APPENDIX 5.15A

Preliminary Stormwater Management Design

WorleyParsons
resources & energy

CALCULATION COVER SHEET

CLIENT	MMC Energy, Inc.
PROJECT	Chula Vista Energy Efficiency Upgrade, Chula Vista, California
SUBJECT	Preliminary Stormwater Management Design
JOB NUMBER	52001001 WBS NUMBER 024
CALCULATION NO.:	CHUL-0-DC-024-CE-001 PAGE 1 OF 11

DESCRIPTION/PURPOSE

Perform preliminary design of site grading and drainage. Determine pre-development and post-development rainfall runoff characteristics to include peak flow rates and runoff volumes. The storm water system will consist of swales and overland flow and will be designed in accordance with the requirements of San Diego County, California, and requirements provided by the City of Chula Vista. Water Quality Best Management Practices (BMPs) will be incorporated into the post-development design to minimize the impact to the downstream Otay River Valley.

METHOD OF ANALYSIS

Use the Rational Method to estimate peak runoff for the collection system design as modified by the San Diego County, Hydrology Manual. Use "Flowmaster" as required to design the open channel flow systems.

CODES AND STANDARDS

None applicable.

INFORMATION SOURCES

1. San Diego County, Hydrology Manual, June 2003
2. City of Chula Vista "Development and Redevelopment Projects Storm Water Management Standards Requirements Manual", 2006
3. "Hydrologic Analysis and Design", Richard H. McCuen, 1998
4. Bentley Systems, "Flowmaster", Service Pack 2
5. TR-55, Urban Hydrology for Small Watersheds, USDA, NRCS, June 1986

REGISTERED PROFESSIONAL ENGINEER
PRADIP KUMAR KHAN
No. 54262
Exp. 12-31-07
CIVIL
STATE OF CALIFORNIA

2-12-07

ASSUMPTIONS

Contained in body of calculation.

CONCLUSIONS OR RESULTS

The storm water management design meets the requirements of the City of Chula Vista and San Diego County.

REV	DATE	DESCRIPTION	PAGES REVISED	PAGES ADDED	PAGES DELETED	BY/DATE	REV/DATE	LDE/DATE
1	2-8-07	Editorial changes	7	0	0	B. Burchfield 2/8/07	J. Winterhalter 2-8-07	P. Khan 2-12-07
0	1-24-07	ORIGINAL ISSUE	NA	NA	NA	B. Burchfield	J.Winterhalter	P. Khan

LIST OF ATTACHMENTS

A. Location Map
B. Email correspondence
C. General Arrangement Drawing, CHUL-1-DW-111-002-001
   Grading And Drainage Drawing, CHUL-1-DW-112-735-001
D. Pre-Development Site Plan – Drainage Areas
E. City of Chula Vista Storm Water Management Forms
F. Map of Soil Hydrologic Groups
G. Isopluvial Maps
H. Runoff Coefficients for the Rational Formula
I. Pre-Development Calculations, Area A
J. Pre-Development Calculations, Area B
K. Post-Development Site Plan – Drainage Areas
L. Post-Development Calculations, Area A
M. Post-Development Calculations, Area B
N. Topographic Map of the Otay River Valley

I. PROJECT DESIGN CRITERIA FOR STORMWATER MANAGEMENT

1. General

The site for the proposed MMC Chula Vista, LLC Project is located in San Diego County, California. The 3.8 acre plant is located at 3497 Main Street in the City of Chula Vista, CA (See Attachment A for a location map). The property has no frontage on Main Street and is south of Main Street approximately 835 feet. A 20-foot wide private easement road provides access to the site. The property to the east of the plant plans to develop this road (See Attachment B). The general arrangement of the proposed plant area is shown on Attachment C.

This is an existing facility operating under an existing NPDES permit. The existing facility is a simple cycle power facility located on the southern portion of the property and provides peaking power to Chula Vista energy users by means of two natural gas fired combustion turbines and one generator. Electricity output is transported over an existing San Diego Gas and Electric 69 kV transmission line feeding the Otay Substation. Water use is limited to on-site domestic use. The northern portion of the property is a vacant lot.

The site is relatively flat and slopes south towards the Otay River Valley. Elevations at the site vary from 62 feet at the northeast corner to 48 feet at the southwest corner.

The site currently drains at three main discharge points however all three discharge points ultimately drain to the same location, the Otay River Valley. See Attachment D for the locations of the pre-development discharge points of interest. The existing brow ditch that separates this property from the property to the north intercepts run-on from the other site.

MMC proposes to modernize the power plant site by replacing the exiting units with two housed, gas turbines. Two exhaust stacks, up to 70feet in height are planned.

2. Design Criteria

The City of Chula Vista requires the following to be used as design criteria: (Attachment B):

- Rainfall data/Hydrological information for calculations: "County of San Diego County Hydrology Manual".

- City of Chula Vista storm water Quality Requirements: "Development and Redevelopment Projects Storm Water Management Standards Requirements Manual"

Design Criteria for the City of Chula Vista were determined by filling out forms from the City of Chula Vista's "Development and Redevelopment Projects Storm Water Management Standards Requirements" Manual. Completed forms are provided in Attachment E. The conclusions of these forms are that:

- The site is not a "priority site" and not subject to SUSMP requirements.
- The project is subject to "Permanent Standard Storm Water BMPs" per Form 5501. The following subsections of Section 2 of Form 5501 must be addressed:
  - A.1-A.3, B-1-B.B.3, C.1-C.3, C.6, C.8, C.10, C.11
- The project is subject to California's state wide General NPDES Permit for storm water discharge associated with construction activities. Construction activities and SWPPP will be addressed at a later date and are not a part of this calculation.

The City of Chula Vista's SUSMP was used as criteria to identify conditions of concern (1.c.3)

- Drainage study to include peak runoff rates, flow velocity, runoff volume, time of concentration, and retention volume for pre-development and post-development conditions.
- Analyze both conditions for the 2-year and 10-year frequencies.
- Use Type I storm.
- 6-hour duration storm.
- Evaluate impacts to downstream conditions.
- Incorporate BMPs as indicated in Section V.2 (this is a SUSMP requirement not necessarily applicable to this project).

The San Diego County Hydrology Manual was used to determine the hydrologic conditions of the site:

- The Rational Method shall be used for sites less than 1 square mile.
- The property has a hydrologic soil group D (Appendix A of the Manual, Attachment F of this report)
- Isopluvial Maps were used to determine the 6-hour precipitation data. (Appendix B of the Manual, Attachment G of this report).

Runoff coefficients were taken from "Hydrologic Analysis and Design" (pp 376-377, also provided as Attachment H). The San Diego Hydrology Manual did not provide coefficients

that coincided with the property land use and does not take into account the hydrologic soil groups.

II STORMWATER DRAINAGE CALCULATION

1. General Approach

Design the site grading to have a minimum slope of 0.5% with a target slope of 1%. Site will be graded such that flows to existing discharge points are unchanged or minimally effected. The majority of the site runoff leaves the site through 2 discharge points (A and B) in both the pre- and post-development conditions. A minimal amount leaves a third point (Area C). Therefore A and B will be used as the points of interest. Determine the peak runoff for the pre-development conditions to discharge points A and B. Sketches in Attachments D and K show the runoff discharge points from the site and their corresponding areas. As can be seen from both sketches, the size of Area C is unchanged, and no development is occurring in this area. In addition to this, additional runoff does not run on to this area in post-development as can be seen in the grading drawing in Attachment C. Therefore, Area C will not be calculated because the area is unchanged from pre to post conditions.

Design the final grading and drainage for the proposed plant. Determine the peak runoff for the site in the pre- and post-development condition. Compare the post-development peak runoff to the pre-development peak runoff. Provide BMPs if post exceeds pre-development per above criteria.

2. Site Soils

According to San Diego County Hydrology Manual, the soils at the site are classified as hydrologic soil group (HSG) D. A site soils map is attached (Attachment F).

3. Drainage Areas

A. Pre-Development Study Area = 3.69 acres

See the Pre-Development Site Plan (Attachment D).
The points of interest are A and B.

Subareas and cover conditions: C values are from "Hydrologic Analysis and Design" (pp 376-377, also provided as Attachment H).

Area A

Grass, open area (C=0.37) = 1.52 acres
Impervious areas (C=0.95) = 0.033 acres
Total= 1.55 acres
$\sum$CA average = 0.59

See Attachment I for pre-development calculations for Area A.

Area B

Gravel, (C=0.80) = 1.56 acres
Grass, (C=0.37) = 0.285 acres
Impervious areas (C=0.95) = 0.25 acres
Total= 2.10 acres
$\sum$CA average = 1.59

See Attachment J for pre-development calculations for Area B.

A brow ditch along the northern boundary intercepts run-on from the north and conveys it to the west away from the project site.

No additional areas drain to Points of Interest A or B from outside the project site.

The existing ammonia tank, unloading area, and switch yard will remain. Existing conditions are such that runoff from these areas is contained by a concrete curbed area and routed to a concrete containment holding tank. The existing containment tank discharges to the sanitary sewer system. Flows from these areas will not affect runoff due to project development.

Runoff from Area C as shown on Sketches CHUL-1-SK-024-735-001 and CHUL-1-SK-024-735-002 runs off the site as sheet flow and will not change from pre and post conditions. This area was not considered during calculations because of no change from pre to post development.

B. Post-Development Area = 3.69 acres

See the Post-Development Site Plan (Attachment K). The points of interest are A and B.

Area A

Grass (C=0.37) =	0.37 acres
Asphalt (C=0.85) =	0.23 acres
Gravel (C=0.80) =	0.25 acres
Impervious areas (C=0.95) =	0.136 acres
Total=	0.99 acres

$\sum$CA average = 0.66

See Attachment L for post-development calculations for Area A.

Area B

Gravel (C=0.80) =	1.21 acres
Asphalt (C=0.85) =	0.50 acres
Grass (C=0.37) =	0.88 acres
Impervious areas (C=0.95) =	0.11 acres
Total=	2.7 acres

$\sum$CA average = 1.84

See Attachment M for post-development calculations for Area B.

4. Rainfall data

Isopluvial- Maps were used to determine the 6-hour precipitation data. (Appendix B of the Manual, Attachments I, J, L, and M of this report).

5. Time of Concentration

Times of concentration were developed by using Worksheet 3 from the TR-55 Manual. These are provided in Attachments I, J, L, and M for all areas and conditions of concern.

6. Runoff Rate (Intensity) Determination

For project areas less than one square mile (640 acres) use Rational method. In Section 3 of the San Diego Hydrology Manual, a procedure was developed that converts the 6-hour precipitation isopluvial map data to an Intensity-Duration curve that is used for the rainfall intensity in the Rational Method. The Intensity –Duration Design Chart from the manual is provided in Attachments I, J, L, and M for their corresponding situation. Calculations were performed for 2-year and 10-year storms for Point of Interest A and B for both pre-development and post-development conditions.

Pre-Development Runoff

$Q_{peak} = \sum CA*I$

Area A = 1.55 acres,
Area B = 2.14 acres,

Area	Return Period (years)	Rainfall depth, $d_{6\text{-hour}}$	Rainfall depth, $d_{24\text{-hour}}$	Time of concentration Tc	Intensity (in/hr)	Qpeak (cfs)	Volume of runoff (ft^3)
A	2	1.2"	1.8"	17 min	1.4	**0.83**	**2,570**
A	10	1.7"	2.75"	17 min	3.5	**2.10**	**3,640**
B	2	1.2"	1.8"	6 min	2.6	**4.77**	**6,970**
B	10	1.7"	2.75"	6 min	6.4	**11.13**	**9,800**

Post-Development Runoff

$Q_{peak} = \sum CA*I$
Area A = 0.99 acres,
Area B = 2.70 acres,

Area	Return Period (years)	Rainfall depth, $d_{6\text{-hour}}$	Rainfall depth, $d_{24\text{-hour}}$	Time of concentration Tc	Intensity (in/hr)	Qpeak (cfs)	Volume of runoff (ft^3)
A	2	1.2"	1.8"	8 min	2.2	**1.72**	**2,875**
A	10	1.7"	2.75"	8 min	5.2	**4.09**	**4,075**
B	2	1.2"	1.8"	5 min	3.0	**5.52**	**8,015**
B	10	1.7"	2.75"	5 min	7	**12.88**	**11,325**

III PERMANENT STORM WATER BMP REQUIREMENTS

This is a preliminary water quality and quantity design, subject to be revision during final design. The preliminary grading and drainage drawing is provided in Attachment C.

This facility is an existing facility operating under an existing NPDES permit. The facility has never had a violation or action against the site. All existing BMPs will remain in place and will continue to

be utilized. Form 5501 (Attachment E) determines which permanent standard storm water BMPs are applicable to this project. This section of this report identifies each of those items to be addressed per the Form 5501.

A. Site Design BMPS

1. A.1-Minimize Project's Impervious Footprint & Conserve Natural Areas

   The proposed arrangement uses the minimum amount of impervious area as practicable. Asphalt paved roads are proposed around the new equipment areas, which will minimize the amount of sediment runoff and the quantity of dust generated. The majority of the existing power plant area will be demolished and replaced with a grassed area to make up for the added impervious areas that are being constructed for the new power plant site.

   The areas immediately surrounding the equipment will be gravel, which is not considered impervious.

   Natural areas will be conserved. Several areas of the property that are currently unused will remain undeveloped post-development.

   Streets are constructed to a minimum width to allow large truck access.

   Existing trees will be preserved where grading permits. Additional trees will be planted.

   Existing drainage patterns will be maintained; the north ditch, the west ditch and the gravel road that drains towards point of interest B.

2. A.2-Minimize Directly Connected Impervious Areas

   Connections between impervious areas have been minimized. A landscaping plan will be provided.

3. A.3-Protect Slopes and Channels

   The site is relatively flat. Areas that are sloped will be seeded and mulched to protect the slopes from erosion. Seeding will be native or drought tolerant vegetation. The only slopes exceeding 3:1 (H:V) are the drainage channel side slopes.

B. Source Control BMPs

1. B.1-Provide Storm Drain System Stenciling and Signage

   No new inlets are proposed for this project, therefore stenciling and signage are not applicable.

2. B.2-Design Outdoor Material Storage Areas to Reduce Pollution Introduction
   All areas that contain any oil and grease, chemicals, etc. are contained in tanks located within a curbed concrete secondary containment areas which collect potential spill waste through drains, which convey flows to a containment tank. This tank discharges to the public sewer system if deemed "clean".

3. B.3-Design Trash Storage Areas to Reduce Pollution Introduction

   There will be no outdoor trash storage.

C. BMPs Applicable to Individual Project Categories

1. C.1-Private Roads

   The roads for this site are designed such that the street runoff flows to a vegetated swale or it follows the drainage paths of the existing site.

2. C.2-Residential Driveways and Guest Parking

   The existing driveway will be utilized. The driveway drains into an existing, adjacent drainage ditch, which drains to the southeast corner of the property. No dedicated guest parking will be provided.

3. C.3-Dock Areas

   No dock areas are proposed. There will be one unloading area on this property to provide truck access to an existing ammonia tank, which is within a contained area.

4. C.8-Parking Areas

   No dedicated parking areas will be provided at this facility.

5. C.10-Hillside Landscaping

   This facility does not include hillside landscaping.

6. C.11-Design of Drainage Systems for Industrial/Commercial facilities

   The areas surrounding equipment are surfaced with gravel, not with pavement. The existing facility did not utilize an inlet and storm sewer drainage system and uses sheet flow for runoff to the points of interest. Point of Interest A runoff never makes its way to a street gutter and although Point of Interest B does drain to a street gutter, all evidence indicates this storm line drains to the Otay River Valley, adjacent to this property. Point of Interest A also drains to the Otay Valley. Therefore, all runoff from this site is drained to the Otay River Valley, regardless of point of exit from the property. Attachment N shows the general topography of the area of the property and of the Otay River.

