW

PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=8'



REFERENCE SHEET 15 & 16
FOR PLAN VIEW

AS-BUILT
ALISA WALPANDO
47945

OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA. 184+25.56 AND STA. 211+78.54 TO SR125)

HUNSAKER & ASSOCIATES SAN DIEGO, INC.
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 - FX(619)558-1414

W.O.# OR 1576

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	Appd	BENCH MARK
Contractor OTAY GENEC CO.		HSA	A/S AS-BUILT	6/2000	RFI	BM 85072="3"BRASS DISK," LS4124" IN WELL MON @ CL INTERS. GUTTERS & OTAY LAKES. ELEV=444.26'(NGVD29) (NGVD29+2.13'=NAVD88)
Inspector CARLOS MELENDEZ		HSA	AS-BUILT	7/2000	RFI	
Date Completed 7/15/03						

SCALE	Office	Designed By	Drawn By	Checked By
Horizontal	Field	CB/BG	DE/AB	CB/AY
Vertical	Traffic	Plans Prepared Under Supervision Of: ALISA S. WALPANDO, Date 10/18/99, R.C.E. No. 47945		

Submitted 10/19/99 By Senior Civil Engineer
Aproved 11/29/99 By City Engineer

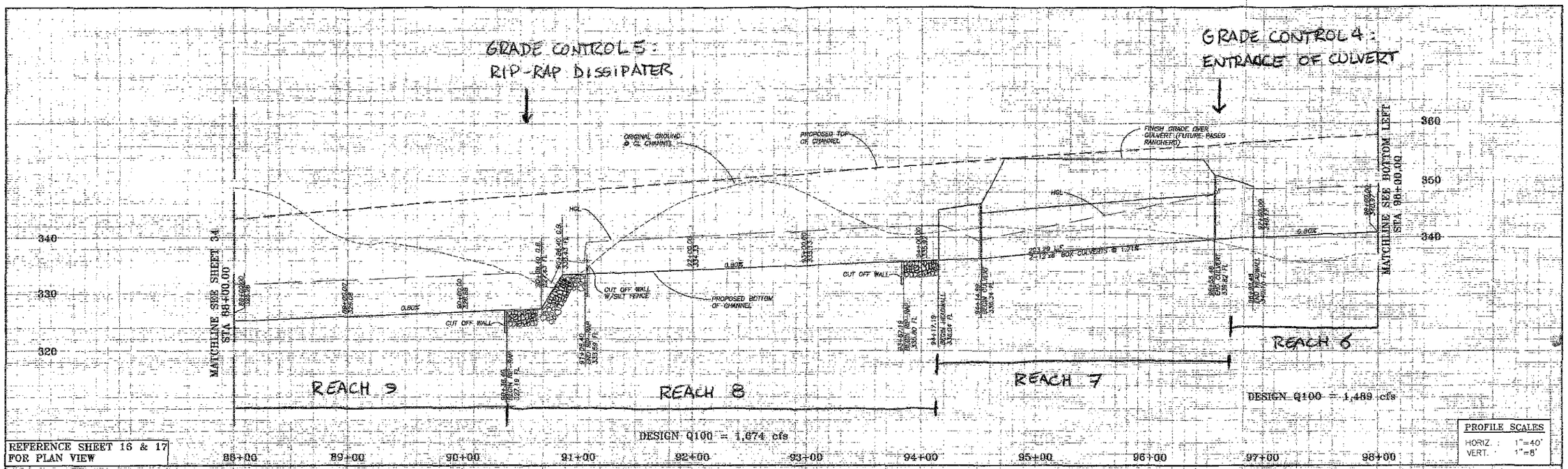
CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT
PROFILE PLANS FOR: OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA 184+26.56 & STA. 211+79.54 TO SR125)
CHULA VISTA TRACT NO. 96-04

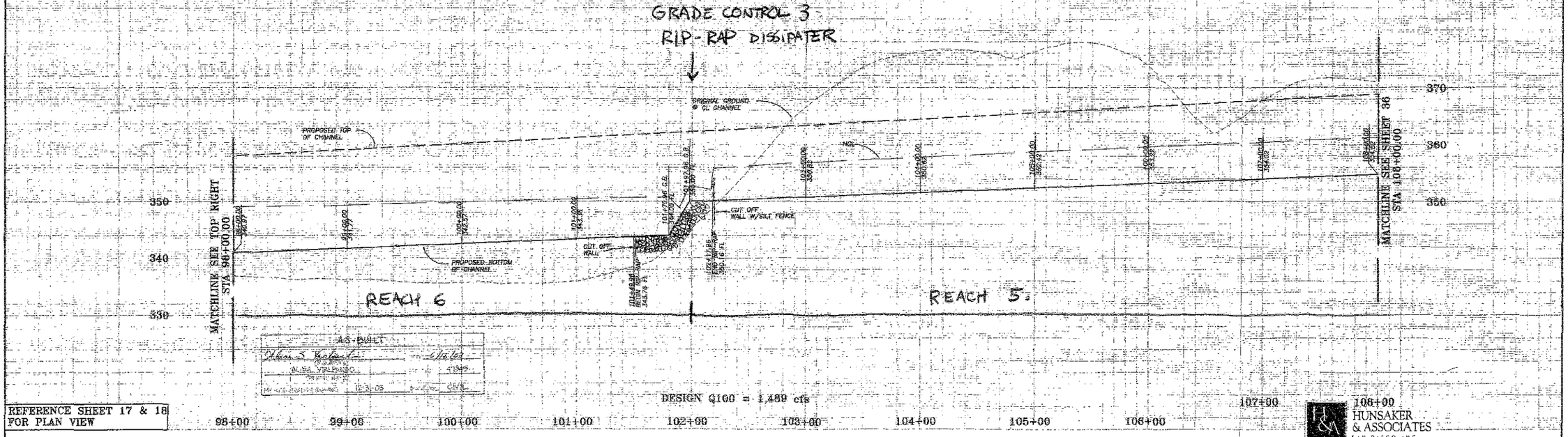
Drawing No. 99-407
Sheet 34 of 52

BIN NO. 4001A
W.O. NO. 025-271

O.W.D. W.O.
File name: R:\01.51\01.51CH34

AS BUILT





HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

W.O.# OR 157G

OLYMPIC PARKWAY CHANNEL
(FROM BRANDYWINE TO STA. 184+23.56 AND STA. 211+79.64 TO SR125)

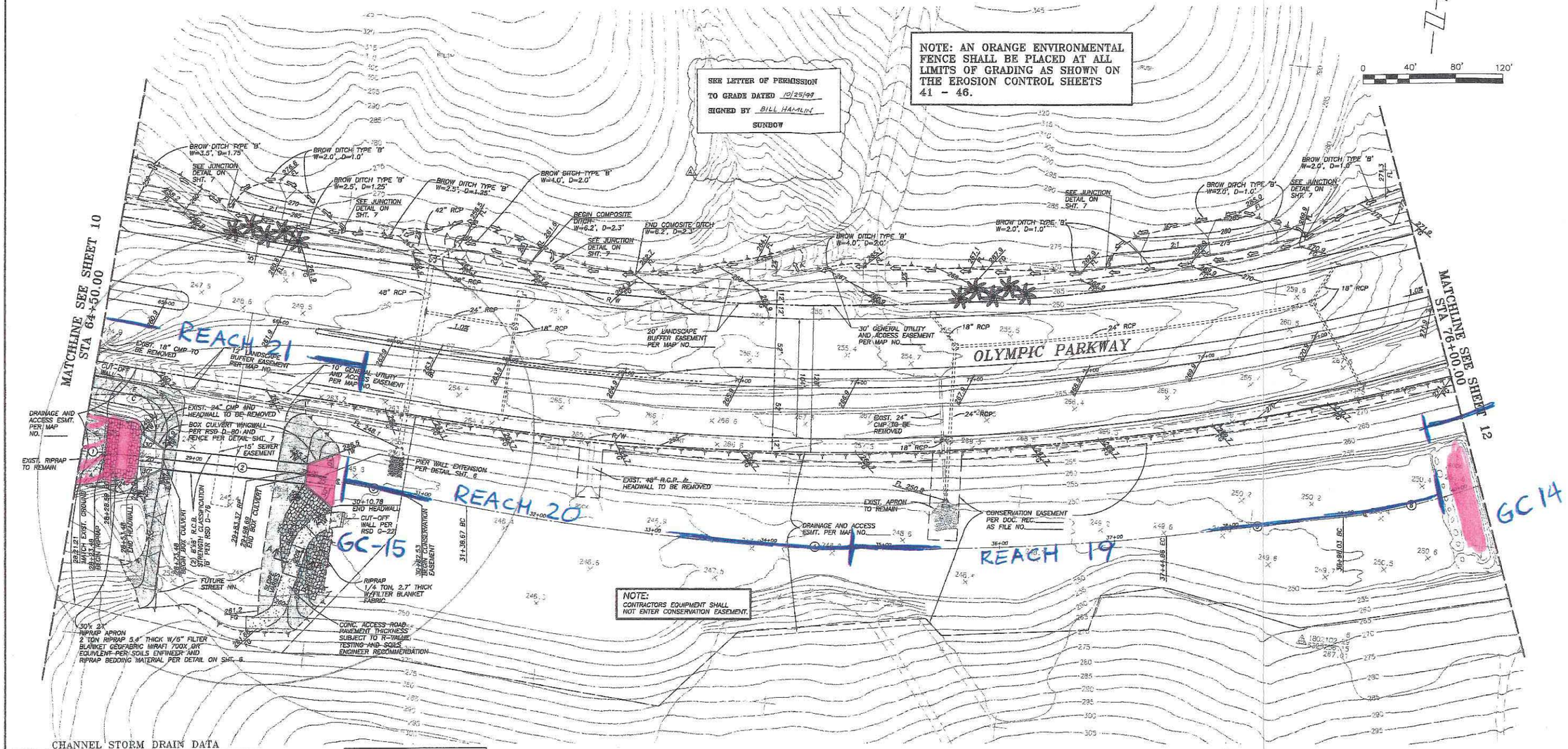
CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd	BENCH MARK	SCALE	Office	Designed By	Drawn By	Checked By	Submitted	Approved	CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT	Drawing No.
Contractor STAY RANCH CO.		AS	AS- BUILT			BM 95072="3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.3'=NAVD88)	Horizontal	Field	CB/BG	DE/AB	CB/AV	10/19/99	12/14/99	PROFILE PLANS FOR: OLYMPIC PARKWAY CHANNEL (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04	99-406
Inspector CARLOS MENDEZ							Vertical	Traffic	Plans Prepared Under Supervision Of			By	By		Sheet 35 of 52
Date Completed 7/5/02									Date 10/19/99			Senior Civil Engineer	City Engineer		
									ALISA S. VALPANDO R.C.E. No. 47945						

AS BUILT

C.W.D. W.O.
File name: R:\0131\01316035

DIN NO. 40018
W.O. NO. 025-271

APPENDIX 2: PLAN VIEW OF POGGI CREEK



CHANNEL STORM DRAIN DATA

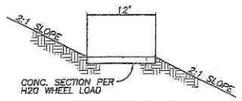
	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 89°43'48" W		117.23'	(2) 8'x8' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	01°50'00"	800.00	25.60	
2	N 89°43'48"W		155.12	
3	N 84°52'52"W		154.96	
4	17°21'58"	2000.00	606.19	
5	N 77°45'11"E		153.17	
6	13°45'40"	500.00	120.09	

FOR CHANNEL PROFILE SEE SHEET 32

AS-BUILT
Alisa S. Vialpando (SIGNATURE) DATE 6/16/03
ALISA VIALPANDO (PRINTED NAME) P.E. NO 47945
MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE CIVIL



SECTION A-A
NOT TO SCALE

OLYMPIC PARKWAY
STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

ALISA S. VIALPANDO No. 47945 Exp. 12/31/'03 Civil

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 · FX(619)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES
Contractor OTAY RANCH CO.	
Inspector CARLOS MELENDEZ	
Date Completed 7/15/03	

BY	REVISIONS	Date	App'd
HEA	A ADD LETTER OF PERMISSION TO GRADE	2/21/00	BK
HEA	AS-BUILT	7/28/03	STEP

BENCH MARK: BM 95072=3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE: Horizontal 1" = 40' Vertical N/A

Office CHULA VISTA Field Traffic

Designed By	Drawn By	Checked By
CB/BG	DE/AB	CB/AV

Plans Prepared Under Supervision Of: Alisa S. Vialpando ALISA S. VIALPANDO Date 10/18/99 R.C.E. No. 47945

Submitted 10/19/99 By Senior Civil Engineer

Approved 10/20/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

Drawing No. 99-430 Sheet 11 of 52

BIN NO. 4001A
W.O. NO. 025-271

OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 AND STA. 211+78.64 TO SR125)

AS BUILT

O.W.D. W.O.
File name: R:\0131\0131CH11

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 – 46.

SEE LETTER OF PERMISSION
TO GRADE DATED 10/25/99
SIGNED BY BILL HAMLIN
SUNBOW

SUPERCEDED BY SUNBOW CV DWG. NO. 00039

SCALE 1" = 40'
0 40' 80' 120'

MATCHLINE SEE SHEET 12 STA 76+00.00

MATCHLINE SEE SHEET 13 STA 87+00.00

OLYMPIC PARKWAY
(FROM BRANDYWINE TO STA. 184+26.56 AND STA. 211+79.54 TO SR125)

OLYMPIC PARKWAY 200'VC

REACH 18

REACH 17

REACH 16

GC 13

GC-12

SEE JUNCTION DETAIL ON SHT. 7

BROW DITCH, TYPE 'B' W=4.5', D=2.5'

BROW DITCH, TYPE 'B' W= 5.0', D= 1.5'

BROW DITCH TYPE 'B' W=5.0', D=1.5'

BROW DITCH TYPE 'B' W=2.5', D=1.25'

BROW DITCH TYPE 'B' W=2.0', D=1.0'

BROW DITCH, TYPE 'B' W= 2.5', D= 1.25'

BROW DITCH TYPE 'B' W=2.5', D=1.25'

BROW DITCH TYPE 'B' W=9.0', D=1.0'

FENCE (MATERIAL PER DETAIL ON SHT. 7)

MODIFIED CONC. INLET APRON PER RSD D-39

STORM DRAIN EASEMENT PER MAP NO.

30' GENERAL UTILITY & ACCESS EASEMENT PER MAP NO.

20' LANDSCAPE BUFFER EASEMENT PER MAP NO.

12' LANDSCAPE BUFFER EASEMENT PER MAP NO.

10' GENERAL UTILITY & ACCESS EASEMENT PER MAP NO.

EXIST. 24" CMP AND APRON TO BE REMOVED

EXIST. 24" CMP TO BE REMOVED

8'-6"W R.C.B. STRENGTH CLASSIFICATION "B" PER RSD D-78 W/ 3 4'DIA. CELLS

BOX CULVERT WINGWALLS PER RSD D-79 AND FENCE PER DTL. SHT. 7

BOX CULVERT WINGWALLS PER RSD D-79

REMOVE EXIST. HEADWALL

EXIST. 48" RCP

EXIST. RIPRAP TO REMAIN

FUTURE ACCESS ROAD

DRAINAGE AND ACCESS EASEMENT PER MAP NO.

CONSERVATION EASEMENT PER DOC. REC. AS FILE NO.

CUT-OFF WALL

EXIST. DROP STRUCTURE TO REMAIN

EXIST. DROP STRUCTURE TO BE REMOVED

RIPRAP APRON 30'x11'0"
2 TON RIPRAP 5.4' THICK W/FSF FILTER BLANKET-GEOFABRIC MIRAFI 700X OR EQUIVALENT PER SOILS ENGINEER AND RIPRAP BEDDING MATERIAL PER DETAIL ON SHEET 6

FOR CHANNEL PROFILE SEE SHEET 32 & 33

CHANNEL STORM DRAIN DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 63°13'47" E		63.16	(6) 8'x4' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	09°14'05"	500.00	80.59	
2	N 54°45'26"E		57.61	
3	N 63°13'47"E		157.19	
4	12°54'11"	500.00	112.60	
5	N 76°07'58"E		57.56	
6	08°54'52"	1000.00	155.58	
7	N 67°26'30"E		486.96	

AS-BUILT
Alisa S. Vialpando (SIGNATURE)
DATE 6/16/03
ALISA VIALPANDO (PRINTED NAME)
PE NO: 47945
MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE CIVIL

OLYMPIC PARKWAY
STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

REGISTERED PROFESSIONAL ENGINEER ALISA S. VIALPANDO No. 47945 Exp. 12/31/99 CIVIL STATE OF CALIFORNIA

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 - FX(619)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd
Contractor OTAY RANCH CO		HEA	A ADD LETTER OF PERMISSION TO GRADE	12/21/99	DK
Inspector CARLOS MELENDEZ		HEA	B REVISE NOTE FOR BOX CULVERT	2/11/00	DK
Date Completed 7/15/03		HEA	AS-BUILT	7/30/03	JTD

BENCH MARK: BM 95072-3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE: Horizontal 1" = 40' | Vertical N/A | Field | Traffic

Office M.B.S by M.H.S

Designed By CB/BG | Drawn By DE/AB | Checked By CB/AV

Plans Prepared Under Supervision Of ALISA S. VIALPANDO
Date 10/18/99
R.C.E. No. 47945

Submitted 10/19/99 By Senior Civil Engineer
Approved 10/20/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY
(FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125)
CHULA VISTA TRACT NO. 96-04

Drawing No. 99-429
Sheet 12 of 52

O.W.D. W.O.
File name: R:\0131\0131CH12

BIN NO. 4001A
W.O. NO. 025-271

AS BUILT

SCALE: 1" = 40'

0 40' 80' 120'

SEE LETTER OF PERMISSION TO GRADE DATED 10/25/99 SIGNED BY BILL HAMLIN SUNBOW

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.

NOTE: CONTRACTOR TO PROTECT EXISTING IMPROVEMENTS. SEE DRAWING NO.'S 99-393 AND 00044-01.

MATCHLINE SEE SHEET 12 STA 87+00.00

MATCHLINE SEE SHEET 14 STA 98+00.00

OLYMPIC PARKWAY

REACH 15

REACH 14

P0661 BASIN

DETENTION BASIN* (SEE DETAIL ON SHT. 8)

GC-1

GC 10

SECTION A-A N.T.S.

SECTION B-B N.T.S.

OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 AND STA. 211+79.54 TO SR125)

NOTE: CONTRACTORS EQUIPMENT SHALL NOT ENTER CONSERVATION EASEMENT.

BOX CULVERT CHANNEL DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 53°17'37"E		71.73'	(2) 8'x4' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 67°26'30"E		416.14	
2	02°54'38"	2000.00	101.80	
3	N 64°31'51"E		19.71	
4	N 50°49'21"E		57.27	
5	N 60°36'11"E		37.93	
6	08°55'53"	3000.00	467.64	
7	N 51°40'19"E		43.71	

FOR CHANNEL PROFILE SEE SHEET 33

AS-BUILT

Alisa S. Vialpando (SIGNATURE) DATE: 6/16/03

ALISA VIALPANDO (PRINTED NAME) R.E. No.: 47945

MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE: CIVIL

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

No. 47945 Exp. 12/31/05 CIVIL STATE OF CALIFORNIA REGISTERED PROFESSIONAL ENGINEER ALISA S. VIALPANDO

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 10179 Huennekens St Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 - FX(619)558-1414

W.O.# OR 1576

CONSTRUCTION RECORD	REFERENCES
Contractor STAY RANCH CO.	DWG 04 061
Inspector CARLOS MELENDEZ	
Date Completed 7/15/03	

BY	REVISIONS	Date	App'd
H&A	A ADD LETTER OF PERMISSION TO GRADE	12/09/99	CAS
H&A	B REVISE ELEV. FOR BOX CULVERT	2/11/00	CAS
H&A	AS-BUILT	7/29/03	TRB
H&A	C REV. BASIN, ADD CONC. & RIP-RAP	6/16/03	DLS

BENCH MARK: BM 95072=3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES ELEV=444.261(NGVD29) (NGVD29+2.13'=NAV88)

SCALE: Horizontal 1" = 40' Vertical N/A

Office H&A by H&A Field Traffic

Designed By CB/BG Drawn By DE/AB Checked By CB/AV

Plans Prepared Under Supervision Of: Alisa S. Vialpando Date 10/16/99 R.C.E. No. 47945

Submitted 10/19/99 By Senior Civil Engineer

Approved 10/20/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125)

CHULA VISTA TRACT NO. 96-04

Drawing No. 99-428

Sheet 13 of 52

O.W.D. W.O.

File name: R:\0131\01310P13

AS BUILT

BIN NO. 4001A
W.O. NO. 025-271

SUPERCEDED BY VILLAGE 1 WEST SOUTH C.V. DWG. NO. 01043

OLYMPIC PARKWAY

MATCHLINE SEE SHEET 13 STA 98+00.00

MATCHLINE SEE SHEET 15 STA 109+00.00

REACH 14

REACH 13

REACH 12

REACH 11

POGGI BASIN

GC-8

GC-9

GC-7

DETENTION BASIN

BROW DITCH TYPE 'B' W=5.0', D=2.5'

13' LANDSCAPE BUFFER EASEMENT PER MAP NO.

BROW DITCH TYPE 'B' W=2.0', D=1.0'

PROPOSED 20' STORM DRAIN EASEMENT PER MAP NO.

BROW DITCH TYPE 'B' W=3.0', D=1.5'

DRAINAGE DITCH JUNCTION PER DETAIL ON SHT. 7

10' GENERAL UTILITY AND ACCESS EASEMENT PER MAP NO.

BROW DITCH TYPE 'B' W=2.0', D=1.0'

DRAINAGE DITCH JUNCTION PER DETAIL ON SHT. 7

PROPOSED STORM DRAIN EASEMENT PER MAP NO.

BROW DITCH TYPE 'B' W=2.0', D=1.0'

BROW DITCH TYPE 'B' W=2.5', D=1.25'

BROW DITCH TYPE 'B' W=3.0', D=1.5'

BROW DITCH TYPE 'B' W=3.5', D=1.75'

BROW DITCH TYPE 'B' W=4.0', D=2.0'

COMPOSITE DITCH W=7.5', D=2.5' SEE DETAIL THIS SHT.

DRAINAGE DITCH JUNCTION PER DETAIL ON SHT. 7

24" RCP

36" RCP

48" RCP

18" RCP

3000 PSI CONCRETE MAINTENANCE APRON SET AT FLOWLINE GRADE OF EXISTING STRUCTURES, 6" THICK CONCRETE PAD REINFORCED WITH #4 REBAR AT 18" SPACING EACH WAY PER WETLAND MITIGATION PLANS.

12' LANDSCAPE BUFFER EASEMENT PER MAP NO.

10' GENERAL UTILITY AND ACCESS EASEMENT PER MAP NO.

BOX CULVERT WARPED WINGWALL PER RSD D-80 AND FENCE PER DETAIL ON SHT. 7

EXIST. WILLOWS & CAT TAILS TO BE REMOVED

EXIST TOE OF SLOPE

BOX CULVERT WARPED WINGWALL PER RSD D-80 AND FENCE PER DETAIL ON SHT. 7

DBL 12'x8' R.C.B. STRENGTH CLASSIFICATION 'B' PER RSD D-77

CUT-OFF WALL PER DETAIL SHT. 6

CUT-OFF WALL W/SILT FENCE PER DETAIL SHT 6 (H=1.5', L=105')

CUT-OFF WALL PER DTL SHT. 90

CUT-OFF WALL PER DETAIL SHT. 6

CUT-OFF WALL W/SILT FENCE PER DETAIL SHT 6 (H=1.5' L=109')

BOTTOM OF CHANNEL

AC CHANNEL ACCESS ROAD

CHANNEL ACCESS ROAD

DRAINAGE AND ACCESS ESMT. PER MAP NO.

TO BE DO GRADING WING DEFLECTOR SEE SHT. 90 FOR DETAIL

PIER WALL EXTENSION SEE DETAIL SHT. 6

FUTURE ENTRY FOR VILLAGE 2

DRAINAGE & ACCESS EASEMENT PER MAP NO.

24" RCP

36" RCP

BROW DITCH TYPE 'B' W=3.5', D=1.75'

DRAINAGE DITCH JUNCTION PER DETAIL SHT.7

DROP STRUCTURE W/SCOUR POOL AND SOUTH NOTCH, PER DETAIL SHT. 90

BROW DITCH TYPE 'B' W=2.0', D=1.0'

DRAINAGE DITCH JUNCTION PER DETAIL ON SHT. 7

BROW DITCH TYPE 'B' W=2.0', D=1.0'

SPLASH PAD PER DETAIL SHT. 6

DRAINAGE DITCH JUNCTION SEE DETAIL SHT. 6

24 TON RIP-RAP OR MIRAFI 700 OR EQUIVALENT GEOTEXTILE SHALL BE PLACED BENEATH THE RIP-RAP AND SHALL BE PLACED APPROXIMATELY IN A 6" BAND AS SHOWN ON WETLAND MITIGATION PLANS.

1/2 TON RIPRAP W=13.5', L=18', T=3.4'

MODIFIED WINGWALL & U HEADWALL PER D-35, W=6', L=U 3.1'

CHANNEL ACCESS ROAD

BROW DITCH TYPE 'B' W=2.0', D=1.0'

88.75' ~ 54" RCP @ 3.92%

BASIN NO. 6 84" CMP RISER TOP EL. 312.0 BOT. EL. 303.0 H=1.0', h=2.11'

RISER TOP ELEV.=305.0 SPILLWAY CREST ELEV.=309.11 SPILLWAY OPENING=18'

BROW DITCH TYPE 'B' END W=2.0', D=1.0'

BROW DITCH TYPE 'B' W=3', D=1.5'

BROW DITCH TYPE 'B' W=2.5', D=1.25'

TYPE 'A' CROSS DRAIN & CONCRETED ROCK APRON PER DETAIL SHT. 6

DROP STRUCTURE PER DETAIL SHT. 6 A=36', B=36', C=32', D=23', E=30', F=17.52', G=20' 2 TON RIPRAP 5.4' THICK PER D-40 W/FILTER BLANKET GEOFABRIC MIRAFI 700X OR EQUIVALENT PER SOILS ENGINEER AND RIPRAP BEDDING MATERIAL PER DETIAL ON SHEET 6

FOR CHANNEL PROFILE SEE SHEET 33 & 34

NOTE: CONTRACTOR TO PROTECT EXISTING IMPROVEMENTS. SEE DRAWING NO.'S 99-393 AND 00044-01

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

AS-BUILT

(SIGNATURE) ALISA VIALPANDO (DRAWN NAME) DATE:

P.E. NO: 47945

MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE: CIVIL

CHANNEL BOX CULVERT DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 51°13'17"E		146.04	(2) 12'x8' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 51°40'19"E		322.48	
2	N 55°13'17"E		148.05	
3	N 48°05'53"E		427.23	
4	09°25'20"	2000.00	189.27	
5	N 53°31'13"E		8.21	

AS-BUILT

Alisa S. Vialpando (SIGNATURE) DATE: 6/16/03

ALISA VIALPANDO (PRINTED NAME) P.E. NO: 47945

MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE: CIVIL

COMPOSITE DITCH

SECTION A-A

REGISTERED PROFESSIONAL ENGINEER ALISA S. VIALPANDO No. 47945 Exp. 12/31/05 CIVIL STATE OF CALIFORNIA

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 · FX(619)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES
Contractor OTAY RANCH CO.	DWG 04061
Inspector CARLOS MELENDEZ	
Date Completed 7/15/03	

BY	REVISIONS	Date	Appd
HFA	A REVISE HEADWALL ELEV.	8/1/00	
HFA	B REVISE RIPRAP STRUCTURE	4/1/01	
HFA	C REVISE EMERGENCY SPILLWAY, RIPRAP	3/1/01	
HFA	AS-BUILT	7/16/03	
HFA	D REV. BASIN, ADD CONC. & RIP-RAP	6/24/05	DZS

BENCH MARK: BM 95072-3"BRASS DISK," LS4324" IN WELL MON @ QL INTERS. RUTGERS & OTAY LAKES. ELEV=444.251(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE	Office	Designed By	Drawn By	Checked By
Horizontal 1" = 40'	Field	CB/BG	DE/AB	CB/AV
Vertical N/A	Traffic	Plans Prepared Under Supervision Of: ALISA S. VIALPANDO	Date 10/12/99	R.C.E. No. 47945

Submitted 10/19/99 By Senior Civil Engineer

Approved 01/20/00 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

Drawing No. 99-427

Sheet 14 of 52

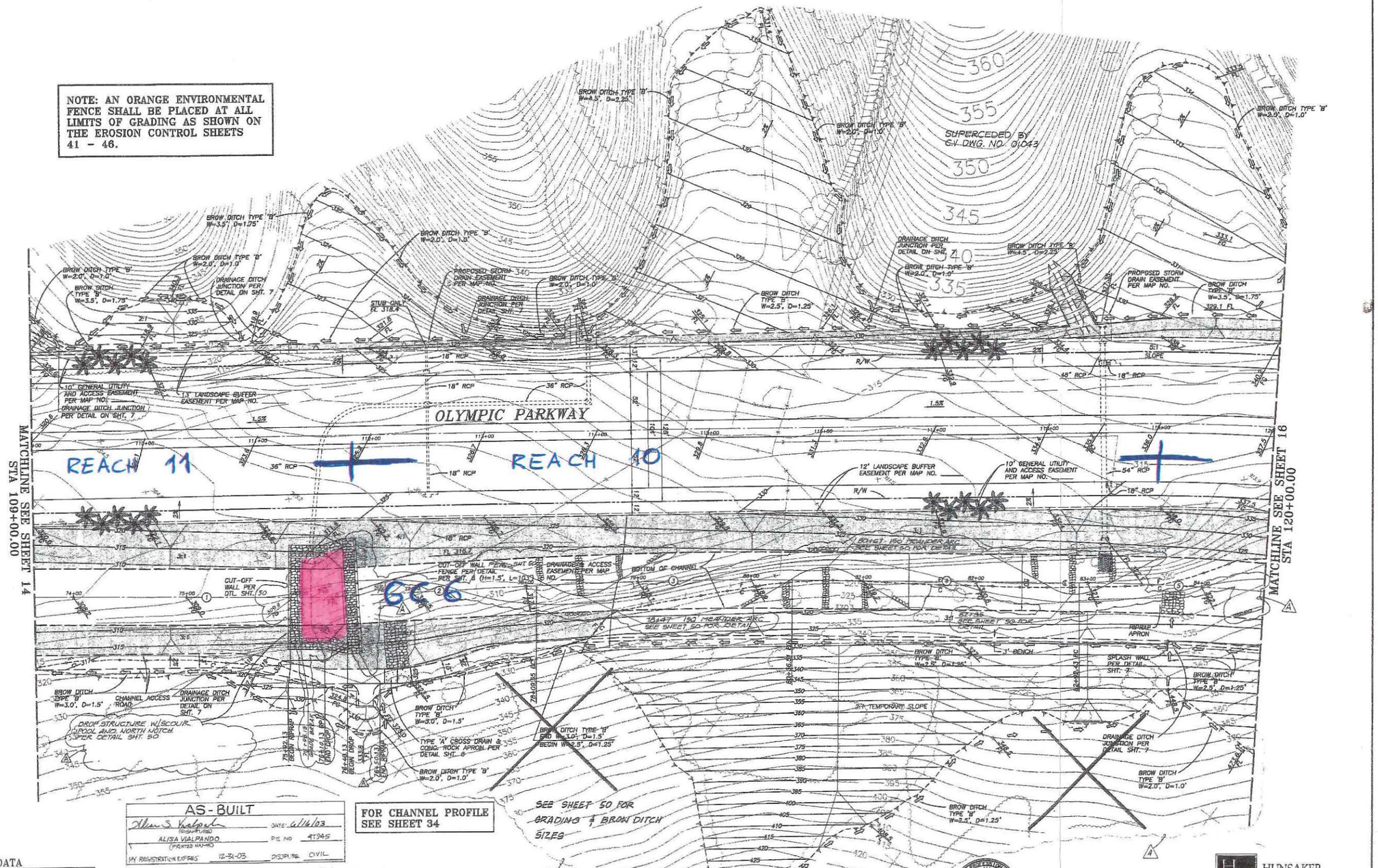
OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+23.56 AND STA. 211+79.54 TO SR125)

BIN NO. 4001A
W.O. NO. 025-271

O.W.D. W.O.
File name: R:\0131\0131CH14

AS BUILT

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.



AS-BUILT

Alisa S. Vialpando DATE 6/16/03
ALISA VIALPANDO (PRINTED NAME) P.E. NO. 47945
MY REGISTRATION EXPIRES 12-31-03 DISCIPLINE CIVIL

FOR CHANNEL PROFILE SEE SHEET 34

CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 53°31'13"E		256.86	
2	N 50°07'16"E		187.42	
3	03°15'04"	4000.00	226.97	
4	N 53°31'13"E		255.91	
5	04°39'34"	2000.00	162.64	

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd
Contractor OTAY RANCH CO.		H&A	AS-BUILT PER FIELD INSPECTION & REVIEW OF AS-BUILT PLANS	6/16/03	
Inspector CARLOS MELENDEZ		H&A	AS-BUILT	10/10/03	
Date Completed 7/15/03					

BENCH MARK: BM 95072=3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE: Horizontal 1" = 40' | Vertical N/A

Office HUNSAKER & ASSOCIATES | Field | Traffic

Designed By CB/BC | Drawn By DE/AB | Checked By CB/AV

Plans Prepared Under Supervision Of: Alisa S. Vialpando | Date 10/14/99 | R.C.E. No. 47945

Submitted 10/19/99 Senior Civil Engineer | Approved 10/20/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

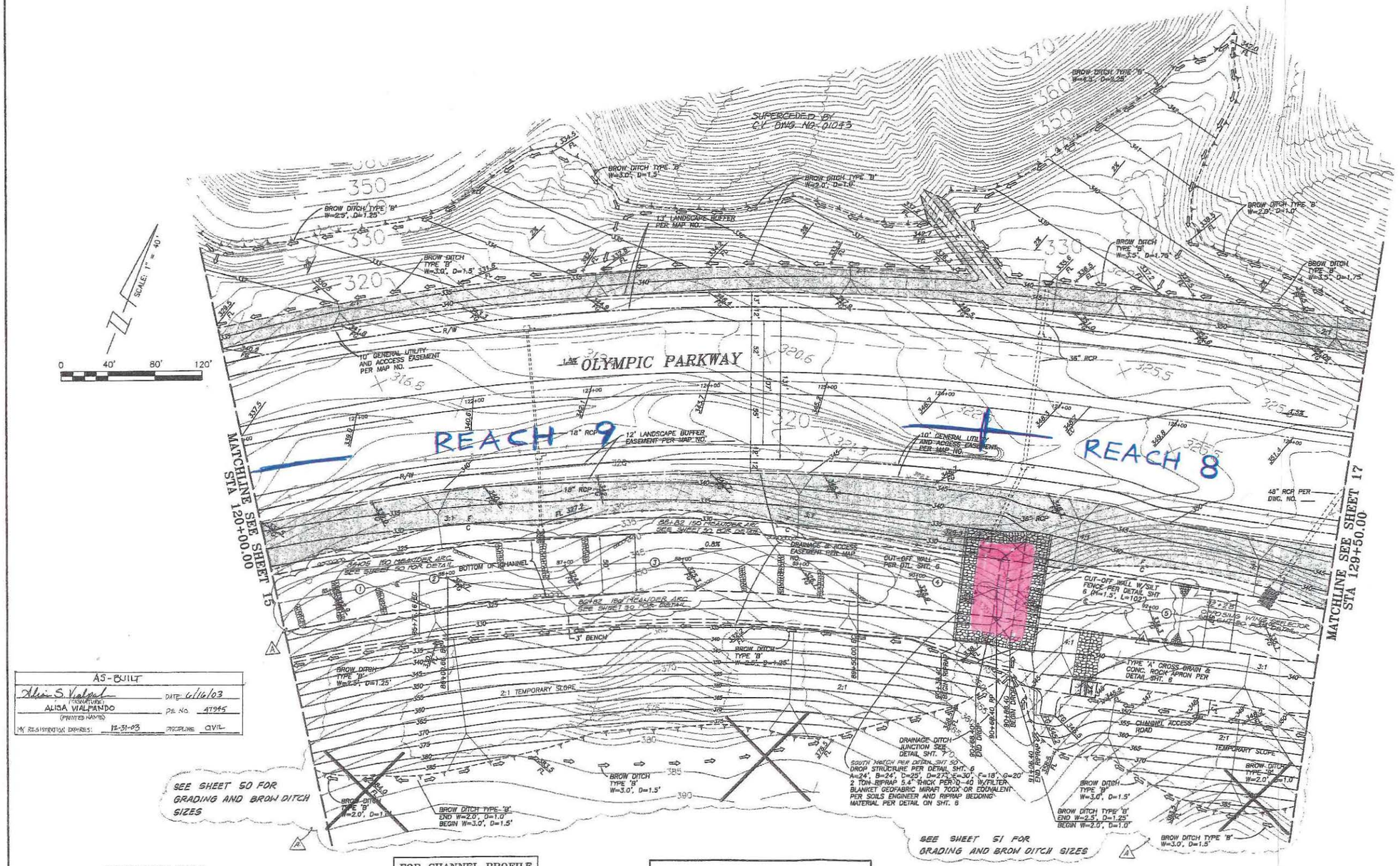
Drawing No. 99-426 Sheet 15 of 52

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 - FX(619)558-1414
W.O.# OR 157G

BIN NO. 4001A
W.O. NO. 025-271

O.W.O. W.O.
File name: R:\0131\0131CH15

AS BUILT



AS-BUILT

Alisa S. Vialpando DATE 6/16/03
SIGNATURE
ALISA VIALPANDO P.E. NO. 47945
(PRINTED NAME)
MY REGISTRATION EXPIRES: 12-31-03 DISCIPLINE CIVIL

CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	03°28'08"	2000.00	121.09	
2	N 81°38'55"E		24.50	
3	13°20'37"	1500.00	349.34	
4	N 74°59'32"E		118.41	
5	N 77°03'48"E		280.66	

FOR CHANNEL PROFILE SEE SHEET 34 & 35

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. 99-355 THROUGH 99-393.

REGISTERED PROFESSIONAL ENGINEER ALISA S. VIALPANDO No. 47845 Exp. 12/31/99 CIVIL STATE OF CALIFORNIA

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca. 92121
SURVEYING PH(619)558-4500 · FX(619)558-1414

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd
Contractor OTAY RANCH CO.		H&A	(A) REVISED GRADING & BROW DITCH SIZES, ADDED STREAM BED	6/16/03	
Inspector CARLOS MELENDEZ		H&A	AS-BUILT	7/15/03	
Date Completed 7/15/03					

BENCH MARK: BM 95072="BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE: Horizontal 1" = 40' Vertical N/A

Office MAS by MAS | Field | Traffic

Designed By CB/BG | Drawn By DE/AB | Checked By CB/AV

Plans Prepared Under Supervision Of Alisa S. Vialpando Date 10/19/99 ALISA S. VIALPANDO R.C.E. No. 47945

Submitted 10/19/99 By Senior Civil Engineer

Approved 10/20/99 By City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA 184+26.56 & STA 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

W.O.# OR 157G

Drawing No. 99-425

Sheet 16 of 52

O.W.D. W.O. File name: R:\013*\0131CH16

BM NO. 4001A
W.C. NO. 025-271

OLYMPIC PARKWAY
(FROM BRANDYWINE TO STA 184+26.56 AND STA. 211+78.54 TO SR125)

AS BUILT

AKA HERITAGE RD.

FOR CONTINUATION OF GRADING SEE SHEET 26

GRADING EXCLUDED FROM

SEE LETTER OF PERMISSION TO GRADE DATED _____ SIGNED BY _____ CITY OF SAN DIEGO

SUPERCEDED BY VIL PHASE 1 DWG NO. 99-420

CITY OF SAN DIEGO SUBDIVISION BOUNDARY

OLYMPIC PARKWAY

LINE CG1 SEE PROFILE SHT. 38

REACH 7

REACH 6

REACH 5

MATCHLINE SEE SHEET 16 STA 129+50.00

MATCHLINE SEE SHEET 18 STA 141+00.00

GC-4

GC-3

GC = Grade Control

MATCH LINE SEE LEFT FOR CONTINUATION

MATCH LINE SEE RIGHT FOR CONTINUATION

SEE SHEET 61 FOR GRADING AND BROW DITCH SIZES

FOR CHANNEL PROFILE SEE SHEET 35

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. ____ THROUGH ____.

STORM DRAIN DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 77°15'90"E		83.07'	36" RCP (1500-D)
2	N 13°11'41"W		81.39'	60" RCP (1800-D)

CHANNEL BOX CULVERT DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 72°53'30"E		203.29'	(2) 12'x8' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 77°03'46"E		101.65	
2	N 72°53'30"E		206.30	
3	N 78°19'18"E		221.15	
4	13°48'59"	2000.00	482.28	
5	N 64°13'57"E		171.59	

TRAPEZOIDAL CHANNEL #1 N.T.S.

NOTE: REFER TO S.D.R.S.D. NO. D-70 FOR DETAILS.

(MOD.) CUTOFF WALL PER S.D.R.S.D. G-22 N.T.S.

SECTION A-A N.T.S.

SCALE: 1" = 40'

0 40' 80' 120'

AS-BUILT
Alisa S. Valpando DATE 6/16/03
Engineer of Work
ALISA VIALPANDO (printed name) P.E. NO. 47945
12-31-03 DISCIPLINE CIVIL
M. REGISTRATION EXPIRES:

HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 10179 Huennekens St. Suite 200
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 - FX(619)558-1414

CONSTRUCTION RECORD	REFERENCES
Contractor OTAY RANCH CO.	
Inspector CARLOS MELENDEZ	
Date Completed 7/15/03	

BY		REVISIONS	Date	App'd
HIA	A	REVISE STORM DRAIN DATA	12/21/99	CH
HIA	B	REVISE ELEVATIONS	3/3/00	CH
HIA	C	REVISE GRADING & SUBDIVISION BOUNDARY	11/1/01	CH
HIA	D	SLOPES ADDED FOR EMERGENCY SPILLWAY, RIP RAP, & FENCE ALIGNMENT	2/28/03	CH
HIA		AS-BUILT	7/22/03	CH

BENCH MARK: BM 95072=3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE		Designed By	Drawn By	Checked By
Horizontal 1" = 40'	Office	CB/BG	DE/AB	CB/AV
Vertical N/A	Field	Plans Prepared Under Supervision Of: Alisa S. Valpando	Date 10/18/99	R.C.E. No. 47945
	Traffic			

Submitted By Senior Civil Engineer 10/19/99

Approved By City Engineer 12/29/99

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

Drawing No. 99-424

Sheet 17 of 52

Replacement for original, which was misplaced 12/17/99

O.W.D. W.O. File name: R:\0131\0131CH17

BIN NO. 4001A W.O. NO. 025-271

OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+23.56 AND STA. 211+79.54 TO SR125)

SEE LETTER OF PERMISSION
TO GRADE DATED _____
SIGNED BY _____
CITY OF SAN DIEGO

SUPERCEDED BY
CV DWG NO. 99 490

GRADING EXCLUDED FROM PERMIT UNTIL LETTER OF PERMISSION IS SIGNED

CITY OF SAN DIEGO

SUBDIVISION BOUNDARY

BROW DITCH TYPE 'D' W=5', D=2.5'

BROW DITCH TYPE 'D' END W=5.0', D=2.5' BEGIN W=4.0', D=2.0'

BROW DITCH TYPE 'B' W=4.0', D=2.0'

BROW DITCH TYPE 'D' BEGIN W=5.0', D=3.0'

BROW DITCH TYPE 'D' W=5.0', D=3.0'

OLYMPIC PARKWAY

13' LANDSCAPE BUFFER EASEMENT PER MAP NO. ____

10' GENERAL UTILITY AND ACCESS EASEMENT PER MAP NO. ____

PIPELINE ESMT. PER DOC. NO. 1999-0034258 DATED JANUARY 21, 1999

LINE CG-2
SEE PROFILE SHT. 36

SD STA 10+14.29 C/L TYPE A-3 C.O.

SD STA 10+00.00 HEADWALL PER D-75

SD STA 11+87.24 C/L TYPE A-3 C.O.

SD STA 21+17.29 HEADWALL PER D-75

MATCHLINE SEE SHEET 17
STA 141+00.00

MATCHLINE SEE SHEET 19
STA 152+00.00

18" RCP

12' LANDSCAPE BUFFER EASEMENT PER MAP NO. ____

10' GENERAL UTILITY AND ACCESS EASEMENT PER MAP NO. ____

DRAINAGE & ACCESS EASEMENT PER MAP NO. ____

REACH 5

REACH 4

BOTTOM OF CHANNEL

CHANNEL ACCESS ROAD

BROW DITCH TYPE 'B' W=4.0', D=2.0'

BROW DITCH TYPE 'B' END W=4.0', D=2.0' BEGIN W=2.5', D=1.25'

BROW DITCH TYPE 'B' W=2.5', D=1.25'

SPLASH WALL PER DETAIL SHT. 7

DRAINAGE DITCH JUNCTION SEE DETAIL SHT. 7

10'x10' ROCK CLASS 1/4 TON RIP RAP (T=2.7') W/ GEOFABRIC FILTER FABRIC BLANKET AND RIP RAP BEDDING MATERIALS PER NOTES ON SHT. 6

BROW DITCH TYPE 'B' W=2.0', D=1.0'

BROW DITCH TYPE 'B' END W=2.0', D=1.0' BEGIN W=3.0', D=1.5'

2:1 TEMPORARY SLOPE

BROW DITCH TYPE 'B' W=3.0', D=1.5'

TYPE 'A' CROSSDRAIN CONCRETED APRON PER DETAIL SHT. 6 AND RIPRAP BEDDING MATERIAL PER DETAIL SHT. 6

10'x10' ROCK CLASS 1/4 TON RIP RAP (T=2.7') W/ GEOFABRIC FILTER BLANKET AND RIP RAP BEDDING MATERIALS PER NOTES ON SHT. 6

SPLASH WALL PER DETAIL SHT. 7

BROW DITCH TYPE 'D' W=5.0', D=3.0'

ROCK SLOPE PROTECTION PER RSD D-74 2 TON RIPRAP (T=2.7') W/FILTER BLANKET GEOFABRIC MIRAFI 700X OR EQUIVALENT PER SOILS ENGINEER AND RIPRAP BEDDING MATERIAL PER NOTES ON SHEET 6.

TEMPORARY EASEMENT

SUBDIVISION BOUNDARY

CITY OF SAN DIEGO

BROW DITCH TYPE 'B' W=2.0', D=1.0'

GRADING EXCLUDED FROM PERMIT UNTIL LETTER OF PERMISSION IS SIGNED

MATCHLINE SEE SHEET 20

SCALE: 1" = 40'

0 40' 80' 120'

AS-BUILT
Alisa S. Valpando DATE 6/16/03
ALISA VALPANDO PE NO. 47945
(SIGNATURE) (PRINT NAME)
BY HUNSAKER & ASSOCIATES DIEGO, INC. 12-31-03 (EXPIRATION) CIVIL

STORM DRAIN DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 19°21'35"E		32.04'	36" RCP (1500-D)
2	N 34°52'00"W		143.00'	36" RCP (1500-D)
3	N 34°16'11"W		33.75'	36" RCP (1500-D)

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 64°13'57"E		75.70	
2	08°30'08"	3000.00	445.18	
3	N 55°43'49"E		602.50	

FOR CHANNEL PROFILE SEE SHEET 35 & 36

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.

OLYMPIC PARKWAY
STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. ____ THROUGH ____.

REGISTERED PROFESSIONAL ENGINEER ALISA S. VALPANDO No. 47945 Exp. 12/31/99 CIVIL STATE OF CALIFORNIA

HUNSAKER & ASSOCIATES SAN DIEGO, INC.
PLANNING 9707 Waples Street, Suite 200
ENGINEERING San Diego, CA 92121
SURVEYING PH(858)558-4500 FAX(858)558-1414

W.O.# OR 157G

CONSTRUCTION RECORD	REFERENCES	BY	REVISIONS	Date	App'd
Contractor OTAY RANCH CO.		HHA	A REVISE STORM DRAIN DATA	6/25/03	
Inspector CARLOS HOLGUIN		HHA	B REVISE ACCESS ROAD LOCATION	2/28/03	
Date Completed 7/15/03		HHA	C MEANDER STREAM BED	10/18/99	
		HHA	AS - BUILT	12/31/03	

BENCH MARK
BM 95072=3"BRASS DISK," LS4324" IN WELL MON @ CL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)

SCALE	
Horizontal 1" = 40'	Office
Vertical N/A	Field
	Traffic

Designed By | Drawn By | Checked By

Plans Prepared Under Supervision Of
Alisa S. Valpando
Date 10/18/99
R.C.E. No. 47945

Submitted 3/1/00 By _____ Senior Civil Engineer
Approved 3/7/00 By _____ City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY
(FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125)
CHULA VISTA TRACT NO. 96-04

Drawing No. 99-423
Sheet 18 of 52

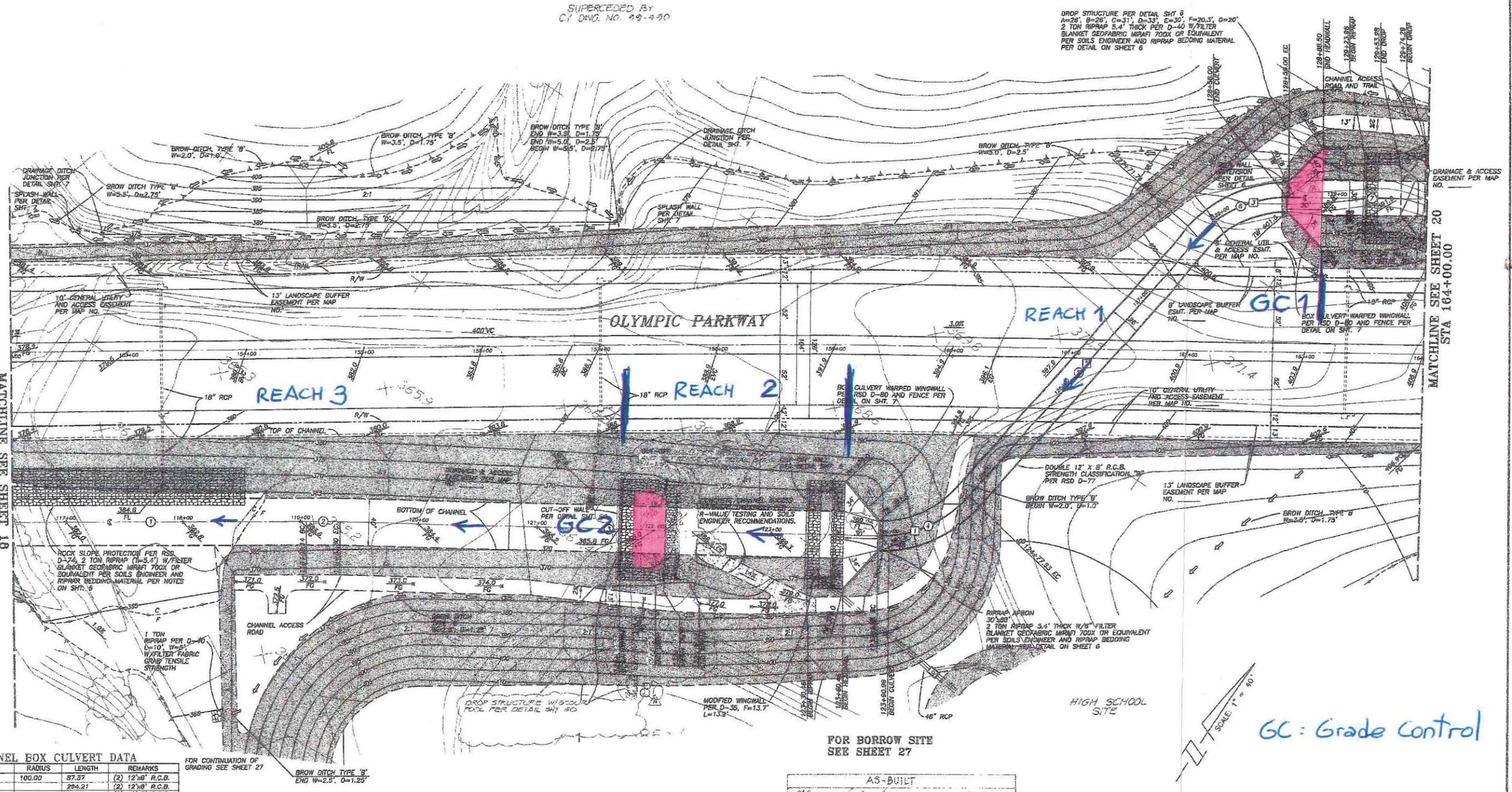
O.W.D. W.O.
File name: R:\0131\0131GR18

AS BUILT

BIN NO. 4001A
W.O. NO. 025-271

OLYMPIC PARKWAY
(FROM BRANDYWINE TO STA. 184+26.56 AND STA. 211+79.54 TO SR125)

SUPERCEDED BY
CV DWG. NO. 99-490



CHANNEL BOX CULVERT DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	50°10'19"	100.00	87.57	(2) 12'x8' R.C.B.
2	N 07°12'00"E		294.21	(2) 12'x8' R.C.B.
3	50°00'00"	100.00	87.27	(2) 12'x8' R.C.B.

CHANNEL CENTERLINE DATA

	BEARING/DELTA	RADIUS	LENGTH	REMARKS
1	N 55°43'49"E		249.74	
2	01°38'31"	1000.00	28.66	
3	N 57°22'20"E		456.16	
4	50°10'19"	100.00	87.57	
5	N 07°12'00"E		294.21	
6	50°00'00"	100.00	87.27	
7	N 57°12'00"E		117.24	

FOR CHANNEL PROFILE SEE SHEET 36 & 37

NOTE: AN ORANGE ENVIRONMENTAL FENCE SHALL BE PLACED AT ALL LIMITS OF GRADING AS SHOWN ON THE EROSION CONTROL SHEETS 41 - 46.

AS-BUILT
Alan S. Vialpando 6/11/02
ALISA S. VIALPANDO R.C.E. 47945
12/31/05 CIVIL

OLYMPIC PARKWAY STORM DRAIN TO BE CONSTRUCTED WITH IMPROVEMENT DWG. NO. ____ THROUGH ____.

No. 47945 Exp. 12/31/99 Civil

HUNSAKER & ASSOCIATES SAN DIEGO, INC.
PLANNING 10179 Huennekens St. Suite 209
ENGINEERING San Diego, Ca 92121
SURVEYING PH(619)558-4500 FX(619)558-1414

W.O.# OR 1576

CONSTRUCTION RECORD		REFERENCES	BY	REVISIONS	Date	App'd	BENCH MARK
Contractor	OTAY RANCH CO.		N.A.F.	1. REVISE DROP STRUCTURE # 12	4/6/99	N.A.F.	BM 95072=3"BRASS DISK," LS4324" IN WELL MON @ PL INTERS. RUTGERS & OTAY LAKES. ELEV=444.261(NGVD29) (NGVD29+2.13'=NAVD88)
Inspector	CARLOS PRELENCIO		N.A.F.	2. AS-BUILT	7/11/99	N.A.F.	
Date Completed	7/15/03						

SCALE		Designed By	Drawn By	Checked By
Horizontal 1" = 40'	Office Approved	CB/BG	DE/AB	CB/AV
Vertical N/A	Field ____	Plans Prepared Under Supervision Of		
	Traffic ____	Alan S. Vialpando ALISA S. VIALPANDO	Date 10/10/99 R.C.E. No. 47945	

Submitted 10/19/99 By Richard Schwarz Senior Civil Engineer
Approved 10/20/99 By Ralph Steinmann City Engineer

CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT

GRADING PLANS FOR: OLYMPIC PARKWAY (FROM BRANDYWINE TO STA. 184+26.56 & STA. 211+79.54 TO SR125) CHULA VISTA TRACT NO. 96-04

Drawing No. 99-422 Sheet 19 of 32

Replacement for original, which was misplaced
AS BUILT 6/11/99

O.W.D. W.O.
File name: R:\0131\0131GH19

BIN NO. 4001A
W.O. NO. 025-271

APPENDIX 3: AERIAL VIEW OF POGGI CREEK



Aerial View of Poggi Creek. Reaches 1 to 4.



Aerial View of Poggi Creek (continuation). Reaches 4 to 7.



Aerial View of Poggi Creek (continuation). Reaches 8 to 11.



Aerial View of Poggi Creek (continuation). Reaches 11 to 15.



Aerial View of Poggi Creek (continuation). Reaches 16 to 19.



Aerial View of Poggi Creek (continuation). Reaches 19 to 21.

APPENDIX 4: POGGI CREEK WATERSHED



LEGEND

- POGGI BASIN MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED (GRADED AND/OR FUTURE MEDIUM DENSITY DEVELOPMENT)
- MINOR WATERSHED (GRADED AND/OR FUTURE HIGH DENSITY DEVELOPMENT)
- MINOR WATERSHED (OPEN SPACE TO REMAIN)

NOTE:
AREAS NOT HATCHED REPRESENT EXISTING DEVELOPED AREAS OR AREAS THAT WILL NOT BE DEVELOPED.

800 0 800 1600 2400
SCALE 1"=800'

HUNSAKER & ASSOCIATES
SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

POGGI BASIN WATERSHED ANALYSIS

APPENDIX 5: SITE VISIT PHOTOS



Photo 1. Reach 1, Control 1 Downstream, Viewing Downstream



Photo 2. Reach 1, Control 1 Upstream, Viewing Downstream. Peak flow was measured in this reach.



Photo 3. Reach 3, Downstream of Control 2



Photo 4. Reach 3, Viewing South



Photo 5. Reach 2, Weir Control



Photo 6. Reach 2, downstream of weir control



Photo 7. Reach 6, GC 3, Rip Rap

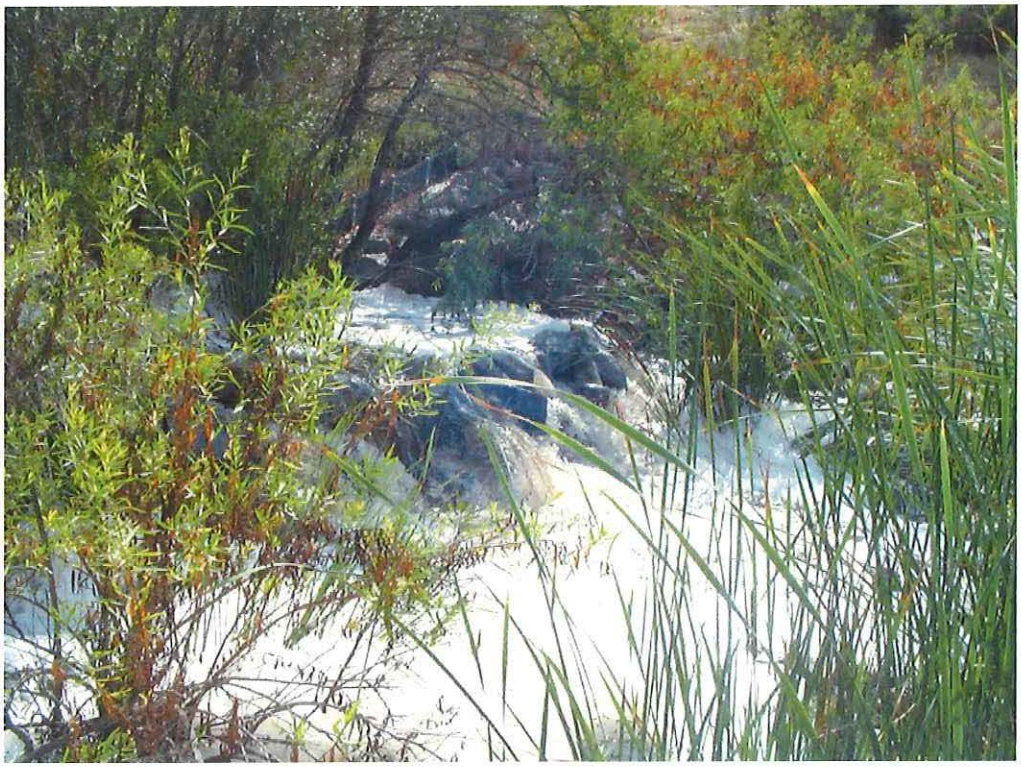


Photo 8. Reach 6, GC 3 further downstream



Photo 9. Entrance to Reach 7, GC-4



Photo 10. Entrance to Reach 7, GC-4 (detail)



Photo 11. Downstream end of Reach 8, GC-5



Photo 12. Reach 8, GC-5, details.



Photo 13. Reach 9, Downstream of GC-5, Viewing South



Photo 14. Reach 11, GC-6 Rip Rap



Photo 15. Reach 11, GC-6, Rip Rap



Photo 16. Reach 11, Downstream of GC-6 North Bank



Photo 17. Reach 12, Downstream of GC-7



Photo 18. Reach 13, Upstream of GC-8, Viewing North



Photo 19. Reach 13, GC-8, Upstream, Viewing South



Photo 20. Reach 13, GC-8, Downstream, Viewing North



Photo 21. Reach 14, GC-9 Poggi Basin



Photo 22. Reach 14, GC-9 Poggi Basin South Viewing



Photo 23. Reach 15, GC-10 South bank



Photo 24. Reach 15, GC-10 Viewing North



Photo 25. Entrance of Reach18 from above, GC13



Photo 26. Wing-wall at the beginning of Reach 18, GC-13



Photos 27 & 28. Entrance of Reach 21. Flow measurements were also performed in this section.

APPENDIX 6: FORM 1: INITIAL DESKTOP ANALYSIS

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32°36'34" N Longitude: 117°01'00° W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 2. Discharge of Culvert to discharge of rip-rap dissipater.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.219
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	12.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	210
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.0
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.020
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	15.3
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.798

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00° W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 3. 200m of 0.8% Channel with natural vegetation.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.239
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	12.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	212
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.0
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.020
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	15.3
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.795

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00° W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 4. 200 m of 0.8% channel with natural vegetation.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.310
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	12.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	218
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.2
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.020
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	15.5
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.786

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 5.
196 m of 0.8% channel up to rip-rap.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.38
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	12.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	224
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.3
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.020
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	15.7
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.777

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 6. Rip-rap to box culverts

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.449
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	12.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	229
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.5
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.020
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	15.9
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.769

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 8. 0.8% vegetated channel to rip-rap.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.535
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	15.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	236
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.7
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.021
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	16.1
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.948

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 9. 0.8% vegetated channel.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.576
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	15.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	240
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	6.8
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.021
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	16.2
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.943

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 10. Continuation of 0.8% vegetated channel.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.651
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	15.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	246
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.0
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.021
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	16.4
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.932

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 11. 0.8% channel & 2 consecutive rip-rap dissipaters.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.725
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	15.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	252
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.1
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.021
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	16.5
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.923

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek, REACH 12. From downstream of rip-rap to entrance of culvert.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.782
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	15.2

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	256
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.3
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.022
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	16.6
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.915

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 15. Outlet of Poggi Basin to rip-rap.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.932
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.008
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	9.1

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	268
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.6
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.022
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.0
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	0.538

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 16. Natural channel (50% of conservation area).

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	2.98
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.004
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	33.5

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	272
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.7
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.011
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.1
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	1.96

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek - REACH 17. Natural channel (50% of conservation area).

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	3.031
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.004
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	29.0

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	276
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	7.8
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.011
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.2
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	1.68

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 19
Natural channel (upper half of second conservation area)

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	3.119
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.0044
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	30.5

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	283
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	8.0
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.012
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.4
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	1.75

(Sheet 1 of 1)

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32° 36' 34" N Longitude: 117° 01' 00" W

Description (river name, crossing streets, etc.): Poggi Creek. REACH 20. Natural channel (lower half of second conservation area).

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	**A**	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	3.172
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	9.76
Site properties (SI units)	**S_v**	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	0.0044
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	33.5

Form 1 Table 2. Simplified peak flow, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	287
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	8.1
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	0.013
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	17.5
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	1.92

(Sheet 1 of 1)

APPENDIX 7: FORM 2: PEBBLE COUNT (EMPTY FORM)

FORM 2: PEBBLE COUNT

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

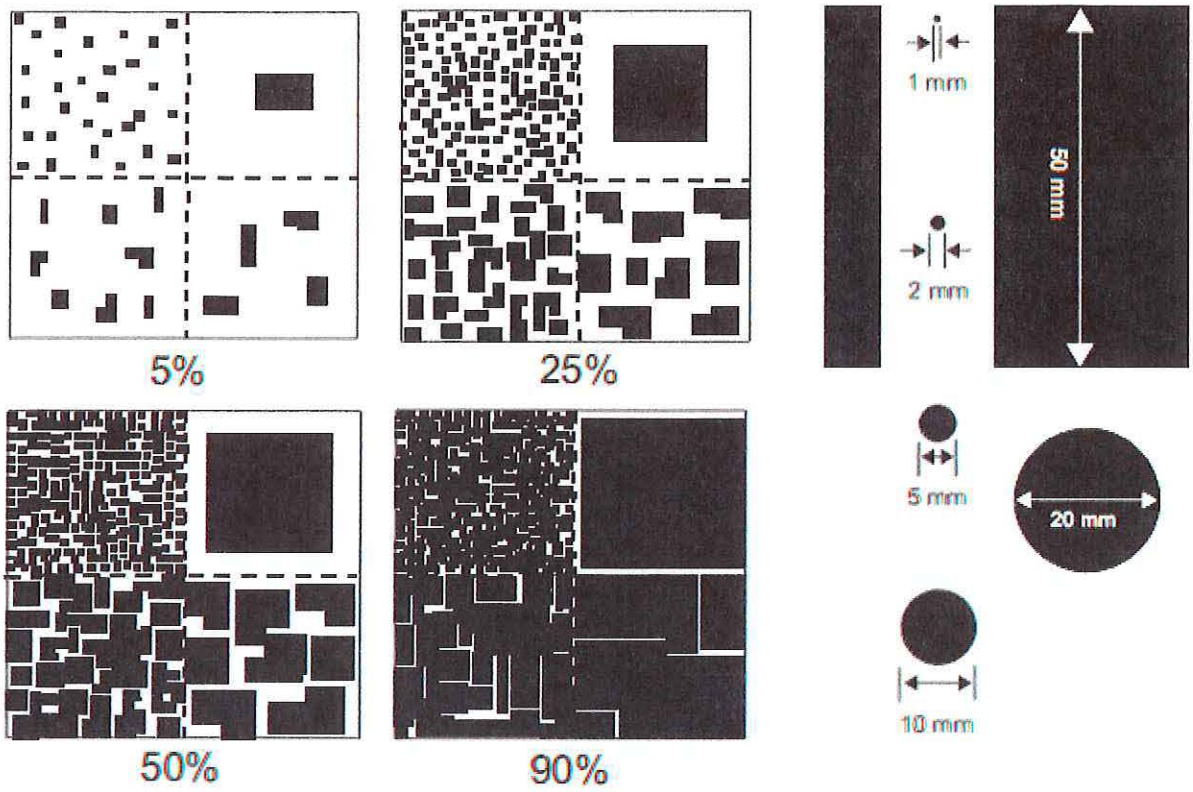
Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1			26			51			76			101		
2			27			52			77			102		
3			28			53			78			103		
4			29			54			79			104		
5			30			55			80			105		
6			31			56			81			106		
7			32			57			82			107		
8			33			58			83			108		
9			34			59			84			109		
10			35			60			85			110		
11			36			61			86			111		
12			37			62			87			112		
13			38			63			88			113		
14			39			64			89			114		
15			40			65			90			115		
16			41			66			91			116		
17			42			67			92			117		
18			44			68			93			118		
19			44			69			94			119		
20			45			70			95			120		
21			46			71			96			121		
22			47			72			97			122		
23			48			73			98			123		
24			49			74			99			124		
25			50			75			100			125		

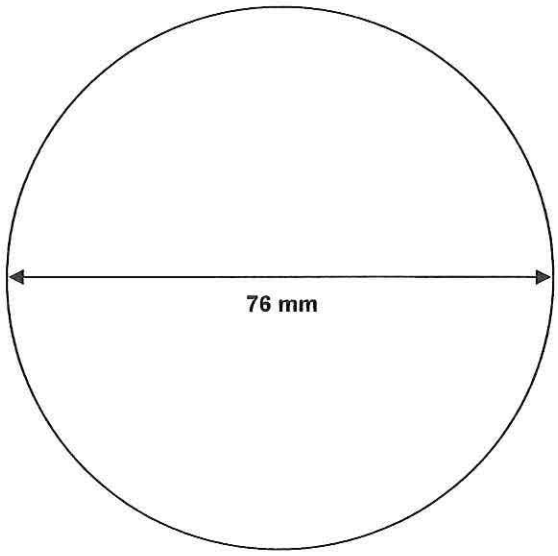
Form 2 Table 2. d_{50} for Screening Index Threshold.

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

(Sheet 1 of 2)



Note: Each quadrant within each box contains the same total area covered using different sized objects.



Form 2 Figure 1. Examples of % coverage by volume and substrate sizing adapted from *NRCS Field Book for Describing and Sampling Soils* (Schoeneberger *et al.* 2002) and Julien (1998).

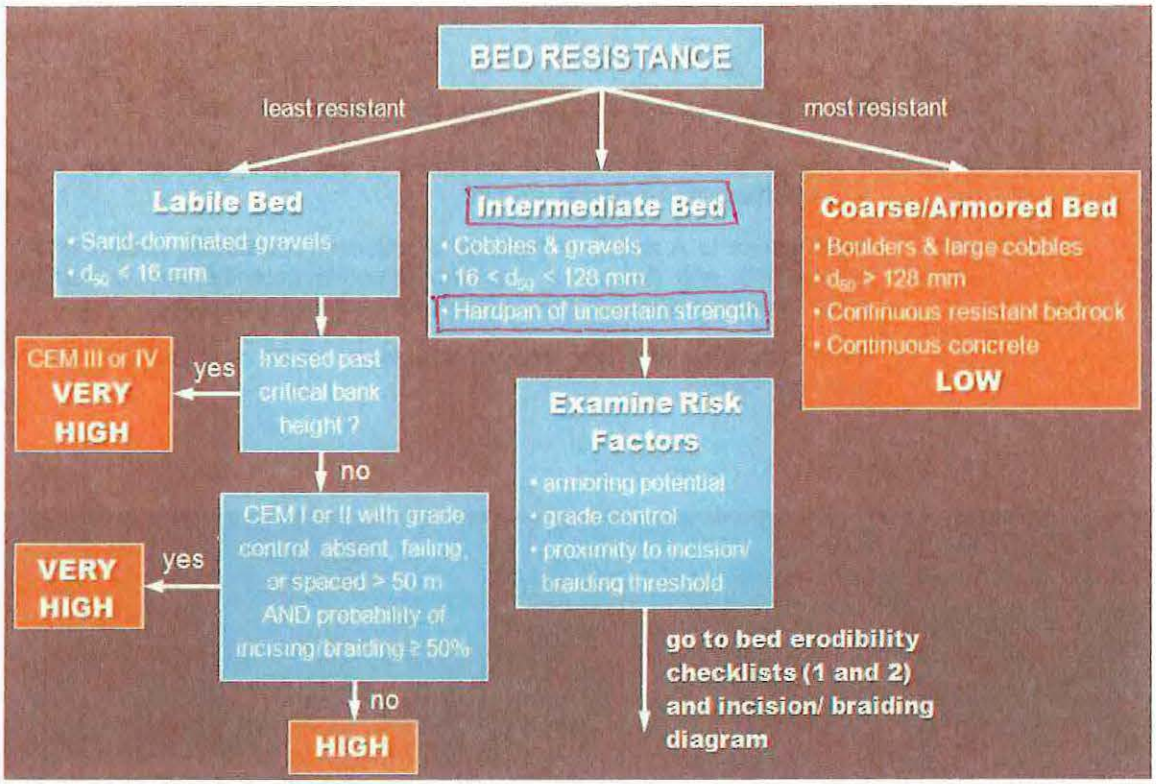
(Sheet 2 of 2)

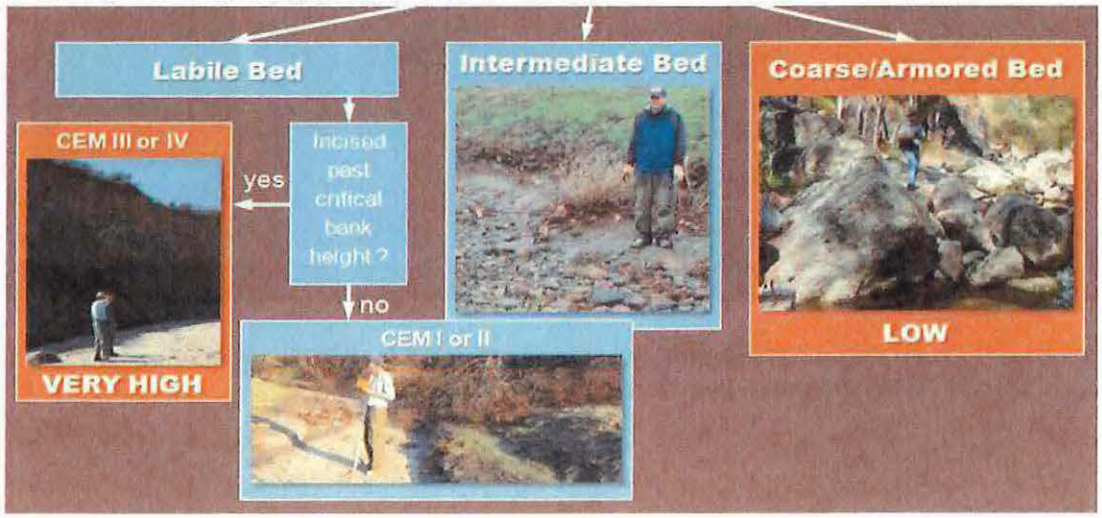
APPENDIX 8: FORM 3: VERTICAL SUSCEPTIBILITY FIELD SHEET

REACHES: 2, 6, 8

FORM 3: VERTICAL SUSCEPTIBILITY FIELD SHEET

Circle appropriate nodes/pathway for proposed site.





Form 3 Figure 1. Vertical Susceptibility photographic supplement to be used in conjunction with Form 3 Bed Resistance above.

(Sheet 1 of 4)

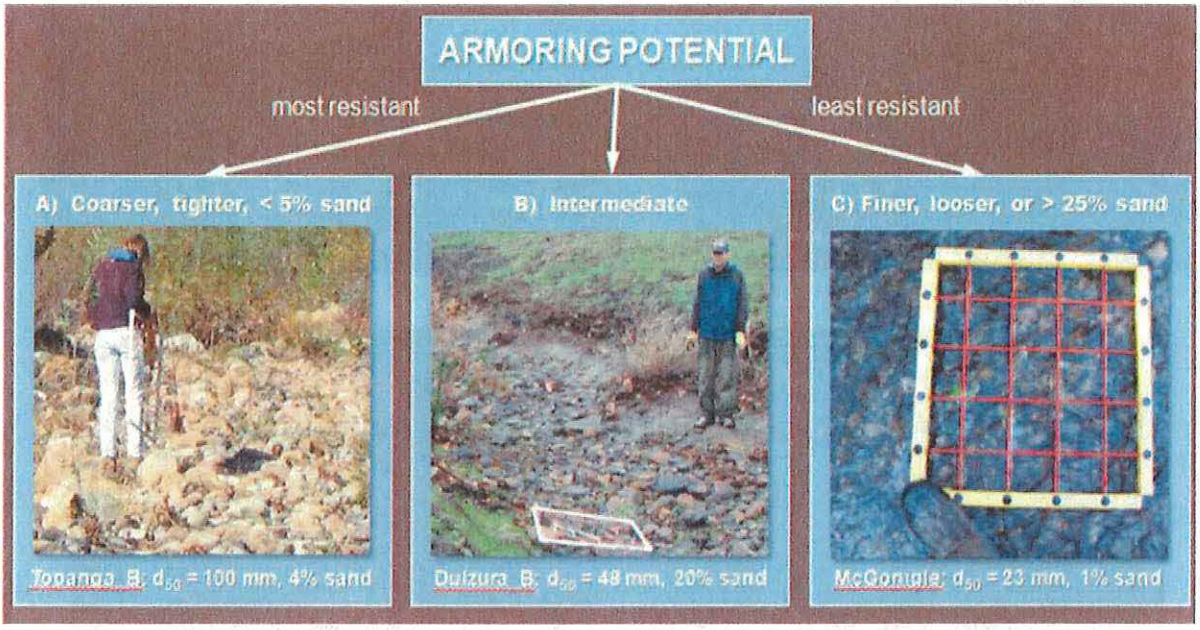
REACHES: 2, 6, 8

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☐	(B)	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



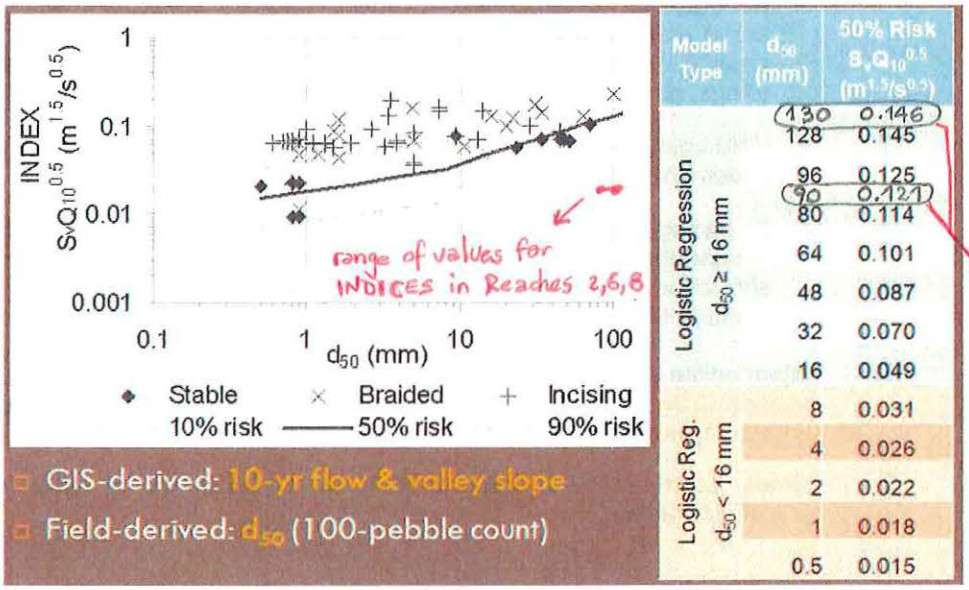
Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in **conjunction with Form 3 Checklist 1.**

(Sheet 2 of 4)

REACHES: 2, 6, 8

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



REACH	d50 (mm)	calc. INDEX
2	90-130	0.020
6	90-130	0.020
8	90-130	0.021

INDEX (LOW risk):

$\frac{0.146 + 0.121}{2} = 0.13$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

All calculated indexes smaller than average expected index for low risk.

SCORE : A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

REACHES: 2, 6, 8

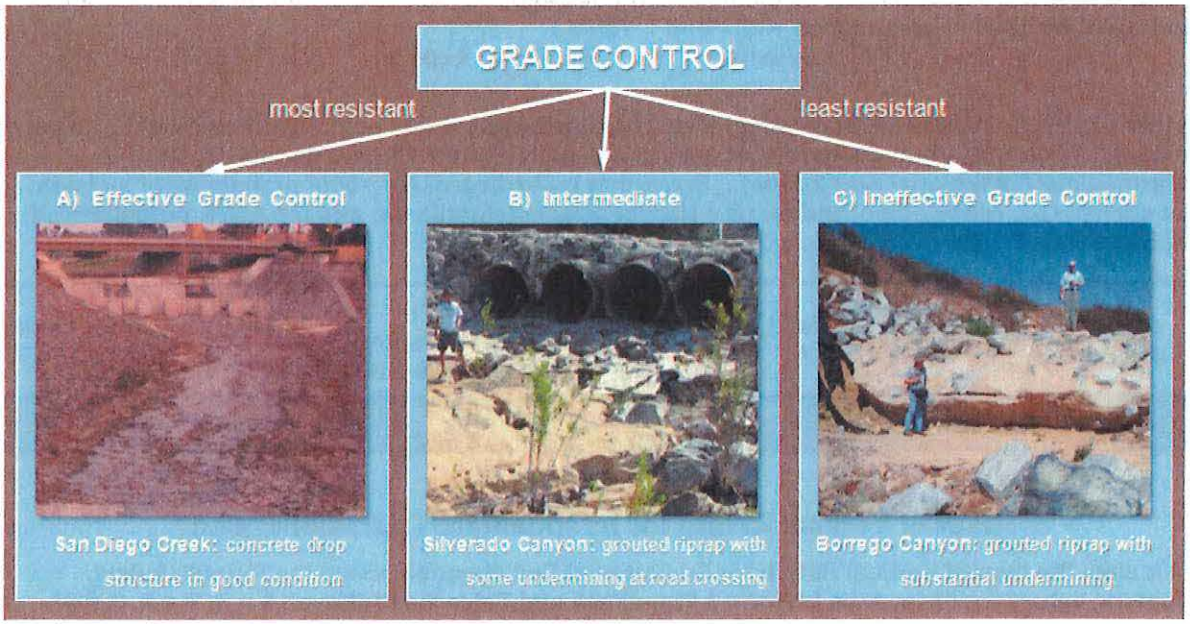
Form 3 Checklist 2: Grade Control

☐ (A) Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☐ B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness

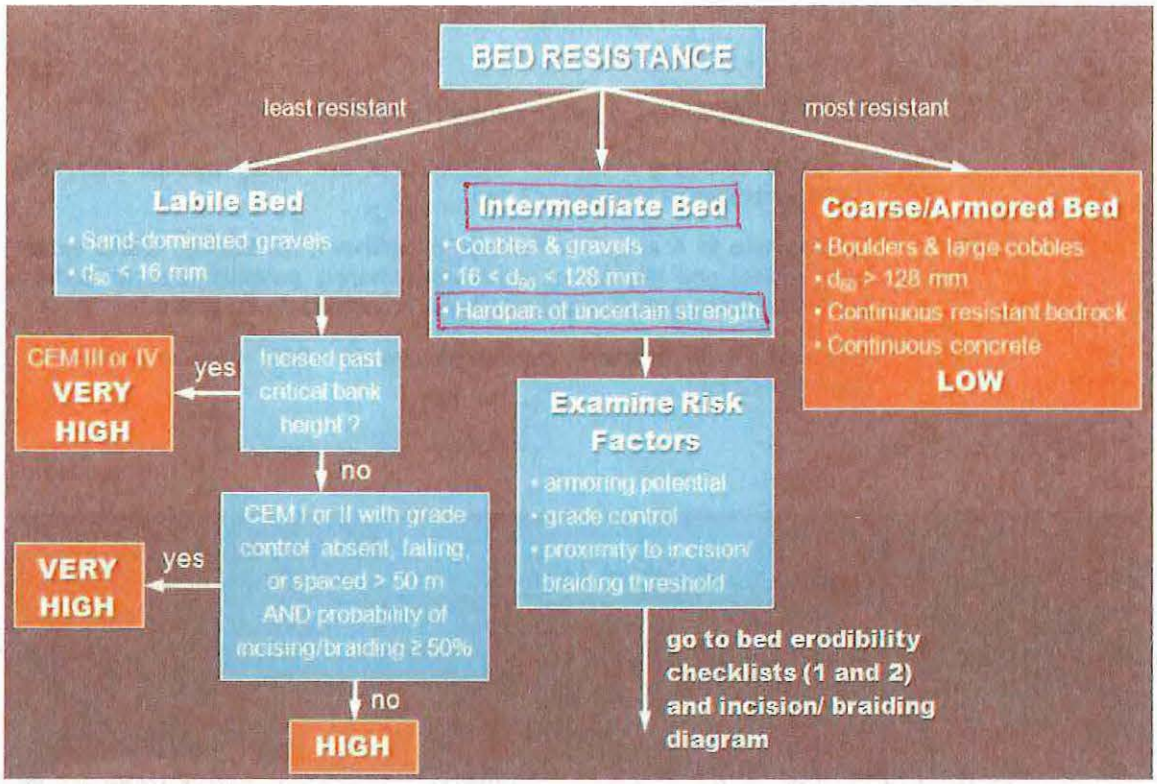


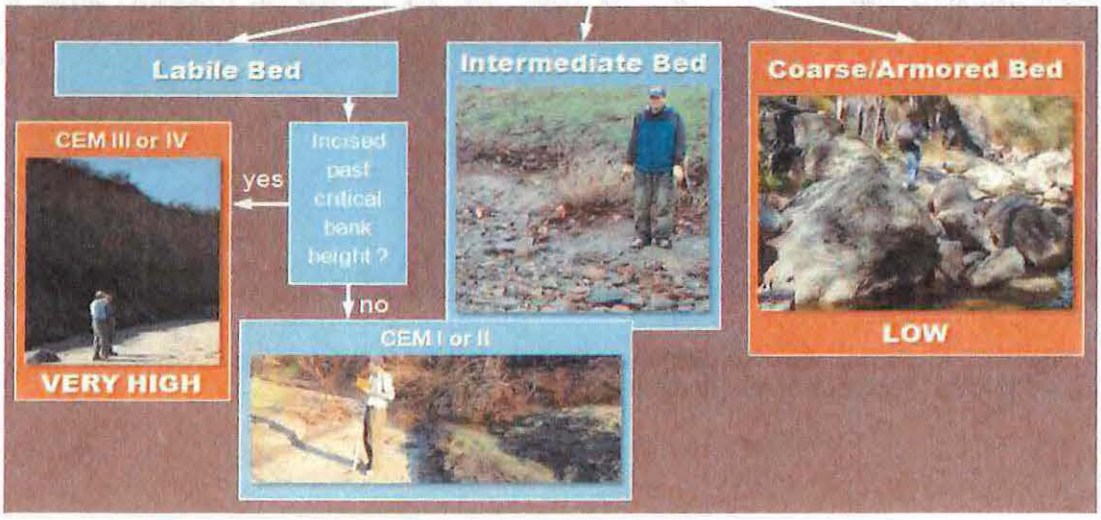
Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

REACHES: 3, 4, 5

FORM 3: VERTICAL SUSCEPTIBILITY FIELD SHEET

Circle appropriate nodes/pathway for proposed site.





Form 3 Figure 1. Vertical Susceptibility photographic supplement to be used in conjunction with Form 3 Bed Resistance above.

(Sheet 1 of 4)

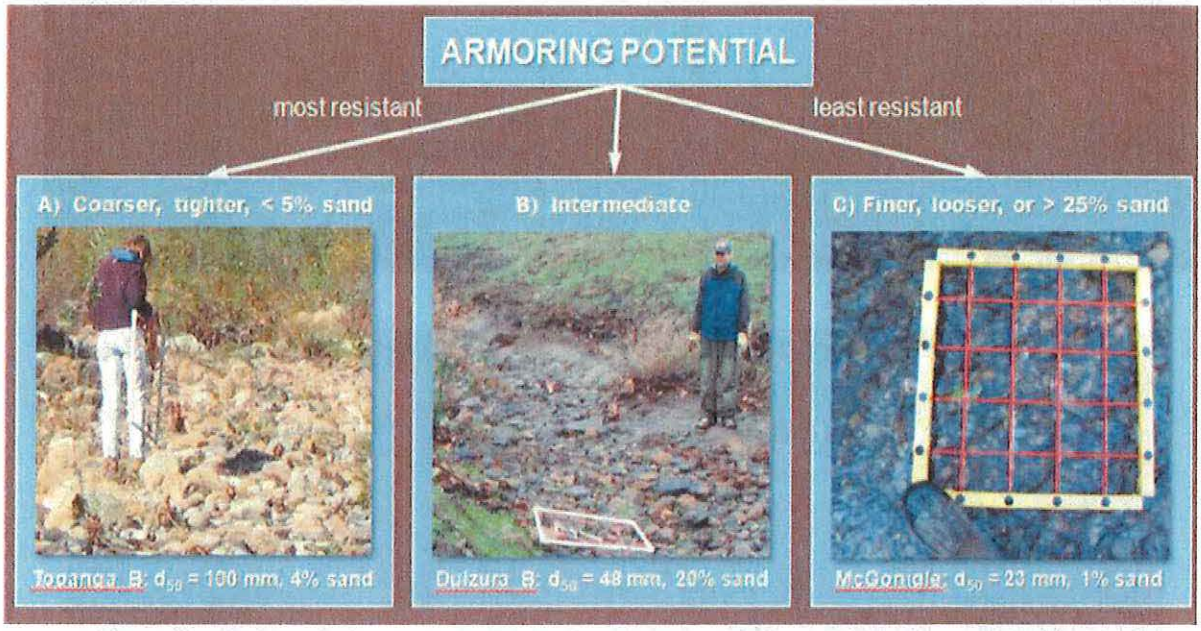
REACHES: 3,4,5

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☐	(B)	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm

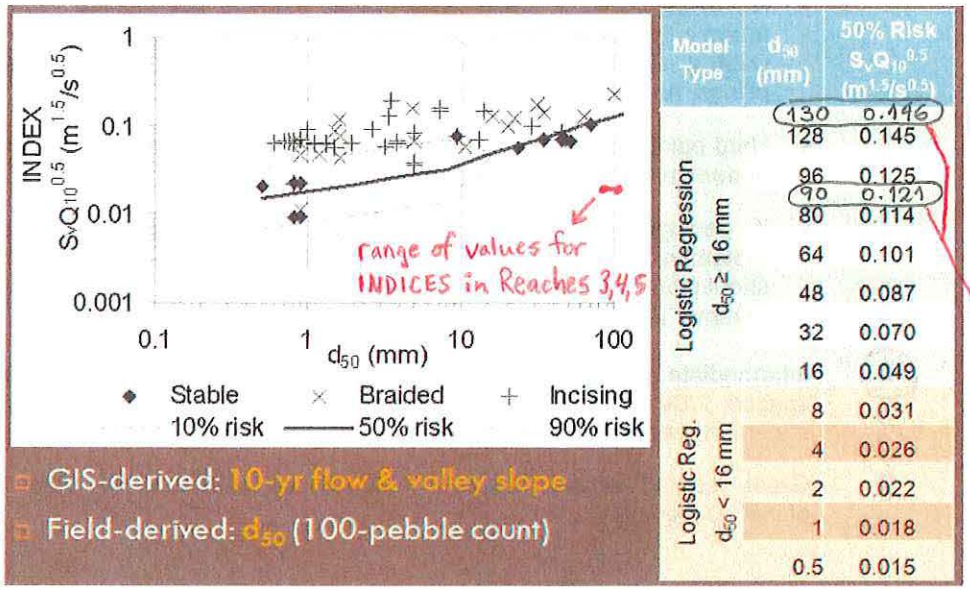


Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 1.