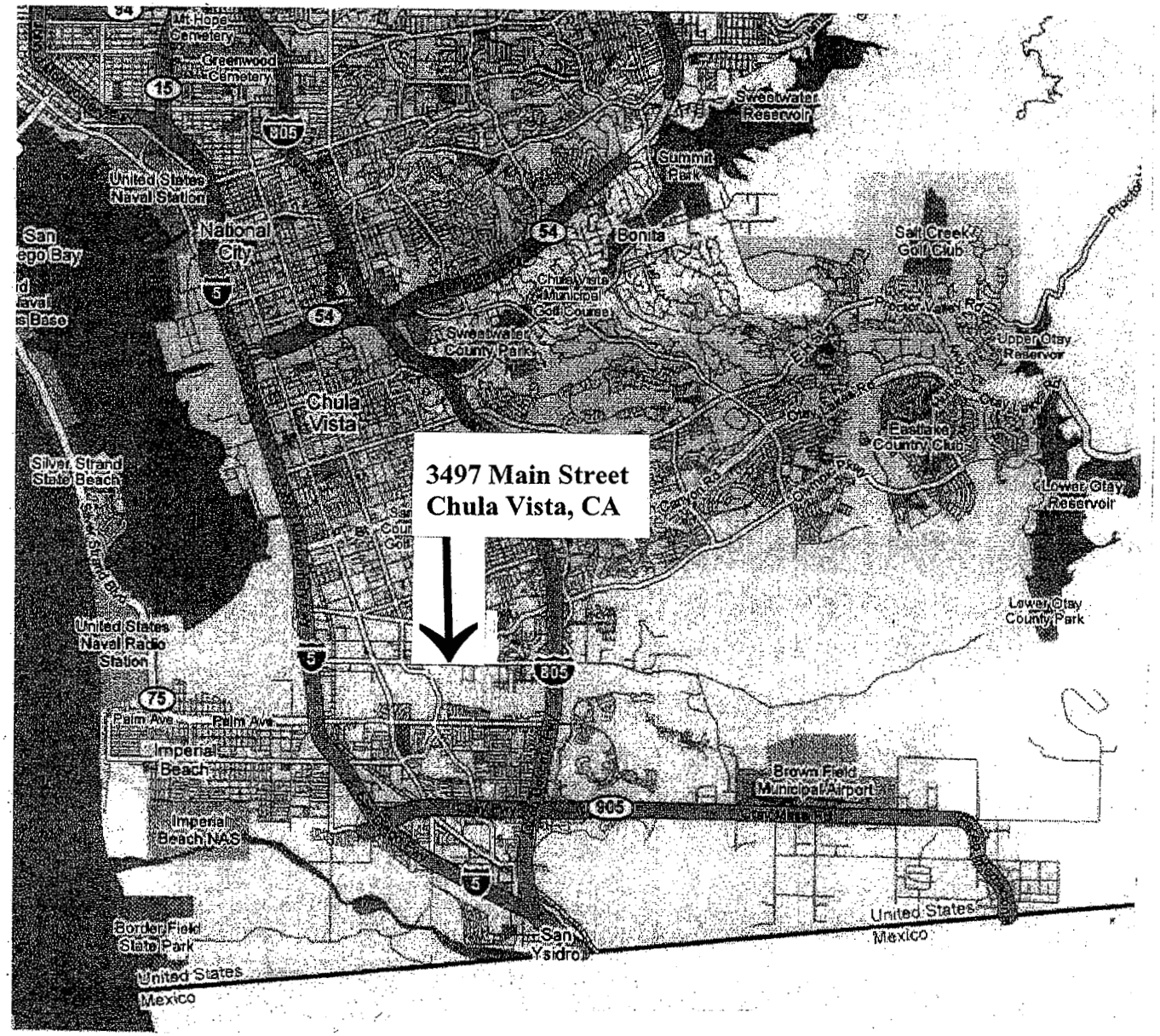
IV DOWNSTREAM IMPACTS

Discharge from all points of interest of this site all drain to the Otay River Valley as shown in the topographic map in Attachment N. Although the flow rates and volumes will increase with the proposed project, the increase amount is small and the impacts are minimal because the site is relatively small (3.81 acres) and the conditions are not substantially different from the pre-development stage. No new drainage patterns were created for this construction.

V CONCLUSIONS

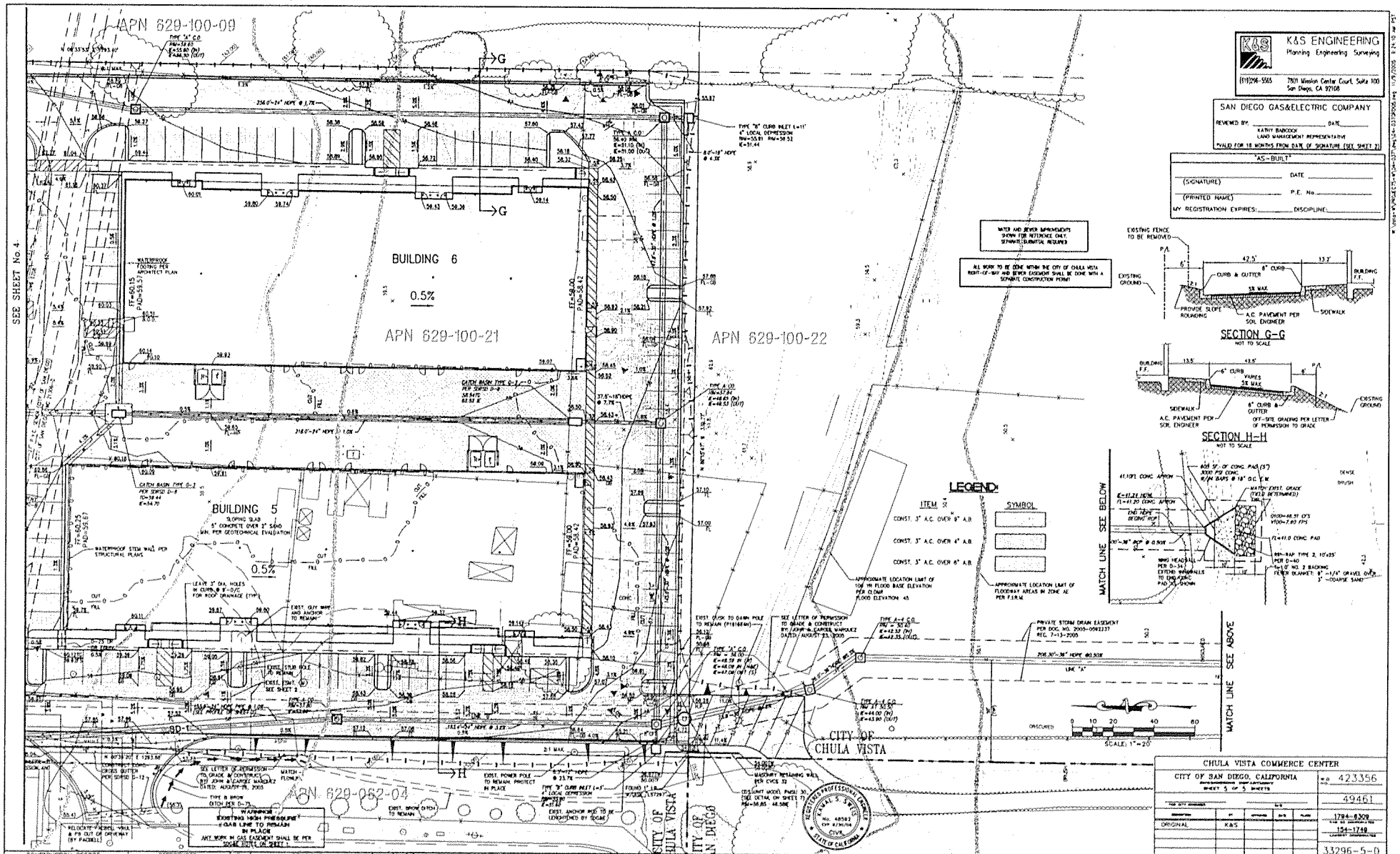
The storm water management for the site meets the requirements of the City of Chula Vista and San Diego County.

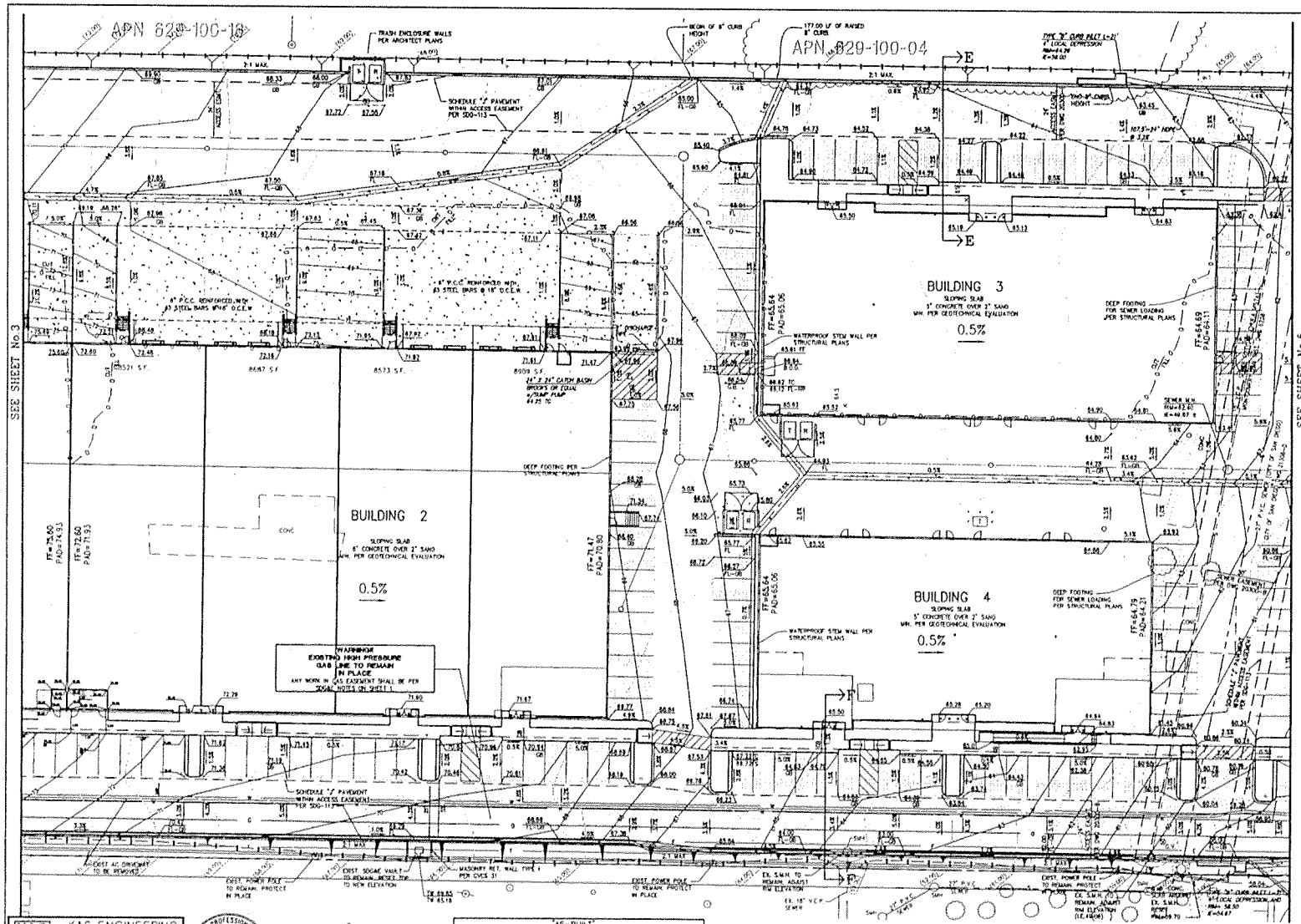
ATTACHMENT A
LOCATION MAP



LOCATION MAP

ATTACHMENT B
EMAIL CORRESPONDENCE


APN 629-100-09
BUILDING 6
0.5%
APN 629-100-21
APN 629-100-22
BUILDING 5
0.5%
APN 629-062-04
CITY OF CHULA VISTA
CITY OF SAN DIEGO
SEE SHEET No. 4
MATCH LINE SEE BELOW
MATCH LINE SEE ABOVE
LEGEND:
ITEM
SYMBOL
CONST. 3" A.C. OVER 8" A.B.
CONST. 3" A.C. OVER 4" A.B.
CONST. 3" A.C. OVER 6" A.B.
SECTION G-G
NOT TO SCALE
SECTION H-H
NOT TO SCALE
SCALE: 1"=20'
K&S ENGINEERING
Planning Engineering Surveying
(619)294-5565
7821 Mission Center Court, Suite 100
San Diego, CA 92108
SAN DIEGO GAS&ELECTRIC COMPANY
REVIEWED BY: KATHY BABCOCK
LAND MANAGEMENT REPRESENTATIVE
VALID FOR 18 MONTHS FROM DATE OF SIGNATURE (SEE SHEET 2)
"AS-BUILT"
(SIGNATURE)
DATE
(PRINTED NAME)
P.E. No.
W/ REGISTRATION EXPIRES:
DISCIPLINE:
CHULA VISTA COMMERCE CENTER
CITY OF SAN DIEGO, CALIFORNIA
SHEET 5 OF 5 SHEETS
423356
49461
1784-8309
154-1749
33296-5-D
ORIGINAL
K&S
CONSTRUCTION RECORD
Contractor
Inspector
Date Completed
REFERENCES
REVISIONS
BENCH MARK
SCALE
HORIZONTAL 1" = 20'
OFFICE
FIELD
TRAFFIC
Designed by
Drawn by
Checked By
Plans Prepared Under Supervision Of
Date
R.C.E. No.
Submitted
Approved
Office:
Principal Civil Engineer
CITY OF CHULA VISTA
ENGINEERING DEPARTMENT
GRADING AND DRAINAGE PLANS FOR:
CHULA VISTA COMMERCE CENTER
3513-3517 MAIN STREET
04095-05
W.O. NO. PG-721
JN-04-037



SPECIAL NOTES

THE FOLLOWING NOTES ARE PROVIDED TO GIVE DIRECTIONS TO THE CONTRACTOR BY THE ENGINEER OF WORK. THE CITY ENGINEER'S SIGNATURE ON THESE PLANS DOES NOT CONSTITUTE APPROVAL OF ANY OF THESE NOTES, AND THE CITY WILL NOT BE RESPONSIBLE FOR THEIR ENFORCEMENT.

1. ALL ELEVATIONS SHOWN ARE FINISHED SURFACE UNLESS OTHERWISE SHOWN.

2. THE OWNER AND/OR CONTRACTOR SHALL VERIFY WITH CIVIL ENGINEER, THE BUILDING STRUCTURAL SECTION(S) PRIOR TO REQUESTING STAKES FOR ROUGH GRADE PADS.

3. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF ALL EXISTING UTILITY CONNECTIONS PRIOR TO STARTING ANY CONSTRUCTION.

4. THE BOUNDARY SHOWN ON THESE PLANS IS NOT NECESSARILY THE RESULT OF A BOUNDARY SURVEY BY K & S ENGINEERING. THE BOUNDARY LINES SHOWN HEREON MAY HAVE BEEN ESTABLISHED FROM RECORD DATA ONLY.

5. ALL SURFACE DRAINAGE SHALL BE DIRECTED A MINIMUM OF 2 PERCENT AWAY FROM THE BUILDING(S). DRAINAGE WITHIN LANDSCAPE AREAS SHALL BE PURSUANT TO THE LANDSCAPE ARCHITECTURAL PLAN. IF LANDSCAPE PLANS ARE NOT REQUIRED, THE CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY TO ENSURE THAT NO PONDING OF WATER OCCURS IN THE PLANTER AREAS. THE FINISHED GRADE WITHIN LANDSCAPE AREAS ADJACENT TO THE BUILDING SHALL BE 8" BELOW THE FINISHED FLOOR. WATERPROOFING AND/OR A STEMWALL IS REQUIRED WHEN THE FINISHED GRADE IS LESS THAN 8" BELOW THE FINISHED FLOOR AND DEPENDED FOOTINGS ARE REQUIRED WHEN THE FINISHED GRADE IS MORE THAN 8" BELOW THE FINISHED FLOOR.

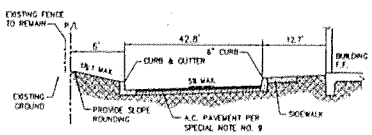
6. ALL STORM DRAIN PIPES SHALL HAVE WATERTIGHT JOINTS INSTALLED.

7. THE HARDSCAPE SHOWN HEREON WAS OBTAINED FROM THE ARCHITECTURAL PLAN. IN THE EVENT OF ANY DISCREPANCIES, THE CONTRACTOR SHALL CONSTRUCT ALL HARDSCAPE PER THE ARCHITECTURAL PLAN.

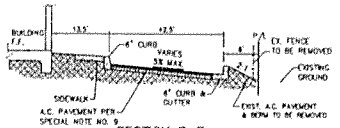
8. THE CONTRACTOR SHALL COMPLY WITH ALL A.D.A. REQUIREMENTS.

9. PRIVATE DRIVE PAVEMENT SECTIONS WITHIN SEWER ACCESS EASEMENTS SHALL BE DESIGNED TO A TI OF 5 AND ACCOMODATE H20 WHEEL LOADING.

FOR PRIVATE: CURB, CURB & GUTTER, A.C. PAVEMENT, 3' CONCRETE RIBBON GUTTER, WALKWAY, SEWER MANHOLE, SEWER LATERALS, 8" TYPE SERVICE WATER MAIN, 24" STORM DRAIN PIPE, STORM DRAIN INLET, GAS MAIN, TELEPHONE & ELECTRIC CONDUIT, WATER MAINS AND LANDSCAPING & IRRIGATION IN CITY OF SAN DIEGO SEWER EASEMENT, SEE ENCROACHMENT MAINTENANCE REMOVAL AGREEMENT 423356-02.



SECTION E-E
NOT TO SCALE



SECTION F-F
NOT TO SCALE

LEGEND:

ITEM	SYMBOL
CONST. 3" A.C. OVER 9" A.B.	
CONST. 3" A.C. OVER 4" A.B.	
CONST. 3" A.C. OVER 6" A.B.	

K&S ENGINEERING
Planning Engineering Surveying
(619)294-5965 7801 Mission Center Court, Suite 100 San Diego, CA 92108

REGISTERED PROFESSIONAL ENGINEER — KAMAL S. SHEIS — No. 48592 — EXP. 6/30/04 — CIVIL — STATE OF CALIFORNIA

"AS-BUILT"
(SIGNATURE) DATE
(PRINTED NAME) P.E. No.
UY REGISTRATION EXPIRES: DISCIPLINE:

ALL WORK TO BE DONE WITHIN THE CITY OF CHULA VISTA RIGHT-OF-WAY AND SEWER EASEMENT SHALL BE DONE WITH A SEPARATE CONSTRUCTION PERMIT

WATER AND SEWER IMPROVEMENTS SHOWN FOR REFERENCE ONLY. SEPARATE SUBMITTAL REQUIRED

SAN DIEGO GAS&ELECTRIC COMPANY
REVIEWED BY: DATE
KATHY BABCOCK
LAND MANAGEMENT REPRESENTATIVE
VALID FOR 18 MONTHS FROM DATE OF SIGNATURE (SEE SHEET 2)

CITY OF SAN DIEGO SEWER & ACCESS EASEMENT
CITY OF SAN DIEGO, CALIFORNIA
SHEET 4 OF 7 SHEETS
W.O. 423356
M.S.S. 49461
1794-6309
154-1749

	BY	APPROVED	DATE	REVISED
ORIGINAL	K&S			

33296-4-D

CONSTRUCTION RECORD	REFERENCES	By	REVISIONS	Date	App'd	BENCH MARK	SCALE
Contractor						CHULA VISTA BENCH MARK NO. 1550 MAIN STREET AND REED LEAD & TAC AT DRAIN INLET, NORTH SIDE OF MAIN STREET AND CENTER. NAVD88 ELEV. 86.670	HORIZONTAL 1"=20'
Inspector							
Date Completed							

OFFICE
FIELD
TRAFFIC

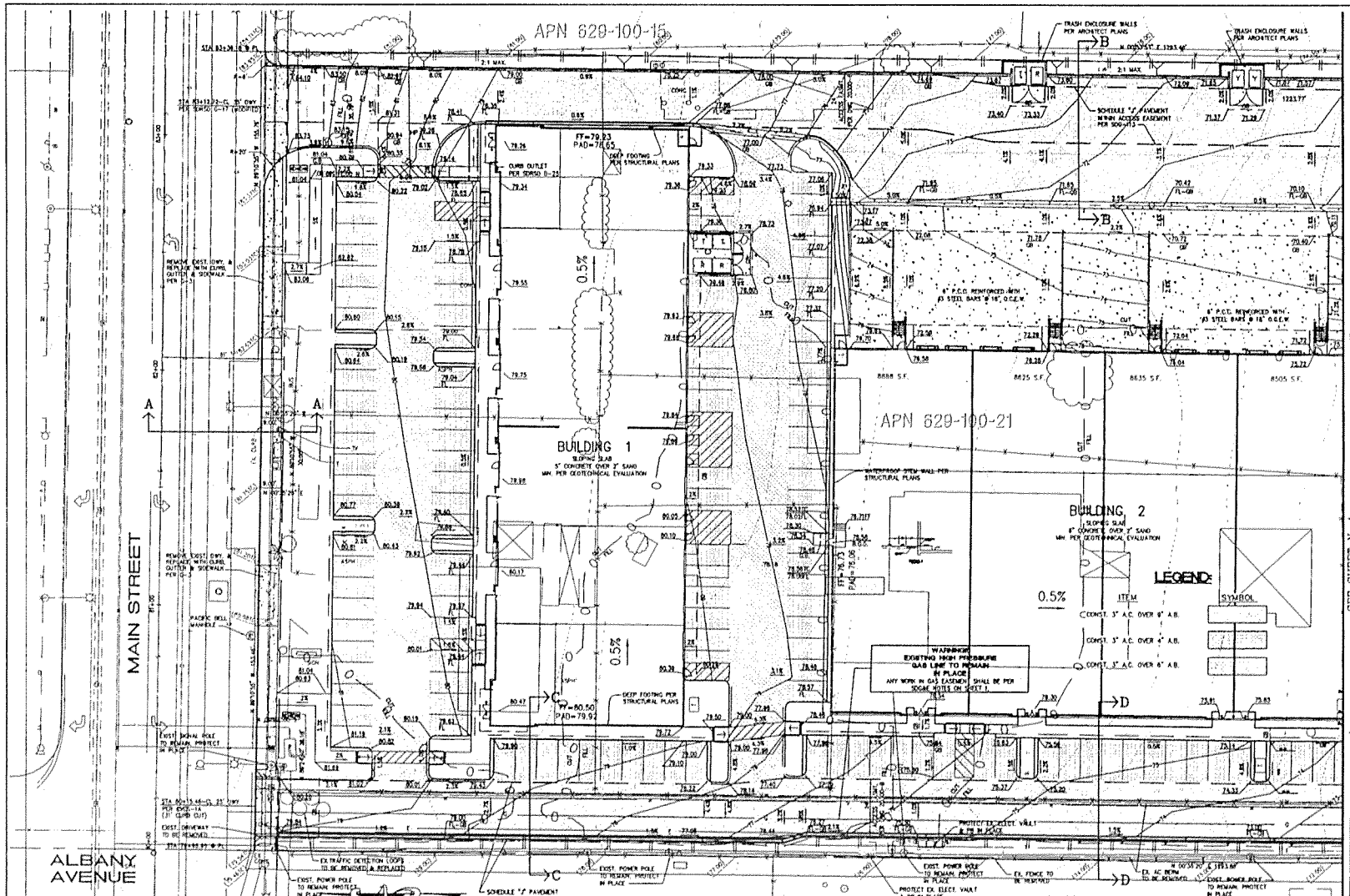
Designed by | Drawn by | Checked By
Plans Prepared Under Supervision Of
Date
R.C.E. No. 48592
KAMAL S. SHEIS

Submitted: Approved:
By: By:
Office: Principal Civil Engineer

CITY OF CHULA VISTA ENGINEERING DEPARTMENT
GRADING AND DRAINAGE PLANS FOR:
CHULA VISTA COMMERCE CENTER
3513-3517 MAIN STREET

Drawing No. 04095-04
W.O. NO. PG-721

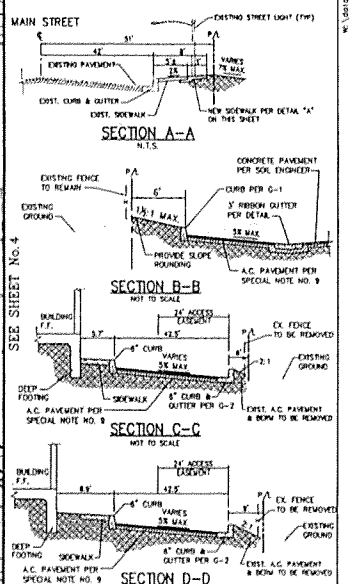
M:\JOBS4-W\PROJECTS-W\04-0371\04-0372\0404.dwg 11/4/2005 9:22:51 AM PST



SPECIAL NOTES

THE FOLLOWING NOTES ARE PROVIDED TO GIVE DIRECTIONS TO THE CONTRACTOR BY THE ENGINEER OF WORK. THE CITY ENGINEER'S SIGNATURE ON THESE PLANS DOES NOT CONSTITUTE APPROVAL OF ANY OF THESE NOTES, AND THE CITY WILL NOT BE RESPONSIBLE FOR THEIR ENFORCEMENT.

1. ALL ELEVATIONS SHOWN ARE FINISHED SURFACE UNLESS OTHERWISE SHOWN.
2. THE CONTRACTOR SHALL VERIFY WITH CIVIL ENGINEER THE BUILDING STRUCTURAL SECTION(S) PRIOR TO REQUESTING STAKES FOR ROUGH GRADE PADS.
3. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF ALL EXISTING UTILITY CONNECTIONS PRIOR TO STARTING ANY CONSTRUCTION.
4. THE BOUNDARY SHOWN ON THESE PLANS IS NOT NECESSARILY THE RESULT OF A BOUNDARY SURVEY BY K & S ENGINEERING. THE BOUNDARY LINES SHOWN HEREON MAY HAVE BEEN ESTABLISHED FROM RECORD DATA ONLY.
5. ALL SURFACE DRAINAGE SHALL BE DIRECTED A MINIMUM OF 2 PERCENT AWAY FROM THE BUILDING(S). DRAINAGE WITHIN LANDSCAPE AREAS SHALL BE PURSUANT TO THE LANDSCAPE ARCHITECTURAL PLAN. IF LANDSCAPE PLANS ARE NOT REQUIRED, THE CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY TO INSURE THAT NO PONDING OF WATER OCCURS IN THE PLANTER AREAS. THE FINISHED GRADE WITHIN LANDSCAPE AREAS ADJACENT TO THE BUILDING SHALL BE 6" BELOW THE FINISHED FLOOR. WATERPROOFING AND/OR A STEMWALL IS REQUIRED WHEN THE FINISHED GRADE IS LESS THAN 6" BELOW THE FINISHED FLOOR AND DEEPENED FOOTINGS ARE REQUIRED WHEN THE FINISHED GRADE IS MORE THAN 8" BELOW THE FINISHED FLOOR.
6. ALL STORM DRAIN PIPES SHALL HAVE WATERTIGHT JOINTS INSTALLED.
7. THE HARDSCAPE SHOWN HEREON WAS OBTAINED FROM THE ARCHITECTURAL PLAN. IN THE EVENT OF ANY DISCREPANCIES, THE CONTRACTOR SHALL CONSTRUCT ALL HARDSCAPE PER THE ARCHITECTURAL PLAN.
8. THE CONTRACTOR SHALL COMPLY WITH ALL A.D.A. REQUIREMENTS.
9. PRIVATE DRIVE PAVEMENT SECTIONS WITHIN SEWER ACCESS EASEMENTS SHALL BE DESIGNED TO A TI OF 5 AND ACCOMODATE H20 WHEEL LOADING.



SAN DIEGO GAS&ELECTRIC COMPANY
REVIEWED BY: _____ DATE _____
KATHY BABCOCK
LAND MANAGEMENT REPRESENTATIVE
(VALID FOR 18 MONTHS FROM DATE OF SIGNATURE)(SEE SHEET 3)

CITY OF SAN DIEGO SEWER & ACCESS EASEMENT

CITY OF SAN DIEGO, CALIFORNIA
SHEET 3 OF 7 SHEETS

W.O.	423356
P.T.S. NO.	49461
	1794-6309
	154-1749
	33296-3-D

DESCRIPTION	BY	APPROVED	DATE	PLAN
ORIGINAL	K&S			

K&S ENGINEERING
Planning Engineering Surveying
(619)298-5965 2801 Mission Center Court, Suite 100 San Diego, CA 92108

"AS-BUILT"
(SIGNATURE) DATE
(PRINTED NAME) P.E. No.
MY REGISTRATION EXPIRES: DISCIPLINE

REGISTERED PROFESSIONAL ENGINEER KARL S. SWISS No. 48592 EXP. 6/30/06 CIVIL STATE OF CALIFORNIA

ALL WORK TO BE DONE WITHIN THE CITY OF CHULA VISTA RIGHT-OF-WAY AND SEWER EASEMENT SHALL BE DONE WITH A SEPARATE CONSTRUCTION PERMIT

WATER AND SEWER IMPROVEMENTS SHOWN FOR REFERENCE ONLY. SEPARATE SUBMITTAL REQUIRED

CONSTRUCTION RECORD	REFERENCES	By	REVISIONS	Date	App'd
Contractor	PG-857, C.O.V. DWG 01079-06				
Inspector	CITY OF S.D. DWG 21306-D, 21307-D				
Date Completed	R OF S 18042, 9199, 4303, 15149				
	18624, MAP 4422, MAP 4291, PM 2563				

BENCH MARK: CHULA VISTA BENCH MARK NO. 1550 MAIN STREET AND REED. LEAD & TAC AT DRAIN INLET, NORTH SIDE MAIN STREET AND CENTER. NAVD88 ELEV. 88.870

SCALE 1" = 20'

Designed by CWG	Drawn by DTK	Checked By K.S.S.	
Plans Prepared Under Supervision Of KARL S. SWISS	Date	R.C.E. No. 48592	

Submitted: _____ Approved: _____
By: _____ By: _____
Office: _____ Principal Civil Engineer

CITY OF CHULA VISTA ENGINEERING DEPARTMENT
GRADING AND DRAINAGE PLANS FOR:
CHULA VISTA COMMERCE CENTER
3513-3517 MAIN STREET

Drawing No. 04095-03
W.O. NO. PG-721

W:\data-W\PROJECTS-W\04-037\dwg\04-037DR003.dwg 11/9/2005 9:21:51 AM PST

Burchfield, Brigitte (Reading)

From: Khosro Aminpour [KAminpour@ci.chula-vista.ca.us]
Sent: Wednesday, November 01, 2006 4:42 PM
To: Burchfield, Brigitte (Reading)
Subject: RE: : Storm Water Plan

Hi Brigitte,

As far as storm water quality, we have our own plan. However, we use the County of San Diego Hydrology Manual for rainfall data and intensity-duration curves for calculating drainage and flood control structures such as sizing drainage pipes, channels, etc.

Khosro Aminpour, P.E.
City of Chula Vista
Storm Water Management Section
Phone: (619) 397-6111

-----Original Message-----
From: Burchfield, Brigitte (Reading)
[mailto:Brigitte.Burchfield@WorleyParsons.com]
Sent: Wednesday, November 01, 2006 1:37 PM
To: Khosro Aminpour
Subject: : Storm Water Plan

Thank you for the link!
So you have adopted your own plan rather than use the County's stormwater plan?
And I therefore don't need the County of San Diego hydrology manual and the stormwater mitigation plan from their website?

Brigitte Burchfield
Civil Engineering
WorleyParsons
610-855-2604
2675 Morgantown Road
Reading, PA 19607

brigitte.burchfield@worleyparsons.com

-----Original Message-----
From: Khosro Aminpour [mailto:KAminpour@ci.chula-vista.ca.us]
Sent: Tuesday, October 31, 2006 3:06 PM
To: Burchfield, Brigitte (Reading)
Subject: Storm Water Plan

Hi Brigitte,

Please find below a link to the City of Chula Vista's Storm Water Manual which includes information about the City's Development and Redevelopment storm water requirements.

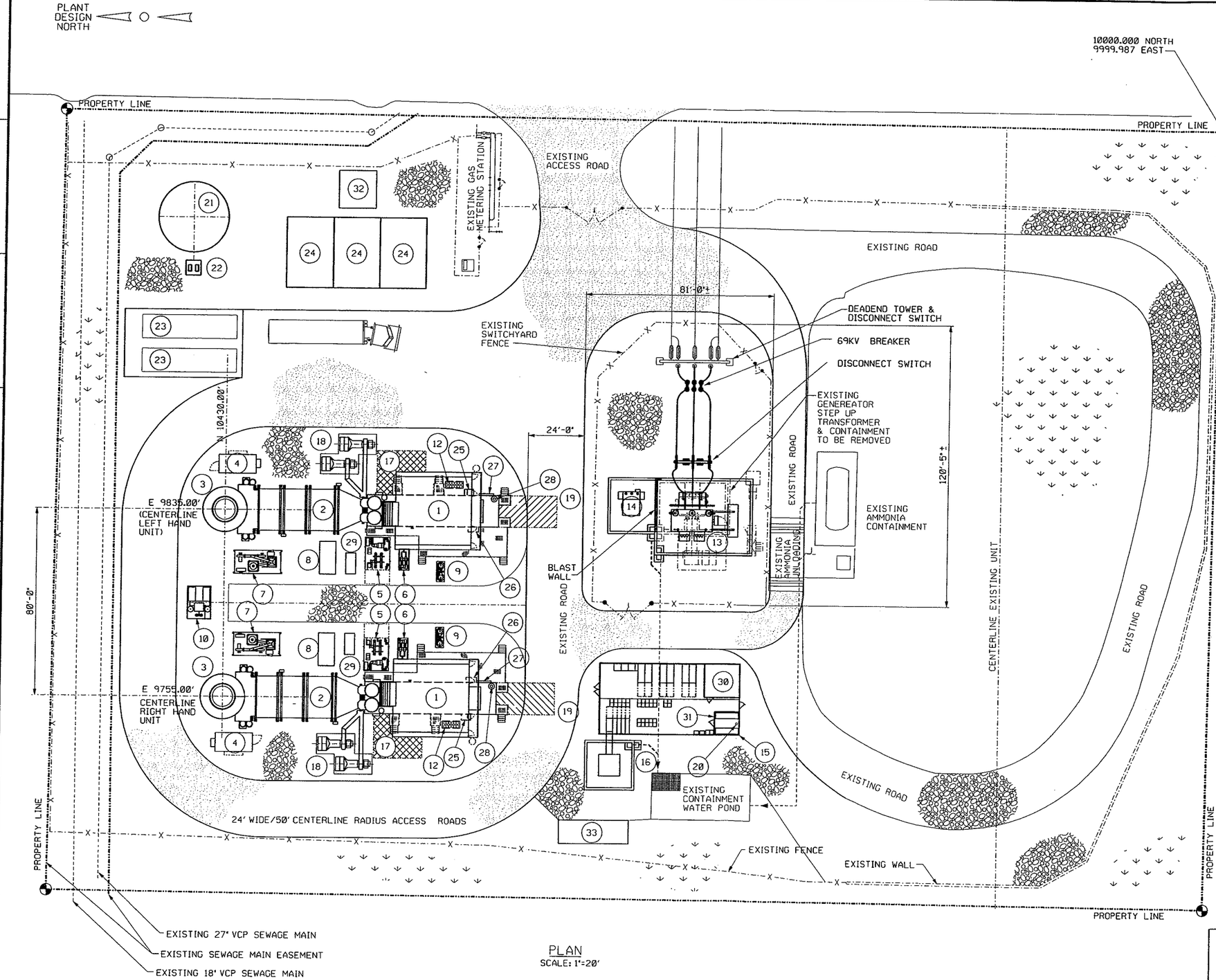
For construction phase of the projects we require a Storm Water Pollution Prevention Plan (SWPPP) if the project is one Acre or more. The Building Industry Association of San Diego has developed a SWPPP template which most developers use. For projects less than one Acre, Form 5504 included in the Storm Water Manual should be completed and submitted in lieu of a SWPPP.