REACHES: 3,4,5

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	130	0.146
	128	0.145
	96	0.125
	90	0.121
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

REACH	d_{50} (mm)	calc. INDEX
3	90-130	0.020
4	90-130	0.020
5	90-130	0.020

INDEX (Low risk):
$\frac{0.146 + 0.121}{2} = 0.133$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

All calculated indexes smaller than average expected index for low risk.
SCORE : A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control\ ) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

REACHES: 3, 4, 5

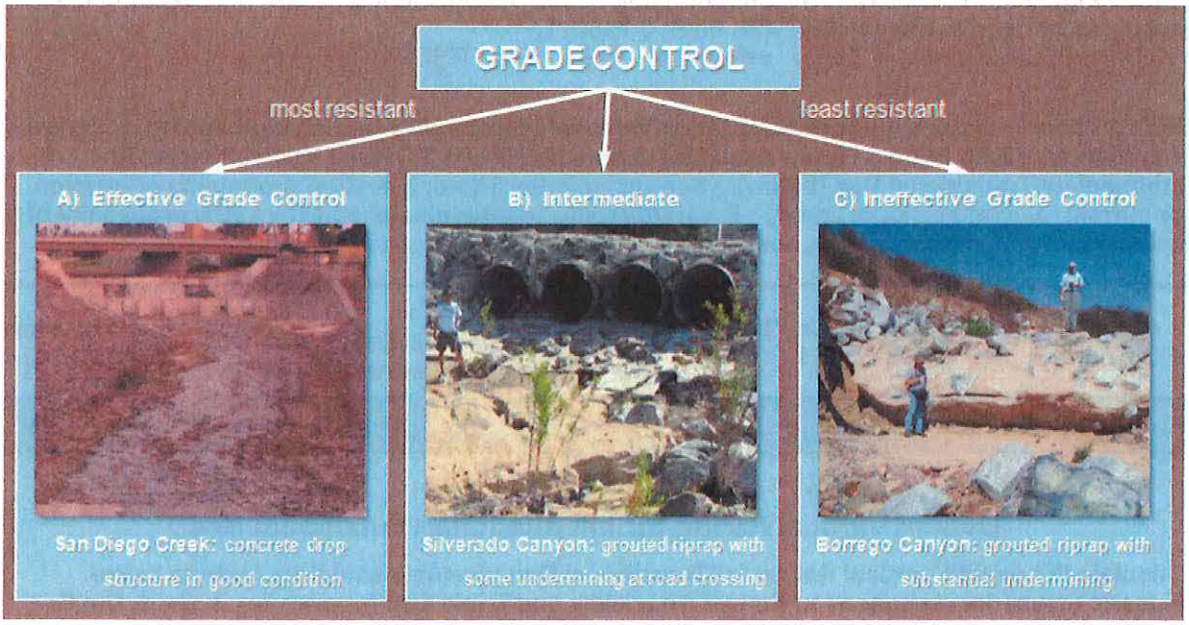
Form 3 Checklist 2: Grade Control

☐ A Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☐ (B) Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness

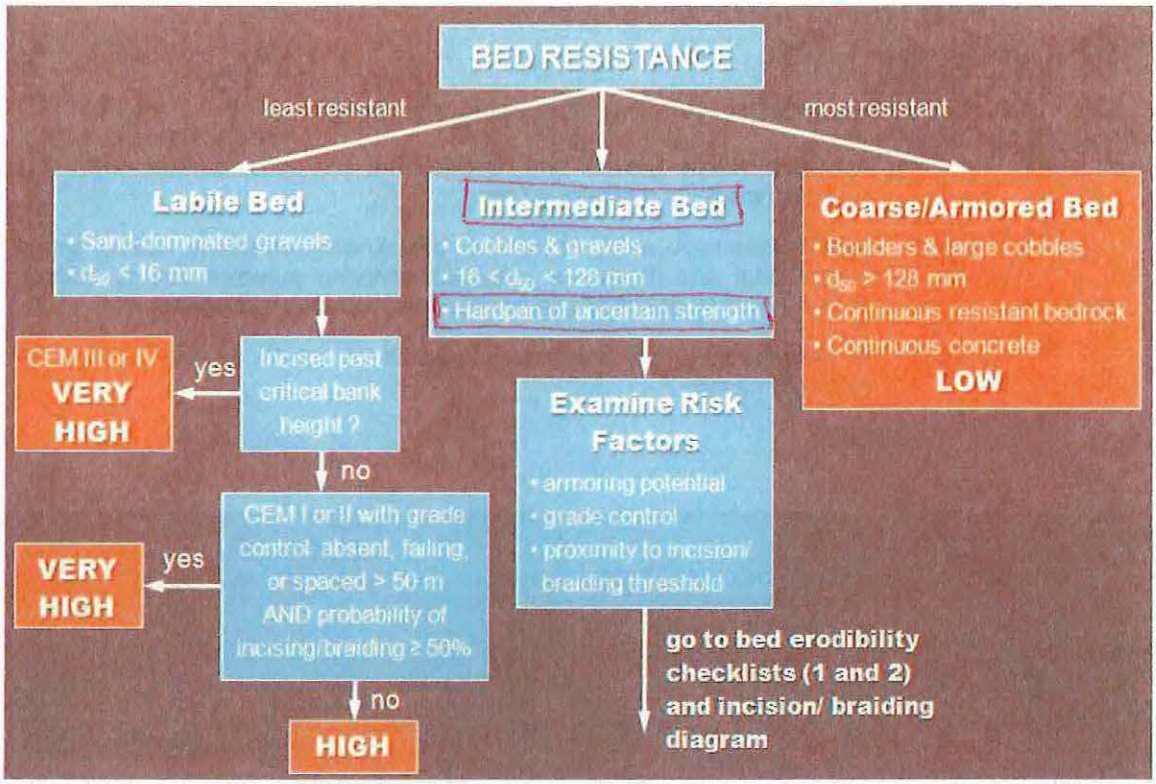


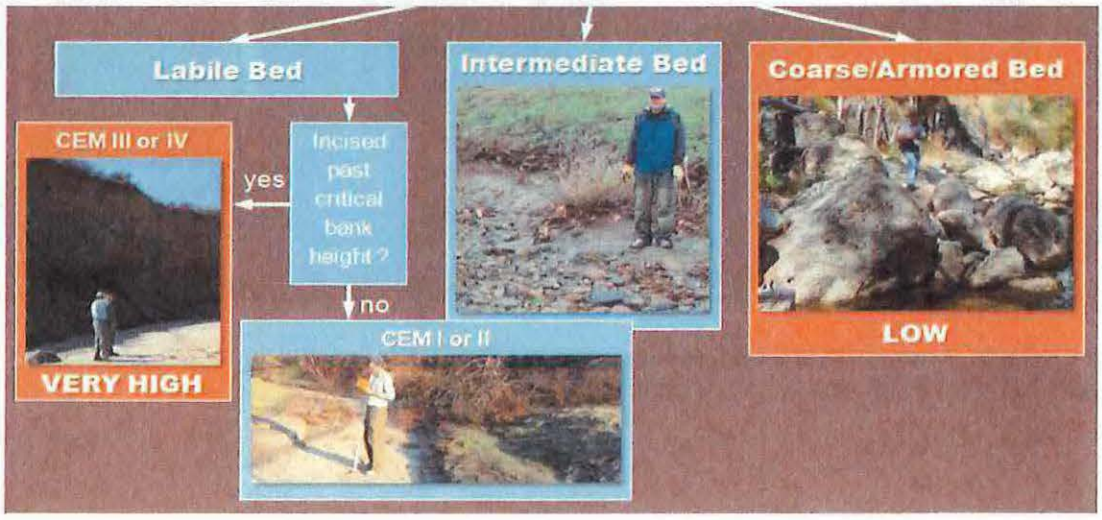
Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

REACHES: 9,10,11

FORM 3: VERTICAL SUSCEPTIBILITY FIELD SHEET

Circle appropriate nodes/pathway for proposed site.





Form 3 Figure 1. Vertical Susceptibility photographic supplement to be used in conjunction with Form 3 Bed Resistance above.

(Sheet 1 of 4)

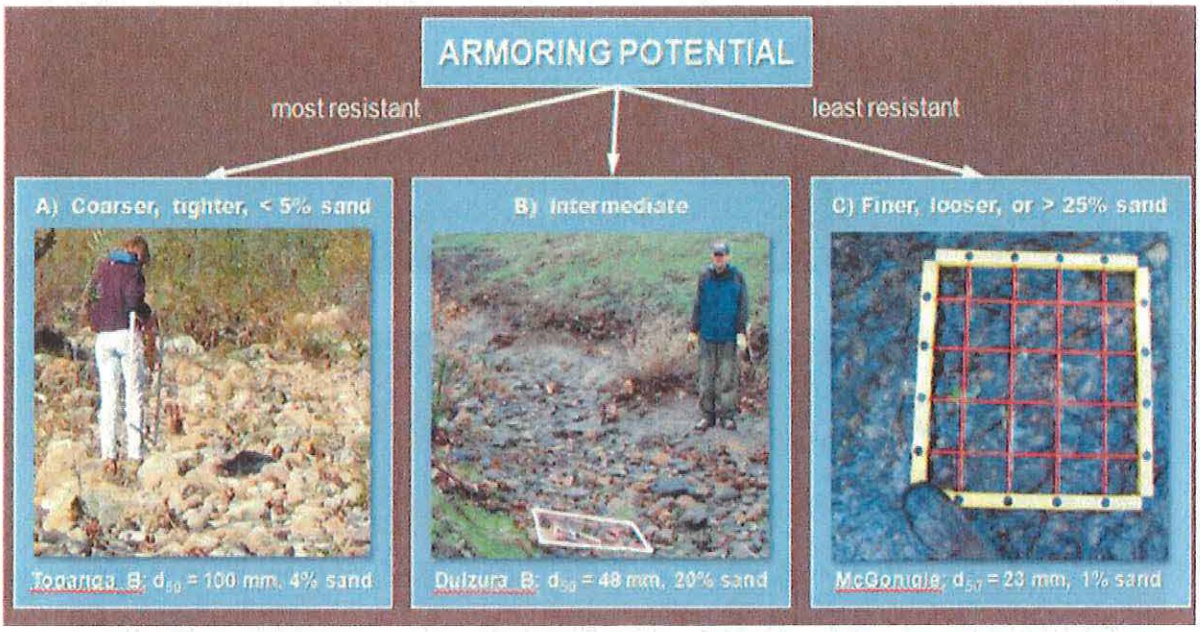
REACHES: 9, 10, 11

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☐	(B)	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 1.

REACHES: 9,10,11

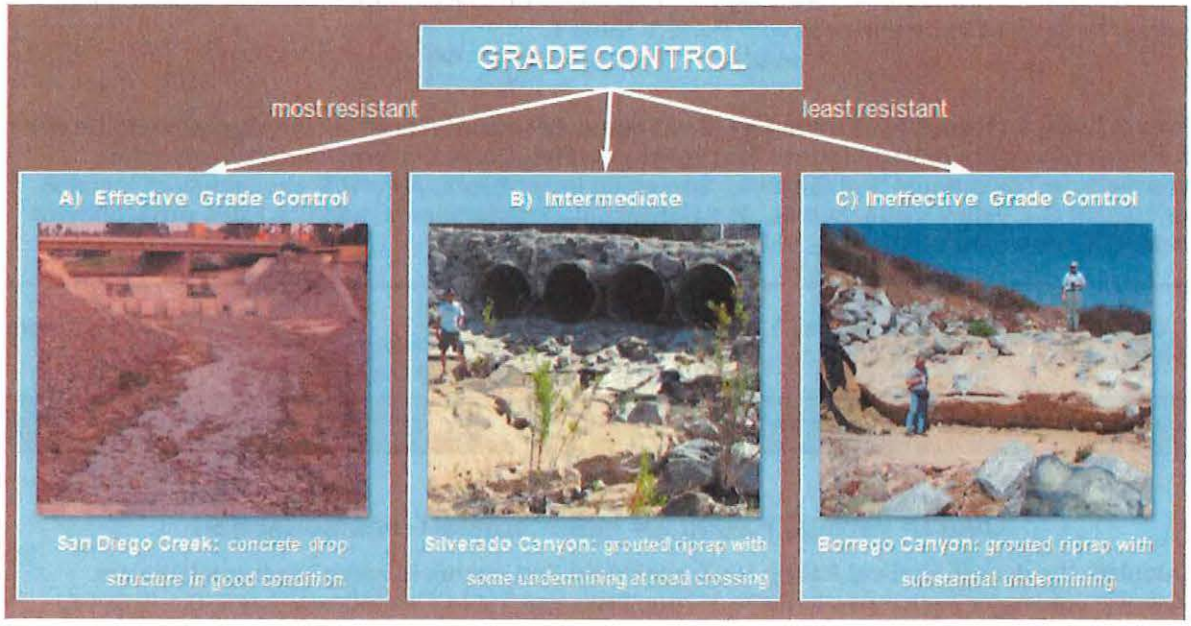
Form 3 Checklist 2: Grade Control

☐ (A) Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☐ B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness

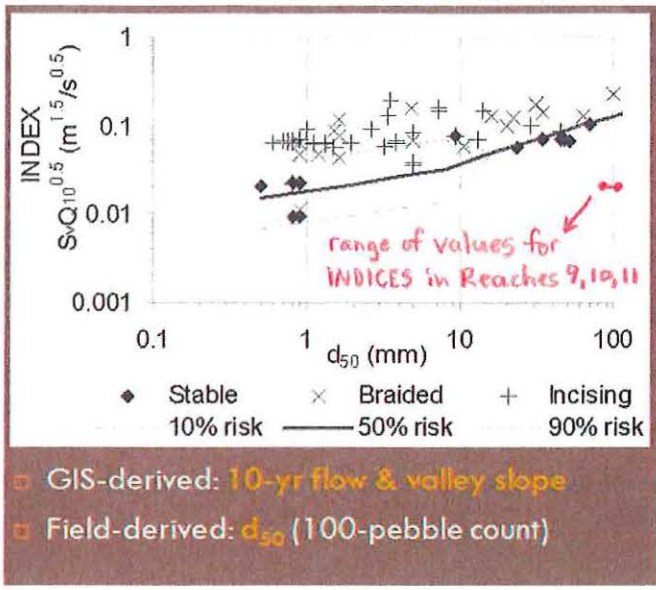


Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

REACHES: 9, 10, 11

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	130	0.146
	128	0.145
	96	0.125
	90	0.121
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

REACH	d50 (mm)	calc. INDEX
9	90-130	0.021
10	90-130	0.021
11	90-130	0.021

INDEX (low risk):

$\frac{0.146 + 0.121}{2} = 0.133$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

All calculated indexes smaller than average expected index for low risk.

SCORE = A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

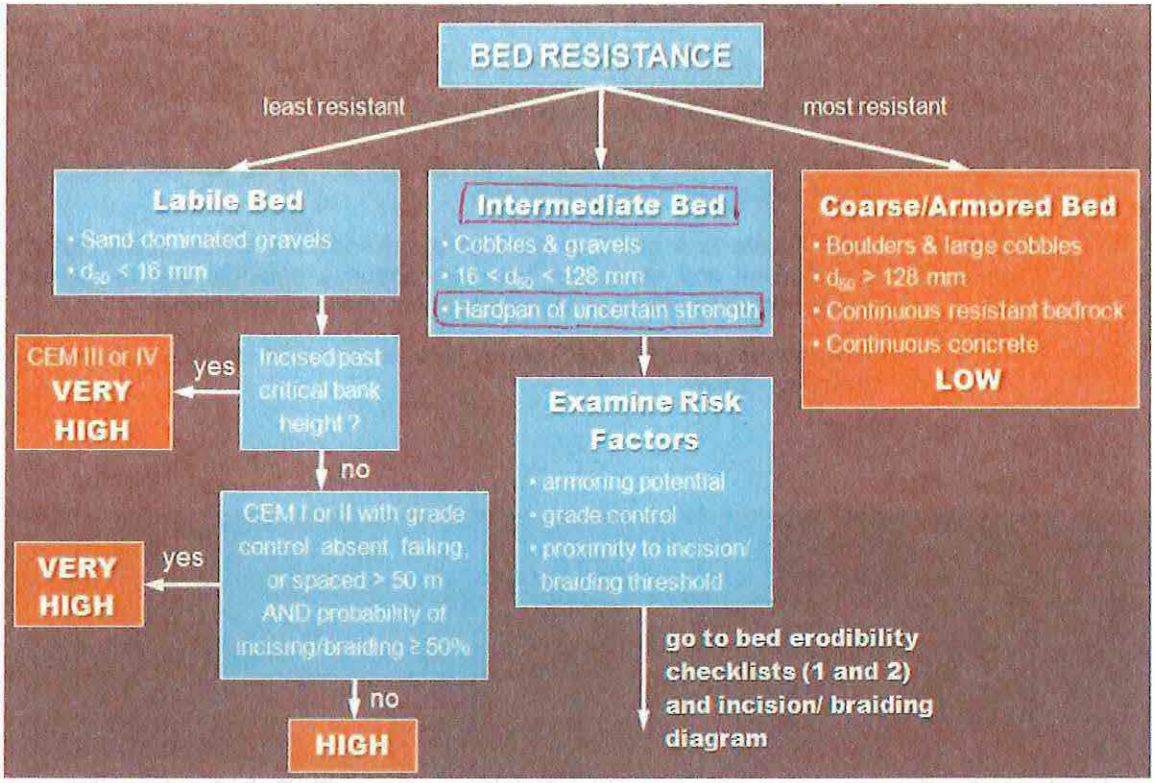
$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control) * screening\ index\ score\}}$$

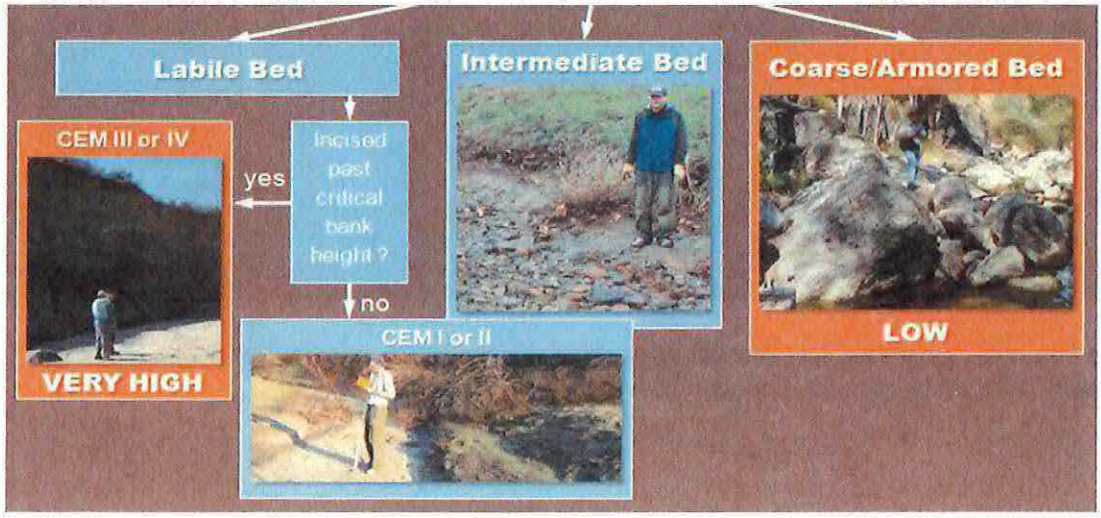
Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

REACHES: 12, 15, 16

FORM 3: VERTICAL SUSCEPTIBILITY FIELD SHEET

Circle appropriate nodes/pathway for proposed site.





Form 3 Figure 1. Vertical Susceptibility photographic supplement to be used in conjunction with Form 3 Bed Resistance above.

(Sheet 1 of 4)

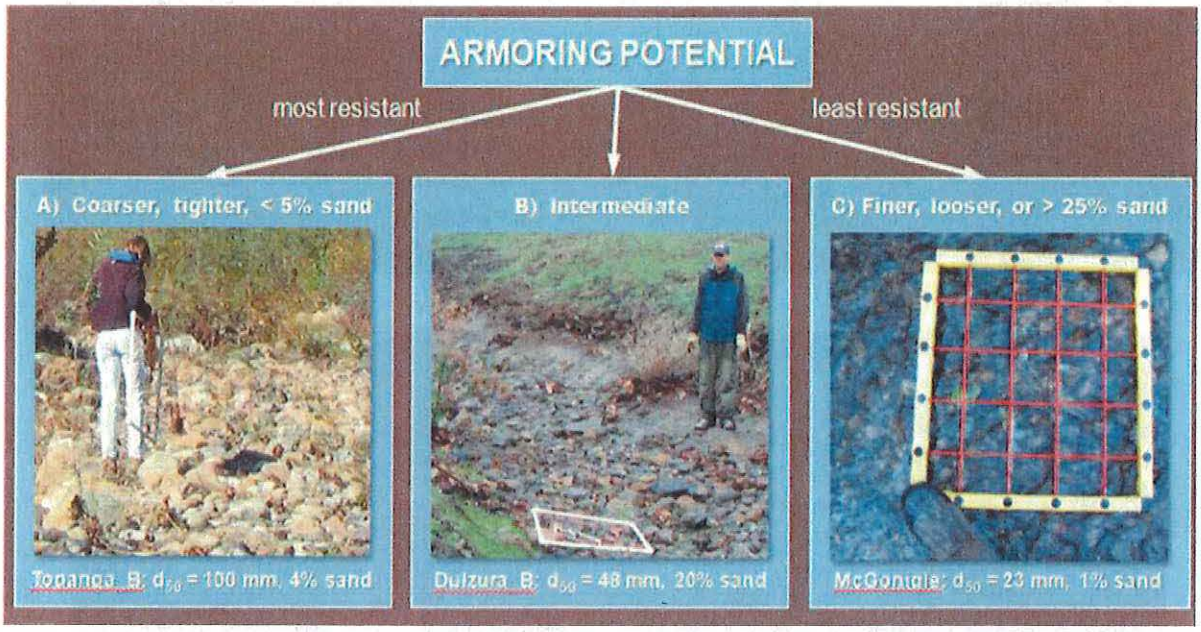
REACHES: 12, 15, 16

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☐	(B)	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in **conjunction with Form 3 Checklist 1.**

REACHES: 12, 15, 16

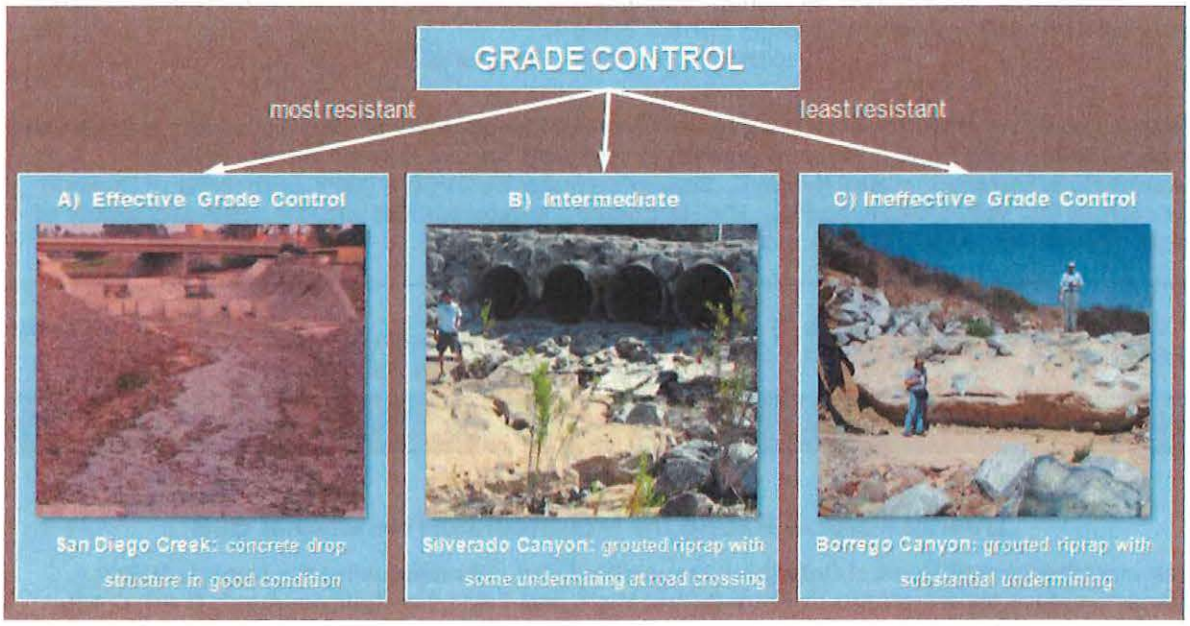
Form 3 Checklist 2: Grade Control

☐ (A) Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☐ B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness

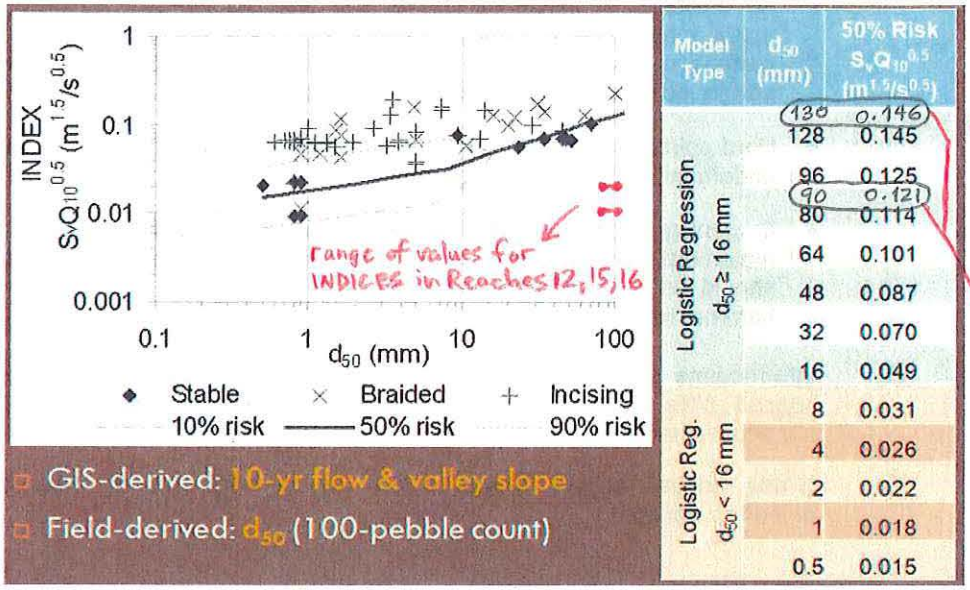


Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

REACHES: 12, 15, 16

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	130	0.146
	128	0.145
	96	0.125
	90	0.121
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

REACH	d50 (mm)	Calc. INDEX
12	90-130	0.022
15	90-130	0.022
16	90-130	0.011

INDEX:

$\frac{0.146 + 0.121}{2} = 0.133$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

All calculated indexes smaller than average expected index for low risk.

SCORE: A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

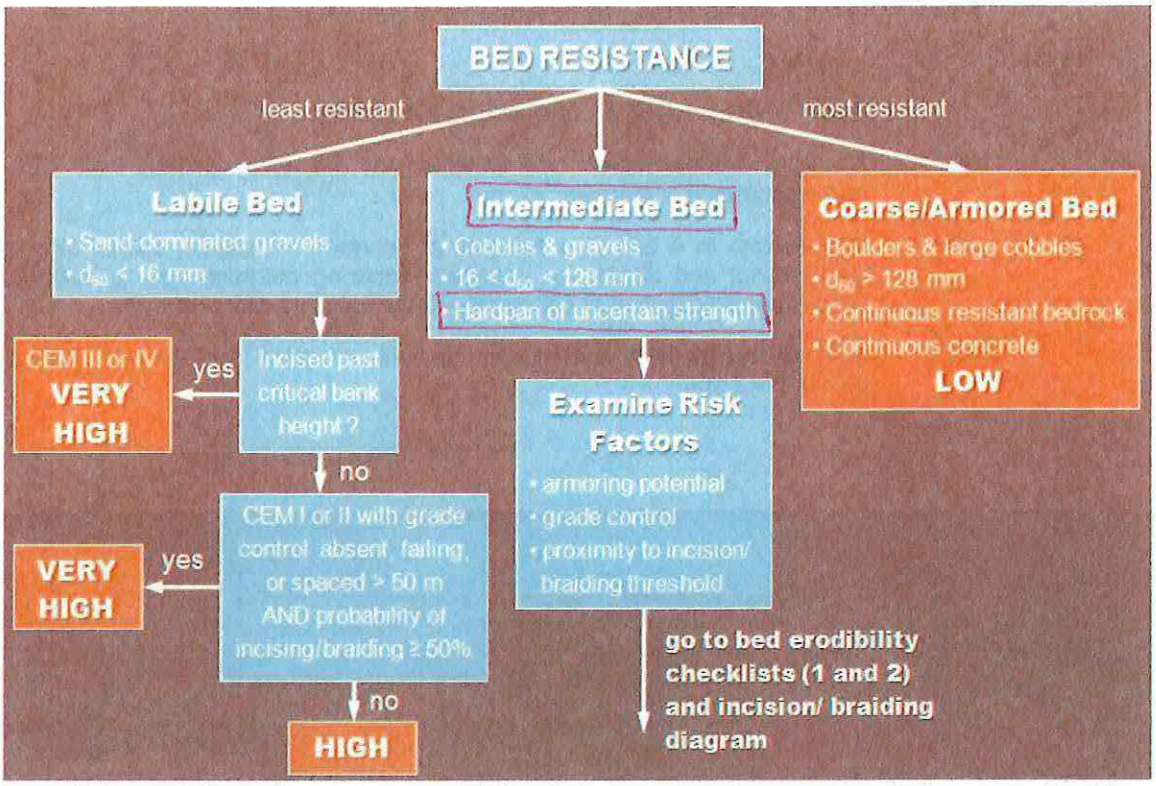
$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control) * screening\ index\ score\}}$$

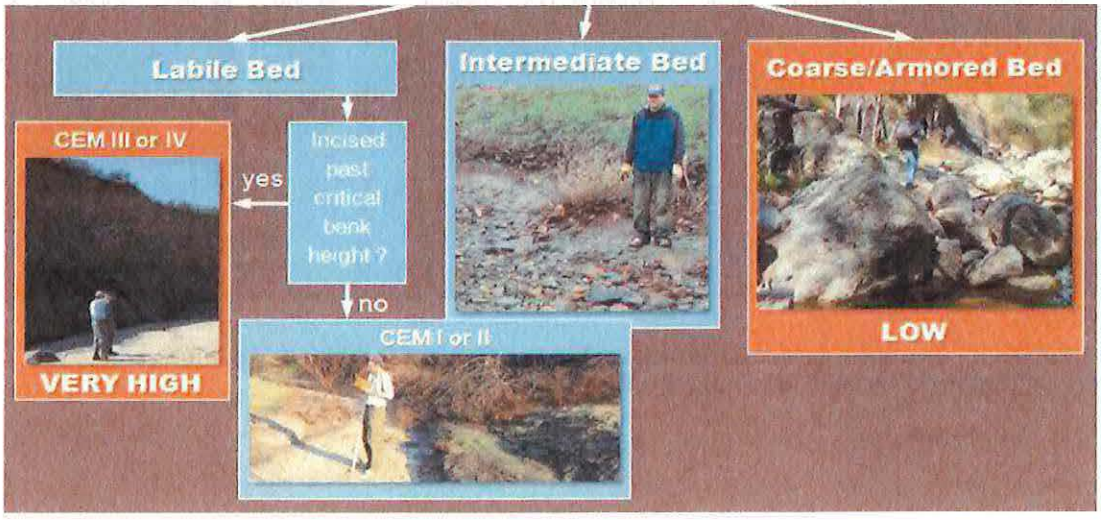
Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

REACHES: 17, 19, 20

FORM 3: VERTICAL SUSCEPTIBILITY FIELD SHEET

Circle appropriate nodes/pathway for proposed site.





Form 3 Figure 1. Vertical Susceptibility photographic supplement to be used in conjunction with Form 3 Bed Resistance above.

(Sheet 1 of 4)

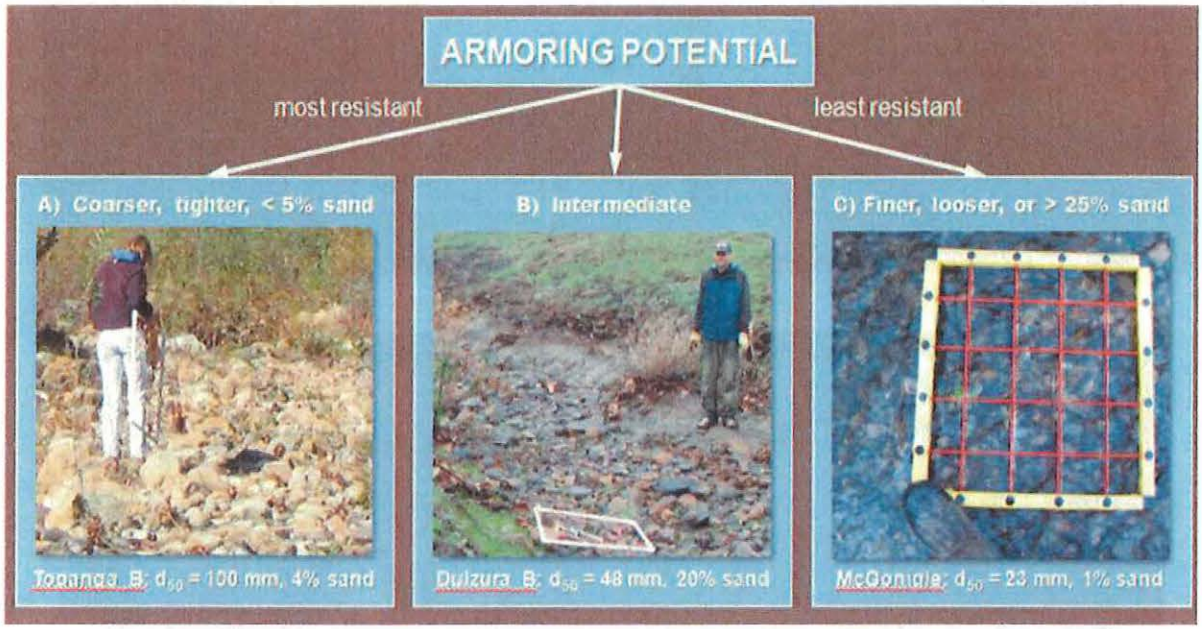
REACHES: 17, 19, 20

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☐	(B)	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 1.

REACHES: 17, 19, 20

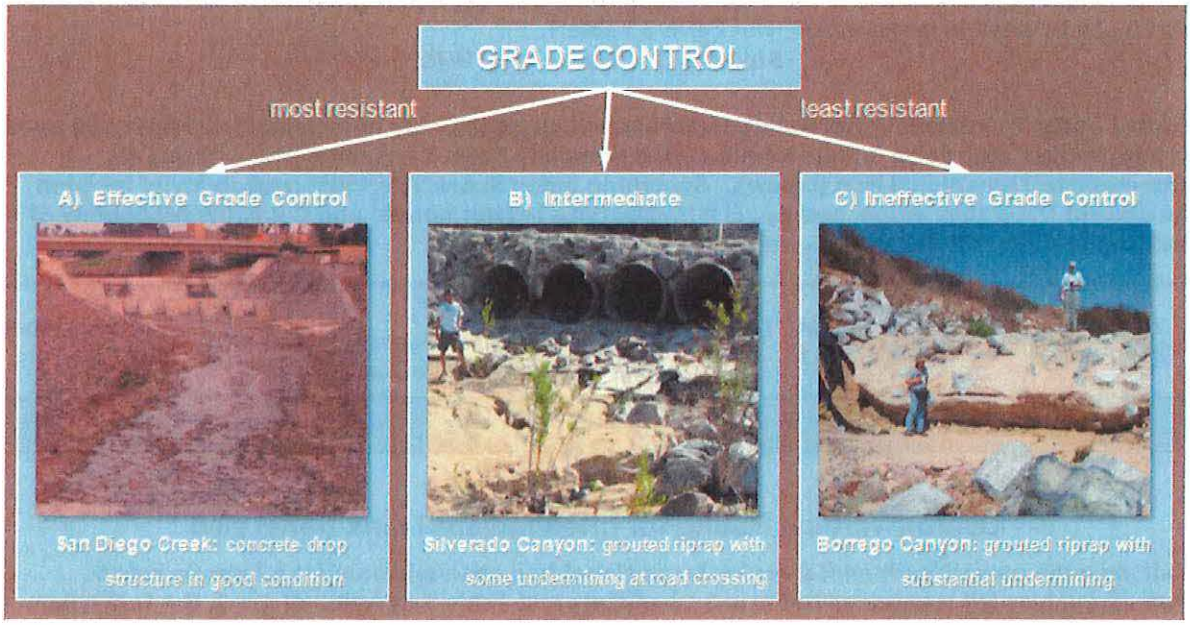
Form 3 Checklist 2: Grade Control

☐ (A) Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☐ B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness

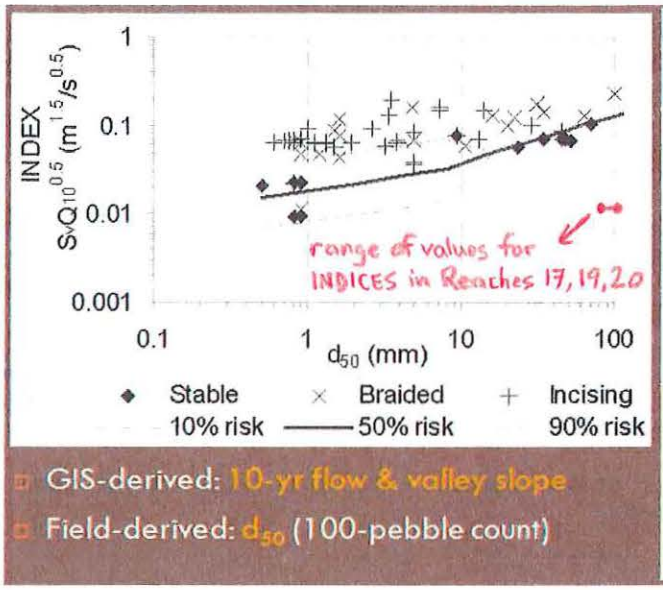


Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

REACHES: 17, 19, 20

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	130	0.146
	128	0.145
	96	0.125
	90	0.121
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

REACH	d50 (mm)	calculated INDEX
17	90-130	0.011
19	90-130	0.012
20	90-130	0.013

INDEX (low risk:)

$\frac{0.146 + 0.121}{2} = 0.133$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

All calculated indexes smaller than average expected index for low risk.
SCORE : A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

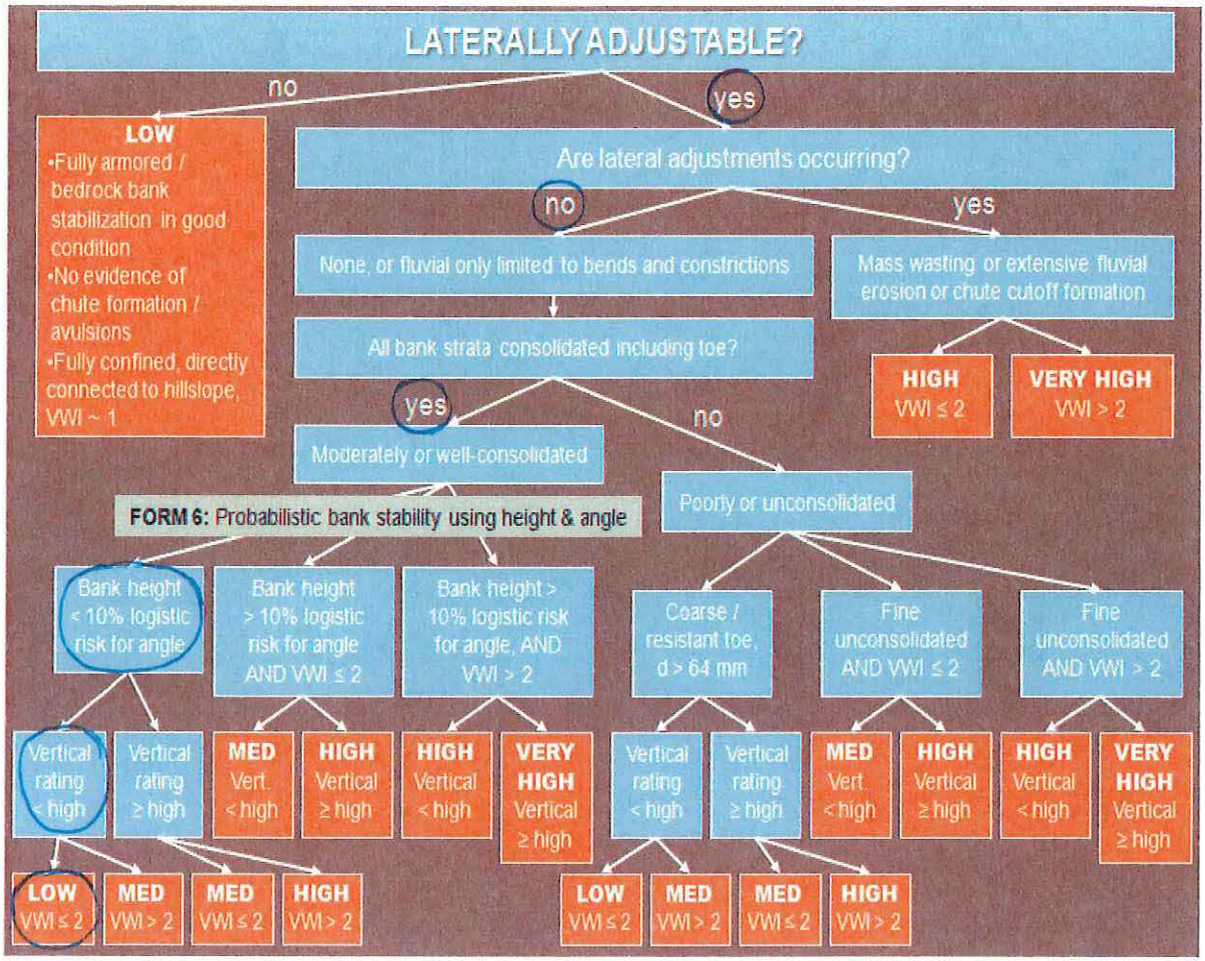
$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

APPENDIX 9: FORM 4: LATERAL SUSCEPTIBILITY FIELD SHEET

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.

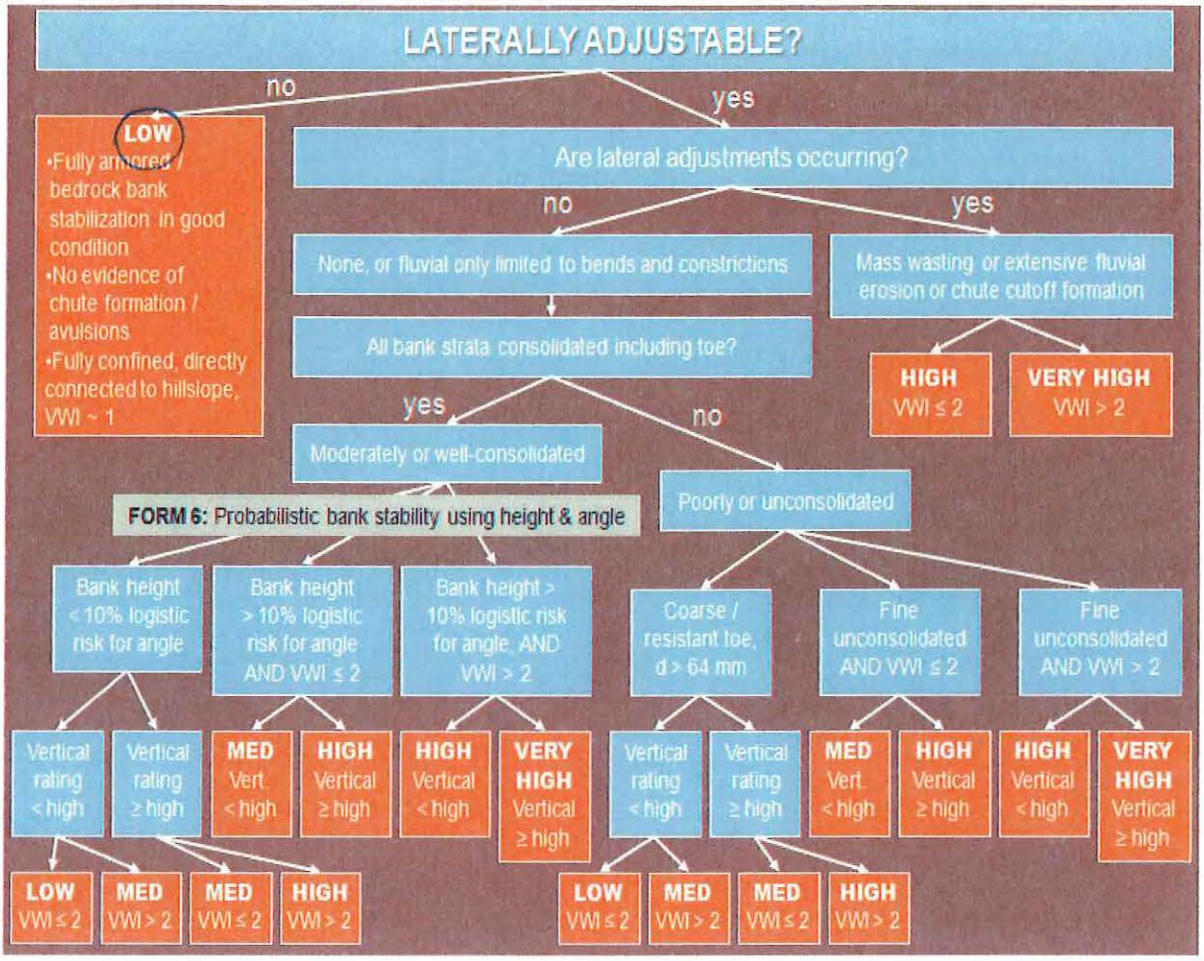


ALL REACHES: 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 15-17, 19, 20

(Sheet 1 of 1)

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



CONCRETE PIPE OR RIP-RAP REACHES:

1, 7, 13, 14, 18, 21

(Sheet 1 of 1)

APPENDIX 10: FORM 5: SEQUENCE OF LATERAL SUSCEPTIBILITY QUESTIONS OPTION

REACHES: 2-6; 8-12; 15-17; 19-20

FORM 5: SEQUENCE OF LATERAL SUSCEPTIBILITY QUESTIONS OPTION

Enter Lateral Susceptibility (Very High, High, Medium, Low) in shaded column.
Mass wasting and bank instability from Form 6, VWI from Form 4, and Vertical Rating from Form 3.

			Lateral Susceptibility
Channel fully confined with VWI ~1 – connected hillslopes OR fully-armored/engineered bed and banks in good condition?	If YES, then LOW		
If NO, Is there active **mass wasting** or extensive fluvial erosion (> 50% of bank length)?	If YES, VWI ≤ 2 = HIGH, VWI > 2 = VERY HIGH		
If NO, Are both banks consolidated?	If YES, How many risk factors present? **Risk Factors:** ○ Bank instability p > 10% ○ VWI > 2 ○ Vertical rating ≥ High	• All three = VERY HIGH • Two of three = HIGH • One of three = MEDIUM • None = LOW	LOW
If NO, Are banks either consolidated or unconsolidated with coarse toe of d > 64 mm?	If YES, How many risk factors present? **Risk Factors:** ○ VWI > 2 ○ Vertical rating ≥ High	• Two = HIGH • One = MEDIUM • None = LOW	
If NO, At least one bank is unconsolidated with toe of d < 64 mm	How many risk factors present? **Risk Factors:** ○ VWI > 2 ○ Vertical rating ≥ High	• Two = VERY HIGH • One = HIGH • None = MEDIUM	

(Sheet 1 of 1)

APPENDIX 11: FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

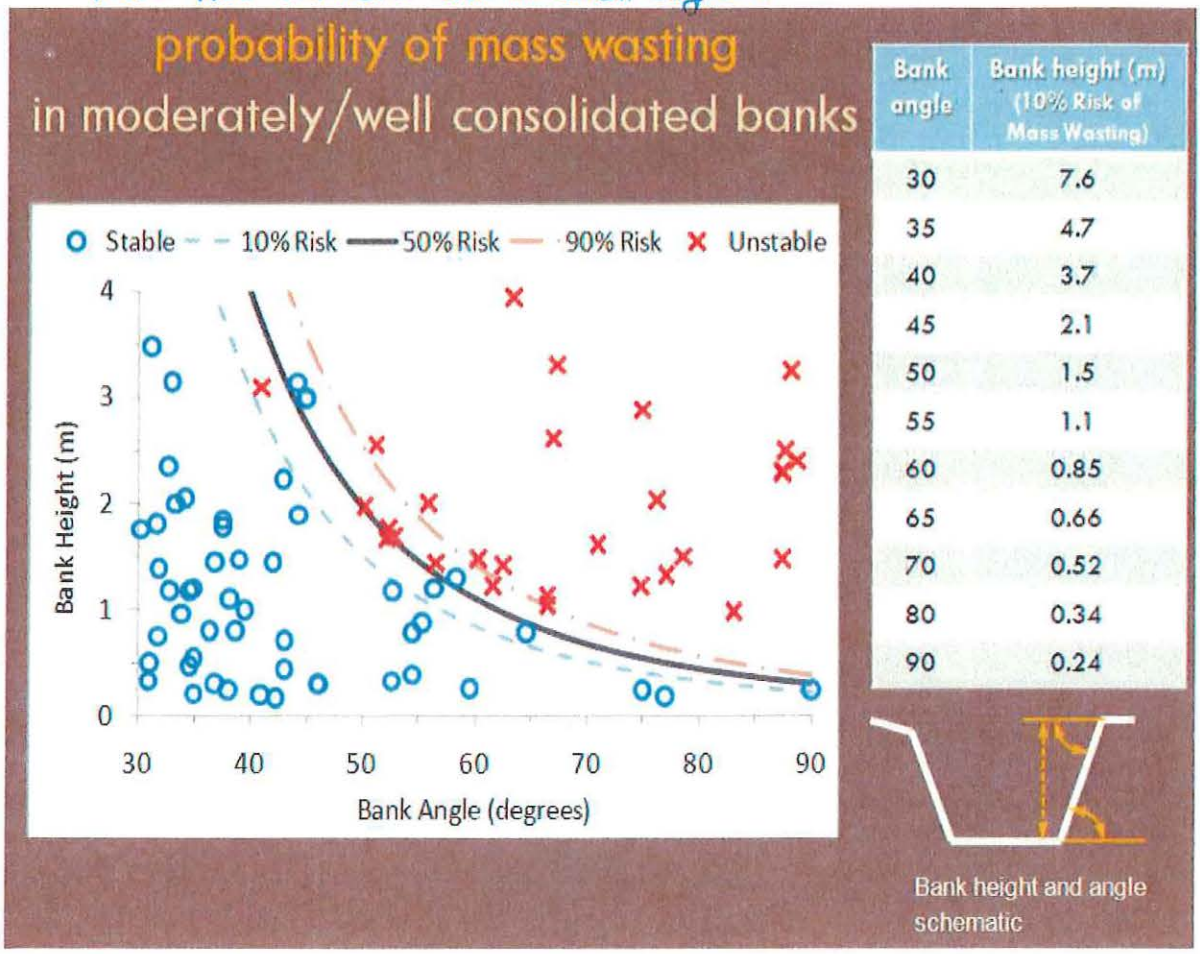
REACHES: 2-6, 8-12; 15;

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk) (>10% Risk)*
Left Bank	26.6	NR	>> 4m	<10% Risk
Right Bank	18.4	NR	>> 4m	<10% Risk

NR: Not relevant due to small angle.



Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

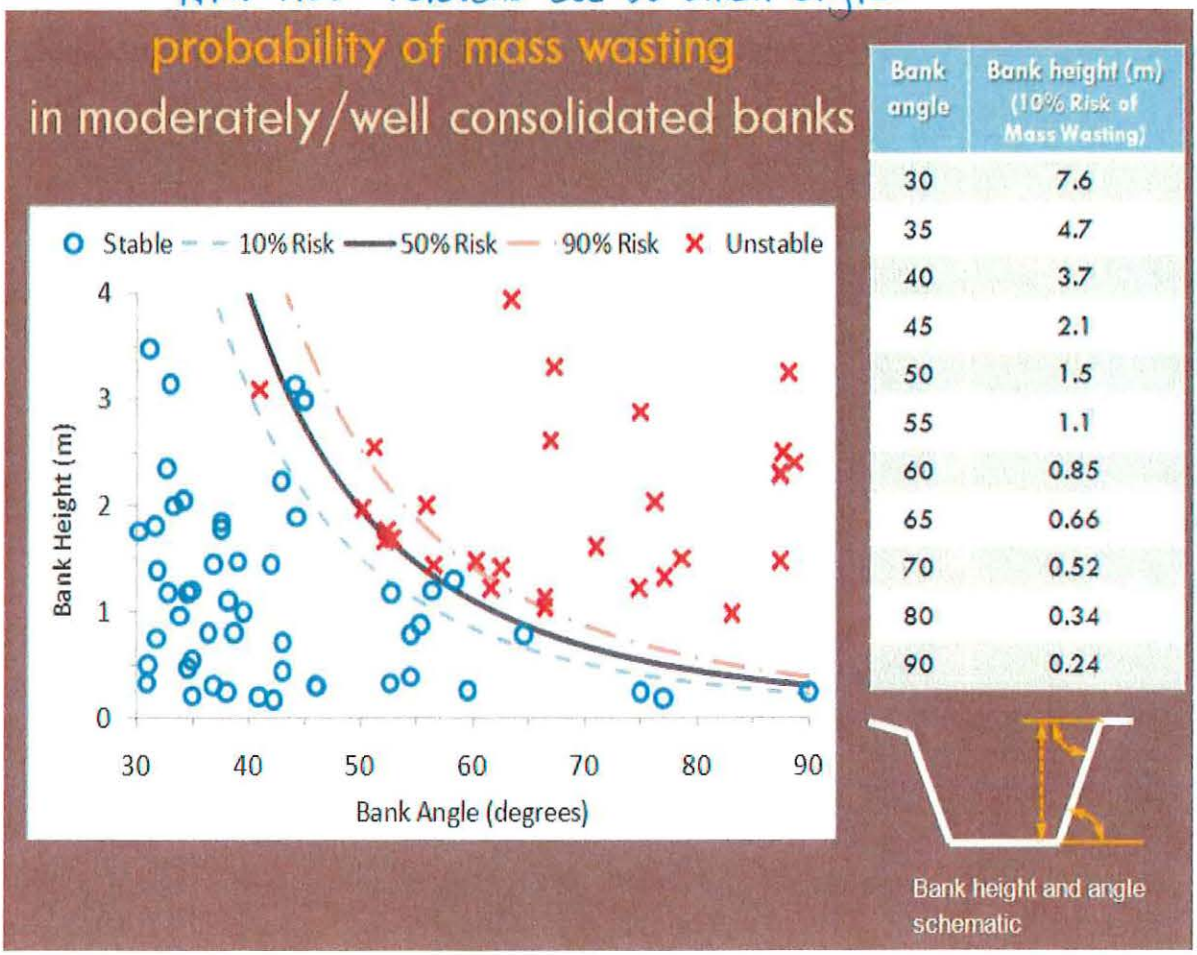
REACHES: 16, 17, 19, 20

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk) (>10% Risk)*
Left Bank	26.6	NR	>> 4m	< 10% Risk
Right Bank	26.6	NR	>> 4m	< 10% Risk

NR: Not relevant due to small angle.



Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

(Sheet 1 of 1)

APPENDIX 12: Example of the Approval of the Equivalent d_{50} Methodology by the SDRWQCB

(Available at http://www.ci.san-marcos.ca.us/Modules/ShowDocument.aspx?documentid=5531 **)**

California Regional Water Quality Control Board
San Diego Region

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Matthew Rodriquez
Secretary for
Environmental Protection

Edmund G. Brown Jr.
Governor

January 27, 2012

Certified Mail – Return Receipt Requested
Article Number: 7011 0470 0002 8961 5179

Mr. Jerry Backoff
Director of Planning
City of San Marcos
1 Civic Center Drive
San Marcos, CA 92069

In reply refer to:
711044: mporter

Dear Mr. Backoff:

SUBJECT: Clean Water Act Section 401 Water Quality Certification No. 11C-058 for the San Marcos Creek Specific Plan Project

Enclosed is the Clean Water Act Section 401 Water Quality Certification for discharges to waters of the U.S. and acknowledgment of enrollment under State Water Resources Control Board Order No. 2003-017-DWQ for the San Marcos Creek Specific Plan Project (project). A description of the project and project location can be found in the project information sheet, location map, and site maps which are included as Attachments 1 through 6.

Any petition for reconsideration of this Certification must be filed with the State Water Resources Control Board within 30 days of certification action (23 CCR § 3867). If no petition is received, it will be assumed that you have accepted and will comply with all the conditions of this Certification.

Failure to comply with all conditions of this Certification may subject the City of San Marcos to enforcement actions by the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board), including administrative enforcement orders requiring you to cease and desist from violations, or to clean up waste and abate existing or threatened conditions of pollution or nuisance; administrative civil liability in amounts of up to $10,000 per day per violation; referral to the State Attorney General for injunctive relief; and, referral to the District Attorney for criminal prosecution.

In the subject line of any response, please include the requested "**In reply refer to:**" information located in the heading of this letter. For questions pertaining to the subject matter, please contact Mike Porter at 858-467-2726 or mporter@waterboards.ca.gov.

Respectfully,

DAVID W. GIBSON
Executive Officer

Enclosures:

Clean Water Act Section 401 Water Quality Certification No. 11C-053 for San Marcos Creek Specific Plan, with six attachments.

E-copies: Refer to Attachment 2 of Certification 11C-053 for the Distribution List.

Tech Staff Info & Use	
File No.	11C-053
WDID	9000002309
Reg. Measure ID	380177
Place ID	711044
Party ID	11161
Person ID	10891

California Regional Water Quality Control Board
San Diego Region

Matthew Rodriquez
Secretary for
Environmental Protection

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Edmund G. Brown Jr.
Governor

Action on Request
for
Clean Water Act Section 401 Water Quality Certification
and
Waste Discharge Requirements
for
Discharge of Dredged and/or Fill Materials

PROJECT: San Marcos Creek Specific Plan
Water Quality Certification No. 11C-053

APPLICANT: Mr. Jerry Backoff
Director of Planning
City of San Marcos
1 Civic Center Drive
San Marcos, CA 92069

WDID	9000002309
Reg. Meas.	380177
Place	711044
Party	11161
Person	108191

ACTION:

☐ Order for Low Impact Certification	☐ Order for Denial of Certification
☑ Order for Technically-conditioned, Programmatic Certification	☐ Waiver of Waste Discharge Requirements
☑ Enrollment in SWRCB GWDR Order No. 2003-017 DWQ	☐ Enrollment in Isolated Waters Order No. 2004-004 DWQ

PROJECT DESCRIPTION:

The San Marcos Creek Specific Plan is a community planning effort designed to provide the necessary framework to create mixed-use/smart-growth zoning, flood control to surrounding properties, and to facilitate urban infill by re-evaluating land uses and establishing a Specific Plan for development regulation within the project area over an estimated 20-year time period. The project area consists of approximately 217 acres of land for which mixed use, park land, right-of-way, and dedicated open space are proposed.

APPENDIX A

SCCWRP INITIAL DESKTOP ANALYSIS

INTRODUCTION

This report provides hydromodification screening analyses for the San Marcos Specific Plan project. The project has been divided into seven drainage subareas north of the creek and one subarea south of the creek (see Figure 1). Each subarea will contain a flow (and treatment) control facility and be served by a storm drain system that discharges into San Marcos Creek. The flow control facility sizing is dependent on the flow threshold in the receiving waterbody.

The County of San Diego's January 13, 2011, *Final Hydromodification Management Plan* (HMP) outlines low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low), $0.3Q_2$ (medium), or $0.5Q_2$ (high). A threshold of $0.1Q_2$ represents a downstream receiving conveyance system with a high susceptibility to erosion. This is the default value used for hydromodification analyses and will result in the most conservative (greatest) on-site facility sizing. A threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low susceptibility threshold, a project must perform a channel screening analysis based on a "hydromodification screening tool" procedure developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's BMP Sizing Calculator to establish the appropriate susceptibility threshold of low, medium, or high.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. The screening was performed to assess San Marcos Creek near the Specific Plan project, which extends from Discovery Street on the downstream end to Grand Avenue on the upstream end.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the required study area. The County of San Diego's HMP specifies the downstream domain of analysis based on the SCCWRP criteria with some refinements. The HMP indicates that the downstream limit is defined when one of these is reached:

- at least one reach downstream of the first grade control point
- tidal backwater/lentic waterbody
- equal order tributary

- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.)

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area should be subdivided into smaller reaches for analysis.

Downstream Domain of Analysis

The downstream domain of analysis for the study area has been determined using the bullet items above. The downstream-most discharge location from the project will be just upstream of the Discovery Street crossing of San Marcos Creek. The first permanent grade control below this discharge location is the Lake San Marcos dam, which is approximately 1.6 miles downstream of the Discovery Street crossing. The Lake San Marcos dam is a concrete arch dam, so it will act as a permanent grade control along San Marcos Creek.

The nearest lentic waterbody is Lake San Marcos. The upper (northerly) end of Lake San Marcos begins approximately 1,900 feet downstream of the Discovery Street crossing. Lake San Marcos then extends for another 1.3 miles to the dam.

The equal order tributary or accumulation of 50 percent drainage area will be significantly further downstream than Lake San Marcos or its dam because the watershed area tributary to the study reach covers over 20 square miles (see discussion in Initial Desktop Analysis section below). The urban conveyance system does not apply since San Marcos Creek is primarily a natural conveyance system.

Based on this information, the downstream domain of analysis is defined by the upper end of Lake San Marcos. This lentic waterbody is the closer to the project site than the other downstream domain of analysis locations.

Upstream Domain of Analysis

Echo Lane crosses San Marcos Creek approximately 900 feet upstream of the upstream project limit at Grand Avenue. The roadway is at the elevation of the creek bed and contains a culvert along the thalweg. The culvert can convey low flow, but during moderate to high storm events the creek flow will overtop the roadway. Since Echo Lane is a non-erodible asphalt crossing spanning the entire creek width, it functions as a grade control and is the first grade control point upstream of the project. Echo Lane is further upstream than the 200 meter limit, but was selected as the upstream domain of analysis because it is a well-defined grade control.

Study Reaches within Domain of Analysis

The domain of analysis along San Marcos Creek extends from the upper end of Lake San Marcos to Echo Lane. The domain of analysis was subdivided into four study reaches with similar characteristics (see the Study Area Exhibit in Appendix A). Reach 1 extends from the upper end of Lake San Marcos to the confluence of San Marcos Creek with Las Posas Creek. The reach length along the creek thalweg is approximately 2,550 feet. Reach 2 extends from the Las Posas Creek confluence to a point nearly 2,350 feet upstream along the thalweg. Reach 3 extends from the upper end of Reach 2 approximately 3,890 feet along the creek thalweg to South Bent Avenue. Reach 4 extends approximately 2,130 feet along the thalweg from South Bent Avenue to Echo Lane.

Reaches 1, 2, 3, and 4 are longer than the 656 feet maximum reach length specified by SCCWRP. The four reach locations were selected based on consistency within each reach. Review of topographic mapping, aerial photographs, and field conditions reveals that the physical (channel geometry and slope), vegetative, hydraulic, and soil conditions within each of these reaches is relatively uniform. Subdividing the reaches into smaller subreaches of less than 656 feet will not yield significantly varying results within a reach. Consequently, the screening tool was applied across Reach 1, 2, 3, and 4, and the results will be the same within each reach.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an "initial desktop analysis" that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1 included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed area, valley slope, and valley width. A review of the NED for San Marcos determined that it is equivalent to USGS quadrangle maps. The topographic resolution on USGS maps is low and typically on a 25-foot contour interval. For this report, recent topographic mapping along San Marcos Creek was used to establish the valley slope and valley width because the topography is at a 1-foot contour interval, which is much greater detail than NED. The 1-foot contour mapping did not cover the area near Lake San Marcos or the south creek bank between South Bent Avenue and Echo Lane. For these areas, the City of San Marcos' 2-foot contour topographic mapping was used.

The watershed area tributary to San Marcos Creek was established in the March 27, 1991, *San Marcos Creek Flood Control Improvement Project – Design Development Study,* by Willdan Associates. This report contains hydrologic analyses that determined the San Marcos Creek watershed area upstream of the Discovery Street bridge to be 17,003 acres (26.57 square miles). This area was used for Reach 1. The watershed area upstream of the Las Posas Creek confluence was determined to 13,427 acres (20.98 square miles). This area was used for Reach 2 through 4. A summary table from the report identifying the watershed areas is included in Appendix A.

The mean annual precipitation is provided by the County of San Diego's BMP Sizing Calculator (see Appendix A) and is 13.3 inches. The valley slope of Reach 1 through 4 was determined from the 1-foot contour interval topographic mapping in the Study Area Exhibit in Appendix A. This is the longitudinal slope measured along the thalweg. The valley width was estimated from

the topographic mapping. This is the valley bottom width defined by clear breaks in the surface slope on the topographic mapping. The valley slope and valley width at each reach is summarized in Table 1.

Reach	Valley Slope, m/m	Valley Width, m
1	0.0033	30
2	0.0049	40
3	0.0042	52
4	0.0038	79

Table 1. Summary of Valley Slope and Width

These values were input to a spreadsheet to calculate the simulated peak flow, screening index, and valley width index outlined in Form 1. The input data and results are included in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is done, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., d_{50} < 16 mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Visual observation reveals that each study reach contains a densely vegetated, natural watercourse (see Figures 2 to 16). The vegetative cover extends across the creek bottoms and sides. The cover was so dense that most areas were difficult to access by foot, and some areas were only possible to access if the vegetation was trimmed. Due to the dense cover and flat valley slopes calculated through Form 1, the vertical and lateral stability was anticipated to have a limited susceptibility to erosion.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 20. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.

2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.

3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Channel bed resistance is a function of the bed material and vegetation. Figures 17 through 19 show photographs of the larger bed material in the study reaches. A gravelometer is included in the photographs for reference. Each square on the gravelometer indicates grain size in millimeters (the gravelometer squares range from 2 to 180 millimeters). The larger material in the figures was discovered in some isolated locations and generally ranges from 16 to 32 millimeters (mm). The channel bed material in the reaches is generally of smaller size.

Figures 2 through 16 show dense vegetation throughout Reaches 1 through 4. Vegetation prevents bed incision because its root structure binds soil and because the aboveground vegetative growth can greatly reduce flow velocities. Table 5-13 from the County of San Diego's *Drainage Design Manual* outlines maximum permissible velocities for various channel linings (Table 5-13 is included in Appendix B). Maximum permissible velocity is defined in the manual as the velocity below which a channel section will remain stable. Table 5-13 indicates that a fully-lined channel with unreinforced vegetation has a maximum permissible velocity of 5 feet per second (fps). Due to the dense cover and large vegetation, the permissible velocity is likely greater than 5 fps in most reach areas. Table 5-13 indicates that 5 fps is equivalent to an unvegetated channel containing cobbles (grain size from 64 to 256 mm) and shingles (rounded cobbles). In comparison, coarse gravel (19 to 75 mm) has a maximum permissible velocity of 4 fps. Based on this information, the heavily vegetated San Marcos Creek channel has an equivalent grain size of at least 64 mm.

Vegetation in a watercourse can be dynamic, i.e., the vegetation size and density can change over time. An increase in vegetation will further reduce the potential for vertical incision, while a decrease can allow greater incision. A primary cause for a reduction in vegetation is removal due to hydraulic forces and shear stress during periods of high flow. Detailed hydraulic analyses of San Marcos Creek along Reaches 1 through 4 show that the flow velocities are primarily non-erosive within the range of hydromodification flows. Therefore, the vegetative condition will not be adversely impacted by these flows. A review of historic aerial photos covering nearly the past 20 years indicates that the vegetative growth has tended to increase over time.

Based on the photographs and site investigation, the bed resistance is within the transitional/intermediate bed category. Dr. Eric Stein from SCCWRP, who co-authored the *Hydromodification Screening Tool* in the *Final Hydromodification Management Plan* (HMP),

indicated that a transitional/intermediate bed requires the most rigorous analysis steps and will generate appropriate results for the size range. Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The channel bed along each of the four reaches is within category B, which represents intermediate bed material within unknown armoring potential due to a surface veneer and dense vegetation. The soil was probed and penetration was relatively difficult through the underlying layer. Due to the dense vegetative growth, the armoring potential could have been rated higher, but Category B was conservatively (i.e., more potential for channel incision) chosen.

Checklist 2 determines grade control characteristics of the channel bed. Grade controls can be improvements such as the roadway crossings at Via Vera Cruz, South Bent Avenue, and Echo Lane. Each of these crossings consists of a non-erodible surface in a well-maintained condition as well as culverts, which together prevent degradation of the upstream channel bed. This combined with the relatively flat valley slope means that each grade control's influence will extend over a large upstream distance. SCCWRP also states that grade controls can be natural. Examples are vegetation or confluences with a larger waterbody such as Lake San Marcos. As indicated above and verified with photographs, each reach contains dense vegetation (see Figures 2 through 16). The plant roots and fallen tree trunks serve as a natural grade control. The spacing of these is much closer than the 50 meters identified in the checklist. Further evidence of the effectiveness of the natural grade controls is the absence of headcutting, mass wasting (large vertical erosion of a channel bank), or undercutting of existing drainage facilities. Based on this information, each reach is within Category A on Checklist 2.

The Mobility Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the Screening Index determined in the initial desktop analysis (see Appendix A). d_{50} is derived from field conditions. As discussed above, the gravelometer revealed particles at 16 mm and greater, while the equivalent grain size

for the densely vegetated channel is at least 64 mm. The Screening Index for each reach calculated in Appendix A varies from 0.0089 to 0.0274. The Mobility Index Threshold diagram shows that the 50 percent probability of incising or braiding for a d_{50} of 16 and 64 mm has indexes of 0.049 and 0.101, respectively. Since the Screening Index values for each reach are less than these values, each reach falls well within Category A.

The overall vertical rating is determined from the Checklist 1, Checklist 2, and Mobility Index Threshold results. The scoring is based on the following values:

Category A = -1, Category B = 0, Category C = 1

The vertical rating score is the sum of the armoring potential score, grade control score, and Mobility Index Threshold score (0 + -1 + -1 = -2). The combined score of -2 is considered a low threshold for vertical susceptibility.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 21) is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial avulsions such as chute cutoffs and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within any of the reaches. The banks are intact in the photographs included in the figures. The dense vegetation supports the absence of large lateral adjustments.

The next step is to assess the consolidation of the bank material. The banks were moderate to well-consolidated. This determination was made because the banks were difficult to penetrate with a probe. In addition, the banks showed limited evidence of crumbling and were composed of tightly-packed particles (see figures).

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. The 1- and 2-foot contour interval topographic mapping indicates that the maximum bank angle is 2 to 1

(horizontal to vertical) or 26.6 degrees in any of the reaches. The majority of the banks are flatter than this. Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 26.6 degree bank angle or less regardless of the bank height.

The final step is based on the braiding risk determined from the Mobility Index Threshold in the vertical rating. The braiding risk for each reach is less than 50 percent per the Vertical Stability analysis above. From this, the lateral susceptibility rating is low (red circles are included on the Form 4 Decision Tree in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for the San Marcos Creek Specific Plan project. The project will discharge into San Marcos Creek at several locations between Discovery Street and Grand Avenue. The assessment was made for San Marcos Creek from the upper end of Lake San Marcos to Echo Lane. The assessment was performed based on office analyses and field work. The results indicate a low threshold for vertical and lateral susceptibilities in all four reaches.

The HMP requires that these results be compared with the critical stress calculator results incorporated in the County of San Diego's BMP Sizing Calculator. The BMP Sizing Calculator results for a typical creek section returns a low susceptibility. Therefore, the SCCWRP analyses and critical stress calculator demonstrate that the project can be designed assuming a low susceptibility, i.e., $0.5Q_2$.

The SCCWRP results are consistent with the physical condition of San Marcos Creek, which has a low longitudinal slope, supports dense vegetative growth, and contains a series of grade controls. The growth is so dense that travel by foot was very difficult in most areas. None of the four study reaches exhibits signs of extensive, ongoing erosion.

APPENDIX 13: RESPONSE TO RICK ENGINEERING COMMENTS

PLAN CHECK COMMENTS AND RESPONSES – SUSCEPTIBILITY ANALYSIS

1. Page 1, paragraph 1 states: "The length of analysis is considerable enough to include multiple grade controls to satisfy domain of analysis criteria as established in the HMP methodology." This statement should be clarified because as a stand-alone report, this document does not provide project information for any specific project that is subject to Final HMP requirements and would have a domain of analysis. Therefore domain of analysis was not reviewed as part of this document. This document is applicable to a length of Poggi Creek (defined in the document). Whether it covers the domain of analysis for any specific project will be determined upon review of that project.

Response:

Paragraph 1 will be changed to read: "The length of analysis is considerable enough to include multiple grade controls. Depending on the discharge point of the specific project studied, it may occur that the length analyzed will satisfy domain of analysis criteria as established in the HMP methodology. As a matter of fact, the length analyzed for Poggi Creek in this document is large enough to satisfy domain of analysis criteria for the following projects (refer to the Exemption Document of each project): Expansion of Neighborhood R-8A, Otay Ranch Village 2; Re-Entitlement of Neighborhoods R-6, R-8A, R-8B, & R-9A, Otay Ranch Village 2 North Project; and Otay Ranch Village 2 West. This study could be used for other projects as well, but the assurance that the length established here is enough to satisfy domain of analysis for a given project must be established by the proponent of such project".

The Susceptibility Analysis document is not in itself an infill exemption; rather, it is a document used for different projects to get an infill exemption, or to demonstrate a low-susceptibility to erosion and the use of a 50% Q_2 low threshold. It is not the intention of the document to provide a low susceptibility response for all projects draining to Poggi Creek upstream of the Poggi Creek Basin, but it is the intent of the document to provide a length large enough for the projects TRWE is trying to exempt.

Action:

Change the wording of paragraph 1.

2. Sections 1.1 and 1.2 of the document provide information describing a field visit, an estimation of flow occurring in Poggi Creek at the time of the visit, and a finding that "there is physical and photographic evidence...that the occurrence of a peak flow larger than the 2-year peak flow does not cause erosion in the analyzed reaches of Poggi Creek". The documentation provided is not sufficient to verify the flow rate or the finding of no erosion. These sections should be removed from the document because the information could not be verified and is not necessary for the susceptibility analysis.

Response:

TRWE disagrees with Rick Engineering regarding the recommendation of removal of sections 1.1 and 1.2. Although those sections are not part of the SCCWRP Methodology, they provide additional physical proof that the consideration of Poggi Creek as a low susceptibility creek to erosion has been observed in the field.

TRWE believes that the documentation provided is sufficient to verify the flow rate or the finding of erosion. Regarding the flow rate, the analytical methodology has been explained in Section 1.1 (flow is the product of surface velocity, flow area and a correction factor associated with the logarithmic velocity profile expected in a turbulent flow). TRWE will add a table indicating the surface velocity, width and depth measurements and an additional explanation of the method to obtain such measurements. Regarding erosion, the last paragraph of Section 1.2 states that " ...the occurrence of a peak flow larger than the 2-year peak flow does not cause erosion in the analyzed reaches of Poggi Creek, as there was no visual indication of sediment transport, bank erosion, floating vegetation or any other indication of erosion". The text will change to read: "...the occurrence of a peak flow larger than the USGS Regression estimate of the 2-year peak flow does not cause erosion in the analyzed reaches of Poggi Creek, as there was no physical indication of (1) bed load transport (movement of sand or fine gravel could not be seen nor felt in the sections where TRWE personnel entered the creek); (2) bank erosion (TRWE personnel could not find a bank which had failed, or was close to failure, or in danger of being eroded); and (3) floating vegetation (usually, in vegetated channels, floating vegetation indicates that the flow has dislodged some vegetation and some erosion is expected; no floating vegetation was observed). Consequently, there is strong physical evidence of the creek having a low susceptibility to erosion".

Action:

Add extra information in Section 1.1 regarding surface velocity and depth measurements, and change the last paragraph of Section 1.2.

3. Section 2.1 and Appendix 6: Based on the text of the report, the contributing area to Grade Control 1 and Grade Control 15 were measured and all other areas between were interpolated. Rick Engineering Company checked the basin areas for Grade Control 1 and Grade Control 15 using the USGS StreamStats program and found different areas (e.g., Grade Control 1 drainage area is 1.3 square miles based on StreamStats vs. 2.2 square miles presented in the report). The report should address any reasons for this difference, and show the drainage basin boundaries and areas on the exhibit in Appendix 4.

Response:

Hunsaker and TRWE checked drainage areas, and consider our detailed analysis of the highly urbanized drainage area to be more reliable than StreamStats.

From the USGS StreamStats website:

"The StreamStats Web application provides access to automated procedures and very large, complex data sets. These data sets are known to contain occasional errors. Users are hereby advised to carefully check all results for accuracy and to exercise their own professional judgment in evaluating the appropriateness of the results for their application. ***Basin delineations in particular frequently have been found to be erroneous.*** *The Web site provides tools and base maps useful for verifying the accuracy of the basin delineations."*

Hunsaker and TRWE will add a figure where a 1.3 sq-mile square is added to clearly demonstrate that the contributing area is indeed the value given in the report.

Action:

No action needed. However, to satisfy potential concerns, an exhibit has been added to compare accurate contributing areas with StreamStats approximate areas.

4. Section 2.1 and Appendix 6, Regarding interpolation of drainage area as a function of reach stationing: A large side drainage joins Poggi Creek near the end of Reach 3. Interpolation of drainage area should start after this significant contribution.

Response:

The contribution alluded to in the comment is less than significant from the point of view of the SCCRWP methodology, as the lateral area draining at the end of Reach 3 is only 4.1% of the total contributing area of Poggi Creek at that point (lateral area equal to 64.2 acres, per the Addendum to Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1 Report, dated November 2006 and prepared by Hunsaker San Diego). Consequently, the value of Q_{10} for Reaches 1, 2 and 3 should be reduced, by a factor of $0.959^{0.87} = 0.964$ (less than 4% reduction). Also, the reference width W_{ref} will be reduced by a factor of $0.964^{0.438} = 0.984$, the VWI will be increased by a factor of $1/0.984 = 1.016$ (less than 2%) and the INDEX factor will be reduced by a factor of $0.964^{0.5} = 0.982$ (less than 2%). In a strict technical sense, Rick Engineering comment is correct, but considering the approximate nature of the methodology, TRWE believes that there is no need to modify the results, as the Valley Width Index will still be below 1, the INDEX value will still be on the order of 0.020 $m^{1.5}/s^{0.5}$, and the VWI index will still be smaller than 1 (0.81 in lieu of 0.80 for Reaches 2 and 3).

Action:

As the area modification for the potentially erodible Reach 2 and Reach 3 is less than 5%, and potential VWI and INDEX changes are less than 2%, no action is needed.

5. Table 1 and Appendix 6: the 10-year screening index (INDEX) was calculated using the wrong units for Q_{10} (use Q_{10} in m3/s).

Response:

Rick Engineering is correct. There was an error in the calculations when TRWE prepared Table 1 and Appendix 6 (wrong units selected in the spreadsheet). TRWE appreciates the review, and has changed the INDEX value to the properly calculated value. Table 6, Appendix 6 and also Form 3, Figure 4 in Appendix 8 have been corrected.

It is important to notice that the new INDEX value corresponds to the previous INDEX value divided by 5.94 ($1/0.3048^{1.5}$). As the lower the INDEX is, the more stable the analyzed creek becomes, this recalculation has emphasized even more the results of the analysis which determined a low susceptibility Poggi Creek with a previous incorrect INDEX value about 6 times larger.

Action:

Correct Table 1, Appendix 6 and Appendix 8, Form 3, Figure 4.

6. Section 4: The analysis presented in Section 4 to determine d_{50} does not determine what grain size is existing in the creek bed or would exist in the creek bed if there was no vegetation. Provide photographic evidence to support the selection of "hardpan of uncertain strength" or find a way to safely access the creek during a dry period and determine d_{50}.

Response:

From a logical point of view, it is inappropriate to ask for evidence to support the selection of an uncertain option, especially when the other two options are clearly defined. In other words, if the support materials are not a mix of coarse gravels and cobbles tightly packed with < 5% of surface material of diameter < 2 mm, (Option A) or a mix of gravel/cobbles that are loosely packed with > 25% of material with diameter < 2 mm (option C), by default the only valid option is Option B. Therefore, photographic evidence is not required.

Regarding the determination of d_{50}, it is clear to TRWE that the SCCRWP Methodology was not intended for vegetated channels, as trying to guess the diameter d_{50} below the vegetation, or in soils that are not granular is not only inappropriate, but also physically unrelated to the erosion mechanism that occurs when no granular soils are present (see for example, Cohesive Sediment movement, Section 12.3: The Beginning of Sediment Motion, Handbook of Hydrology). It would be unrelated to the physical mechanism of erosion in this case to remove vegetation out of the channel and try to determine a d_{50} from a soil where dead organic matter, root conglomerates, silts, clays, and loamy soils are mixed together below a healthy vegetation community, and somehow relate such d_{50} with the critical shear stress equation derived from Shields for near uniform cohesionless sediment particles (Handbook of Hydrology, Chapter 12).

Finally, the access to the creek during a dry period does not solve the problem of d_{50} determination: cattails and dense vegetation will still cover the surface of the creek flooded by low-flows (lesser than 50% of Q_2).

Action:

No action needed.

7. Table 2 and Appendix 8: Do not use "equivalent d_{50}" from Section 4 in Form 3 Figure 4. For hardpan/d_{50} indeterminate, the Screening Index Score is "B". A Screening Index Score of "A" requires support of actual d_{50} from the creek bed.

Response:

We respectfully disagree with Rick Engineering regarding the use of equivalent d_{50}. First, as explained in the previous comment, it does not make physical sense to try to determine a d_{50} value in a non-granular, cohesive soil, covered with vegetation. Second, and most importantly, from a regulatory point of view, the equivalent d_{50} methodology was used by Chang in his determination of the susceptibility analysis of San Marcos Creek for the Creek District Project. As the overall WQMP of the Creek District was directly approved by the San Diego Regional Water Quality Control Board (SDRWQCB), such WQMP constitutes a precedent for the use of the equivalent d_{50} methodology. It must be mentioned that the review came directly from the SDRWQCB, as the City of San Marcos was part of the development team, and there was an obvious conflict of interest for the City to review that project. As proof of this approval (already mentioned in Section 4 in the current document), the new Appendix 12 has been prepared, showing the use of the equivalent d_{50} methodology and the respective Letter of Approval by the SDRWQCB. Appendix 12 would be referenced in the document as shown here in bold letters (section 4, 2nd paragraph): "... This same methodology was also approved in San Marcos Creek by the Water Board [6]. **Information regarding the applicability and approval of the equivalent d_{50} Methodology is also shown in Appendix 12.**"

The adoption of a screening Index B is also a safe approach for those who lack knowledge of sediment transport and erosion, but it is an unqualified approximation, especially in this case where (1) the range of values for the INDEX variable are almost an order of magnitude below the line showing a 10% risk of incision; (2) the difficulty to erode a heavily vegetated channel has already been well documented (see for example Figure 5.1 of the HMP included in our document); and (2) that a flow much larger than the minimum threshold we are pursuing (50% of Q_2) actually occurred during our site visit, and no indication of erosion (either laterally or vertically) was observed.

It must be emphasized that the adoption of low susceptibility does not equate to the lack of erosion in a Creek for all flows. Rather, it implies that the erosion occurring for flows between 10% of Q_2 and 50% of Q_2 is negligible, and the geomorphologically important range of analysis is 50% Q_2 to Q_{10}.

Action:

Include a new Appendix 12: Example of the Approval of the Equivalent d_{50} Methodology by the SDRWQCB. Change 2nd paragraph, Section 4 as indicated. Measurement of d_{50} or changing the Screening Index to B is considered inappropriate here by TRWE, and therefore, not needed.

TECHNICAL MEMORANDUM:

Addendum to the Susceptibility Analysis of Poggi Creek (d_{50} Determination)

Otay Ranch Village 2 North, Chula Vista, CA.

Prepared for:

Hunsaker & Associates San Diego Inc.
March 14, 2013

Luis Parra, PhD, CPSWQ, ToR, D.WRE.
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Senior Project Manager



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TECHNICAL MEMORANDUM

TO: Alisa Vialpando, Principal
Hunsaker & Associates San Diego, Inc.

FROM: Luis Parra, PhD, PE, CPSWQ, ToR, D.WRE.

DATE: March 14, 2013

RE: **Susceptibility Analysis of Poggi Creek (d_{50} Determination)**

ANTECEDENTS

This memorandum summarizes the approach used to determine the medium diameter (d_{50}) of the sediments lying beneath the vegetation cover of Poggi Creek from reaches 2 to 20, where the reaches are defined according to the original Technical Memorandum "Susceptibility Analysis of Poggi Creek" prepared by TRWE for Hunsaker & Associates San Diego Inc. on November 7, 2012, and revised on January 17, 2013.

The determination of d_{50} in this document disregards the dense vegetation currently existing in Poggi Creek in the reaches of interest, and determines the medium diameter of the particles hidden beneath the layers of vegetation and dead organic matter. For this particular case, TRWE disagrees with the use of the cohesionless sediment methodology recommended by SCCWRP, because this methodology is not physically appropriate for vegetated channels. However, The City of Chula Vista, and the third party reviewer (Rick Engineering) are requiring a more conservative approach that considers the absence of vegetation in the channel. Consequently, a pebble count (Form 2) and a review of the regionally-calibrated screening Index Threshold analysis for incising/braiding creeks was performed here.

SITE VISIT AND RESULTS

TRWE performed a new site visit on 3/13/2013. Despite the challenges associated with finding areas free of vegetation for the pebble count analysis, a few spots were found after intense inspection inside the heavily vegetated (cat-tails) channel (see pictures in the Appendix 1). Also, removal of vegetation in some areas was needed to get some samples of sediments, and analysis of areas outside the vegetation strip was made in other cases to have many significant representative samples.

Appendix 1 shows 8 pebble counts that were possible in the 20 reaches analyzed. The value of d_{50} determined from this site visit is shown in Table 1.

The use of the 50% Risk Graphic and Tables is also shown in Appendix 2. It can be seen that both the graphics, and the hand-written interpolation added to the left of the graphics, show that the value of d50 for all reaches combined with the calculated index in the reviewed 1/17/2013 document determines a point below the 50% Risk Curve. Therefore, the Score A assumed in the 1/17/2013 "Susceptibility Analysis of Poggi Creek" document, stands as a valid score even under the new conservative assumptions.

TABLE 1. Values of d_{50}

REACH #	d_{50}	REACH #	d_{50}	REACH #	d_{50}	REACH #	d_{50}
Reach 2	2.9	Reach 6	4.0	Reach 11	4.0	Reach 16	3.7
Reach 3	2.9	Reach 8	4.0	Reach 12	3.4	Reach 17	3.7
Reach 4	2.9	Reach 9	4.0	Reach 15	3.4	Reach 19	3.9
Reach 5	4.0	Reach 10	4.0			Reach 20	4.4

CONCLUSIONS

- The value of d_{50} was determined for 8 different sections and average results are shown in Table 1.
- The combination d_{50} – INDEX determines a point below the 50% Risk of incising/braiding.
- The Score A already assigned in the 1/17/2013 "Susceptibility Analysis of Poggi Creek" document stands.
- No changes in assessment occurred as a consequence of the d_{50} determination, and consequently, the low susceptibility evaluation of Poggi Creek remains.

APPENDIX 1:

- **Form 2 (Pebble Count) for all Reaches**
- **Form 3 (Figure 4, 50% Risk) for all Reaches (Score: A)**
- **Photographic Documentation**

FORM 2: PEBBLE COUNT Reaches 1-4

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		4.0	26		2.0	51		2.0	76		4.0	101		2.0
2		2.0	27		2.0	52		2.8	77		2.0	102		2.0
3		2.0	28		2.0	53		2.8	78		2.0	103		4.0
4		2.0	29		5.6	54		2.0	79		2.0	104		2.0
5		2.0	30		2.0	55		2.8	80		5.6	105		4.0
6		2.0	31		2.0	56		2.0	81		2.8	106		2.0
7		2.8	32		2.0	57		2.0	82		2.0	107		5.6
8		4.0	33		2.0	58		2.0	83		2.8	108		4.0
9		4.0	34		2.8	59		2.0	84		4.0	109		2.0
10		2.0	35		4.0	60		2.8	85		2.0	110		5.6
11		2.0	36		4.0	61		5.6	86		2.0	111		4.0
12		2.8	37		5.6	62		2.0	87		2.0	112		2.8
13		2.0	38		2.8	63		5.6	88		2.0	113		2.0
14		2.0	39		2.8	64		2.0	89		2.0	114		
15		2.0	40		4.0	65		2.0	90		2.0	115		
16		2.8	41		2.0	66		2.0	91		2.8	116		
17		2.0	42		2.0	67		2.0	92		2.0	117		
18		2.0	44		2.0	68		2.0	93		2.0	118		
19		5.6	44		5.6	69		8.0	94		4.0	119		
20		4.0	45		5.6	70		2.0	95		4.0	120		
21		2.0	46		4.0	71		2.0	96		2.0	121		
22		5.6	47		2.0	72		4.0	97		2.8	122		
23		2.0	48		2.0	73		2.0	98		4.0	123		
24		2.0	49		4.0	74		5.6	99		2.0	124		
25		2.8	50		2.0	75		2.0	100		2.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 2.9$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

FORM 2: PEBBLE COUNT Reaches 5-7

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		4.0	26		2.0	51		5.6	76		2.8	101		
2		2.0	27		4.0	52		2.8	77		2.8	102		
3		4.0	28		2.8	53		2.8	78		2.8	103		
4		5.6	29		5.6	54		2.0	79		2.0	104		
5		5.6	30		8.0	55		2.0	80		8.0	105		
6		2.8	31		4.0	56		2.8	81		5.6	106		
7		5.6	32		8.0	57		4.0	82		2.8	107		
8		4.0	33		4.0	58		11.0	83		2.0	108		
9		2.0	34		2.0	59		5.6	84		4.0	109		
10		2.0	35		5.6	60		5.6	85		4.0	110		
11		5.6	36		2.8	61		2.8	86		2.8	111		
12		2.8	37		5.6	62		2.8	87		2.8	112		
13		5.6	38		2.0	63		2.0	88		2.8	113		
14		4.0	39		4.0	64		2.0	89		2.8	114		
15		4.0	40		2.8	65		4.0	90		4.0	115		
16		4.0	41		5.6	66		2.8	91		2.0	116		
17		2.8	42		2.0	67		2.8	92		5.6	117		
18		2.8	44		5.6	68		4.0	93		2.0	118		
19		5.6	44		2.8	69		8.0	94		4.0	119		
20		8.0	45		2.0	70		4.0	95		2.8	120		
21		2.8	46		8.0	71		2.8	96		4.0	121		
22		4.0	47		5.6	72		4.0	97		5.6	122		
23		8.0	48		4.0	73		2.0	98		2.0	123		
24		2.0	49		2.0	74		2.0	99		2.0	124		
25		4.0	50		2.0	75		11.0	100		11.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 4.0$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

(Sheet 1 of 2)

FORM 2: PEBBLE COUNT Reaches 8-11

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		2.8	26		2.0	51		2.8	76		4.0	101		2.8
2		2.8	27		5.6	52		4.0	77		8.0	102		4.0
3		2.0	28		4.0	53		8.0	78		11.0	103		2.8
4		4.0	29		2.0	54		2.8	79		8.0	104		2.8
5		2.0	30		11.0	55		2.0	80		2.8	105		2.0
6		11.0	31		4.0	56		2.0	81		4.0	106		2.0
7		8.0	32		2.0	57		2.0	82		11.0	107		
8		4.0	33		2.0	58		2.0	83		5.6	108		
9		5.6	34		8.0	59		2.0	84		8.0	109		
10		2.0	35		2.8	60		2.0	85		2.0	110		
11		4.0	36		2.8	61		2.0	86		4.0	111		
12		2.8	37		8.0	62		5.6	87		2.0	112		
13		2.0	38		2.0	63		5.6	88		4.0	113		
14		2.0	39		4.0	64		11.0	89		4.0	114		
15		2.0	40		11.0	65		2.0	90		4.0	115		
16		4.0	41		4.0	66		5.6	91		2.0	116		
17		2.8	42		2.8	67		2.8	92		4.0	117		
18		4.0	44		2.0	68		8.0	93		4.0	118		
19		2.0	44		2.0	69		2.0	94		4.0	119		
20		5.6	45		5.6	70		2.0	95		2.8	120		
21		2.8	46		2.0	71		2.0	96		5.6	121		
22		2.0	47		4.0	72		8.0	97		2.0	122		
23		5.6	48		2.8	73		2.8	98		2.8	123		
24		2.8	49		2.8	74		2.8	99		4.0	124		
25		2.0	50		2.0	75		4.0	100		8.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 4.0$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

FORM 2: PEBBLE COUNT Reaches 12-15a

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		11.0	26		2.0	51		8.0	76		2.8	101		
2		11.0	27		5.6	52		2.0	77		8.0	102		
3		5.6	28		5.6	53		4.0	78		4.0	103		
4		2.0	29		5.6	54		2.0	79		4.0	104		
5		2.0	30		2.0	55		2.0	80		2.0	105		
6		5.6	31		2.0	56		11.0	81		2.0	106		
7		4.0	32		2.0	57		4.0	82		11.0	107		
8		2.8	33		2.0	58		2.0	83		2.0	108		
9		2.0	34		2.0	59		4.0	84		2.0	109		
10		2.0	35		2.8	60		2.0	85		2.8	110		
11		2.0	36		2.8	61		5.6	86		5.6	111		
12		2.0	37		2.8	62		2.0	87		2.0	112		
13		4.0	38		2.0	63		2.8	88		2.0	113		
14		2.0	39		2.0	64		2.8	89		2.0	114		
15		2.8	40		2.8	65		8.0	90		4.0	115		
16		2.0	41		5.6	66		2.8	91		2.0	116		
17		4.0	42		2.0	67		2.0	92		2.0	117		
18		5.6	44		5.6	68		2.0	93		8.0	118		
19		2.0	44		8.0	69		2.0	94		8.0	119		
20		2.8	45		4.0	70		2.8	95		2.0	120		
21		2.8	46		2.8	71		5.6	96		8.0	121		
22		8.0	47		2.0	72		2.8	97		2.0	122		
23		4.0	48		2.0	73		2.0	98		2.0	123		
24		4.0	49		5.6	74		2.0	99		2.0	124		
25		2.0	50		2.0	75		2.0	100		2.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 3.6$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

FORM 2: PEBBLE COUNT Reaches 12-15 b

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		2.0	26		2.0	51		2.0	76		2.0	101		4.0
2		2.8	27		4.0	52		2.0	77		2.8	102		4.0
3		2.8	28		5.6	53		2.8	78		4.0	103		
4		2.8	29		2.8	54		4.0	79		2.0	104		
5		2.0	30		2.8	55		2.0	80		2.8	105		
6		4.0	31		4.0	56		2.0	81		2.8	106		
7		4.0	32		2.0	57		2.8	82		2.8	107		
8		4.0	33		5.6	58		2.0	83		2.0	108		
9		4.0	34		4.0	59		4.0	84		5.6	109		
10		2.0	35		2.0	60		2.8	85		5.6	110		
11		2.0	36		2.0	61		2.8	86		2.0	111		
12		2.0	37		2.8	62		2.8	87		5.6	112		
13		2.8	38		5.6	63		2.0	88		2.0	113		
14		2.8	39		5.6	64		2.0	89		4.0	114		
15		2.0	40		2.0	65		2.0	90		2.8	115		
16		2.0	41		2.0	66		2.0	91		4.0	116		
17		2.0	42		2.0	67		5.6	92		2.0	117		
18		2.0	44		5.6	68		4.0	93		2.0	118		
19		2.0	44		2.8	69		4.0	94		5.6	119		
20		2.8	45		5.6	70		4.0	95		4.0	120		
21		2.8	46		5.6	71		2.0	96		2.0	121		
22		5.6	47		2.8	72		2.0	97		2.0	122		
23		5.6	48		2.0	73		2.8	98		2.8	123		
24		4.0	49		4.0	74		5.6	99		2.0	124		
25		2.0	50		2.0	75		2.0	100		4.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 3.1$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

(Sheet 1 of 2)

FORM 2: PEBBLE COUNT Reaches 16-19 a

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		5.6	26		5.6	51		2.0	76		4.0	101		
2		2.0	27		2.8	52		2.8	77		2.0	102		
3		2.0	28		5.6	53		2.8	78		5.6	103		
4		4.0	29		2.8	54		4.0	79		2.8	104		
5		2.0	30		5.6	55		2.8	80		4.0	105		
6		4.0	31		2.0	56		2.0	81		5.6	106		
7		2.8	32		5.6	57		2.0	82		2.8	107		
8		5.6	33		4.0	58		2.0	83		4.0	108		
9		2.0	34		2.8	59		4.0	84		5.6	109		
10		2.8	35		2.0	60		2.0	85		2.0	110		
11		2.0	36		4.0	61		2.0	86		5.6	111		
12		4.0	37		2.8	62		4.0	87		4.0	112		
13		2.0	38		5.6	63		2.8	88		4.0	113		
14		4.0	39		5.6	64		2.8	89		4.0	114		
15		5.6	40		5.6	65		2.8	90		2.0	115		
16		2.0	41		4.0	66		4.0	91		2.0	116		
17		4.0	42		2.0	67		4.0	92		5.6	117		
18		5.6	44		5.6	68		4.0	93		4.0	118		
19		5.6	44		4.0	69		2.0	94		2.0	119		
20		4.0	45		2.0	70		2.0	95		2.0	120		
21		2.0	46		4.0	71		5.6	96		5.6	121		
22		2.8	47		4.0	72		5.6	97		5.6	122		
23		5.6	48		4.0	73		5.6	98		4.0	123		
24		2.0	49		2.0	74		4.0	99		2.0	124		
25		2.0	50		5.6	75		4.0	100		4.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 3.6$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

(Sheet 1 of 2)

FORM 2: PEBBLE COUNT Reaches 16-19 b

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		4.0	26		5.6	51		2.8	76		4.0	101		4.0
2		2.0	27		4.0	52		2.0	77		2.0	102		2.0
3		2.0	28		2.0	53		11.0	78		11.0	103		
4		4.0	29		2.0	54		5.6	79		4.0	104		
5		4.0	30		5.6	55		5.6	80		2.0	105		
6		2.0	31		2.8	56		11.0	81		2.0	106		
7		2.0	32		2.0	57		2.0	82		2.0	107		
8		4.0	33		4.0	58		11.0	83		4.0	108		
9		2.0	34		2.0	59		2.0	84		2.0	109		
10		5.6	35		2.0	60		2.8	85		2.0	110		
11		11.0	36		2.0	61		2.8	86		5.6	111		
12		5.6	37		2.8	62		2.0	87		4.0	112		
13		2.0	38		5.6	63		2.8	88		2.0	113		
14		5.6	39		5.6	64		2.8	89		2.0	114		
15		2.8	40		2.8	65		2.0	90		5.6	115		
16		2.0	41		2.0	66		2.0	91		5.6	116		
17		2.0	42		2.8	67		11.0	92		2.0	117		
18		2.8	44		2.0	68		2.8	93		2.8	118		
19		4.0	44		4.0	69		4.0	94		5.6	119		
20		2.8	45		2.0	70		2.8	95		2.0	120		
21		2.0	46		4.0	71		5.6	96		2.0	121		
22		2.0	47		2.8	72		5.6	97		2.0	122		
23		5.6	48		5.6	73		2.0	98		2.0	123		
24		4.0	49		5.6	74		2.0	99		2.8	124		
25		2.8	50		4.0	75		4.0	100		2.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 3.7$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

FORM 2: PEBBLE COUNT Reaches 19-20

If it is necessary to estimate d_{50}, perform a pebble count, after Bunte and Abt (2001a,b), using a minimum of 100 particles and a standard half-phi template, or by measuring along the intermediate axis of each pebble. Use a grid and tape for equally spaced samples over systematic/complete transects across riffle sections (i.e., if the 100th particle is in the middle of a transect, complete the full transect before stopping the count; if more than 125 particles, record data near the bottom of Sheet 2 of 2). If the source of fines (sand/silt d <2 mm; see Form 2 Table 2 below) is less than ½ inch thick (approximately one finger width) at the sampling point, sample the coarser buried substrate; otherwise record observation of fines. Take photographs to support observations (Detailed instructions in Appendix A.3).

Form 2 Table 1. 100-pebble count tabulation for Vertical Susceptibility. Record station (Sta) and diameter (d) in millimeters.

#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)	#	Sta	d (mm)
1		2.0	26		11.0	51		4.0	76		5.6	101		
2		2.8	27		2.0	52		5.6	77		2.0	102		
3		2.0	28		4.0	53		2.0	78		4.0	103		
4		4.0	29		2.8	54		8.0	79		8.0	104		
5		2.0	30		4.0	55		8.0	80		4.0	105		
6		4.0	31		4.0	56		5.6	81		8.0	106		
7		4.0	32		4.0	57		5.6	82		4.0	107		
8		2.0	33		11.0	58		8.0	83		2.8	108		
9		4.0	34		4.0	59		4.0	84		2.0	109		
10		8.0	35		4.0	60		4.0	85		4.0	110		
11		8.0	36		4.0	61		2.0	86		16.0	111		
12		4.0	37		5.6	62		2.0	87		2.0	112		
13		5.6	38		2.0	63		2.8	88		4.0	113		
14		11.0	39		2.0	64		4.0	89		4.0	114		
15		2.0	40		2.0	65		4.0	90		2.0	115		
16		16.0	41		5.6	66		2.0	91		5.6	116		
17		2.80	42		2.0	67		2.0	92		16.0	117		
18		4.0	44		2.8	68		2.0	93		2.0	118		
19		4.0	44		2.0	69		2.0	94		4.0	119		
20		4.0	45		4.0	70		5.6	95		2.0	120		
21		4.0	46		4.0	71		2.0	96		5.6	121		
22		2.0	47		4.0	72		2.8	97		5.6	122		
23		2.8	48		2.8	73		8.0	98		2.0	123		
24		2.0	49		2.0	74		4.0	99		2.0	124		
25		4.0	50		5.6	75		2.0	100		8.0	125		

Form 2 Table 2. d_{50} for Screening Index Threshold. $d_{50} = 4.4$

Class Name	Diameter (mm)	Helpful Descriptions for Field Identification
Boulder	> 256	Difficult to lift by hand
Cobble	> 64	Typically able to lift
Gravel	> 2	Fits in one hand
Sand	> 0.0625	Can feel between fingers
Silt	> 0.004	Can feel with tongue
Clay	≤ 0.004	Can not feel individual particle

(Sheet 1 of 2)

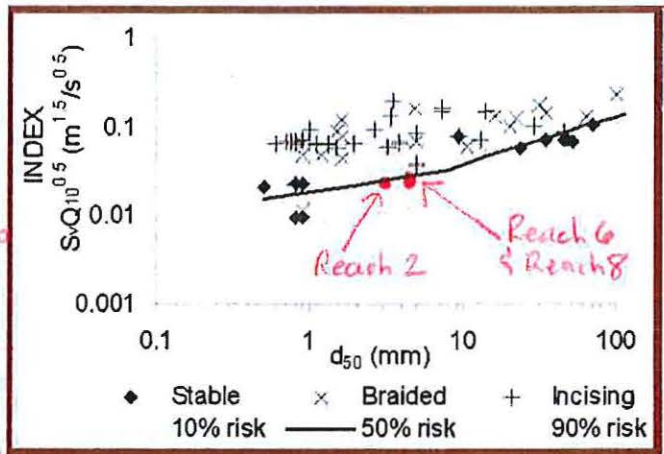
REACHES: 2, 6, 8

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.

Reach	d_{50}	50% risk	INDEX
2	2.9	0.024	0.020
6	4.0	0.026	0.020
8	4.0	0.026	0.021

INDEX < 50% risk
OK



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

Reach 2:
Index: 0.020
d_{50}: 2.9 mm
Reach 6:
Index: 0.020
d_{50}: 4.0 mm
Reach 8:
Index: 0.021
d_{50}: 4.0 mm

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

SCORE = A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

REACHES: 3, 4, 5

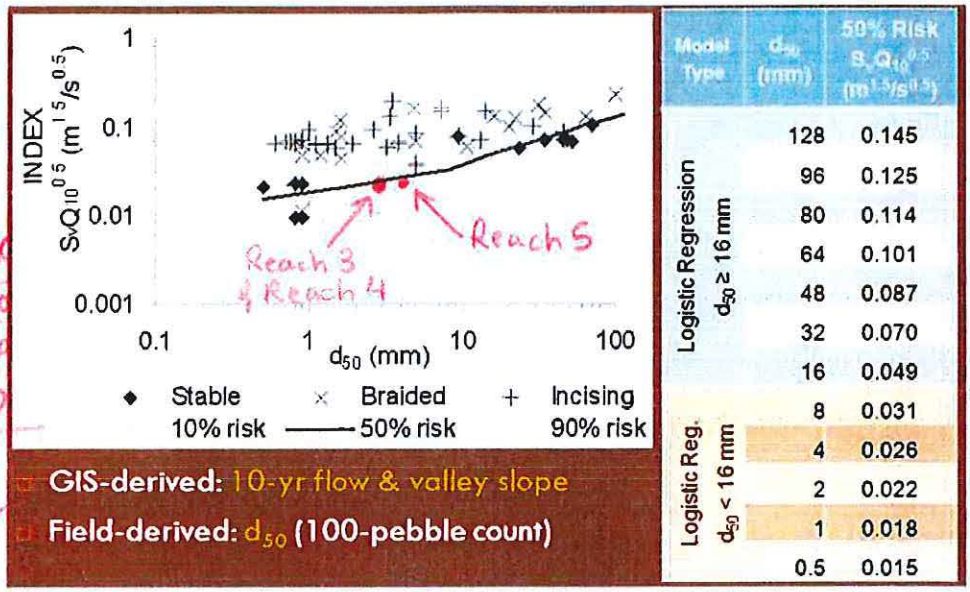
Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.

REACH	d_{50}	50% RISK	INDEX
3	2.9	0.024	0.020
4	2.9	0.024	0.020
5	4.0	0.026	0.020

INDEX < 50% Risk

OK



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

Reach 3:
Index: 0.020
d_{50}: 2.9 mm
Reach 4:
Index: 0.020
d_{50}: 2.9 mm
Reach 5:
Index: 0.020
d_{50}: 4.0 mm

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

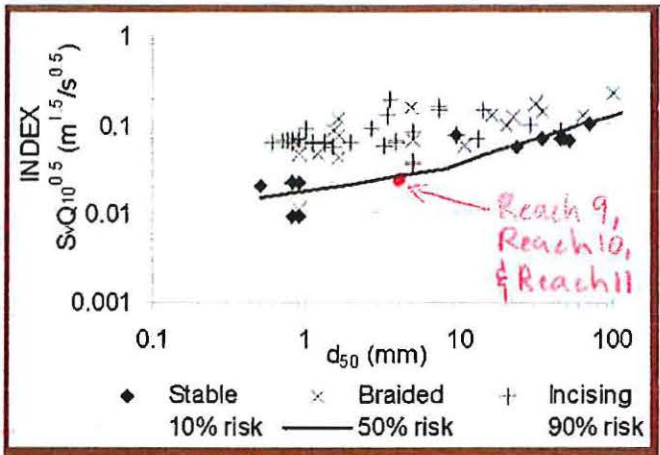
REACHES: 9, 10, 11

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.

REACH	d_{50}	50% Risk	INDEX
9	4.0	0.026	0.021
10	4.0	0.026	0.021
11	4.0	0.026	0.021

INDEX < 50% risk
OK ✓



Model Type	d_{50} (mm)	50% Risk $S_V Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

Reach 9:
Index: 0.021
d_{50}: 4.0 mm
Reach 10:
Index: 0.021
d_{50}: 4.0 mm
Reach 11:
Index: 0.021
d_{50}: 4.0 mm

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

SCORE : A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

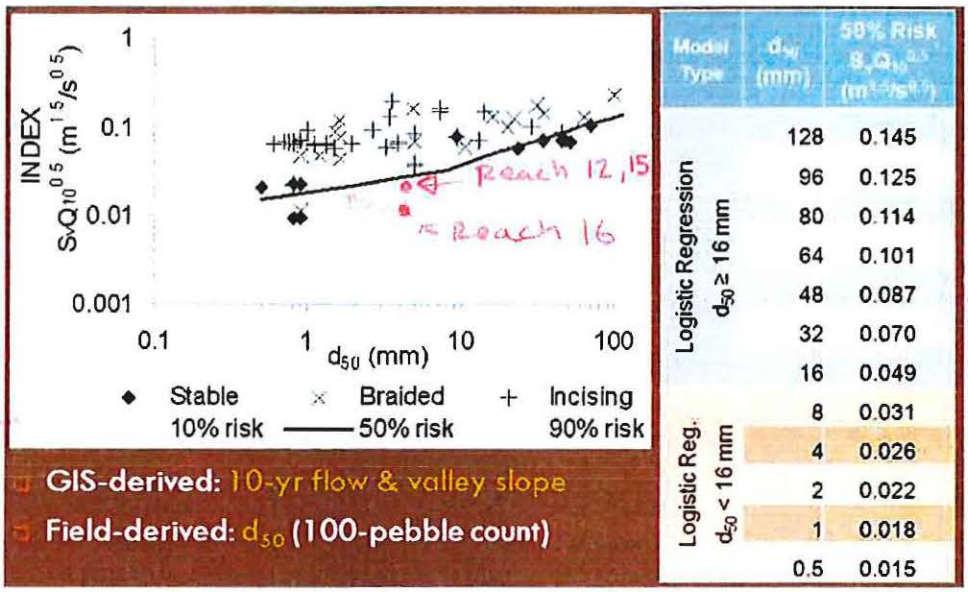
Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

Reaches: 12, 15, 16

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_v Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

REACH	d_{50}	50% RISK	INDEX
2	3.4	0.025	0.022
5	3.4	0.025	0.022
6	3.7	0.026	0.011

INDEX < 50% RISK
OK ✓

Reach 12
Index: 0.022
$d_{50} = \frac{3.6+3.1}{2} = 3.4$

Reach 15
Index = 0.022
$d_{50} = \frac{3.6+3.1}{2} = 3.4$

Reach 16
Index = 0.011
$d_{50} = \frac{3.6137}{2} = 3.7$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

SCORE : A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

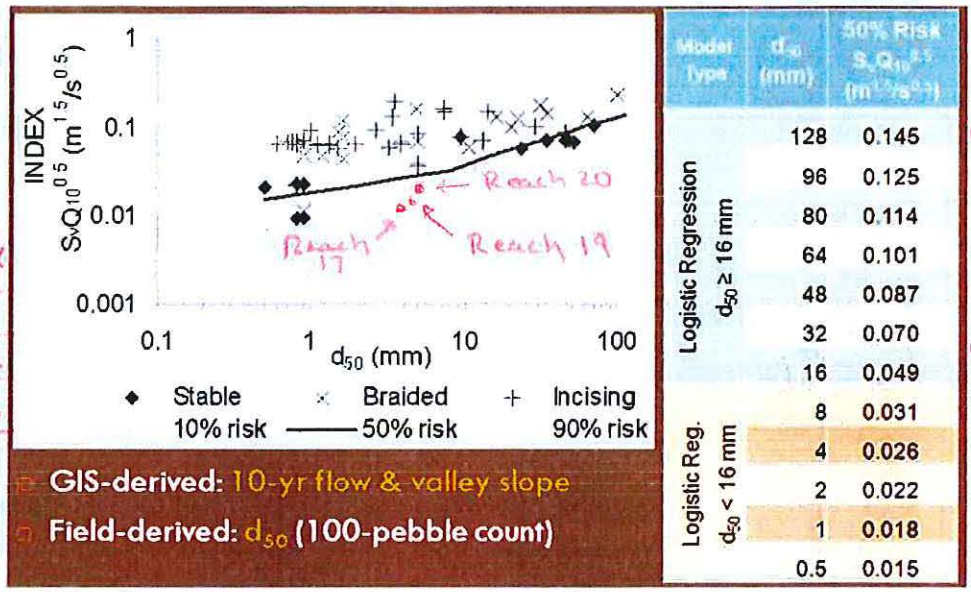
Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

Reaches: 17, 19, 20

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_v Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

REACH	d_{50}	50% RISK	INDEX
17	3.7	0.025	0.011
19	3.9	0.026	0.012
20	4.4	0.027	0.013

INDEX < 50% RISK ok ✓

Reach 17
Index = 0.011
$d_{50} = \frac{3.6+3.7}{2} = 3$

Reach 19
Index = 0.012
$d_{50} = \frac{3.6+3.7+4.4}{3} = 3.9$

Reach 20
Index = 0.013
$d_{50} = 4.4$

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

SCORE: A

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{*}Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring} * grade\ control) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

PHOTOGRAPHIC DOCUMENTATION



Picture 1. Coarse sediments at Reach 20.
Note: large boulders not included in the analysis.



Picture 2. Typical look of the Poggi Creek (most areas)



Picture 3. Gravelometer and coarse sand/ fine gravel
Vicinity of Reach 17.



Picture 4. Coarse sand and fine gravel as excavated around Reach 15, beneath cat-tails.



Picture 5. Gravelometer and coarse sediments around Reach 12.



Picture 6. Gravelometer and coarse sediments (vicinity of Reach 11).



Picture 7. The best spot we could find for flowing Water and sediments around Reach 8.



Picture 8. Typical coarse sand/ fine gravel Reach 3.

ChangConsultants
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F: 858.832.1402
wayne@changconsultants.com

November 17, 2011

Yolanda Calvo
Hunsaker & Associates San Diego, Inc.
9707 Waples Street
San Diego, CA 92121

Subject: Otay Ranch Village 2 North (Chula Vista Tract No. 06-05)

Dear Yolanda:

The Otay Ranch Village 2 North project proposes to discharge into Poggi Canyon Creek on the downstream side of Heritage Road. Heritage Road has been rough graded, but the road improvements have not been installed yet. A double box culvert that conveys creek flows across Heritage Road has been constructed. Storm runoff from the Village 2 North site will be conveyed in a proposed storm drain system that discharges at the headwall and riprap on the downstream end of the box culvert. Poggi Canyon Creek upstream and downstream of the discharge location is an engineered flood control channel. The channel is trapezoidal and generally contains 3:1 to 4:1 side slopes, a 50-foot bottom width, and a 0.8 percent longitudinal slope. A series of riprap-lined grade control structures has been constructed within the channel to reduce the channel slope and prevent scour.

I have performed an initial evaluation of Poggi Canyon Creek to assess whether the project could qualify for a medium (0.3Q2) or high (0.5Q2) low flow threshold for hydromodification purposes. Based on a site visit and review of as-built channel plans, I believe the domain of analysis (i.e., the hydromodification study reach) would extend from Heritage Road on the upstream end to approximately 1,000 feet west of Heritage Road on the downstream end. According to the County of San Diego's *Final Hydromodification Management Plan* (HMP), the upstream domain of analysis location is established by a grade control that prevents headward migration. The box culverts under Heritage Road meet this condition, so they form the upstream study limit. The HMP states that the downstream domain of analysis location can be established by a grade control. There is a riprap-lined graded control structure approximately 300 feet west of the discharge location that will meet the downstream criteria. Therefore, the total study reach would extend from Heritage Road to one reach (defined as approximately 656 feet) below the downstream grade control for a total distance of nearly 1,000 feet.

During my site investigation, I walked the length of the study reach. I observed a densely vegetated channel with limited signs of vertical or lateral erosion throughout (see Figures 1 and 2). The channel appeared to be as designed. I performed some of the required desktop analyses.

The results and backup data are attached. The screening index and valley width index values in the results would support a medium to low erosion susceptibility classification.

Based on my initial field and office work, I believe that a comprehensive hydromodification screening analysis for Poggi Canyon Creek in accordance with the County of San Diego's Final HMP would very possibly yield a high (0.5Q2) low flow threshold.

Sincerely,



Wayne W. Chang, M.S., P.E.

Attachment 2D

FLOW CONTROL FACILITY DESIGN AND STRUCTURAL BMP DRAWDOWN CALCULATIONS

Hydromodification Management Plan (HMP)
-Flow Control Facility Design

This HMP report has been prepared in place of Attachment 2a of the Priority Development Project (PDP) SWQMP for Sunbow PA-23 (February 2020) and has been prepared to be submitted concurrently with the SWQMP.

SECTIONS

1. Introduction/Summary
2. Flow Duration Curve Analysis
3. Elevation vs. Discharge, Elevation vs Area Curves, Drawdown, SWMM Input Calculations
4. Biofiltration Details
5. SWMM Input Data (Existing and Proposed Models)
6. Hydromodification Watershed Maps

I. INTRODUCTION/SUMMARY

This HMP report summarizes the approach used to model the Proposed Sunbow 2, Phase III site within City of Chula Vista, California using the Environmental Protection Agency (EPA) Storm Water Management Model 5.1 (SWMM). SWMM models were prepared for pre- and post-developed conditions at each of the project designated Point of Compliances (POC) in order to demonstrate that the proposed biofiltration basin facilities have sufficient footprints and volumes to meet the current HMP requirements from the Regional Water Quality Control Board (RWQCB).

The Proposed project was subdivided into two (2) subareas with each draining to their respective POC. See Section 6 of this Report for HMP-related maps.

Following are brief descriptions of each POC:

POC 1:

POC 1 is located at the northwest of the project site, at where the public Street A intersects with existing Olympic Pkwy and the basin 1 outfall meets the Poggi Canyon Creek. This POC encompasses the area of DMA 1 (further subdivided into DMA 1-C and DMA 1-D by soil groups), DMA 3 in a total of 23.97 acres in both existing and proposed conditions. However, the designed flows generated from these two DMAs are not 100% detained by our HMP facility BF-1-1, instead, the flows from DMA 1 will be routed through our BF-1-1 basin to minimize the water quality and runoff flow impact of the project while the flow from DMA 3 will be routed through Modular Wetland unit to accomplish only water quality control. The outflows from BF-1-1 and Modular Wetland then confluence at predefined POC1 which locates at downstream end of Poggi Canyon Creek culvert under public street A.

POC 2:

POC 2 is located east of POC1 and is immediately downstream of Poggi Canyon Creek culvert under proposed public street B. In proposed condition, POC2 accepts a total area of 34.86 acres in which DMA 2 (further subdivided into DMA 2-C and DMA 2-D by soil groups), DMA 4 and DMA 5 are enclosed. For consistency, the existing condition of POC 2 is defined and enclosed same tributary areas as we did on proposed condition. The design flow routing in POC 2 is also resemble to that of in POC 1, the flows from DMA 2 will be routed through our BF-1-2 basin to achieve the water quality and runoff flow control purpose while the flow from DMA 4 and 5 will be routed through Modular Wetland unit to accomplish only water quality control. The outflows from BF-1-2 and Modular Wetland then confluence at predefined POC2.

SWMM MODEL DEVELOPMENT

Since each POC is similar in terms of model development, the following will outline the typical model development. Two (2) SWMM models are prepared for each POC; one represents existing conditions and another represents proposed condition.

The existing condition analysis was prepared by defining the area to the respective POC. Similarly, the proposed condition analysis was prepared by defining the areas to the respective POC. However, since not all of the tributary areas are routed through each respective HMP basin, i.e., some of the DMAs are routed directly to compact biofiltration units (Modular Wetland), and some of the DMAs consist more than one hydrologic soil group, further subdivision of the overall tributary area was required. Areas were subdivided as follows:

1. Areas requiring water quality treatment ONLY and routing through Modular Wetland directly.
2. Newly developed areas where runoff is directed to WQ basin but excluding the basin area, then these areas are further subdivided by hydrologic soil groups; and
3. WQ Basin area.

For all SWMM models, flow duration curves were prepared to demonstrate that the proposed biofiltration basin footprints and proposed outlet structure will be sufficient to meet the current HMP requirements.

The inputs required to develop SWMM models include rainfall, watershed characteristics, and BMP configurations. The Lower Otay Reservoir Rain Gage from the Project Clean Water website was used for this study since it is the most representative of the project site precipitation. Evaporation for the site was modeled using average monthly values from the San Diego County hourly dataset. The site was modeled with hydrologic group C, D soils as determined from both the San Diego County Hydrology Manual soil map and the United States Geological Survey (USGS) web-based Soil Survey Map. Other SWMM inputs for the subareas are discussed in the following sections of this document where the selection of parameters is further explained in detail.

BIOFILTRATION MODELING

For each respective POC, part of developed area storm water runoff is routed through a biofiltration basin located at the downstream end of each respective POC drainage area as shown on the Proposed Condition HMP map in Section 6 of this report. The analysis was modeled using the bio-retention cell LID module within SWMM. The bioretention cell module can model the underground gravel storage layer, underdrain with an orifice plate, amended soil layer, and a surface storage pond up to the elevation of the invert of the bottom orifice. Separate diversion and detention basin calculations were prepared to model the portion of the storage pond between the base orifice invert elevations and the spillway elevation from the biofiltration basin, according to the assumptions explained in the Section 2 of this report. Once runoff has been routed through the respective basin outlet structure, it is conveyed via a storm drain pipe to the respective POC.

Basin Discussion: Flow control at each basin is achieved using multiple orifices along the height of a concrete riser structure which may be square or circular. The size, number and location of the orifices along its height are presented in the Basin Table below.

Sunbow HMP-1 Riser Summary (BF-1-1)

Discharge vs Elevation Table

Bottom orifice diameter:	1	"		Top orifice diameter:		3	"
Number:	1			Number:		1	
Cg-low:	0.61			Cg-low:		0.61	
invert elev:	1.00	ft		invert elev:		3.00	ft
Middle orifice diameter:	2	"		Emergency weir:			
number of orif:	1			Invert:	4.00	ft	
Cg-middle:	0.61			Weir Length (ft)	10.00	ft	
invert elev:	2.00	ft		Riser Box LxW	3x2		

Sunbow HMP-2 Riser Summary (BF-1-2)

Discharge vs Elevation Table

Bottom orifice diameter:	1	"		Top orifice diameter:		3	"
Number:	1			Number:		1	
Cg-low:	0.61			Cg-low:		0.61	
invert elev:	1.00	ft		invert elev:		3.00	ft
Middle orifice diameter:	2	"		Emergency weir:			
number of orif:	1			Invert:	4.00	ft	
Cg-middle:	0.61			Weir Length (ft)	10.00	ft	
invert elev:	2.00	ft		Riser Box LxW	3x2		

FLOW DURATION CURVE COMPARISON

The Flow Duration Curves (FDC) for the site were compared at each POC by exporting the hourly runoff time series results from SWMM to a spreadsheet. The FDC for each POC was compared between 50% of the existing condition Q2 (based on "Susceptibility Analysis of Poggi Creek, Nov 7, 2012 (Revised 1/17/2013)", Tory R. Walker Engineering, Inc. "Addendum to the Susceptibility Analysis of Poggi Creek (d50 Determination), March 14, 2013", Tory R. Walker Engineering, Inc. "Otay Ranch Village 2 North (Chula Vista Tract No. 06-05), Nov 17, 2011", ChangConsultants) up to the existing condition Q10. The Q2 and Q10 were determined using a partial duration statistical analysis of the runoff time series in an Excel spreadsheet. As the SWMM Model is a statistical analysis based on the Weibull Plotting Position Method, the Weibull Method was also used within the spreadsheet to ensure that the results were similar to those obtained by the SWMM Model.

The range between 50% of Q_2 and Q_{10} was divided into 100 equal time intervals; the number of hours that each flow rate was exceeded was counted from the hourly series. Additionally, the intermediate peaks with a return period "i" were obtained (Q_i with i=3 to 9). For the purpose of the plot, the values were presented as a percentage of time that exceeded for each flow rate.

Section 6 of this HMP Study provides detailed drainage exhibit for the post-developed conditions. As shown in Figures 4-16 in the succeeding section, the FDC for the proposed condition for each basin is within 110% of the curve for the existing condition. The additional runoff volume generated from developing the site will be released to the downstream storm drain at a flow rate below the 50% Q_2 lower threshold. Additionally, the Proposed Project will not increase peak flow rates between the Q_2 and the Q_{10}, as shown in the graphics in Figures 4-15 and also in the Tables 15-26 included in Section 1. Similar FDC comparison curves also were generated for each POC and included in the following Section 1 of this report.

SUMMARY & CONCLUSION

A summary of existing and proposed conditions draining to each POC is shown in the Tables 7-8 below. The proposed biofiltration basins are proposed to mitigate increased flow frequencies as a result of development. In general the post project natural area has been established as the balance of the existing natural area minus the developed area.

Table 7: POC1 Area Summary

	Existing (AC)	Proposed (AC)
POC 1	30.7	30.7
Bypass Basin	N/A	N/A
TOTAL	30.7	30.7

Table 8: POC2 Area Summary

	Existing (AC)	Proposed (AC)
POC 2	34.86	34.86
Bypass Basin	N/A	N/A
TOTAL	34.86	34.86

This study has demonstrated that the proposed biofiltration basin footprints for the project site is sufficient to meet the current HMP criteria if the biofiltration cross-section area and volume recommended within this report are incorporated at the project site.

Sunbow POC 1 HMP Calculations

Pre-Developed Condition

POC	Type	% Imperviousness	Total Area	Pervious Area	Impervious Area	Length	Elev Up	Elev Down	Slope	Width
DMA-1-D	To Be Dev	0.0%	13.89	13.89	0.00	1000	452	395	5.70%	605
DMA-1-C	To Be Dev	0.0%	16.10	16.10	0.00	1611	470	300	10.55%	435
DMA-3-C	To Be Dev	0.0%	1.00	1.00	0.00	595	310	264	7.73%	73
DMA-6-D	To Be Dev	0.0%	0.13	0.13	0.00	225	263	262	0.44%	25
Total POC-1-EX		0.0%	31.12	30.99	0.00					

Post-Developed Condition

POC	Type	% Imperviousness	Total Area	Pervious Area	Impervious Area	Length	Elev Up	Elev Down	Slope	Width
DMA-1-D	Roof-Roadway	50.0%	13.89	6.95	6.95	1000	452	379	7.30%	605
DMA-1-C	Roof-Roadway	50.0%	15.52	7.76	7.76	1611	470	300	10.55%	420
BF-1-1	Biofiltration Basin	0.0%	0.58	0.58	0.00	173	380	380	0.14%	146
DMA-3-C	Roadway	72.0%	1.00	0.28	0.72	595	310	264	7.73%	73
DMA-6-D	Roadway	56.0%	0.13	0.06	0.07	225	263	262	0.44%	25
TOTAL AREA TO POC-1-PR			31.12	15.62	15.50					

Sunbow POC 2 HMP Calculations

Pre-Developed Condition

POC	Type	% Imperviousness	Total Area	Pervious Area	Impervious Area	Length	Elev Up	Elev Down	Slope	Width
DMA-2-D	To Be Dev	0.0%	36.82	36.82	0.00	522	460	424	6.95%	3073
DMA-5-C	To Be Dev	0.0%	0.82	0.82	0.00	342	345	328	5.00%	104
DMA-4-D	To Be Dev	0.0%	0.84	0.84	0.00	351	345	327	5.02%	104
DMA-7-D	To Be Dev	0.0%	0.14	0.14	0.00	300	275	273	0.50%	20
Total POC-1-EX		0.0%	38.62	38.48	0.00					

Post-Developed Condition

POC	Type	% Imperviousness	Total Area	Pervious Area	Impervious Area	Length	Elev Up	Elev Down	Slope	Width
DMA-2-D	Roof-Roadway	55.0%	36.14	16.26	19.88	207	395	392	1.45%	7594
BF-1-2	Biofiltration Basin	0.0%	0.68	0.68	0.00	70	374	374	0.36%	422
DMA-5-C	Roadway	80.0%	0.82	0.16	0.66	342	345	328	5.00%	104
DMA-4-D	Roadway	77.4%	0.84	0.19	0.65	351	345	327	5.01%	104
DMA-7-D	Roadway	53.0%	0.14	0.07	0.07	300	275	273	0.50%	20
TOTAL AREA TO POC-1-PR			38.62	17.36	21.26					

II. FLOW DURACTION CURVE ANALYSIS

SECTION 1 - Flow Duration Curve Analysis, Plot & Table

The FDCs shall not exceed the existing conditions by more than 10%, neither in peak flow nor duration.

The Figures 4-15 on the following pages illustrate that the FDCs in post-development conditions, after the proposed BMPs are installed, is below the existing FDC. The FDC table following the curve shows that if the interval 0.10Q2 – Q 10 is divided in 100 sub-intervals, then: a) the post development divided by pre-development durations are never larger than 110% (the permit allows up to 110%); and, b) there are no more than 10 intervals in the range 101%-110%, which would imply an excess over 10% of the length of the curve (the permit allows less than 10% of excesses measured as 101-110%).

Consequently, the design passes the hydromodification test.

It is important to note that the FDCs can be expressed in the "x" axis as a percentage of time, hours per year, total number of hours, or any other similar time variable. As those variables only differ by multiplying a constant, their plot in logarithmic scale will appear exactly the same and compliance can be observed regardless of the variable selected. The selection of a logarithmic scale in lieu of the normal scale is preferred, as differences between the pre-development and post-development curves can be depicted more clearly in the entire range of analysis. Both graphics are presented for reference in Figures 4-15 below.

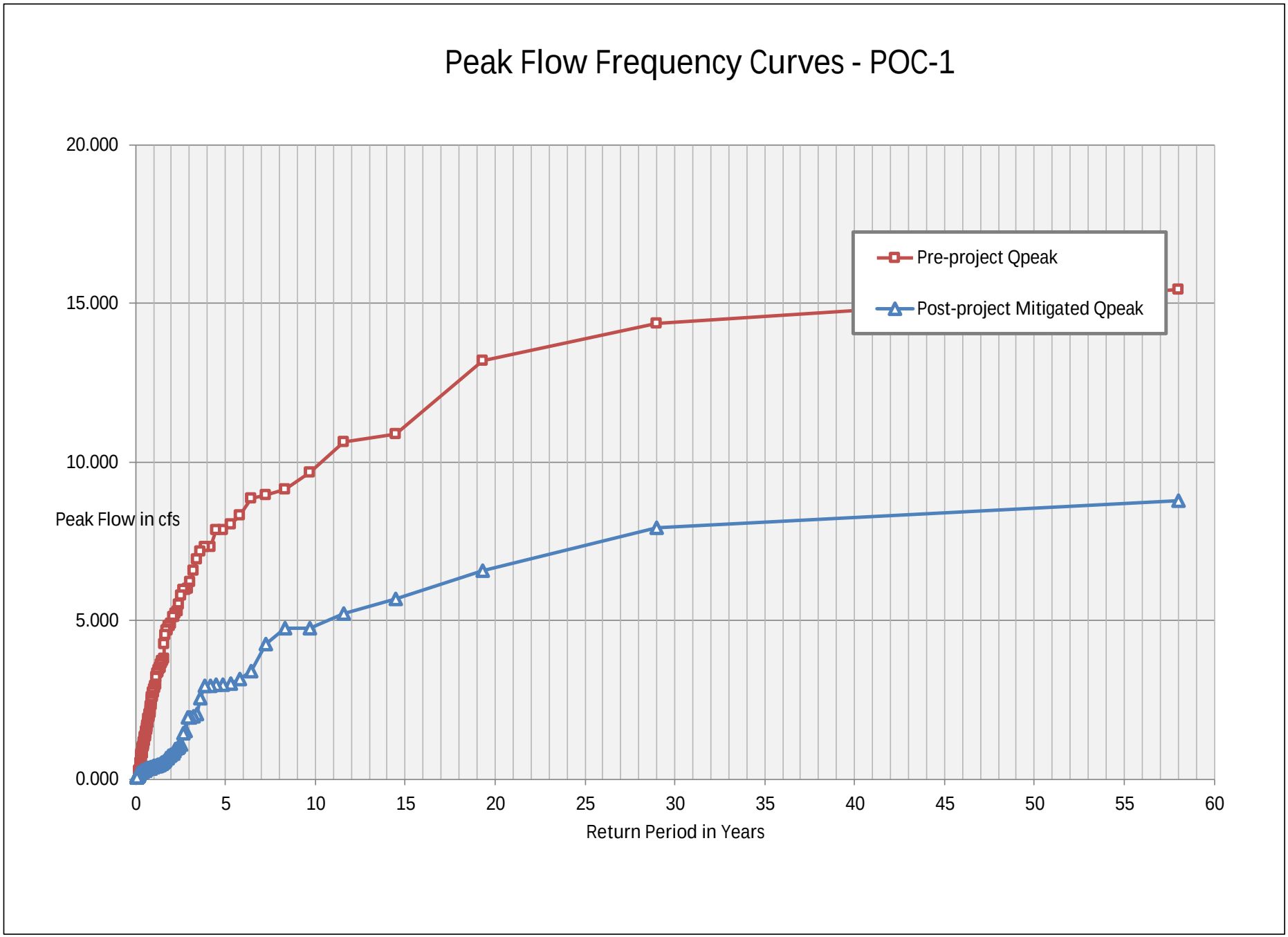
For the "y" axis, the peak flow value is the variable of choice. As an additional analysis performed by H&A, not only the range of analysis is clearly depicted (10% of Q 2 to Q 10) but also all intermediate flows are shown (30% of Q 2, 50% of Q 2, Q 2, Q 3, Q 4, Q 5, Q 6, Q 7, Q 8 and Q 9) in order to demonstrate compliance at any range Q x – Q x+1. It must be pointed out that one of the limitations of both the SWMM and SDHM models is that the intermediate analysis is not performed (to obtain Q i from i = 2 to 10). H&A performed the analysis using the Cunnane Plotting Position Method (the preferred method in the HMP permit) from the "n" largest independent peak flows obtained from the continuous time series.

Flow Duration Curve Analysis, Plot & Table

Figure 4 – POC 1 Flow Duration Curve

SUNBOW
Peak Flow Frequency Summary

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)	Reduction (cfs)
LF = 0.5xQ2	2.447	0.377	2.070
2-year	4.893	0.754	4.139
5-year	7.916	2.997	4.919
10-year	9.841	4.848	4.993


Peak Flow Frequency Curves - POC-1
20.000
15.000
10.000
5.000
0.000
Peak Flow in cfs
0
5
10
15
20
25
30
35
40
45
50
55
60
Return Period in Years
Pre-project Qpeak
Post-project Mitigated Qpeak

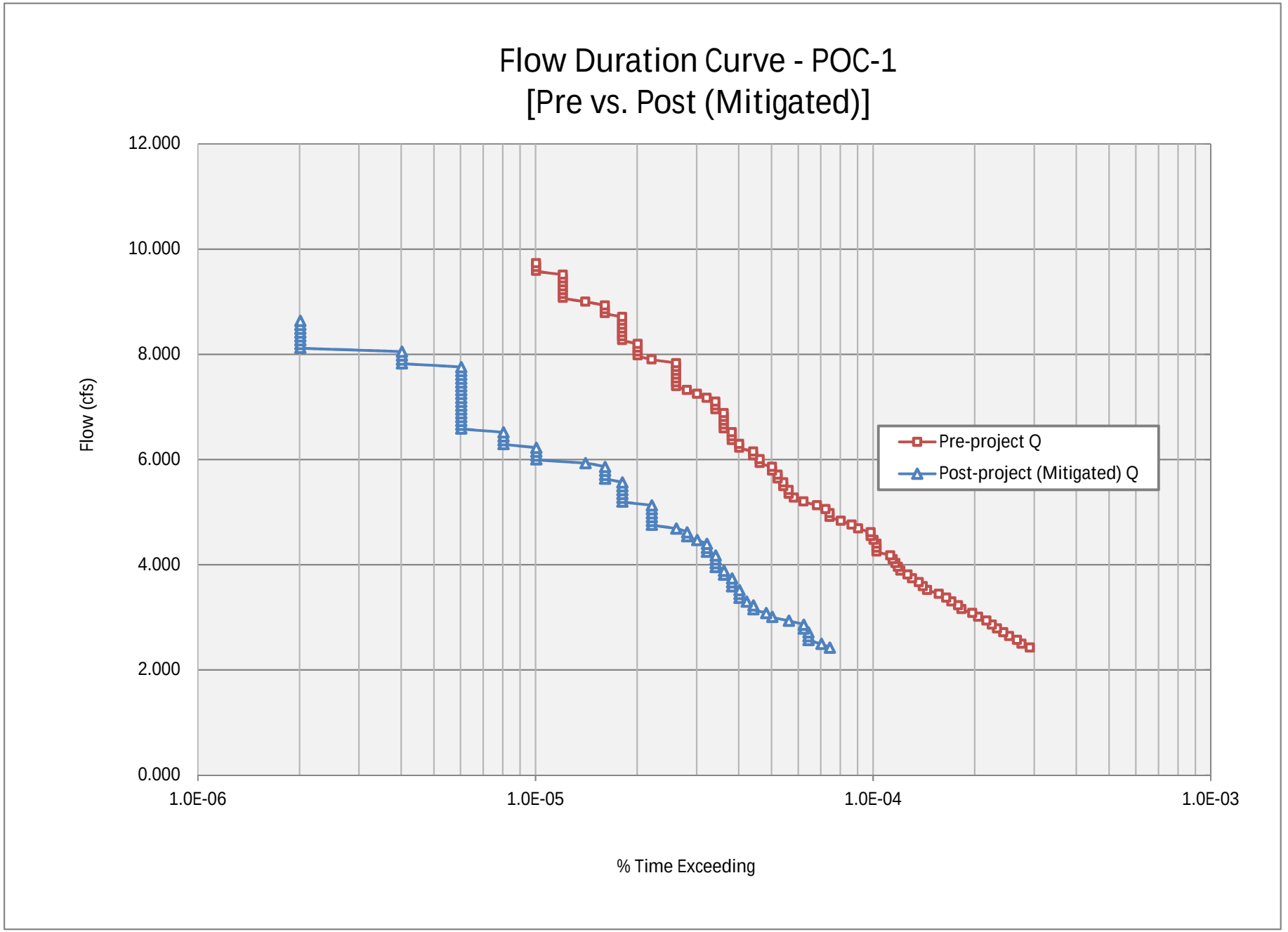
SUNBOW	POC-1

Low-flow Threshold: 50%
0.5xQ2 (Pre): 2.447 cfs
Q10 (Pre): 9.841 cfs
Ordinate #: 100
Incremental Q (Pre): 0.07394 cfs
Total Hourly Data: 495671 hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	2.447	143	2.88E-04	37	7.46E-05	26%	Pass
1	2.520	136	2.74E-04	35	7.06E-05	26%	Pass
2	2.594	132	2.66E-04	32	6.46E-05	24%	Pass
3	2.668	126	2.54E-04	32	6.46E-05	25%	Pass
4	2.742	119	2.40E-04	32	6.46E-05	27%	Pass
5	2.816	114	2.30E-04	31	6.25E-05	27%	Pass
6	2.890	111	2.24E-04	31	6.25E-05	28%	Pass
7	2.964	107	2.16E-04	28	5.65E-05	26%	Pass
8	3.038	101	2.04E-04	25	5.04E-05	25%	Pass
9	3.112	96	1.94E-04	24	4.84E-05	25%	Pass
10	3.186	91	1.84E-04	22	4.44E-05	24%	Pass
11	3.260	88	1.78E-04	22	4.44E-05	25%	Pass
12	3.334	85	1.71E-04	21	4.24E-05	25%	Pass
13	3.408	81	1.63E-04	20	4.03E-05	25%	Pass
14	3.482	75	1.51E-04	20	4.03E-05	27%	Pass
15	3.556	71	1.43E-04	20	4.03E-05	28%	Pass
16	3.630	70	1.41E-04	20	4.03E-05	29%	Pass
17	3.704	67	1.35E-04	19	3.83E-05	28%	Pass
18	3.777	64	1.29E-04	19	3.83E-05	30%	Pass
19	3.851	62	1.25E-04	18	3.63E-05	29%	Pass
20	3.925	60	1.21E-04	18	3.63E-05	30%	Pass
21	3.999	59	1.19E-04	17	3.43E-05	29%	Pass
22	4.073	58	1.17E-04	17	3.43E-05	29%	Pass
23	4.147	57	1.15E-04	17	3.43E-05	30%	Pass
24	4.221	57	1.15E-04	17	3.43E-05	30%	Pass
25	4.295	51	1.03E-04	16	3.23E-05	31%	Pass
26	4.369	51	1.03E-04	16	3.23E-05	31%	Pass
27	4.443	51	1.03E-04	16	3.23E-05	31%	Pass
28	4.517	51	1.03E-04	16	3.23E-05	31%	Pass
29	4.591	49	9.89E-05	14	2.82E-05	29%	Pass
30	4.665	48	9.68E-05	14	2.82E-05	29%	Pass
31	4.739	43	8.68E-05	14	2.82E-05	33%	Pass
32	4.813	43	8.68E-05	11	2.22E-05	26%	Pass
33	4.887	39	7.87E-05	11	2.22E-05	28%	Pass
34	4.961	37	7.46E-05	11	2.22E-05	30%	Pass
35	5.035	37	7.46E-05	11	2.22E-05	30%	Pass
36	5.108	35	7.06E-05	11	2.22E-05	31%	Pass
37	5.182	34	6.86E-05	11	2.22E-05	32%	Pass
38	5.256	31	6.25E-05	10	2.02E-05	32%	Pass
39	5.330	28	5.65E-05	10	2.02E-05	36%	Pass
40	5.404	28	5.65E-05	10	2.02E-05	36%	Pass
41	5.478	28	5.65E-05	9	1.82E-05	32%	Pass
42	5.552	27	5.45E-05	9	1.82E-05	33%	Pass
43	5.626	27	5.45E-05	9	1.82E-05	33%	Pass
44	5.700	26	5.25E-05	8	1.61E-05	31%	Pass
45	5.774	26	5.25E-05	8	1.61E-05	31%	Pass
46	5.848	25	5.04E-05	8	1.61E-05	32%	Pass
47	5.922	25	5.04E-05	8	1.61E-05	32%	Pass
48	5.996	23	4.64E-05	8	1.61E-05	35%	Pass

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
49	6.070	22	4.44E-05	5	1.01E-05	23%	Pass
50	6.144	22	4.44E-05	5	1.01E-05	23%	Pass
51	6.218	21	4.24E-05	5	1.01E-05	24%	Pass
52	6.292	20	4.03E-05	5	1.01E-05	25%	Pass
53	6.366	20	4.03E-05	4	8.07E-06	20%	Pass
54	6.439	19	3.83E-05	4	8.07E-06	21%	Pass
55	6.513	19	3.83E-05	4	8.07E-06	21%	Pass
56	6.587	18	3.63E-05	3	6.05E-06	17%	Pass
57	6.661	18	3.63E-05	3	6.05E-06	17%	Pass
58	6.735	18	3.63E-05	3	6.05E-06	17%	Pass
59	6.809	18	3.63E-05	3	6.05E-06	17%	Pass
60	6.883	18	3.63E-05	3	6.05E-06	17%	Pass
61	6.957	17	3.43E-05	3	6.05E-06	18%	Pass
62	7.031	17	3.43E-05	3	6.05E-06	18%	Pass
63	7.105	17	3.43E-05	3	6.05E-06	18%	Pass
64	7.179	16	3.23E-05	3	6.05E-06	19%	Pass
65	7.253	16	3.23E-05	3	6.05E-06	19%	Pass
66	7.327	14	2.82E-05	3	6.05E-06	21%	Pass
67	7.401	14	2.82E-05	3	6.05E-06	21%	Pass
68	7.475	13	2.62E-05	3	6.05E-06	23%	Pass
69	7.549	13	2.62E-05	3	6.05E-06	23%	Pass
70	7.623	13	2.62E-05	3	6.05E-06	23%	Pass
71	7.697	13	2.62E-05	3	6.05E-06	23%	Pass
72	7.770	13	2.62E-05	3	6.05E-06	23%	Pass
73	7.844	12	2.42E-05	3	6.05E-06	25%	Pass
74	7.918	11	2.22E-05	2	4.03E-06	18%	Pass
75	7.992	11	2.22E-05	2	4.03E-06	18%	Pass
76	8.066	10	2.02E-05	2	4.03E-06	20%	Pass
77	8.140	10	2.02E-05	2	4.03E-06	20%	Pass
78	8.214	10	2.02E-05	2	4.03E-06	20%	Pass
79	8.288	10	2.02E-05	1	2.02E-06	10%	Pass
80	8.362	9	1.82E-05	1	2.02E-06	11%	Pass
81	8.436	9	1.82E-05	1	2.02E-06	11%	Pass
82	8.510	9	1.82E-05	1	2.02E-06	11%	Pass
83	8.584	9	1.82E-05	1	2.02E-06	11%	Pass
84	8.658	9	1.82E-05	1	2.02E-06	11%	Pass
85	8.732	9	1.82E-05	1	2.02E-06	11%	Pass
86	8.806	9	1.82E-05	0	0.00E+00	0%	Pass
87	8.880	8	1.61E-05	0	0.00E+00	0%	Pass
88	8.954	8	1.61E-05	0	0.00E+00	0%	Pass
89	9.028	7	1.41E-05	0	0.00E+00	0%	Pass
90	9.101	7	1.41E-05	0	0.00E+00	0%	Pass
91	9.175	6	1.21E-05	0	0.00E+00	0%	Pass
92	9.249	6	1.21E-05	0	0.00E+00	0%	Pass
93	9.323	6	1.21E-05	0	0.00E+00	0%	Pass
94	9.397	6	1.21E-05	0	0.00E+00	0%	Pass
95	9.471	6	1.21E-05	0	0.00E+00	0%	Pass
96	9.545	6	1.21E-05	0	0.00E+00	0%	Pass
97	9.619	6	1.21E-05	0	0.00E+00	0%	Pass
98	9.693	5	1.01E-05	0	0.00E+00	0%	Pass
99	9.767	5	1.01E-05	0	0.00E+00	0%	Pass
100	9.841	5	1.01E-05	0	0.00E+00	0%	Pass

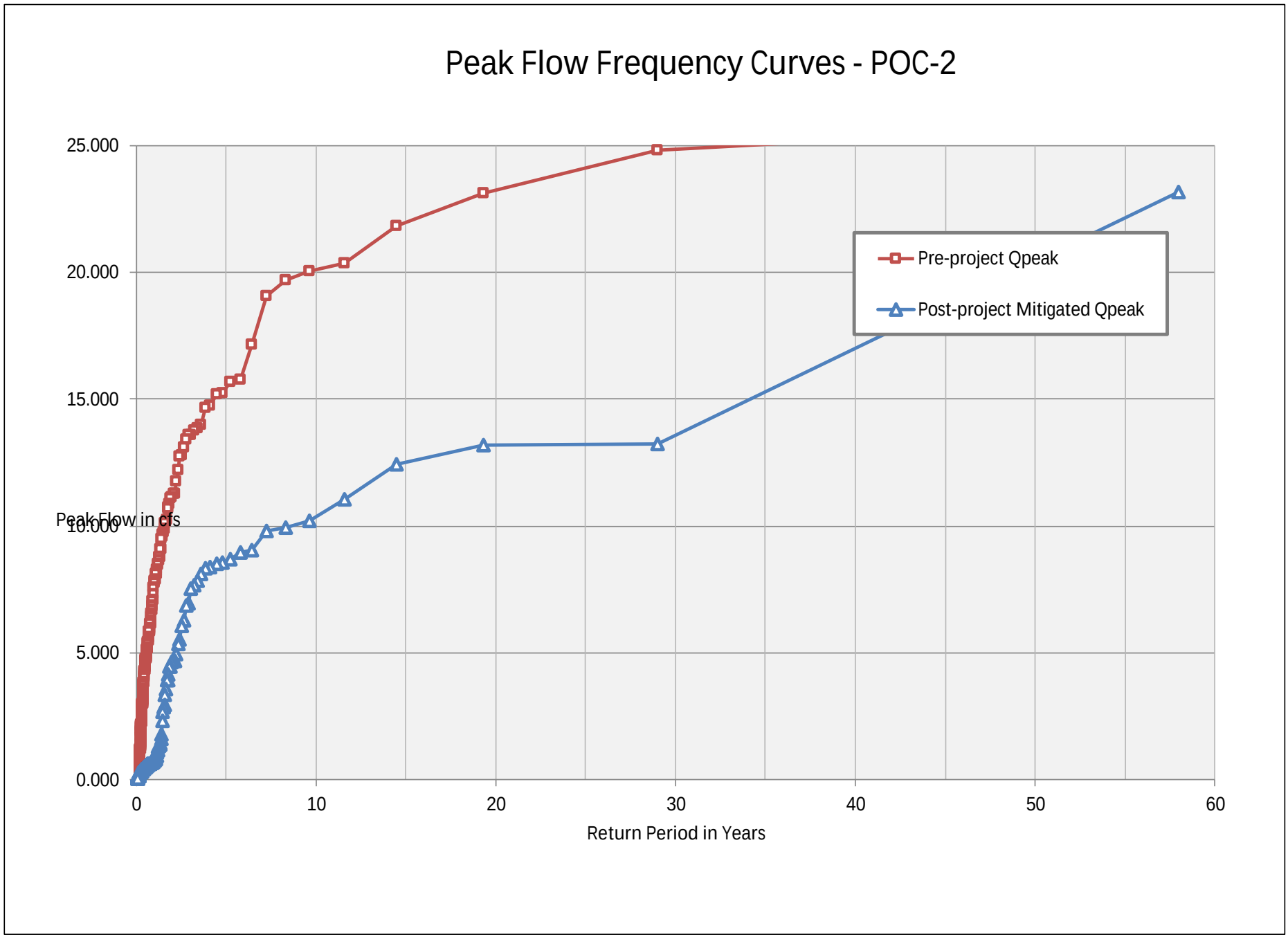

Flow Duration Curve - POC-1
[Pre vs. Post (Mitigated)]
12.000
10.000
8.000
6.000
4.000
2.000
0.000
Flow (cfs)
1.0E-06
1.0E-05
1.0E-04
1.0E-03
% Time Exceeding
Pre-project Q
Post-project (Mitigated) Q

Flow Duration Curve Analysis, Plot & Table

Figure 5 – POC 2 Flow Duration Curve

SUNBOW POC2
Peak Flow Frequency Summary

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)	Reduction (cfs)
LF = 0.5xQ2	5.581	2.332	3.250
2-year	11.162	4.663	6.499
5-year	15.410	8.620	6.790
10-year	20.089	10.340	9.749


Peak Flow Frequency Curves - POC-2
25.000
20.000
15.000
10.000
5.000
0.000
Peak Flow in cfs
0
10
20
30
40
50
60
Return Period in Years
Pre-project Qpeak
Post-project Mitigated Qpeak

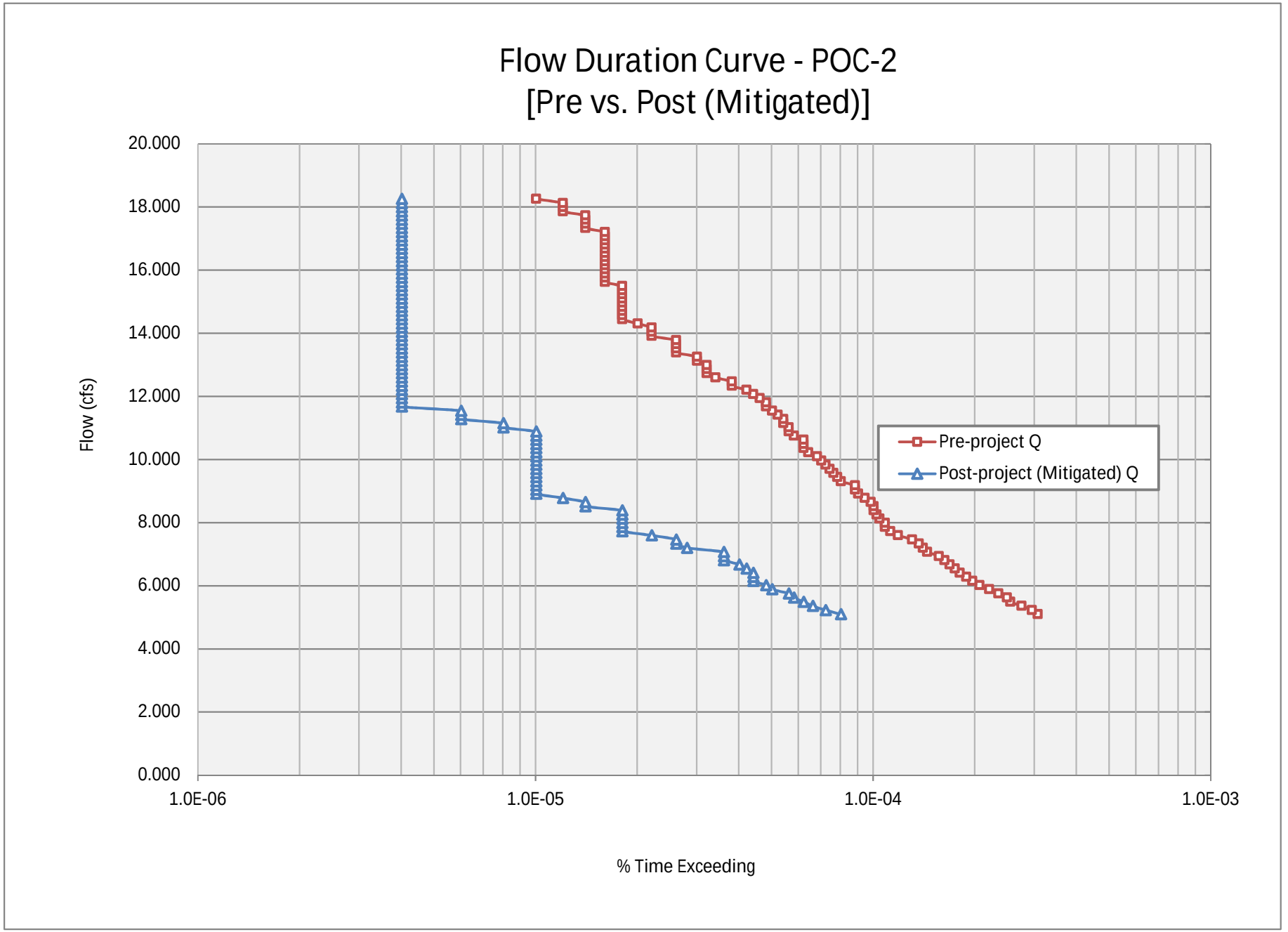
SUNBOW	POC-2

Low-flow Threshold: 50%
0.5xQ2 (Pre): 5.581 cfs
Q10 (Pre): 20.089 cfs
Ordinate #: 100
Incremental Q (Pre): 0.14508 cfs
Total Hourly Data: 495671 hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	5.581	154	3.11E-04	53	1.07E-04	34%	Pass
1	5.726	148	2.99E-04	52	1.05E-04	35%	Pass
2	5.871	141	2.84E-04	49	9.89E-05	35%	Pass
3	6.016	132	2.66E-04	48	9.68E-05	36%	Pass
4	6.161	125	2.52E-04	44	8.88E-05	35%	Pass
5	6.306	117	2.36E-04	40	8.07E-05	34%	Pass
6	6.451	112	2.26E-04	39	7.87E-05	35%	Pass
7	6.597	106	2.14E-04	36	7.26E-05	34%	Pass
8	6.742	100	2.02E-04	33	6.66E-05	33%	Pass
9	6.887	96	1.94E-04	31	6.25E-05	32%	Pass
10	7.032	92	1.86E-04	29	5.85E-05	32%	Pass
11	7.177	88	1.78E-04	28	5.65E-05	32%	Pass
12	7.322	86	1.74E-04	28	5.65E-05	33%	Pass
13	7.467	82	1.65E-04	28	5.65E-05	34%	Pass
14	7.612	78	1.57E-04	27	5.45E-05	35%	Pass
15	7.757	74	1.49E-04	26	5.25E-05	35%	Pass
16	7.902	69	1.39E-04	25	5.04E-05	36%	Pass
17	8.047	67	1.35E-04	25	5.04E-05	37%	Pass
18	8.192	65	1.31E-04	21	4.24E-05	32%	Pass
19	8.338	60	1.21E-04	19	3.83E-05	32%	Pass
20	8.483	57	1.15E-04	18	3.63E-05	32%	Pass
21	8.628	56	1.13E-04	16	3.23E-05	29%	Pass
22	8.773	54	1.09E-04	14	2.82E-05	26%	Pass
23	8.918	52	1.05E-04	14	2.82E-05	27%	Pass
24	9.063	52	1.05E-04	12	2.42E-05	23%	Pass
25	9.208	50	1.01E-04	12	2.42E-05	24%	Pass
26	9.353	50	1.01E-04	12	2.42E-05	24%	Pass
27	9.498	50	1.01E-04	11	2.22E-05	22%	Pass
28	9.643	48	9.68E-05	11	2.22E-05	23%	Pass
29	9.788	45	9.08E-05	11	2.22E-05	24%	Pass
30	9.933	44	8.88E-05	8	1.61E-05	18%	Pass
31	10.079	44	8.88E-05	8	1.61E-05	18%	Pass
32	10.224	40	8.07E-05	7	1.41E-05	18%	Pass
33	10.369	39	7.87E-05	7	1.41E-05	18%	Pass
34	10.514	38	7.67E-05	7	1.41E-05	18%	Pass
35	10.659	38	7.67E-05	7	1.41E-05	18%	Pass
36	10.804	36	7.26E-05	7	1.41E-05	19%	Pass
37	10.949	35	7.06E-05	7	1.41E-05	20%	Pass
38	11.094	35	7.06E-05	6	1.21E-05	17%	Pass
39	11.239	33	6.66E-05	6	1.21E-05	18%	Pass
40	11.384	31	6.25E-05	6	1.21E-05	19%	Pass
41	11.529	31	6.25E-05	6	1.21E-05	19%	Pass
42	11.674	31	6.25E-05	6	1.21E-05	19%	Pass
43	11.820	29	5.85E-05	6	1.21E-05	21%	Pass
44	11.965	28	5.65E-05	6	1.21E-05	21%	Pass
45	12.110	28	5.65E-05	6	1.21E-05	21%	Pass
46	12.255	27	5.45E-05	6	1.21E-05	22%	Pass
47	12.400	27	5.45E-05	6	1.21E-05	22%	Pass
48	12.545	26	5.25E-05	4	8.07E-06	15%	Pass

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
49	12.690	26	5.25E-05	4	8.07E-06	15%	Pass
50	12.835	24	4.84E-05	4	8.07E-06	17%	Pass
51	12.980	24	4.84E-05	4	8.07E-06	17%	Pass
52	13.125	23	4.64E-05	4	8.07E-06	17%	Pass
53	13.270	23	4.64E-05	2	4.03E-06	9%	Pass
54	13.415	22	4.44E-05	2	4.03E-06	9%	Pass
55	13.560	21	4.24E-05	2	4.03E-06	10%	Pass
56	13.706	19	3.83E-05	2	4.03E-06	11%	Pass
57	13.851	17	3.43E-05	2	4.03E-06	12%	Pass
58	13.996	17	3.43E-05	2	4.03E-06	12%	Pass
59	14.141	16	3.23E-05	2	4.03E-06	13%	Pass
60	14.286	16	3.23E-05	2	4.03E-06	13%	Pass
61	14.431	16	3.23E-05	2	4.03E-06	13%	Pass
62	14.576	15	3.03E-05	2	4.03E-06	13%	Pass
63	14.721	14	2.82E-05	2	4.03E-06	14%	Pass
64	14.866	13	2.62E-05	2	4.03E-06	15%	Pass
65	15.011	13	2.62E-05	2	4.03E-06	15%	Pass
66	15.156	13	2.62E-05	2	4.03E-06	15%	Pass
67	15.301	11	2.22E-05	2	4.03E-06	18%	Pass
68	15.447	11	2.22E-05	2	4.03E-06	18%	Pass
69	15.592	11	2.22E-05	2	4.03E-06	18%	Pass
70	15.737	10	2.02E-05	2	4.03E-06	20%	Pass
71	15.882	9	1.82E-05	2	4.03E-06	22%	Pass
72	16.027	9	1.82E-05	2	4.03E-06	22%	Pass
73	16.172	9	1.82E-05	2	4.03E-06	22%	Pass
74	16.317	9	1.82E-05	2	4.03E-06	22%	Pass
75	16.462	9	1.82E-05	2	4.03E-06	22%	Pass
76	16.607	9	1.82E-05	2	4.03E-06	22%	Pass
77	16.752	9	1.82E-05	2	4.03E-06	22%	Pass
78	16.897	9	1.82E-05	2	4.03E-06	22%	Pass
79	17.042	9	1.82E-05	2	4.03E-06	22%	Pass
80	17.188	8	1.61E-05	2	4.03E-06	25%	Pass
81	17.333	8	1.61E-05	2	4.03E-06	25%	Pass
82	17.478	8	1.61E-05	2	4.03E-06	25%	Pass
83	17.623	8	1.61E-05	2	4.03E-06	25%	Pass
84	17.768	8	1.61E-05	2	4.03E-06	25%	Pass
85	17.913	8	1.61E-05	2	4.03E-06	25%	Pass
86	18.058	8	1.61E-05	2	4.03E-06	25%	Pass
87	18.203	8	1.61E-05	2	4.03E-06	25%	Pass
88	18.348	8	1.61E-05	2	4.03E-06	25%	Pass
89	18.493	8	1.61E-05	2	4.03E-06	25%	Pass
90	18.638	8	1.61E-05	2	4.03E-06	25%	Pass
91	18.783	8	1.61E-05	2	4.03E-06	25%	Pass
92	18.928	8	1.61E-05	2	4.03E-06	25%	Pass
93	19.074	8	1.61E-05	2	4.03E-06	25%	Pass
94	19.219	7	1.41E-05	2	4.03E-06	29%	Pass
95	19.364	7	1.41E-05	2	4.03E-06	29%	Pass
96	19.509	7	1.41E-05	2	4.03E-06	29%	Pass
97	19.654	7	1.41E-05	2	4.03E-06	29%	Pass
98	19.799	6	1.21E-05	2	4.03E-06	33%	Pass
99	19.944	6	1.21E-05	2	4.03E-06	33%	Pass
100	20.089	5	1.01E-05	2	4.03E-06	40%	Pass


Flow Duration Curve - POC-2
[Pre vs. Post (Mitigated)]
20.000
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
Flow (cfs)
1.0E-06
1.0E-05
1.0E-04
1.0E-03
% Time Exceeding
Pre-project Q
Post-project (Mitigated) Q

III. ELEVATION VS DISCHARGE, ELEVATION VS AREA, DRAWDOWN, SWMM INPUT PARAMETER CALCULATIONS

Elevation vs. Area

For the flow diverted each respective receiving detention basin, a pond is used to route the hydrographs. The elevation vs area curve in the model is calculated in Excel and imported into the model at a 0.05- 1 ft. interval range.

Elevation vs Discharge

The total discharge peak flow data is imported from an Excel spreadsheet that calculated the elevation vs discharge of the multiple outlet system for each basin.

The orifices have been selected to maximize their size while still restricting flows to conform to the required 50% of the Q2 event flow. While we acknowledge that these orifices may be small, increasing the size of these outlets would impact the ability of the basins to restrict flows beneath the HMP thresholds, thus preventing the BMP from conforming with the HMP requirements.

In order to prevent blockage of the orifices, a debris screen will be fitted to the base invert of the lower orifices located within each basin. Regular maintenance of the riser and orifices will be performed to ensure potential blockages are minimized. A detail of the orifice and riser structure is provided in Section 3 of this attachment. The stage-storage and stage-discharge calculations have been provided on the following pages.

Sunbow Stage Storage	
BF-1-1	
depth	area
0.00	25208
0.05	25307
0.10	25406
0.15	25505
0.20	25605
0.25	25704
0.30	25803
0.35	25902
0.40	26001
0.45	26100
0.50	26200
0.55	26299
0.60	26398
0.65	26497
0.70	26596
0.75	26695
0.80	26794
0.85	26894
0.90	26993
0.95	27092
1.00	27191
1.05	27293
1.10	27395
1.15	27497
1.20	27599
1.25	27701
1.30	27803
1.35	27905
1.40	28007
1.45	28109
1.50	28211
1.55	28313
1.60	28415
1.65	28517
1.70	28619
1.75	28721
1.80	28823
1.85	28925
1.90	29027
1.95	29129
2.00	29231
2.05	29336
2.10	29441
2.15	29545
2.20	29650
2.25	29755
2.30	29860
2.35	29965
2.40	30069
2.45	30174
2.50	30279
2.55	30384
2.60	30489
2.65	30593
2.70	30698
2.75	30803
2.80	30908
2.85	31013
2.90	31117
2.95	31222
3.00	31327
3.05	31435
3.10	31542
3.15	31650
3.20	31758
3.25	31866
3.30	31973
3.35	32081
3.40	32189
3.45	32296
3.50	32404
3.55	32512
3.60	32619
3.65	32727
3.70	32835
3.75	32943
3.80	33050
3.85	33158
3.90	33266
3.95	33373
4.00	33481
4.05	33592
4.10	33702
4.15	33813
4.20	33923
4.25	34034
4.30	34144
4.35	34255
4.40	34365
4.45	34476
4.50	34586
4.55	34697
4.60	34807
4.65	34918
4.70	35028
4.75	35139
4.80	35249
4.85	35360
4.90	35470
4.95	35581
5.00	35691
5.05	35804
5.10	35918
5.15	36031
5.20	36145
5.25	36258
5.30	36371
5.35	36485
5.40	36598
5.45	36712
5.50	36825
5.55	36938
5.60	37052
5.65	37165
5.70	37279
5.75	37392
5.80	37505
5.85	37619
5.90	37732
5.95	37846
6.00	37959

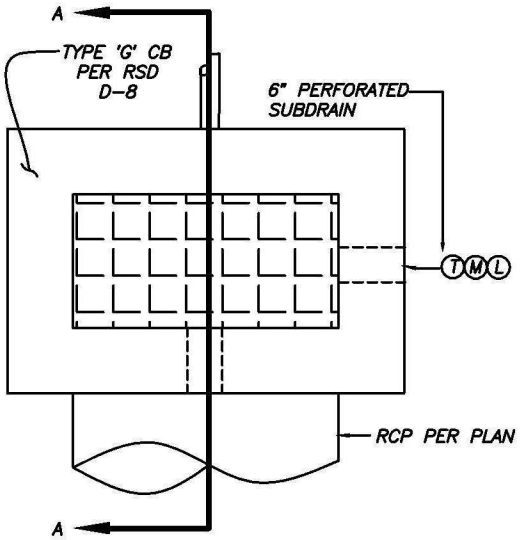
Sunbow HMP-1 Riser Summary (BF-1-1)

Discharge vs Elevation Table

Bottom orifice diameter:	1 "	Top orifice diameter:	3 "
Number:	1	Number:	1
Cg-low:	0.61	Cg-low:	0.61
invert elev:	1.00 ft	invert elev:	3.00 ft
Middle orifice diameter:	2 "	Emergency weir:	
number of orif:	1	Invert:	4.00 ft
Cg-middle:	0.61	Weir Length (ft)	10.00 ft
invert elev:	2.00 ft	Riser Box LxW	3x2

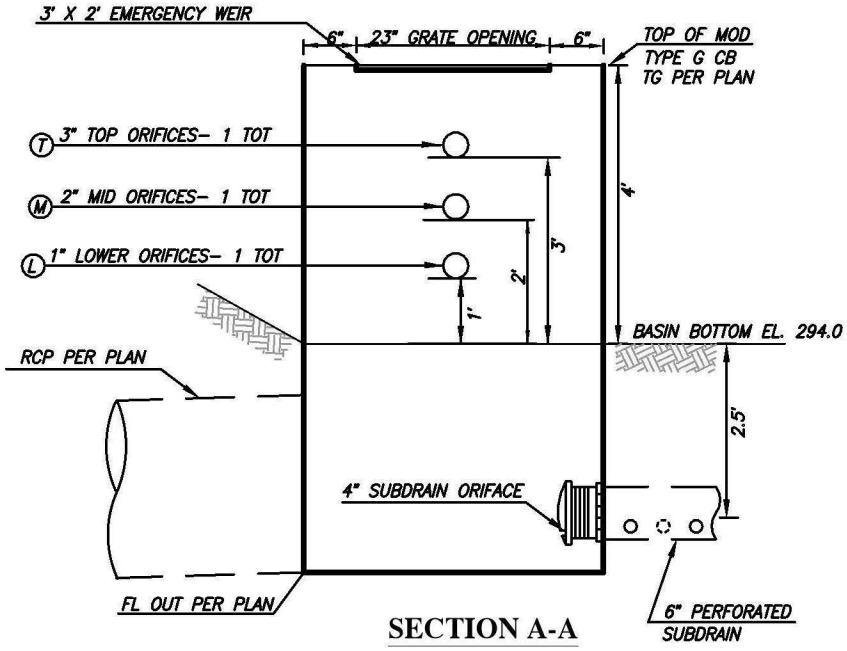
h (ft)	H/D-low -	H/D-mid -	H/D-top -	H/D-peak -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qtop-orif (cfs)	Qtop-weir (cfs)	Qtot-top (cfs)	Qpeak-top (cfs)	Qtot (cfs)	Qtot w/Subdrain (cfs)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
1.05	0.60	0.00	0.00	0.00	0.00	0.00	0.002	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.002	0.825
1.10	1.20	0.00	0.00	0.00	0.01	0.01	0.006	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.006	0.829
1.15	1.80	0.00	0.00	0.00	0.01	0.01	0.009	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.009	0.832
1.20	2.40	0.00	0.00	0.00	0.01	0.01	0.011	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.011	0.834
1.25	3.00	0.00	0.00	0.00	0.01	0.01	0.012	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.012	0.835
1.30	3.60	0.00	0.00	0.00	0.01	0.02	0.014	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.014	0.837
1.35	4.20	0.00	0.00	0.00	0.01	0.03	0.015	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.015	0.838
1.40	4.80	0.00	0.00	0.00	0.02	0.07	0.016	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.016	0.839
1.45	5.40	0.00	0.00	0.00	0.02	0.16	0.017	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.017	0.840
1.50	6.00	0.00	0.00	0.00	0.02	0.34	0.018	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.018	0.841
1.55	6.60	0.00	0.00	0.00	0.02	0.65	0.019	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.019	0.842
1.60	7.20	0.00	0.00	0.00	0.02	1.15	0.020	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.020	0.843
1.65	7.80	0.00	0.00	0.00	0.02	1.92	0.021	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.021	0.844
1.70	8.40	0.00	0.00	0.00	0.02	3.03	0.022	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.022	0.845
1.75	9.00	0.00	0.00	0.00	0.02	4.60	0.022	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.022	0.845
1.80	9.60	0.00	0.00	0.00	0.02	6.74	0.023	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.023	0.846
1.85	10.20	0.00	0.00	0.00	0.02	9.61	0.024	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.024	0.847
1.90	10.80	0.00	0.00	0.00	0.02	13.38	0.025	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.025	0.848
1.95	11.40	0.00	0.00	0.00	0.03	18.22	0.025	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.025	0.848
2.00	12.00	0.00	0.00	0.00	0.03	24.36	0.026	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.026	0.849
2.05	12.60	0.30	0.00	0.00	0.03	32.03	0.027	0.00	0.00	0.003	0.00	0.00	0.000	0.000	0.030	0.853
2.10	13.20	0.60	0.00	0.00	0.03	41.50	0.027	0.01	0.01	0.012	0.00	0.00	0.000	0.000	0.040	0.863
2.15	13.80	0.90	0.00	0.00	0.03	53.07	0.028	0.03	0.02	0.025	0.00	0.00	0.000	0.000	0.053	0.876
2.20	14.40	1.20	0.00	0.00	0.03	67.08	0.029	0.04	0.04	0.036	0.00	0.00	0.000	0.000	0.065	0.888
2.25	15.00	1.50	0.00	0.00	0.03	83.87	0.029	0.04	0.05	0.044	0.00	0.00	0.000	0.000	0.073	0.896
2.30	15.60	1.80	0.00	0.00	0.03	103.84	0.030	0.05	0.06	0.050	0.00	0.00	0.000	0.000	0.080	0.903
2.35	16.20	2.10	0.00	0.00	0.03	127.43	0.031	0.06	0.07	0.055	0.00	0.00	0.000	0.000	0.086	0.909
2.40	16.80	2.40	0.00	0.00	0.03	155.09	0.031	0.06	0.08	0.060	0.00	0.00	0.000	0.000	0.091	0.914
2.45	17.40	2.70	0.00	0.00	0.03	187.34	0.032	0.06	0.08	0.065	0.00	0.00	0.000	0.000	0.096	0.919
2.50	18.00	3.00	0.00	0.00	0.03	224.72	0.032	0.07	0.08	0.069	0.00	0.00	0.000	0.000	0.101	0.924
2.55	18.60	3.30	0.00	0.00	0.03	267.80	0.033	0.07	0.08	0.073	0.00	0.00	0.000	0.000	0.106	0.929
2.60	19.20	3.60	0.00	0.00	0.03	317.23	0.033	0.08	0.09	0.077	0.00	0.00	0.000	0.000	0.110	0.933
2.65	19.80	3.90	0.00	0.00	0.03	373.67	0.034	0.08	0.12	0.080	0.00	0.00	0.000	0.000	0.114	0.937
2.70	20.40	4.20	0.00	0.00	0.03	437.84	0.034	0.08	0.17	0.084	0.00	0.00	0.000	0.000	0.118	0.941
2.75	21.00	4.50	0.00	0.00	0.03	510.51	0.035	0.09	0.26	0.087	0.00	0.00	0.000	0.000	0.122	0.945
2.80	21.60	4.80	0.00	0.00	0.04	592.48	0.035	0.09	0.41	0.090	0.00	0.00	0.000	0.000	0.126	0.949
2.85	22.20	5.10	0.00	0.00	0.04	684.63	0.036	0.09	0.62	0.094	0.00	0.00	0.000	0.000	0.129	0.952
2.90	22.80	5.40	0.00	0.00	0.04	787.87	0.036	0.10	0.93	0.097	0.00	0.00	0.000	0.000	0.133	0.956
2.95	23.40	5.70	0.00	0.00	0.04	903.17	0.037	0.10	1.36	0.099	0.00	0.00	0.000	0.000	0.136	0.959
3.00	24.00	6.00	0.00	0.00	0.04	1031.55	0.037	0.10	1.94	0.102	0.00	0.00	0.000	0.000	0.140	0.963
3.05	24.60	6.30	0.20	0.00	0.04	1174.09	0.038	0.11	2.71	0.105	0.00	0.00	0.004	0.000	0.147	0.970
3.10	25.20	6.60	0.40	0.00	0.04	1331.93	0.038	0.11	3.70	0.108	0.00	0.02	0.016	0.000	0.162	0.985
3.15	25.80	6.90	0.60	0.00	0.04	1506.26	0.039	0.11	4.96	0.110	0.04	0.03	0.034	0.000	0.183	1.006
3.20	26.40	7.20	0.80	0.00	0.04	1698.35	0.039	0.11	6.53	0.113	0.07	0.06	0.056	0.000	0.208	1.031
3.25	27.00	7.50	1.00	0.00	0.04	1909.52	0.040	0.12	8.47	0.115	0.08	0.08	0.081	0.000	0.236	1.059
3.30	27.60	7.80	1.20	0.00	0.04	2141.14	0.040	0.12	10.84	0.118	0.10	0.11	0.101	0.000	0.258	1.081
3.35	28.20	8.10	1.40	0.00	0.04	2394.66	0.041	0.12	13.70	0.120	0.11	0.13	0.114	0.000	0.275	1.098
3.40	28.80	8.40	1.60	0.00	0.04	2671.61	0.041	0.12	17.13	0.123	0.13	0.16	0.126	0.000	0.290	1.113
3.45	29.40	8.70	1.80	0.00	0.04	2973.56	0.041	0.12	21.20	0.125	0.14	0.18	0.137	0.000	0.303	1.126
3.50	30.00	9.00	2.00	0.00	0.04	3302.17	0.042	0.13	26.00	0.127	0.15	0.20	0.147	0.000	0.316	1.139
3.55	30.60	9.30	2.20	0.00	0.04	3659.16	0.042	0.13	31.61	0.129	0.16	0.21	0.157	0.000	0.328	1.151
3.60	31.20	9.60	2.40	0.00	0.04	4046.33	0.043	0.13	38.14	0.132	0.17	0.22	0.166	0.000	0.340	1.163
3.65	31.80	9.90	2.60	0.00	0.04	4465.55	0.043	0.13	45.70	0.134	0.17	0.22	0.174	0.000	0.351	1.174
3.70	32.40	10.20	2.80	0.00	0.04	4918.76	0.044	0.14	54.39	0.136	0.18	0.22	0.182	0.000	0.362	1.185
3.75	33.00	10.50	3.00	0.00	0.04	5408.00	0.044	0.14	64.34	0.138	0.19	0.22	0.190	0.000	0.372	1.195
3.80	33.60	10.80	3.20	0.00	0.04	5935.36	0.044	0.14	75.67	0.140	0.20	0.22	0.197	0.000	0.382	1.205
3.85	34.20	11.10	3.40	0.00	0.04	6503.02	0.045	0.14	88.53	0.142	0.20	0.24	0.205	0.000	0.391	1.214
3.90	34.80	11.40	3.60	0.00	0.05	7113.25	0.045	0.14	103.06	0.144	0.21	0.26	0.212	0.000	0.401	1.224
3.95	35.40	11.70	3.80	0.00	0.05	7768.41	0.046	0.15	119.42	0.146	0.22	0.30	0.218	0.000	0.410	1.233
4.00	36.00	12.00	4.00	0.00	0.05	8470.91	0.046	0.15	137.77	0.148	0.22	0.37	0.225	0.000	0.419	1.242
4.05	36.60	12.30	4.20	0.06	0.05	9223.28	0.046	0.15	158.29	0.150	0.23	0.47	0.231	0.372	0.799	1.622
4.10	37.20	12.60	4.40	0.12	0.05	10028.13	0.047	0.15	181.17	0.152	0.24	0.62	0.237	1.053	1.489	2.312
4.15	37.80	12.90	4.60	0.18	0.05	10888.14	0.047	0.15	206.59	0.154	0.24	0.83	0.243	1.935	2.378	3.201
4.20	38.40	13.20	4.80	0.24	0.05	11806.11	0.047	0.16	234.76	0.155	0.25	1.12	0.249	2.978	3.430	4.253
4.25	39.00	13.50	5.00	0.30	0.05	12784.92	0.048	0.16	265.90	0.157	0.25	1.49	0.255	4.162	4.622	5.445
4.30	39.60	13.80	5.20	0.36	0.05	13827.53	0.048	0.16	300.23	0.159	0.26	1.96	0.260	5.472	5.939	6.762
4.35	40.20	14.10	5.40	0.42	0.05	14937.02	0.049	0.16	337.99	0.161	0.27	2.57	0.266	6.895	7.370	8.193
4.40	40.80	14.40	5.60	0.48	0.05	16116.54	0.049	0.16	379.44	0.163	0.27	3.32	0.271	8.424	8.907	9.730
4.45	41.40	14.70	5.80	0.54	0.05	17369.36	0.049	0.16	424.82	0.164	0.28	4.24	0.277	10.052	10.542	11.365
4.50	42.00	15.00	6.00	0.60	0.05	18698.83	0.050	0.17	474.42	0.166	0.28	5.36	0.282	11.773	12.271	13.094
4.55	42.60	15.30	6.20	0.66	0.05	20108.43	0.050	0.17	528.52	0.168	0.29	6.70	0.287	13.583	14.087	14.910
4.60	43.20	15.60	6.40	0.72	0.05	21601.72	0.050	0.17	587.42	0.169	0.29	8.31	0.292	15.476	15.988	16.811
4.65	43.80	15.90	6.60	0.78	0.05	23182.36	0.051	0.17	651.41	0.171	0.30	10.20	0.297	17.451	17.969	18.792
4.70	44.40	16.20	6.80	0.84	0.05	24854.13	0.051	0.17	720.84	0.173	0.30	12.42	0.302	19.503	20.028	20.851
4.75	45.00	16.50	7.00	0.90	0.05	26620.91	0.051	0.17	796.03	0.174	0.31	15.00	0.306	21.629	22.161	22.984
4.80	45.60	16.80	7.20	0.96	0.05	28486.69	0.052	0.18	877.34	0.176	0.31	17.99	0.311	23.828	24.366	25.189
4.85	46.20	17.10	7.40	1.02	0.05	30455.58	0.052	0.18	965.12	0.178	0.32	21.43	0.316	26.096	26.641	27.464
4.90	46.80	17.40	7.60	1.08	0.05	32531.79	0.052	0.18	1059.76	0.179	0.32	25.37	0.320	28.432	28.984	29.807
4.95	47.40	17.70	7.80	1.14	0.05	34719.63	0.053	0.18	1161.65	0.181	0.32	29.87	0.325	30.834	31.392	32.215
5.00	48.00	18.00	8.00	1.20	0.05	37023.56	0.053	0.18	1271.19	0.182	0.33	34.96	0.329	33.300	33.865	34.688
5.05	48.60	18.30	8.20	1.26	0.05	39448.12	0.053	0.18	1388.80	0.184	0.33	40.72	0.333	35.828	36.399	37.222
5.10	49.20	18.60	8.40	1.32	0.05	41997.99	0.054	0.19	1514.93	0.185	0.34	47.20	0.338	38.418	38.995	39.818
5.15	49.80	18.90	8.60	1.38	0.05	44677.97	0.054	0.19	1650.01	0.187	0.34	54.47	0.342	41.067	41.650	42.473
5.20	50.40	19.20	8.80	1.44	0.05	47492.96	0.054	0.19	1794.53	0.189	0.35	62.59	0.346	43.774	44.363	45.186
5.25	51.00	19.50	9.00	1.50	0.05	50448.01	0.055	0.19	1948.96	0.190	0.35	71.64	0.350	46.538	47.133	47.956
5.30	51.60	19.80	9.20	1.56	0.06	53548.26	0.055	0.19	2113.80	0.192	0.35	81.69	0.354	49.358	49.959	50.782
5.35	52.20	20.10	9.40	1.62	0.06	56799.02	0.055	0.19	2289.57	0.193	0.36	92.82	0.358	52.233	52.840	53.663
5.40	52.80	20.40	9.60	1.68	0.06	60205.68	0.056	0.19	2476.80	0.194	0.36	105.11	0.362	55.162	55.774	56.597
5.45	53.40	20.70	9.80	1.74	0.06	63773.78	0.056	0.20	2676.05	0.196	0.37	118.66	0.366	58.143	58.761	59.584
5.50	54.00	21.00	10.00	1.80	0.06	67509.00	0.056	0.20	2887.86	0.197	0.37	133.55	0.370	61.176	61.800	62.623
5.55	54.60	21.30	10.20	1.86	0.06	71417.13	0.057	0.20	3112.84	0.199	0.37	149.88	0.374	64.260	64.890	65.713
5.60	55.20	21.60	10.40	1.92	0.06	75504.11	0.057	0.20	3351.59	0.200	0.38	167.75	0.378	67.394	68.030	68.853
5.65	55.80	21.90	10.60	1.98	0.06	79776.00	0.057	0.20	3604.71	0.202	0.38	187.26	0.382	70.578	71.219	72.042
5.70	56.40	22.20	10.80	2.04	0.06	84239.00	0.058	0.20	3872.86	0.203	0.39	208.52	0.386	73.810	74.457	75.280
5.75	57.00	22.50	11.00	2.10	0.06	88899.46	0.058	0.20	4156.69	0.205	0.39	231.66	0.389	77.091	77.742	78.565
5.80	57.60	22.80	11.20	2.16	0.06	93763.84	0.058	0.21	4456.87	0.206	0.39	256.77	0.393	80.418	81.075	81.898
5.85	58.20	23.10	11.40	2.22	0.06	98838.78	0.059	0.21	4774.09	0.207	0.40	284.00	0.397	83.792	84.454	85.277
5.90	58.80	23.40	11.60	2.28	0.06	104131.02	0.059	0.21	5109.08	0.209	0.40	313.47	0.400	87.212	87.879	88.702
5.95	59.40	23.70	11.80	2.34	0.06	109647.47	0.059	0.21	5462.57	0.210	0.40	345.31	0.404	90.677	91.350	92.173
6.00	60.00	24.00	12.00	2.40	0.06	115395.17	0.059	0.21	5835.30	0.211	0.41	379.66	0.407	94.187	94.865	95.688