For post-construction phase, a Water Quality Technical Report is required if the project is a Priority Development Project (as defined in Appendix B of the Storm Water Manual, Section I). Water Quality Technical Report Guidelines are included in Attachment B1 of the Storm Water Manual. For projects not falling under Priority Project categories, permanent Best Management Practices are required as shown on Form 5501 of the Storm Water Manual.

I hope this answers your question but please do not hesitate to send me an e-mail or call if you have any questions.

Khosro Aminpour, P.E.
City of Chula Vista
Storm Water Management Section
Phone: (619) 397-6111
http://www.chulavistaca.gov/City_Services/Development_Services/Engineeri
ng/s
tormWaterManual.asp
*** WORLEYPARSONS GROUP NOTICE ***
"This email is confidential. If you are not the intended recipient, you must not disclose or use the information contained in it. If you have received this email in error, please notify us immediately by return email and delete the email and any attachments. Any personal views or opinions expressed by the writer may not necessarily reflect the views or opinions of any company in the WorleyParsons Group of Companies."

ATTACHMENT C
DRAWINGS
GENERAL ARRANGEMENT- CHUL-1-DW-111-002-001
GRADING AND DRAINAGE- CHUL-1-DW-112-735-001



PLAN
SCALE: 1"=20'

20 0 20 40 60
SCALE IN FEET

ITEM	DESCRIPTION
1	GAS TURBINE GENERATOR
2	SCR CATALYST
3	EXHAUST STACK
4	CEMS STATION
5	AUXILIARY SKID
6	SPRINT/SPRAY MIST COOLER SKID
7	AMMONIA DELIVERY SKID
8	GAS TURBINE LUBE OIL FIN FAN COOLER
9	FINAL GAS FUEL FILTER
10	AIR COMPRESSOR SKID
11	DRAIN SUMP
12	CO2 BOTTLES
13	STEP-UP TRANSFORMER & CONTAINMENT
14	AUX TRANSFORMER & CONTAINMENT
15	ELECTRICAL / CONTROL BUILDING
16	480V TRANSFORMER & CONTAINMENT
17	TURBINE REMOVAL/MAINTENANCE PAD AREA
18	TEMPERING AIR FANS
19	MAINTENANCE AND ROTOR PULL SPACE
20	PORTABLE EYEWASH STATION
21	DEMINERALIZED WATER STORAGE TANK
22	DEMINERALIZED WATER FORWARDING PUMPS
23	DEMINERALIZED WATER TRAILERS
24	GAS COMPRESSORS
25	NEUTRAL CUBICLE
26	LINESIDE CUBICLE
27	MAIN GEN TERMINAL BOX
28	GEN AIR/OIL SEPERATOR
29	WATER INJECTION SKID
30	CONTROL ROOM
31	BATTERY ROOM
32	FUEL GAS RECYCLE COOLER
33	BLACK START DIESEL GENERATOR

LEGEND

GRAVEL
ASPHALT
GRASS

PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE J. STANLEY	11/21/06	
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE		

ORIGINATING PERSONNEL

DRAWN BY: MLH
CHECKED BY:
LEAD DESIGNER: R.W. MESSNER
ENGINEER/TECH SPECIALIST:
PROJECT ENGINEERING MANAGER:
PROJECT MANAGER: S.A. BLUE

PROFESSIONAL ENGINEER'S SEAL

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
MCC ENERGY
CHULA VISTA
ENERGY EFFICIENCY UPGRADE PROJECT

GENERAL ARRANGEMENT

SITE PLAN

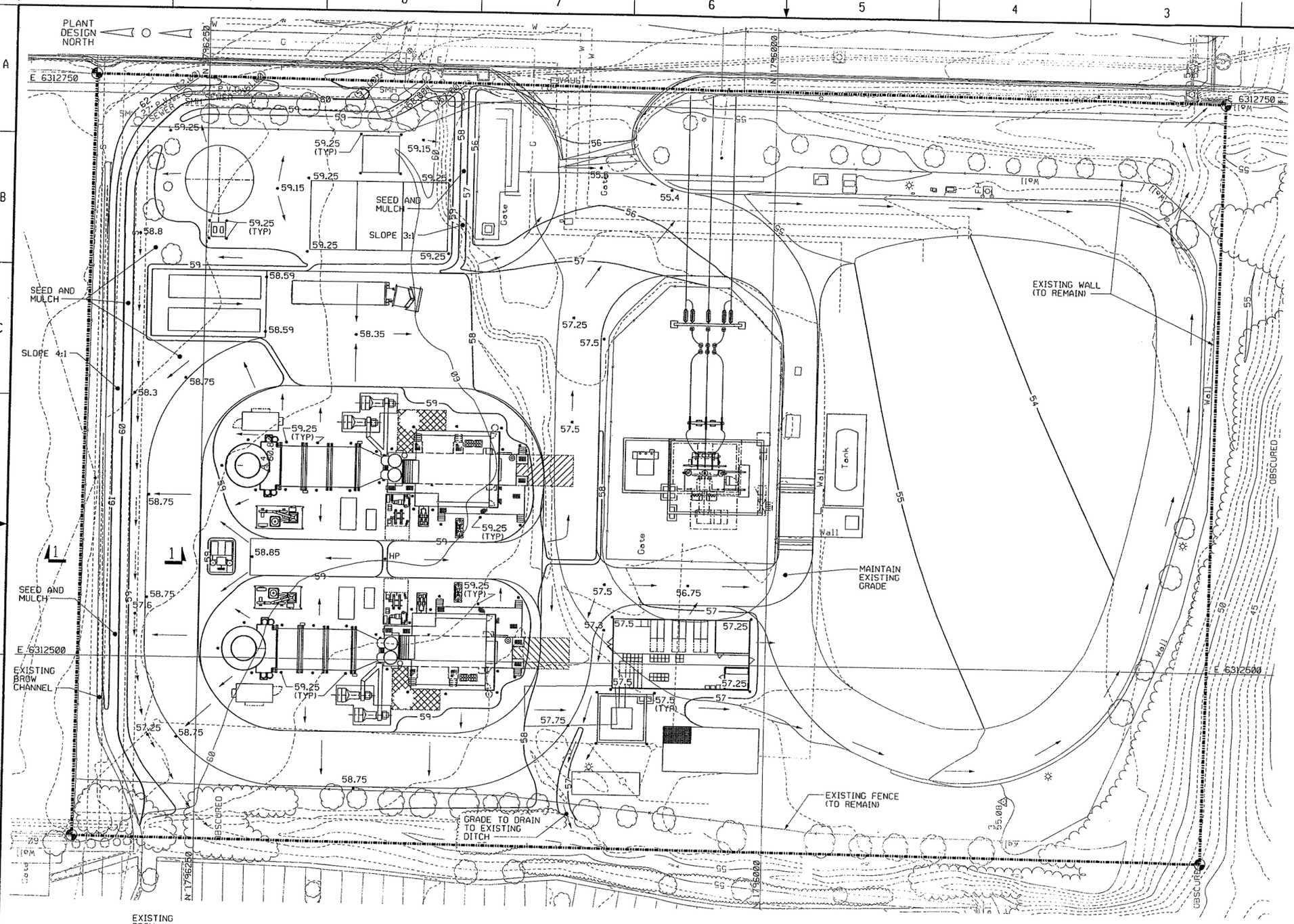
SCALE: 1" = 20'-0
DRAWING SIZE: ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.: CHUL-1-DW-111-002-001
REV: B

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	11/21/06	TMB		RWM		JS		SAB
B	11/22/06	MJB		RWM		JS		SAB

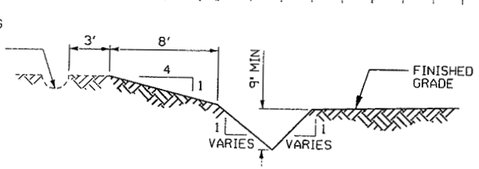
A — ISSUED FOR REVIEW.
B — GENERAL REVISION AND UPDATED PROPERTY LINES; UPDATED AS PER CLIENT COMMENTS

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

DWG-FILE: wpsdarch03d.fil
DWG-DATE: 08-Nov-05 16:01
825002:



PLAN



TYPICAL SECTION 1-1
NO SCALE

NOTES:

1. BACKGROUND TOPOGRAPHY BASED ON PHOTOGRAMMETRIC METHODS PERFORMED BY SAN-LO AERIAL SURVEYS, 4879 VIEWRIDGE AVE., SAN DIEGO, CA 92123, DATE OF PHOTOGRAPHY 10-19-06 AND BY FIELD SURVEY PERFORMED ON 10-24-06.
2. HORIZONTAL CONTROL IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, CCS 83 ZONE 6 (EPOCH 1991.35) AND VERTICAL CONTROL IS BASED ON NAVD88 (FEET).

LEGEND:

- 55 — EXISTING GRADE CONTOURS
- 55 — FINAL GRADE CONTOURS
- •56.5 — FINAL GRADE SPOT ELEVATION
- —X— EXISTING FENCE
- PROPERTY LINE
- FLOW DIRECTION
- PROPOSED DITCH

20 0 20 40 60
SCALE IN FEET

PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE		
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED 'HELD' RETAINS PRELIMINARY STATUS.
LDE P. KHAN	01/24/07	

ORIGINATING PERSONNEL

DRAWN BY: GJU
CHECKED BY: A.L. MERKEL
LEAD DESIGNER: K.P. FEEG
ENGINEER/TECH SPECIALIST: B. BURCHFIELD
PROJECT ENGINEERING MANAGER: N/A
PROJECT MANAGER: S.A. BLUE

PROFESSIONAL ENGINEER'S SEAL

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY PRADIP KHAN P.E. NO. 54262 ON 01/24/07 THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PD___ GRADE EMBY___ STATE___ CA LIC. NO.___ 54262___ DATED 01/24/07

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
MMC ENERGY
CHULA VISTA
ENERGY EFFICIENCY UPGRADE PROJECT

GRADING AND DRAINAGE PLAN

SCALE: 1"=20'
DRAWING SIZE: ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.: CHUL-1-DW-112-735-001
REV: 0

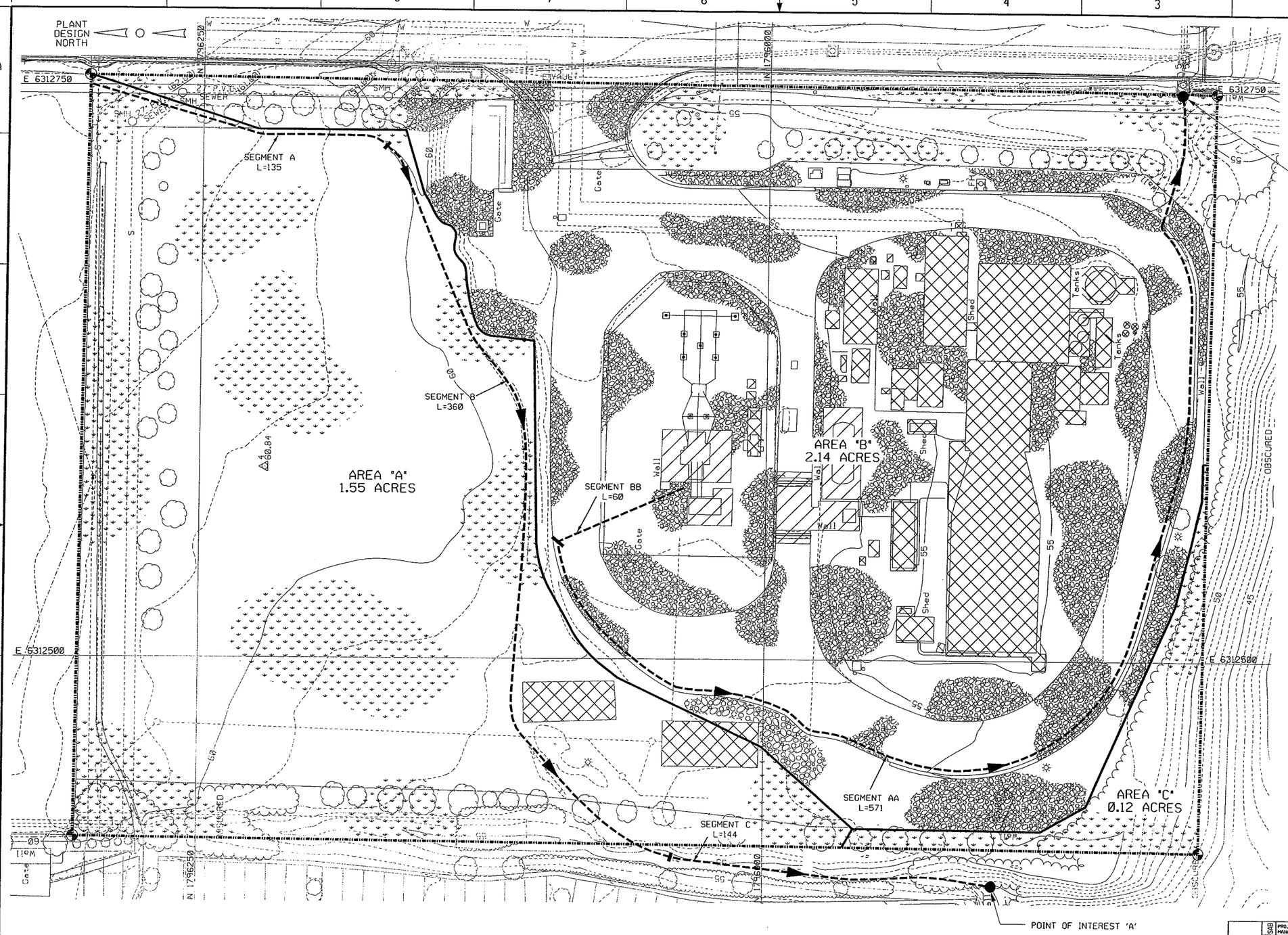
REV	DATE	REVISED	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
0		GJU	GJU	MLM	KPF	BB	PK	WAB	SAB

ISSUED FOR PERMITTING

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

DWG-FILE: chul-1-dw-112-735-001.dgn
DWG-DATE: 24-Jan-07 14:14

ATTACHMENT D
PRE-DEVELOPMENT SITE PLAN – DRAINAGE AREAS



PLAN

NOTES:

1. BACKGROUND TOPOGRAPHY BASED ON PHOTOGRAMMETRIC METHODS PERFORMED BY SAN-LO AERIAL SURVEYS, 4879 VIEWRIDGE AVE., SAN DIEGO, CA 92123. DATE OF PHOTOGRAPHY 10-19-06 AND BY FIELD SURVEY PERFORMED ON 10-24-06.
2. HORIZONTAL CONTROL IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, CCS 83 ZONE 6 (EPOCH 1991.35) AND VERTICAL CONTROL IS BASED ON NAVD88 (FEET).

LEGEND:

- EXISTING GRADE CONTOURS
- EXISTING FENCE
- PROPERTY LINE
- TRIBUTARY AREA BOUNDARY
- TIME OF CONCENTRATION LINE
- GRAVEL
- GRASS
- IMPERVIOUS
- CONTAINED AREAS

TOTAL AREA = 3.81 ACRES

20 0 20 40 60
SCALE IN FEET

PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE		
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE P. KHAN	01/24/07	

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: MRS	
CHECKED BY: A.L. MERKEL	
LEAD DESIGNER: K.P. FEEG	
ENGINEER/TECH SPECIALIST: B. BURCHFIELD	
PROJECT ENGINEERING MANAGER: N/A	
PROJECT MANAGER: S.A. BLUE	

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE:_____ STATE:_____ LIC. NO.:_____ DATE:_____

WorleyParsons resources & energy

CLIENT/PROJECT TITLE

MMC ENERGY
CHULA VISTA
ENERGY EFFICIENCY UPGRADE PROJECT

PRE-DEVELOPMENT
PLAN

SCALE 1"=20'	DRAWING SIZE ARCH D (24" x 36")	
WORLEYPARSONS DWG. NO. CHUL-1-SK-024-735-001		REV 0

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
0	01/24/07	MRS	ALN	KPF	BB	PK	N/A	SAB

ISSUED FOR PERMITTING

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

DWG-FILE: chul-1-sk-024-735-001.dgn
DWG-DATE: 24-Jan-07 08:30

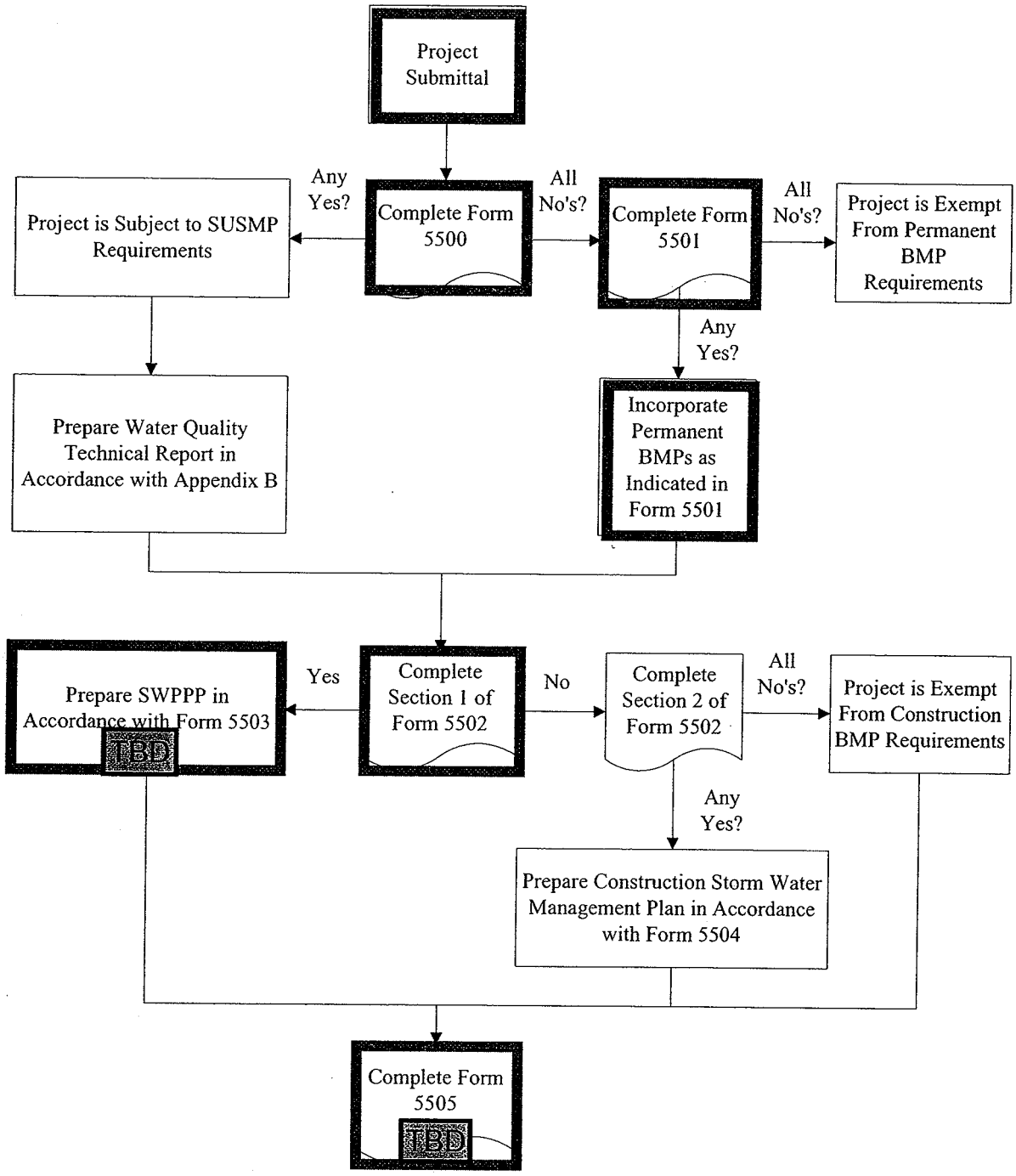
ATTACHMENT E

CITY OF CHULA VISTA STORM WATER MANAGEMENT FORMS

E1/4

Figure 1

Review and Approval Process for Development and Redevelopment Projects



E2/4

CITY OF CHULA VISTA	ENGINEERING 276 Fourth Avenue, Chula Vista, CA 91910 619-691-5021 619-691-5171 FAX	PROJECT PERMANENT STORM WATER BMPs (SUSMP) REQUIREMENTS
	FORM 5500	

Appendix A

Complete the following checklist to determine the project's per manent and construction best management practices requirements. This form must be completed and submitted with the permit application.

If one or more questions in the checklist are answered "Yes," the project is subject to the "Priority Project Permanent Storm Water BMPS (SUSMP)" requirements in Appendix B. If all answers are "No", please complete Form 5501 to determine if the project is subject to the "Standard Permanent Storm Water BMP" requirements.

Does the project meet the definition of one or mor e of the priority project categories? Also, refer to the definition in Appendix F for expanded definition of the Significant Redevelopment priority project

		Yes	No
1.	Detached residential development of 10 or more units		X
2.	Attached residential development of 10 or more units		X
3.	Commercial development greater than 100,000 square feet		X
4.	Automotive repair shop		X
5.	Restaurant		X
6.	Steep hillside development greater than 5,000 square feet		X
7.	Project discharging to receiving waters within Envi ronmentally Sensitive Areas		X
8.	Parking lots greater than or equal to 5,000 square feet or with at least 15 parking spaces, and potentially exposed to urban runoff		X
9.	Streets, roads, highways, and freeways which create a new paved surface that is 5,00 0 square feet or greater		X

* Refer to the definitions in Appendix F for expanded definitions of the priority project categories.

Limited Exclusion: Trenching and resurfacing work associated with utility projects are not considered priority projects. Parking lots, buildings and other structures associated with utility projects are priority projects if one or more of the criteria is met.

J:\Engineer\NPDES\NPDES Manual\Form 5500 I.doc

E3/4

CITY OF CHULA VISTA	ENGINEERING 276 Fourth Avenue, Chula Vista, CA. 91910 619-691-5021 619-691-5171 FAX	PERMANENT STANDARD STORM WATER BMPs REQUIREMENTS
	FORM 5501	

Appendix A

Section 1

Complete the following checklist to determine if the project is subject to "Permanent Standard Storm Water BMPs" requirements.

If one or more questions in the following checklist are answered "Yes", the project is subject to the applicable "Permanent Standard Storm Water BMPs" requirements identified in Section 2 of this Form 5501. If all answers are "No", the project is exempt from permanent storm water BMPs requirements.

	Does the project propose:	Yes	No	Applicable BMP (refer to Section 2 of this Form 5501)
1.	New impervious areas, such as rooftops, ro ads, parking lots, driveways, paths, and sidewalks?	X		A.1, A.2, B1, C.1, C.2, C.8, C11
2.	New pervious landscape areas and irrigation systems?		X	A.1, A.2, B.4, C.10
3.	Permanent structures within 100 feet of any natural water body?		X	A.1, A.2, A.3
4.	Trash storage areas?		X	B.3
5.	Liquid or solid material loading and unloading areas?	X		B.2, C.3
6.	Vehicle or equipment fueling, washing, or maintenance areas?		X	C.4, C.5, C6, C.7, C.9
7.	Require a General NPDES permit for Storm Water Discharges Associated with Industrial Activities (except Construction)? *	X		Applicable BMPs
8.	Commercial or industrial waste handling or storage, excluding typical office or household waste?		X	B2, B3, C.3, C.6
9.	Any grading or ground disturbance during construction?	X		A.1, A.2, A.3, C10
10	Any new storm drains, or alteration to existing storm drains?		X	A.3, B.1, C11

*To find out if the project is required to obtain an individual General NPDES Permit for Storm Water Discharges Associated with Industrial Activities, visit the State Water Resources Control Board web site at, www.swrcb.ca.gov/stormwtr/industrial.html. Applicable BMPs shall be selected from Section 2 of this Form 5501.

E4/4

CITY OF CHULA VISTA	ENGINEERING 276 Fourth Avenue, Chula Vista, CA 91910 619-691-5021 619-691-5171 FAX	**CONSTRUCTION STORM WATER BMP REQUIREMENTS**
FORM 5502		

Appendix A

Construction Storm Water BMP Requirements:
If the answer to the question in Section 1 is "Yes", the project is subject to Appendix C "Construction Storm Water BMP Performance Standards," and must prepare a Storm Water Pollution Prevention Plan (SWPPP) in accordance with guidelines presented in Form 5503 "Storm Water Pollution Preve ntion Plan Guidelines". If the answer to the question in Section 1 is "No", but the answer to any of the questions in Section 2 is "Yes," the project is subject to Appendix C, "Construction Storm Water BMP Performance Standards," and must prepare a Construction Storm Water Management Plan (CSWMP) in accordance with the guidelines presented in Form 5504 "Construction Storm Water Management Plan Guidelines". If every question in this Form 5502 is answered "No," the project is exempt from any construction s torm water BMP requirements.

If any of the answers to the questions in Section 1 or Section 2 of this Form 5502 is "Yes," please complete Form 5505 "Construction Site Prioritization".

Determine Construction Phase Storm Water Requirements:

Section 1

	Would the project meet the following criterion during construction?	Yes	No
1.	Is the project subject to California's state wide General NPDES Permit for Storm Water Discharges Associated with Construction Activities? (Projects over 5 Acres, to be reduced t o 1 Acre on March 10, 2003)	X	

Section 2

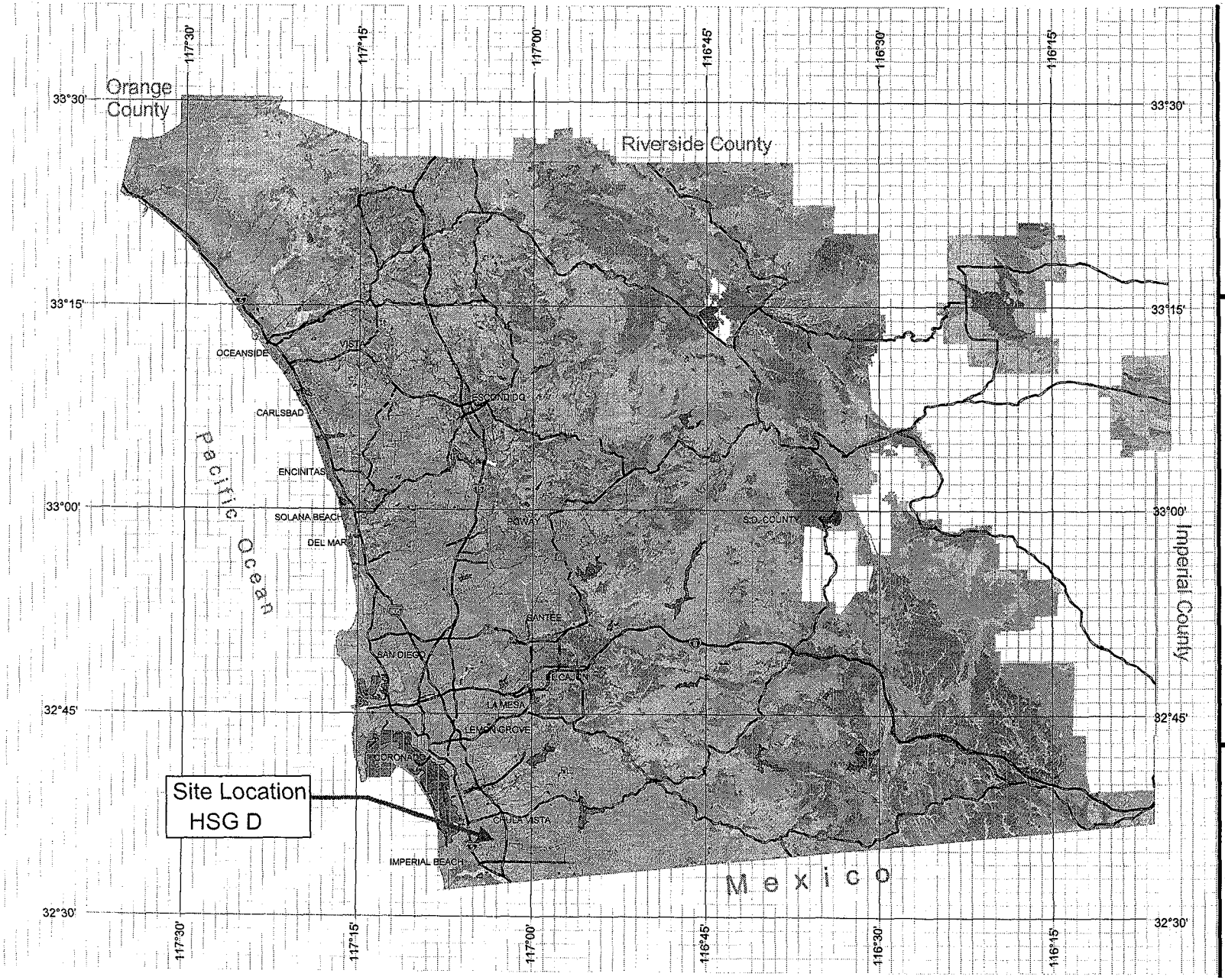
	Would the project meet any of these criteria during construction?	Yes	No
1.	Does the project propose grading or soil disturbance?	X	
2.	Would storm water or urban runoff have the potential to contact any port ion of the construction area, including washing and staging areas?	X	
3.	Would the project use any construction materials that could negatively affect water quality if discharged from the site (such as, paints, solvents, concrete, and stucco)?	X	

J:\Engineer\NPDES\NPDES Manual\Form 5502 1.doc

ATTACHMENT F
MAP OF SOIL HYDROLOGIC GROUPS

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

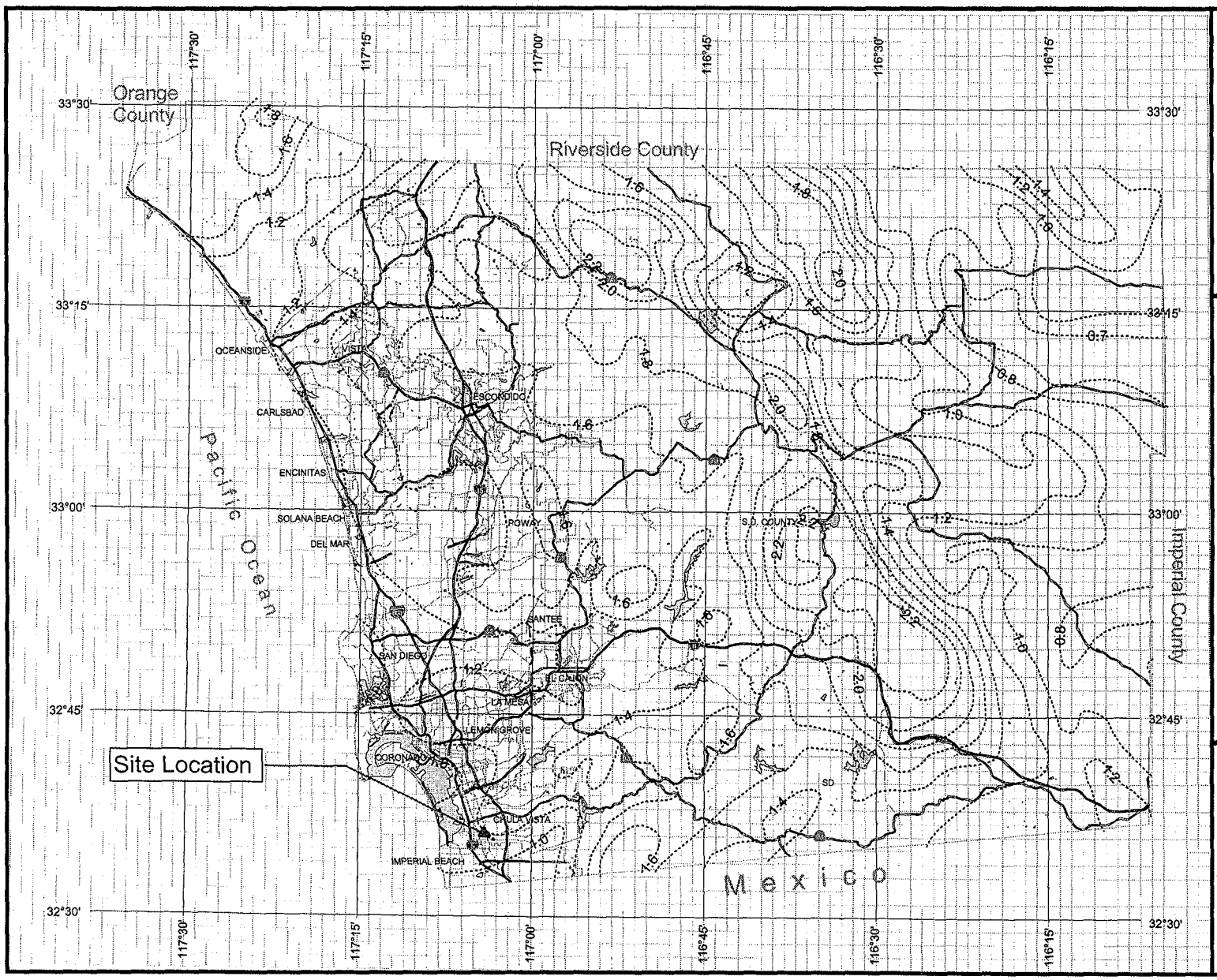
THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright SanGIS. All Rights Reserved.