SUNBOW II, PHASE 3
BASIN 1 RISER ELEVATION VIEW



PLAN VIEW
NTS

NOTE:
(T) INDICATES TOP ORIFICE
(M) INDICATES MIDDLE ORIFICE
(L) INDICATES LOWER ORIFICE



SECTION A-A

Draw Down*				
Elevation	Q_{AVG} (CFS)	$DV_{n, n+1}$ (CF)	DT (HR)	Total T
0.00	0.804	1262.9	0.44	37.14
0.05	0.805	1267.8	0.44	36.70
0.10	0.806	1272.8	0.44	36.27
0.15	0.807	1277.8	0.44	35.83
0.20	0.808	1282.7	0.44	35.39
0.25	0.809	1287.7	0.44	34.95
0.30	0.810	1292.6	0.44	34.50
0.35	0.811	1297.6	0.44	34.06
0.40	0.812	1302.5	0.45	33.62
0.45	0.813	1307.5	0.45	33.17
0.50	0.814	1312.5	0.45	32.72
0.55	0.815	1317.4	0.45	32.28
0.60	0.816	1322.4	0.45	31.83
0.65	0.817	1327.3	0.45	31.38
0.70	0.818	1332.3	0.45	30.92
0.75	0.819	1337.2	0.45	30.47
0.80	0.820	1342.2	0.45	30.02
0.85	0.821	1347.2	0.46	29.56
0.90	0.822	1352.1	0.46	29.11
0.95	0.823	1357.1	0.46	28.65
1.00	0.824	1362.1	0.46	28.19
1.05	0.827	1367.2	0.46	27.73
1.10	0.831	1372.3	0.46	27.27
1.15	0.833	1377.4	0.46	26.81
1.20	0.834	1382.5	0.46	26.35
1.25	0.836	1387.6	0.46	25.89
1.30	0.837	1392.7	0.46	25.43
1.35	0.838	1397.8	0.46	24.97
1.40	0.840	1402.9	0.46	24.51
1.45	0.841	1408.0	0.47	24.04
1.50	0.842	1413.1	0.47	23.58
1.55	0.842	1418.2	0.47	23.11
1.60	0.843	1423.3	0.47	22.64
1.65	0.844	1428.4	0.47	22.18
1.70	0.845	1433.5	0.47	21.71
1.75	0.846	1438.6	0.47	21.23
1.80	0.847	1443.7	0.47	20.76
1.85	0.847	1448.8	0.47	20.29
1.90	0.848	1453.9	0.48	19.81
1.95	0.849	1459.0	0.48	19.34
2.00	0.851	1464.2	0.48	18.86
2.05	0.858	1469.4	0.48	18.38
2.10	0.869	1474.6	0.47	17.91
2.15	0.882	1479.9	0.47	17.43
2.20	0.892	1485.1	0.46	16.97
2.25	0.899	1490.4	0.46	16.51
2.30	0.906	1495.6	0.46	16.05
2.35	0.911	1500.8	0.46	15.59
2.40	0.917	1506.1	0.46	15.13
2.45	0.922	1511.3	0.46	14.67
2.50	0.926	1516.6	0.45	14.22
2.55	0.931	1521.8	0.45	13.76
2.60	0.935	1527.0	0.45	13.31
2.65	0.939	1532.3	0.45	12.86
2.70	0.943	1537.5	0.45	12.40
2.75	0.947	1542.8	0.45	11.95
2.80	0.951	1548.0	0.45	11.50
2.85	0.954	1553.2	0.45	11.04
2.90	0.958	1558.5	0.45	10.59
2.95	0.961	1563.7	0.45	10.14
3.00	0.966	1569.0	0.45	9.69

3.05	0.977	1574.4	0.45	9.24
3.10	0.995	1579.8	0.44	8.79
3.15	1.018	1585.2	0.43	8.35
3.20	1.045	1590.6	0.42	7.92
3.25	1.070	1596.0	0.41	7.49
3.30	1.090	1601.4	0.41	7.08
3.35	1.105	1606.7	0.40	6.67
3.40	1.119	1612.1	0.40	6.27
3.45	1.133	1617.5	0.40	5.87
3.50	1.145	1622.9	0.39	5.47
3.55	1.157	1628.3	0.39	5.08
3.60	1.168	1633.7	0.39	4.69
3.65	1.179	1639.0	0.39	4.30
3.70	1.190	1644.4	0.38	3.91
3.75	1.200	1649.8	0.38	3.53
3.80	1.209	1655.2	0.38	3.15
3.85	1.219	1660.6	0.38	2.77
3.90	1.228	1666.0	0.38	2.39
3.95	1.237	1671.4	0.38	2.01
4.00	1.432	1676.8	0.33	1.63
4.05	1.967	1682.3	0.24	1.31
4.10	2.757	1687.9	0.17	1.07
4.15	3.727	1693.4	0.13	0.90
4.20	4.849	1698.9	0.10	0.78
4.25	6.104	1704.4	0.08	0.68
4.30	7.478	1710.0	0.06	0.60
4.35	8.962	1715.5	0.05	0.54
4.40	10.548	1721.0	0.05	0.48
4.45	12.230	1726.5	0.04	0.44
4.50	14.002	1732.1	0.03	0.40
4.55	15.861	1737.6	0.03	0.37
4.60	17.802	1743.1	0.03	0.33
4.65	19.822	1748.6	0.02	0.31
4.70	21.918	1754.2	0.02	0.28
4.75	24.087	1759.7	0.02	0.26
4.80	26.327	1765.2	0.02	0.24
4.85	28.636	1770.7	0.02	0.22
4.90	31.011	1776.3	0.02	0.20
4.95	33.451	1781.8	0.01	0.19
5.00	35.955	1787.4	0.01	0.17
5.05	38.520	1793.1	0.01	0.16
5.10	41.145	1798.7	0.01	0.15
5.15	43.830	1804.4	0.01	0.14
5.20	46.571	1810.1	0.01	0.12
5.25	49.369	1815.7	0.01	0.11
5.30	52.223	1821.4	0.01	0.10
5.35	55.130	1827.1	0.01	0.09
5.40	58.091	1832.7	0.01	0.08
5.45	61.104	1838.4	0.01	0.08
5.50	64.168	1844.1	0.01	0.07
5.55	67.283	1849.8	0.01	0.06
5.60	70.447	1855.4	0.01	0.05
5.65	73.661	1861.1	0.01	0.04
5.70	76.923	1866.8	0.01	0.04
5.75	80.232	1872.4	0.01	0.03
5.80	83.588	1878.1	0.01	0.02
5.85	86.990	1883.8	0.01	0.02
5.90	90.438	1889.4	0.01	0.01
5.95	93.930	1895.1	0.01	0.01
6.00				0.00

SWMM Model Flow Coefficient Calculation

Basin 1

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	12	in
*Bioretention Soil Layer	S	21	in
**Gravel Layer	G	15	in
TOTAL		4.0	ft
		48	in
Orifice Coefficient	c_g	0.6	--
Low Flow Orifice Diameter	D	4	in
Drain (Flow) exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.823	cfs
Ponding Depth Surface Area	A_{PD}	27191	ft^2
Bioretention Surface Area	A_S, A_G	25208	ft^2
	A_S, A_G	0.5787	ac
Porosity of Bioretention Soil	n	0.40	-
Flow Rate (per unit area)	q	3.525	in/hr
Effective Ponding Depth	PD_{eff}	12.47	in
Flow Coefficient	C	0.5197	--

* Biofiltration Soil Layer = 18"media+3" sand ASTM 33

**Gravel Layer = 3" ASTM#8 + 12" Gravel

Sunbow Stage Storage	
BF-1-2	
depth	area
0.00	29906
0.05	30026
0.10	30146
0.15	30266
0.20	30386
0.25	30506
0.30	30626
0.35	30746
0.40	30866
0.45	30986
0.50	31106
0.55	31226
0.60	31346
0.65	31466
0.70	31586
0.75	31706
0.80	31826
0.85	31946
0.90	32066
0.95	32186
1.00	32193
1.05	32310
1.10	32427
1.15	32545
1.20	32662
1.25	32779
1.30	32896
1.35	33013
1.40	33131
1.45	33248
1.50	33365
1.55	33482
1.60	33599
1.65	33717
1.70	33834
1.75	33951
1.80	34068
1.85	34185
1.90	34303
1.95	34420
2.00	34537
2.05	34657
2.10	34777
2.15	34897
2.20	35017
2.25	35137
2.30	35257
2.35	35377
2.40	35497
2.45	35617
2.50	35737
2.55	35857
2.60	35977
2.65	36097
2.70	36217
2.75	36337
2.80	36457
2.85	36577
2.90	36697
2.95	36817
3.00	36937
3.05	37060
3.10	37183
3.15	37306
3.20	37428
3.25	37551
3.30	37674
3.35	37797
3.40	37920
3.45	38043
3.50	38166
3.55	38288
3.60	38411
3.65	38534
3.70	38657
3.75	38780
3.80	38903
3.85	39025
3.90	39148
3.95	39271
4.00	39394
4.05	39520
4.10	39645
4.15	39771
4.20	39897
4.25	40023
4.30	40148
4.35	40274
4.40	40400
4.45	40525
4.50	40651
4.55	40777
4.60	40902
4.65	41028
4.70	41154
4.75	41280
4.80	41405
4.85	41531
4.90	41657
4.95	41782
5.00	41908
5.05	42037
5.10	42165
5.15	42294
5.20	42422
5.25	42551
5.30	42679
5.35	42808
5.40	42936
5.45	43065
5.50	43193
5.55	43322
5.60	43450
5.65	43579
5.70	43707
5.75	43836
5.80	43964
5.85	44093
5.90	44221
5.95	44350
6.00	44478

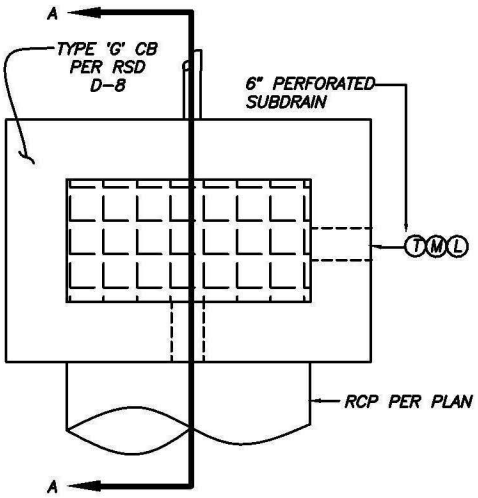
Sunbow HMP-2 Riser Summary (BF-1-2)

Discharge vs Elevation Table

Bottom orifice diameter:	1 "	Top orifice diameter:	3 "
Number:	1	Number:	1
Cg-low:	0.61	Cg-low:	0.61
invert elev:	1.00 ft	invert elev:	3.00 ft
Middle orifice diameter:	2 "	Emergency weir:	
number of orif:	1	Invert:	4.00 ft
Cg-middle:	0.61	Weir Length (ft)	10.00 ft
invert elev:	2.00 ft	Riser Box LxW	3x2

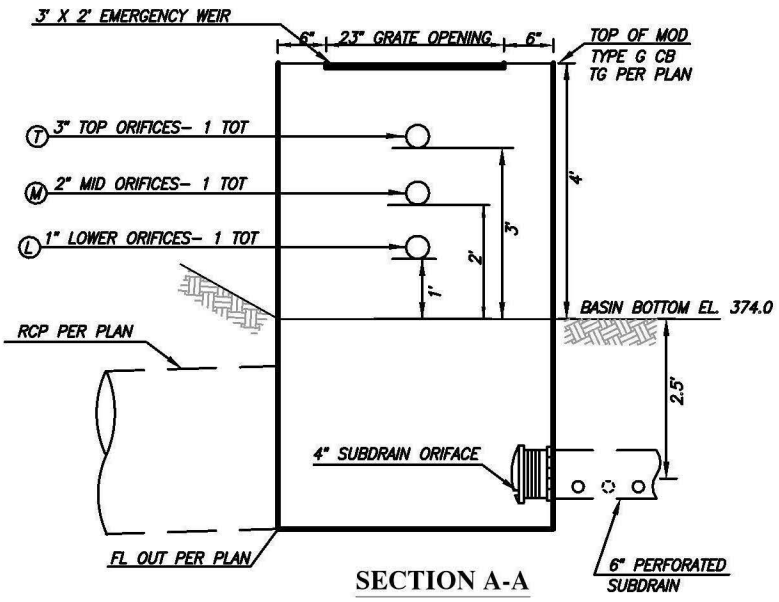
h (ft)	H/D-low -	H/D-mid -	H/D-top -	H/D-peak -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qtop-orif (cfs)	Qtop-weir (cfs)	Qtot-top (cfs)	Qpeak-top (cfs)	Qtot (cfs)	Qtot w/Subdrain (cfs)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.000	0.823
1.05	0.60	0.00	0.00	0.00	0.00	0.00	0.002	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.002	0.825
1.10	1.20	0.00	0.00	0.00	0.01	0.01	0.006	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.006	0.829
1.15	1.80	0.00	0.00	0.00	0.01	0.01	0.009	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.009	0.832
1.20	2.40	0.00	0.00	0.00	0.01	0.01	0.011	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.011	0.834
1.25	3.00	0.00	0.00	0.00	0.01	0.01	0.012	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.012	0.835
1.30	3.60	0.00	0.00	0.00	0.01	0.02	0.014	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.014	0.837
1.35	4.20	0.00	0.00	0.00	0.01	0.03	0.015	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.015	0.838
1.40	4.80	0.00	0.00	0.00	0.02	0.07	0.016	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.016	0.839
1.45	5.40	0.00	0.00	0.00	0.02	0.16	0.017	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.017	0.840
1.50	6.00	0.00	0.00	0.00	0.02	0.34	0.018	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.018	0.841
1.55	6.60	0.00	0.00	0.00	0.02	0.65	0.019	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.019	0.842
1.60	7.20	0.00	0.00	0.00	0.02	1.15	0.020	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.020	0.843
1.65	7.80	0.00	0.00	0.00	0.02	1.92	0.021	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.021	0.844
1.70	8.40	0.00	0.00	0.00	0.02	3.03	0.022	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.022	0.845
1.75	9.00	0.00	0.00	0.00	0.02	4.60	0.022	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.022	0.845
1.80	9.60	0.00	0.00	0.00	0.02	6.74	0.023	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.023	0.846
1.85	10.20	0.00	0.00	0.00	0.02	9.61	0.024	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.024	0.847
1.90	10.80	0.00	0.00	0.00	0.02	13.38	0.025	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.025	0.848
1.95	11.40	0.00	0.00	0.00	0.03	18.22	0.025	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.025	0.848
2.00	12.00	0.00	0.00	0.00	0.03	24.36	0.026	0.00	0.00	0.000	0.00	0.00	0.000	0.000	0.026	0.849
2.05	12.60	0.30	0.00	0.00	0.03	32.03	0.027	0.00	0.00	0.003	0.00	0.00	0.000	0.000	0.030	0.853
2.10	13.20	0.60	0.00	0.00	0.03	41.50	0.027	0.01	0.01	0.012	0.00	0.00	0.000	0.000	0.040	0.863
2.15	13.80	0.90	0.00	0.00	0.03	53.07	0.028	0.03	0.02	0.025	0.00	0.00	0.000	0.000	0.053	0.876
2.20	14.40	1.20	0.00	0.00	0.03	67.08	0.029	0.04	0.04	0.036	0.00	0.00	0.000	0.000	0.065	0.888
2.25	15.00	1.50	0.00	0.00	0.03	83.87	0.029	0.04	0.05	0.044	0.00	0.00	0.000	0.000	0.073	0.896
2.30	15.60	1.80	0.00	0.00	0.03	103.84	0.030	0.05	0.06	0.050	0.00	0.00	0.000	0.000	0.080	0.903
2.35	16.20	2.10	0.00	0.00	0.03	127.43	0.031	0.06	0.07	0.055	0.00	0.00	0.000	0.000	0.086	0.909
2.40	16.80	2.40	0.00	0.00	0.03	155.09	0.031	0.06	0.08	0.060	0.00	0.00	0.000	0.000	0.091	0.914
2.45	17.40	2.70	0.00	0.00	0.03	187.34	0.032	0.06	0.08	0.065	0.00	0.00	0.000	0.000	0.096	0.919
2.50	18.00	3.00	0.00	0.00	0.03	224.72	0.032	0.07	0.08	0.069	0.00	0.00	0.000	0.000	0.101	0.924
2.55	18.60	3.30	0.00	0.00	0.03	267.80	0.033	0.07	0.08	0.073	0.00	0.00	0.000	0.000	0.106	0.929
2.60	19.20	3.60	0.00	0.00	0.03	317.23	0.033	0.08	0.09	0.077	0.00	0.00	0.000	0.000	0.110	0.933
2.65	19.80	3.90	0.00	0.00	0.03	373.67	0.034	0.08	0.12	0.080	0.00	0.00	0.000	0.000	0.114	0.937
2.70	20.40	4.20	0.00	0.00	0.03	437.84	0.034	0.08	0.17	0.084	0.00	0.00	0.000	0.000	0.118	0.941
2.75	21.00	4.50	0.00	0.00	0.03	510.51	0.035	0.09	0.26	0.087	0.00	0.00	0.000	0.000	0.122	0.945
2.80	21.60	4.80	0.00	0.00	0.04	592.48	0.035	0.09	0.41	0.090	0.00	0.00	0.000	0.000	0.126	0.949
2.85	22.20	5.10	0.00	0.00	0.04	684.63	0.036	0.09	0.62	0.094	0.00	0.00	0.000	0.000	0.129	0.952
2.90	22.80	5.40	0.00	0.00	0.04	787.87	0.036	0.10	0.93	0.097	0.00	0.00	0.000	0.000	0.133	0.956
2.95	23.40	5.70	0.00	0.00	0.04	903.17	0.037	0.10	1.36	0.099	0.00	0.00	0.000	0.000	0.136	0.959
3.00	24.00	6.00	0.00	0.00	0.04	1031.55	0.037	0.10	1.94	0.102	0.00	0.00	0.000	0.000	0.140	0.963
3.05	24.60	6.30	0.20	0.00	0.04	1174.09	0.038	0.11	2.71	0.105	0.00	0.00	0.004	0.000	0.147	0.970
3.10	25.20	6.60	0.40	0.00	0.04	1331.93	0.038	0.11	3.70	0.108	0.00	0.02	0.016	0.000	0.162	0.985
3.15	25.80	6.90	0.60	0.00	0.04	1506.26	0.039	0.11	4.96	0.110	0.04	0.03	0.034	0.000	0.183	1.006
3.20	26.40	7.20	0.80	0.00	0.04	1698.35	0.039	0.11	6.53	0.113	0.07	0.06	0.056	0.000	0.208	1.031
3.25	27.00	7.50	1.00	0.00	0.04	1909.52	0.040	0.12	8.47	0.115	0.08	0.08	0.081	0.000	0.236	1.059
3.30	27.60	7.80	1.20	0.00	0.04	2141.14	0.040	0.12	10.84	0.118	0.10	0.11	0.101	0.000	0.258	1.081
3.35	28.20	8.10	1.40	0.00	0.04	2394.66	0.041	0.12	13.70	0.120	0.11	0.13	0.114	0.000	0.275	1.098
3.40	28.80	8.40	1.60	0.00	0.04	2671.61	0.041	0.12	17.13	0.123	0.13	0.16	0.126	0.000	0.290	1.113
3.45	29.40	8.70	1.80	0.00	0.04	2973.56	0.041	0.12	21.20	0.125	0.14	0.18	0.137	0.000	0.303	1.126
3.50	30.00	9.00	2.00	0.00	0.04	3302.17	0.042	0.13	26.00	0.127	0.15	0.20	0.147	0.000	0.316	1.139
3.55	30.60	9.30	2.20	0.00	0.04	3659.16	0.042	0.13	31.61	0.129	0.16	0.21	0.157	0.000	0.328	1.151
3.60	31.20	9.60	2.40	0.00	0.04	4046.33	0.043	0.13	38.14	0.132	0.17	0.22	0.166	0.000	0.340	1.163
3.65	31.80	9.90	2.60	0.00	0.04	4465.55	0.043	0.13	45.70	0.134	0.17	0.22	0.174	0.000	0.351	1.174
3.70	32.40	10.20	2.80	0.00	0.04	4918.76	0.044	0.14	54.39	0.136	0.18	0.22	0.182	0.000	0.362	1.185
3.75	33.00	10.50	3.00	0.00	0.04	5408.00	0.044	0.14	64.34	0.138	0.19	0.22	0.190	0.000	0.372	1.195
3.80	33.60	10.80	3.20	0.00	0.04	5935.36	0.044	0.14	75.67	0.140	0.20	0.22	0.197	0.000	0.382	1.205
3.85	34.20	11.10	3.40	0.00	0.04	6503.02	0.045	0.14	88.53	0.142	0.20	0.24	0.205	0.000	0.391	1.214
3.90	34.80	11.40	3.60	0.00	0.05	7113.25	0.045	0.14	103.06	0.144	0.21	0.26	0.212	0.000	0.401	1.224
3.95	35.40	11.70	3.80	0.00	0.05	7768.41	0.046	0.15	119.42	0.146	0.22	0.30	0.218	0.000	0.410	1.233
4.00	36.00	12.00	4.00	0.00	0.05	8470.91	0.046	0.15	137.77	0.148	0.22	0.37	0.225	0.000	0.419	1.242
4.05	36.60	12.30	4.20	0.06	0.05	9223.28	0.046	0.15	158.29	0.150	0.23	0.47	0.231	0.372	0.799	1.622
4.10	37.20	12.60	4.40	0.12	0.05	10028.13	0.047	0.15	181.17	0.152	0.24	0.62	0.237	1.053	1.489	2.312
4.15	37.80	12.90	4.60	0.18	0.05	10888.14	0.047	0.15	206.59	0.154	0.24	0.83	0.243	1.935	2.378	3.201
4.20	38.40	13.20	4.80	0.24	0.05	11806.11	0.047	0.16	234.76	0.155	0.25	1.12	0.249	2.978	3.430	4.253
4.25	39.00	13.50	5.00	0.30	0.05	12784.92	0.048	0.16	265.90	0.157	0.25	1.49	0.255	4.162	4.622	5.445
4.30	39.60	13.80	5.20	0.36	0.05	13827.53	0.048	0.16	300.23	0.159	0.26	1.96	0.260	5.472	5.939	6.762
4.35	40.20	14.10	5.40	0.42	0.05	14937.02	0.049	0.16	337.99	0.161	0.27	2.57	0.266	6.895	7.370	8.193
4.40	40.80	14.40	5.60	0.48	0.05	16116.54	0.049	0.16	379.44	0.163	0.27	3.32	0.271	8.424	8.907	9.730
4.45	41.40	14.70	5.80	0.54	0.05	17369.36	0.049	0.16	424.82	0.164	0.28	4.24	0.277	10.052	10.542	11.365
4.50	42.00	15.00	6.00	0.60	0.05	18698.83	0.050	0.17	474.42	0.166	0.28	5.36	0.282	11.773	12.271	13.094
4.55	42.60	15.30	6.20	0.66	0.05	20108.43	0.050	0.17	528.52	0.168	0.29	6.70	0.287	13.583	14.087	14.910
4.60	43.20	15.60	6.40	0.72	0.05	21601.72	0.050	0.17	587.42	0.169	0.29	8.31	0.292	15.476	15.988	16.811
4.65	43.80	15.90	6.60	0.78	0.05	23182.36	0.051	0.17	651.41	0.171	0.30	10.20	0.297	17.451	17.969	18.792
4.70	44.40	16.20	6.80	0.84	0.05	24854.13	0.051	0.17	720.84	0.173	0.30	12.42	0.302	19.503	20.028	20.851
4.75	45.00	16.50	7.00	0.90	0.05	26620.91	0.051	0.17	796.03	0.174	0.31	15.00	0.306	21.629	22.161	22.984
4.80	45.60	16.80	7.20	0.96	0.05	28486.69	0.052	0.18	877.34	0.176	0.31	17.99	0.311	23.828	24.366	25.189
4.85	46.20	17.10	7.40	1.02	0.05	30455.58	0.052	0.18	965.12	0.178	0.32	21.43	0.316	26.096	26.641	27.464
4.90	46.80	17.40	7.60	1.08	0.05	32531.79	0.052	0.18	1059.76	0.179	0.32	25.37	0.320	28.432	28.984	29.807
4.95	47.40	17.70	7.80	1.14	0.05	34719.63	0.053	0.18	1161.65	0.181	0.32	29.87	0.325	30.834	31.392	32.215
5.00	48.00	18.00	8.00	1.20	0.05	37023.56	0.053	0.18	1271.19	0.182	0.33	34.96	0.329	33.300	33.865	34.688
5.05	48.60	18.30	8.20	1.26	0.05	39448.12	0.053	0.18	1388.80	0.184	0.33	40.72	0.333	35.828	36.399	37.222
5.10	49.20	18.60	8.40	1.32	0.05	41997.99	0.054	0.19	1514.93	0.185	0.34	47.20	0.338	38.418	38.995	39.818
5.15	49.80	18.90	8.60	1.38	0.05	44677.97	0.054	0.19	1650.01	0.187	0.34	54.47	0.342	41.067	41.650	42.473
5.20	50.40	19.20	8.80	1.44	0.05	47492.96	0.054	0.19	1794.53	0.189	0.35	62.59	0.346	43.774	44.363	45.186
5.25	51.00	19.50	9.00	1.50	0.05	50448.01	0.055	0.19	1948.96	0.190	0.35	71.64	0.350	46.538	47.133	47.956
5.30	51.60	19.80	9.20	1.56	0.06	53548.26	0.055	0.19	2113.80	0.192	0.35	81.69	0.354	49.358	49.959	50.782
5.35	52.20	20.10	9.40	1.62	0.06	56799.02	0.055	0.19	2289.57	0.193	0.36	92.82	0.358	52.233	52.840	53.663
5.40	52.80	20.40	9.60	1.68	0.06	60205.68	0.056	0.19	2476.80	0.194	0.36	105.11	0.362	55.162	55.774	56.597
5.45	53.40	20.70	9.80	1.74	0.06	63773.78	0.056	0.20	2676.05	0.196	0.37	118.66	0.366	58.143	58.761	59.584
5.50	54.00	21.00	10.00	1.80	0.06	67509.00	0.056	0.20	2887.86	0.197	0.37	133.55	0.370	61.176	61.800	62.623
5.55	54.60	21.30	10.20	1.86	0.06	71417.13	0.057	0.20	3112.84	0.199	0.37	149.88	0.374	64.260	64.890	65.713
5.60	55.20	21.60	10.40	1.92	0.06	75504.11	0.057	0.20	3351.59	0.200	0.38	167.75	0.378	67.394	68.030	68.853
5.65	55.80	21.90	10.60	1.98	0.06	79776.00	0.057	0.20	3604.71	0.202	0.38	187.26	0.382	70.578	71.219	72.042
5.70	56.40	22.20	10.80	2.04	0.06	84239.00	0.058	0.20	3872.86	0.203	0.39	208.52	0.386	73.810	74.457	75.280
5.75	57.00	22.50	11.00	2.10	0.06	88899.46	0.058	0.20	4156.69	0.205	0.39	231.66	0.389	77.091	77.742	78.565
5.80	57.60	22.80	11.20	2.16	0.06	93763.84	0.058	0.21	4456.87	0.206	0.39	256.77	0.393	80.418	81.075	81.898
5.85	58.20	23.10	11.40	2.22	0.06	98838.78	0.059	0.21	4774.09	0.207	0.40	284.00	0.397	83.792	84.454	85.277
5.90	58.80	23.40	11.60	2.28	0.06	104131.02	0.059	0.21	5109.08	0.209	0.40	313.47	0.400	87.212	87.879	88.702
5.95	59.40	23.70	11.80	2.34	0.06	109647.47	0.059	0.21	5462.57	0.210	0.40	345.31	0.404	90.677	91.350	92.173
6.00	60.00	24.00	12.00	2.40	0.06	115395.17	0.059	0.21	5835.30	0.211	0.41	379.66	0.407	94.187	94.865	95.688

SUNBOW II, PHASE 3
BASIN 2 RISER ELEVATION VIEW



PLAN VIEW
NTS

NOTE:
(T) INDICATES TOP ORIFICE
(M) INDICATES MIDDLE ORIFICE
(L) INDICATES LOWER ORIFICE



SECTION A-A

Draw Down*				
Elevation	Q_{AVG} (CFS)	$DV_{n, n+1}$ (CF)	DT (HR)	Total T
0.00	0.804	1498.3	0.52	43.89
0.05	0.805	1504.3	0.52	43.38
0.10	0.806	1510.3	0.52	42.86
0.15	0.807	1516.3	0.52	42.34
0.20	0.808	1522.3	0.52	41.81
0.25	0.809	1528.3	0.53	41.29
0.30	0.810	1534.3	0.53	40.77
0.35	0.811	1540.3	0.53	40.24
0.40	0.812	1546.3	0.53	39.71
0.45	0.813	1552.3	0.53	39.18
0.50	0.814	1558.3	0.53	38.65
0.55	0.815	1564.3	0.53	38.12
0.60	0.816	1570.3	0.53	37.59
0.65	0.817	1576.3	0.54	37.05
0.70	0.818	1582.3	0.54	36.51
0.75	0.819	1588.3	0.54	35.98
0.80	0.820	1594.3	0.54	35.44
0.85	0.821	1600.3	0.54	34.90
0.90	0.822	1606.3	0.54	34.36
0.95	0.823	1609.5	0.54	33.81
1.00	0.824	1612.6	0.54	33.27
1.05	0.827	1618.4	0.54	32.73
1.10	0.831	1624.3	0.54	32.18
1.15	0.833	1630.2	0.54	31.64
1.20	0.834	1636.0	0.54	31.09
1.25	0.836	1641.9	0.55	30.55
1.30	0.837	1647.7	0.55	30.00
1.35	0.838	1653.6	0.55	29.46
1.40	0.840	1659.5	0.55	28.91
1.45	0.841	1665.3	0.55	28.36
1.50	0.842	1671.2	0.55	27.81
1.55	0.842	1677.0	0.55	27.26
1.60	0.843	1682.9	0.55	26.71
1.65	0.844	1688.8	0.56	26.15
1.70	0.845	1694.6	0.56	25.60
1.75	0.846	1700.5	0.56	25.04
1.80	0.847	1706.3	0.56	24.48
1.85	0.847	1712.2	0.56	23.92
1.90	0.848	1718.1	0.56	23.36
1.95	0.849	1723.9	0.56	22.80
2.00	0.851	1729.8	0.56	22.23
2.05	0.858	1735.8	0.56	21.67
2.10	0.869	1741.8	0.56	21.11
2.15	0.882	1747.8	0.55	20.55
2.20	0.892	1753.8	0.55	20.00
2.25	0.899	1759.8	0.54	19.45
2.30	0.906	1765.8	0.54	18.91
2.35	0.911	1771.8	0.54	18.37
2.40	0.917	1777.8	0.54	17.83
2.45	0.922	1783.8	0.54	17.29
2.50	0.926	1789.8	0.54	16.75
2.55	0.931	1795.8	0.54	16.21
2.60	0.935	1801.8	0.54	15.68
2.65	0.939	1807.8	0.53	15.14
2.70	0.943	1813.8	0.53	14.61
2.75	0.947	1819.8	0.53	14.07
2.80	0.951	1825.8	0.53	13.54
2.85	0.954	1831.8	0.53	13.01
2.90	0.958	1837.8	0.53	12.47
2.95	0.961	1843.8	0.53	11.94
3.00	0.966	1849.9	0.53	11.41

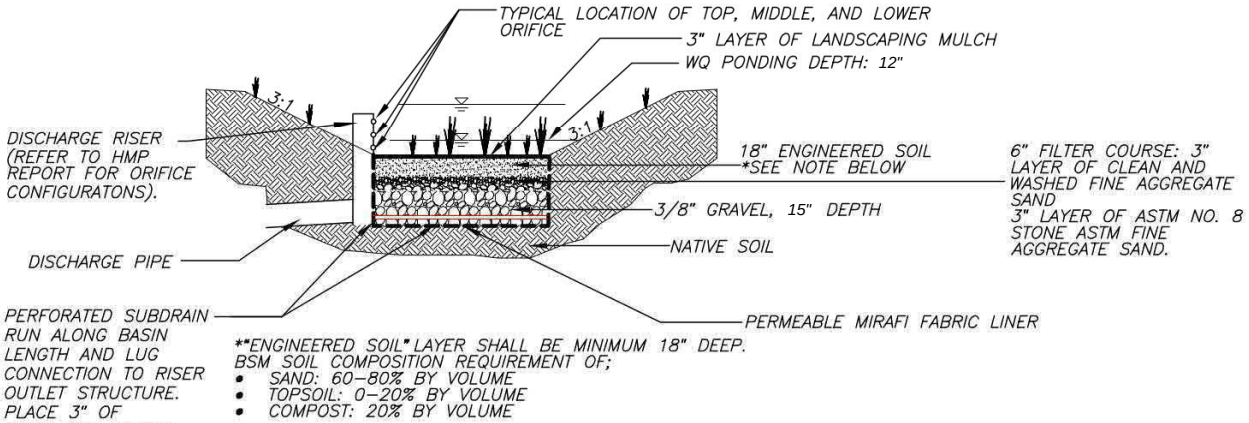
3.05	0.977	1856.1	0.53	10.88
3.10	0.995	1862.2	0.52	10.35
3.15	1.018	1868.3	0.51	9.83
3.20	1.045	1874.5	0.50	9.32
3.25	1.070	1880.6	0.49	8.82
3.30	1.090	1886.8	0.48	8.33
3.35	1.105	1892.9	0.48	7.85
3.40	1.119	1899.1	0.47	7.38
3.45	1.133	1905.2	0.47	6.90
3.50	1.145	1911.3	0.46	6.44
3.55	1.157	1917.5	0.46	5.97
3.60	1.168	1923.6	0.46	5.51
3.65	1.179	1929.8	0.45	5.06
3.70	1.190	1935.9	0.45	4.60
3.75	1.200	1942.1	0.45	4.15
3.80	1.209	1948.2	0.45	3.70
3.85	1.219	1954.3	0.45	3.25
3.90	1.228	1960.5	0.44	2.81
3.95	1.237	1966.6	0.44	2.36
4.00	1.432	1972.8	0.38	1.92
4.05	1.967	1979.1	0.28	1.54
4.10	2.757	1985.4	0.20	1.26
4.15	3.727	1991.7	0.15	1.06
4.20	4.849	1998.0	0.11	0.91
4.25	6.104	2004.3	0.09	0.80
4.30	7.478	2010.6	0.07	0.71
4.35	8.962	2016.8	0.06	0.63
4.40	10.548	2023.1	0.05	0.57
4.45	12.230	2029.4	0.05	0.52
4.50	14.002	2035.7	0.04	0.47
4.55	15.861	2042.0	0.04	0.43
4.60	17.802	2048.3	0.03	0.39
4.65	19.822	2054.5	0.03	0.36
4.70	21.918	2060.8	0.03	0.33
4.75	24.087	2067.1	0.02	0.31
4.80	26.327	2073.4	0.02	0.28
4.85	28.636	2079.7	0.02	0.26
4.90	31.011	2086.0	0.02	0.24
4.95	33.451	2092.3	0.02	0.22
5.00	35.955	2098.6	0.02	0.20
5.05	38.520	2105.0	0.02	0.19
5.10	41.145	2111.5	0.01	0.17
5.15	43.830	2117.9	0.01	0.16
5.20	46.571	2124.3	0.01	0.15
5.25	49.369	2130.7	0.01	0.13
5.30	52.223	2137.2	0.01	0.12
5.35	55.130	2143.6	0.01	0.11
5.40	58.091	2150.0	0.01	0.10
5.45	61.104	2156.4	0.01	0.09
5.50	64.168	2162.9	0.01	0.08
5.55	67.283	2169.3	0.01	0.07
5.60	70.447	2175.7	0.01	0.06
5.65	73.661	2182.1	0.01	0.05
5.70	76.923	2188.6	0.01	0.04
5.75	80.232	2195.0	0.01	0.04
5.80	83.588	2201.4	0.01	0.03
5.85	86.990	2207.8	0.01	0.02
5.90	90.438	2214.3	0.01	0.01
5.95	93.930	2220.7	0.01	0.01
6.00				0.00

SWMM Model Flow Coefficient Calculation

Basin 2

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	12	in
Bioretention Soil Layer	S	21	in
Gravel Layer	G	15	in
TOTAL		4.0	ft
		48	in
Orifice Coefficient	c_g	0.6	--
Low Flow Orifice Diameter	D	4	in
Drain (Flow) exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.823	cfs
Ponding Depth Surface Area	A_{PD}	32193	ft^2
Bioretention Surface Area	A_S, A_G	30000	ft^2
	A_S, A_G	0.6887	ac
Porosity of Bioretention Soil	n	0.40	-
Flow Rate (per unit area)	q	2.962	in/hr
Effective Ponding Depth	PD_{eff}	12.44	in
Flow Coefficient	C	0.4367	--

IV. BIOFILTRATION DETAILS



SOIL SECTION FOR WATER QUALITY/HYDROMODIFICATION BIOFILTRATION BASIN

NOT TO SCALE

BASINS BF-1-1, BF-1-2

V. SWMM INPUT DATA (EXISTING AND PROPOSED MODELS)

Attached are the EPA-SWMM Model outputs for pre-development and post-development conditions for each POC. Similar modeling was used for analyzing the remaining POC locations using the input data found in the previous section. Each area, i.e., sub-catchments, outfalls, storage units, LID controls for the biofiltration cells, ponding on top of the biofiltration (modeled as a storage unit), weir as a discharge, and outfalls (point of compliance), also are shown, as applicable.

Variables in the modeling are associated with typical recommended values by the EPA-SWMM model and typical values found in technical literature (such as Maidment's Handbook of Hydrology). Recommended values for the SWMM model have been obtained from the San Diego County HMP permit criteria established for SWMM calibration.

Soil characteristics of the existing soils were determined based on data provided by Geotechnical Engineer/Geologist. KEY ASSUMPTIONS: Group C & D soils are representative of the existing conditions for the site.

Some values incorporated within the SWMM model have been determined from the professional experience of H&A using conservative assumptions that tend to increase the size of the needed BMP and also generate a long-term runoff as a percentage of rainfall similar to those measured in gage stations in Southern California by the USGS.

Description of model parameters and assumptions:

N-Imperv – Manning's N for impervious surfaces
- 0.012 (typical)

N-Perv – Manning's N for pervious surfaces
- 0.035 (Natural) & 0.10 (Developed Landscape)

Dstore-Imperv – Depth of depression storage on impervious area (in)
- 0.05 (typical)

Dstore-Perv – Depth of depression storage on pervious area (in)
- 0.100 (Developed)
- 0.065 (Natural)

%Zero-Imperv – Percentage of impervious area with no depression storage (%)
- 25 (typical)

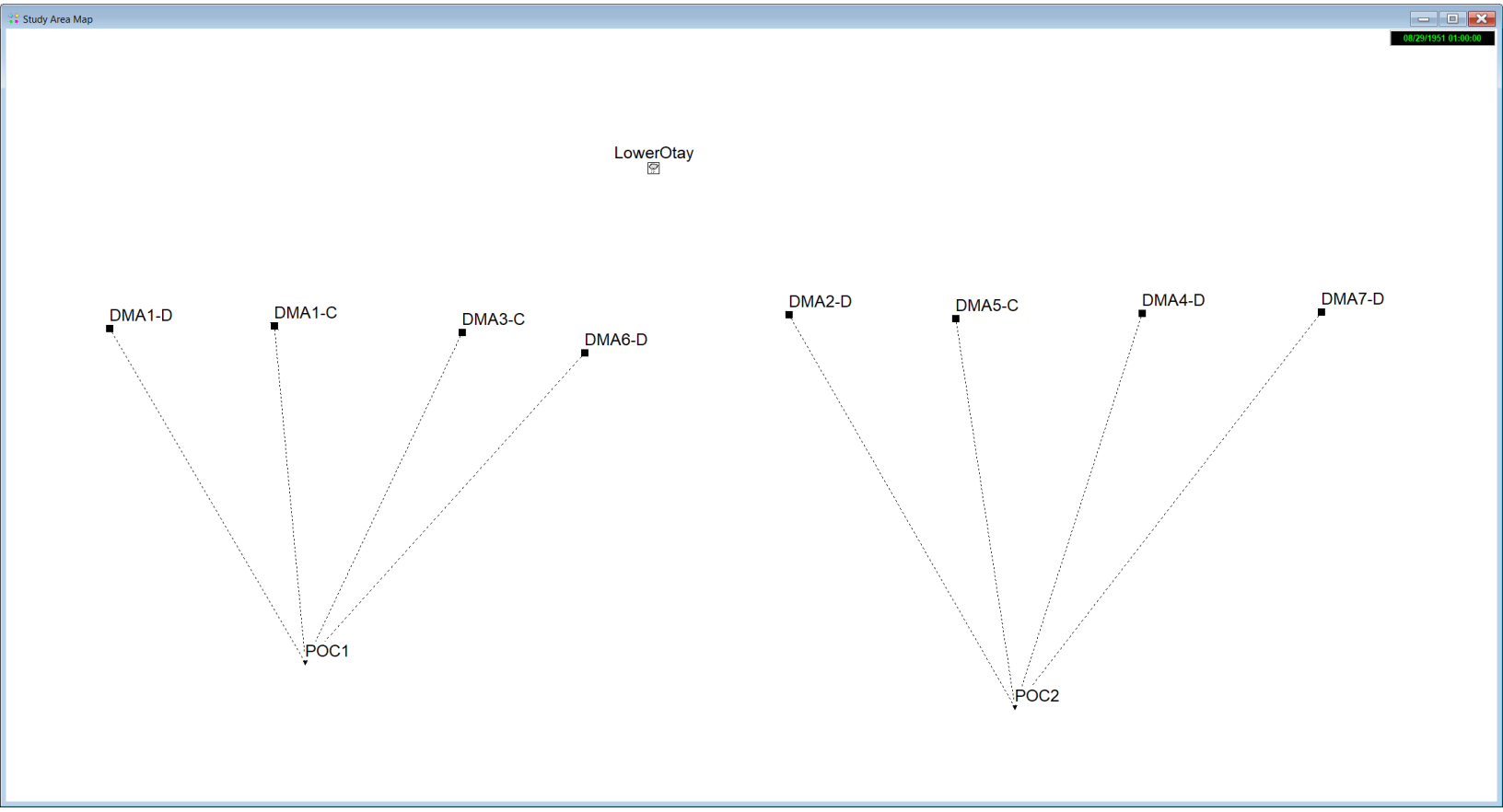
Suction Head – Soil capillary suction head (in)

Conductivity – Soil saturated hydraulic conductivity (in/hr)
- -75% of these values if subcatchment is graded/compacted

Initial Deficit – Initial moisture deficit (fraction)

Soil Type	Suction Head	Conductivity	Initial Deficit
A	1.5	0.3	0.33
B	3	0.2	0.32
C	6	0.1	0.31
D	9	0.025	0.30

POC 1 & 2– Pre-Developed Condition



```
[TITLE]
;;Project Title/Notes
SunBow
Pre-Project Condition

[OPTIONS]
;;Option Value
FLOW_UNITS CFS
INFILTRATION GREEN_AMPT
FLOW_ROUTING KINWAVE
LINK_OFFSETS DEPTH
MIN_SLOPE 0
ALLOW_PONDING NO
SKIP_STEADY_STATE NO

START_DATE 08/29/1951
START_TIME 00:00:00
REPORT_START_DATE 08/29/1951
REPORT_START_TIME 00:00:00
END_DATE 03/14/2008
END_TIME 23:00:00
SWEEP_START 01/01
SWEEP_END 12/31
DRY_DAYS 0
REPORT_STEP 01:00:00
WET_STEP 00:15:00
DRY_STEP 04:00:00
ROUTING_STEP 0:01:00
RULE_STEP 00:00:00

INERTIAL_DAMPING PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP 0.75
LENGTHENING_STEP 0
MIN_SURFAREA 12.557
MAX_TRIALS 8
HEAD_TOLERANCE 0.005
SYS_FLOW_TOL 5
LAT_FLOW_TOL 5
MINIMUM_STEP 0.5 THREADS 1

[EVAPORATION]
;;Data Source Parameters
;;-------------- ----------------
MONTHLY 0.06 0.08 0.11 0.16 0.18 0.21 0.21 0.20 0.16 0.12 0.08 0.06
DRY_ONLY NO

[RAINGAGES]
;;Name Format Interval SCF Source
;;-------------- --------- ------ ------ ----------
LowerOtay VOLUME 1:00 1.0 TIMESERIES LowerOtay

[SUBCATCHMENTS]
```

```
;;Name Rain Gage Outlet Area %Imperv Width %Slope CurbLen SnowPack  ;;-------
------- ---------------- ---------------- -------- -------- -------- --------
-------- ----------------
DMA1-D LowerOtay POC1 13.89 0 605 5.7 0  DMA1-C
LowerOtay POC1 16.10 0 435 10.55 0  DMA3-C LowerOtay POC1 1 0 73 7.73 0
DMA2-D LowerOtay POC2 36.82 0 3073 6.95 0  DMA5-C LowerOtay POC2 0.82 0 104 5
0  DMA4-D LowerOtay POC2 0.839 0 104 5 0  DMA6-D LowerOtay POC1 0.13 0 25
0.44 0  DMA7-D LowerOtay POC2 0.14 0 20 0.5 0

[SUBAREAS]
;;Subcatchment N-Imperv N-Perv S-Imperv S-Perv PctZero RouteTo PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- -----
----- ----------
DMA1-D 0.012 0.15 0.05 0.10 25 OUTLET
DMA1-C 0.012 0.15 0.05 0.10 25 OUTLET  DMA3-C 0.012 0.15 0.05 0.10 25 OUTLET
DMA2-D 0.012 0.15 0.05 0.10 25 OUTLET
DMA5-C 0.012 0.15 0.05 0.10 25 OUTLET
DMA4-D 0.012 0.15 0.05 0.10 25 OUTLET
DMA6-D 0.012 0.15 0.05 0.10 25 OUTLET
DMA7-D 0.012 0.15 0.05 0.10 25 OUTLET

[INFILTRATION]
;;Subcatchment Suction Ksat IMD
;;-------------- ---------- ---------- ----------
DMA1-D 9 0.025 0.3
DMA1-C 6 0.1 0.31
DMA3-C 6 0.1 0.31
DMA2-D 9 0.025 0.3
DMA5-C 6 0.1 0.31
DMA4-D 9 0.025 0.3
DMA6-D 6 0.1 0.31  DMA7-D 9 0.025 0.3

[OUTFALLS]
;;Name Elevation Type Stage Data Gated Route To
;;-------------- ---------- ---------- ---------------- -------- ------------
----
POC1 0 FREE NO
POC2 0 FREE NO

[TIMESERIES]
;;Name Date Time Value
;;-------------- ---------- ---------- ----------
LowerOtay FILE "LWROtay.dat.txt"

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units None
```

```
[COORDINATES]
;;Node X-Coord Y-Coord
;;-------------- ------------------ ------------------
POC1 3380.165 3619.835
POC2 8113.288 3321.976

[VERTICES]
;;Link X-Coord Y-Coord  ;;-------------- ------------------ ------------------
-

[Polygons]
;;Subcatchment X-Coord Y-Coord
;;-------------- ------------------ ------------------
DMA1-D 2074.380 5851.240
DMA1-C 3197.706 5844.032
DMA1-C 3148.120 5893.618
DMA3-C 4425.043 5826.235
DMA2-D 6605.622 5945.486
DMA5-C 7721.465 5919.932
DMA4-D 8965.077 5954.003
DMA6-D 5242.760 5689.949
DMA6-D 5242.760 5689.949
DMA7-D 10157.581 5962.521

[SYMBOLS]
;;Gage X-Coord Y-Coord
;;-------------- ------------------ ------------------
LowerOtay 5711.244 6916.525
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)

SunBow
Pre-Project Condition

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
 Rainfall/Runoff ..... YES
 RDII ..... NO
 Snowmelt ..... NO
 Groundwater ..... NO
 Flow Routing ..... NO
 Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Starting Date 08/29/1951 00:00:00
Ending Date 03/14/2008 23:00:00
Antecedent Dry Days 0.0
Report Time Step ..... 01:00:00 Wet Time Step 00:15:00
Dry Time Step 04:00:00

********** Volume Depth
Runoff Quantity Continuity acre-feet inches
********** --------- -------
Total Precipitation 3438.423 591.650
Evaporation Loss 119.653 20.589
Infiltration Loss 3000.795 516.347
Surface Runoff 372.444 64.086
Final Storage 0.000 0.000
Continuity Error (%) ..... -1.584

********** Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
********** --------- ---------
Dry Weather Inflow 0.000 0.000
Wet Weather Inflow 372.444 121.366
Groundwater Inflow 0.000 0.000
RDII Inflow ..... 0.000 0.000 External Inflow 0.000 0.000
External Outflow 372.444 121.366
Flooding Loss 0.000 0.000
Evaporation Loss 0.000 0.000

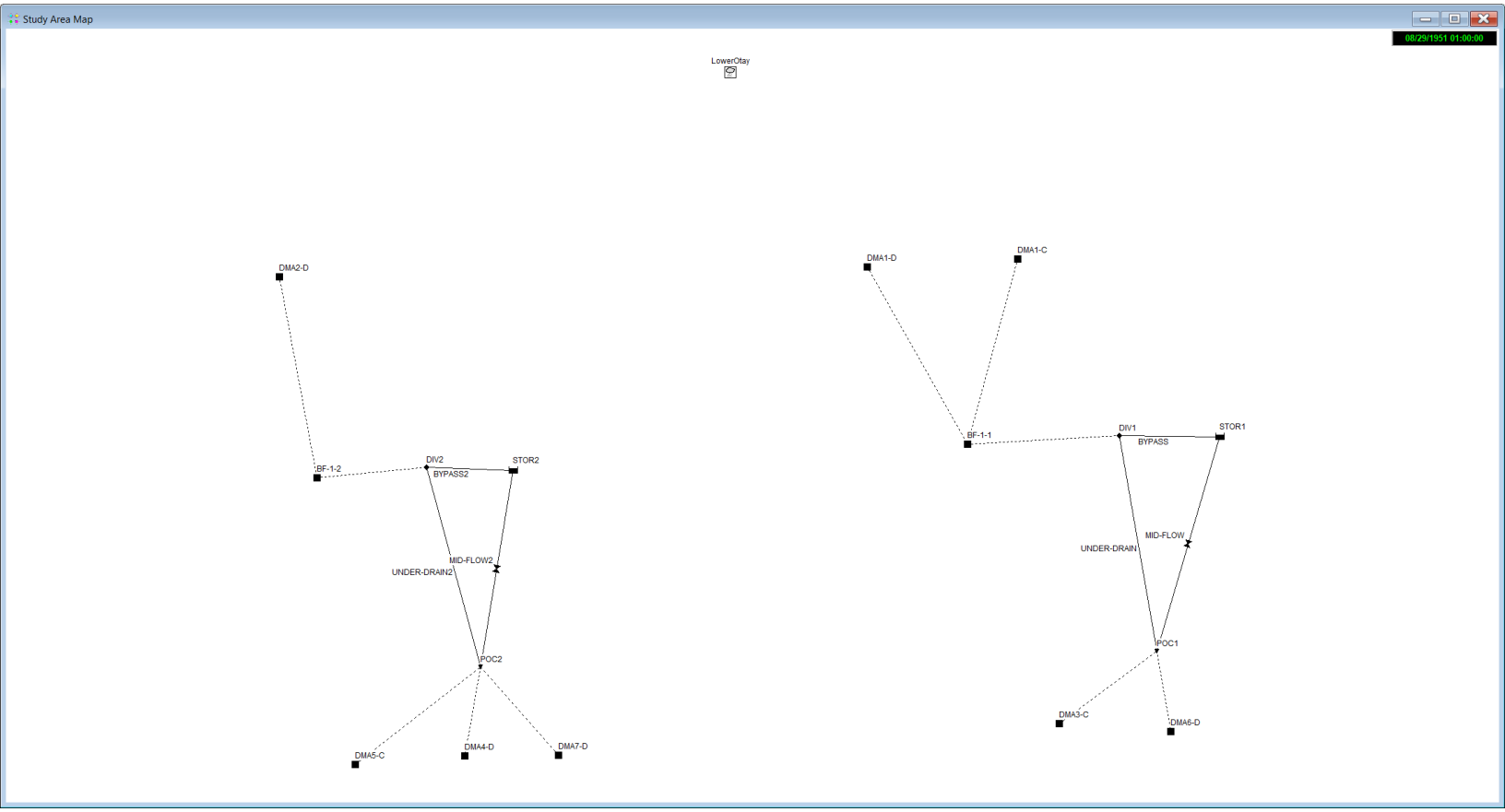
Exfiltration Loss 0.000 0.000
Initial Stored Volume 0.000 0.000
Final Stored Volume 0.000 0.000
Continuity Error (%) 0.000

****
Subcatchment Runoff Summary
****

Total Total Total Total Imperv Perv Total Total Peak Runoff Precip Runon Evap Infil Runoff Runoff Runoff Runoff Runoff Coeff Subcatchment in in in in in in 10^6 gal CFS ---
---
--- DMA1-D 591.65 0.00 26.44 502.60 0.00 74.68 74.68 28.16 8.08 0.126 DMA1-C 591.65 0.00 4.41 572.00 0.00 16.18 16.18 7.08 6.90 0.027 DMA3-C 591.65 0.00 4.26 568.29 0.00 20.19 20.19 0.55 0.58 0.034 DMA2-D 591.65 0.00 26.17 495.05 0.00 82.82 82.82 82.80 24.86 0.140 DMA5-C 591.65 0.00 4.18 567.01 0.00 21.62 21.62 0.48 0.51 0.037 DMA4-D 591.65 0.00 26.09 493.08 0.00 85.03 85.03 1.94 0.58 0.144 DMA6-D 591.65 0.00 4.35 570.25 0.00 18.05 18.05 0.06 0.07 0.031 DMA7-D 591.65 0.00 26.45 502.93 0.00 74.33 74.33 0.28 0.08 0.126

Analysis begun on: Thu Feb 25 12:57:11 2021
Analysis ended on: Thu Feb 25 12:57:48 2021
Total elapsed time: 00:00:37

POC 1 & 2– Developed Condition



```
[TITLE]
;;Project Title/Notes
SunBow
Post-Project mitigated Condition POC1 & POC2

[OPTIONS]
;;Option Value
FLOW_UNITS CFS
INFILTRATION GREEN_AMPT
FLOW_ROUTING KINWAVE
LINK_OFFSETS DEPTH
MIN_SLOPE 0
ALLOW_PONDING NO
SKIP_STEADY_STATE NO

START_DATE 08/29/1951
START_TIME 00:00:00
REPORT_START_DATE 08/29/1951
REPORT_START_TIME 00:00:00
END_DATE 03/14/2008
END_TIME 23:00:00
SWEEP_START 01/01
SWEEP_END 12/31
DRY_DAYS 0
REPORT_STEP 01:00:00
WET_STEP 00:15:00
DRY_STEP 04:00:00
ROUTING_STEP 0:01:00
RULE_STEP 00:00:00

INERTIAL_DAMPING PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP 0.75
LENGTHENING_STEP 0
MIN_SURFAREA 12.557
MAX_TRIALS 8
HEAD_TOLERANCE 0.005
SYS_FLOW_TOL 5
LAT_FLOW_TOL 5 MINIMUM_STEP 0.5
THREADS 1

[EVAPORATION]
;;Data Source Parameters
;;-------------- ----------------
MONTHLY 0.06 0.08 0.11 0.16 0.18 0.21 0.21 0.20 0.16 0.12 0.08 0.06 DRY_ONLY
NO

[RAINGAGES]
;;Name Format Interval SCF Source
;;-------------- --------- ------ ------ ----------
LowerOtay VOLUME 1:00 1.0 TIMESERIES LowerOtay

[SUBCATCHMENTS]
```

```
;;Name Rain Gage Outlet Area %Imperv Width %Slope CurbLen SnowPack ;;--------
------ ---------------- ---------------- -------- -------- -------- --------
-------- ---------------- DMA1-D LowerOtay BF-1-1 13.89 50 605 7.3 0 DMA1-C
LowerOtay BF-1-1 15.52 50 420 10.55 0 DMA3-C LowerOtay POC1 1 72 73 7.73 0
DMA2-D LowerOtay BF-1-2 36.82 55 7594 1.45 0 DMA5-C LowerOtay POC2 0.820 80
104 5 0 DMA4-D LowerOtay POC2 0.839 77.4 104 5 0 BF-1-2 LowerOtay DIV2 0.68 0
80 1 0 ;Future location of Biofiltartion Basin
BF-1-1 LowerOtay div1 0.58 0 146 0.14 0 DMA6-D LowerOtay POC1 0.13 56 25 0.44
0 DMA7-D LowerOtay POC2 0.14 53 20 0.5 0

[SUBAREAS] ;;Subcatchment N-Imperv N-Perv S-Imperv S-Perv PctZero RouteTo
PctRouted ;;-------------- ---------- ---------- ---------- ---------- ------
---- ---------- ----------
DMA1-D 0.012 0.15 0.05 0.10 25 OUTLET
DMA1-C 0.012 0.15 0.05 0.10 25 OUTLET
DMA3-C 0.012 0.15 0.05 0.10 25 OUTLET
DMA2-D 0.012 0.15 0.05 0.10 25 OUTLET
DMA5-C 0.012 0.15 0.05 0.10 25 OUTLET
DMA4-D 0.012 0.15 0.05 0.10 25 OUTLET
BF-1-2 0.012 0.15 0.05 0.10 25 OUTLET
BF-1-1 0.012 0.15 0.05 0.10 25 OUTLET
DMA6-D 0.012 0.15 0.05 0.10 25 OUTLET DMA7-D 0.012 0.15 0.05 0.10 25 OUTLET

[INFILTRATION]
;;Subcatchment Suction Ksat IMD
;;-------------- ---------- ---------- ----------
DMA1-D 9 0.01875 0.3
DMA1-C 6 0.075 0.31
DMA3-C 6 0.075 0.31
DMA2-D 9 0.01875 0.3
DMA5-C 6 0.075 0.31
DMA4-D 9 0.01875 0.3
BF-1-2 3.5 0.5 0.25
BF-1-1 3.5 0.5 0.25
DMA6-D 6 0.075 0.31
DMA7-D 9 0.01875 0.3

[LID_CONTROLS]
;;Name Type/Layer Parameters
;;-------------- ---------- ----------
BF-1-1 BC
BF-1-1 SURFACE 12.47 0.0 0 0 5
BF-1-1 SOIL 21 0.4 0.2 0.1 5 5 1.5 BF-1-1 STORAGE 15 0.67 0 0
BF-1-1 DRAIN 0.5696 0.5 6 6 0 0

BF-1-2 BC
BF-1-2 SURFACE 12.44 0.0 0.1 1.0 5
BF-1-2 SOIL 21 0.4 0.2 0.1 5 5 1.5 BF-1-2 STORAGE 15 0.67 0 0
BF-1-2 DRAIN 0.4367 0.5 6 6 0 0

[LID_USAGE]
;;Subcatchment LID Process Number Area Width InitSat FromImp ToPerv RptFile
DrainTo FromPerv ;;-------------- ---------- ------- ---------- -------
--- ---------- ---------- ---------- ---------- ----------------------- --------------
```

```
- ---------- BF-1-2 BF-1-2 1 26650 0 0 100 0 * * 0 BF-1-1 BF-1-1 1 23000 0 0
100 0 * * 0

[OUTFALLS]
;;Name Elevation Type Stage Data Gated Route To
;;-------------- ---------- ---------- ---------------- -------- ------------
----
POC1 0 FREE NO
POC2 0 FREE NO

[DIVIDERS]
;;Name Elevation Diverted Link Type Parameters
;;-------------- ---------- ---------------- ---------- ----------
DIV1 0 BYPASS CUTOFF 0.823 0 0 0 0 DIV2 0 BYPASS2 CUTOFF 0.823 0 0 0 0

[STORAGE]
;;Name Elev. MaxDepth InitDepth Shape Curve Name/Params N/A Fevap Psi Ksat
IMD ;;-------------- -------- ---------- ----------- ---------- -------------
--------------- -------- -------- -------- -------- STOR1 0 5 0 TABULAR
StorHMP1 0 0 STOR2 0 5 0 TABULAR StorHMP2 0 0

[CONDUITS]
;;Name From Node To Node Length Roughness InOffset OutOffset InitFlow MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ----
------ ---------- ---------- ---------- BYPASS DIV1 STOR1 400 0.01 0 0 0 0
UNDER-DRAIN DIV1 POC1 100 0.013 0 0 0 0 BYPASS2 DIV2 STOR2 400 0.01 0 0 0 0
UNDER-DRAIN2 DIV2 POC2 100 0.013 0 0 0 0

[OUTLETS]
;;Name From Node To Node Offset Type QTable/Qcoeff Qexpon Gated ;;-----------
--- ---------------- ---------------- ---------- --------------- ------------
---- ---------- -------- MID-FLOW STOR1 POC1 0 TABULAR/DEPTH HMP-1 NO MID-
FLOW2 STOR2 POC2 0 TABULAR/DEPTH HMP-2 NO

[XSECTIONS]
;;Link Shape Geom1 Geom2 Geom3 Geom4 Barrels Culvert ;;-------------- -------
----- ---------------- ---------- ---------- ---------- ---------- ----------
BYPASS DUMMY 0 0 0 0 1 UNDER-DRAIN CIRCULAR 0.33 0 0 0 1 BYPASS2 DUMMY 0 0 0
0 1 UNDER-DRAIN2 CIRCULAR 0.33 0 0 0 1

[CURVES]
;;Name Type X-Value Y-Value
;;-------------- ---------- ---------- ----------
HMP-1 Rating 0.00 0.000
HMP-1 0.05 0.002
HMP-1 0.10 0.006
HMP-1 0.15 0.009
HMP-1 0.20 0.011
HMP-1 0.25 0.012
HMP-1 0.30 0.014 HMP-1 0.35 0.015
HMP-1 0.40 0.016
HMP-1 0.45 0.017
HMP-1 0.50 0.018
HMP-1 0.55 0.019
```

HMP-1 0.60 0.020
HMP-1 0.65 0.021
HMP-1 0.70 0.022
HMP-1 0.75 0.022
HMP-1 0.80 0.023
HMP-1 0.85 0.024
HMP-1 0.90 0.025
HMP-1 0.95 0.025
HMP-1 1.00 0.026
HMP-1 1.05 0.030
HMP-1 1.10 0.040
HMP-1 1.15 0.053
HMP-1 1.20 0.065
HMP-1 1.25 0.073
HMP-1 1.30 0.080 HMP-1 1.35 0.086
HMP-1 1.40 0.091
HMP-1 1.45 0.096
HMP-1 1.50 0.101
HMP-1 1.55 0.106
HMP-1 1.60 0.110
HMP-1 1.65 0.114
HMP-1 1.70 0.118
HMP-1 1.75 0.122
HMP-1 1.80 0.126
HMP-1 1.85 0.129
HMP-1 1.90 0.133
HMP-1 1.95 0.136
HMP-1 2.00 0.140
HMP-1 2.05 0.147
HMP-1 2.10 0.162
HMP-1 2.15 0.183
HMP-1 2.20 0.208
HMP-1 2.25 0.236
HMP-1 2.30 0.258 HMP-1 2.35 0.275
HMP-1 2.40 0.290
HMP-1 2.45 0.303
HMP-1 2.50 0.316
HMP-1 2.55 0.328
HMP-1 2.60 0.340
HMP-1 2.65 0.351
HMP-1 2.70 0.362
HMP-1 2.75 0.372
HMP-1 2.80 0.382
HMP-1 2.85 0.391
HMP-1 2.90 0.401
HMP-1 2.95 0.410
HMP-1 3.00 0.419
HMP-1 3.05 0.799
HMP-1 3.10 1.489
HMP-1 3.15 2.378
HMP-1 3.20 3.430
HMP-1 3.25 4.622
HMP-1 3.30 5.939 HMP-1 3.35 7.370
HMP-1 3.40 8.907

HMP-1 3.45 10.542
HMP-1 3.50 12.271
HMP-1 3.55 14.087
HMP-1 3.60 15.988
HMP-1 3.65 17.969
HMP-1 3.70 20.028
HMP-1 3.75 22.161
HMP-1 3.80 24.366
HMP-1 3.85 26.641
HMP-1 3.90 28.984
HMP-1 3.95 31.392
HMP-1 4.00 33.865
HMP-1 4.05 36.399
HMP-1 4.10 38.995
HMP-1 4.15 41.650
HMP-1 4.20 44.363
HMP-1 4.25 47.133
HMP-1 4.30 49.959 HMP-1 4.35 52.840
HMP-1 4.40 55.774
HMP-1 4.45 58.761
HMP-1 4.50 61.800
HMP-1 4.55 64.890
HMP-1 4.60 68.030
HMP-1 4.65 71.219
HMP-1 4.70 74.457
HMP-1 4.75 77.742
HMP-1 4.80 81.075
HMP-1 4.85 84.454
HMP-1 4.90 87.879
HMP-1 4.95 91.350
HMP-1 5.00 94.865
;
HMP-2 Rating 1.00 0.000
HMP-2 1.05 0.002
HMP-2 1.10 0.006
HMP-2 1.15 0.009
HMP-2 1.20 0.011
HMP-2 1.25 0.012 HMP-2 1.30 0.014
HMP-2 1.35 0.015
HMP-2 1.40 0.016
HMP-2 1.45 0.017
HMP-2 1.50 0.018
HMP-2 1.55 0.019
HMP-2 1.60 0.020
HMP-2 1.65 0.021
HMP-2 1.70 0.022
HMP-2 1.75 0.022
HMP-2 1.80 0.023
HMP-2 1.85 0.024
HMP-2 1.90 0.025
HMP-2 1.95 0.025
HMP-2 2.00 0.026
HMP-2 2.05 0.030
HMP-2 2.10 0.040

HMP-2 2.15 0.053
HMP-2 2.20 0.065
HMP-2 2.25 0.073 HMP-2 2.30 0.080
HMP-2 2.35 0.086
HMP-2 2.40 0.091
HMP-2 2.45 0.096
HMP-2 2.50 0.101
HMP-2 2.55 0.106
HMP-2 2.60 0.110
HMP-2 2.65 0.114
HMP-2 2.70 0.118
HMP-2 2.75 0.122
HMP-2 2.80 0.126
HMP-2 2.85 0.129
HMP-2 2.90 0.133
HMP-2 2.95 0.136
HMP-2 3.00 0.140
HMP-2 3.05 0.147
HMP-2 3.10 0.162
HMP-2 3.15 0.183
HMP-2 3.20 0.208
HMP-2 3.25 0.236 HMP-2 3.30 0.258
HMP-2 3.35 0.275
HMP-2 3.40 0.290
HMP-2 3.45 0.303
HMP-2 3.50 0.316
HMP-2 3.55 0.328
HMP-2 3.60 0.340
HMP-2 3.65 0.351
HMP-2 3.70 0.362
HMP-2 3.75 0.372
HMP-2 3.80 0.382
HMP-2 3.85 0.391
HMP-2 3.90 0.401
HMP-2 3.95 0.410
HMP-2 4.00 0.419
HMP-2 4.05 0.799
HMP-2 4.10 1.489
HMP-2 4.15 2.378
HMP-2 4.20 3.430
HMP-2 4.25 4.622 HMP-2 4.30 5.939
HMP-2 4.35 7.370
HMP-2 4.40 8.907
HMP-2 4.45 10.542
HMP-2 4.50 12.271
HMP-2 4.55 14.087
HMP-2 4.60 15.988
HMP-2 4.65 17.969
HMP-2 4.70 20.028
HMP-2 4.75 22.161
HMP-2 4.80 24.366
HMP-2 4.85 26.641
HMP-2 4.90 28.984
HMP-2 4.95 31.392

```
HMP-2 5.00 33.865
HMP-2 5.05 36.399
HMP-2 5.10 38.995
HMP-2 5.15 41.650
HMP-2 5.20 44.363
HMP-2 5.25 47.133 HMP-2 5.30 49.959
HMP-2 5.35 52.840
HMP-2 5.40 55.774
HMP-2 5.45 58.761
HMP-2 5.50 61.800
HMP-2 5.55 64.890
HMP-2 5.60 68.030
HMP-2 5.65 71.219
HMP-2 5.70 74.457
HMP-2 5.75 77.742
HMP-2 5.80 81.075
HMP-2 5.85 84.454
HMP-2 5.90 87.879
HMP-2 5.95 91.350
HMP-2 6.00 94.865
;
StorHMP1 Storage 0.00 27191
StorHMP1 0.05 27293
StorHMP1 0.10 27395
StorHMP1 0.15 27497
StorHMP1 0.20 27599 StorHMP1 0.25 27701
StorHMP1 0.30 27803
StorHMP1 0.35 27905
StorHMP1 0.40 28007
StorHMP1 0.45 28109
StorHMP1 0.50 28211
StorHMP1 0.55 28313
StorHMP1 0.60 28415
StorHMP1 0.65 28517
StorHMP1 0.70 28619
StorHMP1 0.75 28721
StorHMP1 0.80 28823
StorHMP1 0.85 28925
StorHMP1 0.90 29027
StorHMP1 0.95 29129
StorHMP1 1.00 29231
StorHMP1 1.05 29336
StorHMP1 1.10 29441
StorHMP1 1.15 29545
StorHMP1 1.20 29650 StorHMP1 1.25 29755
StorHMP1 1.30 29860
StorHMP1 1.35 29965
StorHMP1 1.40 30069
StorHMP1 1.45 30174
StorHMP1 1.50 30279
StorHMP1 1.55 30384
StorHMP1 1.60 30489
StorHMP1 1.65 30593
StorHMP1 1.70 30698
```

StorHMP1 1.75 30803
StorHMP1 1.80 30908
StorHMP1 1.85 31013
StorHMP1 1.90 31117
StorHMP1 1.95 31222
StorHMP1 2.00 31327
StorHMP1 2.05 31435
StorHMP1 2.10 31542
StorHMP1 2.15 31650
StorHMP1 2.20 31758 StorHMP1 2.25 31866
StorHMP1 2.30 31973
StorHMP1 2.35 32081
StorHMP1 2.40 32189
StorHMP1 2.45 32296
StorHMP1 2.50 32404
StorHMP1 2.55 32512
StorHMP1 2.60 32619
StorHMP1 2.65 32727
StorHMP1 2.70 32835
StorHMP1 2.75 32943
StorHMP1 2.80 33050
StorHMP1 2.85 33158
StorHMP1 2.90 33266
StorHMP1 2.95 33373
StorHMP1 3.00 33481
StorHMP1 3.05 33592
StorHMP1 3.10 33702
StorHMP1 3.15 33813
StorHMP1 3.20 33923 StorHMP1 3.25 34034
StorHMP1 3.30 34144
StorHMP1 3.35 34255
StorHMP1 3.40 34365
StorHMP1 3.45 34476
StorHMP1 3.50 34586
StorHMP1 3.55 34697
StorHMP1 3.60 34807
StorHMP1 3.65 34918
StorHMP1 3.70 35028
StorHMP1 3.75 35139
StorHMP1 3.80 35249
StorHMP1 3.85 35360
StorHMP1 3.90 35470
StorHMP1 3.95 35581
StorHMP1 4.00 35691
StorHMP1 4.05 35804
StorHMP1 4.10 35918
StorHMP1 4.15 36031
StorHMP1 4.20 36145 StorHMP1 4.25 36258
StorHMP1 4.30 36371
StorHMP1 4.35 36485
StorHMP1 4.40 36598
StorHMP1 4.45 36712
StorHMP1 4.50 36825
StorHMP1 4.55 36938

```
StorHMP1 4.60 37052
StorHMP1 4.65 37165
StorHMP1 4.70 37279
StorHMP1 4.75 37392
StorHMP1 4.80 37505
StorHMP1 4.85 37619
StorHMP1 4.90 37732
StorHMP1 4.95 37846
StorHMP1 5.00 37959
;
StorHMP2 Storage 0.00 32193
StorHMP2 0.05 32310
StorHMP2 0.10 32427
StorHMP2 0.15 32545 StorHMP2 0.20 32662
StorHMP2 0.25 32779
StorHMP2 0.30 32896
StorHMP2 0.35 33013
StorHMP2 0.40 33131
StorHMP2 0.45 33248
StorHMP2 0.50 33365
StorHMP2 0.55 33482
StorHMP2 0.60 33599
StorHMP2 0.65 33717
StorHMP2 0.70 33834
StorHMP2 0.75 33951
StorHMP2 0.80 34068
StorHMP2 0.85 34185
StorHMP2 0.90 34303
StorHMP2 0.95 34420
StorHMP2 1.00 34537
StorHMP2 1.05 34657
StorHMP2 1.10 34777
StorHMP2 1.15 34897 StorHMP2 1.20 35017
StorHMP2 1.25 35137
StorHMP2 1.30 35257
StorHMP2 1.35 35377
StorHMP2 1.40 35497
StorHMP2 1.45 35617
StorHMP2 1.50 35737
StorHMP2 1.55 35857
StorHMP2 1.60 35977
StorHMP2 1.65 36097
StorHMP2 1.70 36217
StorHMP2 1.75 36337
StorHMP2 1.80 36457
StorHMP2 1.85 36577
StorHMP2 1.90 36697
StorHMP2 1.95 36817
StorHMP2 2.00 36937
StorHMP2 2.05 37060
StorHMP2 2.10 37183
StorHMP2 2.15 37306 StorHMP2 2.20 37428
StorHMP2 2.25 37551
StorHMP2 2.30 37674
```

StorHMP2 2.35 37797
StorHMP2 2.40 37920
StorHMP2 2.45 38043
StorHMP2 2.50 38166
StorHMP2 2.55 38288
StorHMP2 2.60 38411
StorHMP2 2.65 38534
StorHMP2 2.70 38657
StorHMP2 2.75 38780
StorHMP2 2.80 38903
StorHMP2 2.85 39025
StorHMP2 2.90 39148
StorHMP2 2.95 39271
StorHMP2 3.00 39394
StorHMP2 3.05 39520
StorHMP2 3.10 39645
StorHMP2 3.15 39771 StorHMP2 3.20 39897
StorHMP2 3.25 40023
StorHMP2 3.30 40148
StorHMP2 3.35 40274
StorHMP2 3.40 40400
StorHMP2 3.45 40525
StorHMP2 3.50 40651
StorHMP2 3.55 40777
StorHMP2 3.60 40902
StorHMP2 3.65 41028
StorHMP2 3.70 41154
StorHMP2 3.75 41280
StorHMP2 3.80 41405
StorHMP2 3.85 41531
StorHMP2 3.90 41657
StorHMP2 3.95 41782
StorHMP2 4.00 41908
StorHMP2 4.05 42037
StorHMP2 4.10 42165
StorHMP2 4.15 42294 StorHMP2 4.20 42422
StorHMP2 4.25 42551
StorHMP2 4.30 42679
StorHMP2 4.35 42808
StorHMP2 4.40 42936
StorHMP2 4.45 43065
StorHMP2 4.50 43193
StorHMP2 4.55 43322
StorHMP2 4.60 43450
StorHMP2 4.65 43579
StorHMP2 4.70 43707
StorHMP2 4.75 43836
StorHMP2 4.80 43964
StorHMP2 4.85 44093
StorHMP2 4.90 44221
StorHMP2 4.95 44350
StorHMP2 5.00 44478

[TIMESERIES]

```
;;Name Date Time Value
;;-------------- ---------- ---------- ---------- LowerOtay FILE
"LWROtay.dat.txt"

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units None

[COORDINATES]
;;Node X-Coord Y-Coord
;;-------------- ------------------ ------------------
POC1 4533.679 2497.409
POC2 -1279.793 2362.694
DIV1 4212.435 4352.332
DIV2 -1746.114 4082.902
STOR1 5072.539 4341.969
STOR2 -1000.000 4051.813

[VERTICES]
;;Link X-Coord Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment X-Coord Y-Coord
;;-------------- ------------------ ------------------
DMA1-D 2046.581 5807.730
DMA1-C 3363.636 5851.240
DMA1-C 3314.050 5900.826
DMA3-C 3694.301 1875.648
DMA2-D -3010.363 5720.207
DMA5-C -2357.513 1523.316
DMA4-D -1414.508 1595.855
BF-1-2 -2689.119 3989.637
BF-1-1 2906.736 4279.793
DMA6-D 4655.026 1805.792
DMA7-D -609.029 1601.363

[SYMBOLS]
;;Gage X-Coord Y-Coord
;;-------------- ------------------ ------------------
LowerOtay 877.106 7472.745
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

SunBow
Post-Project mitigated Condition POC1 & POC2

WARNING 04: minimum elevation drop used for Conduit BYPASS
WARNING 04: minimum elevation drop used for Conduit UNDER-DRAIN
WARNING 04: minimum elevation drop used for Conduit BYPASS2
WARNING 04: minimum elevation drop used for Conduit UNDER-DRAIN2

***********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
***********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
 Rainfall/Runoff ........ YES
 RDII ................... NO
 Snowmelt ............... NO
 Groundwater ............ NO  Flow Routing ............ YES
 Ponding Allowed ........ NO
 Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 08/29/1951 00:00:00
Ending Date .............. 03/14/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00
Routing Time Step ........ 60.00 sec


************************* Volume Depth
Runoff Quantity Continuity acre-feet inches
************************* --------- -------
Initial LID Storage ...... 0.199 0.034
Total Precipitation ...... 3471.950 591.650
Evaporation Loss ......... 433.336 73.844
Infiltration Loss ........ 1359.475 231.666
Surface Runoff ........... 1714.743 292.207
LID Drainage ............. 4.444 0.757 Final Storage ............ 0.199 0.034
Continuity Error (%) ..... -1.153


************************* Volume Volume
Flow Routing Continuity acre-feet 10^6 gal
```

```
************************** --------- ---------
Dry Weather Inflow ....... 0.000 0.000
Wet Weather Inflow ....... 1719.187 560.223
Groundwater Inflow ....... 0.000 0.000
RDII Inflow .............. 0.000 0.000
External Inflow .......... 0.000 0.000
External Outflow ......... 1020.798 332.642
Flooding Loss ............ 698.055 227.472
Evaporation Loss ......... 0.000 0.000
Exfiltration Loss ........ 0.000 0.000
Initial Stored Volume .... 0.000 0.000
Final Stored Volume ...... 0.803 0.262
Continuity Error (%) ..... -0.027


****************************** Highest Flow Instability Indexes
******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step : 60.00 sec
Average Time Step : 60.00 sec
Maximum Time Step : 60.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01
Percent Not Converging : 0.00


***************************
Subcatchment Runoff Summary
***************************

-------------------------------------------------------------------------------
------------------------------------------------  Total Total Total Total
Imperv Perv Total Total Peak Runoff  Precip Runon Evap Infil Runoff Runoff
Runoff Runoff Runoff Coeff Subcatchment in in in in in in in 10^6 gal CFS ---
-------------------------------------------------------------------------------
---------------------------------------------- DMA1-D 591.65 0.00 66.12
231.08 246.10 53.54 299.64 113.01 10.23 0.506 DMA1-C 591.65 0.00 57.28 281.00
244.85 12.57 257.42 108.48 10.64 0.435 DMA3-C 591.65 0.00 78.42 155.84 355.43
8.81 364.24 9.89 0.76 0.616 DMA2-D 591.65 0.00 68.63 202.93 273.33 53.82
327.15 327.08 28.60 0.553 DMA5-C 591.65 0.00 85.80 111.00 396.28 6.72 403.00
8.97 0.65 0.681 DMA4-D 591.65 0.00 87.24 101.76 383.47 27.64 411.11 9.37 0.68
0.695 BF-1-2 591.65 17714.19 494.08 712.65 0.00 17116.75 17158.84 316.83
28.54 0.937 BF-1-1 591.65 14064.10 499.74 675.42 0.00 13477.82 13520.41
212.93 21.01 0.923 DMA6-D 591.65 0.00 62.71 246.31 275.48 12.16 287.65 1.02
0.09 0.486 DMA7-D 591.65 0.00 69.16 217.62 259.92 49.90 309.82 1.18 0.10
0.524


**********************
```

LID Performance Summary
****

 Total Evap Infil Surface Drain Initial Final Continuity Inflow Loss Loss
Outflow Outflow Storage Storage Error Subcatchment LID Control in in in in in
in in % ---

BF-1-2 BF-1-2 591.65 544.87 0.00 0.00 46.78 2.10 2.10 -0.00
BF-1-1 BF-1-1 591.65 544.87 0.00 0.00 46.78 2.10 2.10 -0.00

****
Node Depth Summary
****

 Average Maximum Maximum Time of Max Reported
 Depth Depth HGL Occurrence Max Depth
Node Type Feet Feet Feet days hr:min Feet ---

POC1 OUTFALL 0.01 0.33 0.33 0 01:25 0.33
POC2 OUTFALL 0.01 0.33 0.33 0 01:06 0.33
DIV1 DIVIDER 0.01 0.33 0.33 0 01:17 0.33
DIV2 DIVIDER 0.01 0.33 0.33 0 00:54 0.33
STOR1 STORAGE 0.15 3.55 3.55 16964 17:23 3.38
STOR2 STORAGE 1.24 4.82 4.82 16970 17:18 4.74

****
Node Inflow Summary
****

 Maximum Maximum Lateral Total Flow
 Lateral Total Time of Max Inflow Inflow Balance Inflow Inflow Occurrence
Volume Volume Error
Node Type CFS CFS days hr:min 10^6 gal 10^6 gal Percent ---

POC1 OUTFALL 0.85 14.08 16964 17:23 10.9 116 0.000
POC2 OUTFALL 1.43 25.57 16970 17:18 19.5 216 0.000
DIV1 DIVIDER 21.01 21.01 16970 17:16 213 213 0.000
DIV2 DIVIDER 28.54 28.54 17229 06:16 317 317 0.000
STOR1 STORAGE 0.00 20.19 16970 17:16 0 104 0.012
STOR2 STORAGE 0.00 27.71 17229 06:16 0 196 0.019

****
Node Flooding Summary
****
 Flooding refers to all water that overflows a node, whether it ponds or not.