This products may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

D

ATTACHMENT G
ISOPLUVIAL MAPS



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

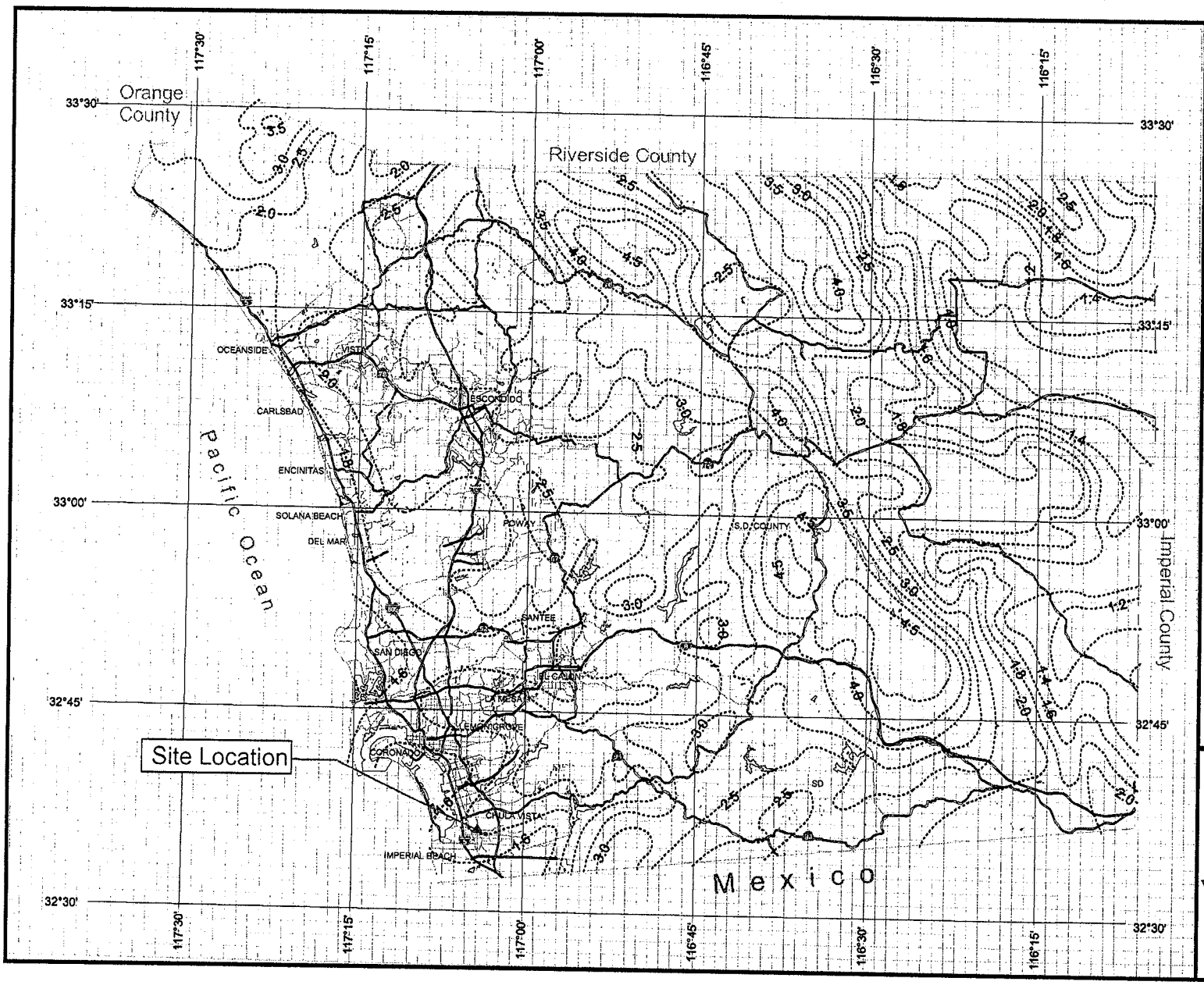
3 0 3 Miles

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright SanGIS. All Rights Reserved.

This products may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

6/4



County of San Diego Hydrology Manual

Rainfall Isopluvials

2 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Management Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

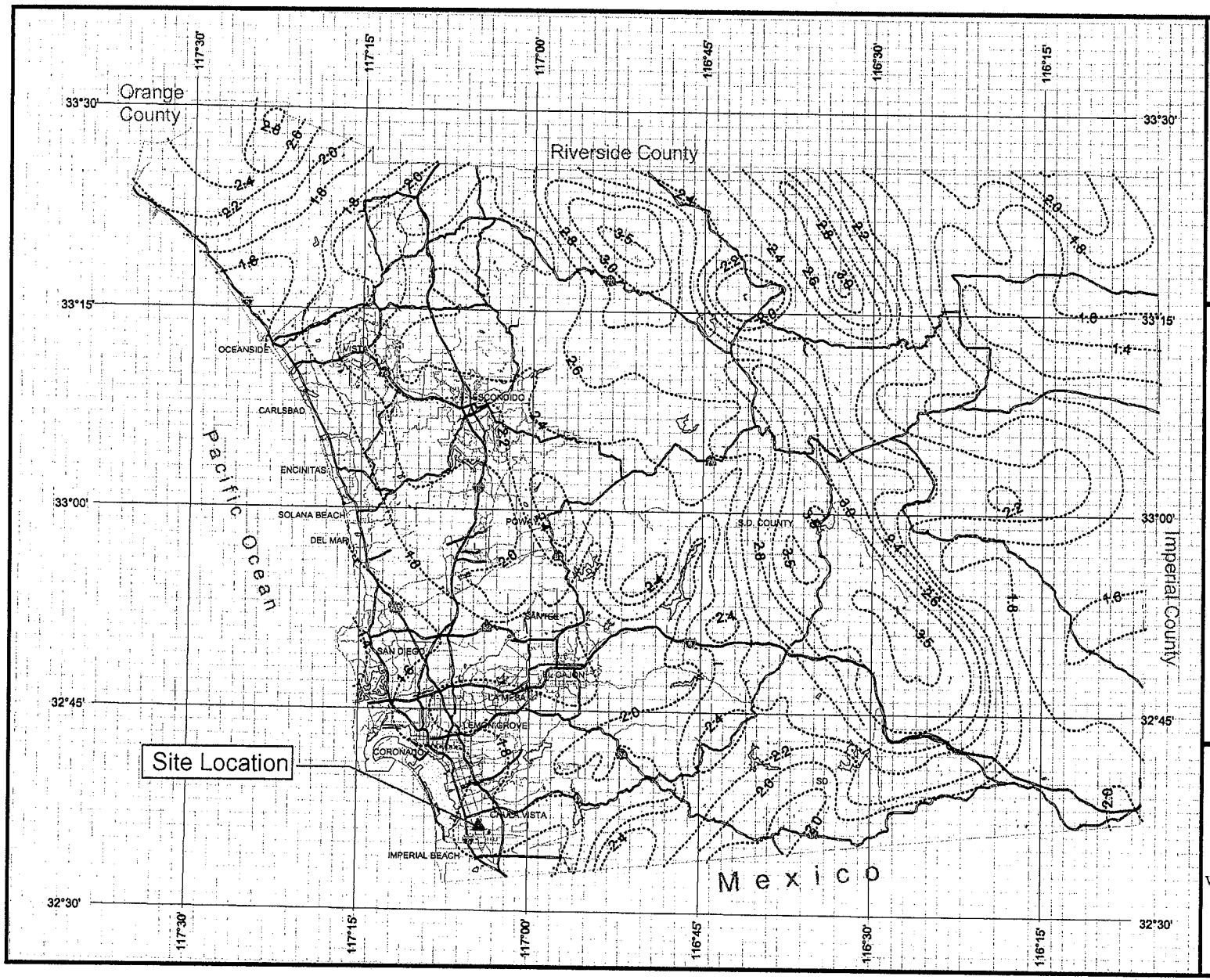
3 0 3 Miles

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.
Copyright SanGIS. All Rights Reserved

This products may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

62/4



County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS

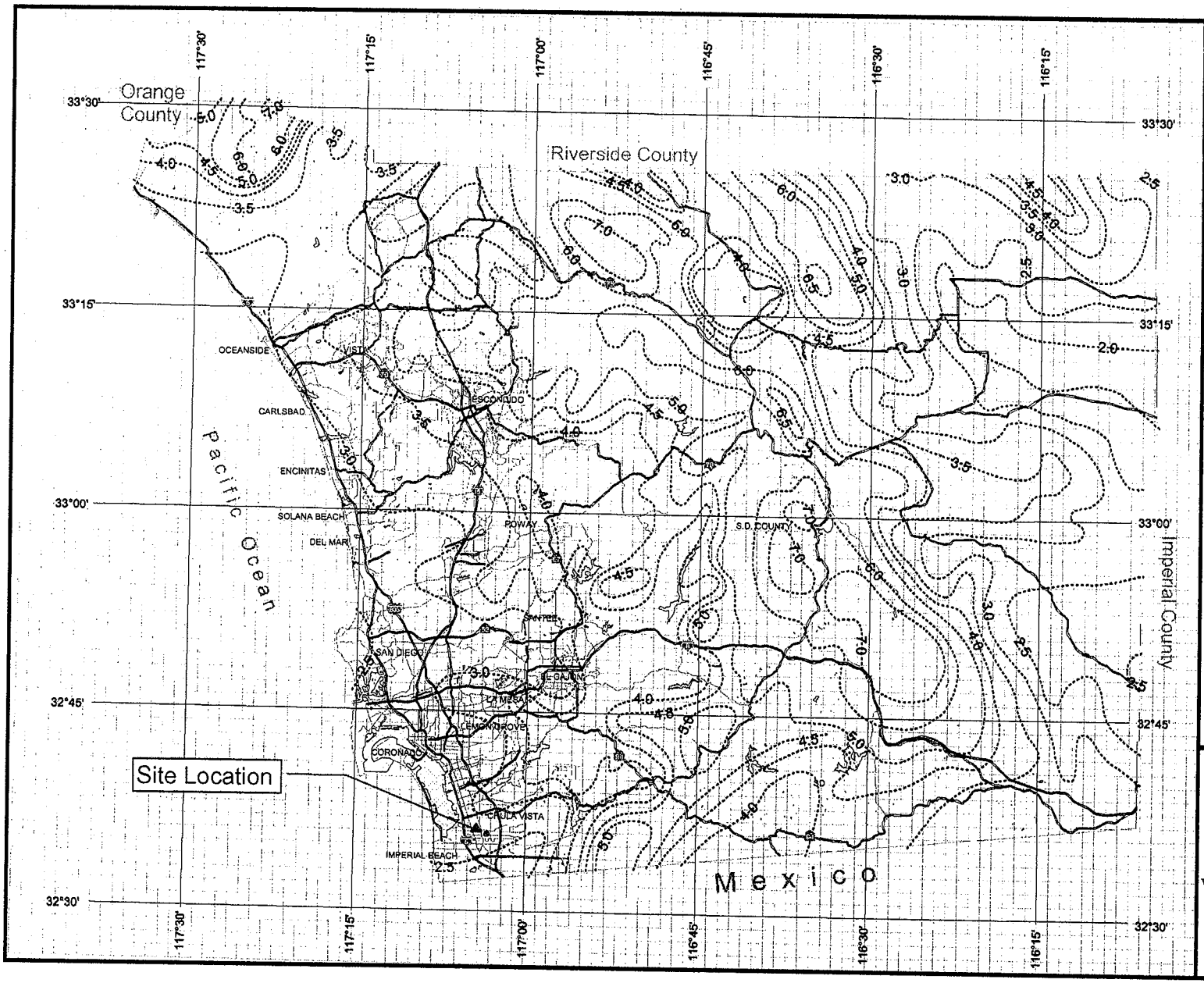
SanGIS We Have San Diego Covered!

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright SanGIS. All Rights Reserved.

This products may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps

G3/4



County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Systems

SanGIS
We Have San Diego Covered!

N
W E
S

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright SanGIS. All Rights Reserved.

This products may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

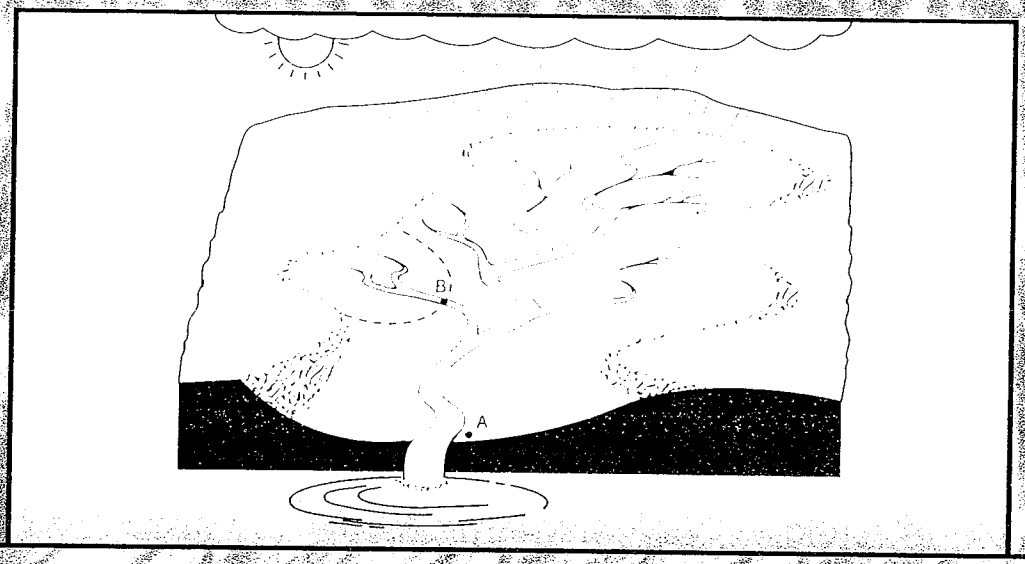
3 0 3 Miles

64/4

ATTACHMENT H

RUNOFF COEFFICIENTS FOR THE RATIONAL FORMULA

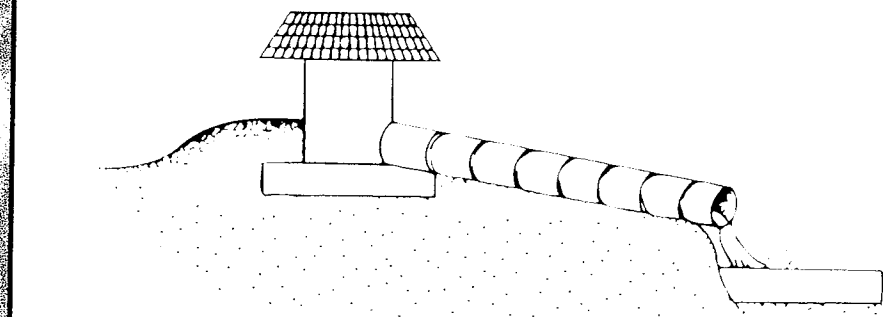
H113



HYDROLOGIC ANALYSIS AND DESIGN

RICHARD H. McCUEN

SECOND EDITION



gravel 0.60

M2/3

TABLE 7–9 Runoff Coefficients for the Rational Formula versus Hydrologic Soil Group (A, B, C, D) and Slope Range

	A			B			C			D		
Land Use	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+	0–2%	2–6%	6%+
Cultivated land	0.08[a]	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14[b]	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
grass	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential lot	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
size 1/8 acre	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Residential lot	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
size 1/4 acre	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Residential lot	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
size 1/3 acre	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Residential lot	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
size 1/2 acre	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Residential lot	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
size 1 acre	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking/	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
paved/impervious	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

[a] Runoff coefficients for storm recurrence intervals less than 25 years.

[b] Runoff coefficients for storm recurrence intervals of 25 years or longer.

problem with tables such as Table 7–10 is that for each land use a range of values is provided. This can lead to inconsistency in application. As a general rule, the mean of the range should be used unless a different value can be fully justified. It would be improper for a low value to be selected to reduce the size and therefore the cost of the drainage system.