```
 Total Maximum
 Maximum Time of Max Flood Ponded
 Hours Rate Occurrence Volume Volume
Node Flooded CFS days hr:min 10^6 gal 1000 ft3 ------------------------------
-----------------------------------------
DIV1 9928.60 0.82 57 06:23 107.746 0.000
DIV2 9421.35 0.82 57 06:19 119.709 0.000


**********************
Storage Volume Summary
**********************

-------------------------------------------------------------------------------
---------------------
 Average Avg Evap Exfil Maximum Max Time of Max Maximum  Volume Pcnt Pcnt
Pcnt Volume Pcnt Occurrence Outflow
Storage Unit 1000 ft3 Full Loss Loss 1000 ft3 Full days hr:min CFS ----------
-------------------------------------------------------------------------------
-----------
STOR1 4.301 3 0 0 109.511 67 16964 17:22 13.91
STOR2 42.116 22 0 0 183.186 96 16970 17:17 25.27


************************
Outfall Loading Summary
************************

------------------------------------------------------------
 Flow Avg Max Total
 Freq Flow Flow Volume
Outfall Node Pcnt CFS CFS 10^6 gal
------------------------------------------------------------
POC1 37.41 0.02 14.08 116.175 POC2 48.82 0.03 25.57 216.443
------------------------------------------------------------
System 43.12 0.06 25.57 332.617


********************
Link Flow Summary
********************

-------------------------------------------------------------------------------
 Maximum Time of Max Maximum Max/ Max/
 |Flow| Occurrence |Veloc| Full Full
Link Type CFS days hr:min ft/sec Flow Depth --------------------------------
-----------------------------------------
BYPASS DUMMY 20.19 16970 17:16
UNDER-DRAIN CONDUIT 0.01 3748 19:11 0.18 1.08 1.00
BYPASS2 DUMMY 27.71 17229 06:16
UNDER-DRAIN2 CONDUIT 0.01 1558 05:44 0.18 1.08 1.00
MID-FLOW DUMMY 13.91 16964 17:23 MID-FLOW2 DUMMY 25.27 16970 17:18
```

****
Conduit Surcharge Summary
****

Conduit	Both Ends	Hours Upstream	Hours Dnstream	Hours Full Normal Flow	Hours Above Full Capacity Limited
UNDER-DRAIN	9894.62	9894.62	9894.62	165.32	9894.62
UNDER-DRAIN2	9379.15	9379.15	9379.15	130.45	9379.15

Analysis begun on: Thu Feb 25 13:07:44 2021
Analysis ended on: Thu Feb 25 13:08:58 2021
Total elapsed time: 00:01:14

EXPLANATION OF SELECTED VARIABLES

Parameters for the pre- and post-development models include soil type group C, D in accordance with the San Diego County Hydrology Manual and the USGS Soil Survey. Suction head, conductivity and initial deficit corresponds to average values expected for the soil types, according to sources consulted, professional experience, and approximate values obtained by the interim Orange County modeling approach.

H&A selected infiltration values, such that the percentage of total precipitation that becomes runoff, is realistic for soil type group C, D and slightly smaller than measured values for Southern California watersheds.

Selection of a Kinematic Approach: As the continuous model is based on hourly rainfall, and the time of concentration for the pre-development and post-development conditions is significantly smaller than 60 minutes, precise routing of the flows through the impervious surfaces, the underdrain pipe system, and the discharge pipe was considered unnecessary. The truncation error of the precipitation into hourly steps is much more significant than the precise routing in a system where the time of concentration is much smaller than 1 hour.

The area of 'POC1PRDevArea' + POC1PRBasin must be equal to the area of the development tributary to that particular biofiltration facility. Five (5) decimal places were given regarding the areas of the bio-retention to insure that the area used by the program for the LID subroutine corresponds exactly with these tributaries.

LID Control Editor: Explanation of Significant Variables

INFILTRATION

Height:

The storage depth variable within the SWMM model is representative of the storage volume provided in the vault.

Seepage Rate:

The seepage rate is directly input from the geotechnical report.

Clogging factor:

A clogging factor was not used (0 indicates that there is no clogging assumed within the model). The reason for this is related to the fairness of a comparison with the SDHM model and the HMP sizing tables: a clogging factor was not considered, and instead, a conservative value of infiltration was recommended.

Storage Depth:

The storage depth variable within the SWMM model is representative of the storage volume provided beneath the engineered soil and mulch components of the biofiltration facility. This

storage volume is comprised of a gravel located bed beneath a layer of engineered soil and a 0.25 foot (3-inch) layer of landscaping mulch.

Porosity:
A porosity value of 0.4 has been selected for the model. The amended soil is to be highly sandy in content in order to have a saturated hydraulic conductivity of approximately 5 in/hr.

H&A considers this value to be slightly high; however, in order to comply with the HMP Permit, the value recommended by the Copermittees for the porosity of amended soil is 0.4, per Appendix A of the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011.

Void Ratio:
The ratio of the void volume divided by the soil volume is directly related to porosity as n/(1-n). As the underdrain layer is composed of gravel, a porosity value of 0.4 has been selected, which results in a void ratio of 0.4/ (1-0.4) = 0.67 for the gravel detention layer.

Clogging factor:
A clogging factor was not used (0 indicates that there is not clogging assumed within the model). The reason for this is related to the fairness of a comparison with the SDHM model and the HMP sizing tables: a clogging factor was not considered, and instead, a conservative value of infiltration was recommended.

Drain (Flow) coefficient:
The flow coefficient in the SWMM Model is the coefficient needed to transform the orifice equation into a general power law equation of the form:

$$q = C(H - H_D)^n \qquad (1)$$

where q is the peak flow in in/hr., n is the exponent (typically 0.5 for orifice equation), H D is the elevation of the centroid of the orifice in inches (assumed equal to the invert of the orifice for small orifices and in our design equal to 0) and H is the depth of the water in inches.

The general orifice equation can be expressed as:

$$Q = \frac{\pi}{4} c_g \frac{D^2}{144} \sqrt{2g \frac{(H - H_D)}{12}} \qquad (2)$$

where Q is the peak flow in cfs, D is the diameter in inches, c g is the typical discharge coefficient for orifices (0.61-0.63 for thin walls and around 0.75-0.8 for thick walls), g is the acceleration of gravity in ft./s^2, and H and H D are defined above and are also used in inches in Equation (2).

Cutoff Flow:

This is the only significant variable in the diversion, as the type of diversion is defined by this value. Any excess of flow over this value will be diverted into a pond subroutine (the surface stage of the bio-retention basin) and routed there. The determination of this value equates to the value obtained with equation (2) above, plus 1%, when H = depth of gravel layer and H_D=0 (orifice situated at the datum). Thus, once flows exceed the maximum discharge the LID orifice experiences a head of the storage depth, ponding occurs within the biofiltration basin, routing these additional flows via the pond riser.

Note:

The complete storage and rating curves and the respective explanation is shown at the end of this appendix. A variable area vs. elevation storage curve was used for the final model, and a discharge that is a function of the outlet structure in the surface was used also.

VI. HYDROMODIFICATION WATERSHED MAPS

SEE ATTACHMENT 2A FOR HMP MAPS

ATTACHMENT 3

Structural BMP Maintenance Information
Hydromodification Control Measures

Project Name/ Sunbow II, Phase 3

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Attachment 3: For private entity operation and maintenance, Attachment 3 must include a Storm Water Management Facilities Maintenance Agreement with Grant of Access and Covenant's ("Maintenance Agreement") Template can be found at the following link (also refer to Chapter 8.2.1 for more information's):

The following information must be included in the exhibits attached to the Maintenance Agreement:

- [x] Vicinity map (Depiction of Project Site)
- [x] Legal Description for Project Site
- [x] Site design BMPs for which DCV reduction is claimed for meeting the pollutant
- [x] control obligations.
- [x] BMP and HMP type, location, type, manufacture model, and dimensions, specifications, cross section
- [ ] LID features such as (permeable paver and LS location, dim, SF).
- [x] Maintenance recommendations and frequency

RECORDING REQUESTED BY AND
WHEN RECORDED RETURN TO:

CITY OF CHULA VISTA
OFFICE OF THE CITY CLERK
276 FOURTH AVENUE
CHULA VISTA, CA 91910

This Instrument Benefits City Only. Above Space for Recorder's Use
No Fee Required.

CCV File No. MPA20-0006

STORM WATER MANAGEMENT FACILITIES MAINTENANCE AGREEMENT WITH GRANT OF ACCESS AND COVENANTS

Sunbow II, Phase 3

THIS STORM WATER MANAGEMENT FACILITIES MAINTENANCE AGREEMENT ("Agreement"), dated June 16, 2020 for the purpose of reference only and effective the date on which the last party hereto affixes his/her signature ("Effective Date"), is entered into between **Lennar Homes**, ("Owner(s)") and the City of Chula Vista, a municipal corporation, ("City") (individually, each may be referred to as "Party" and collectively as "Parties") with reference to the following facts:

RECITALS

WHEREAS, Owner(s) has(have) **Applied for Design Review permit** for the development of **Sunbow II, Phase 3** ("Project"), located on parcels **644-011-06-00, 644-020-11-00** "Project Site" as depicted in Exhibit "A" and more particularly described in Exhibit "B" , both attached hereto and incorporated herein by reference;
and

WHEREAS, as a condition of (or condition # x of y) approval**,** Owner(s) is(are) required to implement and maintain structural or non-structural pollution prevention measures, such as site design, source control, treatment control, and hydromodification control (where applicable) methods required to minimize polluted runoff and any other environmental impacts from Project during the post-development phase (collectively "BMPs"); and

WHEREAS, pursuant to City's urban runoff regulations, including Chula Vista Municipal Code, Chapter 14.20 (the "Storm Water Management and Discharge Control Ordinance) and the Chula Vista BMP Design Manual, Owner(s) is(are) required to prepare and submit a Stormwater Quality Management Plan (SWQMP), which includes an Inspection, Operation, and Maintenance Plan (IOMP); and

WHEREAS, the Owner(s) has(have) submitted SWQMP, which is on file in the office of the City Engineer; and

WHEREAS, the SWQMP proposes that storm water runoff from Project be detained and treated by the use of permanent Storm Water Management Facilities ("SWMFs"); and

WHEREAS, the SWMFs are classified in the SWQMP as site design, treatment control, and hydromodification control BMPs; and

WHEREAS, the SWQMP specifies the manner and standards by which the SWMFs must be inspected, maintained, and repaired in order to retain their effectiveness; and

WHEREAS, prior to the issuance of any construction permits for Project, City requires Owner(s) to enter into Agreement to ensure the installation, inspection, maintenance, and repair of permanent SWMFs.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree to the following covenants, terms, and conditions:

ARTICLE I. DEFINITIONS

1.1 Unless context indicates otherwise, for the purpose of this Agreement, all the below-listed terms shall be defined as follows:

"Agreement" means this Storm Water Management Facilities Maintenance Agreement.

"Best Management Practices, or BMPs" means structural or non-structural pollution prevention measures, such as site design, source control, treatment control, and hydromodification control methods required to minimize polluted runoff from Project during the post-development phase. BMPs include, but are not limited to, Storm Water Management Facilities.

"City" means the City of Chula Vista, an official of the City, or any staff member authorized to act on behalf of the City.

"Inspection, Operation, and Maintenance Plan, or IOMP" means a description of inspection, operation, and maintenance activities and schedules required to ensure proper operation and effectiveness of the SWMFs into perpetuity.

"Owner(s)" means the land owner(s) of Project Site, which is the subject of this Agreement, anyone authorized to act on behalf of the land owner(s) of Project Site, and any and all of owner's successors in interest, whether individual, partnership, corporation, or other entity such as a Home Owners' Association, regardless of the manner of transfer, including purchase, devise, or gift. If land owner of SWMFs is different from development land owner (as may be in the case of offsite SWMFs), both owners are parties to Agreement and shall sign the Signature Page as Owner(s)

"Project" means all improvements and land dedicated to the development, which is the subject of Agreement, including any offsite water quality facilities.

"Project Site" means the land dedicated to the development, which is the subject of Agreement, including any offsite water quality facilities.

"Responsible Party" means Owner(s) and any other person, corporation, or legal entity accepting, in writing and in City approved form, responsibility on behalf of Owner(s).

"Security" means any Bond, Cash Deposit, or Letter of Credit that City may require from Owner(s) to assure the faithful performance of the obligations of Agreement.

"Storm Water Management Facilities" ("SWMFs") means all onsite and offsite structural facilities constructed as Project's site design, treatment control, or hydromodification control BMPs, proposed as part of the development project submittals, and as approved by City prior to the issuance of a development permit, or as amended with City's approval after the development is complete.

"Water Quality Technical Report" ("SWQMP") means a document prepared in accordance with the requirements of the Chula Vista Development Storm Water Manual, and submitted to the City as part of Project's permit application documents.

ARTICLE II. – OWNER'S OBLIGATIONS

2.1 **Maintenance of Stormwater Management Facilities.** Owner(s) shall install, inspect, maintain, repair, and replace all SWMFs for the Project as required by the Director of Public Works, or his/her designated representative ("Director).

2.1.1 Scope of Maintenance. Maintenance shall include inspection and servicing of SWMFs on the schedule determined necessary to ensure the SWMFs retain their effectiveness.

2.1.2 Duration of Obligation. Owner's obligation to maintain, repair and replace the SWMFs shall continue in perpetuity until all obligations under this Agreement are transferred to, and assumed by, another owner or entity approved by City ("Responsible Party").

2.2 **Grant of Right of Entry**. Owner(s) shall grant to the City, its representatives, or contractors, or any Responsible Party, the right to enter the Project to inspect SWMFs, or perform any permitted acts or obligations under this Agreement, including maintenance of said facilities in the event the Owner(s) fails(fail) to fulfill its(their) maintenance obligations after proper notice.

2.2.1 No Prior Notice. City shall have the right, at any time and without prior notice to Owner(s), to enter upon any part of Project as may be necessary or convenient for any acts permitted hereunder.

2.2.2 Unobstructed Access. Owner(s) shall at all times maintain Project so as to make City's access clear and unobstructed.

2.3 **Modification of IOMP**. Owner(s) shall, at the City's request, in City's sole discretion, amend the IOMP. The Owner(s) may amend the IOMP from time-to-time, subject to City approval. The IOMP is attached hereto as Exhibit "C."

2.3.1 Part of Owner's Obligations. Any obligations, conditions, or requirements of an amended IOMP shall become part of this Agreement immediately as if originally included herein, and the Owner(s) shall be responsible for such amended obligations, conditions, or requirements. The amended IOMP shall not be applied retroactively.

The IOMP shall describe employee training programs and duties, routine inspection, service and operating schedules, maintenance frequency, and specific maintenance activities.

2.4 **Submission of Documents**. Owner(s) shall include a copy of the Inspection, Operation, and Maintenance Plan ("IOMP") for the SWMFs in the SWQMP for Project and submit a copy to City, at the time Agreement is executed.

ARTICLE III. – CITY'S RIGHTS

3.1 **Perform Maintenance**. City shall have the right, but not the obligation, to elect to perform any or all of the maintenance activities

3.1.1 Notice. Except in the Case of an emergency, prior to performing any maintenance activities, City shall provide Owner(s) with a written notice, informing Owner(s) of its (their) failure to satisfactorily perform its (their) obligations under Agreement.

3.1.1.1 *Emergencies*. In the event of an emergency, as determined by City, City shall not be required to provide Owner(s) with notice in advance of performing any and all maintenance activities it deems necessary.

3.1.2 Time to Cure. Owner(s) shall have a reasonable time, as defined in the Notice, to cure any failure to perform its (their) maintenance obligations. If a cure cannot be completed within the time limit identified in the Notice, Owner(s) shall provide City with a written request for additional time, which shall include sufficiently detailed explanation as to why the cure cannot be completed within such timeframe. If the City approves a request for additional time, Owner(s) shall immediately commence such cure and diligently pursue to completion.

3.1.3 Costs of Maintenance. In the event City performs any maintenance under this Article III, then Owner(s) shall pay all costs City incurred in performing said maintenance activities. Payment shall be subject to the following terms:

3.1.3.1 *Due Date*. Net 30.

3.1.3.2 *Interest*. Any late payment shall be subject to a rate of eight percent (8%) interest per annum.

3.1.3.3 *Use of Security*. If payment is not received by the Due Date, City may, at its option, recover its costs through use of any security provided by Owner(s). Any costs associated with recovery shall be charged to and be an obligation of Owner(s).

3.2 **City Inspections**. City shall have the right to conduct inspections of the SWMFs from time-to-time as required by the National Pollutant Discharge Elimination System Municipal Permit, Order No. R9-2013-0001 and any re-issuances thereof, to ensure adequate maintenance and effectiveness of the SWMFs. Owner(s) agrees (agree) to pay all inspection fees as may be established by City.

ARTICLE IV. INDEMNITY

4.1 **General Requirement**. Owner(s) shall defend, indemnify, protect and hold harmless the City, its elected and appointed officers, agents, employees, and volunteers ("Indemnitees") from and against any and all claims, demands, causes of action, costs, expenses, liability, loss, damage or injury, in law or equity, to property or persons, including wrongful death, in any manner arising out of or incident to any alleged acts, omissions, negligence, or willful misconduct of Owner(s), its officials, officers, employees, agents, and contractors ("Indemnitors"), arising out of or related to the installation, inspection, maintenance, repair, or replacement of the BMPs or this Agreement. This indemnity provision does not include any claims, damages, liability, costs and expenses (including without limitations, attorneys fees) arising from the sole negligence or sole willful misconduct of the Indemnitees. Also covered is under the indemnity obligations is liability arising from, connected with, caused by or claimed to be caused by the active or passive negligent acts or omissions of the Indemnitees, which may be in combination with the active or passive negligent acts or omissions of the Indemnitors.

4.2 **Costs of Defense and Award**. Included in the obligations in Section 4.1, above, is the Owner's obligation to defend, at Owner's own cost, expense and risk, any and all aforesaid suits, actions or other legal proceedings of every kind that may be brought or instituted against the Indemnitees. Owner(s) shall pay and satisfy any judgment, award or decree that may be rendered against Indemnitees for any and all legal expense and cost incurred by each of them in connection therewith.

4.3 **Conduct Own Defense**. If City elects, at its sole discretion, to conduct its own defense, participate in its own defense, or obtain independent legal counsel in defense on any claim related to the installation, inspection, maintenance, repair or replacement of the SWMFs, Owner(s) agrees (agree) to pay the reasonable value of attorney's fees and all of City's reasonable costs.

4.4 **Insurance Proceeds**. Owner's obligation to indemnify shall not be restricted to insurance proceeds, if any, received by Indemnitees.

4.5 **Declarations**. Owner's obligations under this Article IV shall not be limited by any prior or subsequent declaration by the Owner(s).

4.6 **Enforcement Costs**. Owner(s) agrees (agree) to pay any and all costs Indemnitees incur enforcing the indemnity and defense provisions set forth in this Article IV.

4.7 **Survival**. Owner's obligations under this Article IV shall survive the termination of this Agreement.

ARTICLE V. INSURANCE

5.1 **Insurance**. In the event that insurance is required by City, Owner(s) shall not begin work under this Agreement until it has (they have) : (i) obtained, and upon the City's request provided to the City, insurance certificates reflecting evidence of all insurance required in this Article V; (ii) obtained City approval of each company or companies; and (iii) confirmed that all policies contain the specific provisions required by this Section.

5.2 **Types of Insurance**. At all times during the term of this Agreement, Owner(s) shall maintain those types of insurance coverage and amounts of coverage required by City to protect the City from any potential claims, which may arise from the installation, inspection, maintenance, repair or replacement of the SWMFs or any other obligations under this Agreement.

5.3 **Policy Endorsements Required**.

5.3.1 Additional Insureds. City of Chula Vista, its officers, officials, employees, agents and volunteers are to be named as additional insureds with respect all required policies of insurance with respect to liability arising out of obligations under this Agreement performed by or on behalf of the Owner(s).

5.3.2 Primary Insurance. The Owner's General Liability insurance coverage must be primary insurance as it pertains to the City, its officers, officials, employees, agents, and volunteers. Any insurance or self-insurance maintained by the City, its officers, officials, employees, or volunteers is wholly separate from the insurance of the Owner(s) and in no way relieves the Owner(s) from its (their) responsibility to provide insurance.

5.3.3 Waiver of Subrogation. Owner's insurer will provide a Waiver of Subrogation in favor of the City for each required policy providing coverage for the term required by this Agreement.

5.3.4 Cancellation. The insurance policies required must be endorsed to state that coverage will not be canceled by either party, except after thirty (30) days' prior written notice to the City by certified mail, return receipt requested. The words "will endeavor" and "but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents, or representatives" shall be deleted from all certificates.

5.4 **Proof of Insurance Coverage**. Owner(s) shall furnish the City with original certificates and amendatory endorsements affecting coverage required. The endorsements should be on insurance industry forms, provided those endorsements or policies conform to the contract requirements. All certificates and endorsements are to be received and approved by the City before work commences on the Project. The City reserves the right to require, at any time, complete, certified copies of all required insurance policies, including endorsements evidencing the coverage required by these specifications.

5.5 **Deductibles and Self-Insured Retentions**. Any deductibles or self-insured retentions must be declared to and approved by the City. At the option of the City, either the insurer will reduce or eliminate such deductibles or self-insured retentions as they pertain to the City, its officers, officials, employees and volunteers; or the Owner(s) will provide a financial guarantee satisfactory to the City guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

5.6 **Active Negligence**. Coverage shall not extend to any indemnity coverage for the active negligence of the additional insureds in any case where an agreement to indemnify the additional insured would be invalid under Subdivision (b) of Section 2782 of the Civil Code.

5.7 **Not a Limitation of Other Obligations**. Insurance provisions under this Article shall not be construed to limit the Owner's obligations under this Agreement, including Indemnity.

ARTICLE VI. SECURITY

6.1 **Security Required**. If within any five-year period, City inspectors determine on two occasions that Owner(s) has (have) failed to effectively operate, maintain, or repair the SWMFs, City may require Owner(s) to provide City with Security to assure the faithful performance of the obligations of this Agreement.

6.1.1 Amount of Security. The amount of the security shall equal the cost to maintain the SWMFs for two (2) years, which cost shall be determined as identified in the Project SWQMP ("Security Amount").

6.1.2 Type of Security. Security may be of any of the following types:

6.1.2.1 *Performance Bond*. Owner(s) shall provide to the City a performance bond in favor of the City in the Security Amount and subject to the provisions below.

a. Certificate of Agency. All bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

b. Licensing and Rating. The bonds shall be from surety companies admitted to do business in the State of California, licensed or authorized in the jurisdiction in which the Project is located to issue bonds for the limits required by this agreement, listed as approved by the United States

Department of Treasury Circular 570, http://www.fms.treas.gov/c570, and which also satisfy the requirements stated in Section 995.660 of the Code of Civil Procedure, except as provided otherwise by laws or regulation, and have a minimum AM Best rating of "A-" to an amount not to exceed ten percent (10%) of its capital and surplus.

c. Insolvency or Bankruptcy. If the surety on any bond furnished by the Owner(s) is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located, Owner(s) shall within seven (7) days thereafter substitute or require the substitution of another bond and surety, acceptable to the City.

6.1.2.2 *Letter of Credit*. As security for Owner's obligations under this Agreement, Owner(s) shall cause an irrevocable letter of credit in the Security Amount ("Letter of Credit") to be issued in favor of the City by a reputable state or national financial institution with a branch located in Chula Vista.

a. Draw on Letter of Credit. The City may draw upon the Letter of Credit for the full amount or any series of partial amounts as necessary by means of a sight draft accompanied by a statement from the City Manager, Deputy City Manager, Business Center Manager, that the Owner(s) has(have) not satisfied Owner's obligations hereunder.

6.1.2.3 *Cash Deposit*. In lieu of a Performance Bond or Letter of Credit, Owner(s) may deposit the Security Amount with the City.

a. Return of Security. Any unused balance of the Security at the end of the Term shall be returned to the Owner(s) in accordance with City's accounting procedures.

6.1.3 Adjustment for Inflation. The Security Amount shall be adjusted at a rate of 5% per annum.

6.1.4 Term. Security shall remain in full force and effect for two (2) years from the date it is received by the City provided no further failures are identified by City Inspectors during the initial two (2) year period. In the event additional violations occur, the City shall retain the Security until such time as the City Manager, in his sole discretion, deems appropriate to ensure the Owner's obligations will be satisfied.

6.1.5 Form of Security. Security required under this Article shall be in a form satisfactory to the City Manager and City Attorney.

6.1.6 Use of Security. In accordance with Article III, City may use all or any portion of this Security to fund the costs associated with the City's performance of any of the maintenance activities for the Project's SWMFs.

6.1.7 Replenish Security. If at any time the Security Amount shall drop below the amount required under Section 6.1.1, Owner(s) shall deposit additional funds, provide an additional Letter of Credit to City, or provide an additional bond within thirty (30) days, such that the total amount of Security available to the City is equal to the amount required in Section 6.1.1.

ARTICLE VII. RECORDS

7.1 **Record Keeping**. The designation of a Responsible Party to maintain the SWMFs does not relieve Owner(s) of any of the obligations or duties under this Agreement. Owner(s), its (their) successors, or a designated Responsible Party, shall retain records of the IOMP and maintenance and inspection activities for at least five years. Said records shall be made available within 5 days, upon request by City.

ARTICLE VIII. STANDARD PROVISIONS

8.1 **Headings**. All headings are for convenience only and shall not affect the interpretation of this Agreement.

8.2 **Gender & Number**. Whenever the context requires, the use herein of (i) the neuter gender includes the masculine and the feminine genders and (ii) the singular number includes the plural number.

8.3 **Reference to Paragraphs**. Each reference in this Agreement to an Article or Section refers, unless otherwise stated, to an Article or Section in this Agreement.

8.4. **Incorporation of Recitals**. All recitals herein are incorporated into this Agreement and are made a part hereof.

8.5 **Covenants and Conditions**. All provisions of this Agreement expressed as either covenants or conditions on the part of the City or the Owner(s), shall be deemed to be both covenants and conditions.

8.6 **Integration.** This Agreement and the Exhibits and references incorporated into this Agreement fully express all understandings of the Parties concerning the matters covered in this Agreement. No change, alteration, or modification of the terms or conditions of this Agreement, and no verbal understanding of the Parties, their officers, agents, or employees shall be valid unless made in the form of a written change agreed to in writing by both Parties or an amendment to this Agreement agreed to by both Parties. All prior negotiations and agreements are merged into this Agreement.

8.7 **Severability**. The unenforceability, invalidity, or illegality of any provision of this Agreement shall not render any other provision of this Agreement unenforceable, invalid, or illegal. In the event that any provision of this Agreement shall for any reason, be determined to be invalid, illegal, or unenforceable in any respect, the remainder of this Agreement shall remain in full force and effect and the parties hereto shall negotiate in good faith and agree to such amendments, modifications, or supplements to this Agreement

or such other appropriate action as shall, to the maximum extent practicable in light of such determination, implement and give effect to the intentions of the parties as reflected herein.

8.8 **Drafting Ambiguities**. The Parties agree that they are aware that they have the right to be advised by counsel with respect to the negotiations, terms and conditions of this Agreement, and the decision of whether or not to seek advice of counsel with respect to this Agreement is a decision that is the sole responsibility of each Party. This Agreement shall not be construed in favor of or against either Party by reason of the extent to which each Party participated in the drafting of the Agreement.

8.9 **Conflicts Between Terms**. If an apparent conflict or inconsistency exists between the main body of this Agreement and the Exhibits, the main body of this Agreement shall control. If a conflict exists between an applicable federal, state, or local law, rule, regulation, order, or code and this Agreement, the law, rule, regulation, order, or code shall control. Varying degrees of stringency among the main body of this Agreement, the Exhibits, and laws, rules, regulations, orders, or codes are not deemed conflicts, and the most stringent requirement shall control. Each Party shall notify the other immediately upon the identification of any apparent conflict or inconsistency concerning this Agreement.

8.10 **Prompt Performance**. Time is of the essence of each covenant and condition set forth in this Agreement.

8.11 **Good Faith Performance**. The Parties shall cooperate with each other in good faith, and assist each other in the performance of the provisions of this Agreement.

8.12 **Further Assurances**. City and Owner each agree to execute and deliver such additional documents as may be required to effectuate the purposes of this Agreement.

8.13 **Exhibits**. Each of the following Exhibits is attached hereto and incorporated herein by this reference:

Exhibit A: Vicinity map
Exhibit B: Legal Description for Project
Exhibit C: BMP and HMP type, location and dimensions
Exhibit D: Maintenance recommendations and frequency. Inspection, Operation, and Maintenance Plan (IOMP)

8.14 **Compliance with Controlling Law**. The Owner(s) shall comply with all laws, ordinances, regulations, and policies of the federal, state, and local governments applicable to this Agreement. In addition, the Owner(s) shall comply immediately with all directives issued by the City or its authorized representatives under authority of any laws, statutes, ordinances, rules, or regulations.

8.15 **Enforcement**. Failure to comply with the terms of this Agreement constitutes a violation of the Chula Vista Municipal Code Chapter 14.20 "Storm Water Management and Discharge Control" and may result in enforcement action pursuant to City's storm water regulations and administrative procedures.

8.16 **Jurisdiction, Venue, and Attorney Fees**. This Agreement shall be governed by and construed in accordance with the laws of the State of California. Any action arising under or relating to this Agreement shall be brought only in the federal or state courts located in San Diego County, State of California, and if applicable, the City of Chula Vista, or as close thereto as possible. Venue for this Agreement, and performance hereunder, shall be the City of Chula Vista. The prevailing Party in any such suit or proceeding shall be entitled to a reasonable award of attorney fees in addition to any other award made in such suit or proceeding.

8.17 **Administrative Claims Requirement and Procedures**. No suit shall be brought arising out of this agreement, against the City, unless a claim has first been presented in writing and filed with the City of Chula Vista and acted upon by the City of Chula Vista in accordance with the procedures set forth in Chapter 1.34 of the Chula Vista Municipal Code, the provisions of which are incorporated by this reference as if fully set forth herein.

8.18 **Third Party Relationships**. Nothing in this Agreement shall create a contractual relationship between City and any individual, entity, or other not a party to this Agreement.

8.19 **Non-Assignment**. The Owner(s) shall not assign the obligations under this Agreement, whether by express assignment, by sale of the company, or any monies due or to become due, without the City's prior written approval. Any assignment in violation of this paragraph shall constitute a Default. In no event shall any putative assignment create a contractual relationship between the City and any putative assignee.

8.20 **Successors in Interest**. This Agreement and all rights and obligations created by this Agreement shall be in force and effect whether or not any Parties to the Agreement have been succeeded by another entity, and all rights and obligations created by this Agreement shall be vested and binding on any Party's successor in interest.

8.21 **Agreement Runs with Project**. The terms, covenants and conditions contained in this Agreement shall constitute covenants running with the land and shall be binding upon the heirs, executors, administrators, successors and assigns of Owner(s) and City and shall be deemed to be for the benefit of all persons owning any interest in Project, the City, and the Public. It is the intent of the Parties that this Agreement be recorded and be binding upon all persons purchasing or otherwise acquiring all or any lot, unit or other portion of Project, who shall be deemed to have consented to and become bound by all the provisions of this Agreement. This Agreement shall commence upon execution of this Agreement by all Parties named in the Agreement.

8.22 **Independent Contractors**. The Owner(s), any contractors, subcontractors, and any other individuals employed by the Owner(s) shall be independent contractors and not agents of the City. Any provisions of this Agreement that may appear to give the City any right to direct the Owner(s) concerning the details of performing the Services under this Agreement, or to exercise any control over such performance, shall mean only that the Owner(s) shall follow the direction of the City concerning the end results of the performance.

8.23 **No Waiver**. No failure of either the City or Owner(s) to insist upon the strict performance by the other of any covenant, term or condition of this Agreement, nor any failure to exercise any right or remedy consequent upon a breach of any covenant, term, or condition of this Agreement, shall constitute a waiver of any such breach of such covenant, term or condition. No waiver of any breach shall affect or alter this Agreement, and each and every covenant, condition, and term hereof shall continue in full force and effect to any existing or subsequent breach.

8.24 **Notices**. Owner(s) agrees(agree) that it shall, prior to transferring ownership of any land on which any part of the Project covered by this Agreement are located, and also prior to transferring ownership of any such SWMFs, provide clear written notice of the above maintenance obligations associated with that SWMF to the transferee. Owner(s) further agrees(agree) to provide evidence that Owner(s) has(have) requested the California Department of Real Estate to include in the public report issued for the development of Project, a notification regarding the SWMF maintenance requirements described in this Agreement.

8.24.1 Serving Notice. All notices, demands or requests provided for or permitted to be given pursuant to this Agreement must be in writing. All notices, demands and requests to be sent to any Party shall be deemed to have been properly given or served if personally served or deposited in the United States mail, addressed to such party, postage prepaid, registered or certified, with return receipt requested

8.25 **Entitlement to Subsequent Notices**. No notice to or demand on the Parties for notice of an event not herein legally required to be given shall in itself create the right in the Parties to any other or further notice or demand in the same, similar or other circumstances.

8.26 **Remedies**. The rights of the Parties under this Agreement are cumulative and not exclusive of any rights or remedies that the Parties might otherwise have unless this Agreement provides to the contrary.

8.27 **Counterparts**. This Agreement may be executed in more than one counterpart, each of which shall be deemed to be an original but all of which, when taken together shall constitute but one instrument.

8.28 **Signing Authority**. Each signatory and party hereto hereby warrants and represents to the other party that it has legal authority and capacity and direction from its principal to enter into this Agreement; that all resolutions or other actions have been taken so as to enable it to enter into this Agreement and agrees to hold the other Party or Parties hereto harmless if it is later determined that such authority does not exist.

End of page (next page is signature page)

SIGNATURE PAGE FOR
STORM WATER MANAGEMENT FACILITIES MAINTENANCE
AGREEMENT WITH GRANT OF ACCESS AND COVENANTS

(INSERT PROJECT)

IN WITNESS WHEREOF, the parties have executed this Agreement on the 15th day of January, 2020.

OWNER:

_____

_____

By: _____

Its: _____

By: _____

Its: _____

CITY OF CHULA VISTA:

_____
City Engineer

APPROVED AS TO FORM:

_____
City Attorney

ATTEST:

_____
City Clerk

Dated: _____

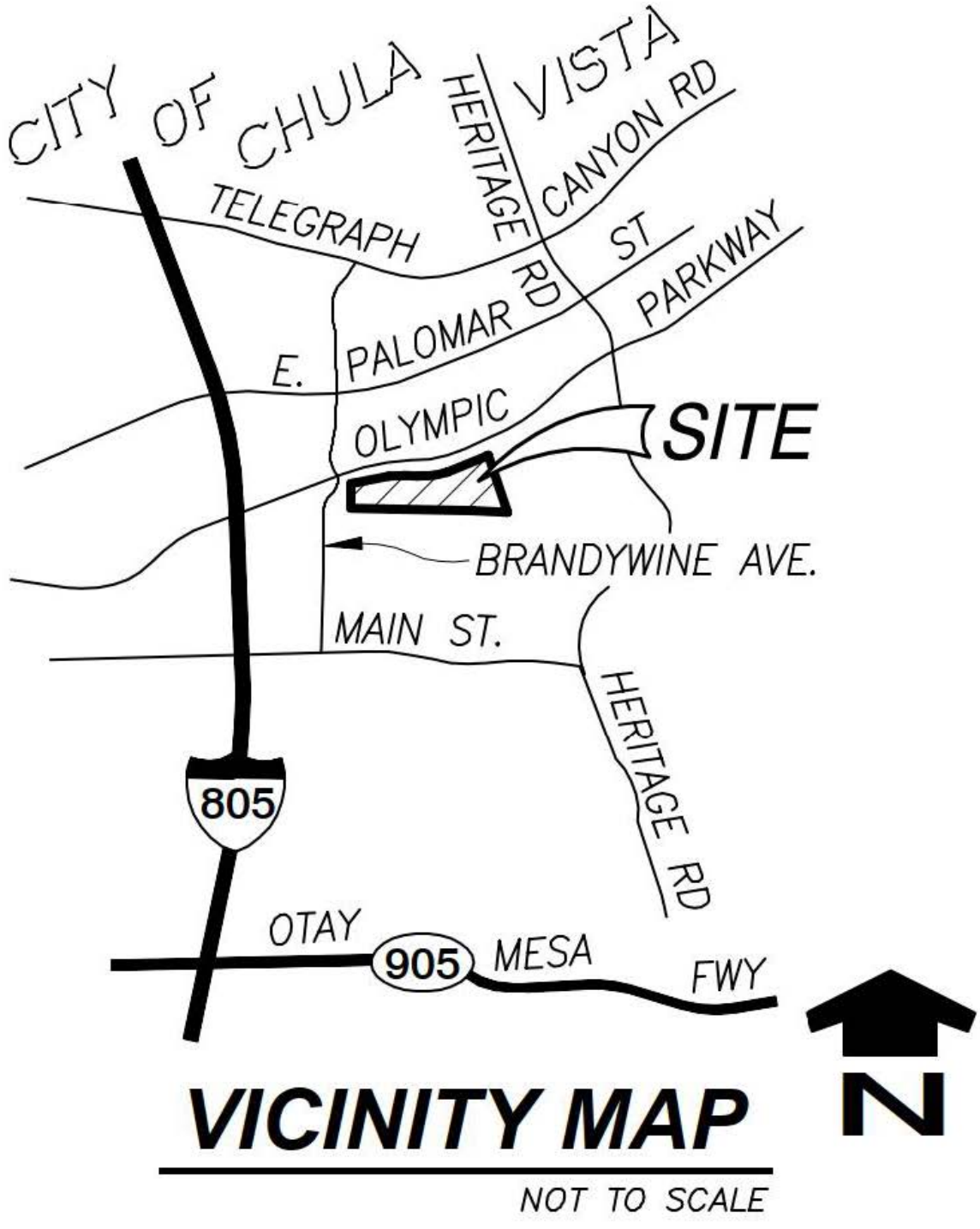
(Notary to attach acknowledgment for each signature.)
(Corporate Authority required for each Signatory, if applicable.)

Attachments:

1. Exhibit A: Depiction of Project Site
2. Exhibit B: Legal Description for Project Site
3. Exhibit C: BMP and HMP type, location and dimensions
4. Exhibit D: Maintenance recommendations and frequency. Inspection, Operation, and Maintenance Plan (IOMP)

EXHIBIT "A"

SUNBOW II, PHASE 3
VICINITY MAP



VICINITY MAP

NOT TO SCALE

EXHIBIT "B"
LEGAL DESCRIPTION

LEGAL DESCRIPTION:

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF CHULA VISTA, IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

THAT PORTION OF THE "REMAINDER LOT" OF CHULA VISTA TRACT 90-07 SUNBOW II, UNITS 1 AND 2, IN THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP THEREOF NO. 13423, FILED IN THE OFFICE OF THE COUNTY RECORDER OF THE COUNTY OF SAN DIEGO, MAY 28, 1997, LYING WITHIN SECTIONS 17 AND 18, TOWNSHIP 18 SOUTH, RANGE 1 WEST, SAN BERNARDINO MERIDIAN, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING THEREFROM THAT PORTION LYING NORTHERLY OF THE SOUTHERLY BOUNDARY OF CHULA VISTA TRACT NO. 90-07, SUNBOW, PHASE 1C UNITS 5, 6, 13, 14 AND 15, ACCORDING TO MAP THEREOF NO. 13917 IN THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, JANUARY 19, 2000.

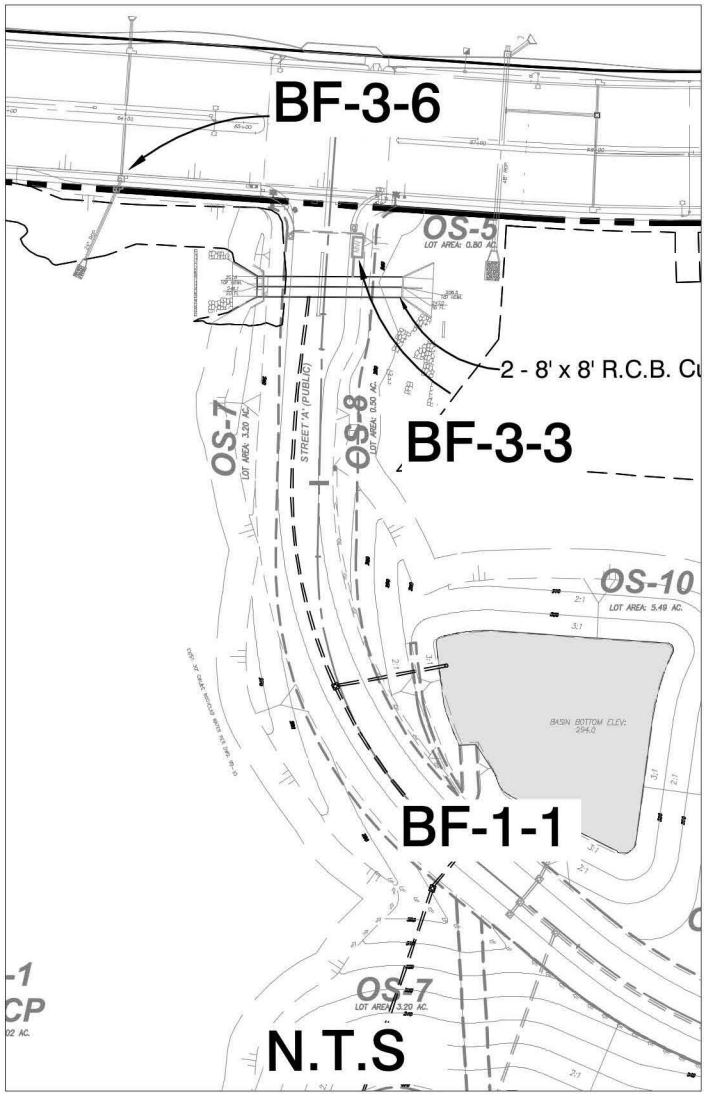
APN(S): 644-011-06-00 AND 644-020-11-00

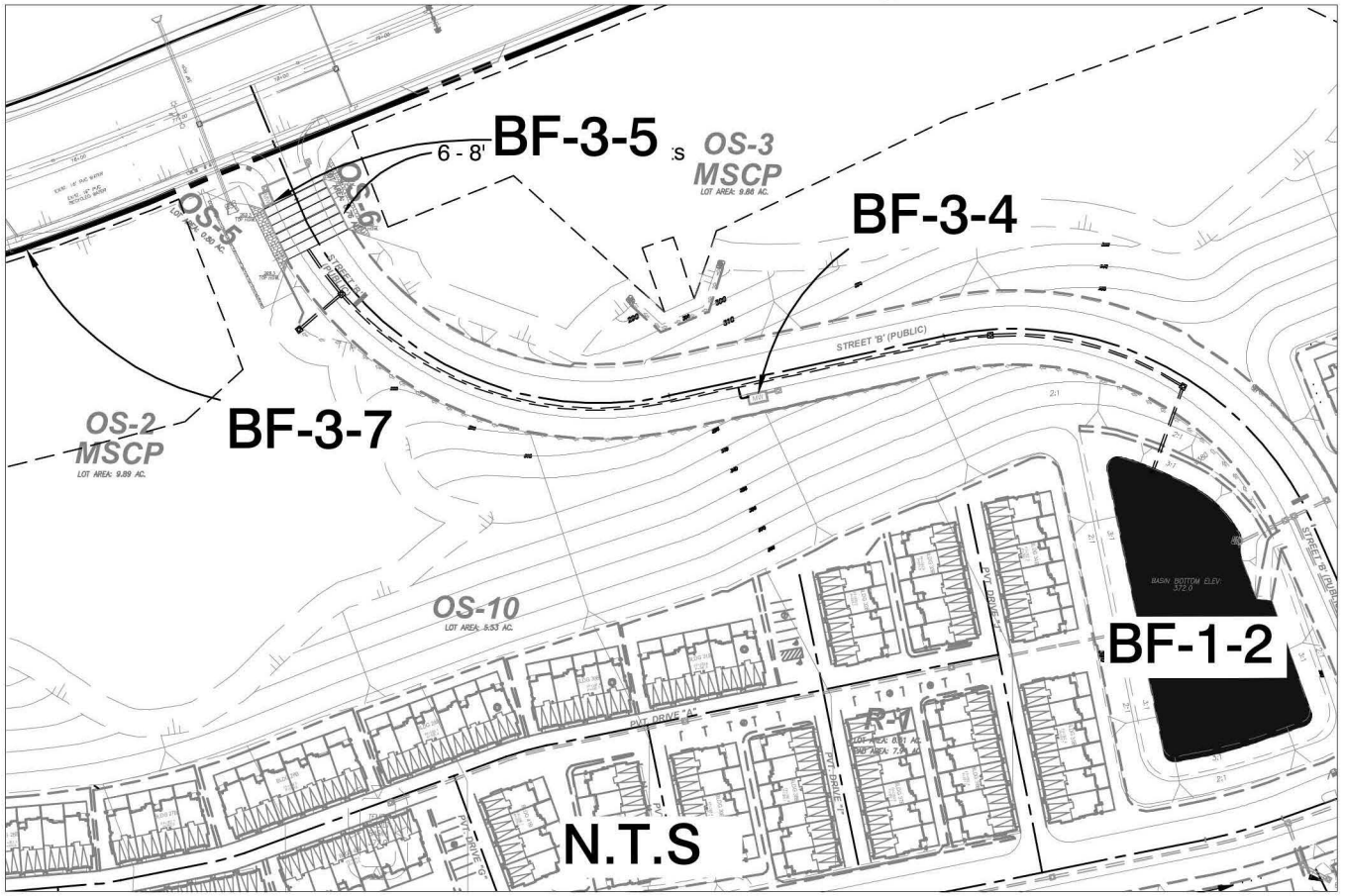
EXHIBIT "C"

BMP and HMP type, location and dimensions (see attachment 4)

EXHIBIT "C"

SUNBOW II, PHASE 3
BMP type location and dimensions





BF-1-1 BIOFILTRATION BMP
MODEL: BIOFILTRATION BASIN (NO INFILTRATION)
FOR DETENTION AND WATER QUALITY CONTROL
BOTTOM AREA: 25208sqft BASIN DEPTH: 6ft

BF-1-2 BIOFILTRATION BMP
MODEL: BIOFILTRATION BASIN (NO INFILTRATION)
FOR DETENTION AND WATER QUALITY CONTROL
BOTTOM AREA: 29906sqft BASIN DEPTH: 6ft

BF-3-3 FLOW BASED COMPACT BIOFILTRATION BMP
MODEL: MWS-L-4-15-V
TREATMENT FLOW 0.175CFS
DIMENSION LxWxH: 16'x5'x4'

BF-3-4, 5 FLOW BASED COMPACT BIOFILTRATION BMP
MODEL: MWS-L-4-17-V
TREATMENT FLOW 0.200CFS
DIMENSION LxWxH: 18'x5'x4'

BF-3-6, 7 FLOW BASED COMPACT BIOFILTRATION BMP
MODEL: BC-RGISB-MF-22-24
TREATMENT FLOW 0.12CFS
DIMENSION: INSERTED SD INLET

EXHIBIT "D"

Maintenance recommendations and frequency. Inspection, Operation, and Maintenance Plan (IOMP)

MODULAR WETLAND

SITE DESIGN, SOURCE CONTROL AND POLLUTANT CONTROL BMP OPERATION + MAINTENANCE PROCEDURE							
STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT APPROVAL NO.: TBD							
O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNDER: RYAN COMPANIES US, INC.							
BMP DESCRIPTION	**INSPECTION FREQUENCY**	**MAINTENANCE FREQUENCY**	**MAINTENANCE METHOD**	**QUANTITY**	**INCLUDED IN O&M MANUAL**		**SHEET NUMBERS**
POLLUTANT CONTROL BMP(S)							
DESCRIPTION:PROPRIETARY BIOFILTRATION UNIT	BI-ANNUAL	6-12 MONTHS AS NEEDED	REPLCMNT OF SOIL MATERIAL REMOVE DEBRIS AS NEEDED	3	YES		CVT#20-0002, Sheet 3, 4, 5
DESCRIPTION:PROPRIETARY BIOFILTRATION UNIT	SEE TABLE BELOW			2	YES		CVT#20-0002, Sheet 3, 4, 5

BIOFILTRATION

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintain when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintain when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintain when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintain when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly.

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
		• Replenish mulch annually, or more frequently when needed based on inspection.
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintain when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintain when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintain when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintain when needed.

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
	hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the City Engineer shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintain when needed.

The following inspection and maintenance activities shall be performed and completed as indicated.

Maintenance Program for Inlet Stenciling

Inspection Frequency/Indications:	Regular Maintenance Inspections q Before wet season begins (September); q After wet season (April).
Maintenance Indications	**Maintenance Activities**
q Inlet stenciling/signage begins to weather or fade	q Re-stamp signage
q Broken or damaged structure	q Repair or replace signage structure

Maintenance Program for Modular Wetland Biofiltration Units

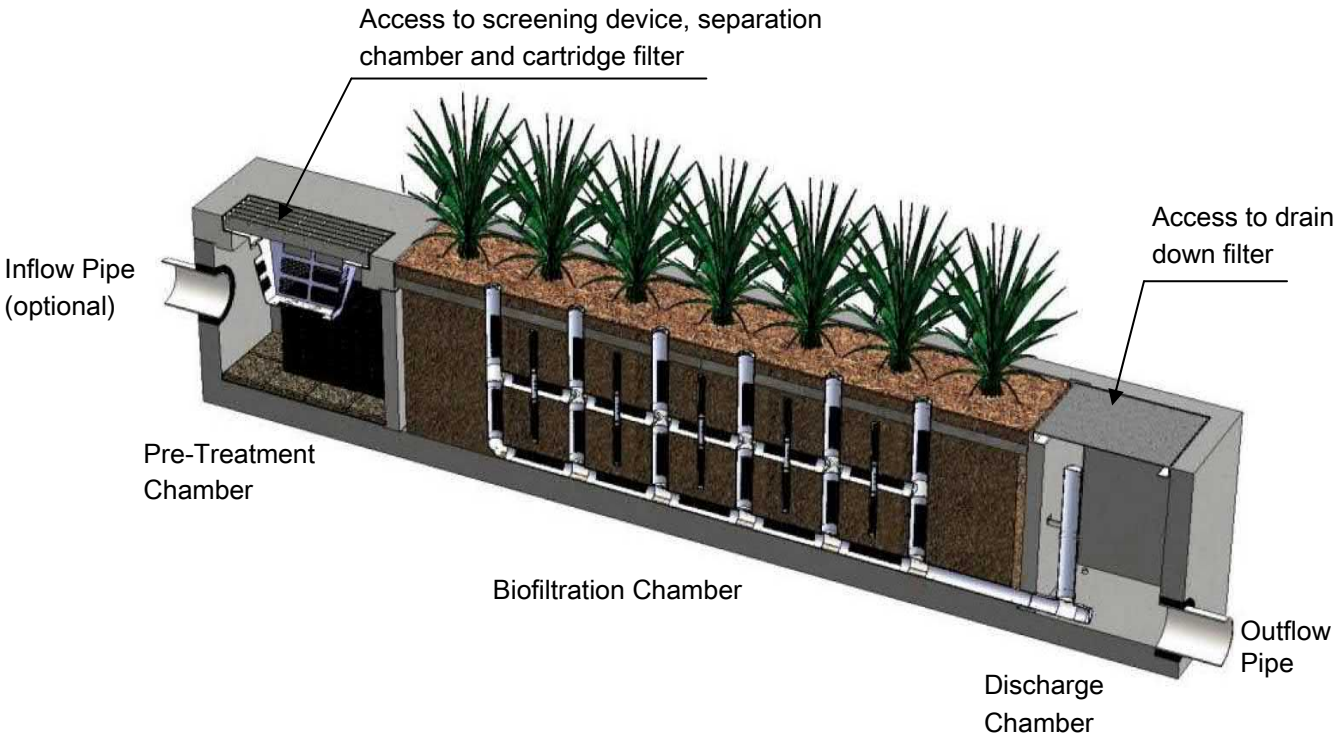
Inspection Frequency/Indications:	Regular Maintenance Inspections q Monthly during wet season q Annually before wet season (September) Performance Inspection q 72 hrs after rainfall events greater than 0.5 in.
Maintenance Indications	**Maintenance Activities**
q Excessive trash, debris, or sediment in unit. (i.e., sump is 85 percent full or sump is 50 percent full during two consecutive monthly inspections)	q Remove trash and debris within 15 days. Empty unit when the unit is 85 percent full or 50 percent full during two consecutive monthly inspections, or annually in May.
q Presence of trash and debris in weir box.	q Remove trash and debris while onsite conducting inspection
q When standing water in sump is observed during annual and performance inspection.	q If standing water cannot be removed or remains through the wet season, notify vector control.
q Minor structural damage (i.e., screen becomes clogged, damaged or loose)	q Clean screen, re-fasten screen if appropriate.
q Cracked or fatigued neoprene vector seals	q Replace damaged seal
q Major damage to structures (i.e., holes in screen, large debris, damage to housing or weir box)	q Immediately consult with engineer and manufacturer=s representative to develop a course of action and effect repairs prior to the wet season.
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.



Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.







Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.







Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.



Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.









Inspection Form



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Round Curb Inlet Filter (R-GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

Bio Clean
A Forterra Company

Overview

The Bio Clean Round Curb Inlet Filter (R-GISB) is a favorite amongst cities and municipalities nationwide. Many agencies have chosen this system as their standard due to its quick cleaning time and large storage capacity.

Its patented 'Shelf System' allows cleaning to be done in less than 15 minutes, and its larger storage capacity of 3.85 cubic feet allows for maximized cleaning intervals and minimized attention required by maintenance crews.

The modularized design of the 'Shelf System' for curb inlets makes it adaptable to any size or type catch basin.

Its multi-stage filtration screens allow this device to meet "full trash capture" requirements by removing 100% of trash & debris 5 mm and greater. Made of marine grade fiberglass and high grade stainless steel these filters come in standard and custom designs.

This filtration system addresses a wide array of pollutants including trash and debris, sediments, TSS, nutrients, metals, and hydrocarbons.

Includes the Patented 'Shelf System'

Higher Storage Capacity & 15 Minute Service Time



Advantages

- 8 Year Warranty
- Works in Any Size Catch Basin
- No Nets or Geofabrics
- 15+ Year User Life
- Meets LEED Requirements
- Patented Shelf System
- Fiberglass Construction

Performance

- 74%-86% Removal of TSS
- 54% Removal of Oils & Grease
- 57%-71% Removal of Phosphorus
- 56%-60% Removal of Nitrogen

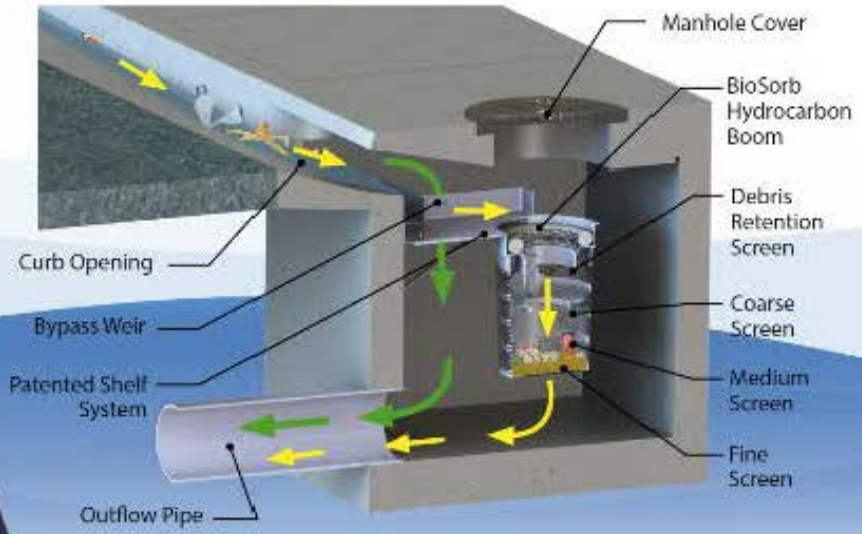
Specifications

Model #	Treatment Flow (CFS)	Bypass Flow (CFS)
BC-RGISB-22-24	2.4	Unlimited

Operation

Bypass Flow Path

Treatment Flow Path



www.BioCleanEnvironmental.com

Round Curb Inlet Filter (R-GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

Media Filter

The Bio Clean Round Curb Inlet Media Filter (RGISB-MF) is an advanced level filtration device designed with a multi-layered media filter for increased removal efficiencies.

Performance

- 85% Removal of Fine TSS
- 69% Removal of Dissolved Phosphorus
- 95% Removal of Copper
- 87% Removal of Lead
- 95% Removal of Zinc
- 90% to 95% Removal of Oils & Grease
- 68% Removal of Fecal Coliform (bacteria)

Specifications

Model #	Media Treatment Flow (CFS)	Screen Treatment Flow (CFS)	Bypass Flow (CFS)
BC-RGISB-MF-22-24	0.12	2	Unlimited

Higher Flow Rate Models Available

Operation



Installation & Maintenance



Cleaned Without Catch Basin Entry ✓

Cleaned Easily With Vac Truck ✓

15 Minute Service Time ✓

Application

- Parking Lots
- Roadways



Easily Removed without Entry into Basin



Always Positioned Under Manhole Opening

Approvals

City and County of Honolulu

County of San Diego

County of Orange

Meets Full Capture Requirements

398 Via El Centro
Oceanside, CA 92058
p 760.433.7640 f 760.433.3176
www.BioCleanEnvironmental.com

Bio Clean

A Forterra Company

ATTACHMENT 4

Copy of Plan Sheets Showing Permanent Storm Water BMPs

Use this checklist to ensure the required information has been included on the plans:

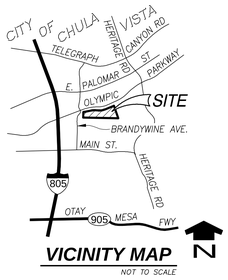
The plans must identify:

- [x] Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- [x] The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- [x] Details and specifications for construction of structural BMP(s)
- [x] Signage indicating the location and boundary of structural BMP(s) as required by the City Engineer
- [x] How to access the structural BMP(s) to inspect and perform maintenance
- [x] Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- [x] Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- [x] Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- [x] Recommended equipment to perform maintenance
- [x] When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- [x] Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
- [x] All BMPs must be fully dimensioned on the plans
- [x] When proprietary BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Broucher photocopies are not allowed.

TENTATIVE MAP CVT-20-0002

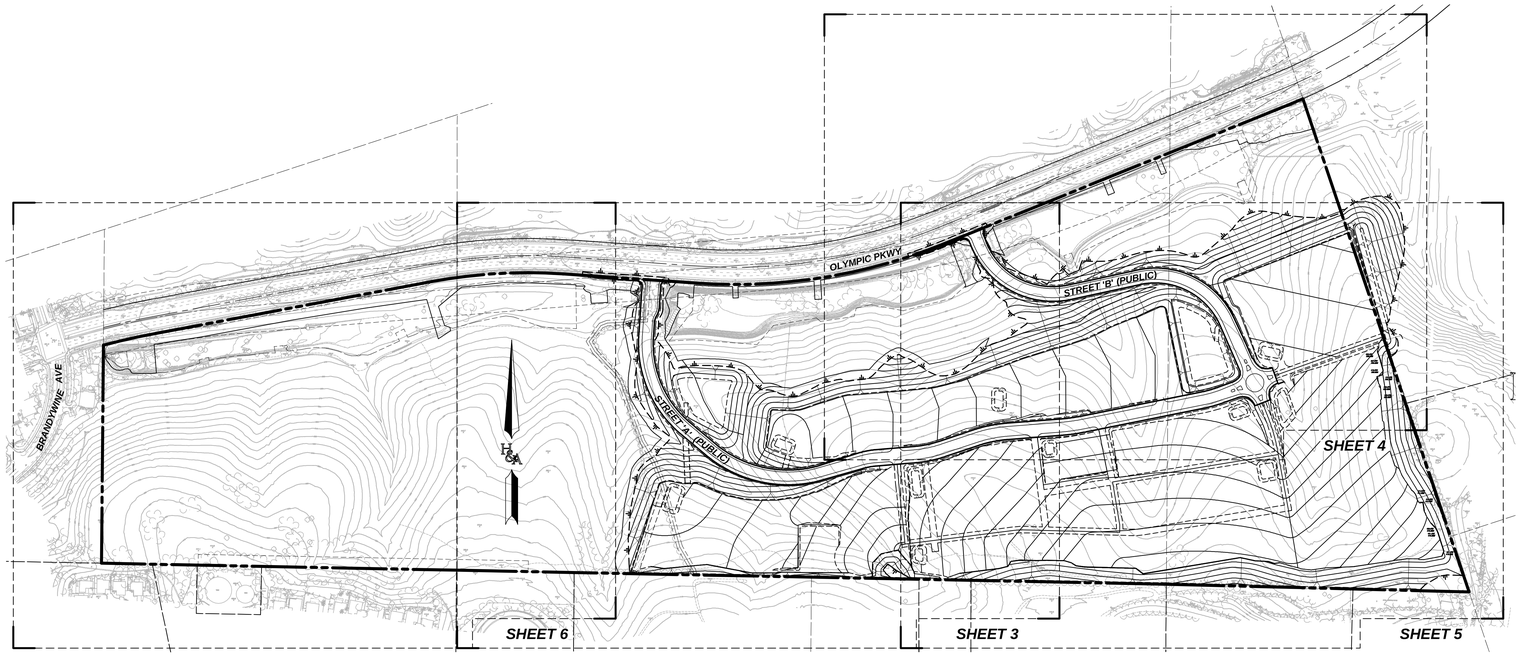
SUNBOW II, PHASE 3

CITY OF CHULA VISTA, CALIFORNIA



VICINITY MAP

NOT TO SCALE



KEY MAP

SCALE: 1"=200'

LEGEND

- SUBDIVISION BOUNDARY
- PROPOSED LOT LINE
- PROPOSED NEIGHBORHOOD BOUNDARY
- EXISTING PAD ELEVATION — P=379.4
- EXISTING TENTATIVE MAP NO. & LOT NO. — LOT 2\ 008868
- EXISTING ASSESSOR'S PARCEL NO. — 3813010200
- PROPOSED LOT NUMBER — (5)
- PROPOSED RESIDENTIAL NEIGHBORHOOD — **R-1**
- PROPOSED OPEN SPACE LOT — **OS-1**
- COMMUNITY PURPOSE FACILITY LOT — **CPF-1**
- PROPOSED BROW DITCH
- PROPOSED EASEMENT LINE
- EXISTING EASEMENT LINE
- EXISTING SEWER MAIN WITH MANHOLE
- PROPOSED SEWER MAIN WITH MANHOLE (8" PVC UNLESS OTHERWISE NOTED)
- EXISTING WATER MAIN WITH FIRE HYDRANT — W
- PROPOSED WATER MAIN (8" PVC UNLESS OTHERWISE NOTED) — W
- PROPOSED FIRE MAIN WITH FIRE HYDRANT (8" PVC UNLESS OTHERWISE NOTED) — F
- EXISTING RECLAIMED WATER MAIN — RW
- PROPOSED RECLAIMED WATER MAIN (8" PVC UNLESS OTHERWISE NOTED) — RW
- EXISTING GAS MAIN — GAS
- EXISTING STORM DRAIN SYSTEM
- PROPOSED STORM DRAIN SYSTEM
  - A. INLET OR CATCH BASIN
  - B. HEADWALL
  - C. CLEANOUT
  - D. CATCH BASIN
  - E. MODULAR WETLANDS UNIT
  - RIP RAP
- PROPOSED BYPASS STORM DRAIN
- PROPOSED STREET CENTERLINE ELEVATION — 385.4
- PROPOSED STREET GRADE — 2.0%
- STREET LIGHT
- CUT/FILL LINE — F / C
- PROPOSED FILL SLOPE — 2: 1 MAX
- PROPOSED CUT SLOPE — 1.5: 1 MAX
- RETAINING WALL
- 6' BLOCK WALL

PUBLIC UTILITIES

SEWER	CITY OF CHULA VISTA
WATER	OTAY WATER DISTRICT
STORM DRAIN	CITY OF CHULA VISTA
TELEPHONE	AT&T
GAS AND ELECTRIC	SDG&E
CABLE T.V.	COX COMMUNICATIONS
POLICE & FIRE	CITY OF CHULA VISTA
SCHOOLS	CHULA VISTA ELEMENTARY SCHOOL DISTRICT
	SWEETWATER UNION HIGH SCHOOL DISTRICT

EASEMENT & ENCUMBRANCE NOTES

SEE SHEET 7

LEGAL DESCRIPTION:

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF CHULA VISTA, IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

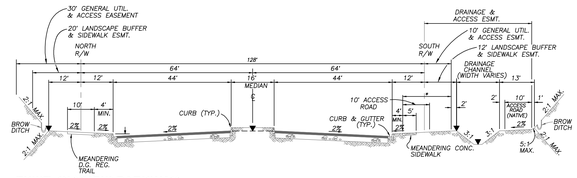
THAT PORTION OF THE "REMAINDER LOT" OF CHULA VISTA TRACT 90-07 SUNBOW II, UNITS 1 AND 2, IN THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP THEREOF NO. 13423, FILED IN THE OFFICE OF THE COUNTY RECORDER OF THE COUNTY OF SAN DIEGO, MAY 28, 1997, LYING WITHIN SECTIONS 17 AND 18, TOWNSHIP 18 SOUTH, RANGE 1 WEST, SAN BERNARDINO MERIDIAN, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING THEREFROM THAT PORTION LYING NORTHERLY OF THE SOUTHERLY BOUNDARY OF CHULA VISTA TRACT NO. 90-07, SUNBOW, PHASE 1C UNITS 5, 6, 13, 14 AND 15, ACCORDING TO MAP THEREOF NO. 13917 IN THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, JANUARY 19, 2000.

APN(S): 644-011-06-00 AND 644-020-11-00

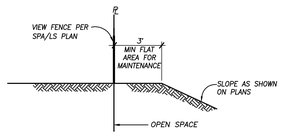
ABBREVIATIONS

FP	FLOOD PLAIN
FPP	FIRE PROTECTION PLAN
LSVC	LIGHTED SAG VERTICAL CURVE
MH	MANHOLE
NSF	NET SQ. FT.
NTS	NOT TO SCALE
PI	POINT OF INTERSECTION (V.C.)
PL	PROPERTY LINE
RCP	REINFORCED CONCRETE PIPE
RW	RECLAIMED WATER
R/W	RIGHT OF WAY
S	SEWER
SD	STORM DRAIN
SF	GROSS SQ. FT.
W	WATER



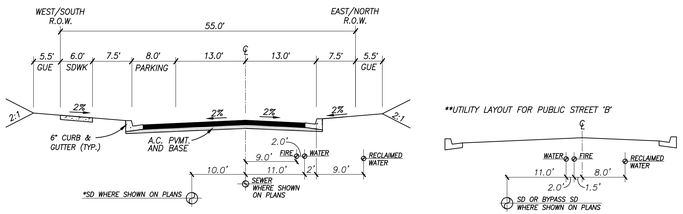
EXIST. OLYMPIC PARKWAY

NTS



TYPICAL PERIMETER SLOPE BENCH

NTS

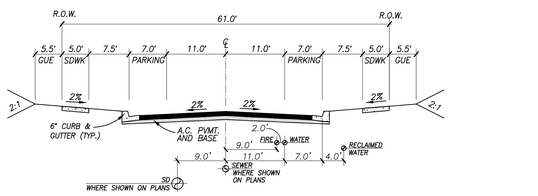


MODIFIED CLASS III PUBLIC COLLECTOR WITH PARKING AND SIDEWALK ONE SIDE

STREET 'A' FROM OLYMPIC PARKWAY TO FIRST INTERSECTION OF R-1 & R-5 — NTS

*DEEP STORM DRAIN WHERE SHOWN ON PLANS

**STREET 'B' FROM OLYMPIC PARKWAY TO STREET 'A'



MODIFIED CLASS III PUBLIC COLLECTOR WITH PARKING AND SIDEWALK BOTH SIDES

STREET 'A' FROM FIRST INDERSECTION OF R-1 & R-5 TO STREET 'B' — NTS

GENERAL NOTES

1. GROSS SITE AREA EXISTING: 135.724 ACRES
   GROSS SITE AREA PROPOSED 135.724 ACRES
2. TOTAL NUMBER OF LOTS: 22
   - MULTI-FAMILY RESIDENTIAL: 6 LOTS
   - COMMUNITY PURPOSE FACILITY: 1 LOT
   - POGGI CREEK EASMENT: 3 LOTS
   - OPEN SPACE: 9 LOTS
   - OPEN SPACE PRESERVE: 3 LOTS
3. TOTAL NUMBER OF UNITS PROPOSED 718 UNITS
   MF RESIDENTIAL 718 UNITS
4. MAXIMUM NUMBER UNITS ALLOWED PER "SUNBOW II, PHASE 3 SPA": 718
5. ASSESSOR'S PARCEL NUMBERS: 644-011-06-00 & 644-020-11-00
6. EXISTING GENERAL PLAN DESIGNATIONS: LIMITED INDUSTRIAL, OPEN SPACE, OPEN SPACE PRESERVE
7. ZONING: EXISTING: INDUSTRIAL PARK & OPEN SPACE
   PROPOSED: SEE SUNBOW II, PHASE 3 SPA
8. PRESENT LAND USE: VACANT
   PROPOSED GENERAL PLAN LAND USES: RESIDENTIAL MEDIUM, RESIDENTIAL MEDIUM HIGH, OPEN SPACE, OPEN SPACE PRESERVE

GENERAL DESIGN NOTES

1. WATER SYSTEM TO BE INSTALLED IN ACCORDANCE WITH THE STANDARDS OF THE OTAY WATER DISTRICT AND SHALL BE MAINTAINED AND OPERATED BY THE DISTRICT.
2. SPECIFIC METHODS OF HANDLING STORM WATER ARE SUBJECT TO DETAILED APPROVAL BY THE DEVELOPMENT SERVICES DEPARTMENT AT THE TIME OF SUBMISSION OF IMPROVEMENT AND GRADING PLANS. DESIGN SHALL BE ACCOMPLISHED ON THE BASIS OF THE REQUIREMENTS OF THE SUBDIVISION MANUAL. DRAINAGE EASEMENTS SHALL BE PROVIDED AS REQUIRED BY THE CITY DEVELOPMENT SERVICES DEPARTMENT.
3. SANITARY SEWER TO BE PROVIDED AND CONNECTED TO CITY OF CHULA VISTA SEWERS. SEWER MAINS ARE 8" MINIMUM P.V.C. UNLESS SHOWN OTHERWISE.
4. EVIDENCE SHALL BE PROVIDED OF HAVING OBTAINED GRADING RIGHTS UPON ADJACENT PROPERTY WHERE REQUIRED DURING FINAL ENGINEERING.
5. STREET TREE DEPOSITS SHALL BE PAID IN ACCORDANCE WITH ORDINANCE NUMBER 1369 AND NO. 1687 OF THE CITY OF CHULA VISTA.
6. UTILITIES SHALL BE UNDERGROUND AND EASEMENTS PROVIDED AS NECESSARY.
7. SUBDIVIDER TO PROVIDE AND INSTALL APPROVED STREET LIGHT STANDARDS AND FIXTURES IN THE TYPE AND NUMBER APPROVED BY THE DEVELOPMENT SERVICES DEPARTMENT FOR PUBLIC RIGHT-OF-WAY.
8. SLOPE PLANTING SHALL BE IN ACCORDANCE WITH THE CITY OF CHULA VISTA LANDSCAPE MANUAL, AND/OR THE OTAY RANCH VILLAGE DESIGN PLAN.
9. GRADING SHALL BE CONSTRUCTED IN ACCORDANCE WITH TITLE 15 OF THE CITY OF CHULA VISTA MUNICIPAL CODE.
10. ALL WORK IN THE PUBLIC RIGHT-OF-WAY SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, THE SAN DIEGO AREA REGIONAL STANDARD DRAWINGS AND THE DESIGN AND CONSTRUCTION STANDARDS OF THE CITY OF CHULA VISTA.
11. FIRE HYDRANTS TO BE INSTALLED IN ACCORDANCE WITH THE CITY OF CHULA VISTA DESIGN STANDARD NO. 8. FIRE HYDRANTS AS SHOWN ON THIS MAP SHALL BE USED AS A GUIDE ONLY.
12. ONE FOOT CONTROL LOTS TO BE GRANTED TO THE CITY OF CHULA VISTA BY SEPARATE DEED WHERE DETERMINED NECESSARY BY THE DEVELOPMENT SERVICES DEPARTMENT.
13. GRADING AND MODEL HOMES MAY BE BUILT, AFTER CITY APPROVAL, PRIOR TO FINAL MAP RECORDATION.
14. GRADING SHOWN HEREON IS PRELIMINARY AND SUBJECT TO MODIFICATION IN FINAL DESIGN SUBJECT TO SUBSTANTIAL CONFORMANCE APPROVAL BY THE CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT.
15. THIS PROJECT IS A MULTIPLE UNIT (NEIGHBORHOOD) SUBDIVISION. MULTIPLE FINAL MAPS MAY BE FILED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 4 OF SECTION 66456.1 OF THE SUBDIVISION MAP ACT.
16. FINAL MAPS MAY BE RECORDED FOR THE PURPOSE OF SUBDIVIDING VILLAGES OR PORTIONS THEREOF INTO UNIMPROVED NEIGHBORHOODS WITH LEGAL ACCESS WITH THE INTENT OF TRANSFERRING TITLE TO MERCHANT BUILDERS.
17. STORM DRAIN AND SEWER SHOWN HEREON IS PRELIMINARY AND SUBJECT TO MODIFICATION IN FINAL DESIGN.
18. TEMPORARY AND PERMANENT STRUCTURAL BEST MANAGEMENT PRACTICES WILL BE INCORPORATED IN THE DESIGN AND IMPLEMENTATION OF THE DEVELOPMENT.
19. PRELIMINARY GEOTECHNICAL REPORT PREPARED BY: GEOCON, INC. DATED APRIL 10, 2020.
20. REFER TO THE "WATER QUALITY TECHNICAL REPORT SWQMP" DATED JUNE 23, 2020, PREPARED BY HUNSAKER & ASSOCIATES FOR COMPLIANCE WITH THE REGIONAL WATER QUALITY CONTROL BOARD JURISDICTIONAL PERMIT.
21. TEMPORARY TURNAROUNDS SHALL BE PROVIDED AT ALL DEAD END STREETS DURING FINAL ENGINEERING AS REQUESTED BY THE DEVELOPMENT SERVICES DEPARTMENT.
22. THE 100' FUEL MODIFICATION ZONE IS THE EXTENT OF THE ZONE AS DESCRIBED IN THE SUNBOW AREA 23 FIRE PROTECTION PLAN DATED SEPT. 2020.

CONDOMINIUM NOTES

THIS IS A MAP OF A RESIDENTIAL CONDOMINIUM PROJECT AS DEFINED IN SECTION 4125 OF THE CIVIL CODE OF THE STATE OF CALIFORNIA AND IS FILED PURSUANT TO THE SUBDIVISION MAP ACT. PLANNING NEIGHBORHOODS INCLUDED WITHIN THE RESIDENTIAL CONDOMINIUM PROJECT DESIGNATION ARE R-1, R-2, R-3, R-4, R-5 & R-6, FOR A MAXIMUM NUMBER OF 718 DWELLING UNITS.

SOURCE OF TOPOGRAPHY

THE TOPOGRAPHIC MAPPING USED FOR THIS SURVEY IS BASED ON A FIELD SURVEY PERFORMED BY HUNSAKER & ASSOC. TOGETHER WITH AERIAL TOPOGRAPHY PRODUCED BY R.J. LUND & ASSOCIATES PER FLIGHT OF OCTOBER 2, 2019.

BENCHMARK:

BRASS DISK MARKED "SD CITY ENGR." IN 3/4" IRON PIPE. 1.5 MILES EAST OF INTERSECTION OF MAIN ST. & HERITAGE RD. ON ROCK MOUNTAIN 100' EASTERLY OF PROMINENT 10' HIGH BOULDER & 1700' SOUTHERLY OF WATER STORAGE FACILITY. (PT. #1359 PER R.O.S. 14841)
ELEV. 628.319
DATUM: NAVD '88

EARTHWORK/GRADING QUANTITIES

CUT: 1,200,000 C.Y.
FILL: 1,200,000 C.Y.

GRADING QUANTITIES SHOWN ARE RAW QUANTITIES ONLY AND DO NOT INCLUDE THE EFFECT OF REMEDIAL GRADING SHOWN IN THE PRELIMINARY SOILS REPORT.

APPLICANT/OWNER

ACI SUNBOW, LLC
2356 MOORE STREET
SAN DIEGO, CA 92110
(619) 544-9100

WILLIAM R. HAMLIN

CIVIL ENGINEER

HUNSAKER & ASSOCIATES, SAN DIEGO, INC.
9707 WAPLES ST.
SAN DIEGO, CA 92121
(858) 558-4500

PROJECT WAIVERS

DESIGN WAIVER REQUESTED FOR STREETS 'A' & 'B', A CLASS III COLLECTOR TO REDUCE DESIGN SPEED FROM 30 MPH TO 25 MPH.

SHEET INDEX

SHEET 1 - TITLE SHEET/ ST. SECTIONS
SHEET 2 - LOTTING/ SUMMARY TABLES
SHEET 3 - PROJECT DESIGN
SHEET 4 - PROJECT DESIGN
SHEET 5 - PROJECT DESIGN
SHEET 6 - PROJECT DESIGN
SHEET 7 - BOUNDARY, EASEMENTS & ENCUMBRANCES

REGISTERED PROFESSIONAL ENGINEER — ALISA S. VIALPANDO — R.C.E. 47945 — Exp. 12/31/21 — CIVIL — STATE OF CALIFORNIA

ALISA S. VIALPANDO R.C.E. 47945 DATE 9/21/20
MY REGISTRATION EXPIRES ON 12/31/21

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 FX(858)558-1414

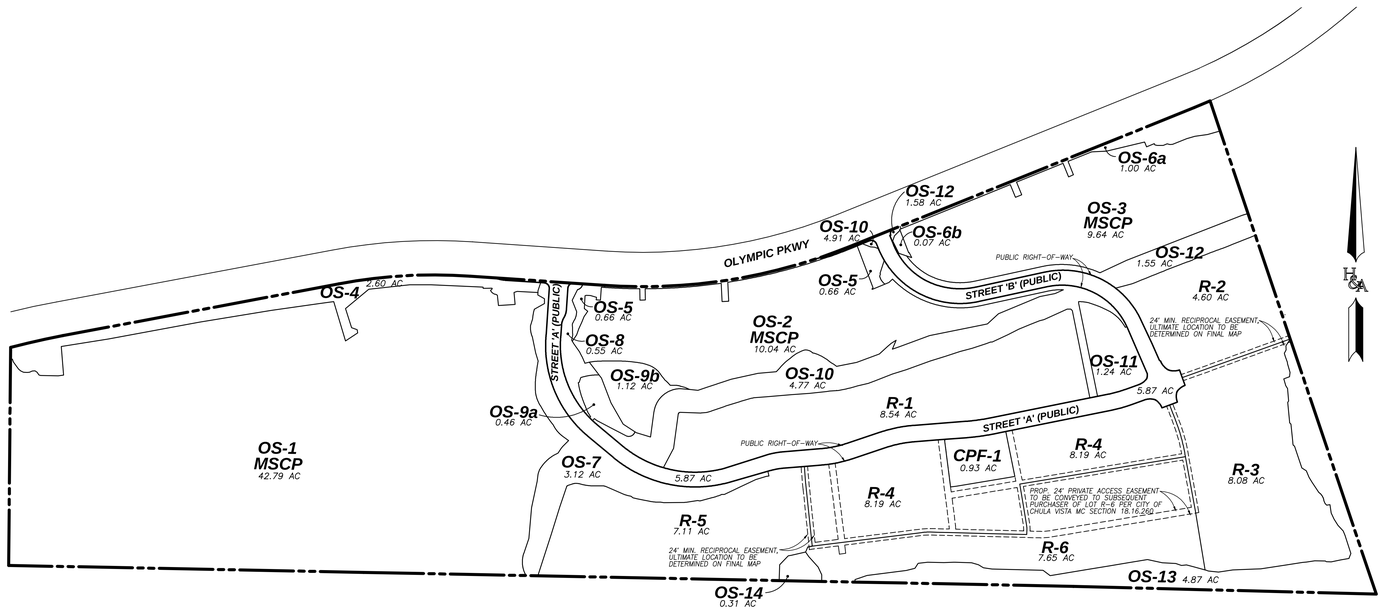
NO.	REVISIONS	DATE	BY
1	FIRST SUBMITTAL	02/26/20	H&A
2	SECOND SUBMITTAL	04/27/20	H&A
3	THIRD SUBMITTAL	06/23/20	H&A
4	FINAL SUBMITTAL	01/26/20	H&A
5			
6			
7			

TENTATIVE MAP/SPA/GPA/REZONE
CVT # 20-0002
SUNBOW II
PHASE 3
City Of Chula Vista, California

SHEET 1 OF 7

W.O. 2167-0161

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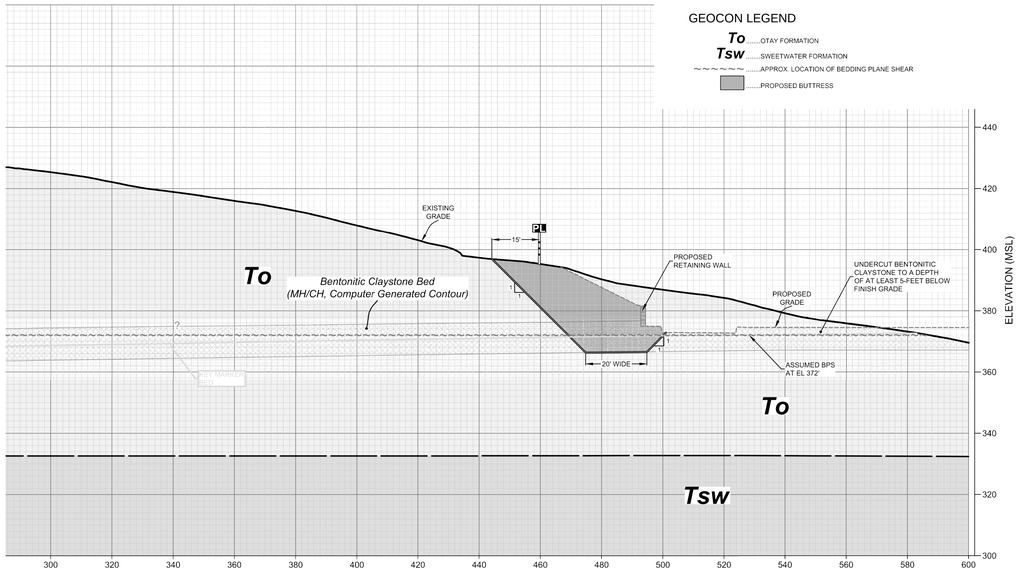


LOTTING

SCALE: 1"=200'

Sunbow 2, Phase III Project Summary				
Land Use Summary				
Neighborhood	Land Use	AC	Units	Density
R-1	RM	8.54	131	15.3
R-2	RM	4.60	73	15.9
R-3	RM	8.08	108	13.4
R-4	RM	8.19	118	14.4
R-5	RM	7.11	104	14.6
R-6	RC	7.65	184	24.1
Residential Subtotal		44.17	718	16.3
Land Use		AC		
MSCP Open Space Preserve (OS Lots 1-3 & 9b)		63.62		
Open Space (OS Lots 7, 8, 9a, 10-14)		16.80		
Poggi Creek Easement (OS Lots 4, 5, 6a & 6b)		4.34		
Community Purpose Facility Land (CPF-1)		0.93		
Public Streets A & B		5.87		
Total Project Area		135.72	718	16.3

Note: Acreages are rounded to the nearest 1/100th acre and may vary slightly from calculated total.



GEOCON CROSS-SECTION A-A

(SEE SHEET 3 FOR LOCATION) NTS

NOTE: CROSS-SECTION FROM PRELIMINARY GEOTECHNICAL INVESTIGATION PREPARED BY GEOCON DATED APRIL 10, 2020.

LOTTING/ SUMMARY TABLES

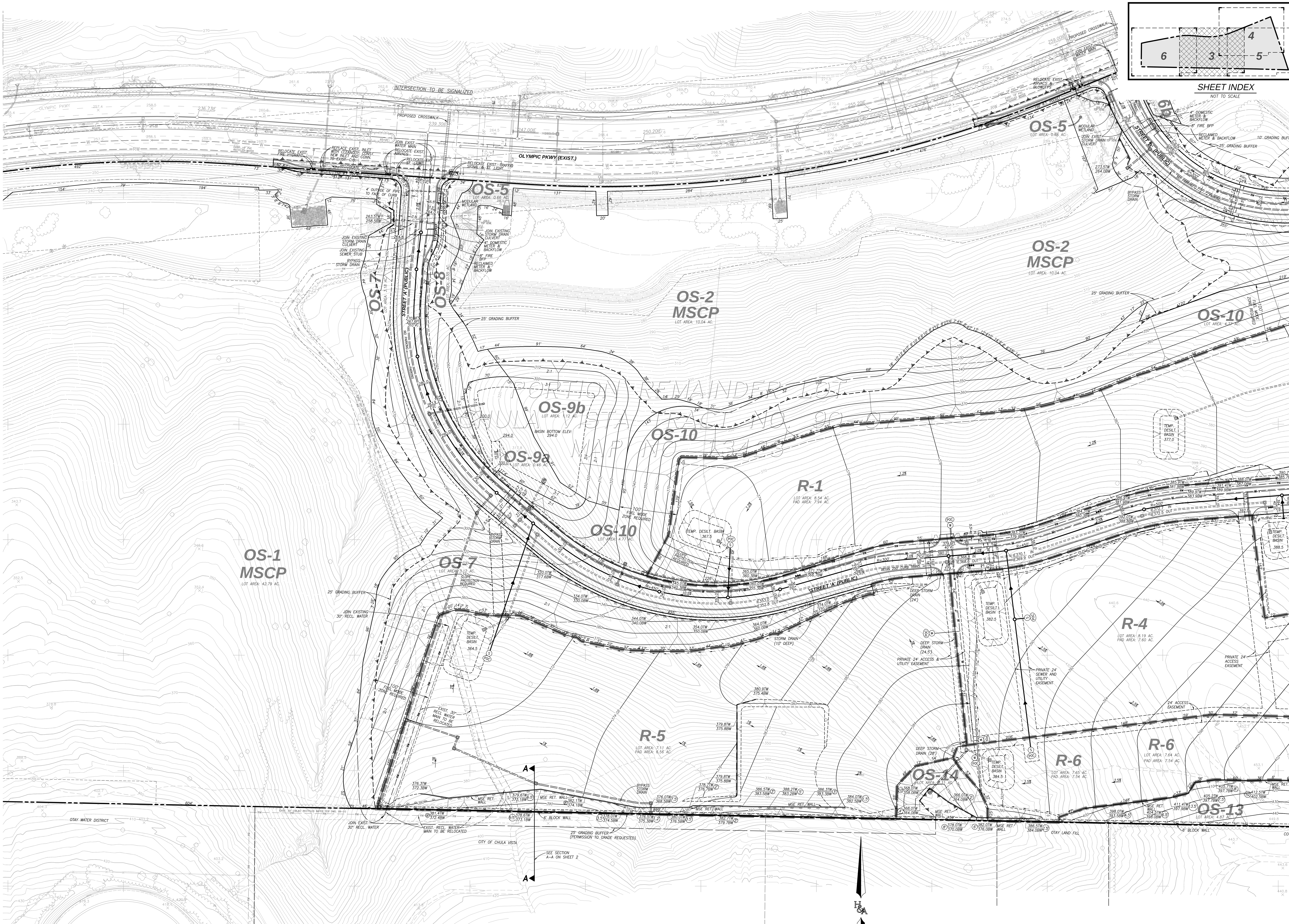
PREPARED BY:
HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 9707 Wrigley Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

TENTATIVE MAP/SPA/GPA/REZONE
CVT # 20-0002
SUNBOW II PHASE 3
City Of Chula Vista, California

SHEET 2 OF 7

W.O. 2167-0161

FOR CONTINUATION SEE SHEET 6



FOR CONTINUATION SEE SHEET 4

FOR CONTINUATION SEE SHEET 5

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC

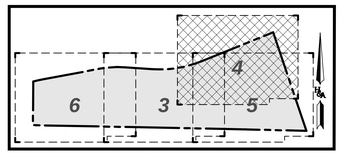
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 · FX(858)558-1414

TENTATIVE MAP/SPA/GPA/REZONE
CVT # 20-0002
SUNBOW II PHASE 3
City Of Chula Vista, California

SHEET 3 OF 7

W.O. 2167-0161

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SHEET INDEX
NOT TO SCALE

PORTION REMAINDER LOT
CHULA VISTA TRACT NO. 90-07
MAP NO. 13423

SCALE 1" = 50'

FOR CONTINUATION SEE SHEET 3

FOR CONTINUATION SEE SHEET 5

PREPARED BY:
HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

TENTATIVE MAP/SPA/GPA/REZONE
CVT # 20-0002
SUNBOW II
PHASE 3
City Of Chula Vista, California

SHEET 4 OF 7

W.O. 2167-0161

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FOR CONTINUATION SEE SHEET 4

FOR CONTINUATION SEE SHEET 3



PREPARED BY:		
HUNSAKER & ASSOCIATES SAN DIEGO, INC	TENTATIVE MAP/SPA/GPA/REZONE CVT # 20-0002	SHEET 5 OF 7
PLANNING 9707 Waples Street ENGINEERING San Diego, Ca 92121 SURVEYING PH(858)558-4500 - FX(858)558-1414	**SUNBOW II PHASE 3** City Of Chula Vista, California	

W.O. 2167-0161

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LOT A
CHULA VISTA TRACT NO. 90-07
MAP NO. 13720

MAP NO. 7979

OLYMPIC PKWY (EXIST.)

OS-4
LOT AREA: 2.60 AC.

OS-4
LOT AREA: 2.60 AC.

OS-1
MSCP
LOT AREA: 42.79 AC.

OS-1
MSCP
LOT AREA: 42.79 AC.

LOT 4
MAP NO. 11842

SOUTH BAY COMMUNITY SERVICES

MAP NO. 8726

P.M. ROS 6926

CENTER
SECTION 18

MAP NO. 8832

OTAY WATER DISTRICT

ROBINHOOD POINT ASSOCIATION

OTAY WATER DISTRICT

SCALE 1" =50'

SHEET INDEX
NOT TO SCALE

FOR CONTINUATION SEE SHEET 3

PREPARED BY:
HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

TENTATIVE MAP/SPA/GPA/REZONE
CVT # 20-0002
SUNBOW II
PHASE 3
City Of Chula Vista, California

SHEET 6 OF 7

W.O. 2167-0161

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EXCEPTIONS:

A. PROPERTY TAXES, INCLUDING ANY PERSONAL PROPERTY TAXES AND ANY ASSESSMENTS COLLECTED WITH TAXES, ARE AS FOLLOWS: TAX IDENTIFICATION NO.: 644-011-06-00 FISCAL YEAR: 2019-2020 1ST INSTALLMENT: $6,937.21, UNPAID (DELINQUENT AFTER DECEMBER 10) PENALTY: $693.72 2ND INSTALLMENT: $6,937.21, UNPAID (DELINQUENT AFTER APRIL 10) PENALTY AND COST: $703.72 HOMEOWNERS EXEMPTION: $NONE CODE AREA: 01211 PROPERTY TAXES, INCLUDING ANY PERSONAL PROPERTY TAXES AND ANY ASSESSMENTS COLLECTED WITH TAXES, ARE AS FOLLOWS: TAX IDENTIFICATION NO.: 644-020-11-00 FISCAL YEAR: 2019-2020 1ST INSTALLMENT: $5,971.60, UNPAID (DELINQUENT AFTER DECEMBER 10) PENALTY: $597.16 2ND INSTALLMENT: $5,971.60, UNPAID (DELINQUENT AFTER APRIL 10) PENALTY AND COST: $607.16 HOMEOWNERS EXEMPTION: $NONE CODE AREA: 01211

B. INTENTIONALLY OMITTED.

C. PENDING ASSESSMENT FOR THE DISTRICT SHOWN BELOW: DISTRICT: COMMUNITY FACILITIES DISTRICT #4, SWEETWATER UNION HIGH SCHOOL DISTRICT, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, SUNBOW DISCLOSED BY: ASSESSMENT DISTRICT DIAGRAM RECORDING DATE: SEPTEMBER 12, 1988 RECORDING NO.: 88-456922 OF OFFICIAL RECORDS WHEN THE NOTICE OF ASSESSMENT IS RECORDED IN THE PUBLIC RECORDS, THE ASSESSMENT SHALL BECOME A LIEN ON SAID LAND.

D. PENDING ASSESSMENT FOR THE DISTRICT SHOWN BELOW: DISTRICT: BOUNDARY MAP COMMUNITY FACILITIES DISTRICT NO. 4, CHULA VISTA CITY SCHOOL DISTRICT, CO. OF SAN DIEGO, STATE OF CALIFORNIA, SUNBOW DISCLOSED BY: ASSESSMENT DISTRICT DIAGRAM RECORDING DATE: SEPTEMBER 15, 1988 RECORDING NO.: 88-463618 OF OFFICIAL RECORDS WHEN THE NOTICE OF ASSESSMENT IS RECORDED IN THE PUBLIC RECORDS, THE ASSESSMENT SHALL BECOME A LIEN ON SAID LAND.

E. THE HEREIN DESCRIBED PROPERTY LIES WITHIN THE BOUNDARIES OF A MELLO-ROOS COMMUNITY FACILITIES DISTRICT (CFD) AS FOLLOWS: CFD NO: COMMUNITY FACILITIES DISTRICT NO. 4 FOR: CHULA VISTA CITY SCHOOL DISTRICT DISCLOSED BY: NOTICE OF SPECIAL TAX LIEN RECORDING DATE: FEBRUARY 23, 1989 RECORDING NO.: 89-092569 OF OFFICIAL RECORDS THIS PROPERTY, ALONG WITH ALL OTHER PARCELS IN THE CFD, IS LIABLE FOR AN ANNUAL SPECIAL TAX. THIS SPECIAL TAX IS INCLUDED WITH AND PAYABLE WITH THE GENERAL PROPERTY TAXES OF THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO. THE TAX MAY NOT BE PREPAID. FURTHER INFORMATION MAY BE OBTAINED BY CONTACTING: JOHN E. LINN, ASSISTANT SUPERINTENDENT BUSINESS MANAGEMENT CHULA VISTA CITY SCHOOL DISTRICT 84 EAST "J" STREET CHULA VISTA, CA 92010 TELEPHONE: (619) 425-9600

F. THE HEREIN DESCRIBED PROPERTY LIES WITHIN THE BOUNDARIES OF A MELLO-ROOS COMMUNITY FACILITIES DISTRICT (CFD) AS FOLLOWS: CFD NO: COMMUNITY FACILITIES DISTRICT NO. 3 FOR: SWEETWATER UNION HIGH SCHOOL DISTRICT DISCLOSED BY: NOTICE OF SPECIAL TAX LIEN RECORDING DATE: APRIL 24, 1989 RECORDING NO.: 89-213041 OF OFFICIAL RECORDS THIS PROPERTY, ALONG WITH ALL OTHER PARCELS IN THE CFD, IS LIABLE FOR AN ANNUAL SPECIAL TAX. THIS SPECIAL TAX IS INCLUDED WITH AND PAYABLE WITH THE GENERAL PROPERTY TAXES OF THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO. THE TAX MAY NOT BE PREPAID. FURTHER INFORMATION MAY BE OBTAINED BY CONTACTING: ANDREW B. CAMPBELL ADMINISTRATOR OF PLANNING SWEETWATER UNION HIGH SCHOOL DISTRICT 1130 FIFTH AVENUE CHULA VISTA, CA 92011 TELEPHONE: (619) 691-5553

G. PENDING ASSESSMENT FOR THE DISTRICT SHOWN BELOW: DISTRICT: COMMUNITY FACILITIES DISTRICT NO. 98-3 (OPEN SPACE MAINTENANCE DISTRICT NO. 35, SUNBOW II) DISCLOSED BY: ASSESSMENT DISTRICT BOUNDARY RECORDING DATE: JULY 1, 1998 RECORDING NO.: 1998-0408047 OF OFFICIAL RECORDS WHEN THE NOTICE OF ASSESSMENT IS RECORDED IN THE PUBLIC RECORDS, THE ASSESSMENT SHALL BECOME A LIEN ON SAID LAND.

H. PENDING ASSESSMENT FOR THE DISTRICT SHOWN BELOW: DISTRICT: COMMUNITY FACILITIES DISTRICT NO. 2001-1 (SUNBOW II - VILLAGES 5-10) DISCLOSED BY: ASSESSMENT DISTRICT BOUNDARY RECORDING DATE: JUNE 21, 2000 RECORDING NO.: 2000-0327005 OF OFFICIAL RECORDS WHEN THE NOTICE OF ASSESSMENT IS RECORDED IN THE PUBLIC RECORDS, THE ASSESSMENT SHALL BECOME A LIEN ON SAID LAND.

I. THE LIEN OF SUPPLEMENTAL OR ESCAPED ASSESSMENTS OF PROPERTY TAXES, IF ANY, MADE PURSUANT TO THE PROVISIONS OF CHAPTER 3.5 (COMMENCING WITH SECTION 75) OR PART 2, CHAPTER 3, ARTICLES 3 AND 4, RESPECTIVELY, OF THE REVENUE AND TAXATION CODE OF THE STATE OF CALIFORNIA AS A RESULT OF THE TRANSFER OF TITLE TO THE VESTEE NAMED IN SCHEDULE A OR AS A RESULT OF CHANGES IN OWNERSHIP OR NEW CONSTRUCTION OCCURRING PRIOR TO DATE OF POLICY.

1. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT: PURPOSE: ROADS, SLOPES AND UTILITIES AND INCIDENTAL PURPOSES, AS GRANTED/RESERVED BY VARIOUS INSTRUMENTS OF RECORD, ONE OF WHICH RECORDED AUGUST 1, 1986 AS INSTRUMENT NO. 86-323965 OF OFFICIAL RECORDS AFFECTS: A PORTION OF SAID LAND AS MORE PARTICULARLY DESCRIBED IN SAID DOCUMENT. PURPORTEDLY SAID EASEMENT WAS CONVEYED TO ACI SUNBOW, LLC, A CALIFORNIA LIMITED LIABILITY COMPANY, BY A QUITCLAIM DEED FROM OTAY PROJECT, LLC, A DELAWARE LIMITED LIABILITY COMPANY, RECORDED DECEMBER 28, 1998 AS INSTRUMENT NO. 1998-0849422 OF OFFICIAL RECORDS.

2. INTENTIONALLY OMITTED.

3. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT ENTITLED: AGREEMENT DATED: OCTOBER 6, 1988 EXECUTED BY: SWEETWATER UNION HIGH SCHOOL DISTRICT AND RANCHO DEL SUR, A CALIFORNIA GENERAL PARTNERSHIP RECORDING DATE: OCTOBER 28, 1988 RECORDING NO: 88-551824 OF OFFICIAL RECORDS REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

4. INTENTIONALLY OMITTED.

5. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT ENTITLED: SUBDIVISION IMPROVEMENT AGREEMENT DATED: JANUARY 19, 1999 EXECUTED BY: CITY OF CHULA VISTA, A MUNICIPAL CORPORATION AND ACI SUNBOW, LLC RECORDING DATE: MARCH 2, 1999 RECORDING NO: 1999-0132642 OF OFFICIAL RECORDS REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

6. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT ENTITLED: SUPPLEMENTAL SUBDIVISION IMPROVEMENT AGREEMENT DATED: JANUARY 19, 1999 EXECUTED BY: CITY OF CHULA VISTA, CALIFORNIA AND ACI SUNBOW, LLC, A CALIFORNIA LIMITED LIABILITY COMPANY RECORDING DATE: MARCH 2, 1999 RECORDING NO: 1999-0132643 OF OFFICIAL RECORDS REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

7. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT: GRANTED TO: UNITED STATES OF AMERICA
PURPOSE: CONSERVATION RECORDING DATE: MAY 31, 2000
RECORDING NO: 2000-0285604 OF OFFICIAL RECORDS
AFFECTS: A PORTION OF SAID LAND AS MORE PARTICULARLY DESCRIBED IN SAID DOCUMENT.

8. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT ENTITLED: MEMORANDUM OF CONTINUING DISCLOSURE AGREEMENT CREATING COVENANT RUNNING WITH THE LAND RECORDING DATE: AUGUST 30, 2000 RECORDING NO: 2000-0465676 OF OFFICIAL RECORDS REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

9. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT ENTITLED: GRANT OF EASEMENT OF RIGHT-OF-WAY TO OTAY WATER DISTRICT RECORDING DATE: DECEMBER 1, 2003
RECORDING NO: 2003-1422539 OF OFFICIAL RECORDS
REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

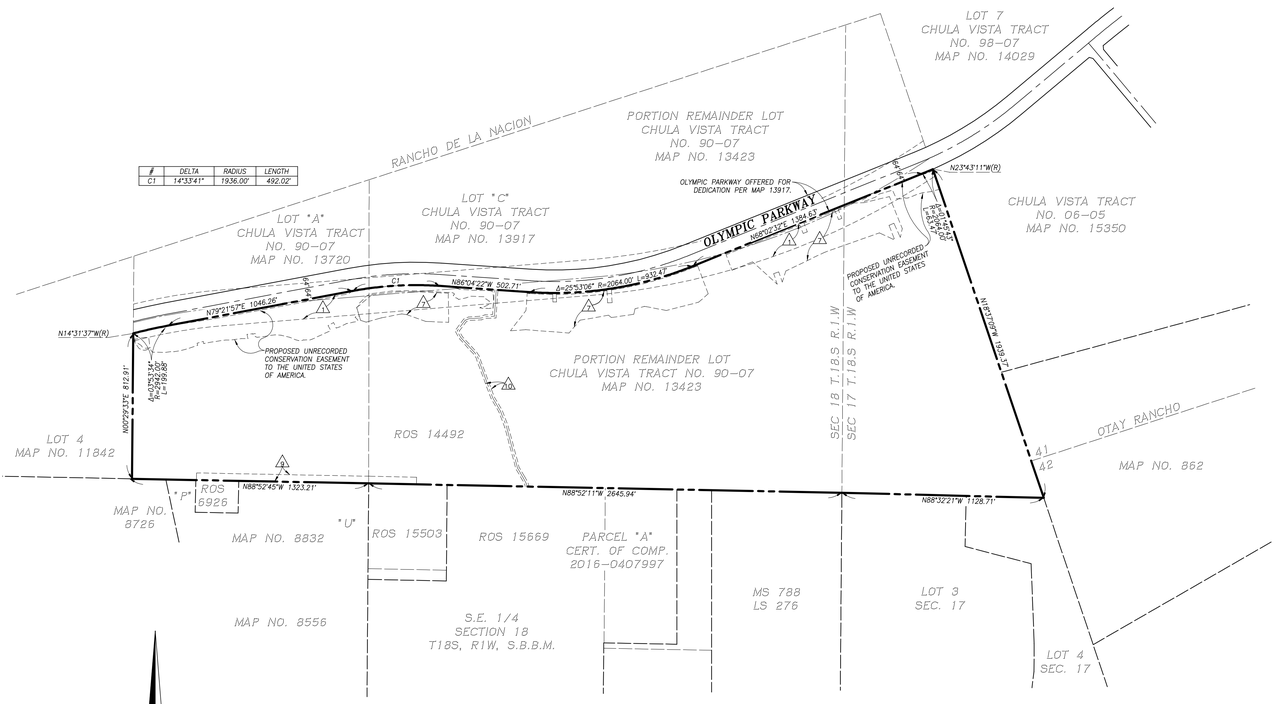
10. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS CONDEMNED BY AN INSTRUMENT, ENTITLED: FINAL ORDER OF CONDEMNATION COURT: SUPERIOR CASE NO.: GIC850206-1 IN FAVOR OF: OTAY WATER DISTRICT, A PUBLIC BODY, CORPORATE AND POLITIC
PURPOSE: A PERMANENT PIPELINE EASEMENT
RECORDING DATE: JUNE 28, 2006
RECORDING NO: 2006-0456071 OF OFFICIAL RECORDS
AFFECTS: A PORTION OF SAID LAND AS MORE PARTICULARLY DESCRIBED IN SAID DOCUMENT.

11. PLEASE BE ADVISED THAT OUR SEARCH DID NOT DISCLOSE ANY OPEN DEEDS OF TRUST OF RECORD. IF YOU SHOULD HAVE KNOWLEDGE OF ANY OUTSTANDING OBLIGATION, PLEASE CONTACT THE TITLE DEPARTMENT IMMEDIATELY FOR FURTHER REVIEW PRIOR TO CLOSING.

12. WATER RIGHTS, CLAIMS OR TITLE TO WATER, WHETHER OR NOT DISCLOSED BY THE PUBLIC RECORDS.

13. MATTERS WHICH MAY BE DISCLOSED BY AN INSPECTION AND/OR BY A CORRECT ALTA/NSPS LAND TITLE SURVEY OF SAID LAND THAT IS SATISFACTORY TO THE COMPANY, AND/OR BY INQUIRY OF THE PARTIES IN POSSESSION THEREOF.

14. ANY RIGHTS OF THE PARTIES IN POSSESSION OF A PORTION OF, OR ALL OF, SAID LAND, WHICH RIGHTS ARE NOT DISCLOSED BY THE PUBLIC RECORDS, THE COMPANY WILL REQUIRE, FOR REVIEW, A FULL AND COMPLETE COPY OF ANY UNRECORDED AGREEMENT, CONTRACT, LICENSE AND/OR LEASE, TOGETHER WITH ALL SUPPLEMENTS, ASSIGNMENTS AND AMENDMENTS THERETO, BEFORE ISSUING ANY POLICY OF TITLE INSURANCE WITHOUT EXCEPTING THIS ITEM FROM COVERAGE. THE COMPANY RESERVES THE RIGHT TO EXCEPT ADDITIONAL ITEMS AND/OR MAKE ADDITIONAL REQUIREMENTS AFTER REVIEWING SAID DOCUMENTS.



#	DELTA	RADIUS	LENGTH
C1	14°33'41"	1936.00'	492.02'

H&A

300 0 300 600 900
SCALE 1"= 300'

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF CHULA VISTA, IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

THAT PORTION OF THE "REMAINDER LOT" OF CHULA VISTA TRACT 90-07 SUNBOW II, UNITS 1 AND 2, IN THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP THEREOF NO. 13423, FILED IN THE OFFICE OF THE COUNTY RECORDER OF THE COUNTY OF SAN DIEGO, MAY 28, 1997, LYING WITHIN SECTIONS 17 AND 18, TOWNSHIP 18 SOUTH, RANGE 1 WEST, SAN BERNARDINO MERIDIAN, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING THEREFROM THAT PORTION LYING NORTHERLY OF THE SOUTHERLY BOUNDARY OF CHULA VISTA TRACT NO. 90-07, SUNBOW, PHASE 1C UNITS 5, 6, 13, 14 AND 15, ACCORDING TO MAP THEREOF NO. 13917 IN THE CITY OF CHULA VISTA, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, JANUARY 19, 2000.

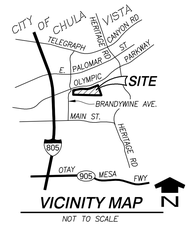
APN(S): 644-011-06-00 AND 644-020-11-00

ASSESSOR'S PARCEL NO.

644-011-06-00
644-020-11-00

TITLE REPORT

THIS SURVEY IS BASED ON THE PRELIMINARY TITLE REPORT ISSUED BY CHICAGO TITLE INSURANCE COMPANY, ORDER NO. 00105855-996-SD1-KC DATED NOVEMBER 6, 2019.



VICINITY MAP
NOT TO SCALE

BOUNDARY, EASEMENTS & ENCUMBRANCES

PREPARED BY:
HUNSAKER & ASSOCIATES SAN DIEGO, INC.
PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH(858)558-4500 - FX(858)558-1414

TENTATIVE MAP/SPA/GPA/REZONE
CVT # 20-0002
SUNBOW II PHASE 3
City Of Chula Vista, California

SHEET 7 OF 7

W.O. 2167-0161

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ATTACHMENT 5

Drainage Report

Attach project's drainage report. Refer to the Subdivision Manual to determine the reporting requirements.

DRAINAGE STUDY
for
SUNBOW II, PHASE 3(TM)

APN: 644-011-06-00, 644-020-11-00

Prepared for:
Lennar Homes
16465 Via Esprillo Suite 150
San Diego, CA 92127

W.O. 2167-016

September 30, 2020

January 26, 2021



Alisa S. Vialpando 6/21

Alisa Vialpando, RCE # 47945
Hunsaker & Associates
San Diego, Inc.

Date

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CHAPTER 1 - EXECUTIVE SUMMARY

1.1 - Introduction

The Sunbow Planning Area is located in the City of Chula Vista, California, in south of the Olympic Pkwy, north of the Otay Landfill (see the Vicinity Map below).

Sunbow II, Phase 3 Sectional Planning Area (SPA) Plan Amendment encompasses approximately 135.7[1] acres (Project Area) that includes a 67.5 development area comprised of 44.2 acres of residential, a 0.9-acre Community Purpose Facility (CPF) site, 5.9 acres of public streets and 16.5 manufactured slopes/basins. Approximately 4.3 acres of conserved Poggi Creek Easement areas, a 0.3 acre of conserved wetland resource area and 63.6[2] acres of adjacent MSCP Preserve area are also within the Project Area.

The total drainage area of the project is approximately 117.3 acres. In between with the north side of the site and the south curb of the Olympic Pkwy, the Poggi Canyon creek is running parallel to the road from northwest to southwest. The south boundary of the site is delineated by the natural ridges along landfill boarder.

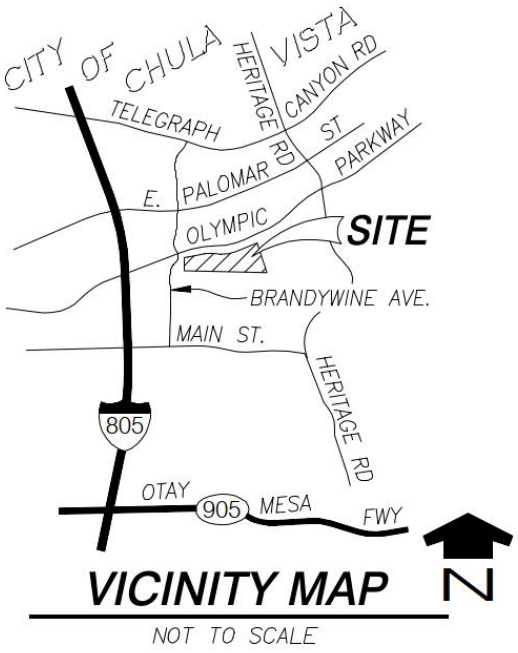
The project will consist of 718 units of multi-story townhomes as well as associated public and private roads, and parking spaces. The storm drain and storm water quality control facilities are proposed to meet the city requirements. This study will be focusing on quantifying the runoff for the 100-year storm event and analyzing the capacity of the storm drain and detention basin to minimize the impact of the proposed development.

Treatment of storm water runoff from the site has been addressed in a separate report – 'The Priority Development Project Storm Water Quality Management Plan (SWQMP) for Sunbow Planning Area' dated June 23, 2020 prepared by Hunsaker & Associates San Diego Inc.

Per City's drainage criteria, the onsite hydrology calculation will be based on 100-year storm event.

---

[1] Acreages are rounded to the nearest 1/10th acre and may vary slightly from calculated total.
[2] The Proposed MSCP area includes approximately 1.31 acres of "Mapping Correction Area" and approximately 1.12 acres of MSCP Allowable Use (Basin – Future Facility).



VICINITY MAP

NOT TO SCALE

Per County of San Diego drainage criteria, the Modified Rational Method should be used to determine peak design flowrates when the contributing drainage area is less than 1.0 square mile. Since the total watershed area discharging from the site is less than 1.0 square mile, the AES-2015 computer software was used to model the runoff response per the Modified Rational Method. Methodology used for the computation of design rainfall events, runoff coefficients, and rainfall intensity values are consistent with criteria set forth in the "County of San Diego 2003 Hydrology Manual." A more detailed explanation of methodology used for this analysis is listed in Chapter 2 of this report.

Detailed calculations such as storm drain hydraulics, inlet calculations, and street capacity calculations will be addressed during final engineering.

The 50-yr and 100-yr depth provided in Chapter 2 are for P6.

1.2 – Summary of Existing Conditions

The 117.3-acre hydrologic catchment primarily consist of natural grades and hills all covered by native vegetations and shrubs. The site is accessible from Olympic Pkwy through two separate bridges crossing Poggi Canyon creek in north side. The Poggi Canyon creek flows from northeast to southwest and accepts large amount of storm runoff from surrounding area. It is also the downstream of the onsite runoff from both our existing and proposed condition. The local high points are in southern boundary of the site adjacent to the Otay landfill and make the overall on site flow pattern simply south to north.

A small portion of the site in southwest corner was occupied by a water tank which is serving the nearby residential areas.

Based on the site topo, the existing condition catchment was divided into 7 sub-catchments. All onsite runoff from sub-catchment under design event will flow from south to north into Poggi Canyon creek and eventually confluence at the northwest corner of our catchment (hydrologic node 126).

1.3 – Summary of Developed Condition

The Proposed Project's residential land use includes four unique multi-family attached residential product types with 15 unique floor plans, ranging in square footage from approximately 1,100 to 2,050 square feet in two- and three-story units. Each home includes a two-car garage and two to four bedrooms.

The Proposed Project includes a Chula Vista General Plan Amendment, Sunbow General Development Plan Amendment, Sunbow II SPA Plan Amendment, a rezone, and a Tentative Map. The Proposed Project also includes a Chula Vista MSCP Boundary Adjustment to implement minor adjustments to the development limits and the adjacent MSCP Preserve areas that would result in a 0.09-acre increase to MSCP Preserve Area and an MSCP Minor Amendment to address off-site grading adjacent to the southwestern boundary of the development area.

The development of the site will include adding the storm drains, curb inlets, cleanouts along the proposed onsite private roads and parking spaces to collect and convey the storm runoff to the two proposed detention and water quality control basins located at northeast and northwest part of the development area.

The project also proposed bypassing storm drains running from south into Poggi Canyon creek in north to collect and bypass the offsite flow primarily from south and east side of the catchment.

After the majority of the onsite runoff is treated and detained by the biofiltration basin, the outflow will confluence with the bypass storm drain and discharge into the Poggi Canyon creek. For small amount of runoff generated from the north portion of proposed public roads which will be connecting with Olympic Pkwy, only the water quality control measurements are proposed, i.e., multiple Modular Wetland structures will be installed to control the water quality. The outflow from Modular Wetlands then discharges into Poggi Canyon creek without detention.

A calculation node 126 (similar as the one in existing condition hydrology) has been assigned at the ultimate downstream point of our development area. The hydrology results from existing and proposed conditions at this point will be compared to ensure no impact exists after implementing attenuation measurements.

Pollution Control and Hydromodification Flow Control of the overall site will be addressed in the separate report 'The Priority Development Project Storm Water Quality Management Plan (SWQMP) for Sunbow Planning Area' dated June 15, 2020 prepared by Hunsaker & Associates San Diego Inc.

1.4 – Results and Recommendations

Table 1 below summarizes the existing and proposed peak flows from the site. The developed peak flows consider the flow attenuation from the proposed detention basin. Per the San Diego County rainfall isolpluvial maps, the design rainfall depth for the 50-year flow event at the project site area is 2.10-inches, 100-year flow event at the project site area is 2.40-inches.

Table 1 - Summary of 100 Year Peak Flows

	Existing Condition			Developed Condition				Flow Reduction between EX and PR(ATT)
POC	EX NODE	AREA (acres)	Q100 (cfs)	PR NODE	AREA (acres)	Q100 (cfs) Unattenuated	Q100 (cfs) Attenuated**	
1	126	117.3		126	117.5*	165.62	60.81	
Total	-	117.3	90.81	-	117.5*	165.62	60.81	90.81-60.81=30

* The 0.2 acres of increase is due to the rounding error. Offsite letter of permission to grade to be provided during final engineering.
** Design flows used for storm drain design.

Since the proposed development will increase runoff generated by the project site, the project will utilize onsite detention facilities to mitigate for the increase in peak flow. As a result, the mitigated Q100 of proposed condition demonstrates 25.07 cfs flow rate reduction compare to that of the existing condition. Runoff generated by the project will not exceed pre-project peak flow rates, and runoff velocities will be dissipated by rock riprap at storm drain outfalls. Riprap design (per SDRSD D-40) will be provided with hydraulics during final engineering stage.

The project has been designed to honor pre-project watershed basins and outfall locations. Considering the limitations which result from Subdivision layout and design, minor exchanges in watershed areas occur but are minimized to the maximum extent practicable.

Since the project site is located outside any FEMA floodplain zones (#06073C2157G), there is no requirement for a Letter of Map Revision.

For the HEC-HMS detention calculation for flows through the basin, refer to the calculations in Chapter 5.

The above results show there is no adverse impact from the proposed development after the attenuation because there is reduction in flows.

Peak flow rates listed above were generated based on the criteria set forth in the "*2003 San Diego County Hydrology Manual*" (methodology presented in Chapter 2 of this report). The Modified Rational Method output is located in Chapter 3.

1.5 - References

"San Diego County Hydrology Manual"; Department of Public Works – Flood Control Division; County of San Diego, California; Revised June 2003.

"*The Priority Development Project Storm Water Quality Management Plan (SWQMP) for Sunbow II, Phase 3*" dated June, 2020 prepared by Hunsaker & Associates San Diego Inc.

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.1 – County of San Diego Drainage Design Criteria

2.3 SELECTION OF HYDROLOGIC METHOD AND DESIGN CRITERIA

Design Frequency – The flood frequency for determining the design storm discharge is 50 years for drainage that is upstream of any major roadway and 100 years frequency for all design storms at a major roadway, crossing the major roadway and thereafter. The 50-year storm flows shall be contained within the pipe and not encroach into the travel lane. For the 100-year storm this includes allowing one lane of a four-lane road (four or more lanes) to be used for conveyance without encroaching onto private property outside the dedicated street right-of-way. Natural channels that remain natural within private property are excluded from the right-of-way guideline.

Design Method – The choice of method to determine flows (discharge) shall be based on the size of the watershed area. For an area 0 to approximately l square mile the Rational Method or the Modified Rational Method shall be used. For watershed areas larger than l square mile the NRCS hydrologic method shall be used. Please check with the governing agency for any variations to these guidelines.

SECTION 3
RATIONAL METHOD AND MODIFIED RATIONAL METHOD

3.1 THE RATIONAL METHOD

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. The RM is recommended for analyzing the runoff response from drainage areas up to approximately l square mile in size. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately l square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately l square mile in size (see Section 3.4), or the NRCS Hydrologic Method should be used for watersheds greater than approximately l square mile in size (see Section 4).

The RM can be applied using any design storm frequency *(e.g.,* 100-year, 50-year, 10-year, etc.). The local agency determines the design storm frequency that must be used based on the type of project and specific local requirements. A discussion of design storm frequency is provided in Section 2.3 of this manual. A procedure has been developed that converts the 6-hour and 24-hour precipitation isopluvial map data to an Intensity-Duration curve that can be used for the rainfall intensity in the RM formula as shown in Figure 3-1. The RM is applicable to a 6-hour storm duration because the procedure uses Intensity-Duration Design Charts that are based on a 6-hour storm duration.

3.1.1 Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (TC), which is the time required for water to

flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

$$Q = C\,I\,A$$

Where: Q = peak discharge, in cubic feet per second (cfs)

C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)

I = average rainfall intensity for a duration equal to the T_c for the area, in inches per hour (Note: If the computed T_c is less than 5 minutes, use 5 minutes for computing the peak discharge, Q)

A = drainage area contributing to the design location, in acres

Combining the units for the expression CIA yields:

$$\left(\frac{1\,\text{acre}\times\text{inch}}{\text{hour}}\right)\left(\frac{43{,}560\,\text{ft}^2}{\text{acre}}\right)\left(\frac{1\,\text{foot}}{12\,\text{inches}}\right)\left(\frac{1\,\text{hour}}{3{,}600\,\text{seconds}}\right) \Rightarrow 1.008\,\text{cfs}$$

For practical purposes the unit conversion coefficient difference of 0.8% can be ignored.

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Unlike the MRM (discussed in Section 3.4) or the NRCS hydrologic method (discussed in Section 4), the RM does not create hydrographs and therefore does not add separate subarea hydrographs at collection points. Instead, the RM develops peak discharges in the main line by increasing the T_c as flow travels downstream.

Characteristics of, or assumptions inherent to, the RM are listed below:

- The discharge flow rate resulting from any I is maximum when the I lasts as long as or longer than the T_c.

- The storm frequency of peak discharges is the same as that of I for the given T_c.

- The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in Section 4.1.2.4).

- The peak rate of runoff is the only information produced by using the RM.

3.1.2 Runoff Coefficient

Table 3-1 lists the estimated runoff coefficients for urban areas. The concepts related to the runoff coefficient were evaluated in a report entitled *Evaluation, Rational Method "C" Values* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

The runoff coefficients are based on land use and soil type. Soil type can be determined from the soil type map provided in Appendix A. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table 3-1, as adjustments to these values may be appropriate based on site-specific characteristics. In any event, the impervious percentage (% Impervious) as given in the table, for any area, shall govern the selected value for C. The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\% \text{ Impervious}) + C_p \times (1 - \% \text{ Impervious})$$

Where: C_p = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can be determined from the soil type map provided in Appendix A.

The values in Table 3-1 are typical for most urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the local agency.

3.1.3 Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr) for a duration equal to the T_c for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_c calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration Design Chart (Figure 3-1). The 6-hour storm rainfall amount (P_6) and the 24-hour storm rainfall amount (P_{24}) for the selected storm frequency are also needed for calculation of I. P_6 and P_{24} can be read from the isopluvial maps provided in Appendix B. An Intensity-Duration Design Chart applicable to all areas within San Diego County is provided as Figure 3-1. Figure 3-2 provides an example of use of the Intensity-Duration Design Chart. Intensity can also be calculated using the following equation:

$$I = 7.44\ P_6\ D^{-0.645}$$

Where: P_6 = adjusted 6-hour storm rainfall amount (see discussion below)
D = duration in minutes (use T_c)

Note: This equation applies only to the 6-hour storm rainfall amount (i.e., P_6 cannot be changed to P_{24} to calculate a 24-hour intensity using this equation).

The Intensity-Duration Design Chart and the equation are for the 6-hour storm rainfall amount. In general, P_6 for the selected frequency should be between 45% and 65% of P_{24} for the selected frequency. If P_6 is not within 45% to 65% of P_{24}, P_6 should be increased or decreased as necessary to meet this criteria. The isopluvial lines are based on precipitation gauge data. At the time that the isopluvial lines were created, the majority of precipitation gauges in San Diego County were read daily, and these readings yielded 24-hour precipitation data. Some 6-hour data were available from the few recording gauges distributed throughout the County at that time; however, some 6-hour data were extrapolated. Therefore, the 24-hour precipitation data for San Diego County are considered to be more reliable.

3.1.4 Time of Concentration

The Time of Concentration (T_c) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The T_c is composed of two components: initial time of concentration (T_i) and travel time (T_t). Methods of computation for T_i and T_t are discussed below. The T_i is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea." Guidelines for designating the initial subarea are provided within the discussion of computation of T_i. The T_t is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial subarea to the point of interest. For the RM, the T_c at any point within the drainage area is given by:

$$T_c = T_i + T_t$$

Methods of calculation differ for natural watersheds (nonurbanized) and for urban drainage systems. When analyzing storm drain systems, the designer must consider the possibility that an existing natural watershed may become urbanized during the useful life of the storm drain system. Future land uses must be used for T_c and runoff calculations, and can be determined from the local Community General Plan.

3.1.4.1 Initial Time of Concentration

The initial time of concentration is typically based on sheet flow at the upstream end of a drainage basin. The Overland Time of Flow (Figure 3-3) is approximated by an equation developed by the Federal Aviation Agency (FAA) for analyzing flow on runaways (FAA, 1970). The usual runway configuration consists of a crown, like most freeways, with sloping pavement that directs flow to either side of the runway. This type of flow is uniform in the direction perpendicular to the velocity and is very shallow. Since these depths are ¼ of an inch (more or less) in magnitude, the relative roughness is high. Some higher relative roughness values for overland flow are presented in Table 3.5 of the *HEC-1 Flood Hydrograph Package User's Manual* (USACE, 1990).

The sheet flow that is predicted by the FAA equation is limited to conditions that are similar to runway topography. Some considerations that limit the extent to which the FAA equation applies are identified below:

- Urban Areas – This "runway type" runoff includes:
  1) Flat roofs, sloping at 1% ±
  2) Parking lots at the extreme upstream drainage basin boundary (at the "ridge" of a catchment area).
     Even a parking lot is limited in the amounts of sheet flow. Parked or moving vehicles would "break-up" the sheet flow, concentrating runoff into streams that are not characteristic of sheet flow.
  3) Driveways are constructed at the upstream end of catchment areas in some developments. However, if flow from a roof is directed to a driveway through a downspout or other conveyance mechanism, flow would be concentrated.
  4) Flat slopes are prone to meandering flow that tends to be disrupted by minor irregularities and obstructions. Maximum Overland Flow lengths are shorter for the flatter slopes (see Table 3-2).

- Rural or Natural Areas - The FAA equation is applicable to these conditions since (.5% to 10%) slopes that are uniform in width of flow have slow velocities consistent with the equation. Irregularities in terrain limit the length of application.
  1) Most hills and ridge lines have a relatively flat area near the drainage divide. However, with flat slopes of .5% ±, minor irregularities would cause flow to concentrate into streams.
  2) Parks, lawns and other vegetated areas would have slow velocities that are consistent with the FAA Equation.

The concepts related to the initial time of concentration were evaluated in a report entitled *Initial Time of Concentration, Analysis of Parameters* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

3.1.4.1A Planning Considerations

The purpose of most hydrology studies is to develop flood flow values for areas that are not at the upstream end of the basin. Another example is the Master Plan, which is usually completed before the actual detailed design of lots, streets, etc. are accomplished. In these situations it is necessary that the initial time of concentration be determined without detailed information about flow patterns.

To provide guidance for the initial time of concentration design parameters, Table 3-2 includes the Land Use Elements and other variables related to the Time of Concentration. The table development included a review of the typical "layout" of the different Land Use Elements and related flow patterns and consideration of the extent of the sheet flow regimen, the effect of ponding, the significance to the drainage basin, downstream effects, etc.

3.1.4.1B Computation Criteria

(a) Developed Drainage Areas With Overland Flow - T_i may be obtained directly from the chart, "Rational Formula – Overland Time of Flow Nomograph," shown in Figure 3-3 or from Table 3-2. This chart is based on the Federal Aviation Agency (FAA) equation (FAA, 1970). For the short rain durations (<15 minutes) involved, intensities are high but the depth of flooding is limited and much of the runoff is stored temporarily in the overland flow and in shallow ponded areas. In developed areas, overland flow is limited to lengths given in Table 3-2. Beyond these distances, flow tends to become concentrated into streets, gutters, swales, ditches, etc.

(b) Natural Or Rural Watersheds – These areas usually have an initial subarea at the upstream end with sheet flow. The sheet flow length is limited to 50 to 100 feet as specified in Table 3-2. The Overland Time of Flow Nomograph, Figure 3-3, can be used to obtain T_i. The initial time of concentration can excessively affect the magnitude of flow further downstream in the drainage basin. For instance, variations in the initial time of concentration for an initial subarea of one acre can change the flow further downstream where the area is 400 acres by 100%. Therefore, the initial time of concentration is limited (see Table 3-2).

The Rational Method procedure included in the original Hydrology Manual (1971) and Design and Procedure Manual (1968) included a 10 minute value to be added to the initial time of concentration developed through the Kirpich Formula (see Figure 3-4) for a natural watershed. That procedure is superceded by the procedure above to use Table 3-2 or Figure 3-3 to determine T_i for the appropriate sheet flow length of the initial subarea. The values for natural watersheds given in Table 3-2 vary from 13 to 7 minutes, depending on slope. If the total length of the initial subarea is greater than the maximum length allowable based on Table 3-2, add the travel time based on the Kirpich formula for the remaining length of the initial subarea.

3.1.4.2 Travel Time

The T_t is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial subarea to the point of interest. The T_t is computed by dividing the length of the flow path by the computed flow velocity. Since the velocity normally changes as a result of each change in flow rate or slope, such as at an inlet or grade break, the total T_t must be computed as the sum of the T_t's for each section of the flow path. Use Figure 3-6 to estimate time of travel for street gutter flow. Velocity in a channel can be estimated by using the nomograph shown in Figure 3-7 (Manning's Equation Nomograph).

(a) Natural Watersheds – This includes rural, ranch, and agricultural areas with natural channels. Obtain T_t directly from the Kirpich nomograph in Figure 3-4 or from the equation. This nomograph requires values for length and change in elevation along the effective slope line for the subarea. See Figure 3-5 for a representation of the effective slope line.

This nomograph is based on the Kirpich formula, which was developed with data from agricultural watersheds ranging from 1.25 to 112 acres in area, 350 to 4,000 feet in length, and 2.7 to 8.8% slope (Kirpich, 1940). A maximum length of 4,000 feet should be used for the subarea length. Typically, as the flow length increases, the depth of flow will increase, and therefore it is considered a concentration of flow at points beyond lengths listed in Figure 3-2. However, because the Kirpich formula has been shown to be applicable for watersheds up to 4,000 feet in length (Kirpich, 1940), a subarea may be designated with a length up to 4,000 feet provided the topography and slope of the natural channel are generally uniform.

Justification needs to be included with this calculation showing that the watershed will remain natural forever. Examples include areas located in the Multiple Species Conservation Plan (MSCP), areas designated as open space or rural in a community's General Plan, and Cleveland National Forest.

(b) Urban Watersheds - Flow through a closed conduit where no additional flow can enter the system during the travel, length, velocity and T_t are determined using the peak flow in the conduit. In cases where the conduit is not closed and additional flow from a contributing subarea is added to the total flow during travel (e.g., street flow in a gutter), calculation of velocity and T_t is performed using an assumed average flow based on the total area (including upstream subareas) contributing to the point of interest. The Manning equation is usually used to determine velocity. Discharges for small watersheds typically range from 2 to 3 cfs per acre, depending on land use, drainage area, and slope and rainfall intensity.

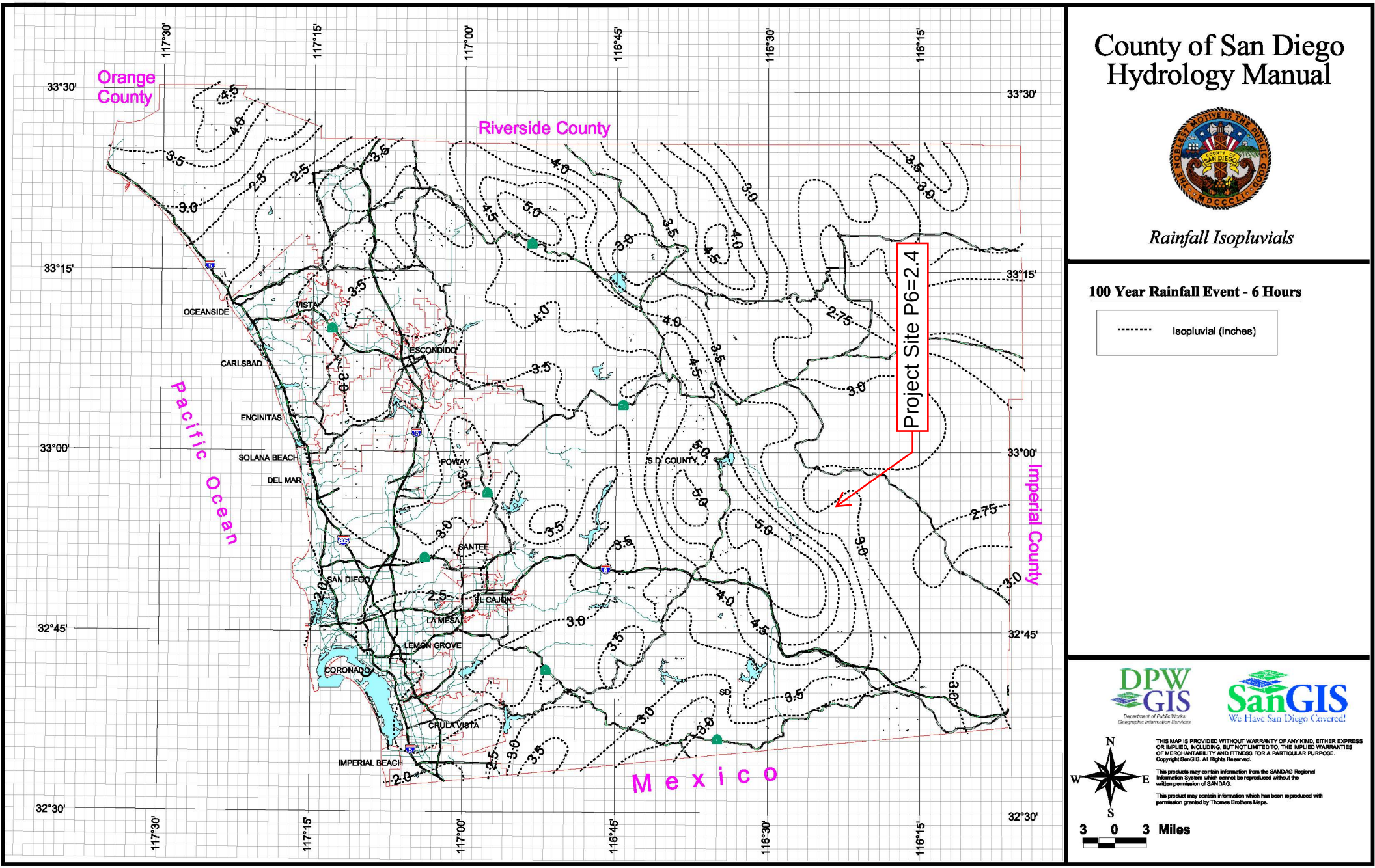
Note: The MRM should be used to calculate the peak discharge when there is a junction from independent subareas into the drainage system.

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

100-Year, 6-Hour Rainfall Isopluvial Map



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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CHAPTER 2

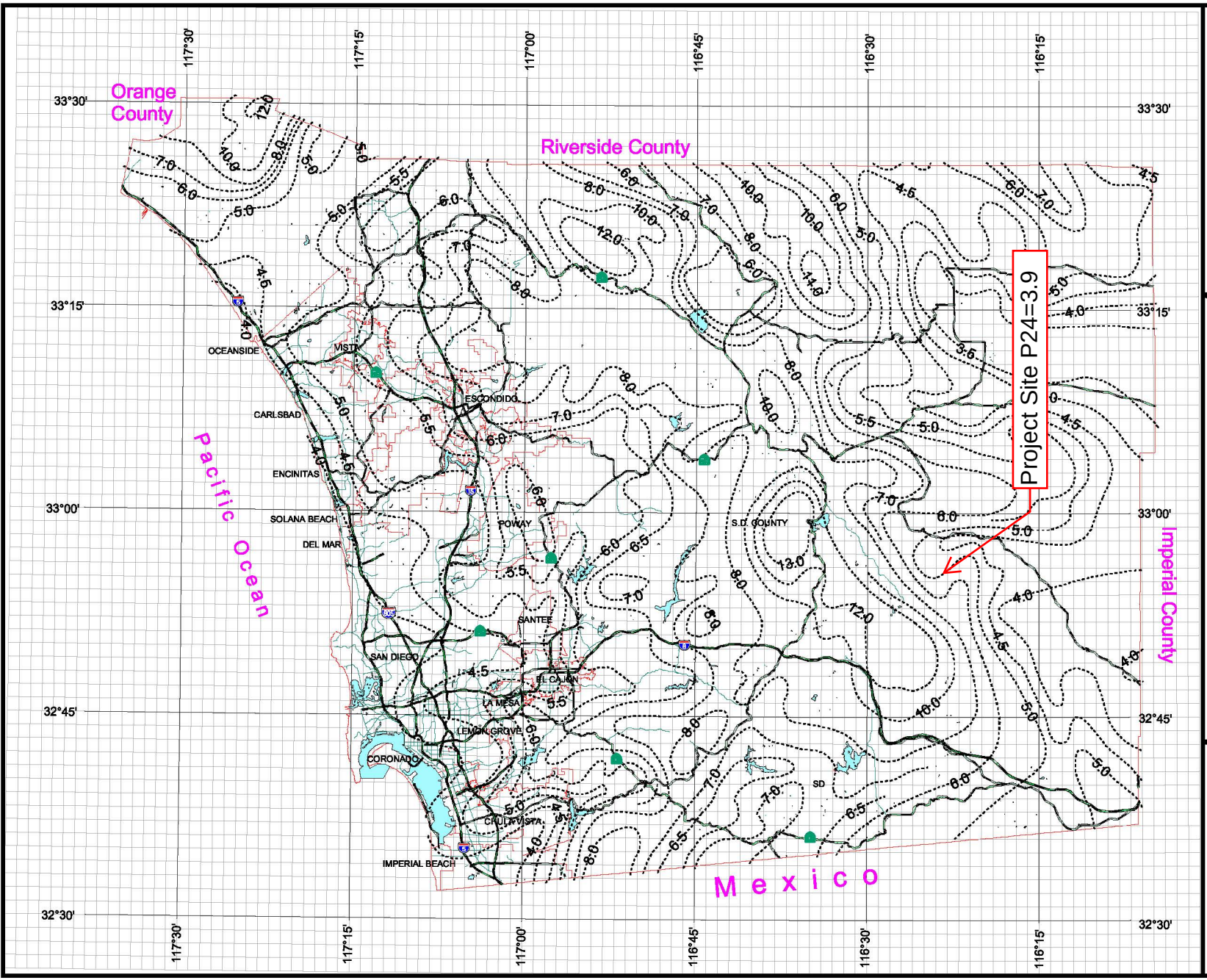
METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

100-Year, 24-Hour Rainfall Isopluvial Map

County of San Diego Hydrology Manual

Rainfall Isopluvials



100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

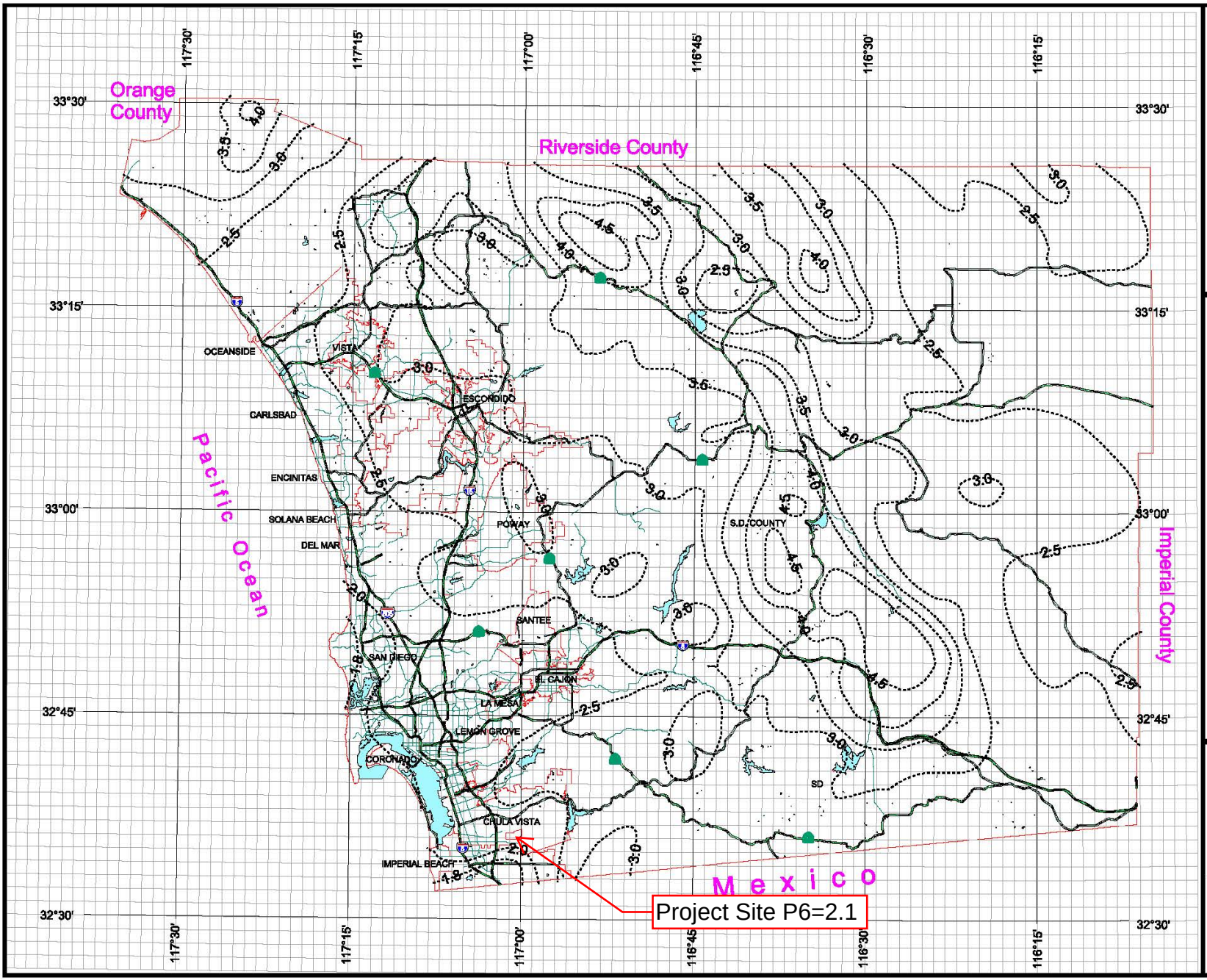
50-Year, 6-Hour Rainfall Isopluvial Map

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (Inches)



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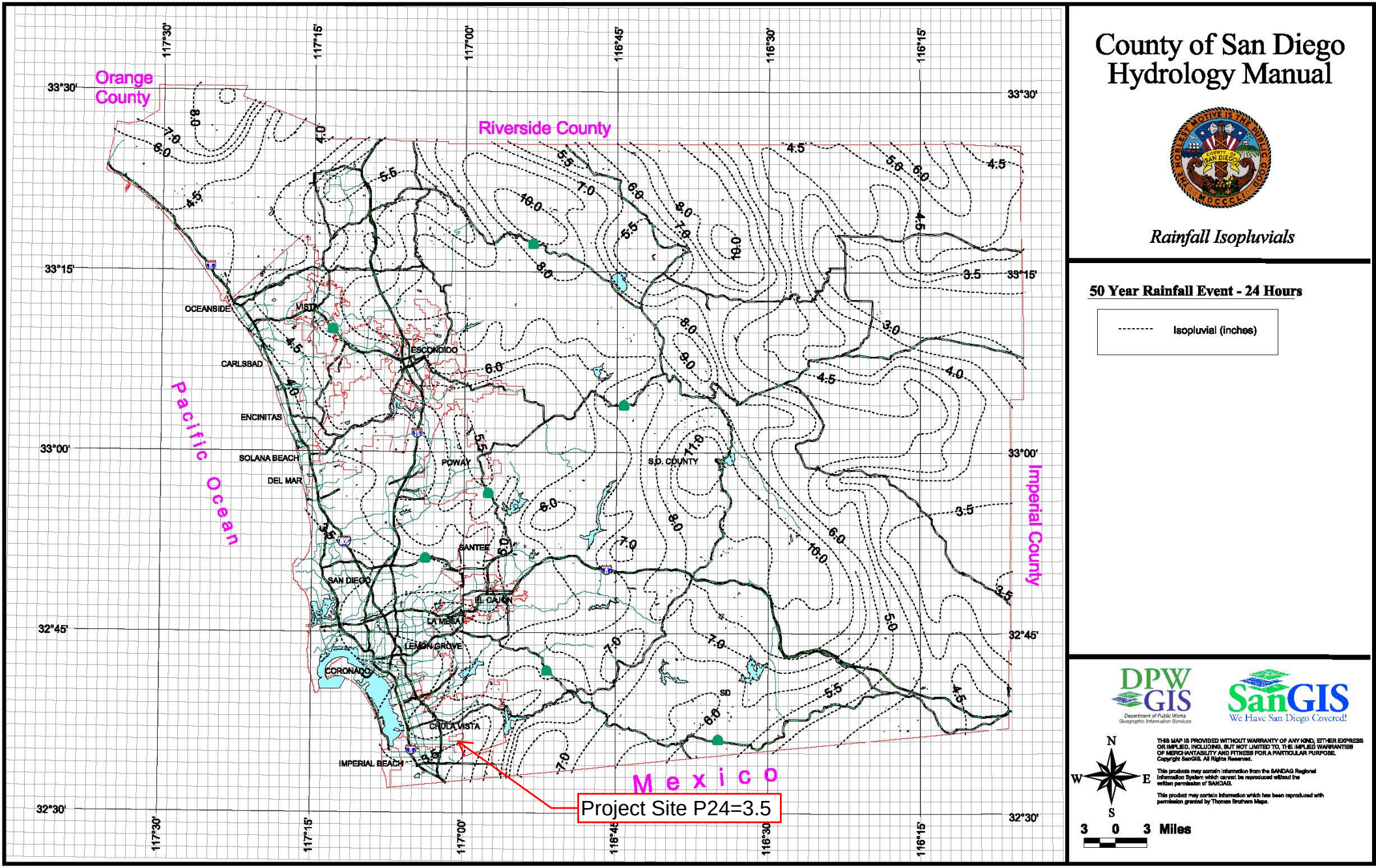
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CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

50-Year, 24-Hour Rainfall Isopluvial Map



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.3 – Rainfall Coefficient Determination

Development Density Map

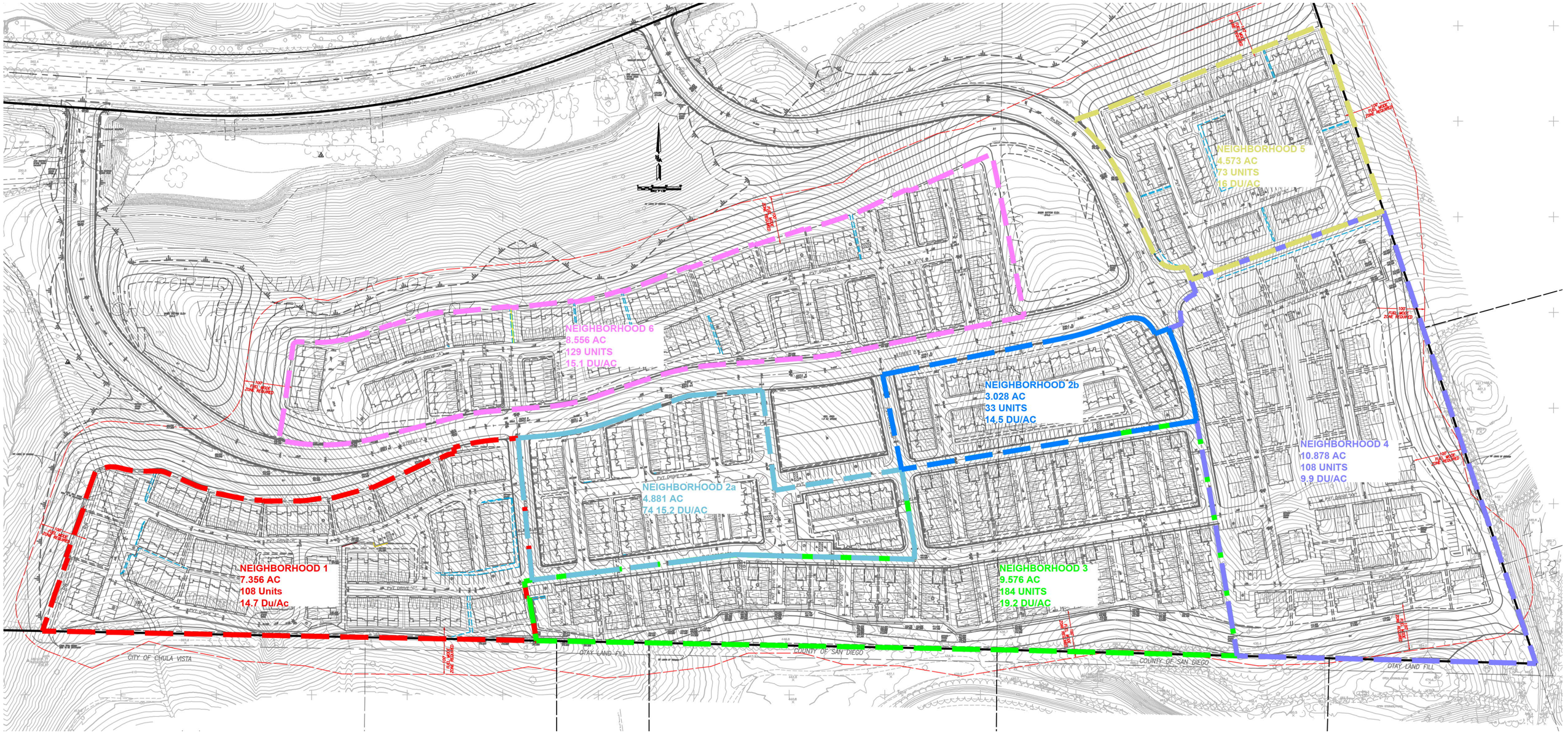


Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

Maximum Overland Flow Length & Initial Time of Concentration Table

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

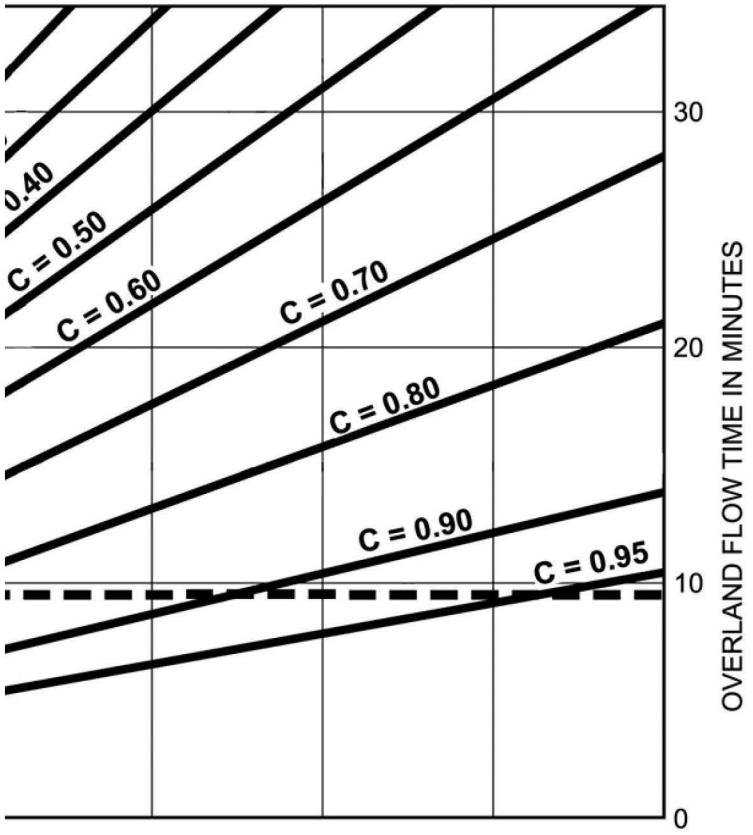
*See Table 3-1 for more detailed description

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

Urban Watershed Overland Time of Flow Nomograph

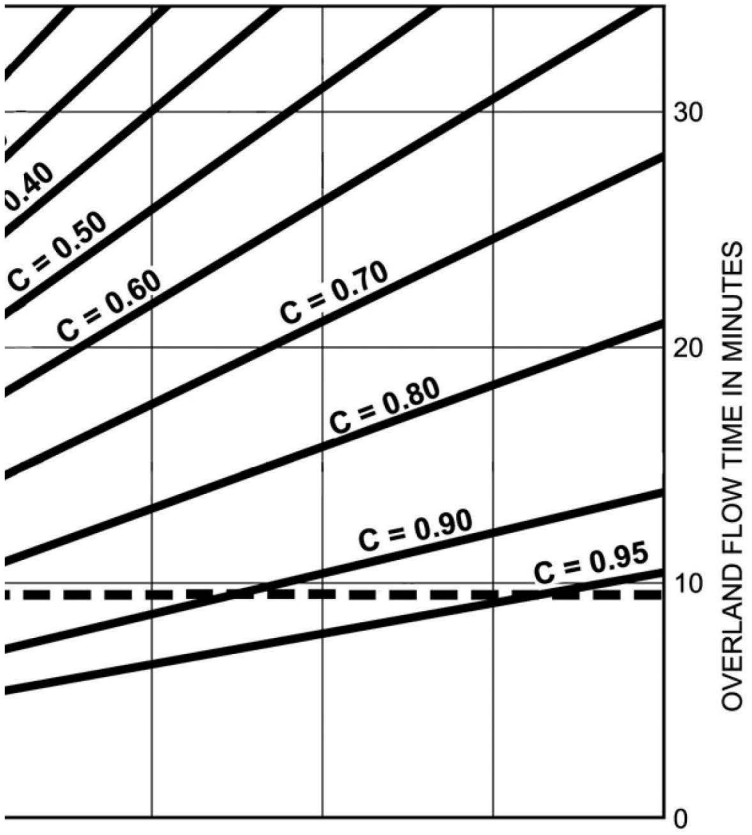


$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

FIGURE

Time of Flow Nomograph

3-5



$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

FIGURE

Time of Flow Nomograph

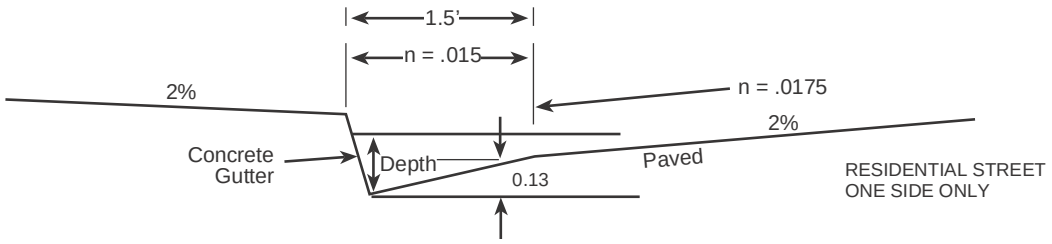
3-3

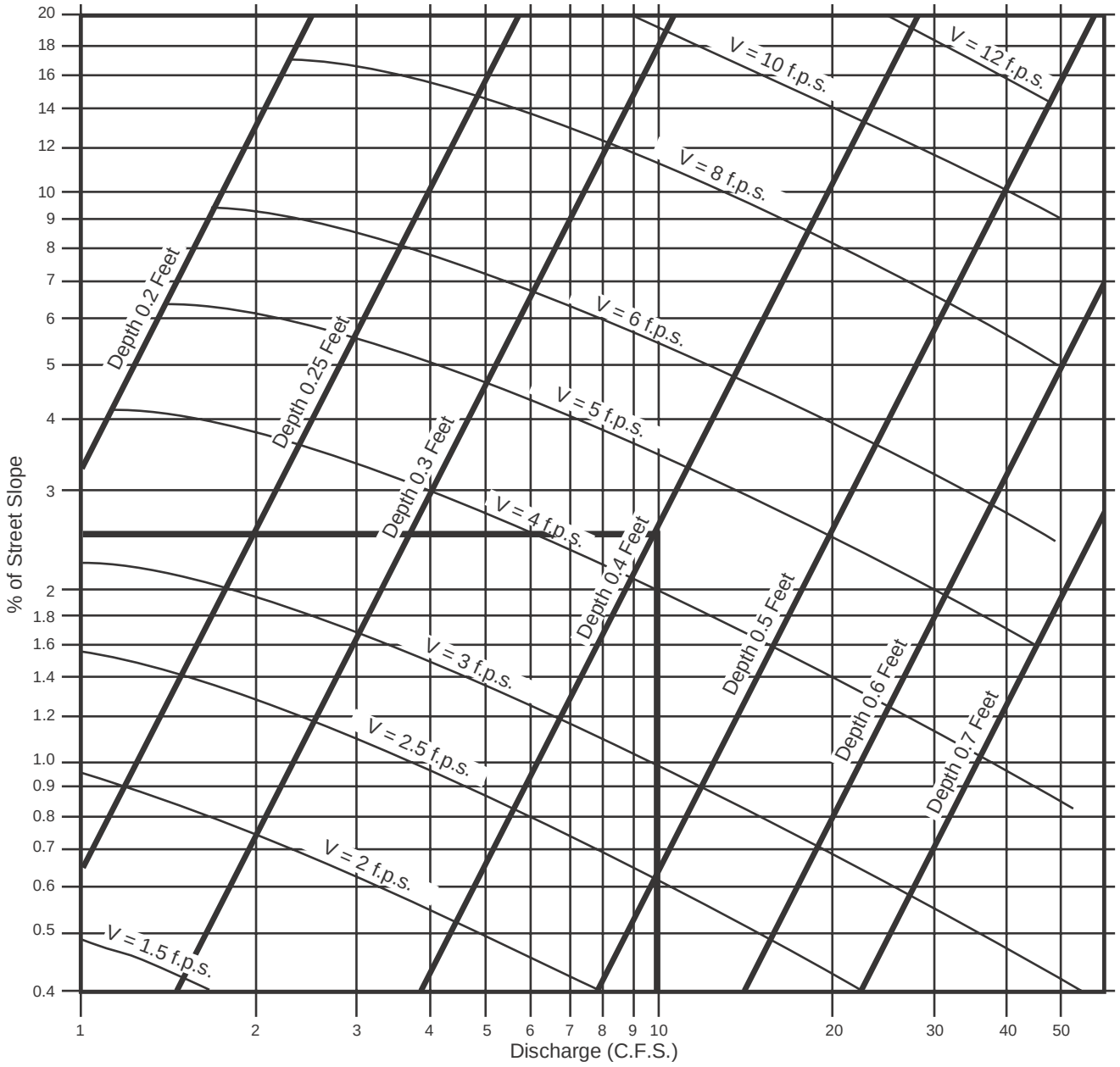
CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

Gutter & Roadway Discharge-Velocity Chart





EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE: San Diego County Department of Special District Services Design Manual

F I G U R E

Gutter and Roadway Discharge - Velocity Chart

3-6

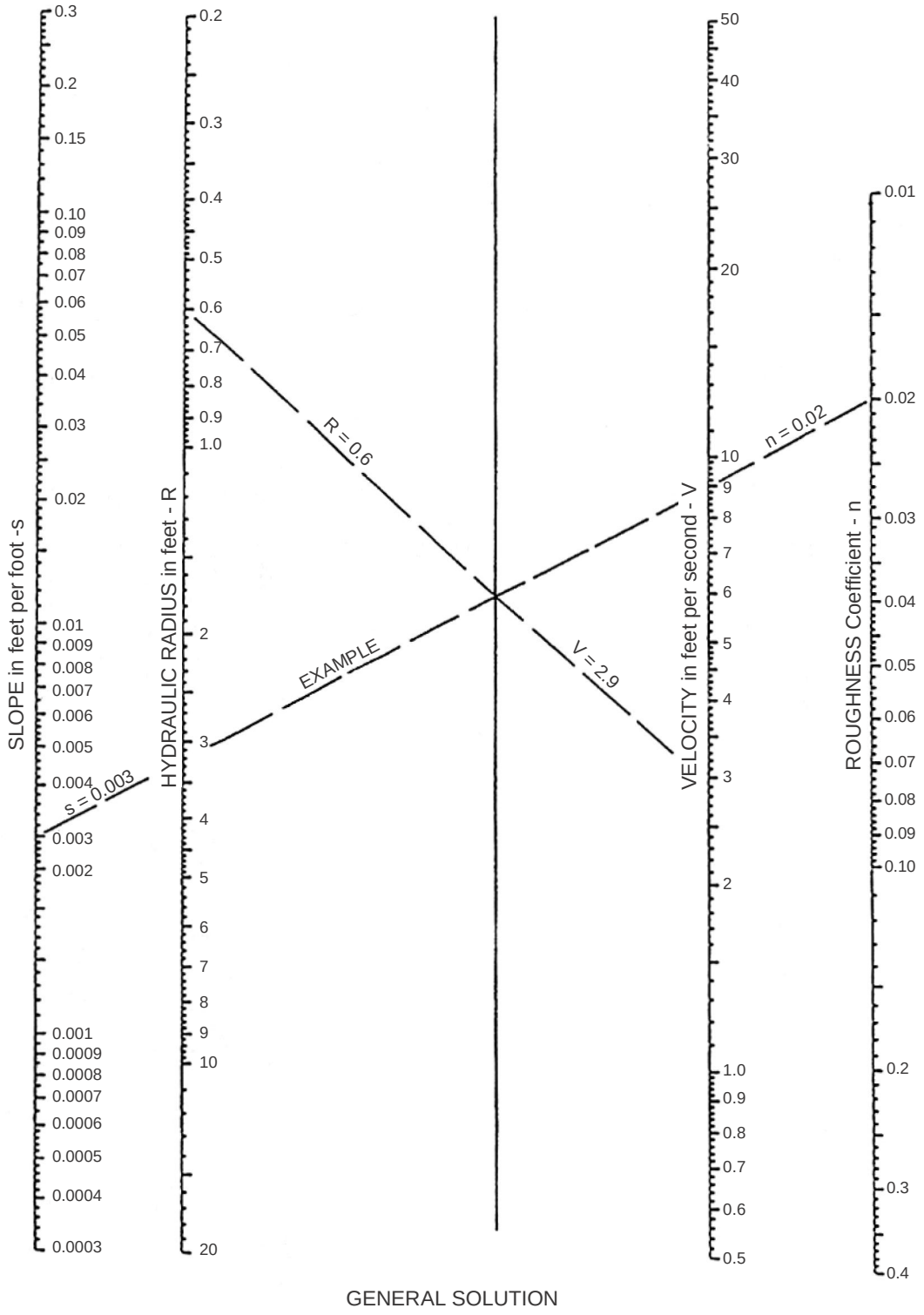
CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

Manning's Equation Nomograph

EQUATION: $V = \frac{1.49}{n} R^{2/3} s^{1/2}$



GENERAL SOLUTION

SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph

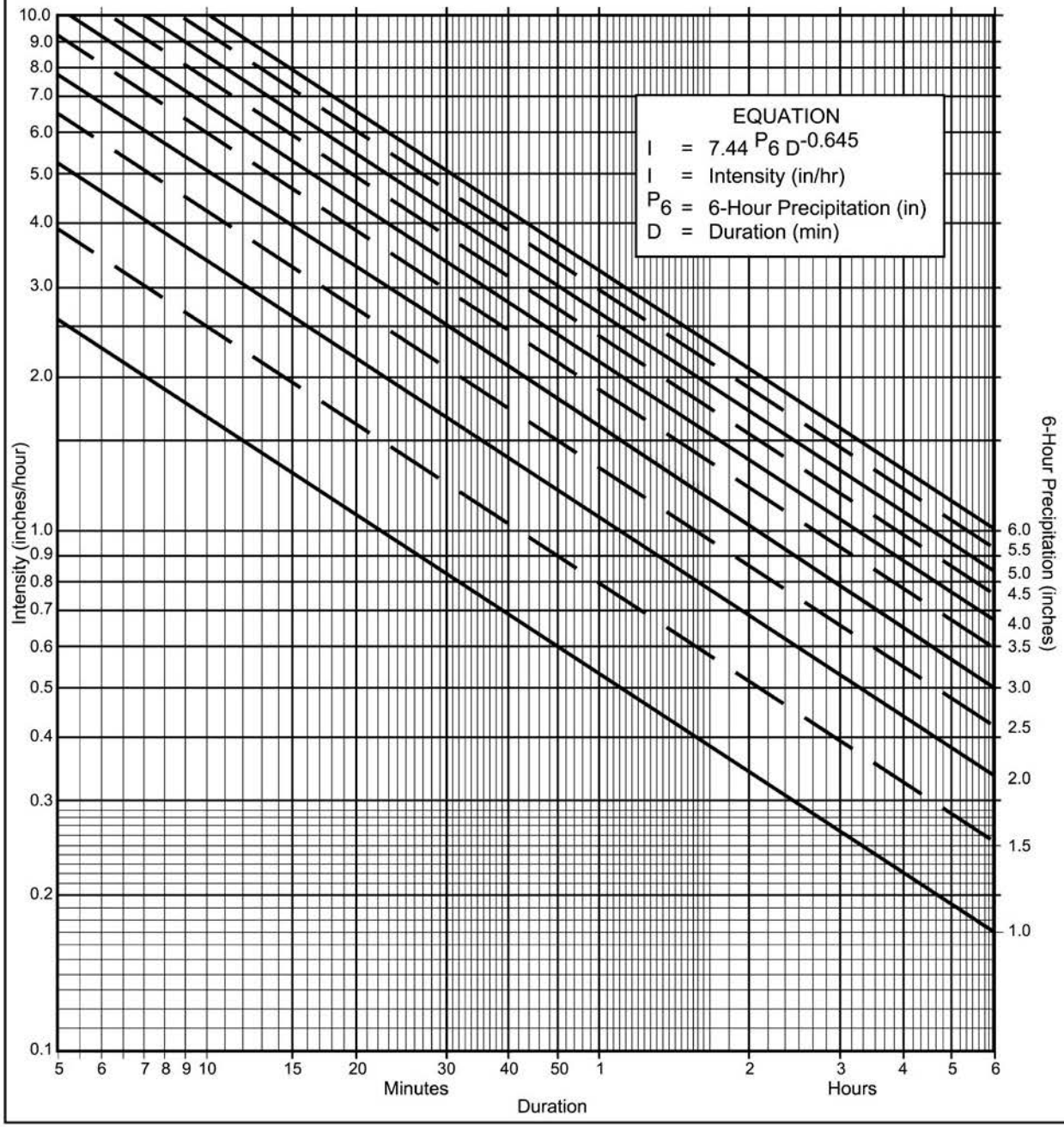
3-7

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

Intensity-Duration Design Chart



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.4 in., P_{24} = 3.9, $\frac{P_6}{P_{24}}$ = 61 %(2)

(c) Adjusted P_6(2) = 2.4 in.

(d) t_x = _____ min.

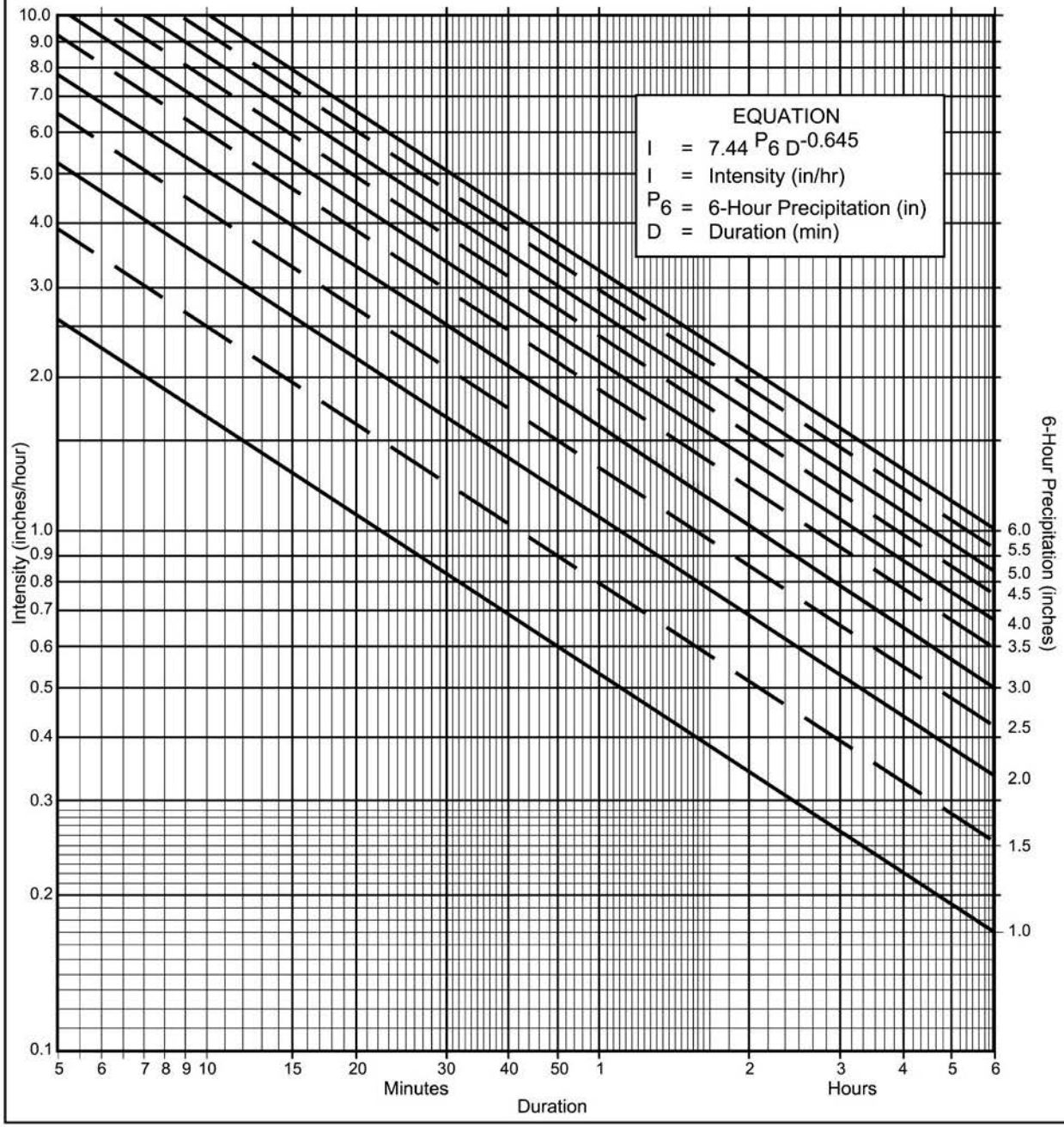
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 50 year

(b) P_6 = 2.1 in., P_{24} = 3.5, $\frac{P_6}{P_{24}}$ = 60 %(2)

(c) Adjusted P_6(2) = 2.1 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.5 - Rational Method Model Development Summary

Rational Method Hydrologic Analysis

Computer Software Package – AES-2015

Design Storm - 50-Year Return Interval for Storm Drain Hydraulics
100 - Year Return Interval for Inlet Sizing (Sump) and Detention

Land Use – High Density Residential (HDR) in Developed Areas

Soil Type – From the soil map, both group C and D are discovered from the site, however, to be conservative, Hydrologic soil group D was assumed for all areas. Group D soils have very slow infiltration rates when thoroughly wetted. Consisting chiefly of clay soils with a high swelling potential, soils with a high permanent water table, soils with clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials, Group D soils have a very slow rate of water transmission.

Runoff Coefficient – According to Development Density Map, the overall development density rated from 10DU/AC to 19.2 DU/AC, as a result, a set of runoff Cs then are determined based on County Hydrology Manual Table 3-1:
Onsite graded pervious slopes: 0.35
14.7 DU/A – 19.2DU/A: 0.71
9.9 DU/A: 0.6
Roads: 0.87

Method of Analysis – The Rational Method is the most widely used hydrologic model for estimating peak runoff rates. Applied to small urban and semi-urban areas with drainage areas less than 1.0 square mile, the Rational Method relates storm rainfall intensity, a runoff coefficient, and drainage area to peak runoff rate. This relationship is expressed by the equation:

Q = CIA, where:

Q = The peak runoff rate in cubic feet per second at the point of analysis.

C = A runoff coefficient representing the area - averaged ratio of runoff to rainfall intensity.

I = The time-averaged rainfall intensity in inches per hour corresponding to the time of concentration.

A = The drainage basin area in acres.

To perform a node-link study, the total watershed area is divided into subareas which discharge at designated nodes.

The procedure for the subarea summation model is as follows:

(1) Subdivide the watershed into an initial subarea (generally 1 lot) and subsequent subareas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each subarea.

(2) Estimate an initial T_c by using the appropriate nomograph or overland flow velocity estimation.

(3) Using the initial T_c, determine the corresponding values of I. Then Q = C I A.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to the particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES-2010 computer subarea menu is as follows:

SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipeflow travel time (computer estimated).
4. Pipeflow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through subarea.
7. User - specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$Q_p = Q_a + Q_b$; $T_p = T_a = T_b$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.

$Q_p = Q_a + Q_b \ (I_a/I_b)$; $T_p = T_a$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

$Q_p = Q_b + Q_a \ (T_b/T_a)$; $T_p = T_b$

CHAPTER 3

EXISTING AND PROPOSED CONDITION RATIONAL METHOD HYDROLOGIC ANALYSIS

EXISTING CONDITION

```
****************************************************************************

           RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2015 Advanced Engineering Software (aes)
             Ver. 22.0 Release Date: 07/01/2015  License ID 1239

                           Analysis prepared by:




----------------------------------------------------------------------------
  FILE NAME: R:\1561\HYD\DR\CALCS\TM\AES\EX.DAT
  TIME/DATE OF STUDY: 10:00 01/20/2020
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.400
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   12.0      6.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0160
  2   15.0      7.5    0.020/0.020/0.020   0.33    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+--------------------------------------------------------------------------+
| BEGIN EXISTING CONDITION HYD                                             |
| SUNBOW PA-23                                                             |
```



```
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   116.00
  UPSTREAM ELEVATION(FEET) =    474.00
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =     14.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.38
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.38

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    274.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2118.00   CHANNEL SLOPE =  0.0878
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.38
  FLOW VELOCITY(FEET/SEC) =   4.45 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   7.94   Tc(MIN.) =   14.21
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.224
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
```

```
 SUBAREA AREA(ACRES) =   27.29   SUBAREA RUNOFF(CFS) =   30.79
 TOTAL AREA(ACRES) =       27.5   TOTAL RUNOFF(CFS) =      31.02
 TC(MIN.) =   14.21

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    114.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    274.00  DOWNSTREAM(FEET) =    272.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   707.00   CHANNEL SLOPE =  0.0028
 CHANNEL FLOW THRU SUBAREA(CFS) =      31.02
 FLOW VELOCITY(FEET/SEC) =   1.80 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   6.55   Tc(MIN.) =   20.76
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    114.00 =    2941.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    114.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.524
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    5.75   SUBAREA RUNOFF(CFS) =    5.08
 TOTAL AREA(ACRES) =       33.2   TOTAL RUNOFF(CFS) =      31.02
 TC(MIN.) =   20.76
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   20.76
 RAINFALL INTENSITY(INCH/HR) =   2.52
 TOTAL STREAM AREA(ACRES) =    33.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     31.02

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```



```
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   149.00
 UPSTREAM ELEVATION(FEET) =    452.00
 DOWNSTREAM ELEVATION(FEET) =    445.00
 ELEVATION DIFFERENCE(FEET) =      7.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.061
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.647
 SUBAREA RUNOFF(CFS) =      0.36
 TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    445.00  DOWNSTREAM(FEET) =    272.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1550.00   CHANNEL SLOPE =  0.1116
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.36
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   5.45   Tc(MIN.) =   13.51
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =    1699.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.331
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =   18.92   SUBAREA RUNOFF(CFS) =   22.06
 TOTAL AREA(ACRES) =       19.1   TOTAL RUNOFF(CFS) =      22.31
 TC(MIN.) =   13.51

****************************************************************************
 FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =   1
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.51
  RAINFALL INTENSITY(INCH/HR) =   3.33
  TOTAL STREAM AREA(ACRES) =    19.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     22.31

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       31.02    20.76        2.524         33.24
      2       22.31    13.51        3.331         19.14

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       42.49    13.51       3.331
      2       47.93    20.76       2.524

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      47.93   Tc(MIN.) =   20.76
  TOTAL AREA(ACRES) =       52.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    114.00 =    2941.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    126.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    272.00  DOWNSTREAM(FEET) =    232.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1830.00   CHANNEL SLOPE =  0.0219
  CHANNEL FLOW THRU SUBAREA(CFS) =      47.93
  FLOW VELOCITY(FEET/SEC) =   5.65 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.40   Tc(MIN.) =   26.16
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    126.00 =    4771.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    126.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```



```
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.175
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =   21.40   SUBAREA RUNOFF(CFS) =   16.29
  TOTAL AREA(ACRES) =       73.8   TOTAL RUNOFF(CFS) =      56.16
  TC(MIN.) =   26.16

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
================================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   136.00
  UPSTREAM ELEVATION(FEET) =    444.00
  DOWNSTREAM ELEVATION(FEET) =    435.00
  ELEVATION DIFFERENCE(FEET) =      9.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.191
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.002
  SUBAREA RUNOFF(CFS) =      0.46
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    434.00  DOWNSTREAM(FEET) =    264.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1683.00   CHANNEL SLOPE =  0.1010
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.46
```

```
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   5.91   Tc(MIN.) =   13.10
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =    1819.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.397
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =   27.07   SUBAREA RUNOFF(CFS) =   32.18
 TOTAL AREA(ACRES) =       27.3   TOTAL RUNOFF(CFS) =      32.49
 TC(MIN.) =   13.10

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   13.10
 RAINFALL INTENSITY(INCH/HR) =   3.40
 TOTAL STREAM AREA(ACRES) =    27.33
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     32.49

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   123.00
 UPSTREAM ELEVATION(FEET) =    452.00
 DOWNSTREAM ELEVATION(FEET) =    420.00
 ELEVATION DIFFERENCE(FEET) =     32.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
```



```
 SUBAREA RUNOFF(CFS) =      0.63
 TOTAL AREA(ACRES) =      0.33   TOTAL RUNOFF(CFS) =      0.63

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    420.00  DOWNSTREAM(FEET) =    418.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   391.00   CHANNEL SLOPE =  0.0051
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.63
 FLOW VELOCITY(FEET/SEC) =   1.07 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   6.07   Tc(MIN.) =   12.34
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     514.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.531
 RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .6300
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  89
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5973
 SUBAREA AREA(ACRES) =    2.50   SUBAREA RUNOFF(CFS) =    5.56
 TOTAL AREA(ACRES) =        2.8   TOTAL RUNOFF(CFS) =       5.97
 TC(MIN.) =   12.34

****************************************************************************
 FLOW PROCESS FROM NODE    134.00 TO NODE    124.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    418.00  DOWNSTREAM(FEET) =    264.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1048.00   CHANNEL SLOPE =  0.1469
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       5.97
 FLOW VELOCITY(FEET/SEC) =   6.96 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.51   Tc(MIN.) =   14.85
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    124.00 =    1562.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    134.00 TO NODE    124.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.133
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3999
 SUBAREA AREA(ACRES) =   11.19   SUBAREA RUNOFF(CFS) =   12.27
 TOTAL AREA(ACRES) =       14.0   TOTAL RUNOFF(CFS) =      17.57
 TC(MIN.) =   14.85

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   14.85
 RAINFALL INTENSITY(INCH/HR) =   3.13
 TOTAL STREAM AREA(ACRES) =    14.02
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.57

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       32.49    13.10        3.397         27.33
     2       17.57    14.85        3.133         14.02

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       47.99    13.10       3.397
     2       47.54    14.85       3.133

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      47.99   Tc(MIN.) =   13.10
 TOTAL AREA(ACRES) =       41.3
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =    1819.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
```



```
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    264.00  DOWNSTREAM(FEET) =    232.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   389.00   CHANNEL SLOPE =  0.0823
 CHANNEL FLOW THRU SUBAREA(CFS) =      47.99
 FLOW VELOCITY(FEET/SEC) =  10.97 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.59   Tc(MIN.) =   13.70
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    126.00 =    2208.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.301
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3661
 SUBAREA AREA(ACRES) =    2.17   SUBAREA RUNOFF(CFS) =    2.51
 TOTAL AREA(ACRES) =       43.5   TOTAL RUNOFF(CFS) =      52.60
 TC(MIN.) =   13.70

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       52.60    13.70       3.301       43.52
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    126.00 =    2208.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       56.16    26.16       2.175       73.78
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    126.00 =    4771.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      82.00      13.70        3.301
     2      90.81      26.16        2.175

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      90.81   Tc(MIN.) =   26.16
  TOTAL AREA(ACRES) =      117.3

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| END EXISTING CONDITION HYD                                               |
| SUNBOW PA-23                                                             |
|                                                                          |
+--------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      117.3  TC(MIN.) =     26.16
  PEAK FLOW RATE(CFS)   =      90.81
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

PROPOSED CONDITION (UNATTENUATED)

```
************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2015 Advanced Engineering Software (aes)
              Ver. 22.0 Release Date: 07/01/2015  License ID 1239

                           Analysis prepared by:




------------------------------------------------------------------------
  FILE NAME: R:\1561\HYD\DR\CALCS\TM\AES\PR.DAT
  TIME/DATE OF STUDY: 17:02 06/12/2020
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.400
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   12.0      6.0    0.020/0.020/0.020   0.50    1.50 0.0312 0.125 0.0160
  2   15.0      7.5    0.020/0.020/0.020   0.33    1.50 0.0312 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+----------------------------------------------------------------------+
| BEGIN PROPOSED CONDITION HYD                                         |
| SUNBOW PA-23                                                         |
|                                                                      |
+----------------------------------------------------------------------+

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    88.00
  UPSTREAM ELEVATION(FEET) =    474.00
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =     14.00
```



```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.879
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.696
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.40

************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    438.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   317.00   CHANNEL SLOPE =  0.0694
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.40
  FLOW VELOCITY(FEET/SEC) =   3.95 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.34   Tc(MIN.) =    7.22
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     405.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  81
------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
========================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.991
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    1.73   SUBAREA RUNOFF(CFS) =    3.02
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =       3.37
  TC(MIN.) =    7.22

************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    128.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   403.20
  FLOW LENGTH(FEET) =   594.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.37
  PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =    8.17
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =     999.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    128.00 IS CODE =  10
------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
========================================================================

************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   342.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    434.00
  ELEVATION DIFFERENCE(FEET) =     30.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.546
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.315
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   434.00  DOWNSTREAM(FEET) =   408.60
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   0.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.54
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.35
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    6.64
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.64
  RAINFALL INTENSITY(INCH/HR) =   5.27
  TOTAL STREAM AREA(ACRES) =     0.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  UPSTREAM ELEVATION(FEET) =    440.00
  DOWNSTREAM ELEVATION(FEET) =    412.00
  ELEVATION DIFFERENCE(FEET) =     28.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.42
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.42
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.27
  RAINFALL INTENSITY(INCH/HR) =   5.47
  TOTAL STREAM AREA(ACRES) =     0.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.42

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.35     6.64        5.265          0.19
      2        0.42     6.27        5.466          0.22

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        0.75     6.27       5.466
      2        0.76     6.64       5.265

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       0.76   Tc(MIN.) =    6.64
  TOTAL AREA(ACRES) =        0.4
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   408.00  DOWNSTREAM(FEET) =   402.70
  FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.33
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.76
  PIPE TRAVEL TIME(MIN.) =   3.25    Tc(MIN.) =    9.89
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    124.00 =    1052.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.89
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     0.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.76

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
```

```
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    460.00
  DOWNSTREAM ELEVATION(FEET) =    420.00
  ELEVATION DIFFERENCE(FEET) =     40.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.27

************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  62
------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
========================================================================
  UPSTREAM ELEVATION(FEET) =  408.60  DOWNSTREAM ELEVATION(FEET) =  402.70
  STREET LENGTH(FEET) =   788.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.15
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.01
    SPLIT DEPTH(FEET) =    0.27   SPLIT FLOOD WIDTH(FEET) =    7.27
    SPLIT FLOW(CFS) =    1.01   SPLIT VELOCITY(FEET/SEC.) =    1.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.01
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
  STREET FLOW TRAVEL TIME(MIN.) =   6.52   Tc(MIN.) =   12.79
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.451
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.695
  SUBAREA AREA(ACRES) =    3.17      SUBAREA RUNOFF(CFS) =    7.77
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =       7.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.20   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     888.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
------------------------------------------------------------------------
```



```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.79
  RAINFALL INTENSITY(INCH/HR) =   3.45
  TOTAL STREAM AREA(ACRES) =     3.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.94

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.76     9.89        4.072          0.41
      2        7.94    12.79        3.451          3.31

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.90     9.89       4.072
      2        8.58    12.79       3.451

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.58   Tc(MIN.) =   12.79
  TOTAL AREA(ACRES) =        3.7
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    124.00 =    1052.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    127.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.70  DOWNSTREAM(FEET) =   402.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.36
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.58
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   12.92
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    127.00 =    1112.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.92
  RAINFALL INTENSITY(INCH/HR) =   3.43
  TOTAL STREAM AREA(ACRES) =     3.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.58

************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    123.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
```

```
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   143.00
 UPSTREAM ELEVATION(FEET) =    474.00
 DOWNSTREAM ELEVATION(FEET) =    460.00
 ELEVATION DIFFERENCE(FEET) =     14.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.311
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.441
 SUBAREA RUNOFF(CFS) =      0.34
 TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.34

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    125.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    440.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   229.00   CHANNEL SLOPE =  0.0873
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.34
 FLOW VELOCITY(FEET/SEC) =   4.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.86   Tc(MIN.) =    7.17
 LONGEST FLOWPATH FROM NODE    121.00 TO NODE    125.00 =     372.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    125.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.011
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    1.39   SUBAREA RUNOFF(CFS) =    2.44
 TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =       2.75
 TC(MIN.) =    7.17

****************************************************************************
 FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   408.00  DOWNSTREAM(FEET) =   402.00
 FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.76
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.75
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    7.89
 LONGEST FLOWPATH FROM NODE    121.00 TO NODE    127.00 =     662.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```



```
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.89
 RAINFALL INTENSITY(INCH/HR) =   4.71
 TOTAL STREAM AREA(ACRES) =     1.57
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.75

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        8.58    12.92        3.428          3.72
     2        2.75     7.89        4.713          1.57

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        8.99     7.89       4.713
     2       10.58    12.92       3.428

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      10.58   Tc(MIN.) =   12.92
 TOTAL AREA(ACRES) =        5.3
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    127.00 =    1112.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   404.00  DOWNSTREAM(FEET) =   403.20
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.14
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      10.58
 PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   13.11
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    128.00 =    1192.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    128.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1       10.58    13.11       3.396        5.29
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    128.00 =    1192.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1        3.37     8.17        4.607        1.93
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =     999.00 FEET.