A primary use of the Rational Method has been for design problems for small urban areas such as the sizing of inlets and culverts, which are characterized by small drainage areas and short times of concentration. For such designs, short-duration storms are critical, which is why the time of concentration is used as the input duration for obtaining i from the intensity-duration-frequency curve. If the storm duration occurs at a constant rate i and uniformly over the entire watershed, the volume of rainfall would equal iAt_c, which would have units of acre-inches

(A, B, C, D) and

D		
0–2%	2–6%	6%+
0.18	0.23	0.31
0.24	0.29	0.41
0.30	0.40	0.50
0.37	0.50	0.62
0.24	0.30	0.40
0.30	0.40	0.50
0.12	0.16	0.20
0.15	0.20	0.25
0.33	0.36	0.42
0.41	0.45	0.54
0.30	0.34	0.40
0.38	0.42	0.52
0.28	0.32	0.39
0.36	0.40	0.50
0.26	0.30	0.37
0.34	0.38	0.48
0.24	0.29	0.35
0.31	0.35	0.46
0.69	0.69	0.70
0.86	0.86	0.88
0.72	0.72	0.72
0.89	0.89	0.90
0.73	0.75	0.78
0.89	0.91	0.95
0.16	0.21	0.28
0.22	0.27	0.39
0.85	0.86	0.87
0.95	0.96	0.97

ıge of values is pro-
ıe mean of the range
ɜ improper for a low
ıge system.
for small urban areas
ll drainage areas and
ritical, which is why
from the intensity-
ıd uniformly over the
e units of acre-inches

H3/3

TABLE 7–10 Runoff Coefficients for the Rational Method

Description of Area	Range of Runoff Coefficients	Recommended Value*
Business		
Downtown	0.70–0.95	0.85
Neighborhood	0.50–0.70	0.60
Residential		
Single-family	0.30–0.50	0.40
Multiunits, detached	0.40–0.60	0.50
Multiunits, attached	0.60–0.75	0.70
Residential (suburban)	0.25–0.40	0.35
Apartment	0.50–0.70	0.60
Industrial		
Light	0.50–0.80	0.65
Heavy	0.60–0.90	0.75
Parks, cemeteries	0.10–0.25	0.20
Playgrounds	0.20–0.35	0.30
Railroad yard	0.20–0.35	0.30
Unimproved	0.10–0.30	0.20

It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure often is applied to typical "sample" block as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are listed below.

Character of Surface	Range of Runoff Coefficients	Recommended Value*
Pavement		
Asphaltic and Concrete	0.70–0.95	0.85
Brick/gravel	0.75–0.85	0.80
Roofs	0.75–0.95	0.85
Lawns, sandy soil		
Flat, 2%	0.05–0.10	0.08
Average, 2 to 7%	0.10–0.15	0.13
Steep, 7%	0.15–0.20	0.18
Lawns, heavy soil		
Flat, 2%	0.13–0.17	0.15
Average, 2 to 7%	0.18–0.22	0.20
Steep, 7%	0.25–0.35	0.30

The coefficients in these two tabulations are applicable for storms of 5- to 10-year frequencies. Less frequent, higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

*Recommended value not included in original source.

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers, New York, p. 332, 1969.

ATTACHMENT I
PRE-DEVELOPMENT CALCULATIONS, AREA A

Pre-Development Area 'A'

-Total Area = 1.55 ac contributing to Point A in west ditch
(see CHUL-1-SK-024-735-001)

Grassy: C*A = 0.37*(1.52 ac) = 0.56

Impervious: 0.95 * 0.033 ac = 0.031
$\sum CA = 0.59$

-Time of Concentration: See worksheet #3 (0.28 hr) use 17 minutes

- i_{2yr} = 1.4 in/hr (see figure 3-1. pg I4 in this Attachment)

-$Q_{2yr} = I \sum CA$ = 1.4 in/hr * 0.59 = 0.83 cfs

-$V_{2yr\ runoff} = (\sum CA/A) * (d*A)/12$ =[(0.59/1.55)*(1.2 in * 1.55 ac)]/ (12 in/ft) =
=0.059 ac-ft = 2,570 ft^3

- i_{10yr} = 3.5 in/hr (see figure 3-1, pg I5, in this Attachment)

- $Q_{10yr} = i \sum CA$ = 3.5 * 0.59 = 2.1 cfs

-$V_{10yr\ runoff} = (\sum CA/A) * (d*A)/12$ =[(0.59/1.55)* (1.7 in * 1.55ac)]/12 =
=0.0835ac-ft =3,640 ft^3

I2/5

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
MMC CHULA VISTA	B. Burchfield	01/10/07
Location	**Checked**	**Date**
Area 'A' Pre-Development		

Check one: [x] Present [ ] Developed

Check one: [x] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID		
		A	
1. Surface description (table 3-1)		Unpaved	
2. Manning's roughness coefficient, n (table 3-1)		0.13	
3. Flow length, L (total L † 300 ft)	ft	135	
4. Two-year 24-hour rainfall, P_2	in	1.8"	
5. Land slope, s	ft/ft	0.024	
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.23	+ = 0.23

Shallow concentrated flow

	Segment ID		
		B	
7. Surface description (paved or unpaved)		unpaved	
8. Flow length, L	ft	360	
9. Watercourse slope, s	ft/ft	0.02	
10. Average velocity, V (figure 3-1)	ft/s	2.23	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.04	+ = 0.04

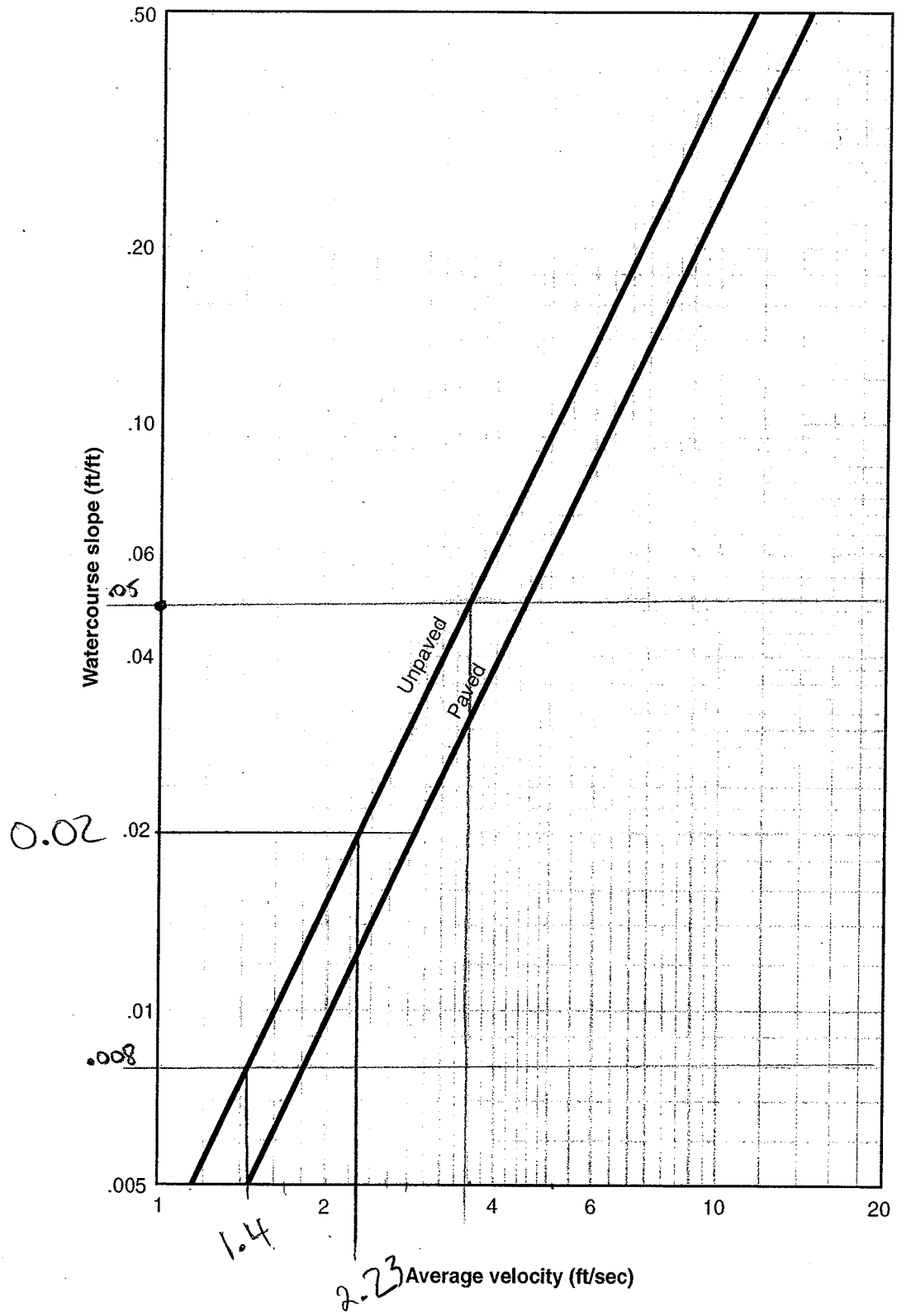
Channel flow

	Segment ID		
		C west ditch	
12. Cross sectional flow area, a	ft^2	18	
13. Wetted perimeter, p_w	ft	36.4	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	0.5	
15 Channel slope, s	ft/ft	0.028	
16. Manning's roughness coefficient, n		0.045	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	3.34	
18. Flow length, L	ft	144	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.012	+ = 0.012
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	Hr		0.28

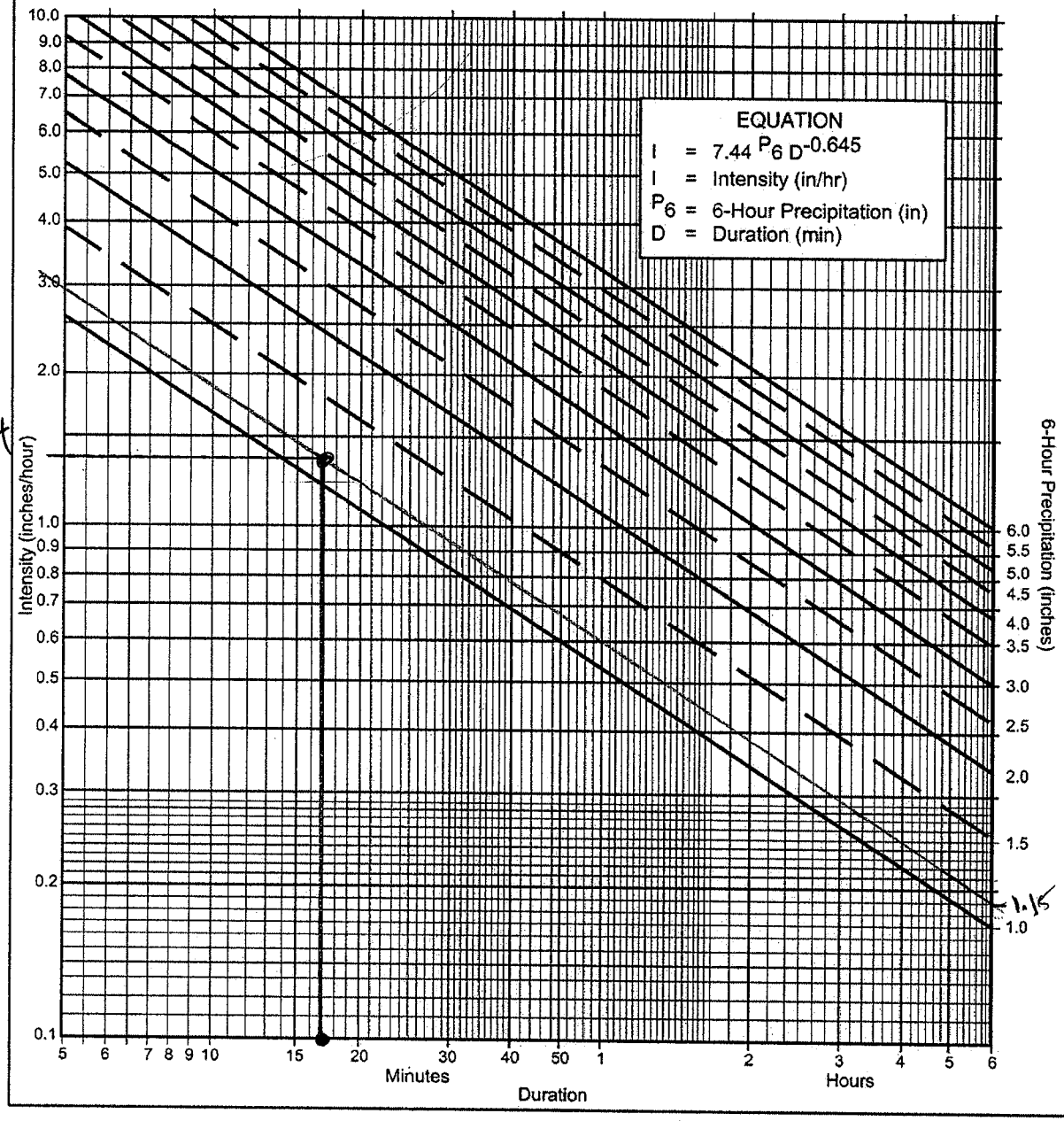
Use 17 min

I3/5

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Pre-development - Area A. 1/11/07



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 2 year

(b) P_6 = 1.2 in., P_{24} = 1.8, $\frac{P_6}{P_{24}}$ = 0.67 %(2)

(c) Adjusted P_6(2) = 1.15 in. $\frac{1.15}{1.8}$ 0.64

(d) t_x = 17 min.

(e) I = 1.4 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

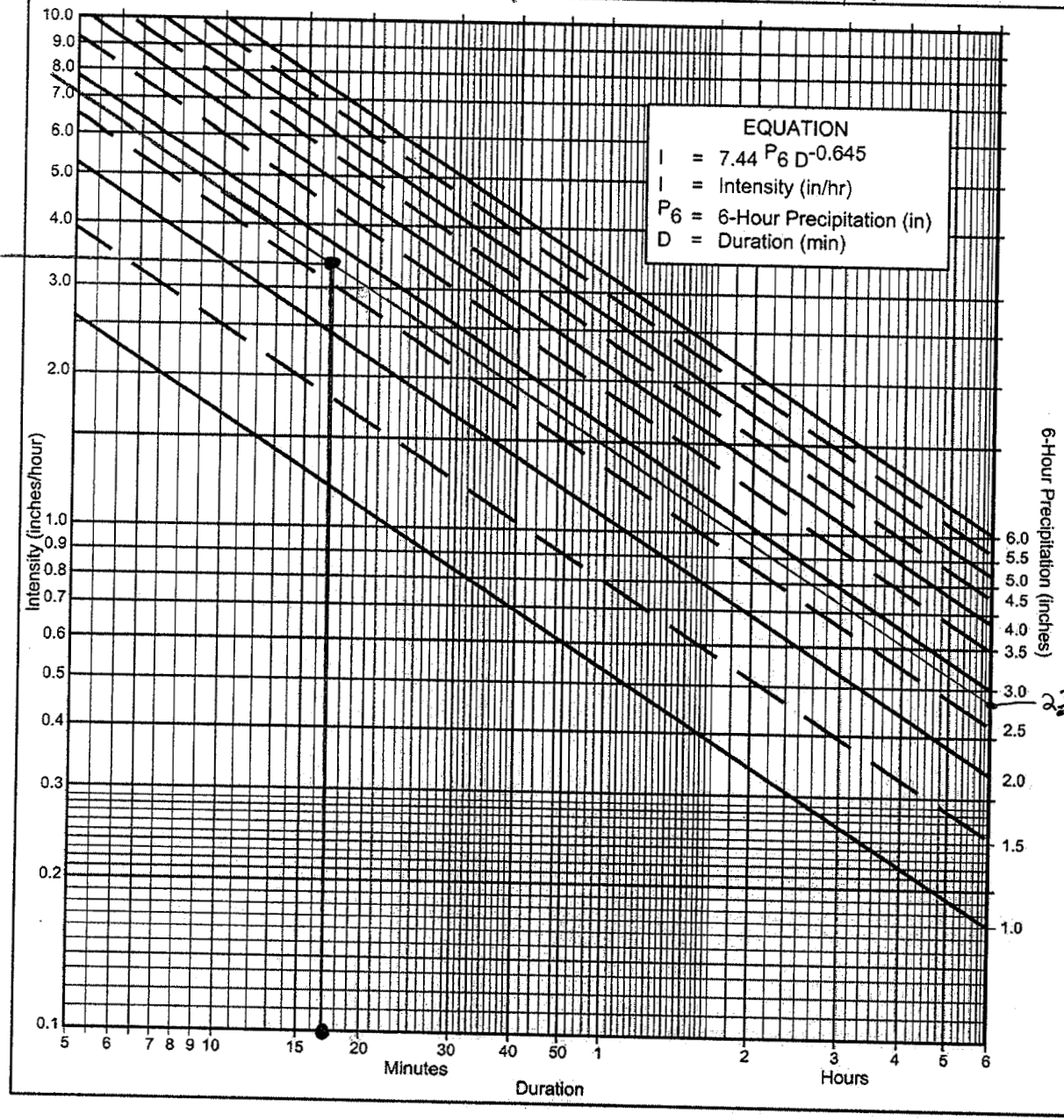
Intensity-Duration Design Chart - Template

FIGURE 3-1

14/5

Pre-development - Area A

1/11/07



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 10 year

(b) P_6 = 1.7 in., P_{24} = 2.75, $\frac{P_6}{P_{24}}$ = 0.62 %(2)

(c) Adjusted P_6(2) = 2.75 in.

(d) t_x = 17 min.