 ** PEAK FLOW RATE TABLE **
```

```
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       9.97       8.17        4.607
      2      13.07      13.11        3.396

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.07   Tc(MIN.) =   13.11
  TOTAL AREA(ACRES) =        7.2

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    128.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   403.20  DOWNSTREAM(FEET) =   402.45
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.87
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.07
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   13.15
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    134.00 =    1222.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.15
  RAINFALL INTENSITY(INCH/HR) =   3.39
  TOTAL STREAM AREA(ACRES) =     7.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.07

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   101.00
  UPSTREAM ELEVATION(FEET) =    450.00
  DOWNSTREAM ELEVATION(FEET) =    417.00
  ELEVATION DIFFERENCE(FEET) =     33.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.23
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  417.00  DOWNSTREAM ELEVATION(FEET) =  402.45
  STREET LENGTH(FEET) =   673.30   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.49
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.08
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   3.65   Tc(MIN.) =    9.91
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.067
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.589
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    6.59
  TOTAL AREA(ACRES) =        2.8        PEAK FLOW RATE(CFS) =       6.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  3.42   DEPTH*VELOCITY(FT*FT/SEC.) =   1.25
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     774.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.91
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     2.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.76

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       13.07    13.15        3.388          7.22
      2        6.76     9.91        4.067          2.82

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       16.61     9.91       4.067
      2       18.70    13.15       3.388

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.70   Tc(MIN.) =   13.15
  TOTAL AREA(ACRES) =       10.0
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    134.00 =    1222.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    146.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.45  DOWNSTREAM(FEET) =   392.90
  FLOW LENGTH(FEET) =   352.60   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.30
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.70
  PIPE TRAVEL TIME(MIN.) =   0.48    Tc(MIN.) =   13.63
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    146.00 =    1574.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================


****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   106.00
  UPSTREAM ELEVATION(FEET) =    435.00
  DOWNSTREAM ELEVATION(FEET) =    415.00
  ELEVATION DIFFERENCE(FEET) =     20.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.46
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    144.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  415.60  DOWNSTREAM ELEVATION(FEET) =  398.00
  STREET LENGTH(FEET) =   643.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
```



```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.10
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.27
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.49
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.16
  STREET FLOW TRAVEL TIME(MIN.) =   3.07   Tc(MIN.) =    7.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.978
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    7.17
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =       7.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  3.85   DEPTH*VELOCITY(FT*FT/SEC.) =   1.41
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    144.00 =     749.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    144.00 TO NODE    145.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   398.00  DOWNSTREAM(FEET) =   393.00
  FLOW LENGTH(FEET) =   185.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.82
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.53
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    7.56
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    145.00 =     934.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.56
  RAINFALL INTENSITY(INCH/HR) =   4.84
  TOTAL STREAM AREA(ACRES) =     2.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.53

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    143.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =    407.00
  DOWNSTREAM ELEVATION(FEET) =    406.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.640
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    55.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.810
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    145.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  406.00  DOWNSTREAM ELEVATION(FEET) =  393.00
  STREET LENGTH(FEET) =   478.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.31
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.10
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
  STREET FLOW TRAVEL TIME(MIN.) =   2.57   Tc(MIN.) =   10.21
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.990
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    1.49      SUBAREA RUNOFF(CFS) =    3.57
  TOTAL AREA(ACRES) =        1.7        PEAK FLOW RATE(CFS) =       4.00

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.17
  FLOW VELOCITY(FEET/SEC.) =  3.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    145.00 =     628.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.21
  RAINFALL INTENSITY(INCH/HR) =   3.99
```



```
  TOTAL STREAM AREA(ACRES) =     1.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        7.53     7.56        4.844          2.52
      2        4.00    10.21        3.990          1.67

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       10.49     7.56       4.844
      2       10.20    10.21       3.990

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.49   Tc(MIN.) =    7.56
  TOTAL AREA(ACRES) =        4.2
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    145.00 =     934.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    146.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   394.00  DOWNSTREAM(FEET) =   393.00
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.49
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.63
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    146.00 =     979.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       10.49     7.63       4.813        4.19
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    146.00 =     979.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       18.70    13.63       3.311       10.04
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    146.00 =    1574.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      20.96       7.63        4.813
      2      25.91      13.63        3.311

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      25.91   Tc(MIN.) =   13.63
  TOTAL AREA(ACRES) =       14.2

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    154.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.90  DOWNSTREAM(FEET) =   391.00
  FLOW LENGTH(FEET) =    84.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.44
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.91
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   13.74
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    154.00 =    1658.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.74
  RAINFALL INTENSITY(INCH/HR) =   3.29
  TOTAL STREAM AREA(ACRES) =    14.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     25.91

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    152.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   140.00
  UPSTREAM ELEVATION(FEET) =    401.00
  DOWNSTREAM ELEVATION(FEET) =    400.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.563
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.43
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.842
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    152.00 TO NODE    154.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
```



```
  UPSTREAM ELEVATION(FEET) =  400.00  DOWNSTREAM ELEVATION(FEET) =  391.00
  STREET LENGTH(FEET) =   358.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.28
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.02
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.86
  STREET FLOW TRAVEL TIME(MIN.) =   1.99   Tc(MIN.) =    9.56
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.164
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    3.50
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       3.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.27
  FLOW VELOCITY(FEET/SEC.) =  3.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    154.00 =     498.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.56
  RAINFALL INTENSITY(INCH/HR) =   4.16
  TOTAL STREAM AREA(ACRES) =     1.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.95

****************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    153.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   140.00
  UPSTREAM ELEVATION(FEET) =    401.00
  DOWNSTREAM ELEVATION(FEET) =    400.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.563
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.43
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.842
```

```
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    153.00 TO NODE    154.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  400.00  DOWNSTREAM ELEVATION(FEET) =  391.40
  STREET LENGTH(FEET) =   358.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.22
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    5.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
  STREET FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =    9.88
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.076
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    0.57      SUBAREA RUNOFF(CFS) =    1.39
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       1.83

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.36
  FLOW VELOCITY(FEET/SEC.) =  2.78   DEPTH*VELOCITY(FT*FT/SEC.) =   0.76
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    154.00 =     498.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.88
  RAINFALL INTENSITY(INCH/HR) =   4.08
  TOTAL STREAM AREA(ACRES) =     0.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.83

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       25.91    13.74        3.294         14.23
      2        3.95     9.56        4.164          1.58
      3        1.83     9.88        4.076          0.75

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```



```
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       23.74     9.56        4.164
      2       24.32     9.88        4.076
      3       30.52    13.74        3.294

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      30.52   Tc(MIN.) =   13.74
  TOTAL AREA(ACRES) =       16.6
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    154.00 =    1658.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   391.40  DOWNSTREAM(FEET) =   390.10
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.32
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.52
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   13.77
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    169.00 =    1688.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    162.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   108.00
  UPSTREAM ELEVATION(FEET) =    396.00
  DOWNSTREAM ELEVATION(FEET) =    395.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.707
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    62.78
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.807
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    164.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  396.00  DOWNSTREAM ELEVATION(FEET) =  392.30
```

```
  STREET LENGTH(FEET) =   340.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.36
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.75
  STREET FLOW TRAVEL TIME(MIN.) =   2.53   Tc(MIN.) =    8.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.583
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    4.23
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       4.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.43   DEPTH*VELOCITY(FT*FT/SEC.) =   0.89
  LONGEST FLOWPATH FROM NODE    160.00 TO NODE    164.00 =     448.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    168.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.30  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =   233.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.97
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.65
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =    8.89
  LONGEST FLOWPATH FROM NODE    160.00 TO NODE    168.00 =     681.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.89
  RAINFALL INTENSITY(INCH/HR) =   4.36
  TOTAL STREAM AREA(ACRES) =     1.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.65

****************************************************************************
  FLOW PROCESS FROM NODE    161.00 TO NODE    163.00 IS CODE =  21
----------------------------------------------------------------------------
```



```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   118.00
  UPSTREAM ELEVATION(FEET) =    396.00
  DOWNSTREAM ELEVATION(FEET) =    395.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.766
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.42
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.768
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    168.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  395.00  DOWNSTREAM ELEVATION(FEET) =  390.00
  STREET LENGTH(FEET) =   580.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.50
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.16
    SPLIT DEPTH(FEET) =    0.16   SPLIT FLOOD WIDTH(FEET) =    1.54
    SPLIT FLOW(CFS) =    0.13   SPLIT VELOCITY(FEET/SEC.) =    0.94
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.16
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
  STREET FLOW TRAVEL TIME(MIN.) =   4.47   Tc(MIN.) =   10.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.983
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    5.94
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       6.31

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.16   DEPTH*VELOCITY(FT*FT/SEC.) =   0.79
  LONGEST FLOWPATH FROM NODE    161.00 TO NODE    168.00 =     698.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.24
 RAINFALL INTENSITY(INCH/HR) =   3.98
 TOTAL STREAM AREA(ACRES) =     2.23
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.31

****************************************************************************
 FLOW PROCESS FROM NODE    165.00 TO NODE    167.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   121.00
 UPSTREAM ELEVATION(FEET) =    394.20
 DOWNSTREAM ELEVATION(FEET) =    392.80
 ELEVATION DIFFERENCE(FEET) =      1.40
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.456
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    66.57
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.977
 SUBAREA RUNOFF(CFS) =      0.64
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.64

****************************************************************************
 FLOW PROCESS FROM NODE    167.00 TO NODE    168.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  392.80  DOWNSTREAM ELEVATION(FEET) =  390.00
 STREET LENGTH(FEET) =   284.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.58
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    8.39
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.92
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
 STREET FLOW TRAVEL TIME(MIN.) =   2.47   Tc(MIN.) =    7.92
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.699
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
```



```
 SUBAREA AREA(ACRES) =    0.56      SUBAREA RUNOFF(CFS) =    1.87
 TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       2.37

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.08
 FLOW VELOCITY(FEET/SEC.) =  2.09   DEPTH*VELOCITY(FT*FT/SEC.) =   0.68
 LONGEST FLOWPATH FROM NODE    165.00 TO NODE    168.00 =     405.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    168.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   391.00  DOWNSTREAM(FEET) =   390.50
 FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.99
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.37
 PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    8.09
 LONGEST FLOWPATH FROM NODE    165.00 TO NODE    169.00 =     455.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.09
 RAINFALL INTENSITY(INCH/HR) =   4.64
 TOTAL STREAM AREA(ACRES) =     0.71
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.37

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        4.65     8.89        4.364          1.43
     2        6.31    10.24        3.983          2.23
     3        2.37     8.09        4.636          0.71

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       11.59     8.09       4.636
     2       12.36     8.89       4.364
     3       12.59    10.24       3.983

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.59   Tc(MIN.) =   10.24
 TOTAL AREA(ACRES) =        4.4
 LONGEST FLOWPATH FROM NODE    161.00 TO NODE    169.00 =     698.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
```

```
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       12.59    10.24       3.983        4.37
  LONGEST FLOWPATH FROM NODE    161.00 TO NODE    169.00 =     698.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       30.52    13.77       3.289       16.56
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    169.00 =    1688.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      35.27      10.24       3.983
      2      40.91      13.77       3.289

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.91   Tc(MIN.) =   13.77
  TOTAL AREA(ACRES) =       20.9

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.10  DOWNSTREAM(FEET) =   388.90
  FLOW LENGTH(FEET) =   113.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.30
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.91
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   13.96
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    198.00 =    1801.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    172.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =    440.00
  DOWNSTREAM ELEVATION(FEET) =    410.00
  ELEVATION DIFFERENCE(FEET) =     30.00
```



```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.33
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.33

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    176.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  408.00  DOWNSTREAM ELEVATION(FEET) =  388.50
  STREET LENGTH(FEET) =   671.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.12
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.55
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.08
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.85
  STREET FLOW TRAVEL TIME(MIN.) =   3.63   Tc(MIN.) =    9.90
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.070
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.667
  SUBAREA AREA(ACRES) =    1.26      SUBAREA RUNOFF(CFS) =    3.64
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       3.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.89
  FLOW VELOCITY(FEET/SEC.) =  3.54   DEPTH*VELOCITY(FT*FT/SEC.) =   1.15
  LONGEST FLOWPATH FROM NODE    170.00 TO NODE    176.00 =     791.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.90
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     1.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.88

****************************************************************************
  FLOW PROCESS FROM NODE    171.00 TO NODE    173.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
 UPSTREAM ELEVATION(FEET) =    394.50
 DOWNSTREAM ELEVATION(FEET) =    394.00
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.778
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.760
 SUBAREA RUNOFF(CFS) =      0.29
 TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
 FLOW PROCESS FROM NODE    173.00 TO NODE    176.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
 UPSTREAM ELEVATION(FEET) =  394.00  DOWNSTREAM ELEVATION(FEET) =  388.50
 STREET LENGTH(FEET) =   460.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.84
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.30
   HALFSTREET FLOOD WIDTH(FEET) =    8.67
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.11
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
 STREET FLOW TRAVEL TIME(MIN.) =   3.63   Tc(MIN.) =    9.41
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.206
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    1.02      SUBAREA RUNOFF(CFS) =    3.05
 TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.25

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.02
 FLOW VELOCITY(FEET/SEC.) =  2.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
 LONGEST FLOWPATH FROM NODE    171.00 TO NODE    176.00 =     520.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.41
 RAINFALL INTENSITY(INCH/HR) =   4.21
```



```
 TOTAL STREAM AREA(ACRES) =     1.09
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.25

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        3.88     9.90        4.070          1.43
     2        3.25     9.41        4.206          1.09

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        6.95     9.41       4.206
     2        7.03     9.90       4.070

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       7.03   Tc(MIN.) =    9.90
 TOTAL AREA(ACRES) =        2.5
 LONGEST FLOWPATH FROM NODE    170.00 TO NODE    176.00 =     791.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    176.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   388.50  DOWNSTREAM(FEET) =   388.25
 FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.64
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.03
 PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    9.96
 LONGEST FLOWPATH FROM NODE    170.00 TO NODE    198.00 =     816.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        7.03     9.96       4.054        2.52
 LONGEST FLOWPATH FROM NODE    170.00 TO NODE    198.00 =     816.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       40.91    13.96       3.261       20.93
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    198.00 =    1801.60 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      36.23       9.96       4.054
     2      46.57      13.96       3.261

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      46.57   Tc(MIN.) =   13.96
  TOTAL AREA(ACRES) =       23.5

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    182.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    409.50
  DOWNSTREAM ELEVATION(FEET) =    408.50
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.354
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    67.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.050
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    184.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  406.00  DOWNSTREAM ELEVATION(FEET) =  394.40
  STREET LENGTH(FEET) =   529.30   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.50
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.33
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.16
  STREET FLOW TRAVEL TIME(MIN.) =   2.65   Tc(MIN.) =    8.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.668
```



```
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.786
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    7.93
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       8.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  3.45   DEPTH*VELOCITY(FT*FT/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    184.00 =     609.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    184.00 TO NODE    196.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   394.50  DOWNSTREAM(FEET) =   390.50
  FLOW LENGTH(FEET) =   421.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.74
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.33
  PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =    9.04
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    196.00 =    1030.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    196.00 TO NODE    196.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.04
  RAINFALL INTENSITY(INCH/HR) =   4.31
  TOTAL STREAM AREA(ACRES) =     2.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.33

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    192.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    96.00
  UPSTREAM ELEVATION(FEET) =    404.00
  DOWNSTREAM ELEVATION(FEET) =    403.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.601
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.42
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.877
  SUBAREA RUNOFF(CFS) =      0.42
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.42

****************************************************************************
  FLOW PROCESS FROM NODE    192.00 TO NODE    194.00 IS CODE =  62
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  403.00  DOWNSTREAM ELEVATION(FEET) =  395.30
  STREET LENGTH(FEET) =   704.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.75
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.43
    SPLIT DEPTH(FEET) =    0.34   SPLIT FLOOD WIDTH(FEET) =   10.83
    SPLIT FLOW(CFS) =    2.96   SPLIT VELOCITY(FEET/SEC.) =    2.29
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.43
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.89
  STREET FLOW TRAVEL TIME(MIN.) =   4.82   Tc(MIN.) =   10.42
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.938
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    4.41      SUBAREA RUNOFF(CFS) =   12.33
  TOTAL AREA(ACRES) =        4.5        PEAK FLOW RATE(CFS) =      12.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.97   DEPTH*VELOCITY(FT*FT/SEC.) =   1.23
  LONGEST FLOWPATH FROM NODE    190.00 TO NODE    194.00 =     800.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    194.00 TO NODE    196.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   395.30  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.83
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.61
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   10.46
  LONGEST FLOWPATH FROM NODE    190.00 TO NODE    196.00 =     842.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    196.00 TO NODE    196.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
```



```
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.46
  RAINFALL INTENSITY(INCH/HR) =   3.93
  TOTAL STREAM AREA(ACRES) =     4.51
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.61

  ** CONFLUENCE DATA **
  STREAM     RUNOFF        Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.33     9.04        4.314          2.27
      2       12.61    10.46        3.929          4.51

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       19.24     9.04        4.314
      2       20.19    10.46        3.929

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.19   Tc(MIN.) =   10.46
  TOTAL AREA(ACRES) =        6.8
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    196.00 =    1030.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    196.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.00  DOWNSTREAM(FEET) =   388.90
  FLOW LENGTH(FEET) =   115.30   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.36
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.19
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   10.69
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    198.00 =    1145.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==========================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY     AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.19    10.69        3.875        6.78
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    198.00 =    1145.60 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY     AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
      1       46.57    13.96        3.261       23.45
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    198.00 =    1801.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
```

```
     1      55.85      10.69        3.875
     2      63.57      13.96        3.261

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      63.57   Tc(MIN.) =   13.96
  TOTAL AREA(ACRES) =       30.2

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   388.90  DOWNSTREAM(FEET) =   379.20
  FLOW LENGTH(FEET) =   262.50   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.67
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      63.57
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   14.19
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    204.00 =    2064.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.19
  RAINFALL INTENSITY(INCH/HR) =   3.23
  TOTAL STREAM AREA(ACRES) =    30.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     63.57

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    392.80
  DOWNSTREAM ELEVATION(FEET) =    391.80
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.511
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    66.11
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.939
  SUBAREA RUNOFF(CFS) =      0.25
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  62
```



```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  391.80  DOWNSTREAM ELEVATION(FEET) =  379.20
  STREET LENGTH(FEET) =   481.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.37
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   2.96   Tc(MIN.) =    8.48
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.499
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    2.20
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.40

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.11
  FLOW VELOCITY(FEET/SEC.) =  3.09   DEPTH*VELOCITY(FT*FT/SEC.) =   0.89
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     571.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.48
  RAINFALL INTENSITY(INCH/HR) =   4.50
  TOTAL STREAM AREA(ACRES) =     0.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       63.57    14.19        3.226         30.23
      2        2.40     8.48        4.499          0.75

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       40.36     8.48       4.499
```

```
     2       65.29    14.19       3.226

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      65.29   Tc(MIN.) =   14.19
  TOTAL AREA(ACRES) =       31.0
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    204.00 =    2064.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE      2.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   375.00  DOWNSTREAM(FEET) =   374.00
  FLOW LENGTH(FEET) =    51.50   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.67
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      65.29
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   14.25
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE      2.00 =    2115.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE      2.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.218
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6174
  SUBAREA AREA(ACRES) =    1.74   SUBAREA RUNOFF(CFS) =    1.96
  TOTAL AREA(ACRES) =       32.7   TOTAL RUNOFF(CFS) =      65.29
  TC(MIN.) =   14.25
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    212.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   138.00
  UPSTREAM ELEVATION(FEET) =    392.60
  DOWNSTREAM ELEVATION(FEET) =    390.00
  ELEVATION DIFFERENCE(FEET) =      2.60
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.884
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    73.84
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.49
```



```
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    214.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  390.00  DOWNSTREAM ELEVATION(FEET) =  384.20
  STREET LENGTH(FEET) =   474.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.32
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.58
    SPLIT DEPTH(FEET) =    0.27   SPLIT FLOOD WIDTH(FEET) =    7.36
    SPLIT FLOW(CFS) =    1.31   SPLIT VELOCITY(FEET/SEC.) =    1.98
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
  STREET FLOW TRAVEL TIME(MIN.) =   3.07   Tc(MIN.) =    7.95
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.688
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    2.90      SUBAREA RUNOFF(CFS) =    9.65
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =      10.02

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.08
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    214.00 =     612.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    224.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   384.20  DOWNSTREAM(FEET) =   379.20
  FLOW LENGTH(FEET) =   526.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.02
  PIPE TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =    9.21
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    224.00 =    1138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    224.00 IS CODE =   1
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.21
  RAINFALL INTENSITY(INCH/HR) =   4.26
  TOTAL STREAM AREA(ACRES) =     3.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.02

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    222.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    396.70
  DOWNSTREAM ELEVATION(FEET) =    396.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.847
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    57.83
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.716
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.32

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    224.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  396.00  DOWNSTREAM ELEVATION(FEET) =  390.60
  STREET LENGTH(FEET) =   458.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.12
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   3.50   Tc(MIN.) =    9.34
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.225
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    1.18      SUBAREA RUNOFF(CFS) =    3.54
```



```
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       3.78

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.77
  FLOW VELOCITY(FEET/SEC.) =  2.52   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    224.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    224.00 TO NODE    224.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.34
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =     1.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.78

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.02     9.21        4.263          3.01
      2        3.78     9.34        4.225          1.26

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       13.75     9.21        4.263
      2       13.71     9.34        4.225

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.75   Tc(MIN.) =    9.21
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    224.00 =    1138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    224.00 TO NODE      2.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   375.40  DOWNSTREAM(FEET) =   374.00
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.76
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.75
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    9.52
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE      2.00 =    1278.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY     AREA
```

```
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       13.75     9.52       4.175        4.27
 LONGEST FLOWPATH FROM NODE    210.00 TO NODE      2.00 =    1278.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       65.29    14.25       3.218       32.72
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE      2.00 =    2115.60 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      57.34       9.52       4.175
     2      75.88      14.25       3.218

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      75.88   Tc(MIN.) =   14.25
 TOTAL AREA(ACRES) =       37.0

****************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE     10.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   374.00  DOWNSTREAM(FEET) =   310.00
 FLOW LENGTH(FEET) =   503.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  30.63
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      75.88
 PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   14.52
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     10.00 =    2618.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   14.52
 RAINFALL INTENSITY(INCH/HR) =   3.18
 TOTAL STREAM AREA(ACRES) =    36.99
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     75.88

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    232.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    379.20
```



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 DOWNSTREAM ELEVATION(FEET) =    374.00
 ELEVATION DIFFERENCE(FEET) =      5.20
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.272
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    90.40
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.61
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.61

****************************************************************************
 FLOW PROCESS FROM NODE    232.00 TO NODE     10.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  374.00  DOWNSTREAM ELEVATION(FEET) =  320.00
 STREET LENGTH(FEET) =   480.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.61
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.24
   HALFSTREET FLOOD WIDTH(FEET) =    5.89
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.61
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.37
 STREET FLOW TRAVEL TIME(MIN.) =   1.43   Tc(MIN.) =    3.70
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =    0.73      SUBAREA RUNOFF(CFS) =    4.02
 TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       4.62

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.92
 FLOW VELOCITY(FEET/SEC.) =  6.20   DEPTH*VELOCITY(FT*FT/SEC.) =   1.76
 LONGEST FLOWPATH FROM NODE    230.00 TO NODE     10.00 =     580.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    3.70
 RAINFALL INTENSITY(INCH/HR) =   6.32
 TOTAL STREAM AREA(ACRES) =     0.84
```

```
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.62

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       75.88    14.52        3.179         36.99
     2        4.62     3.70        6.323          0.84

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       23.94     3.70       6.323
     2       78.20    14.52       3.179

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      78.20   Tc(MIN.) =   14.52
 TOTAL AREA(ACRES) =       37.8
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     10.00 =    2618.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   320.00  DOWNSTREAM(FEET) =   276.20
 FLOW LENGTH(FEET) =   535.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  26.33
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      78.20
 PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =   14.86
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     14.00 =    3153.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   14.86
 RAINFALL INTENSITY(INCH/HR) =   3.13
 TOTAL STREAM AREA(ACRES) =    37.83
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     78.20

****************************************************************************
 FLOW PROCESS FROM NODE    231.00 TO NODE    233.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
 UPSTREAM ELEVATION(FEET) =    323.00
 DOWNSTREAM ELEVATION(FEET) =    315.00
 ELEVATION DIFFERENCE(FEET) =      8.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.489
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
```



```
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.55
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
 FLOW PROCESS FROM NODE    233.00 TO NODE     14.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  315.00  DOWNSTREAM ELEVATION(FEET) =  274.00
 STREET LENGTH(FEET) =   449.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.48
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =    6.05
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.12
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.26
 STREET FLOW TRAVEL TIME(MIN.) =   1.46   Tc(MIN.) =    2.95
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    3.85
 TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       4.40

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.11
 FLOW VELOCITY(FEET/SEC.) =  5.67   DEPTH*VELOCITY(FT*FT/SEC.) =   1.64
 LONGEST FLOWPATH FROM NODE    231.00 TO NODE     14.00 =     509.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    2.95
 RAINFALL INTENSITY(INCH/HR) =   6.32
 TOTAL STREAM AREA(ACRES) =     0.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.40

+----------------------------------------------------------------------------+
| OFFSET FLOW FROM NORTHEAST                                                 |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

```
**************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   134.00
 UPSTREAM ELEVATION(FEET) =    400.00
 DOWNSTREAM ELEVATION(FEET) =    350.00
 ELEVATION DIFFERENCE(FEET) =     50.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.38
 TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.38

**************************************************************************
 FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  52
--------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    350.00  DOWNSTREAM(FEET) =    260.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1386.00   CHANNEL SLOPE =  0.0649
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.38
 FLOW VELOCITY(FEET/SEC) =   3.82 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   6.04   Tc(MIN.) =   12.31
 LONGEST FLOWPATH FROM NODE     12.00 TO NODE     14.00 =    1520.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.536
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =   10.10   SUBAREA RUNOFF(CFS) =   12.50
 TOTAL AREA(ACRES) =       10.3   TOTAL RUNOFF(CFS) =      12.75
 TC(MIN.) =   12.31

**************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
--------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =   12.31
 RAINFALL INTENSITY(INCH/HR) =   3.54
 TOTAL STREAM AREA(ACRES) =    10.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.75

 ** CONFLUENCE DATA **
```



```
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       78.20    14.86        3.132         37.83
     2        4.40     2.95        6.323          0.80
     3       12.75    12.31        3.536         10.30

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       46.19     2.95        6.323
     2       84.46    12.31        3.536
     3       91.67    14.86        3.132

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      91.67   Tc(MIN.) =   14.86
 TOTAL AREA(ACRES) =       48.9
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     14.00 =    3153.60 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     28.00 IS CODE =  52
--------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    260.00  DOWNSTREAM(FEET) =    248.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1259.00   CHANNEL SLOPE =  0.0095
 CHANNEL FLOW THRU SUBAREA(CFS) =      91.67
 FLOW VELOCITY(FEET/SEC) =   4.51 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   4.65   Tc(MIN.) =   19.51
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     28.00 =    4412.60 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     28.00 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.628
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5244
 SUBAREA AREA(ACRES) =   14.95   SUBAREA RUNOFF(CFS) =   13.75
 TOTAL AREA(ACRES) =       63.9   TOTAL RUNOFF(CFS) =      91.67
 TC(MIN.) =   19.51
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

**************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =  10
--------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==========================================================================

+------------------------------------------------------------------------+
| BEGIN WEST BASIN HYD                                                   |
|                                                                        |
|                                                                        |
+------------------------------------------------------------------------+

**************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    504.00 IS CODE =  21
```

```
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   218.00
  UPSTREAM ELEVATION(FEET) =    402.60
  DOWNSTREAM ELEVATION(FEET) =    400.80
  ELEVATION DIFFERENCE(FEET) =      1.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.785
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    59.77
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.756
  SUBAREA RUNOFF(CFS) =      1.76
  TOTAL AREA(ACRES) =      0.43   TOTAL RUNOFF(CFS) =      1.76

************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    506.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.80  DOWNSTREAM(FEET) =   400.00
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.59
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.76
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    6.08
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =     298.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.08
  RAINFALL INTENSITY(INCH/HR) =   5.58
  TOTAL STREAM AREA(ACRES) =     0.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.76

************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    503.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    97.00
  UPSTREAM ELEVATION(FEET) =    445.00
  DOWNSTREAM ELEVATION(FEET) =    412.00
  ELEVATION DIFFERENCE(FEET) =     33.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.172
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.520
  SUBAREA RUNOFF(CFS) =      0.35
```



```
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.35

************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    506.00 IS CODE =  62
------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
========================================================================
  UPSTREAM ELEVATION(FEET) =  406.00  DOWNSTREAM ELEVATION(FEET) =  403.50
  STREET LENGTH(FEET) =   264.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.39
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.88
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
  STREET FLOW TRAVEL TIME(MIN.) =   2.35   Tc(MIN.) =    8.52
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.485
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.641
  SUBAREA AREA(ACRES) =    0.76      SUBAREA RUNOFF(CFS) =    2.42
  TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       2.70

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.73
  FLOW VELOCITY(FEET/SEC.) =  2.13   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    506.00 =     361.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.52
  RAINFALL INTENSITY(INCH/HR) =   4.48
  TOTAL STREAM AREA(ACRES) =     0.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.70

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        1.76     6.08        5.577          0.43
      2        2.70     8.52        4.485          0.94

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        3.68     6.08       5.577
     2        4.12     8.52       4.485

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       4.12   Tc(MIN.) =    8.52
 TOTAL AREA(ACRES) =        1.4
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    506.00 =     361.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    514.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   403.50  DOWNSTREAM(FEET) =   391.50
 FLOW LENGTH(FEET) =   379.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.82
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       4.12
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    9.23
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    514.00 =     740.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    514.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.257
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6890
 SUBAREA AREA(ACRES) =    1.72   SUBAREA RUNOFF(CFS) =    5.20
 TOTAL AREA(ACRES) =        3.1   TOTAL RUNOFF(CFS) =       9.06
 TC(MIN.) =    9.23

****************************************************************************
 FLOW PROCESS FROM NODE    514.00 TO NODE     22.50 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   391.50  DOWNSTREAM(FEET) =   387.90
 FLOW LENGTH(FEET) =   154.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.76
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.06
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    9.50
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     22.50 =     894.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE     22.50 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
```



```
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.50
 RAINFALL INTENSITY(INCH/HR) =   4.18
 TOTAL STREAM AREA(ACRES) =     3.09
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.06

****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   139.00
 UPSTREAM ELEVATION(FEET) =    468.00
 DOWNSTREAM ELEVATION(FEET) =    448.00
 ELEVATION DIFFERENCE(FEET) =     20.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.25
 TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    448.00  DOWNSTREAM(FEET) =    364.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   482.00   CHANNEL SLOPE =  0.1743
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.25
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.69   Tc(MIN.) =    7.96
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =     621.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.685
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    5.56   SUBAREA RUNOFF(CFS) =    9.12
 TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =       9.33
 TC(MIN.) =    7.96

****************************************************************************
 FLOW PROCESS FROM NODE     22.00 TO NODE     22.50 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   364.00  DOWNSTREAM(FEET) =   363.15
```

```
 FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.03
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.33
 PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    8.16
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.50 =     706.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE     22.50 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.16
 RAINFALL INTENSITY(INCH/HR) =   4.61
 TOTAL STREAM AREA(ACRES) =     5.69
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.33

****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     20.50 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    468.00
 DOWNSTREAM ELEVATION(FEET) =    450.00
 ELEVATION DIFFERENCE(FEET) =     18.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.21
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.21

****************************************************************************
 FLOW PROCESS FROM NODE     20.50 TO NODE     21.50 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    450.00  DOWNSTREAM(FEET) =    380.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   354.00   CHANNEL SLOPE =  0.1977
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.21
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =    7.51
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     21.50 =     454.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     20.50 TO NODE     21.50 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.864
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
```



```
 SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    1.87
 TOTAL AREA(ACRES) =        1.2   TOTAL RUNOFF(CFS) =       2.06
 TC(MIN.) =    7.51

****************************************************************************
 FLOW PROCESS FROM NODE     21.50 TO NODE     22.50 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   380.00  DOWNSTREAM(FEET) =   378.00
 FLOW LENGTH(FEET) =   195.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.84
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.06
 PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =    8.18
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.50 =     649.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE     22.50 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.18
 RAINFALL INTENSITY(INCH/HR) =   4.60
 TOTAL STREAM AREA(ACRES) =     1.21
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.06

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        9.06     9.50        4.181          3.09
     2        9.33     8.16        4.610          5.69
     3        2.06     8.18        4.602          1.21

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       19.60     8.16       4.610
     2       19.61     8.18       4.602
     3       19.40     9.50       4.181

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      19.61   Tc(MIN.) =    8.18
 TOTAL AREA(ACRES) =       10.0
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     22.50 =     894.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE    524.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   386.52  DOWNSTREAM(FEET) =   381.20
 FLOW LENGTH(FEET) =   266.00   MANNING'S N =  0.012
```

```
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.99
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.61
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    8.59
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    524.00 =    1160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    524.00 TO NODE    524.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.59
  RAINFALL INTENSITY(INCH/HR) =   4.46
  TOTAL STREAM AREA(ACRES) =     9.99
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.61

****************************************************************************
  FLOW PROCESS FROM NODE    520.00 TO NODE    522.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.00
  UPSTREAM ELEVATION(FEET) =    391.60
  DOWNSTREAM ELEVATION(FEET) =    390.70
  ELEVATION DIFFERENCE(FEET) =      0.90
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.745
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    61.21
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.782
  SUBAREA RUNOFF(CFS) =      0.49
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
  FLOW PROCESS FROM NODE    522.00 TO NODE    524.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  390.00  DOWNSTREAM ELEVATION(FEET) =  381.20
  STREET LENGTH(FEET) =   353.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.70
```



```
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.72
  STREET FLOW TRAVEL TIME(MIN.) =   2.13   Tc(MIN.) =    7.87
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.719
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.64      SUBAREA RUNOFF(CFS) =    2.14
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.55

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.48
  FLOW VELOCITY(FEET/SEC.) =  3.04   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE    520.00 TO NODE    524.00 =     456.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    524.00 TO NODE    524.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.87
  RAINFALL INTENSITY(INCH/HR) =   4.72
  TOTAL STREAM AREA(ACRES) =     0.76
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.55

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       19.61     8.59        4.462          9.99
      2        2.55     7.87        4.719          0.76

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       21.09     7.87       4.719
      2       22.02     8.59       4.462

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      22.02   Tc(MIN.) =    8.59
  TOTAL AREA(ACRES) =       10.8
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    524.00 =    1160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    524.00 TO NODE    556.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   381.00  DOWNSTREAM(FEET) =   380.40
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.62
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.02
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    8.70
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    556.00 =    1220.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    556.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    530.00 TO NODE    532.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    403.40
  DOWNSTREAM ELEVATION(FEET) =    401.80
  ELEVATION DIFFERENCE(FEET) =      1.60
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.057
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    71.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.277
  SUBAREA RUNOFF(CFS) =      0.49
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
  FLOW PROCESS FROM NODE    532.00 TO NODE    534.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  401.50  DOWNSTREAM ELEVATION(FEET) =  395.80
  STREET LENGTH(FEET) =   246.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.29
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.56
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   1.60   Tc(MIN.) =    6.66
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.255
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    1.60
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.01

  END OF SUBAREA STREET FLOW HYDRAULICS:
```



```
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.73
  FLOW VELOCITY(FEET/SEC.) =  2.81   DEPTH*VELOCITY(FT*FT/SEC.) =   0.79
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    534.00 =     346.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    534.00 TO NODE    544.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   395.50  DOWNSTREAM(FEET) =   392.00
  FLOW LENGTH(FEET) =   153.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.39
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.01
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    7.06
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    544.00 =     499.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    544.00 TO NODE    544.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.06
  RAINFALL INTENSITY(INCH/HR) =   5.06
  TOTAL STREAM AREA(ACRES) =     0.54
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.01

****************************************************************************
  FLOW PROCESS FROM NODE    540.00 TO NODE    542.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    89.00
  UPSTREAM ELEVATION(FEET) =    397.60
  DOWNSTREAM ELEVATION(FEET) =    396.50
  ELEVATION DIFFERENCE(FEET) =      1.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.369
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    67.36
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.040
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE    542.00 TO NODE    544.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  396.50  DOWNSTREAM ELEVATION(FEET) =  393.40
  STREET LENGTH(FEET) =   258.60   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.90
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.77
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.15
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
  STREET FLOW TRAVEL TIME(MIN.) =   2.01   Tc(MIN.) =    7.38
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.921
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.84      SUBAREA RUNOFF(CFS) =    2.94
  TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       3.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.11
  FLOW VELOCITY(FEET/SEC.) =  2.43   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    540.00 TO NODE    544.00 =     347.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    544.00 TO NODE    544.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.38
  RAINFALL INTENSITY(INCH/HR) =   4.92
  TOTAL STREAM AREA(ACRES) =     0.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.28

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.01     7.06        5.061          0.54
      2        3.28     7.38        4.921          0.94

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        5.16     7.06       5.061
      2        5.24     7.38       4.921

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.24   Tc(MIN.) =    7.38
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    544.00 =     499.00 FEET.

****************************************************************************
```



```
  FLOW PROCESS FROM NODE    544.00 TO NODE    545.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.00  DOWNSTREAM(FEET) =   388.00
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.67
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.24
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    7.68
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    545.00 =     659.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    545.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.68
  RAINFALL INTENSITY(INCH/HR) =   4.79
  TOTAL STREAM AREA(ACRES) =     1.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.24

****************************************************************************
  FLOW PROCESS FROM NODE    541.00 TO NODE    543.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    397.60
  DOWNSTREAM ELEVATION(FEET) =    396.00
  ELEVATION DIFFERENCE(FEET) =      1.60
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.825
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    543.00 TO NODE    545.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  396.00  DOWNSTREAM ELEVATION(FEET) =  389.70
  STREET LENGTH(FEET) =   278.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.18
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.81
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.81
  STREET FLOW TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =    6.47
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.353
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.93      SUBAREA RUNOFF(CFS) =    3.53
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       3.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.36
  FLOW VELOCITY(FEET/SEC.) =  3.25   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE    541.00 TO NODE    545.00 =     358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    545.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.47
  RAINFALL INTENSITY(INCH/HR) =   5.35
  TOTAL STREAM AREA(ACRES) =     1.02
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.24     7.68        4.793          1.48
      2        3.88     6.47        5.353          1.02

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        8.57     6.47       5.353
      2        8.71     7.68       4.793

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.71   Tc(MIN.) =    7.68
  TOTAL AREA(ACRES) =        2.5
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    545.00 =     659.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    548.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```



```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   388.00  DOWNSTREAM(FEET) =   385.00
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.71
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    7.94
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    548.00 =     804.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    548.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.94
  RAINFALL INTENSITY(INCH/HR) =   4.69
  TOTAL STREAM AREA(ACRES) =     2.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.71

****************************************************************************
  FLOW PROCESS FROM NODE    546.00 TO NODE    547.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    393.90
  DOWNSTREAM ELEVATION(FEET) =    392.50
  ELEVATION DIFFERENCE(FEET) =      1.40
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.960
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    547.00 TO NODE    548.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  392.50  DOWNSTREAM ELEVATION(FEET) =  386.80
  STREET LENGTH(FEET) =   280.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.28
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    8.39
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.82
  STREET FLOW TRAVEL TIME(MIN.) =   1.68   Tc(MIN.) =    6.64
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.264
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    1.00      SUBAREA RUNOFF(CFS) =    3.74
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.07

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.83
  FLOW VELOCITY(FEET/SEC.) =  3.16   DEPTH*VELOCITY(FT*FT/SEC.) =   1.08
  LONGEST FLOWPATH FROM NODE    546.00 TO NODE    548.00 =     360.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    548.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.64
  RAINFALL INTENSITY(INCH/HR) =   5.26
  TOTAL STREAM AREA(ACRES) =     1.09
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.07

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.71     7.94        4.691          2.50
      2        4.07     6.64        5.264          1.09

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.84     6.64       5.264
      2       12.34     7.94       4.691

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.34   Tc(MIN.) =    7.94
  TOTAL AREA(ACRES) =        3.6
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    548.00 =     804.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    554.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   384.50  DOWNSTREAM(FEET) =   383.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.1 INCHES
```



```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.75
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.34
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.04
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    554.00 =     864.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    554.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.04
  RAINFALL INTENSITY(INCH/HR) =   4.66
  TOTAL STREAM AREA(ACRES) =     3.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.34

****************************************************************************
  FLOW PROCESS FROM NODE    550.00 TO NODE    552.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   144.00
  UPSTREAM ELEVATION(FEET) =    403.00
  DOWNSTREAM ELEVATION(FEET) =    399.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.597
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    77.78
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.55
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
  FLOW PROCESS FROM NODE    552.00 TO NODE    554.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  398.80  DOWNSTREAM ELEVATION(FEET) =  383.00
  STREET LENGTH(FEET) =   675.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.33
```

```
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.12
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   3.60   Tc(MIN.) =    6.20
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.503
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.05      SUBAREA RUNOFF(CFS) =    5.03
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       5.51

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.95
  FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.30
  LONGEST FLOWPATH FROM NODE    550.00 TO NODE    554.00 =     819.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    554.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.20
  RAINFALL INTENSITY(INCH/HR) =   5.50
  TOTAL STREAM AREA(ACRES) =     1.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.51

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.34     8.04        4.656          3.59
      2        5.51     6.20        5.503          1.15

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       15.95     6.20       5.503
      2       17.00     8.04       4.656

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.00   Tc(MIN.) =    8.04
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    554.00 =     864.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    556.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   383.00  DOWNSTREAM(FEET) =   382.20
  FLOW LENGTH(FEET) =    36.70   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.07
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.00
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    8.09
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    556.00 =     900.70 FEET.
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    556.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       17.00     8.09       4.635        4.74
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    556.00 =     900.70 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       22.02     8.70       4.423       10.75
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    556.00 =    1220.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      37.48       8.09        4.635
      2      38.24       8.70        4.423

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      38.24   Tc(MIN.) =    8.70
  TOTAL AREA(ACRES) =       15.5

****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    556.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    568.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   382.20  DOWNSTREAM(FEET) =   352.00
  FLOW LENGTH(FEET) =   388.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.64
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.24
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    9.00
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    568.00 =    1608.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    568.00 TO NODE    568.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.00
  RAINFALL INTENSITY(INCH/HR) =   4.33
  TOTAL STREAM AREA(ACRES) =    15.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     38.24

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    560.00 TO NODE    562.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
 UPSTREAM ELEVATION(FEET) =    394.00
 DOWNSTREAM ELEVATION(FEET) =    384.50
 ELEVATION DIFFERENCE(FEET) =      9.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.091
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.45
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
 FLOW PROCESS FROM NODE    562.00 TO NODE    564.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  384.00  DOWNSTREAM ELEVATION(FEET) =  378.00
 STREET LENGTH(FEET) =   564.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.60
   ***STREET FLOW SPLITS OVER STREET-CROWN***
   FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
   FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.40
   SPLIT DEPTH(FEET) =    0.25   SPLIT FLOOD WIDTH(FEET) =    6.14
   SPLIT FLOW(CFS) =    0.86   SPLIT VELOCITY(FEET/SEC.) =    1.74
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.37
   HALFSTREET FLOOD WIDTH(FEET) =   12.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.40
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
 STREET FLOW TRAVEL TIME(MIN.) =   3.91   Tc(MIN.) =    7.01
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.087
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    8.31
 TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       8.67

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  2.55   DEPTH*VELOCITY(FT*FT/SEC.) =   0.96
 LONGEST FLOWPATH FROM NODE    560.00 TO NODE    564.00 =     654.00 FEET.

****************************************************************************
```



```
 FLOW PROCESS FROM NODE    564.00 TO NODE    566.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   378.00  DOWNSTREAM(FEET) =   374.20
 FLOW LENGTH(FEET) =   322.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.42
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       8.67
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    7.73
 LONGEST FLOWPATH FROM NODE    560.00 TO NODE    566.00 =     976.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    564.00 TO NODE    566.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.775
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7100
 SUBAREA AREA(ACRES) =    1.64   SUBAREA RUNOFF(CFS) =    5.56
 TOTAL AREA(ACRES) =        4.0   TOTAL RUNOFF(CFS) =      13.70
 TC(MIN.) =    7.73

****************************************************************************
 FLOW PROCESS FROM NODE    566.00 TO NODE    568.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   374.00  DOWNSTREAM(FEET) =   350.00
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  23.28
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      13.70
 PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    7.82
 LONGEST FLOWPATH FROM NODE    560.00 TO NODE    568.00 =    1106.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    568.00 TO NODE    568.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.82
 RAINFALL INTENSITY(INCH/HR) =   4.74
 TOTAL STREAM AREA(ACRES) =     4.04
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.70

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       38.24     9.00        4.328         15.49
     2       13.70     7.82        4.738          4.04
```

```
 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       46.93     7.82       4.738
     2       50.75     9.00       4.328

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      50.75   Tc(MIN.) =    9.00
 TOTAL AREA(ACRES) =       19.5
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    568.00 =    1608.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    568.00 TO NODE     19.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   353.00  DOWNSTREAM(FEET) =   335.00
 FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  25.03
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      50.75
 PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    9.12
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     19.00 =    1788.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     19.00 TO NODE     19.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.12
 RAINFALL INTENSITY(INCH/HR) =   4.29
 TOTAL STREAM AREA(ACRES) =    19.53
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     50.75

****************************************************************************
 FLOW PROCESS FROM NODE     18.00 TO NODE     19.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   237.00
 UPSTREAM ELEVATION(FEET) =    370.00
 DOWNSTREAM ELEVATION(FEET) =    340.00
 ELEVATION DIFFERENCE(FEET) =     30.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.46
 TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
```



```
 FLOW PROCESS FROM NODE     19.00 TO NODE     19.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.27
 RAINFALL INTENSITY(INCH/HR) =   5.47
 TOTAL STREAM AREA(ACRES) =     0.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.46

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       50.75     9.12        4.291         19.53
     2        0.46     6.27        5.466          0.24

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       40.30     6.27       5.466
     2       51.11     9.12       4.291

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      51.11   Tc(MIN.) =    9.12
 TOTAL AREA(ACRES) =       19.8
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     19.00 =    1788.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     19.00 TO NODE    586.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   335.00  DOWNSTREAM(FEET) =   315.00
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  25.04
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      51.11
 PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    9.25
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    586.00 =    1988.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    586.00 TO NODE    586.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    570.00 TO NODE    572.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   104.00
 UPSTREAM ELEVATION(FEET) =    387.90
```

```
  DOWNSTREAM ELEVATION(FEET) =    387.00
  ELEVATION DIFFERENCE(FEET) =      0.90
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.752
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.96
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.777
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.37

****************************************************************************
  FLOW PROCESS FROM NODE    572.00 TO NODE    574.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  387.00  DOWNSTREAM ELEVATION(FEET) =  380.00
  STREET LENGTH(FEET) =   292.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.39
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.42
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.67
  STREET FLOW TRAVEL TIME(MIN.) =   1.86   Tc(MIN.) =    7.62
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.821
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    2.02
  TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       2.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.20
  FLOW VELOCITY(FEET/SEC.) =  2.94   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    574.00 =     396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    574.00 TO NODE    575.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   380.00  DOWNSTREAM(FEET) =   376.80
  FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.80
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.33
```



```
  PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    575.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    575.00 TO NODE    575.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.21
  RAINFALL INTENSITY(INCH/HR) =   4.59
  TOTAL STREAM AREA(ACRES) =     0.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.33

****************************************************************************
  FLOW PROCESS FROM NODE    571.00 TO NODE    573.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   117.00
  UPSTREAM ELEVATION(FEET) =    383.70
  DOWNSTREAM ELEVATION(FEET) =    383.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.062
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    52.95
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.585
  SUBAREA RUNOFF(CFS) =      0.48
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.48

****************************************************************************
  FLOW PROCESS FROM NODE    573.00 TO NODE    575.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  383.00  DOWNSTREAM ELEVATION(FEET) =  376.80
  STREET LENGTH(FEET) =   476.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.74
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.60
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
  STREET FLOW TRAVEL TIME(MIN.) =   3.05   Tc(MIN.) =    9.11
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.294
```

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 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    2.13      SUBAREA RUNOFF(CFS) =    6.49
 TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       6.86

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  2.66   DEPTH*VELOCITY(FT*FT/SEC.) =   0.97
 LONGEST FLOWPATH FROM NODE    571.00 TO NODE    575.00 =     593.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    575.00 TO NODE    575.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.11
 RAINFALL INTENSITY(INCH/HR) =   4.29
 TOTAL STREAM AREA(ACRES) =     2.25
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.86

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        2.33     8.21        4.591          0.68
     2        6.86     9.11        4.294          2.25

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        8.51     8.21       4.591
     2        9.04     9.11       4.294

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       9.04   Tc(MIN.) =    9.11
 TOTAL AREA(ACRES) =        2.9
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    575.00 =     604.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    575.00 TO NODE    578.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   376.80  DOWNSTREAM(FEET) =   373.00
 FLOW LENGTH(FEET) =   320.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.50
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.04
 PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =    9.82
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    578.00 =     924.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    575.00 TO NODE    578.00 IS CODE =  81
----------------------------------------------------------------------------
```



```
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.090
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7100
 SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.90
 TOTAL AREA(ACRES) =        3.9   TOTAL RUNOFF(CFS) =      11.41
 TC(MIN.) =    9.82

****************************************************************************
 FLOW PROCESS FROM NODE    578.00 TO NODE    584.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   373.00  DOWNSTREAM(FEET) =   370.50
 FLOW LENGTH(FEET) =   189.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.16
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      11.41
 PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =   10.21
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    584.00 =    1113.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    584.00 TO NODE    584.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.21
 RAINFALL INTENSITY(INCH/HR) =   3.99
 TOTAL STREAM AREA(ACRES) =     3.93
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.41

****************************************************************************
 FLOW PROCESS FROM NODE    580.00 TO NODE    582.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   110.00
 UPSTREAM ELEVATION(FEET) =    378.00
 DOWNSTREAM ELEVATION(FEET) =    376.50
 ELEVATION DIFFERENCE(FEET) =      1.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.245
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    68.64
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.131
 SUBAREA RUNOFF(CFS) =      0.52
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
 FLOW PROCESS FROM NODE    582.00 TO NODE    584.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  376.50  DOWNSTREAM ELEVATION(FEET) =  370.50
  STREET LENGTH(FEET) =   478.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.04
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.61
    SPLIT DEPTH(FEET) =    0.25   SPLIT FLOOD WIDTH(FEET) =    6.33
    SPLIT FLOW(CFS) =    0.97   SPLIT VELOCITY(FEET/SEC.) =    1.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
  STREET FLOW TRAVEL TIME(MIN.) =   3.05   Tc(MIN.) =    8.30
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.561
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    2.79      SUBAREA RUNOFF(CFS) =    9.03
  TOTAL AREA(ACRES) =        2.9        PEAK FLOW RATE(CFS) =       9.42

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.78   DEPTH*VELOCITY(FT*FT/SEC.) =   1.05
  LONGEST FLOWPATH FROM NODE    580.00 TO NODE    584.00 =     588.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    584.00 TO NODE    584.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.30
  RAINFALL INTENSITY(INCH/HR) =   4.56
  TOTAL STREAM AREA(ACRES) =     2.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.42

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       11.41    10.21        3.990          3.93
      2        9.42     8.30        4.561          2.91

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
```



```
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       19.41     8.30        4.561
      2       19.66    10.21        3.990

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.66   Tc(MIN.) =   10.21
  TOTAL AREA(ACRES) =        6.8
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    584.00 =    1113.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    584.00 TO NODE    586.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   370.50  DOWNSTREAM(FEET) =   315.00
  FLOW LENGTH(FEET) =   161.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  32.25
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.66
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   10.29
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    586.00 =    1274.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    586.00 TO NODE    586.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY     AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
      1       19.66    10.29        3.969         6.84
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    586.00 =    1274.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY     AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
      1       51.11     9.25        4.251        19.77
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    586.00 =    1988.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      68.78       9.25        4.251
      2      67.38      10.29        3.969

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      68.78   Tc(MIN.) =    9.25
  TOTAL AREA(ACRES) =       26.6

****************************************************************************
  FLOW PROCESS FROM NODE    586.00 TO NODE    586.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    586.00 TO NODE    594.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   315.00  DOWNSTREAM(FEET) =   295.00
  FLOW LENGTH(FEET) =   186.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.11
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      68.78
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.36
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    594.00 =    2174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE    594.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.36
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =    26.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     68.78

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    592.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    382.20
  DOWNSTREAM ELEVATION(FEET) =    378.00
  ELEVATION DIFFERENCE(FEET) =      4.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.339
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    87.83
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    592.00 TO NODE    594.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  378.00  DOWNSTREAM ELEVATION(FEET) =  295.00
  STREET LENGTH(FEET) =   826.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
```



```
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.83
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.91
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.67
  STREET FLOW TRAVEL TIME(MIN.) =   2.33   Tc(MIN.) =    4.67
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.25      SUBAREA RUNOFF(CFS) =    6.88
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       7.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.17
  FLOW VELOCITY(FEET/SEC.) =  6.73   DEPTH*VELOCITY(FT*FT/SEC.) =   2.22
  LONGEST FLOWPATH FROM NODE    590.00 TO NODE    594.00 =     918.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE    594.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.67
  RAINFALL INTENSITY(INCH/HR) =   6.32
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.76

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       68.78     9.36        4.219         26.61
      2        7.76     4.67        6.323          1.41

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       42.05     4.67       6.323
      2       73.96     9.36       4.219

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      73.96   Tc(MIN.) =    9.36
  TOTAL AREA(ACRES) =       28.0
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    594.00 =    2174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE      1.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   295.00  DOWNSTREAM(FEET) =   294.00
```

```
  FLOW LENGTH(FEET) =    71.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.34
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      73.96
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    9.45
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE      1.00 =    2245.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE      1.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.193
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6113
  SUBAREA AREA(ACRES) =    2.07   SUBAREA RUNOFF(CFS) =    3.04
  TOTAL AREA(ACRES) =       30.1   TOTAL RUNOFF(CFS) =      77.13
  TC(MIN.) =    9.45

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE     27.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   294.00  DOWNSTREAM(FEET) =   285.00
  FLOW LENGTH(FEET) =    98.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  27.54
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      77.13
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    9.51
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE     27.00 =    2343.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| BEGIN OFFSITE HYD                                                        |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE     23.00 TO NODE     24.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    66.00
  UPSTREAM ELEVATION(FEET) =    476.00
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =     16.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.091
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
```



```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.250
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE     25.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    372.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   336.00   CHANNEL SLOPE =  0.2619
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.35
  FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.18   Tc(MIN.) =    6.27
  LONGEST FLOWPATH FROM NODE     23.00 TO NODE     25.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE     25.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.464
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    2.46   SUBAREA RUNOFF(CFS) =    4.70
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =       5.01
  TC(MIN.) =    6.27

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     26.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   372.00  DOWNSTREAM(FEET) =   305.00
  FLOW LENGTH(FEET) =   897.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.69
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.01
  PIPE TRAVEL TIME(MIN.) =   1.18    Tc(MIN.) =    7.45
  LONGEST FLOWPATH FROM NODE     23.00 TO NODE     26.00 =    1299.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     26.00 TO NODE     27.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   305.00  DOWNSTREAM(FEET) =   284.00
  FLOW LENGTH(FEET) =   185.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.72
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.01
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.66
```

```
 LONGEST FLOWPATH FROM NODE     23.00 TO NODE     27.00 =    1484.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        5.01     7.66       4.803        2.62
 LONGEST FLOWPATH FROM NODE     23.00 TO NODE     27.00 =    1484.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       77.13     9.51       4.176       30.09
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     27.00 =    2343.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      67.12       7.66        4.803
     2      81.49       9.51        4.176

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      81.49   Tc(MIN.) =    9.51
 TOTAL AREA(ACRES) =       32.7

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   283.90  DOWNSTREAM(FEET) =   264.00
 FLOW LENGTH(FEET) =   343.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  23.49
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      81.49
 PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    9.75
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     28.00 =    2686.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.75
 RAINFALL INTENSITY(INCH/HR) =   4.11
 TOTAL STREAM AREA(ACRES) =    32.71
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     81.49
```



```
****************************************************************************
 FLOW PROCESS FROM NODE    600.00 TO NODE    602.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
 UPSTREAM ELEVATION(FEET) =    296.00
 DOWNSTREAM ELEVATION(FEET) =    285.00
 ELEVATION DIFFERENCE(FEET) =     11.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.664
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.66
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.66

****************************************************************************
 FLOW PROCESS FROM NODE    602.00 TO NODE     28.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  285.00  DOWNSTREAM ELEVATION(FEET) =  262.00
 STREET LENGTH(FEET) =   386.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.26
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.26
   HALFSTREET FLOOD WIDTH(FEET) =    6.52
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.16
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.07
 STREET FLOW TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =    3.21
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =    0.58      SUBAREA RUNOFF(CFS) =    3.19
 TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       3.85

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.39
 FLOW VELOCITY(FEET/SEC.) =  4.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE     28.00 =     461.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 3.21
RAINFALL INTENSITY(INCH/HR) = 6.32
TOTAL STREAM AREA(ACRES) = 0.70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.85

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	81.49	9.75	4.109	32.71
2	3.85	3.21	6.323	0.70

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	30.68	3.21	6.323
2	83.99	9.75	4.109

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 83.99 Tc(MIN.) = 9.75
TOTAL AREA(ACRES) = 33.4
LONGEST FLOWPATH FROM NODE 501.00 TO NODE 28.00 = 2686.00 FEET.

****

FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 11

>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	83.99	9.75	4.109	33.41

LONGEST FLOWPATH FROM NODE 501.00 TO NODE 28.00 = 2686.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	91.67	19.51	2.628	63.88

LONGEST FLOWPATH FROM NODE 110.00 TO NODE 28.00 = 4412.60 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	129.82	9.75	4.109
2	145.38	19.51	2.628

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 145.38 Tc(MIN.) = 19.51
TOTAL AREA(ACRES) = 97.3

****

FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 12

>>>>>CLEAR MEMORY BANK # 1 <<<<<

****

FLOW PROCESS FROM NODE 28.00 TO NODE 126.00 IS CODE = 52

>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 248.00 DOWNSTREAM(FEET) = 232.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 249.00 CHANNEL SLOPE = 0.0643
CHANNEL FLOW THRU SUBAREA(CFS) = 145.38
FLOW VELOCITY(FEET/SEC) = 13.48 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 0.31 Tc(MIN.) = 19.82
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 126.00 = 4661.60 FEET.

****

FLOW PROCESS FROM NODE 126.00 TO NODE 126.00 IS CODE = 1

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 19.82
RAINFALL INTENSITY(INCH/HR) = 2.60
TOTAL STREAM AREA(ACRES) = 97.29
PEAK FLOW RATE(CFS) AT CONFLUENCE = 145.38

****

FLOW PROCESS FROM NODE 30.00 TO NODE 32.00 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 88
INITIAL SUBAREA FLOW-LENGTH(FEET) = 123.00
UPSTREAM ELEVATION(FEET) = 452.00
DOWNSTREAM ELEVATION(FEET) = 420.00
ELEVATION DIFFERENCE(FEET) = 32.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.267
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 100.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.466
SUBAREA RUNOFF(CFS) = 0.63
TOTAL AREA(ACRES) = 0.33 TOTAL RUNOFF(CFS) = 0.63

****

FLOW PROCESS FROM NODE 32.00 TO NODE 34.00 IS CODE = 52

>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 420.00 DOWNSTREAM(FEET) = 418.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 391.00 CHANNEL SLOPE = 0.0051
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 0.63
FLOW VELOCITY(FEET/SEC) = 1.07 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 6.07 Tc(MIN.) = 12.34
LONGEST FLOWPATH FROM NODE 30.00 TO NODE 34.00 = 514.00 FEET.

****

FLOW PROCESS FROM NODE 32.00 TO NODE 34.00 IS CODE = 81

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.531
  RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .6300
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5973
  SUBAREA AREA(ACRES) =    2.50   SUBAREA RUNOFF(CFS) =    5.56
  TOTAL AREA(ACRES) =        2.8   TOTAL RUNOFF(CFS) =       5.97
  TC(MIN.) =   12.34

********************************************************************************
  FLOW PROCESS FROM NODE     34.00 TO NODE    126.00 IS CODE =  52
--------------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    418.00  DOWNSTREAM(FEET) =    232.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1437.70   CHANNEL SLOPE =  0.1294
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.97
  FLOW VELOCITY(FEET/SEC) =   6.96 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.44   Tc(MIN.) =   15.78
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE    126.00 =    1951.70 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     34.00 TO NODE    126.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.012
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3846
  SUBAREA AREA(ACRES) =   17.40   SUBAREA RUNOFF(CFS) =   18.35
  TOTAL AREA(ACRES) =       20.2   TOTAL RUNOFF(CFS) =      23.44
  TC(MIN.) =   15.78

********************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.78
  RAINFALL INTENSITY(INCH/HR) =   3.01
  TOTAL STREAM AREA(ACRES) =    20.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      145.38    19.82        2.601         97.29
      2       23.44    15.78        3.012         20.23

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```



```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      139.23    15.78        3.012
      2      165.62    19.82        2.601

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     165.62   Tc(MIN.) =   19.82
  TOTAL AREA(ACRES) =      117.5
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    126.00 =    4661.60 FEET.

+----------------------------------------------------------------------------+
| EDN PROPOSED CONDITION HYD                                                 |
| SUNBOW PA-23                                                               |
|                                                                            |
+----------------------------------------------------------------------------+
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      117.5  TC(MIN.) =     19.82
  PEAK FLOW RATE(CFS)   =     165.62
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

PROPOSED CONDITION (ATTENUATED)

```
************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2015 Advanced Engineering Software (aes)
              Ver. 22.0 Release Date: 07/01/2015  License ID 1239

                            Analysis prepared by:




------------------------------------------------------------------------
  FILE NAME: R:\1561\HYD\DR\CALCS\TM\AES\PRATT.DAT
  TIME/DATE OF STUDY: 12:36 06/19/2020
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.400
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   12.0      6.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0160
  2   15.0      7.5    0.020/0.020/0.020   0.33    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+-------------------------------------------------------------------------+
| APPLY THE ATTENUATED FLOW DATA AS BASIN INFLOW                          |
|                                                                         |
|                                                                         |
+-------------------------------------------------------------------------+

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    88.00
  UPSTREAM ELEVATION(FEET) =    474.00
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =     14.00
```



```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.879
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.696
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.40

************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    438.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   317.00   CHANNEL SLOPE =  0.0694
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.40
  FLOW VELOCITY(FEET/SEC) =   3.95 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.34   Tc(MIN.) =    7.22
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     405.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  81
------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
========================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.991
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    1.73   SUBAREA RUNOFF(CFS) =    3.02
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =       3.37
  TC(MIN.) =    7.22

************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    128.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   403.20
  FLOW LENGTH(FEET) =   594.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.37
  PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =    8.17
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =     999.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    128.00 IS CODE =  10
------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
========================================================================

************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   342.00
  UPSTREAM ELEVATION(FEET) =    464.00
  DOWNSTREAM ELEVATION(FEET) =    434.00
  ELEVATION DIFFERENCE(FEET) =     30.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.546
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.315
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    114.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   434.00  DOWNSTREAM(FEET) =   408.60
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   0.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.54
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.35
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    6.64
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.64
  RAINFALL INTENSITY(INCH/HR) =   5.27
  TOTAL STREAM AREA(ACRES) =     0.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  UPSTREAM ELEVATION(FEET) =    440.00
  DOWNSTREAM ELEVATION(FEET) =    412.00
  ELEVATION DIFFERENCE(FEET) =     28.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.42
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.42
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.27
  RAINFALL INTENSITY(INCH/HR) =   5.47
  TOTAL STREAM AREA(ACRES) =     0.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.42

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.35     6.64        5.265          0.19
      2        0.42     6.27        5.466          0.22

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        0.75     6.27       5.466
      2        0.76     6.64       5.265

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       0.76   Tc(MIN.) =    6.64
  TOTAL AREA(ACRES) =        0.4
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    114.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   408.00  DOWNSTREAM(FEET) =   402.70
  FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.33
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.76
  PIPE TRAVEL TIME(MIN.) =   3.25    Tc(MIN.) =    9.89
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    124.00 =    1052.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.89
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     0.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.76

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  21
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    460.00
  DOWNSTREAM ELEVATION(FEET) =    420.00
  ELEVATION DIFFERENCE(FEET) =     40.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    124.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  408.60  DOWNSTREAM ELEVATION(FEET) =  402.70
  STREET LENGTH(FEET) =   788.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.15
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.01
    SPLIT DEPTH(FEET) =    0.27   SPLIT FLOOD WIDTH(FEET) =    7.27
    SPLIT FLOW(CFS) =    1.01   SPLIT VELOCITY(FEET/SEC.) =    1.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.01
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
  STREET FLOW TRAVEL TIME(MIN.) =   6.52   Tc(MIN.) =   12.79
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.451
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.695
  SUBAREA AREA(ACRES) =    3.17      SUBAREA RUNOFF(CFS) =    7.77
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =       7.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.20   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =     888.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =   1
----------------------------------------------------------------------------
```



```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.79
  RAINFALL INTENSITY(INCH/HR) =   3.45
  TOTAL STREAM AREA(ACRES) =     3.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.94

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.76     9.89        4.072          0.41
      2        7.94    12.79        3.451          3.31

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.90     9.89       4.072
      2        8.58    12.79       3.451

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.58   Tc(MIN.) =   12.79
  TOTAL AREA(ACRES) =        3.7
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    124.00 =    1052.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.70  DOWNSTREAM(FEET) =   402.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.36
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.58
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   12.92
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    127.00 =    1112.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.92
  RAINFALL INTENSITY(INCH/HR) =   3.43
  TOTAL STREAM AREA(ACRES) =     3.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.58

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    123.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
```

```
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   143.00
 UPSTREAM ELEVATION(FEET) =    474.00
 DOWNSTREAM ELEVATION(FEET) =    460.00
 ELEVATION DIFFERENCE(FEET) =     14.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.311
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.441
 SUBAREA RUNOFF(CFS) =      0.34
 TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.34

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    125.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    440.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   229.00   CHANNEL SLOPE =  0.0873
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.34
 FLOW VELOCITY(FEET/SEC) =   4.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.86   Tc(MIN.) =    7.17
 LONGEST FLOWPATH FROM NODE    121.00 TO NODE    125.00 =     372.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    125.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.011
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    1.39   SUBAREA RUNOFF(CFS) =    2.44
 TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =       2.75
 TC(MIN.) =    7.17

****************************************************************************
 FLOW PROCESS FROM NODE    125.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   408.00  DOWNSTREAM(FEET) =   402.00
 FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.76
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.75
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    7.89
 LONGEST FLOWPATH FROM NODE    121.00 TO NODE    127.00 =     662.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```



```
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.89
 RAINFALL INTENSITY(INCH/HR) =   4.71
 TOTAL STREAM AREA(ACRES) =     1.57
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.75

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        8.58    12.92        3.428          3.72
     2        2.75     7.89        4.713          1.57

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        8.99     7.89       4.713
     2       10.58    12.92       3.428

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      10.58   Tc(MIN.) =   12.92
 TOTAL AREA(ACRES) =        5.3
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    127.00 =    1112.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   404.00  DOWNSTREAM(FEET) =   403.20
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.14
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      10.58
 PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   13.11
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    128.00 =    1192.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    128.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       10.58    13.11       3.396        5.29
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    128.00 =    1192.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        3.37     8.17       4.607        1.93
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =     999.00 FEET.

 ** PEAK FLOW RATE TABLE **
```

```
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       9.97       8.17        4.607
      2      13.07      13.11        3.396

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.07   Tc(MIN.) =   13.11
  TOTAL AREA(ACRES) =        7.2

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    128.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   403.20  DOWNSTREAM(FEET) =   402.45
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.87
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.07
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   13.15
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    134.00 =    1222.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.15
  RAINFALL INTENSITY(INCH/HR) =   3.39
  TOTAL STREAM AREA(ACRES) =     7.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.07

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   101.00
  UPSTREAM ELEVATION(FEET) =    450.00
  DOWNSTREAM ELEVATION(FEET) =    417.00
  ELEVATION DIFFERENCE(FEET) =     33.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.23
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  417.00  DOWNSTREAM ELEVATION(FEET) =  402.45
  STREET LENGTH(FEET) =   673.30   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.49
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.08
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.08
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   3.65   Tc(MIN.) =    9.91
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.067
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.589
  SUBAREA AREA(ACRES) =    2.70      SUBAREA RUNOFF(CFS) =    6.59
  TOTAL AREA(ACRES) =        2.8        PEAK FLOW RATE(CFS) =       6.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  3.42   DEPTH*VELOCITY(FT*FT/SEC.) =   1.25
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     774.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.91
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     2.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.76

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       13.07    13.15        3.388          7.22
      2        6.76     9.91        4.067          2.82

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       16.61     9.91       4.067
      2       18.70    13.15       3.388

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.70   Tc(MIN.) =   13.15
  TOTAL AREA(ACRES) =       10.0
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    134.00 =    1222.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    146.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.45  DOWNSTREAM(FEET) =   392.90
  FLOW LENGTH(FEET) =   352.60   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.30
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.70
  PIPE TRAVEL TIME(MIN.) =   0.48    Tc(MIN.) =   13.63
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    146.00 =    1574.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================


****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   106.00
  UPSTREAM ELEVATION(FEET) =    435.00
  DOWNSTREAM ELEVATION(FEET) =    415.00
  ELEVATION DIFFERENCE(FEET) =     20.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.46
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    144.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  415.60  DOWNSTREAM ELEVATION(FEET) =  398.00
  STREET LENGTH(FEET) =   643.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
```



```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.10
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.27
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.49
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.16
  STREET FLOW TRAVEL TIME(MIN.) =   3.07   Tc(MIN.) =    7.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.978
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    7.17
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =       7.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  3.85   DEPTH*VELOCITY(FT*FT/SEC.) =   1.41
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    144.00 =     749.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    144.00 TO NODE    145.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   398.00  DOWNSTREAM(FEET) =   393.00
  FLOW LENGTH(FEET) =   185.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.82
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.53
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    7.56
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    145.00 =     934.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.56
  RAINFALL INTENSITY(INCH/HR) =   4.84
  TOTAL STREAM AREA(ACRES) =     2.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.53

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    143.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =    407.00
  DOWNSTREAM ELEVATION(FEET) =    406.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.640
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    55.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.810
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    145.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  406.00  DOWNSTREAM ELEVATION(FEET) =  393.00
  STREET LENGTH(FEET) =   478.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.31
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.10
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
  STREET FLOW TRAVEL TIME(MIN.) =   2.57   Tc(MIN.) =   10.21
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.990
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    1.49      SUBAREA RUNOFF(CFS) =    3.57
  TOTAL AREA(ACRES) =        1.7        PEAK FLOW RATE(CFS) =       4.00

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.17
  FLOW VELOCITY(FEET/SEC.) =  3.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    145.00 =     628.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    145.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.21
  RAINFALL INTENSITY(INCH/HR) =   3.99
```



```
  TOTAL STREAM AREA(ACRES) =     1.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        7.53     7.56        4.844          2.52
      2        4.00    10.21        3.990          1.67

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       10.49     7.56       4.844
      2       10.20    10.21       3.990

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.49   Tc(MIN.) =    7.56
  TOTAL AREA(ACRES) =        4.2
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    145.00 =     934.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    146.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   394.00  DOWNSTREAM(FEET) =   393.00
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.49
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.63
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    146.00 =     979.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       10.49     7.63       4.813        4.19
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    146.00 =     979.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       18.70    13.63       3.311       10.04
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    146.00 =    1574.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      20.96       7.63        4.813
      2      25.91      13.63        3.311

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      25.91   Tc(MIN.) =   13.63
  TOTAL AREA(ACRES) =       14.2

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    146.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    154.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.90  DOWNSTREAM(FEET) =   391.00
  FLOW LENGTH(FEET) =    84.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.44
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.91
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   13.74
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    154.00 =    1658.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.74
  RAINFALL INTENSITY(INCH/HR) =   3.29
  TOTAL STREAM AREA(ACRES) =    14.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     25.91

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    152.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   140.00
  UPSTREAM ELEVATION(FEET) =    401.00
  DOWNSTREAM ELEVATION(FEET) =    400.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.563
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.43
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.842
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    152.00 TO NODE    154.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
```



```
  UPSTREAM ELEVATION(FEET) =  400.00  DOWNSTREAM ELEVATION(FEET) =  391.00
  STREET LENGTH(FEET) =   358.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.28
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.02
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.86
  STREET FLOW TRAVEL TIME(MIN.) =   1.99   Tc(MIN.) =    9.56
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.164
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    3.50
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       3.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.27
  FLOW VELOCITY(FEET/SEC.) =  3.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    154.00 =     498.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.56
  RAINFALL INTENSITY(INCH/HR) =   4.16
  TOTAL STREAM AREA(ACRES) =     1.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.95

****************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    153.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   140.00
  UPSTREAM ELEVATION(FEET) =    401.00
  DOWNSTREAM ELEVATION(FEET) =    400.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.563
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.43
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.842
```

```
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    153.00 TO NODE    154.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  400.00  DOWNSTREAM ELEVATION(FEET) =  391.40
  STREET LENGTH(FEET) =   358.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.22
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    5.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
  STREET FLOW TRAVEL TIME(MIN.) =   2.32   Tc(MIN.) =    9.88
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.076
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    0.57      SUBAREA RUNOFF(CFS) =    1.39
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       1.83

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.36
  FLOW VELOCITY(FEET/SEC.) =  2.78   DEPTH*VELOCITY(FT*FT/SEC.) =   0.76
  LONGEST FLOWPATH FROM NODE    151.00 TO NODE    154.00 =     498.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.88
  RAINFALL INTENSITY(INCH/HR) =   4.08
  TOTAL STREAM AREA(ACRES) =     0.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.83

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       25.91    13.74        3.294         14.23
      2        3.95     9.56        4.164          1.58
      3        1.83     9.88        4.076          0.75

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```



```
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       23.74     9.56        4.164
      2       24.32     9.88        4.076
      3       30.52    13.74        3.294

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      30.52   Tc(MIN.) =   13.74
  TOTAL AREA(ACRES) =       16.6
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    154.00 =    1658.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   391.40  DOWNSTREAM(FEET) =   390.10
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.32
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.52
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   13.77
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    169.00 =    1688.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    162.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   108.00
  UPSTREAM ELEVATION(FEET) =    396.00
  DOWNSTREAM ELEVATION(FEET) =    395.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.707
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    62.78
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.807
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    164.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  396.00  DOWNSTREAM ELEVATION(FEET) =  392.30
```

```
  STREET LENGTH(FEET) =   340.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.36
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.75
  STREET FLOW TRAVEL TIME(MIN.) =   2.53   Tc(MIN.) =    8.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.583
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    4.23
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       4.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.43   DEPTH*VELOCITY(FT*FT/SEC.) =   0.89
  LONGEST FLOWPATH FROM NODE    160.00 TO NODE    164.00 =     448.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    168.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.30  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =   233.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.97
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.65
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =    8.89
  LONGEST FLOWPATH FROM NODE    160.00 TO NODE    168.00 =     681.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.89
  RAINFALL INTENSITY(INCH/HR) =   4.36
  TOTAL STREAM AREA(ACRES) =     1.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.65

****************************************************************************
  FLOW PROCESS FROM NODE    161.00 TO NODE    163.00 IS CODE =  21
----------------------------------------------------------------------------
```



```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   118.00
  UPSTREAM ELEVATION(FEET) =    396.00
  DOWNSTREAM ELEVATION(FEET) =    395.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.766
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.42
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.768
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    168.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  395.00  DOWNSTREAM ELEVATION(FEET) =  390.00
  STREET LENGTH(FEET) =   580.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.50
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.16
    SPLIT DEPTH(FEET) =    0.16   SPLIT FLOOD WIDTH(FEET) =    1.54
    SPLIT FLOW(CFS) =    0.13   SPLIT VELOCITY(FEET/SEC.) =    0.94
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.16
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
  STREET FLOW TRAVEL TIME(MIN.) =   4.47   Tc(MIN.) =   10.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.983
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    5.94
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       6.31

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.16   DEPTH*VELOCITY(FT*FT/SEC.) =   0.79
  LONGEST FLOWPATH FROM NODE    161.00 TO NODE    168.00 =     698.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.24
 RAINFALL INTENSITY(INCH/HR) =   3.98
 TOTAL STREAM AREA(ACRES) =     2.23
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.31

****************************************************************************
 FLOW PROCESS FROM NODE    165.00 TO NODE    167.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   121.00
 UPSTREAM ELEVATION(FEET) =    394.20
 DOWNSTREAM ELEVATION(FEET) =    392.80
 ELEVATION DIFFERENCE(FEET) =      1.40
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.456
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    66.57
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.977
 SUBAREA RUNOFF(CFS) =      0.64
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.64

****************************************************************************
 FLOW PROCESS FROM NODE    167.00 TO NODE    168.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  392.80  DOWNSTREAM ELEVATION(FEET) =  390.00
 STREET LENGTH(FEET) =   284.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.58
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    8.39
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.92
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
 STREET FLOW TRAVEL TIME(MIN.) =   2.47   Tc(MIN.) =    7.92
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.699
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
```



```
 SUBAREA AREA(ACRES) =    0.56      SUBAREA RUNOFF(CFS) =    1.87
 TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       2.37

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.08
 FLOW VELOCITY(FEET/SEC.) =  2.09   DEPTH*VELOCITY(FT*FT/SEC.) =   0.68
 LONGEST FLOWPATH FROM NODE    165.00 TO NODE    168.00 =     405.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    168.00 TO NODE    169.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   391.00  DOWNSTREAM(FEET) =   390.50
 FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.99
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.37
 PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    8.09
 LONGEST FLOWPATH FROM NODE    165.00 TO NODE    169.00 =     455.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.09
 RAINFALL INTENSITY(INCH/HR) =   4.64
 TOTAL STREAM AREA(ACRES) =     0.71
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.37

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        4.65     8.89        4.364          1.43
     2        6.31    10.24        3.983          2.23
     3        2.37     8.09        4.636          0.71

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       11.59     8.09       4.636
     2       12.36     8.89       4.364
     3       12.59    10.24       3.983

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.59   Tc(MIN.) =   10.24
 TOTAL AREA(ACRES) =        4.4
 LONGEST FLOWPATH FROM NODE    161.00 TO NODE    169.00 =     698.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
```

```
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       12.59    10.24       3.983        4.37
  LONGEST FLOWPATH FROM NODE    161.00 TO NODE    169.00 =     698.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       30.52    13.77       3.289       16.56
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    169.00 =    1688.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      35.27      10.24       3.983
      2      40.91      13.77       3.289

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.91   Tc(MIN.) =   13.77
  TOTAL AREA(ACRES) =       20.9

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    169.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.10  DOWNSTREAM(FEET) =   388.90
  FLOW LENGTH(FEET) =   113.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.30
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.91
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   13.96
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    198.00 =    1801.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    172.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =    440.00
  DOWNSTREAM ELEVATION(FEET) =    410.00
  ELEVATION DIFFERENCE(FEET) =     30.00
```



```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.33
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.33

****************************************************************************
  FLOW PROCESS FROM NODE    172.00 TO NODE    176.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  408.00  DOWNSTREAM ELEVATION(FEET) =  388.50
  STREET LENGTH(FEET) =   671.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.12
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.55
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.08
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.85
  STREET FLOW TRAVEL TIME(MIN.) =   3.63   Tc(MIN.) =    9.90
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.070
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.667
  SUBAREA AREA(ACRES) =    1.26      SUBAREA RUNOFF(CFS) =    3.64
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       3.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.89
  FLOW VELOCITY(FEET/SEC.) =  3.54   DEPTH*VELOCITY(FT*FT/SEC.) =   1.15
  LONGEST FLOWPATH FROM NODE    170.00 TO NODE    176.00 =     791.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.90
  RAINFALL INTENSITY(INCH/HR) =   4.07
  TOTAL STREAM AREA(ACRES) =     1.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.88

****************************************************************************
  FLOW PROCESS FROM NODE    171.00 TO NODE    173.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    394.50
  DOWNSTREAM ELEVATION(FEET) =    394.00
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.778
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.760
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.29

******************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    176.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  394.00  DOWNSTREAM ELEVATION(FEET) =  388.50
  STREET LENGTH(FEET) =   460.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.84
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.67
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.11
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
  STREET FLOW TRAVEL TIME(MIN.) =   3.63   Tc(MIN.) =    9.41
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.206
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    1.02      SUBAREA RUNOFF(CFS) =    3.05
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.25

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.02
  FLOW VELOCITY(FEET/SEC.) =  2.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    171.00 TO NODE    176.00 =     520.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    176.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.41
  RAINFALL INTENSITY(INCH/HR) =   4.21
```



```
  TOTAL STREAM AREA(ACRES) =     1.09
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.25

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.88     9.90        4.070          1.43
      2        3.25     9.41        4.206          1.09

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.95     9.41       4.206
      2        7.03     9.90       4.070

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.03   Tc(MIN.) =    9.90
  TOTAL AREA(ACRES) =        2.5
  LONGEST FLOWPATH FROM NODE    170.00 TO NODE    176.00 =     791.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    176.00 TO NODE    198.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   388.50  DOWNSTREAM(FEET) =   388.25
  FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.64
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.03
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    9.96
  LONGEST FLOWPATH FROM NODE    170.00 TO NODE    198.00 =     816.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  11
------------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        7.03     9.96       4.054        2.52
  LONGEST FLOWPATH FROM NODE    170.00 TO NODE    198.00 =     816.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       40.91    13.96       3.261       20.93
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    198.00 =    1801.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      36.23       9.96        4.054
      2      46.57      13.96        3.261

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      46.57   Tc(MIN.) =   13.96
  TOTAL AREA(ACRES) =       23.5

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    182.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    409.50
  DOWNSTREAM ELEVATION(FEET) =    408.50
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.354
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    67.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.050
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    184.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  406.00  DOWNSTREAM ELEVATION(FEET) =  394.40
  STREET LENGTH(FEET) =   529.30   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.50
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.33
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.16
  STREET FLOW TRAVEL TIME(MIN.) =   2.65   Tc(MIN.) =    8.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.668
```



```
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.786
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    7.93
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       8.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  3.45   DEPTH*VELOCITY(FT*FT/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    184.00 =     609.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    184.00 TO NODE    196.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   394.50  DOWNSTREAM(FEET) =   390.50
  FLOW LENGTH(FEET) =   421.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.74
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.33
  PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =    9.04
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    196.00 =    1030.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    196.00 TO NODE    196.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.04
  RAINFALL INTENSITY(INCH/HR) =   4.31
  TOTAL STREAM AREA(ACRES) =     2.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.33

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    192.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    96.00
  UPSTREAM ELEVATION(FEET) =    404.00
  DOWNSTREAM ELEVATION(FEET) =    403.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.601
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.42
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.877
  SUBAREA RUNOFF(CFS) =      0.42
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.42

****************************************************************************
  FLOW PROCESS FROM NODE    192.00 TO NODE    194.00 IS CODE =  62
----------------------------------------------------------------------------
```

```
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==========================================================================
 UPSTREAM ELEVATION(FEET) =  403.00  DOWNSTREAM ELEVATION(FEET) =  395.30
 STREET LENGTH(FEET) =   704.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.75
   ***STREET FLOW SPLITS OVER STREET-CROWN***
   FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
   FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.43
   SPLIT DEPTH(FEET) =    0.34   SPLIT FLOOD WIDTH(FEET) =   10.83
   SPLIT FLOW(CFS) =    2.96   SPLIT VELOCITY(FEET/SEC.) =    2.29
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.37
   HALFSTREET FLOOD WIDTH(FEET) =   12.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.43
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.89
 STREET FLOW TRAVEL TIME(MIN.) =   4.82   Tc(MIN.) =   10.42
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.938
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    4.41      SUBAREA RUNOFF(CFS) =   12.33
 TOTAL AREA(ACRES) =        4.5        PEAK FLOW RATE(CFS) =      12.61

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  2.97   DEPTH*VELOCITY(FT*FT/SEC.) =   1.23
 LONGEST FLOWPATH FROM NODE    190.00 TO NODE    194.00 =     800.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    194.00 TO NODE    196.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   395.30  DOWNSTREAM(FEET) =   390.00
 FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  19.83
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.61
 PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   10.46
 LONGEST FLOWPATH FROM NODE    190.00 TO NODE    196.00 =     842.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    196.00 TO NODE    196.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```



```
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.46
 RAINFALL INTENSITY(INCH/HR) =   3.93
 TOTAL STREAM AREA(ACRES) =     4.51
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.61

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        8.33     9.04        4.314          2.27
     2       12.61    10.46        3.929          4.51

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       19.24     9.04        4.314
     2       20.19    10.46        3.929

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      20.19   Tc(MIN.) =   10.46
 TOTAL AREA(ACRES) =        6.8
 LONGEST FLOWPATH FROM NODE    180.00 TO NODE    196.00 =    1030.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    196.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   390.00  DOWNSTREAM(FEET) =   388.90
 FLOW LENGTH(FEET) =   115.30   MANNING'S N =  0.012
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.36
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      20.19
 PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   10.69
 LONGEST FLOWPATH FROM NODE    180.00 TO NODE    198.00 =    1145.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1       20.19    10.69       3.875        6.78
 LONGEST FLOWPATH FROM NODE    180.00 TO NODE    198.00 =    1145.60 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1       46.57    13.96       3.261       23.45
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    198.00 =    1801.60 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
```

```
     1      55.85      10.69        3.875
     2      63.57      13.96        3.261

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      63.57   Tc(MIN.) =   13.96
  TOTAL AREA(ACRES) =       30.2

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   388.90  DOWNSTREAM(FEET) =   379.20
  FLOW LENGTH(FEET) =   262.50   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.67
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      63.57
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   14.19
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    204.00 =    2064.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.19
  RAINFALL INTENSITY(INCH/HR) =   3.23
  TOTAL STREAM AREA(ACRES) =    30.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     63.57

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    392.80
  DOWNSTREAM ELEVATION(FEET) =    391.80
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.511
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    66.11
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.939
  SUBAREA RUNOFF(CFS) =      0.25
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  62
```



```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  391.80  DOWNSTREAM ELEVATION(FEET) =  379.20
  STREET LENGTH(FEET) =   481.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.37
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   2.96   Tc(MIN.) =    8.48
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.499
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    2.20
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.40

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.11
  FLOW VELOCITY(FEET/SEC.) =  3.09   DEPTH*VELOCITY(FT*FT/SEC.) =   0.89
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     571.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.48
  RAINFALL INTENSITY(INCH/HR) =   4.50
  TOTAL STREAM AREA(ACRES) =     0.75
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       63.57    14.19        3.226         30.23
      2        2.40     8.48        4.499          0.75

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       40.36     8.48       4.499
```

```
     2       65.29    14.19       3.226

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      65.29   Tc(MIN.) =   14.19
  TOTAL AREA(ACRES) =       31.0
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    204.00 =    2064.10 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE      2.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   375.00  DOWNSTREAM(FEET) =   374.00
  FLOW LENGTH(FEET) =    51.50   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.67
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      65.29
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   14.25
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE      2.00 =    2115.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE      2.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.218
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6174
  SUBAREA AREA(ACRES) =    1.74   SUBAREA RUNOFF(CFS) =    1.96
  TOTAL AREA(ACRES) =       32.7   TOTAL RUNOFF(CFS) =      65.29
  TC(MIN.) =   14.25
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    212.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   138.00
  UPSTREAM ELEVATION(FEET) =    392.60
  DOWNSTREAM ELEVATION(FEET) =    390.00
  ELEVATION DIFFERENCE(FEET) =      2.60
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.884
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    73.84
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.49
```



```
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    214.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  390.00  DOWNSTREAM ELEVATION(FEET) =  384.20
  STREET LENGTH(FEET) =   474.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.32
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.58
    SPLIT DEPTH(FEET) =    0.27   SPLIT FLOOD WIDTH(FEET) =    7.36
    SPLIT FLOW(CFS) =    1.31   SPLIT VELOCITY(FEET/SEC.) =    1.98
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
  STREET FLOW TRAVEL TIME(MIN.) =   3.07   Tc(MIN.) =    7.95
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.688
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    2.90      SUBAREA RUNOFF(CFS) =    9.65
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =      10.02

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  2.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.08
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    214.00 =     612.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    224.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   384.20  DOWNSTREAM(FEET) =   379.20
  FLOW LENGTH(FEET) =   526.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.02
  PIPE TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =    9.21
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    224.00 =    1138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    224.00 IS CODE =   1
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.21
  RAINFALL INTENSITY(INCH/HR) =   4.26
  TOTAL STREAM AREA(ACRES) =     3.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.02

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    222.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    396.70
  DOWNSTREAM ELEVATION(FEET) =    396.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.847
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    57.83
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.716
  SUBAREA RUNOFF(CFS) =      0.32
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.32

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    224.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  396.00  DOWNSTREAM ELEVATION(FEET) =  390.60
  STREET LENGTH(FEET) =   458.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.12
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   3.50   Tc(MIN.) =    9.34
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.225
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    1.18      SUBAREA RUNOFF(CFS) =    3.54
```



```
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       3.78

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.77
  FLOW VELOCITY(FEET/SEC.) =  2.52   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    224.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    224.00 TO NODE    224.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.34
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =     1.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.78

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.02     9.21        4.263          3.01
      2        3.78     9.34        4.225          1.26

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       13.75     9.21       4.263
      2       13.71     9.34       4.225

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.75   Tc(MIN.) =    9.21
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    224.00 =    1138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    224.00 TO NODE      2.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   375.40  DOWNSTREAM(FEET) =   374.00
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.76
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.75
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    9.52
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE      2.00 =    1278.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY     AREA
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       13.75     9.52       4.175        4.27
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE      2.00 =    1278.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       65.29    14.25       3.218       32.72
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE      2.00 =    2115.60 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      57.34       9.52       4.175
      2      75.88      14.25       3.218

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      75.88   Tc(MIN.) =   14.25
  TOTAL AREA(ACRES) =       37.0

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| APPLY THE ATTENUATED FLOW DATA AS BASIN INFLOW                           |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  59.25   RAIN INTENSITY(INCH/HOUR) =  1.28
  TOTAL AREA(ACRES) =    37.00   TOTAL RUNOFF(CFS) =      5.80

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE     10.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   374.00  DOWNSTREAM(FEET) =   310.00
  FLOW LENGTH(FEET) =   503.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.99
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.80
  PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =   59.77
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE     10.00 =    2618.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```



```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   59.77
  RAINFALL INTENSITY(INCH/HR) =   1.28
  TOTAL STREAM AREA(ACRES) =    37.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.80

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    232.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    379.20
  DOWNSTREAM ELEVATION(FEET) =    374.00
  ELEVATION DIFFERENCE(FEET) =      5.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.272
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    90.40
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.61
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.61

****************************************************************************
  FLOW PROCESS FROM NODE    232.00 TO NODE     10.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  374.00  DOWNSTREAM ELEVATION(FEET) =  320.00
  STREET LENGTH(FEET) =   480.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.61
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    5.89
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.37
  STREET FLOW TRAVEL TIME(MIN.) =   1.43   Tc(MIN.) =    3.70
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    0.73      SUBAREA RUNOFF(CFS) =    4.02
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       4.62
```

```
 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.92
 FLOW VELOCITY(FEET/SEC.) =  6.20   DEPTH*VELOCITY(FT*FT/SEC.) =   1.76
 LONGEST FLOWPATH FROM NODE    230.00 TO NODE     10.00 =     580.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    3.70
 RAINFALL INTENSITY(INCH/HR) =   6.32
 TOTAL STREAM AREA(ACRES) =     0.84
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.62

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        5.80    59.77        1.276         37.00
     2        4.62     3.70        6.323          0.84

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        4.98     3.70       6.323
     2        6.73    59.77       1.276

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       6.73   Tc(MIN.) =   59.77
 TOTAL AREA(ACRES) =       37.8
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     10.00 =    2618.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   320.00  DOWNSTREAM(FEET) =   276.20
 FLOW LENGTH(FEET) =   535.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  14.25
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       6.73
 PIPE TRAVEL TIME(MIN.) =   0.63    Tc(MIN.) =   60.40
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     14.00 =    3153.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   60.40
 RAINFALL INTENSITY(INCH/HR) =   1.27
```



```
 TOTAL STREAM AREA(ACRES) =    37.84
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.73

****************************************************************************
 FLOW PROCESS FROM NODE    231.00 TO NODE    233.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
 UPSTREAM ELEVATION(FEET) =    323.00
 DOWNSTREAM ELEVATION(FEET) =    315.00
 ELEVATION DIFFERENCE(FEET) =      8.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.489
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.55
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
 FLOW PROCESS FROM NODE    233.00 TO NODE     14.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  315.00  DOWNSTREAM ELEVATION(FEET) =  274.00
 STREET LENGTH(FEET) =   449.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.48
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =    6.05
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.12
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.26
 STREET FLOW TRAVEL TIME(MIN.) =   1.46   Tc(MIN.) =    2.95
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    3.85
 TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       4.40

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.11
 FLOW VELOCITY(FEET/SEC.) =  5.67   DEPTH*VELOCITY(FT*FT/SEC.) =   1.64
 LONGEST FLOWPATH FROM NODE    231.00 TO NODE     14.00 =     509.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    2.95
 RAINFALL INTENSITY(INCH/HR) =   6.32
 TOTAL STREAM AREA(ACRES) =     0.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.40

+--------------------------------------------------------------------------+
| APPLY THE ATTENUATED FLOW DATA AS BASIN INFLOW                           |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   134.00
 UPSTREAM ELEVATION(FEET) =    400.00
 DOWNSTREAM ELEVATION(FEET) =    350.00
 ELEVATION DIFFERENCE(FEET) =     50.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.38
 TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.38

****************************************************************************
 FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    350.00  DOWNSTREAM(FEET) =    260.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1386.00   CHANNEL SLOPE =  0.0649
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.38
 FLOW VELOCITY(FEET/SEC) =   3.82 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   6.04   Tc(MIN.) =   12.31
 LONGEST FLOWPATH FROM NODE     12.00 TO NODE     14.00 =    1520.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.536
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =   10.10   SUBAREA RUNOFF(CFS) =   12.50
```



```
 TOTAL AREA(ACRES) =       10.3   TOTAL RUNOFF(CFS) =      12.75
 TC(MIN.) =   12.31

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =   12.31
 RAINFALL INTENSITY(INCH/HR) =   3.54
 TOTAL STREAM AREA(ACRES) =    10.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.75

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        6.73    60.40        1.268         37.84
     2        4.40     2.95        6.323          0.80
     3       12.75    12.31        3.536         10.30

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1        8.81     2.95        6.323
     2       17.62    12.31        3.536
     3       12.19    60.40        1.268

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      17.62   Tc(MIN.) =   12.31
 TOTAL AREA(ACRES) =       48.9
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     14.00 =    3153.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     28.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    260.00  DOWNSTREAM(FEET) =    248.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  1259.00   CHANNEL SLOPE =  0.0095
 CHANNEL FLOW THRU SUBAREA(CFS) =      17.62
 FLOW VELOCITY(FEET/SEC) =   2.83 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   7.42   Tc(MIN.) =   19.73
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     28.00 =    4412.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     28.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.609
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.2314
 SUBAREA AREA(ACRES) =   14.95   SUBAREA RUNOFF(CFS) =   13.65
 TOTAL AREA(ACRES) =       63.9   TOTAL RUNOFF(CFS) =      38.56
```

```
 TC(MIN.) =   19.73

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    504.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   218.00
 UPSTREAM ELEVATION(FEET) =    402.60
 DOWNSTREAM ELEVATION(FEET) =    400.80
 ELEVATION DIFFERENCE(FEET) =      1.80
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.785
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    59.77
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.756
 SUBAREA RUNOFF(CFS) =      1.76
 TOTAL AREA(ACRES) =      0.43   TOTAL RUNOFF(CFS) =      1.76

****************************************************************************
 FLOW PROCESS FROM NODE    504.00 TO NODE    506.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   400.80  DOWNSTREAM(FEET) =   400.00
 FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.59
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.76
 PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    6.08
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =     298.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.08
 RAINFALL INTENSITY(INCH/HR) =   5.58
 TOTAL STREAM AREA(ACRES) =     0.43
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.76

****************************************************************************
 FLOW PROCESS FROM NODE    501.00 TO NODE    503.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
```



```
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    97.00
 UPSTREAM ELEVATION(FEET) =    445.00
 DOWNSTREAM ELEVATION(FEET) =    412.00
 ELEVATION DIFFERENCE(FEET) =     33.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.172
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.520
 SUBAREA RUNOFF(CFS) =      0.35
 TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
 FLOW PROCESS FROM NODE    503.00 TO NODE    506.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  406.00  DOWNSTREAM ELEVATION(FEET) =  403.50
 STREET LENGTH(FEET) =   264.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.54
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    8.39
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.88
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
 STREET FLOW TRAVEL TIME(MIN.) =   2.35   Tc(MIN.) =    8.52
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.485
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.641
 SUBAREA AREA(ACRES) =    0.76      SUBAREA RUNOFF(CFS) =    2.42
 TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       2.70

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.73
 FLOW VELOCITY(FEET/SEC.) =  2.13   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    506.00 =     361.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.52
 RAINFALL INTENSITY(INCH/HR) =   4.48
 TOTAL STREAM AREA(ACRES) =     0.94
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.70
```

```
 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        1.76     6.08        5.577          0.43
     2        2.70     8.52        4.485          0.94

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        3.68     6.08       5.577
     2        4.12     8.52       4.485

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       4.12   Tc(MIN.) =    8.52
 TOTAL AREA(ACRES) =        1.4
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    506.00 =     361.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    514.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   403.50  DOWNSTREAM(FEET) =   391.50
 FLOW LENGTH(FEET) =   379.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.82
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       4.12
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    9.23
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    514.00 =     740.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    506.00 TO NODE    514.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.257
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6890
 SUBAREA AREA(ACRES) =    1.72   SUBAREA RUNOFF(CFS) =    5.20
 TOTAL AREA(ACRES) =        3.1   TOTAL RUNOFF(CFS) =       9.06
 TC(MIN.) =    9.23

****************************************************************************
 FLOW PROCESS FROM NODE    514.00 TO NODE     22.50 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   391.50  DOWNSTREAM(FEET) =   387.90
 FLOW LENGTH(FEET) =   154.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.76
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```



```
 PIPE-FLOW(CFS) =       9.06
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    9.50
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     22.50 =     894.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE     22.50 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.50
 RAINFALL INTENSITY(INCH/HR) =   4.18
 TOTAL STREAM AREA(ACRES) =     3.09
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.06

****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   139.00
 UPSTREAM ELEVATION(FEET) =    468.00
 DOWNSTREAM ELEVATION(FEET) =    448.00
 ELEVATION DIFFERENCE(FEET) =     20.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.25
 TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    448.00  DOWNSTREAM(FEET) =    364.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   482.00   CHANNEL SLOPE =  0.1743
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.25
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.69   Tc(MIN.) =    7.96
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =     621.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.685
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    5.56   SUBAREA RUNOFF(CFS) =    9.12
```

```
 TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =       9.33
 TC(MIN.) =    7.96

****************************************************************************
 FLOW PROCESS FROM NODE     22.00 TO NODE     22.50 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   364.00  DOWNSTREAM(FEET) =   363.15
 FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.03
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.33
 PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    8.16
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.50 =     706.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE     22.50 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.16
 RAINFALL INTENSITY(INCH/HR) =   4.61
 TOTAL STREAM AREA(ACRES) =     5.69
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.33

****************************************************************************
 FLOW PROCESS FROM NODE     20.00 TO NODE     20.50 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    468.00
 DOWNSTREAM ELEVATION(FEET) =    450.00
 ELEVATION DIFFERENCE(FEET) =     18.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.21
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.21

****************************************************************************
 FLOW PROCESS FROM NODE     20.50 TO NODE     21.50 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    450.00  DOWNSTREAM(FEET) =    380.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   354.00   CHANNEL SLOPE =  0.1977
 NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =       0.21
 FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =    7.51
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     21.50 =     454.00 FEET.
```



```
****************************************************************************
 FLOW PROCESS FROM NODE     20.50 TO NODE     21.50 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.864
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
 SUBAREA AREA(ACRES) =    1.10   SUBAREA RUNOFF(CFS) =    1.87
 TOTAL AREA(ACRES) =        1.2   TOTAL RUNOFF(CFS) =       2.06
 TC(MIN.) =    7.51

****************************************************************************
 FLOW PROCESS FROM NODE     21.50 TO NODE     22.50 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   380.00  DOWNSTREAM(FEET) =   378.00
 FLOW LENGTH(FEET) =   195.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.84
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.06
 PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =    8.18
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.50 =     649.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE     22.50 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.18
 RAINFALL INTENSITY(INCH/HR) =   4.60
 TOTAL STREAM AREA(ACRES) =     1.21
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.06

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        9.06     9.50        4.181          3.09
     2        9.33     8.16        4.610          5.69
     3        2.06     8.18        4.602          1.21

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       19.60     8.16       4.610
     2       19.61     8.18       4.602
     3       19.40     9.50       4.181

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      19.61   Tc(MIN.) =    8.18
 TOTAL AREA(ACRES) =       10.0
```

```
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     22.50 =     894.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.50 TO NODE    524.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   386.52  DOWNSTREAM(FEET) =   381.20
 FLOW LENGTH(FEET) =   266.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.99
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      19.61
 PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    8.59
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    524.00 =    1160.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    524.00 TO NODE    524.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.59
 RAINFALL INTENSITY(INCH/HR) =   4.46
 TOTAL STREAM AREA(ACRES) =     9.99
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.61

****************************************************************************
 FLOW PROCESS FROM NODE    520.00 TO NODE    522.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.00
 UPSTREAM ELEVATION(FEET) =    391.60
 DOWNSTREAM ELEVATION(FEET) =    390.70
 ELEVATION DIFFERENCE(FEET) =      0.90
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.745
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    61.21
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.782
 SUBAREA RUNOFF(CFS) =      0.49
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
 FLOW PROCESS FROM NODE    522.00 TO NODE    524.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  390.00  DOWNSTREAM ELEVATION(FEET) =  381.20
 STREET LENGTH(FEET) =   353.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```



```
 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.57
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.26
   HALFSTREET FLOOD WIDTH(FEET) =    6.70
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.72
 STREET FLOW TRAVEL TIME(MIN.) =   2.13   Tc(MIN.) =    7.87
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.719
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    0.64      SUBAREA RUNOFF(CFS) =    2.14
 TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.55

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.48
 FLOW VELOCITY(FEET/SEC.) =  3.04   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
 LONGEST FLOWPATH FROM NODE    520.00 TO NODE    524.00 =     456.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    524.00 TO NODE    524.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.87
 RAINFALL INTENSITY(INCH/HR) =   4.72
 TOTAL STREAM AREA(ACRES) =     0.76
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.55

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       19.61     8.59        4.462          9.99
     2        2.55     7.87        4.719          0.76

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       21.09     7.87        4.719
     2       22.02     8.59        4.462

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      22.02   Tc(MIN.) =    8.59
 TOTAL AREA(ACRES) =       10.8
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    524.00 =    1160.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    524.00 TO NODE    556.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   381.00  DOWNSTREAM(FEET) =   380.40
 FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.62
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      22.02
 PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    8.70
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    556.00 =    1220.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    556.00 TO NODE    556.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    530.00 TO NODE    532.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    403.40
 DOWNSTREAM ELEVATION(FEET) =    401.80
 ELEVATION DIFFERENCE(FEET) =      1.60
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.057
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    71.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.277
 SUBAREA RUNOFF(CFS) =      0.49
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
 FLOW PROCESS FROM NODE    532.00 TO NODE    534.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  401.50  DOWNSTREAM ELEVATION(FEET) =  395.80
 STREET LENGTH(FEET) =   246.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.29
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.25
   HALFSTREET FLOOD WIDTH(FEET) =    6.23
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.56
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
```



```
 STREET FLOW TRAVEL TIME(MIN.) =   1.60   Tc(MIN.) =    6.66
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.255
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    1.60
 TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.01

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.73
 FLOW VELOCITY(FEET/SEC.) =  2.81   DEPTH*VELOCITY(FT*FT/SEC.) =   0.79
 LONGEST FLOWPATH FROM NODE    530.00 TO NODE    534.00 =     346.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    534.00 TO NODE    544.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   395.50  DOWNSTREAM(FEET) =   392.00
 FLOW LENGTH(FEET) =   153.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.39
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.01
 PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    7.06
 LONGEST FLOWPATH FROM NODE    530.00 TO NODE    544.00 =     499.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    544.00 TO NODE    544.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.06
 RAINFALL INTENSITY(INCH/HR) =   5.06
 TOTAL STREAM AREA(ACRES) =     0.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.01

****************************************************************************
 FLOW PROCESS FROM NODE    540.00 TO NODE    542.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    89.00
 UPSTREAM ELEVATION(FEET) =    397.60
 DOWNSTREAM ELEVATION(FEET) =    396.50
 ELEVATION DIFFERENCE(FEET) =      1.10
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.369
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    67.36
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.040
 SUBAREA RUNOFF(CFS) =      0.43
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.43
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    542.00 TO NODE    544.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  396.50  DOWNSTREAM ELEVATION(FEET) =  393.40
  STREET LENGTH(FEET) =   258.60   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.90
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.77
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.15
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
  STREET FLOW TRAVEL TIME(MIN.) =   2.01   Tc(MIN.) =    7.38
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.921
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.84      SUBAREA RUNOFF(CFS) =    2.94
  TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       3.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.11
  FLOW VELOCITY(FEET/SEC.) =  2.43   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    540.00 TO NODE    544.00 =     347.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    544.00 TO NODE    544.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.38
  RAINFALL INTENSITY(INCH/HR) =   4.92
  TOTAL STREAM AREA(ACRES) =     0.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.28

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.01     7.06        5.061         0.54
      2        3.28     7.38        4.921         0.94

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```



```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        5.16     7.06        5.061
      2        5.24     7.38        4.921

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.24   Tc(MIN.) =    7.38
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    544.00 =     499.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    544.00 TO NODE    545.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.00  DOWNSTREAM(FEET) =   388.00
  FLOW LENGTH(FEET) =   160.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.67
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.24
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    7.68
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    545.00 =     659.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    545.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.68
  RAINFALL INTENSITY(INCH/HR) =   4.79
  TOTAL STREAM AREA(ACRES) =     1.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.24

****************************************************************************
  FLOW PROCESS FROM NODE    541.00 TO NODE    543.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    397.60
  DOWNSTREAM ELEVATION(FEET) =    396.00
  ELEVATION DIFFERENCE(FEET) =      1.60
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.825
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    543.00 TO NODE    545.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) =  396.00  DOWNSTREAM ELEVATION(FEET) =  389.70
  STREET LENGTH(FEET) =   278.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.18
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.81
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.81
  STREET FLOW TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =    6.47
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.353
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.93      SUBAREA RUNOFF(CFS) =    3.53
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       3.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.36
  FLOW VELOCITY(FEET/SEC.) =  3.25   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE    541.00 TO NODE    545.00 =     358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    545.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.47
  RAINFALL INTENSITY(INCH/HR) =   5.35
  TOTAL STREAM AREA(ACRES) =     1.02
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.24     7.68        4.793          1.48
      2        3.88     6.47        5.353          1.02

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1        8.57     6.47        5.353
      2        8.71     7.68        4.793
```



```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.71   Tc(MIN.) =    7.68
  TOTAL AREA(ACRES) =        2.5
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    545.00 =     659.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    548.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   388.00  DOWNSTREAM(FEET) =   385.00
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.71
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    7.94
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    548.00 =     804.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    548.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.94
  RAINFALL INTENSITY(INCH/HR) =   4.69
  TOTAL STREAM AREA(ACRES) =     2.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.71

****************************************************************************
  FLOW PROCESS FROM NODE    546.00 TO NODE    547.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    393.90
  DOWNSTREAM ELEVATION(FEET) =    392.50
  ELEVATION DIFFERENCE(FEET) =      1.40
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.960
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    547.00 TO NODE    548.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  392.50  DOWNSTREAM ELEVATION(FEET) =  386.80
  STREET LENGTH(FEET) =   280.00   CURB HEIGHT(INCHES) =  6.0
```

```
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.28
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    8.39
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.82
 STREET FLOW TRAVEL TIME(MIN.) =   1.68   Tc(MIN.) =    6.64
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.264
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    1.00      SUBAREA RUNOFF(CFS) =    3.74
 TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.07

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.83
 FLOW VELOCITY(FEET/SEC.) =  3.16   DEPTH*VELOCITY(FT*FT/SEC.) =   1.08
 LONGEST FLOWPATH FROM NODE    546.00 TO NODE    548.00 =     360.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    548.00 TO NODE    548.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.64
 RAINFALL INTENSITY(INCH/HR) =   5.26
 TOTAL STREAM AREA(ACRES) =     1.09
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.07

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        8.71     7.94        4.691          2.50
     2        4.07     6.64        5.264          1.09

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       11.84     6.64       5.264
     2       12.34     7.94       4.691

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      12.34   Tc(MIN.) =    7.94
 TOTAL AREA(ACRES) =        3.6
 LONGEST FLOWPATH FROM NODE    530.00 TO NODE    548.00 =     804.00 FEET.
```



```
****************************************************************************
 FLOW PROCESS FROM NODE    548.00 TO NODE    554.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   384.50  DOWNSTREAM(FEET) =   383.00
 FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.75
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.34
 PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.04
 LONGEST FLOWPATH FROM NODE    530.00 TO NODE    554.00 =     864.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    554.00 TO NODE    554.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.04
 RAINFALL INTENSITY(INCH/HR) =   4.66
 TOTAL STREAM AREA(ACRES) =     3.59
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.34

****************************************************************************
 FLOW PROCESS FROM NODE    550.00 TO NODE    552.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   144.00
 UPSTREAM ELEVATION(FEET) =    403.00
 DOWNSTREAM ELEVATION(FEET) =    399.00
 ELEVATION DIFFERENCE(FEET) =      4.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.597
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    77.78
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.55
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
 FLOW PROCESS FROM NODE    552.00 TO NODE    554.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  398.80  DOWNSTREAM ELEVATION(FEET) =  383.00
 STREET LENGTH(FEET) =   675.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.33
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.12
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   3.60   Tc(MIN.) =    6.20
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.503
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.05      SUBAREA RUNOFF(CFS) =    5.03
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       5.51

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.95
  FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.30
  LONGEST FLOWPATH FROM NODE    550.00 TO NODE    554.00 =     819.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    554.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.20
  RAINFALL INTENSITY(INCH/HR) =   5.50
  TOTAL STREAM AREA(ACRES) =     1.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.51

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.34     8.04        4.656          3.59
      2        5.51     6.20        5.503          1.15

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       15.95     6.20       5.503
      2       17.00     8.04       4.656

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.00   Tc(MIN.) =    8.04
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    554.00 =     864.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    556.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```



```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   383.00  DOWNSTREAM(FEET) =   382.20
  FLOW LENGTH(FEET) =    36.70   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.07
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.00
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    8.09
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    556.00 =     900.70 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    556.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       17.00     8.09       4.635         4.74
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    556.00 =     900.70 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       22.02     8.70       4.423        10.75
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    556.00 =    1220.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      37.48       8.09        4.635
      2      38.24       8.70        4.423

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      38.24   Tc(MIN.) =    8.70
  TOTAL AREA(ACRES) =       15.5

****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    556.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    568.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   382.20  DOWNSTREAM(FEET) =   352.00
  FLOW LENGTH(FEET) =   388.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.64
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.24
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    9.00
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    568.00 =    1608.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    568.00 TO NODE    568.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.00
 RAINFALL INTENSITY(INCH/HR) =   4.33
 TOTAL STREAM AREA(ACRES) =    15.49
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     38.24

**************************************************************************
 FLOW PROCESS FROM NODE    560.00 TO NODE    562.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
 UPSTREAM ELEVATION(FEET) =    394.00
 DOWNSTREAM ELEVATION(FEET) =    384.50
 ELEVATION DIFFERENCE(FEET) =      9.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.091
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.45
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.45

**************************************************************************
 FLOW PROCESS FROM NODE    562.00 TO NODE    564.00 IS CODE =  62
--------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==========================================================================
 UPSTREAM ELEVATION(FEET) =  384.00  DOWNSTREAM ELEVATION(FEET) =  378.00
 STREET LENGTH(FEET) =   564.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.60
   ***STREET FLOW SPLITS OVER STREET-CROWN***
   FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
   FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.40
   SPLIT DEPTH(FEET) =    0.25   SPLIT FLOOD WIDTH(FEET) =    6.14
   SPLIT FLOW(CFS) =    0.86   SPLIT VELOCITY(FEET/SEC.) =    1.74
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.37
   HALFSTREET FLOOD WIDTH(FEET) =   12.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.40
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
 STREET FLOW TRAVEL TIME(MIN.) =   3.91   Tc(MIN.) =    7.01
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.087
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
```



```
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    8.31
 TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       8.67

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  2.55   DEPTH*VELOCITY(FT*FT/SEC.) =   0.96
 LONGEST FLOWPATH FROM NODE    560.00 TO NODE    564.00 =     654.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE    564.00 TO NODE    566.00 IS CODE =  31
--------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   378.00  DOWNSTREAM(FEET) =   374.20
 FLOW LENGTH(FEET) =   322.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.42
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       8.67
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    7.73
 LONGEST FLOWPATH FROM NODE    560.00 TO NODE    566.00 =     976.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE    564.00 TO NODE    566.00 IS CODE =  81
--------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.775
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7100
 SUBAREA AREA(ACRES) =    1.64   SUBAREA RUNOFF(CFS) =    5.56
 TOTAL AREA(ACRES) =        4.0   TOTAL RUNOFF(CFS) =      13.70
 TC(MIN.) =    7.73

**************************************************************************
 FLOW PROCESS FROM NODE    566.00 TO NODE    568.00 IS CODE =  31
--------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   374.00  DOWNSTREAM(FEET) =   350.00
 FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  23.28
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      13.70
 PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    7.82
 LONGEST FLOWPATH FROM NODE    560.00 TO NODE    568.00 =    1106.00 FEET.

**************************************************************************
 FLOW PROCESS FROM NODE    568.00 TO NODE    568.00 IS CODE =   1
--------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.82
```

```
 RAINFALL INTENSITY(INCH/HR) =   4.74
 TOTAL STREAM AREA(ACRES) =     4.04
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.70

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       38.24     9.00        4.328         15.49
     2       13.70     7.82        4.738          4.04

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       46.93     7.82       4.738
     2       50.75     9.00       4.328

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      50.75   Tc(MIN.) =    9.00
 TOTAL AREA(ACRES) =       19.5
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    568.00 =    1608.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    568.00 TO NODE     19.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   353.00  DOWNSTREAM(FEET) =   335.00
 FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  25.03
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      50.75
 PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    9.12
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     19.00 =    1788.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     19.00 TO NODE     19.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.12
 RAINFALL INTENSITY(INCH/HR) =   4.29
 TOTAL STREAM AREA(ACRES) =    19.53
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     50.75

****************************************************************************
 FLOW PROCESS FROM NODE     18.00 TO NODE     19.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   237.00
 UPSTREAM ELEVATION(FEET) =    370.00
 DOWNSTREAM ELEVATION(FEET) =    340.00
 ELEVATION DIFFERENCE(FEET) =     30.00
```



```
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
 SUBAREA RUNOFF(CFS) =      0.46
 TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
 FLOW PROCESS FROM NODE     19.00 TO NODE     19.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.27
 RAINFALL INTENSITY(INCH/HR) =   5.47
 TOTAL STREAM AREA(ACRES) =     0.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.46

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       50.75     9.12        4.291         19.53
     2        0.46     6.27        5.466          0.24

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       40.30     6.27       5.466
     2       51.11     9.12       4.291

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      51.11   Tc(MIN.) =    9.12
 TOTAL AREA(ACRES) =       19.8
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     19.00 =    1788.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     19.00 TO NODE    586.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   335.00  DOWNSTREAM(FEET) =   315.00
 FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  25.04
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      51.11
 PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    9.25
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    586.00 =    1988.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    586.00 TO NODE    586.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    570.00 TO NODE    572.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   104.00
  UPSTREAM ELEVATION(FEET) =    387.90
  DOWNSTREAM ELEVATION(FEET) =    387.00
  ELEVATION DIFFERENCE(FEET) =      0.90
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.752
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.96
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.777
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.37

****************************************************************************
  FLOW PROCESS FROM NODE    572.00 TO NODE    574.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  387.00  DOWNSTREAM ELEVATION(FEET) =  380.00
  STREET LENGTH(FEET) =   292.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.39
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.42
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.67
  STREET FLOW TRAVEL TIME(MIN.) =   1.86   Tc(MIN.) =    7.62
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.821
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
  SUBAREA AREA(ACRES) =    0.59      SUBAREA RUNOFF(CFS) =    2.02
  TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       2.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.20
  FLOW VELOCITY(FEET/SEC.) =  2.94   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    574.00 =     396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    574.00 TO NODE    575.00 IS CODE =  31
----------------------------------------------------------------------------
```



```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   380.00  DOWNSTREAM(FEET) =   376.80
  FLOW LENGTH(FEET) =   208.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.80
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.33
  PIPE TRAVEL TIME(MIN.) =   0.60    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    575.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    575.00 TO NODE    575.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.21
  RAINFALL INTENSITY(INCH/HR) =   4.59
  TOTAL STREAM AREA(ACRES) =     0.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.33

****************************************************************************
  FLOW PROCESS FROM NODE    571.00 TO NODE    573.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  92
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   117.00
  UPSTREAM ELEVATION(FEET) =    383.70
  DOWNSTREAM ELEVATION(FEET) =    383.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.062
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    52.95
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.585
  SUBAREA RUNOFF(CFS) =      0.48
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.48

****************************************************************************
  FLOW PROCESS FROM NODE    573.00 TO NODE    575.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  383.00  DOWNSTREAM ELEVATION(FEET) =  376.80
  STREET LENGTH(FEET) =   476.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
```

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 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.74
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.36
   HALFSTREET FLOOD WIDTH(FEET) =   11.48
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.60
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
 STREET FLOW TRAVEL TIME(MIN.) =   3.05   Tc(MIN.) =    9.11
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.294
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    2.13      SUBAREA RUNOFF(CFS) =    6.49
 TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       6.86

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  2.66   DEPTH*VELOCITY(FT*FT/SEC.) =   0.97
 LONGEST FLOWPATH FROM NODE    571.00 TO NODE    575.00 =     593.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    575.00 TO NODE    575.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.11
 RAINFALL INTENSITY(INCH/HR) =   4.29
 TOTAL STREAM AREA(ACRES) =     2.25
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.86

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        2.33     8.21        4.591          0.68
     2        6.86     9.11        4.294          2.25

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        8.51     8.21       4.591
     2        9.04     9.11       4.294

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       9.04   Tc(MIN.) =    9.11
 TOTAL AREA(ACRES) =        2.9
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    575.00 =     604.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    575.00 TO NODE    578.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   376.80  DOWNSTREAM(FEET) =   373.00
 FLOW LENGTH(FEET) =   320.00   MANNING'S N =  0.012
```



```
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.50
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       9.04
 PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =    9.82
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    578.00 =     924.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    575.00 TO NODE    578.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.090
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7100
 SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    2.90
 TOTAL AREA(ACRES) =        3.9   TOTAL RUNOFF(CFS) =      11.41
 TC(MIN.) =    9.82

****************************************************************************
 FLOW PROCESS FROM NODE    578.00 TO NODE    584.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   373.00  DOWNSTREAM(FEET) =   370.50
 FLOW LENGTH(FEET) =   189.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.16
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      11.41
 PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =   10.21
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    584.00 =    1113.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    584.00 TO NODE    584.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.21
 RAINFALL INTENSITY(INCH/HR) =   3.99
 TOTAL STREAM AREA(ACRES) =     3.93
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.41

****************************************************************************
 FLOW PROCESS FROM NODE    580.00 TO NODE    582.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   110.00
 UPSTREAM ELEVATION(FEET) =    378.00
 DOWNSTREAM ELEVATION(FEET) =    376.50
 ELEVATION DIFFERENCE(FEET) =      1.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.245
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    68.64
```

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         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.131
SUBAREA RUNOFF(CFS) =      0.52
TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
 FLOW PROCESS FROM NODE    582.00 TO NODE    584.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  376.50  DOWNSTREAM ELEVATION(FEET) =  370.50
 STREET LENGTH(FEET) =   478.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.04
   ***STREET FLOW SPLITS OVER STREET-CROWN***
   FULL DEPTH(FEET) =    0.37   FLOOD WIDTH(FEET) =   12.00
   FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.61
   SPLIT DEPTH(FEET) =    0.25   SPLIT FLOOD WIDTH(FEET) =    6.33
   SPLIT FLOW(CFS) =    0.97   SPLIT VELOCITY(FEET/SEC.) =    1.88
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.37
   HALFSTREET FLOOD WIDTH(FEET) =   12.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
 STREET FLOW TRAVEL TIME(MIN.) =   3.05   Tc(MIN.) =    8.30
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.561
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7100
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  92
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.710
 SUBAREA AREA(ACRES) =    2.79      SUBAREA RUNOFF(CFS) =    9.03
 TOTAL AREA(ACRES) =        2.9        PEAK FLOW RATE(CFS) =       9.42

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  2.78   DEPTH*VELOCITY(FT*FT/SEC.) =   1.05
 LONGEST FLOWPATH FROM NODE    580.00 TO NODE    584.00 =     588.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    584.00 TO NODE    584.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.30
 RAINFALL INTENSITY(INCH/HR) =   4.56
 TOTAL STREAM AREA(ACRES) =     2.91
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.42
```



```
 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       11.41    10.21        3.990          3.93
     2        9.42     8.30        4.561          2.91

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       19.41     8.30        4.561
     2       19.66    10.21        3.990

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      19.66   Tc(MIN.) =   10.21
 TOTAL AREA(ACRES) =        6.8
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    584.00 =    1113.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    584.00 TO NODE    586.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   370.50  DOWNSTREAM(FEET) =   315.00
 FLOW LENGTH(FEET) =   161.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  32.25
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      19.66
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   10.29
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    586.00 =    1274.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    586.00 TO NODE    586.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1       19.66    10.29        3.969         6.84
 LONGEST FLOWPATH FROM NODE    570.00 TO NODE    586.00 =    1274.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY     AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)   (ACRE)
     1       51.11     9.25        4.251       19.77
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE    586.00 =    1988.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      68.78       9.25        4.251
     2      67.38      10.29        3.969

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      68.78   Tc(MIN.) =    9.25
 TOTAL AREA(ACRES) =       26.6
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    586.00 TO NODE    586.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    586.00 TO NODE    594.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   315.00  DOWNSTREAM(FEET) =   295.00
  FLOW LENGTH(FEET) =   186.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.11
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      68.78
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.36
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    594.00 =    2174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE    594.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.36
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =    26.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     68.78

****************************************************************************
  FLOW PROCESS FROM NODE    590.00 TO NODE    592.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    92.00
  UPSTREAM ELEVATION(FEET) =    382.20
  DOWNSTREAM ELEVATION(FEET) =    378.00
  ELEVATION DIFFERENCE(FEET) =      4.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.339
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    87.83
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    592.00 TO NODE    594.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  378.00  DOWNSTREAM ELEVATION(FEET) =  295.00
```



```
  STREET LENGTH(FEET) =   826.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.83
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.91
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.67
  STREET FLOW TRAVEL TIME(MIN.) =   2.33   Tc(MIN.) =    4.67
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.25      SUBAREA RUNOFF(CFS) =    6.88
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       7.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.17
  FLOW VELOCITY(FEET/SEC.) =  6.73   DEPTH*VELOCITY(FT*FT/SEC.) =   2.22
  LONGEST FLOWPATH FROM NODE    590.00 TO NODE    594.00 =     918.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE    594.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.67
  RAINFALL INTENSITY(INCH/HR) =   6.32
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.76

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       68.78     9.36        4.219         26.61
      2        7.76     4.67        6.323          1.41

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       42.05     4.67       6.323
      2       73.96     9.36       4.219

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      73.96   Tc(MIN.) =    9.36
```

```
  TOTAL AREA(ACRES) =       28.0
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE    594.00 =    2174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE      1.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   295.00  DOWNSTREAM(FEET) =   294.00
  FLOW LENGTH(FEET) =    71.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.34
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      73.96
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    9.45
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE      1.00 =    2245.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    594.00 TO NODE      1.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.193
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6113
  SUBAREA AREA(ACRES) =    2.07   SUBAREA RUNOFF(CFS) =    3.04
  TOTAL AREA(ACRES) =       30.1   TOTAL RUNOFF(CFS) =      77.13
  TC(MIN.) =    9.45

+--------------------------------------------------------------------------+
| APPLY THE ATTENUATED FLOW DATA AS BASIN INFLOW                           |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  59.45   RAIN INTENSITY(INCH/HOUR) =  1.28
  TOTAL AREA(ACRES) =    30.10   TOTAL RUNOFF(CFS) =      4.70

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE     27.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   294.00  DOWNSTREAM(FEET) =   285.00
  FLOW LENGTH(FEET) =    98.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.39
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.70
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   59.57
  LONGEST FLOWPATH FROM NODE    501.00 TO NODE     27.00 =    2343.00 FEET.
```



```
****************************************************************************
  FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| APPLY THE ATTENUATED FLOW DATA AS BASIN INFLOW                           |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE     23.00 TO NODE     24.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    66.00
  UPSTREAM ELEVATION(FEET) =    476.00
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =     16.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.091
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.250
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE     25.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    372.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   336.00   CHANNEL SLOPE =  0.2619
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.35
  FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.18   Tc(MIN.) =    6.27
  LONGEST FLOWPATH FROM NODE     23.00 TO NODE     25.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE     25.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.464
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3500
  SUBAREA AREA(ACRES) =    2.46   SUBAREA RUNOFF(CFS) =    4.70
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =       5.01
  TC(MIN.) =    6.27

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     26.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   372.00  DOWNSTREAM(FEET) =   305.00
 FLOW LENGTH(FEET) =   897.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  12.69
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       5.01
 PIPE TRAVEL TIME(MIN.) =   1.18    Tc(MIN.) =    7.45
 LONGEST FLOWPATH FROM NODE     23.00 TO NODE     26.00 =    1299.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     26.00 TO NODE     27.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   305.00  DOWNSTREAM(FEET) =   284.00
 FLOW LENGTH(FEET) =   185.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  14.72
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       5.01
 PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.66
 LONGEST FLOWPATH FROM NODE     23.00 TO NODE     27.00 =    1484.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        5.01     7.66       4.803        2.62
 LONGEST FLOWPATH FROM NODE     23.00 TO NODE     27.00 =    1484.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        4.70    59.57       1.279       30.10
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     27.00 =    2343.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       5.61       7.66        4.803
     2       6.03      59.57        1.279

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       6.03   Tc(MIN.) =   59.57
 TOTAL AREA(ACRES) =       32.7

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
```



```
 FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   283.90  DOWNSTREAM(FEET) =   264.00
 FLOW LENGTH(FEET) =   343.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  12.20
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       6.03
 PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =   60.04
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     28.00 =    2686.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   60.04
 RAINFALL INTENSITY(INCH/HR) =   1.27
 TOTAL STREAM AREA(ACRES) =    32.72
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.03

****************************************************************************
 FLOW PROCESS FROM NODE    600.00 TO NODE    602.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
 UPSTREAM ELEVATION(FEET) =    296.00
 DOWNSTREAM ELEVATION(FEET) =    285.00
 ELEVATION DIFFERENCE(FEET) =     11.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.664
 WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.66
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.66

****************************************************************************
 FLOW PROCESS FROM NODE    602.00 TO NODE     28.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  285.00  DOWNSTREAM ELEVATION(FEET) =  262.00
 STREET LENGTH(FEET) =   386.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 12.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   6.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
```

```
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.26
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.26
   HALFSTREET FLOOD WIDTH(FEET) =    6.52
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.16
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.07
 STREET FLOW TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =    3.21
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 STREETS & ROADS (CURBS/STORM DRAINS) RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =    0.58      SUBAREA RUNOFF(CFS) =    3.19
 TOTAL AREA(ACRES) =        0.7        PEAK FLOW RATE(CFS) =       3.85

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.39
 FLOW VELOCITY(FEET/SEC.) =  4.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE     28.00 =     461.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    3.21
 RAINFALL INTENSITY(INCH/HR) =   6.32
 TOTAL STREAM AREA(ACRES) =     0.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.85

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        6.03    60.04        1.273        32.72
     2        3.85     3.21        6.323         0.70

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        4.17     3.21       6.323
     2        6.81    60.04       1.273

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       6.81   Tc(MIN.) =   60.04
 TOTAL AREA(ACRES) =       33.4
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     28.00 =    2686.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
```



```
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.81    60.04        1.273       33.42
 LONGEST FLOWPATH FROM NODE    501.00 TO NODE     28.00 =    2686.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       38.56    19.73        2.609       63.89
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE     28.00 =    4412.60 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      40.80      19.73        2.609
     2      25.62      60.04        1.273

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      40.80   Tc(MIN.) =   19.73
 TOTAL AREA(ACRES) =       97.3

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     28.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE    126.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    248.00  DOWNSTREAM(FEET) =    232.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   249.00   CHANNEL SLOPE =  0.0643
 CHANNEL FLOW THRU SUBAREA(CFS) =      40.80
 FLOW VELOCITY(FEET/SEC) =   9.26 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.45   Tc(MIN.) =   20.18
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    126.00 =    4661.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   20.18
 RAINFALL INTENSITY(INCH/HR) =   2.57
 TOTAL STREAM AREA(ACRES) =    97.31
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     40.80

****************************************************************************
 FLOW PROCESS FROM NODE     30.00 TO NODE     32.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  88
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   123.00
 UPSTREAM ELEVATION(FEET) =    452.00
 DOWNSTREAM ELEVATION(FEET) =    420.00
```

```
  ELEVATION DIFFERENCE(FEET) =     32.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.466
  SUBAREA RUNOFF(CFS) =      0.63
  TOTAL AREA(ACRES) =      0.33   TOTAL RUNOFF(CFS) =      0.63

****************************************************************************
  FLOW PROCESS FROM NODE     32.00 TO NODE     34.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    420.00  DOWNSTREAM(FEET) =    418.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   391.00   CHANNEL SLOPE =  0.0051
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.63
  FLOW VELOCITY(FEET/SEC) =   1.07 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.07   Tc(MIN.) =   12.34
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     34.00 =     514.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     32.00 TO NODE     34.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.531
  RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .6300
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5973
  SUBAREA AREA(ACRES) =    2.50   SUBAREA RUNOFF(CFS) =    5.56
  TOTAL AREA(ACRES) =        2.8   TOTAL RUNOFF(CFS) =       5.97
  TC(MIN.) =   12.34

****************************************************************************
  FLOW PROCESS FROM NODE     34.00 TO NODE    126.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    418.00  DOWNSTREAM(FEET) =    232.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1437.70   CHANNEL SLOPE =  0.1294
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.97
  FLOW VELOCITY(FEET/SEC) =   6.96 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.44   Tc(MIN.) =   15.78
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE    126.00 =    1951.70 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     34.00 TO NODE    126.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.012
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3846
  SUBAREA AREA(ACRES) =   17.40   SUBAREA RUNOFF(CFS) =   18.35
```



```
  TOTAL AREA(ACRES) =       20.2   TOTAL RUNOFF(CFS) =      23.44
  TC(MIN.) =   15.78

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    126.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.78
  RAINFALL INTENSITY(INCH/HR) =   3.01
  TOTAL STREAM AREA(ACRES) =    20.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       40.80    20.18        2.571         97.31
      2       23.44    15.78        3.012         20.23

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

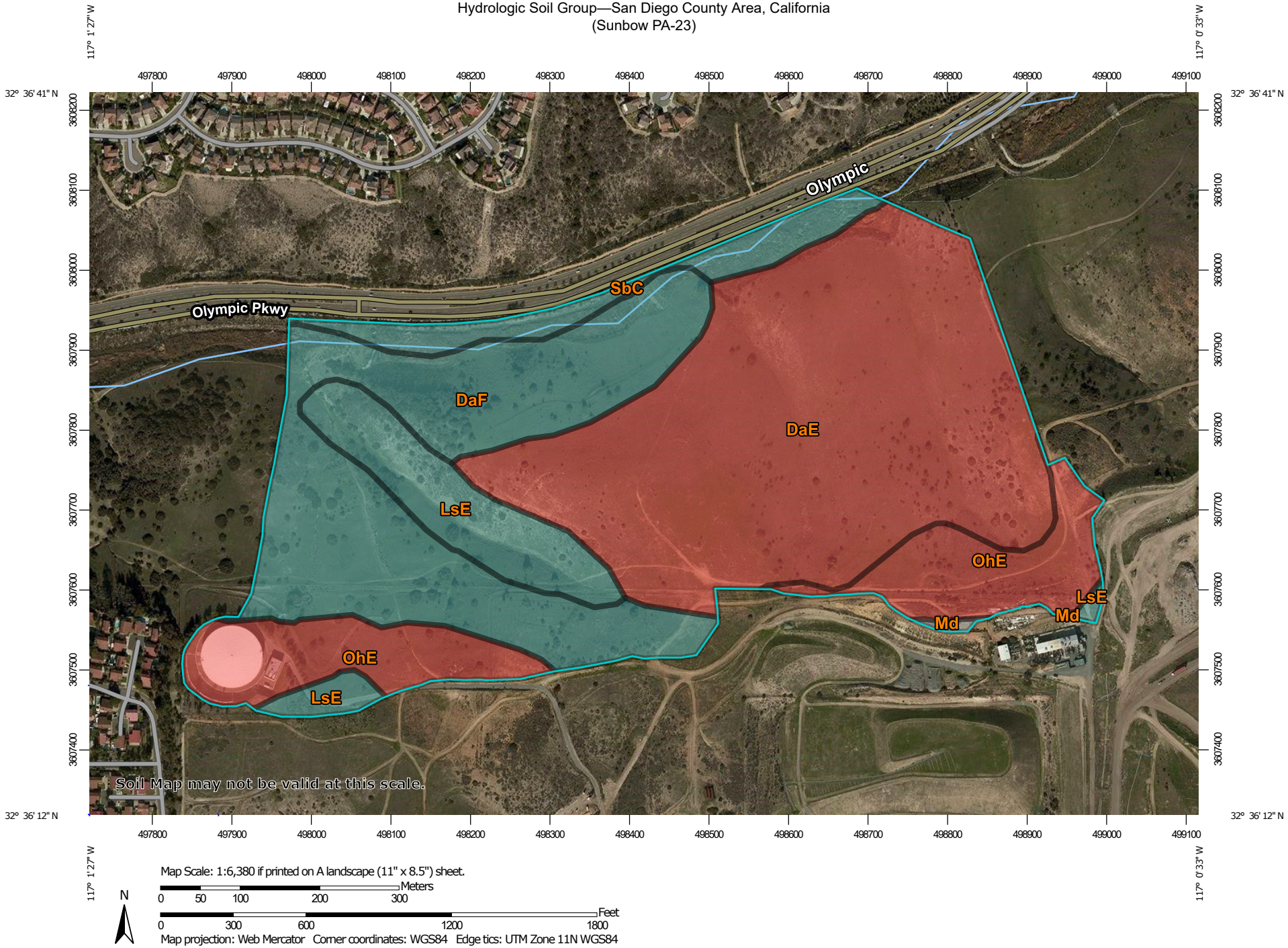
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc      INTENSITY
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
      1       55.36    15.78       3.012
      2       60.81    20.18       2.571

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      60.81   Tc(MIN.) =   20.18
  TOTAL AREA(ACRES) =      117.5
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    126.00 =    4661.60 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      117.5  TC(MIN.) =     20.18
  PEAK FLOW RATE(CFS)   =      60.81
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

HYDROLOGIC SOIL GROUP

Hydrologic Soil Group—San Diego County Area, California
(Sunbow PA-23)



Map Scale: 1:6,380 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DaE	Diablo clay, 15 to 30 percent slopes	D	53.0	45.2%
DaF	Diablo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	C	31.9	27.2%
LsE	Linne clay loam, 9 to 30 percent slopes	C	10.3	8.7%
Md	Made land		0.3	0.2%
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes	D	16.3	13.9%
SbC	Salinas clay loam, 2 to 9 percent slopes	C	5.6	4.8%
Totals for Area of Interest			**117.3**	**100.0%**

CHAPTER 5

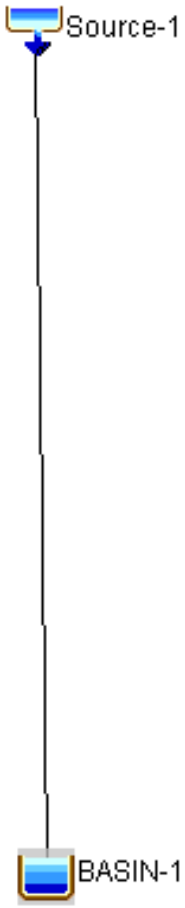
DETENTION ANALYSIS & CALCULATIONS

HEC-HMS

Project : Sunbow Detention

Basin Model : Basin 1

Jan 20 12:02:27 PST 2020



RATIONAL METHOD HYDROGRAPH PROGRAM
COPYRIGHT 1992, 2001 RICK ENGINEERING COMPANY

RUN DATE 6/16/2020
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 10 MIN.
6 HOUR RAINFALL 2.4 INCHES
BASIN AREA 30.1 ACRES
RUNOFF COEFFICIENT 0.6113
PEAK DISCHARGE 77.13 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 2.6
TIME (MIN) = 20	DISCHARGE (CFS) = 2.7
TIME (MIN) = 30	DISCHARGE (CFS) = 2.8
TIME (MIN) = 40	DISCHARGE (CFS) = 2.9
TIME (MIN) = 50	DISCHARGE (CFS) = 3
TIME (MIN) = 60	DISCHARGE (CFS) = 3
TIME (MIN) = 70	DISCHARGE (CFS) = 3.2
TIME (MIN) = 80	DISCHARGE (CFS) = 3.3
TIME (MIN) = 90	DISCHARGE (CFS) = 3.4
TIME (MIN) = 100	DISCHARGE (CFS) = 3.5
TIME (MIN) = 110	DISCHARGE (CFS) = 3.8
TIME (MIN) = 120	DISCHARGE (CFS) = 3.9
TIME (MIN) = 130	DISCHARGE (CFS) = 4.2
TIME (MIN) = 140	DISCHARGE (CFS) = 4.3
TIME (MIN) = 150	DISCHARGE (CFS) = 4.7
TIME (MIN) = 160	DISCHARGE (CFS) = 4.9
TIME (MIN) = 170	DISCHARGE (CFS) = 5.5
TIME (MIN) = 180	DISCHARGE (CFS) = 5.8
TIME (MIN) = 190	DISCHARGE (CFS) = 6.6
TIME (MIN) = 200	DISCHARGE (CFS) = 7.2
TIME (MIN) = 210	DISCHARGE (CFS) = 8.8
TIME (MIN) = 220	DISCHARGE (CFS) = 10
TIME (MIN) = 230	DISCHARGE (CFS) = 14.7
TIME (MIN) = 240	DISCHARGE (CFS) = 18
TIME (MIN) = 250	DISCHARGE (CFS) = 77.13
TIME (MIN) = 260	DISCHARGE (CFS) = 11.8
TIME (MIN) = 270	DISCHARGE (CFS) = 7.9
TIME (MIN) = 280	DISCHARGE (CFS) = 6.2
TIME (MIN) = 290	DISCHARGE (CFS) = 5.2
TIME (MIN) = 300	DISCHARGE (CFS) = 4.5
TIME (MIN) = 310	DISCHARGE (CFS) = 4
TIME (MIN) = 320	DISCHARGE (CFS) = 3.7
TIME (MIN) = 330	DISCHARGE (CFS) = 3.4
TIME (MIN) = 340	DISCHARGE (CFS) = 3.1
TIME (MIN) = 350	DISCHARGE (CFS) = 2.9
TIME (MIN) = 360	DISCHARGE (CFS) = 2.7
TIME (MIN) = 370	DISCHARGE (CFS) = 0

Basin 1 (West Basin)
Elevation-Area & Elevation-Discharge Function

Elevation-Area Function

Elevation (FT)	Area (AC)
0.00	0.57870
0.05	0.58097
0.10	0.58325
0.15	0.58552
0.20	0.58780
0.25	0.59008
0.30	0.59235
0.35	0.59463
0.40	0.59691
0.45	0.59918
0.50	0.60146
0.55	0.60373
0.60	0.60601
0.65	0.60829
0.70	0.61056
0.75	0.61284
0.80	0.61511
0.85	0.61739
0.90	0.61967
0.95	0.62194
1.00	0.62422
1.05	0.62656
1.10	0.62890
1.15	0.63124
1.20	0.63359
1.25	0.63593
1.30	0.63827
1.35	0.64061
1.40	0.64295
1.45	0.64529
1.50	0.64764
1.55	0.64998
1.60	0.65232
1.65	0.65466
1.70	0.65700
1.75	0.65934
1.80	0.66169
1.85	0.66403
1.90	0.66637
1.95	0.66871
2.00	0.67105
2.05	0.67346
2.10	0.67586
2.15	0.67827
2.20	0.68067
2.25	0.68308
2.30	0.68549
2.35	0.68789
2.40	0.69030

Elevation (FT)	Area (AC)
2.40	0.69030
2.45	0.69270
2.50	0.69511
2.55	0.69752
2.60	0.69992
2.65	0.70233
2.70	0.70473
2.75	0.70714
2.80	0.70955
2.85	0.71195
2.90	0.71436
2.95	0.71676
3.00	0.71917
3.05	0.72164
3.10	0.72411
3.15	0.72659
3.20	0.72906
3.25	0.73153
3.30	0.73400
3.35	0.73648
3.40	0.73895
3.45	0.74142
3.50	0.74389
3.55	0.74637
3.60	0.74884
3.65	0.75131
3.70	0.75378
3.75	0.75626
3.80	0.75873
3.85	0.76120
3.90	0.76367
3.95	0.76615
4.00	0.76862
4.05	0.77115
4.10	0.77369
4.15	0.77623
4.20	0.77876
4.25	0.78130
4.30	0.78384
4.35	0.78638
4.40	0.78891
4.45	0.79145
4.50	0.79399
4.55	0.79652
4.60	0.79906
4.65	0.80160
4.70	0.80413
4.75	0.80667
4.80	0.80921
4.85	0.81174

4.80	0.80921
4.85	0.81174
4.90	0.81428
4.95	0.81682
5.00	0.81935
5.05	0.82196
5.10	0.82456
5.15	0.82716
5.20	0.82977
5.25	0.83237
5.30	0.83497
5.35	0.83758
5.40	0.84018
5.45	0.84278
5.50	0.84539
5.55	0.84799
5.60	0.85059
5.65	0.85320
5.70	0.85580
5.75	0.85840
5.80	0.86101
5.85	0.86361
5.90	0.86621
5.95	0.86882
6.00	0.87142

Elevation-Discharge Function

Elevation (FT)	Discharge (CFS)
0.00	0.80300
0.05	0.80400
0.10	0.80500
0.15	0.80600
0.20	0.80700
0.25	0.80800
0.30	0.80900
0.35	0.81000
0.40	0.81100
0.45	0.81200
0.50	0.81300
0.55	0.81400
0.60	0.81500
0.65	0.81600
0.70	0.81700
0.75	0.81800
0.80	0.81900
0.85	0.82000
0.90	0.82100
0.95	0.82200
1.00	0.82300
1.05	0.82515
1.10	0.82945
1.15	0.83179
1.20	0.83362
1.25	0.83519
1.30	0.83657
1.35	0.83783
1.40	0.83898
1.45	0.84006
1.50	0.84108
1.55	0.84204
1.60	0.84295
1.65	0.84382
1.70	0.84466
1.75	0.84547
1.80	0.84625
1.85	0.84700
1.90	0.84774
1.95	0.84845
2.00	0.84914
2.05	0.85311
2.10	0.86263
2.15	0.87588
2.20	0.88821
2.25	0.89595
2.30	0.90266
2.35	0.90869
2.40	0.91422

Elevation (FT)	Discharge (CFS)
2.40	0.91422
2.45	0.91935
2.50	0.92418
2.55	0.92875
2.60	0.93309
2.65	0.93725
2.70	0.94125
2.75	0.94510
2.80	0.94881
2.85	0.95241
2.90	0.95591
2.95	0.95931
3.00	0.96261
3.05	0.96999
3.10	0.98474
3.15	1.00557
3.20	1.03095
3.25	1.05920
3.30	1.08145
3.35	1.09774
3.40	1.11256
3.45	1.12627
3.50	1.13913
3.55	1.15128
3.60	1.16284
3.65	1.17390
3.70	1.18453
3.75	1.19478
3.80	1.20469
3.85	1.21430
3.90	1.22363
3.95	1.23270
4.00	1.24155
4.05	1.62249
4.10	2.31166
4.15	3.20144
4.20	4.25341
4.25	5.44539
4.30	6.76242
4.35	8.19350
4.40	9.73012
4.45	11.36543
4.50	13.09377
4.55	14.91036
4.60	16.81106
4.65	18.79231
4.70	20.85094
4.75	22.98411
4.80	25.18932

4.80	25.18932
4.85	27.46426
4.90	29.80686
4.95	32.21521
5.00	34.68755
5.05	37.22226
5.10	39.81784
5.15	42.47290
5.20	45.18611
5.25	47.95627
5.30	50.78221
5.35	53.66287
5.40	56.59720
5.45	59.58425
5.50	62.62311
5.55	65.71289
5.60	68.02977
5.65	71.21897
5.70	74.45673
5.75	77.74233
5.80	81.07509
5.85	84.45434
5.90	87.87946
5.95	91.34983
6.00	94.86487

Project: Sunbow Detention Simulation Run: Run 1

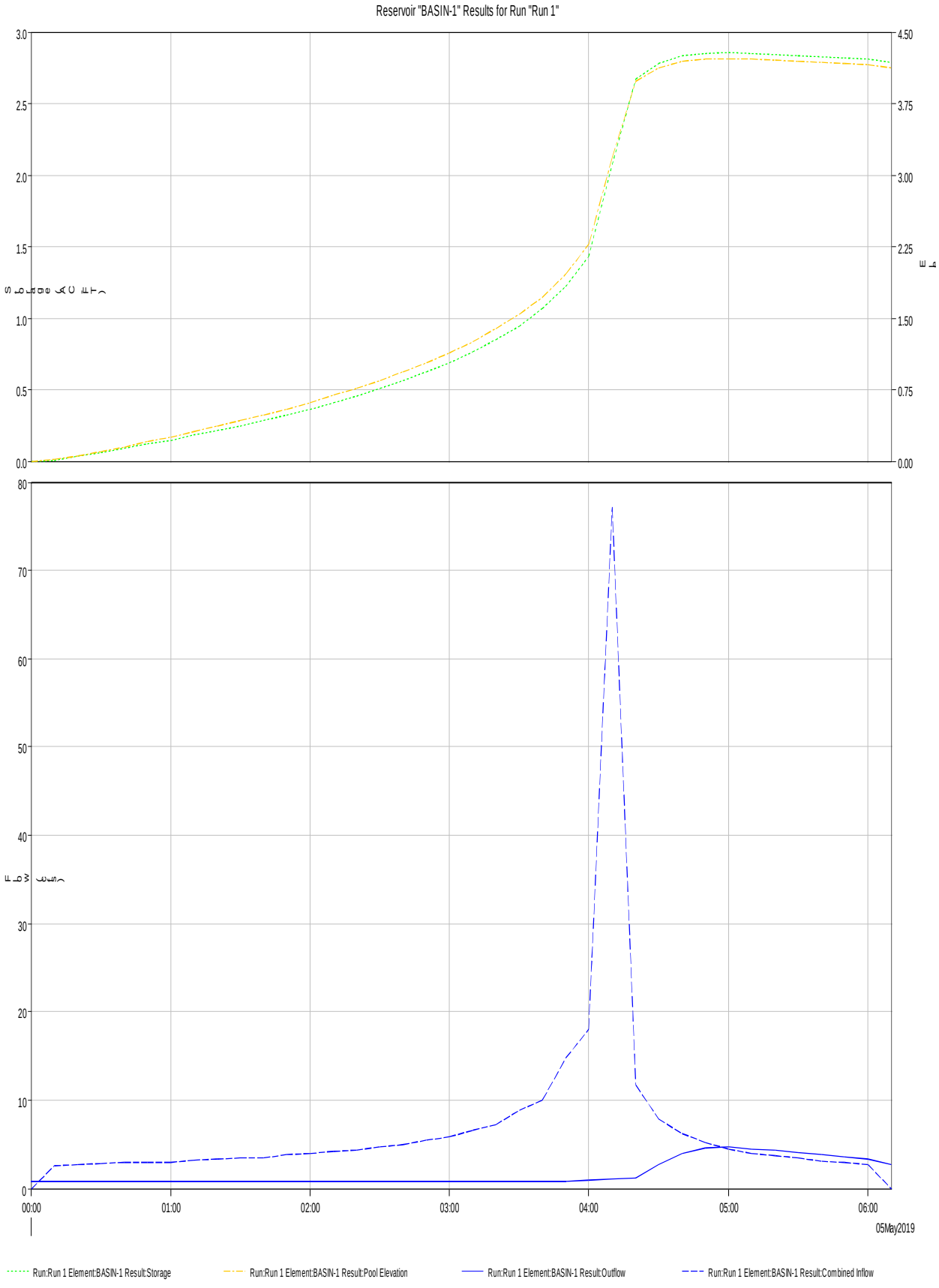
Reservoir: BASIN-1

Start of Run:	05May2019, 00:00	Basin Model:	Basin 1
End of Run:	05May2019, 06:10	Meteorologic Model:	Met 1
Compute Time:	16Jun2020, 13:51:06	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow:	77.1 (CFS)	Date/Time of Peak Inflow:	05May2019, 04:10
Peak Discharge:	4.7 (CFS)	Date/Time of Peak Discharge:	05May2019, 05:00
Inflow Volume:	0.20 (IN)	Peak Storage:	2.9 (AC-FT)
Discharge Volume:	0.05 (IN)	Peak Elevation:	4.2 (FT)


Reservoir "BASIN-1" Results for Run "Run 1"
Storage (AC-FT)
Elev (FT)
Flow (CFS)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4.50
3.75
3.00
2.25
1.50
0.75
0.00
80
70
60
50
40
30
20
10
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
05May2019
Run:Run 1 Element:BASIN-1 Result:Storage
Run:Run 1 Element:BASIN-1 Result:Pool Elevation
Run:Run 1 Element:BASIN-1 Result:Outflow
Run:Run 1 Element:BASIN-1 Result:Combined Inflow

Project: Sunbow Detention Simulation Run: Run 1
Reservoir: BASIN-1

Start of Run:	05May2019, 00:00	Basin Model:	Basin 1
End of Run:	05May2019, 06:10	Meteorologic Model:	Met 1
Compute Time:	16Jun2020, 13:51:06	Control Specifications:	Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
05May2019	00:00	0.0	0.0	0.0	0.8
05May2019	00:10	2.6	0.0	0.0	0.8
05May2019	00:20	2.7	0.0	0.1	0.8
05May2019	00:30	2.8	0.1	0.1	0.8
05May2019	00:40	2.9	0.1	0.1	0.8
05May2019	00:50	3.0	0.1	0.2	0.8
05May2019	01:00	3.0	0.1	0.3	0.8
05May2019	01:10	3.2	0.2	0.3	0.8
05May2019	01:20	3.3	0.2	0.4	0.8
05May2019	01:30	3.4	0.2	0.4	0.8
05May2019	01:40	3.5	0.3	0.5	0.8
05May2019	01:50	3.8	0.3	0.5	0.8
05May2019	02:00	3.9	0.4	0.6	0.8
05May2019	02:10	4.2	0.4	0.7	0.8
05May2019	02:20	4.3	0.5	0.8	0.8
05May2019	02:30	4.7	0.5	0.8	0.8
05May2019	02:40	4.9	0.6	0.9	0.8
05May2019	02:50	5.5	0.6	1.0	0.8
05May2019	03:00	5.8	0.7	1.1	0.8
05May2019	03:10	6.6	0.8	1.3	0.8
05May2019	03:20	7.2	0.8	1.4	0.8
05May2019	03:30	8.8	0.9	1.5	0.8
05May2019	03:40	10.0	1.1	1.7	0.8
05May2019	03:50	14.7	1.2	2.0	0.8
05May2019	04:00	18.0	1.4	2.3	0.9

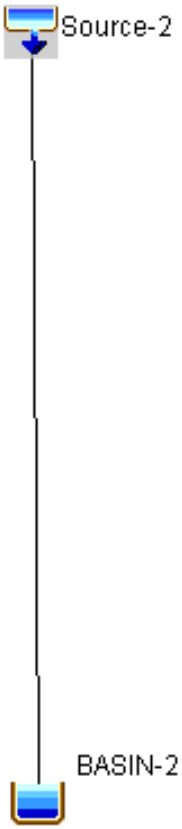
Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
05May2019	04:10	77.1	2.1	3.2	1.0
05May2019	04:20	11.8	2.7	4.0	1.2
05May2019	04:30	7.9	2.8	4.1	2.7
05May2019	04:40	6.2	2.8	4.2	4.0
05May2019	04:50	5.2	2.9	4.2	4.5
05May2019	05:00	4.5	2.9	4.2	4.7
05May2019	05:10	4.0	2.9	4.2	4.5
05May2019	05:20	3.7	2.8	4.2	4.3
05May2019	05:30	3.4	2.8	4.2	4.0
05May2019	05:40	3.1	2.8	4.2	3.8
05May2019	05:50	2.9	2.8	4.2	3.5
05May2019	06:00	2.7	2.8	4.2	3.3
05May2019	06:10	0.0	2.8	4.1	2.8

HEC-HMS

Project : Sunbow Detention

Basin Model : Basin 1

Jan 20 12:02:27 PST 2020



RATIONAL METHOD HYDROGRAPH PROGRAM
COPYRIGHT 1992, 2001 RICK ENGINEERING COMPANY

RUN DATE 1/20/2020
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 15 MIN.
6 HOUR RAINFALL 2.4 INCHES
BASIN AREA 37 ACRES
RUNOFF COEFFICIENT 0.637
PEAK DISCHARGE 75.88 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 15	DISCHARGE (CFS) = 3.4
TIME (MIN) = 30	DISCHARGE (CFS) = 3.5
TIME (MIN) = 45	DISCHARGE (CFS) = 3.7
TIME (MIN) = 60	DISCHARGE (CFS) = 3.8
TIME (MIN) = 75	DISCHARGE (CFS) = 4.1
TIME (MIN) = 90	DISCHARGE (CFS) = 4.3
TIME (MIN) = 105	DISCHARGE (CFS) = 4.6
TIME (MIN) = 120	DISCHARGE (CFS) = 4.9
TIME (MIN) = 135	DISCHARGE (CFS) = 5.4
TIME (MIN) = 150	DISCHARGE (CFS) = 5.7
TIME (MIN) = 165	DISCHARGE (CFS) = 6.6
TIME (MIN) = 180	DISCHARGE (CFS) = 7.1
TIME (MIN) = 195	DISCHARGE (CFS) = 8.7
TIME (MIN) = 210	DISCHARGE (CFS) = 9.9
TIME (MIN) = 225	DISCHARGE (CFS) = 14.5
TIME (MIN) = 240	DISCHARGE (CFS) = 18
TIME (MIN) = 255	DISCHARGE (CFS) = 75.88
TIME (MIN) = 270	DISCHARGE (CFS) = 11.7
TIME (MIN) = 285	DISCHARGE (CFS) = 7.8
TIME (MIN) = 300	DISCHARGE (CFS) = 6.1
TIME (MIN) = 315	DISCHARGE (CFS) = 5.1
TIME (MIN) = 330	DISCHARGE (CFS) = 4.4
TIME (MIN) = 345	DISCHARGE (CFS) = 4
TIME (MIN) = 360	DISCHARGE (CFS) = 3.6
TIME (MIN) = 375	DISCHARGE (CFS) = 0

Basin 2 (East Basin)
Elevation-Area & Elevation-Discharge Function

Elevation-Area Function

Elevation (FT)	Area (AC)
0.00	0.68655
0.05	0.68930
0.10	0.69206
0.15	0.69481
0.20	0.69757
0.25	0.70032
0.30	0.70308
0.35	0.70583
0.40	0.70859
0.45	0.71134
0.50	0.71410
0.55	0.71686
0.60	0.71961
0.65	0.72237
0.70	0.72512
0.75	0.72788
0.80	0.73063
0.85	0.73339
0.90	0.73614
0.95	0.73890
1.00	0.73905
1.05	0.74174
1.10	0.74443
1.15	0.74712
1.20	0.74981
1.25	0.75250
1.30	0.75519
1.35	0.75788
1.40	0.76057
1.45	0.76326
1.50	0.76596
1.55	0.76865
1.60	0.77134
1.65	0.77403
1.70	0.77672
1.75	0.77941
1.80	0.78210
1.85	0.78479
1.90	0.78748
1.95	0.79017
2.00	0.79286
2.05	0.79562
2.10	0.79837
2.15	0.80112
2.20	0.80388
2.25	0.80663
2.30	0.80939
2.35	0.81214
2.40	0.81490
2.45	0.81765

Elevation (FT)	Area (AC)
2.40	0.81490
2.45	0.81765
2.50	0.82041
2.55	0.82316
2.60	0.82592
2.65	0.82867
2.70	0.83143
2.75	0.83418
2.80	0.83694
2.85	0.83969
2.90	0.84245
2.95	0.84520
3.00	0.84796
3.05	0.85078
3.10	0.85360
3.15	0.85642
3.20	0.85924
3.25	0.86206
3.30	0.86488
3.35	0.86770
3.40	0.87052
3.45	0.87334
3.50	0.87616
3.55	0.87898
3.60	0.88180
3.65	0.88462
3.70	0.88744
3.75	0.89026
3.80	0.89308
3.85	0.89590
3.90	0.89872
3.95	0.90154
4.00	0.90436
4.05	0.90725
4.10	0.91013
4.15	0.91302
4.20	0.91590
4.25	0.91879
4.30	0.92168
4.35	0.92456
4.40	0.92745
4.45	0.93033
4.50	0.93322
4.55	0.93610
4.60	0.93899
4.65	0.94188
4.70	0.94476
4.75	0.94765
4.80	0.95053
4.85	0.95342

4.80	0.95053
4.85	0.95342
4.90	0.95630
4.95	0.95919
5.00	0.96208
5.05	0.96503
5.10	0.96798
5.15	0.97093
5.20	0.97388
5.25	0.97683
5.30	0.97978
5.35	0.98272
5.40	0.98567
5.45	0.98862
5.50	0.99157
5.55	0.99452
5.60	0.99747
5.65	1.00040
5.70	1.00340
5.75	1.00630
5.80	1.00930
5.85	1.01220
5.90	1.01520
5.95	1.01810
6.00	1.02110

Elevation-Discharge Function

Elevation (FT)	Discharge (CFS)
0.00	1.8210
0.05	1.8220
0.10	1.8230
0.15	1.8240
0.20	1.8250
0.25	1.8260
0.30	1.8270
0.35	1.8280
0.40	1.8290
0.45	1.8300
0.50	1.8310
0.55	1.8331
0.60	1.8374
0.65	1.8398
0.70	1.8416
0.75	1.8432
0.80	1.8446
0.85	1.8458
0.90	1.8470
0.95	1.8481
1.00	1.8491
1.05	1.8533
1.10	1.8631
1.15	1.8766
1.20	1.8891
1.25	1.8971
1.30	1.9040
1.35	1.9102
1.40	1.9158
1.45	1.9211
1.50	1.9261
1.55	1.9308
1.60	1.9352
1.65	1.9395
1.70	1.9436
1.75	1.9475
1.80	1.9514
1.85	1.9551
1.90	1.9586
1.95	1.9621
2.00	1.9655
2.05	1.9688
2.10	1.9720
2.15	1.9752
2.20	1.9782
2.25	1.9813
2.30	1.9842
2.35	1.9871
2.40	1.9899

Elevation (FT)	Discharge (CFS)
2.40	1.9899
2.45	1.9927
2.50	1.9955
2.55	1.9982
2.60	2.0008
2.65	2.0034
2.70	2.0060
2.75	2.0086
2.80	2.0111
2.85	2.0135
2.90	2.0159
2.95	2.0183
3.00	2.0207
3.05	2.0272
3.10	2.0411
3.15	2.0612
3.20	2.0858
3.25	2.1133
3.30	2.1349
3.35	2.1505
3.40	2.1647
3.45	2.1778
3.50	2.1901
3.55	2.2017
3.60	2.2127
3.65	2.2233
3.70	2.2334
3.75	2.2432
3.80	2.2526
3.85	2.2618
3.90	2.2707
3.95	2.2794
4.00	2.2878
4.05	2.6684
4.10	3.3572
4.15	4.2466
4.20	5.2982
4.25	6.4898
4.30	7.8065
4.35	9.2373
4.40	10.7740
4.45	12.4090
4.50	14.1370
4.55	15.9530
4.60	17.8530
4.65	19.8340
4.70	21.8930
4.75	24.0260
4.80	26.2310

4.80	26.2310
4.85	28.5050
4.90	30.8480
4.95	33.2560
5.00	35.7280
5.05	38.2620
5.10	40.8580
5.15	43.5120
5.20	46.2250
5.25	48.9950
5.30	51.8210
5.35	54.7020
5.40	57.6360
5.45	60.6230
5.50	63.6610
5.55	66.7510
5.60	68.0600
5.65	71.2490
5.70	74.4860
5.75	77.7720
5.80	81.1040
5.85	84.4830
5.90	87.9080
5.95	91.3780
6.00	94.8930

Project: Sunbow Detention Simulation Run: Run 2

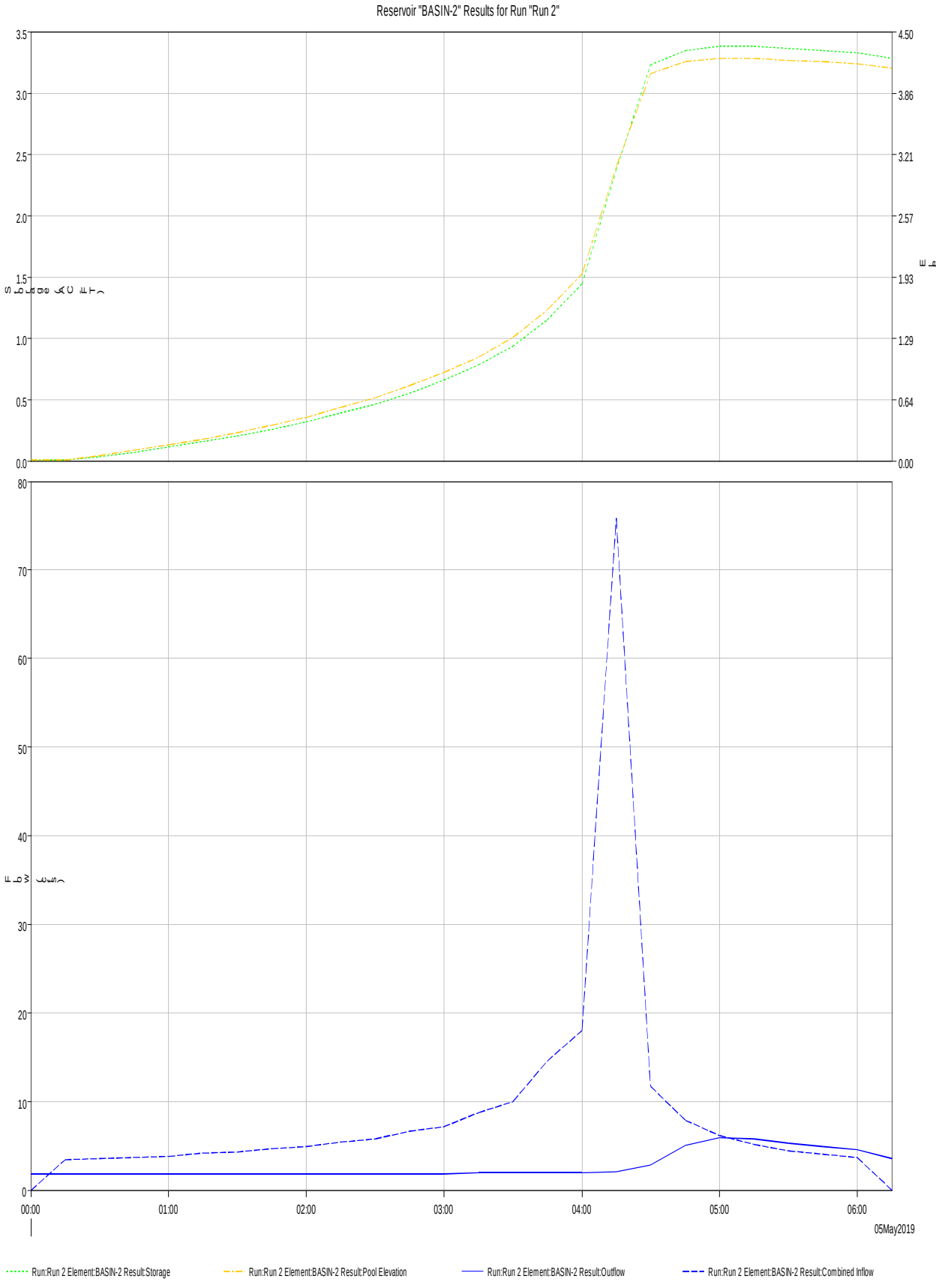
Reservoir: BASIN-2

Start of Run:	05May2019, 00:00	Basin Model:	Basin 2
End of Run:	05May2019, 06:15	Meteorologic Model:	Met 1
Compute Time:	19Jun2020, 12:23:53	Control Specifications:	Control 2

Volume Units: IN

Computed Results

Peak Inflow:	75.9 (CFS)	Date/Time of Peak Inflow:	05May2019, 04:15
Peak Discharge:	5.8 (CFS)	Date/Time of Peak Discharge:	05May2019, 05:00
Inflow Volume:	0.25 (IN)	Peak Storage:	3.4 (AC-FT)
Discharge Volume:	0.08 (IN)	Peak Elevation:	4.2 (FT)


Reservoir "BASIN-2" Results for Run "Run 2"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4.50
3.86
3.21
2.57
1.93
1.29
0.64
0.00
80
70
60
50
40
30
20
10
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
05May2019
Run:Run 2 Element:BASIN-2 Result:Storage
Run:Run 2 Element:BASIN-2 Result:Pool Elevation
Run:Run 2 Element:BASIN-2 Result:Outflow
Run:Run 2 Element:BASIN-2 Result:Combined Inflow

Project: Sunbow Detention Simulation Run: Run 2
Reservoir: BASIN-2

Start of Run:	05May2019, 00:00	Basin Model:	Basin 2
End of Run:	05May2019, 06:15	Meteorologic Model:	Met 1
Compute Time:	19Jun2020, 12:23:53	Control Specifications:	Control 2

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
05May2019	00:00	0.0	0.0	0.0	1.8
05May2019	00:15	3.4	0.0	0.0	1.8
05May2019	00:30	3.5	0.0	0.1	1.8
05May2019	00:45	3.7	0.1	0.1	1.8
05May2019	01:00	3.8	0.1	0.2	1.8
05May2019	01:15	4.1	0.2	0.2	1.8
05May2019	01:30	4.3	0.2	0.3	1.8
05May2019	01:45	4.6	0.3	0.4	1.8
05May2019	02:00	4.9	0.3	0.5	1.8
05May2019	02:15	5.4	0.4	0.6	1.8
05May2019	02:30	5.7	0.5	0.7	1.8
05May2019	02:45	6.6	0.6	0.8	1.8
05May2019	03:00	7.1	0.7	0.9	1.8
05May2019	03:15	8.7	0.8	1.1	1.9
05May2019	03:30	9.9	0.9	1.3	1.9
05May2019	03:45	14.5	1.1	1.6	1.9
05May2019	04:00	18.0	1.4	2.0	2.0
05May2019	04:15	75.9	2.4	3.1	2.0
05May2019	04:30	11.7	3.2	4.1	2.7
05May2019	04:45	7.8	3.3	4.2	5.0
05May2019	05:00	6.1	3.4	4.2	5.8
05May2019	05:15	5.1	3.4	4.2	5.7
05May2019	05:30	4.4	3.4	4.2	5.3
05May2019	05:45	4.0	3.3	4.2	4.9
05May2019	06:00	3.6	3.3	4.2	4.5

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
05May2019	06:15	0.0	3.3	4.1	3.5

CHAPTER 6
HYDROLOGY MAPS

Drainage Study for
Sunbow II, Phase 3

EXISTING CONDITION
HYDROLOGY MAPS

126 — Q_{100} = 90.81 cfs. A = 117.3 ac. T_c = 26.16 min.

126 232'
124 264'
134 418'
132 420'
130 452'
110 452'
122 435'
120 444'
114 272'
112 445'
104 274'
100 474'
102 460'

3.17 ACRES
21.4 ac 1830' ft
11.19 ac 1048 ft
27.07 ac 1683 ft
2.5 ac 391 ft
0.33 ac 123 ft
0.26 ac 136 ft
0.22 ac 149 ft
5.75 ac 707 ft
18.92 ac 1550' ft
27.29 ac 2118 ft
0.20 ac 116 ft

100 0 100 200 300
SCALE 1" = 100'

LEGEND

- PROJECT BOUNDARY
- DRAINAGE BOUNDARY
- INITIAL SUBAREA
- FLOW DIRECTION
- NODE #/ELEVATION (200 / 1665)
- ACREAGE / FLOW LENGTH (0.22 ac / 81.5 ft)

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HUNSAKER & ASSOCIATES SAN DIEGO, INC
PLANNING ENGINEERING SURVEYING
9707 Waples Street San Diego, Ca 92121
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DRAINAGE MAP
EXISTING CONDITION
SUNBOW II, PHASE 3
CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 1

W.O. 2167-0151

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PROPOSED CONDITION
HYDROLOGY MAPS

SEE SHEET 2 OF 2

14 — Q_{100} = 91.67cfs. — A = 48.9 ac. — T_c = 14.86min.

14 — $Q_{100ATT.}$ = 17.62cfs. — A = 48.9 ac. — T_c = 12.31min.

14.95 ACRES

OS-6a — LOT AREA: 1.00 AC.

OS-3 MSCP — LOT AREA: 9.64 AC. — 10.1 ACRES

OS-5 — LOT AREA: 10.04 AC.

OS-6b

OLYMPIC PKWY (EXIST.)

STREET 'B' (PUBLIC)

OS-12 — LOT AREA: 5.85 AC.

OS-10 — LOT AREA: 4.84 AC.

R-1 — LOT AREA: 6.14 AC. — PAD AREA: 4.79 AC.

CPF-1 — LOT AREA: 0.93 AC. — PAD AREA: 0.79 AC.

R-4 — LOT AREA: 6.14 AC. — PAD AREA: 4.79 AC.

R-6 — LOT AREA: 2.41 AC. — PAD AREA: 1.93 AC.

R-2 — LOT AREA: 4.62 AC. — PAD AREA: 3.70 AC.

R-3 — LOT AREA: 8.14 AC. — PAD AREA: 7.70 AC.

OS-13 — LOT AREA: 4.62 AC.

OS-14 — LOT AREA: 4.62 AC.

OS-11 — LOT AREA: 1.25 AC.

0.70 ACRES | 0.73 ACRES | 0.10 ACRES | 0.11 ACRES | 1.74 ACRES | 0.56 ACRES | 0.69 ACRES | 2.10 ACRES | 1.30 ACRES | 0.15 ACRES | 0.13 ACRES | 0.20 ACRES | 1.18 ACRES | 0.11 ACRES | 2.90 ACRES | 2.30 ACRES | 0.10 ACRES | 0.06 ACRES | 1.02 ACRES | 0.08 ACRES | 0.07 ACRES | 0.57 ACRES | 1.40 ACRES | 1.49 ACRES | 2.40 ACRES | 1.64 ACRES | 1.05 ACRES | 0.16 ACRES | 0.84 ACRES | 0.93 ACRES | 1.00 ACRES | 4.41 ACRES | 2.15 ACRES | 0.43 ACRES | 0.64 ACRES | 2.13 ACRES | 0.09 ACRES | 0.12 ACRES | 0.59 ACRES | 1.48 ACRES | 0.76 ACRES | 3.17 ACRES | 0.24 ACRES | 0.18 ACRES | 0.22 ACRES | 0.19 ACRES | 0.14 ACRES | 0.17 ACRES | 1.39 ACRES | 0.18 ACRES | 0.20 ACRES | 1.73 ACRES | 2.70 ACRES | 1.26 ACRES | 0.18 ACRES | 1.1 ACRES | 5.56 ACRES

60 0 60 120 180
SCALE 1" = 60'

LEGEND

- PROJECT BOUNDARY
- DRAINAGE BOUNDARY
- INITIAL SUBAREA
- FLOW DIRECTION
- NODE # (939)
- SUBAREA ACREAGE (46.5 ACRES)

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DRAINAGE MAP
PROPOSED CONDITION
SUNBOW II, PHASE 3
CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 2

W.O. 2167-0151

28 — Q_{100}= 145.38cfs. | A= 97.3 ac. | T_c =19.51min.

14 — Q_{100}= 91.67cfs. | A= 48.9 ac. | T_c =14.86min.

126 — Q_{100}= 165.62cfs. | A=117.5 ac. | T_c =19.82min.

126 — $Q_{100ATT.}$= 60.81cfs. | A=117.5 ac. | T_c =20.18min.

14 — $Q_{100ATT.}$= 17.62cfs. | A= 48.9 ac. | T_c =12.31min.

28 — $Q_{100ATT.}$= 40.8cfs. | A= 97.3 ac. | T_c =19.73min.

OS-1 MSCP LOT AREA: 42.79 AC.
OS-2 MSCP LOT AREA: 10.04 AC.
OS-4 LOT AREA: 2.60 AC.
OS-5 LOT AREA: 0.66 AC.
OS-5a LOT AREA: 0.55 AC.
OS-5b LOT AREA: 0.70 AC.
OS-7 LOT AREA: 3.18 AC.
OS-7 LOT AREA: 0.16 AC.
OS-9a LOT AREA: 0.46 AC.
OS-9b LOT AREA: 1.12 AC.
OS-10 LOT AREA: 4.89 AC.
OS-12 LOT AREA: 4.62 AC.
OS-14 LOT AREA: 7.10 AC.
CPF-1 LOT AREA: 0.93 AC. PAD AREA: 0.79 AC.
R-1 LOT AREA: 7.10 AC.
R-4 LOT AREA: 10.04 AC.
R-5 LOT AREA: 7.10 AC.
R-6 LOT AREA: 4.62 AC.

OLYMPIC PKWY (EXIST.)
STREET 'B' (PUBLIC)
EXIST. 8" PVC WATER
EXIST. 4" PVC RECYCLED WATER
EXIST. 30" CMLAC RECYCLED WATER PER DWG. 93-13

17.4 ACRES
14.95 ACRES
2.79 ACRES
2.13 ACRES
2.07 ACRES
2.90 ACRES
2.30 ACRES
1.64 ACRES
1.25 ACRES
1.05 ACRES
0.93 ACRES
1.00 ACRES
0.84 ACRES
0.64 ACRES
0.59 ACRES
0.58 ACRES
0.70 ACRES
0.43 ACRES
0.76 ACRES
1.48 ACRES
0.24 ACRES
0.18 ACRES
0.12 ACRES
0.10 ACRES
0.09 ACRES
0.08 ACRES
0.11 ACRES
0.16 ACRES
0.24 ACRES
0.13 ACRES
2.46 ACRES
1.1 ACRES
5.56 ACRES
2.5 ACRES
0.33 ACRES

LEGEND

- PROJECT BOUNDARY
- DRAINAGE BOUNDARY
- INITIAL SUBAREA
- FLOW DIRECTION
- NODE # (9.35)
- SUBAREA ACREAGE (46.5 ACRES)

SCALE 1" = 60'

SEE SHEET 1 OF 2

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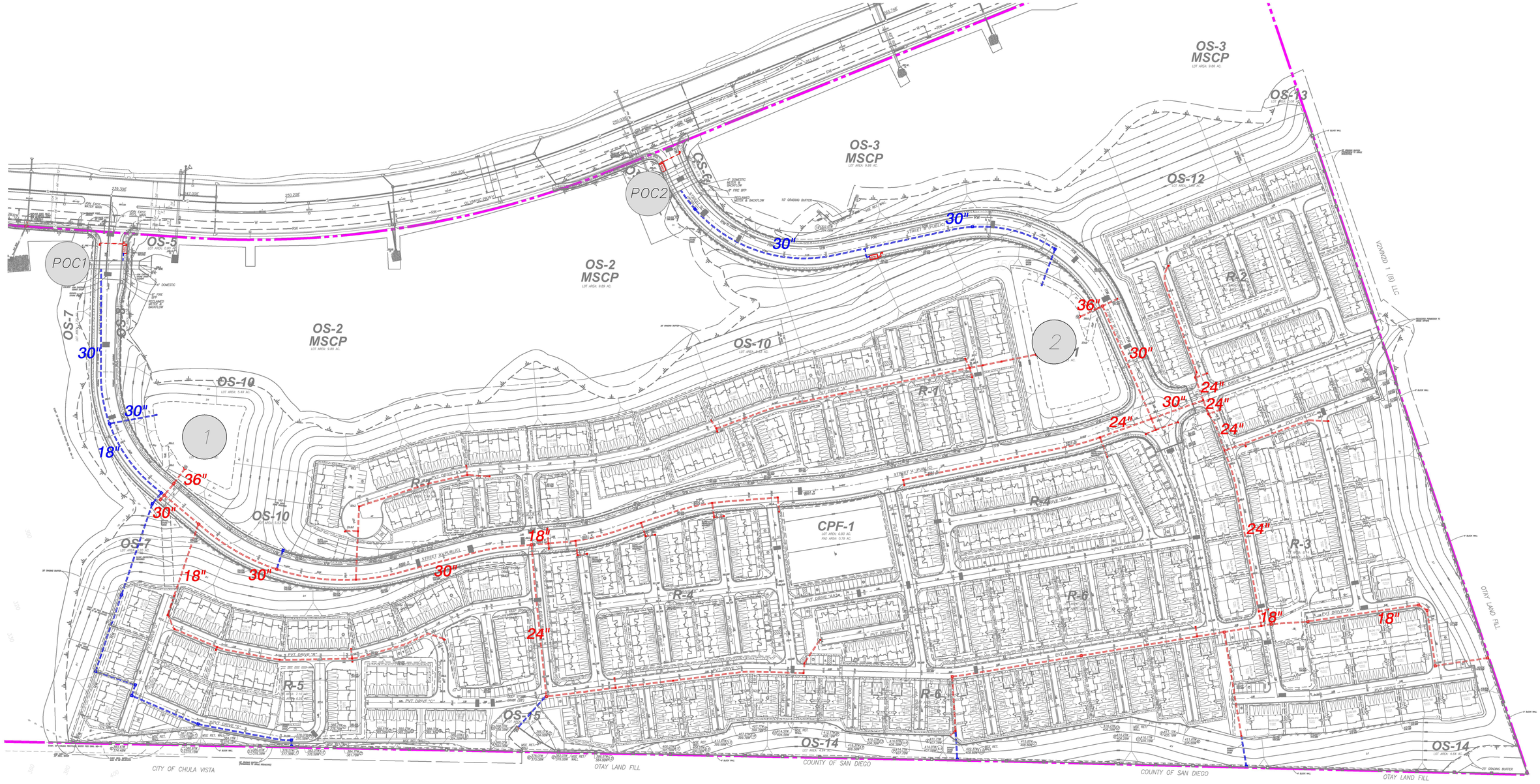
DRAINAGE MAP
PROPOSED CONDITION
SUNBOW II, PHASE 3
CITY OF CHULA VISTA, CALIFORNIA

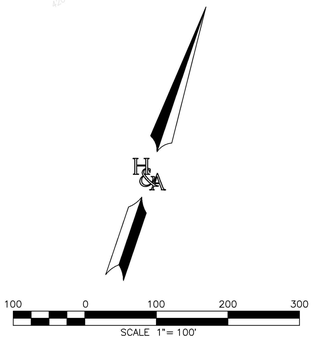
MAP 2 OF 2

W.O. 2167-0151

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CHAPTER 7
Preliminary Pipe Sizing





LEGEND

BYPASS STORMDRAIN

URBAN OR UNTREATED RUNOFF STORM DRAIN

1 WATER QUALITY HYDROMODIFICATION BASIN

NOTE: PIPES 18" UNLESS OTHERWISE NOTED

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PROPOSED CONDITION STORMDRAIN SIZING EXHIBIT SUNBOW II, PHASE 3

CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 1

W.O. 2167-0151

R:\1561\Hyd\DR\ACAD\TM\1561$HYD-PR-DR-V2(w_ Wetland and Building loss).dwg[]Jun-22-2020:16:53