(e) I = 3.5 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

15/5

ATTACHMENT J
PRE-DEVELOPMENT CALCULATIONS, AREA B

Pre-Development Area 'B'

-Total Area = 2.14 acres. 2.10 acres contribute to Point B at Southeast corner of property (see CHUL-1-SK-024-735-001)

- C*A
  Gravel areas = 0.80 * 1.56 = 1.25
  Impervious Areas = 0.95 * 0.25 = 0.238
  Grassy Area = 0.37 * 0.285 = 0.105
  (front of property, dense condition)

- $\sum CA = 1.59$

-Time of Concentration: see worksheet 3 = 5 minutes

- i_{2yr}= 3.0 in/hr (see Figure 3-1, pg J5, in the Attachment)

- $Q_{2yr} = i \sum CA$ = 3.0 in/hr * 1.59 = 4.77 cfs

-$V_{2yr\ runoff} = (\sum CA/A) * (d*A)/12$ =[(1.59/2.14)* (1.2 in * 2.10)]/12 = 0.16 ac-ft = 6,970 ft^3

- i_{10yr} = 7.0 in/hr (Figure 3-1, pg J6, in this Attachment)

-$Q_{10yr} = i \sum CA$ = 7.0 * 1.59 = 11.13 cfs

-$V_{10yr\ runoff} = (\sum CA/A) * (d*A)/12$ =[(1.59/2.10)*(1.7 in * 2.10 ac)]/12 =0.225 ac-ft =9,800 ft^3

52/6

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
MMC CHULA VISTA	B. Burchfield	01/10/07
Location	**Checked**	**Date**
Area 'B' Pre-Development		

Check one: [x] Present [ ] Developed

Check one: [x] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID		
1. Surface description (table 3-1)	BB		
2. Manning's roughness coefficient, n (table 3-1)	Gravel		
3. Flow length, L (total L † 300 ft) ft	0.011		
4. Two-year 24-hour rainfall, P_2 in	60		
5. Land slope, s 57.5-57/60= ft/ft	1.8"		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.008		
	0.03	+	= 0.03

Shallow concentrated flow

	Segment ID		
7. Surface description (paved or unpaved)			
8. Flow length, L ft			
9. Watercourse slope, s ft/ft			
10. Average velocity, V (figure 3-1) ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	= N/A

Channel flow

	Segment ID		
12. Cross sectional flow area, a ft^2	AA		
13. Wetted perimeter, p_w ft	See Flowmaster		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	See Flowmaster		
15 Channel slope, s 57-51/571= ft/ft	See Flowmaster		
16. Manning's roughness coefficient, n	0.011		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ See Flowmaster ft/s	0.011		
18. Flow length, L ft	2.92		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	571		
	0.054	+	= 0.054
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr			0.084

Use 5 min

J3/6

Worksheet for pre-B gutter

Project Description

Solve For	Discharge

Input Data

Channel Slope	0.01100	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.05	ft/ft
Road Cross Slope	0.05	ft/ft
Spread	7.00	ft
Roughness Coefficient	0.020	

Results

Discharge	3.57	ft^3/s
Flow Area	1.23	ft^2
Depth	0.35	ft
Gutter Depression	0.00	ft
Velocity	2.92	ft/s

J4/6

Cross Section for pre-B gutter

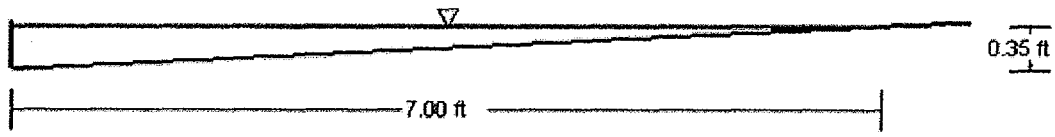
Project Description

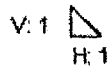
Solve For	Discharge

Input Data

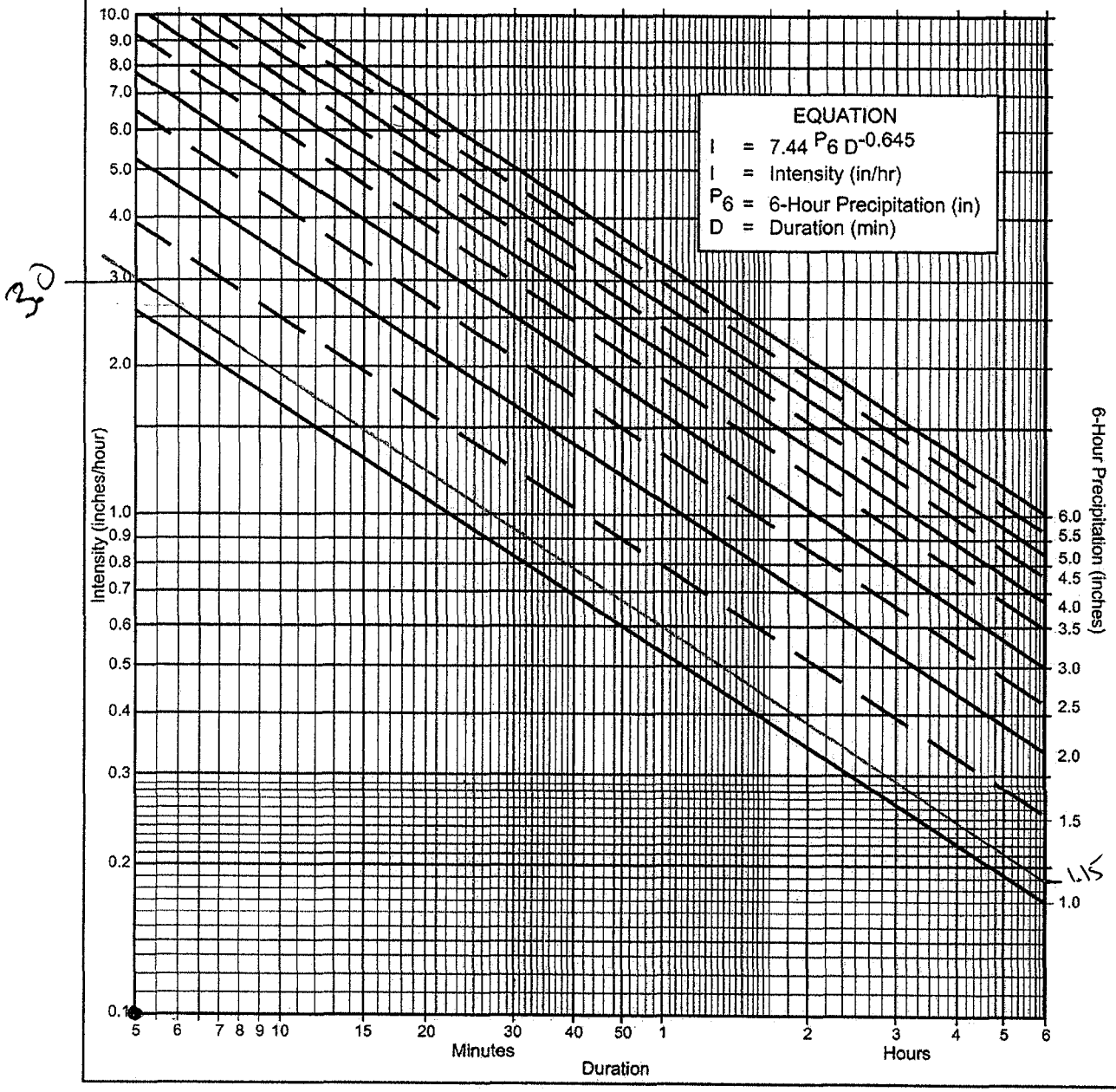
Channel Slope	0.01100	ft/ft
Discharge	3.57	ft³/s
Gutter Width	2.00	ft
Gutter Cross Slope	0.05	ft/ft
Road Cross Slope	0.05	ft/ft
Spread	7.00	ft
Roughness Coefficient	0.020	

Cross Section Image





Predevelopment 'B'



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 2 year

(b) P_6 = 1.2 in., P_{24} = 1.8, $\frac{P_6}{P_{24}}$ = 0.67%(2)

(c) Adjusted $P_6^{(2)}$ = 1.15 in.

(d) t_x = 5 min.

(e) I = 3.0 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

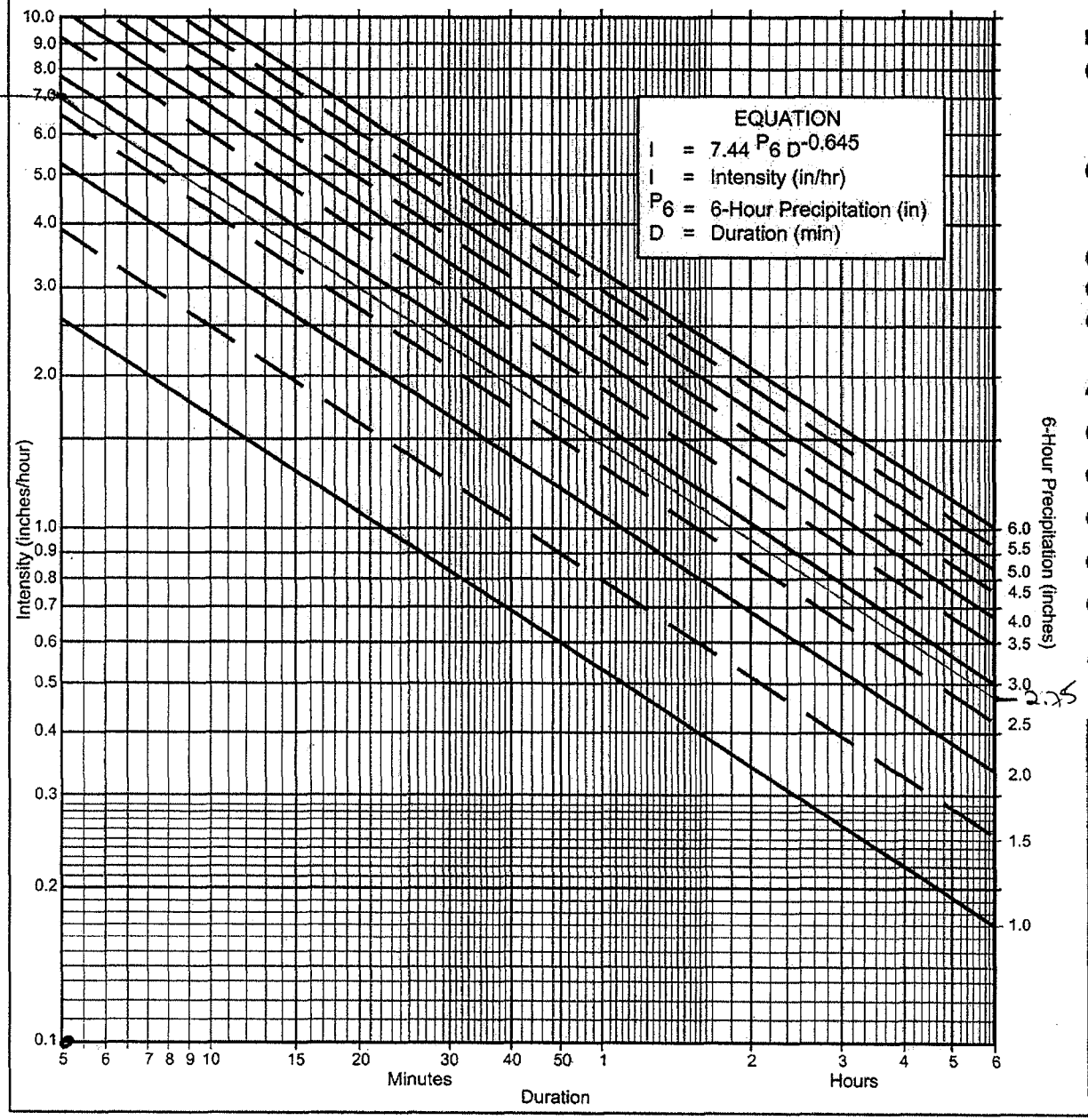
FIGURE

3-1

5516

Predevelopment 'B'

70



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 10 year

(b) P_6 = 1.7 in., P_{24} = 2.75, $\frac{P_6}{P_{24}}$ = 0.62%(2)

(c) Adjusted P_6(2) = 2.75 in.

(d) t_x = 5 min.

(e) I = 7.0 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

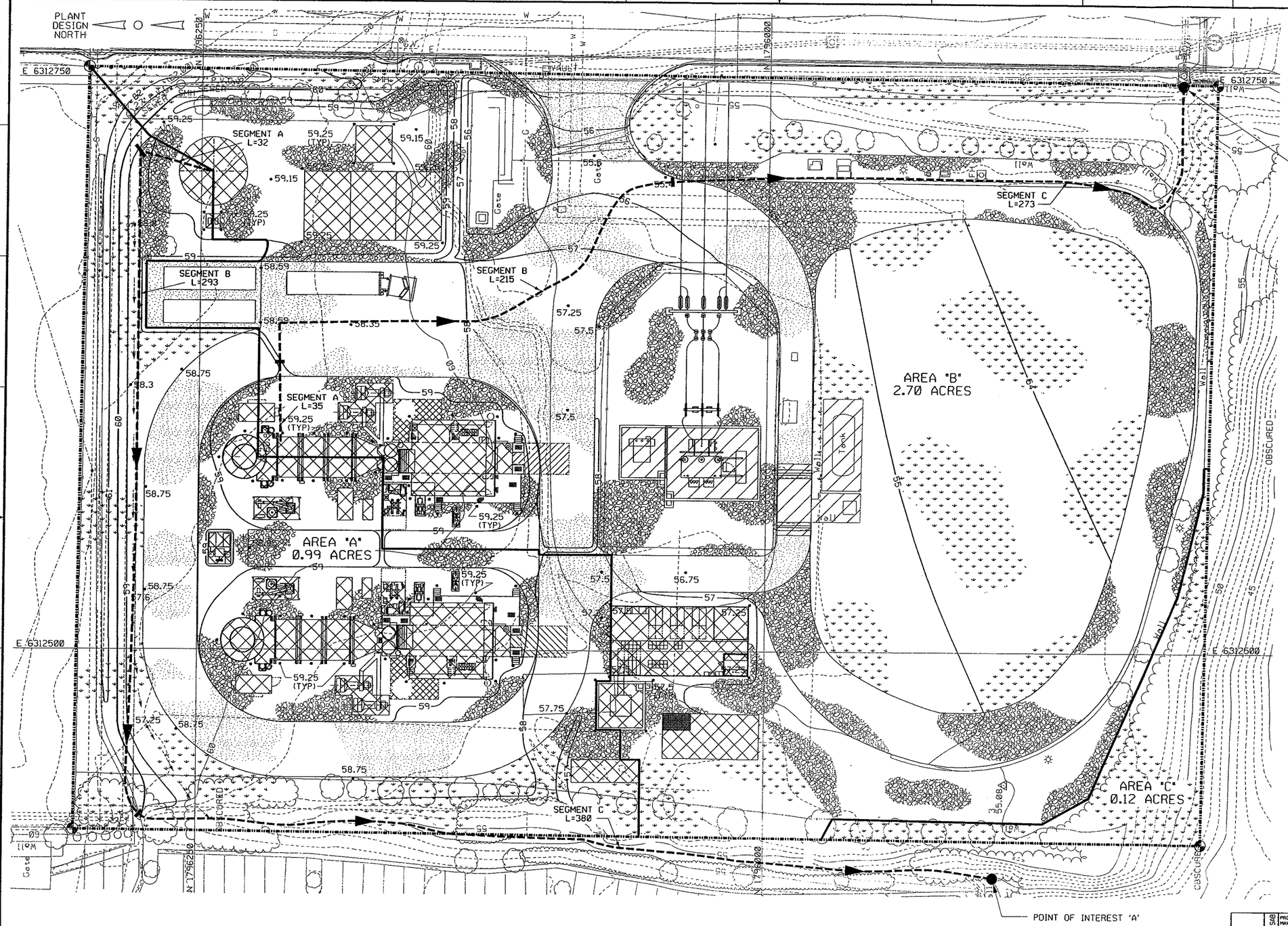
Intensity-Duration Design Chart - Template

FIGURE

3-1D

5016

ATTACHMENT K
POST-DEVELOPMENT SITE PLAN – DRAINAGE AREAS



PLAN

NOTES:

1. BACKGROUND TOPOGRAPHY BASED ON PHOTOGRAMMETRIC METHODS PERFORMED BY SAN-LO AERIAL SURVEYS, 4879 VIEWRIDGE AVE., SAN DIEGO, CA 92123, DATE OF PHOTOGRAPHY 10-19-06 AND BY FIELD SURVEY PERFORMED ON 10-24-06.
2. HORIZONTAL CONTROL IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, CCS 83 ZONE 6 (EPOCH 1991.35) AND VERTICAL CONTROL IS BASED ON NAVD88 (FEET).

LEGEND:

- EXISTING GRADE CONTOURS
- EXISTING FENCE
- PROPERTY LINE
- TRIBUTARY AREA BOUNDARY
- TIME OF CONCENTRATION LINE
- GRAVEL
- ASPHALT (ROADS)
- GRASS
- IMPERVIOUS
- CONTAINED

TOTAL AREA = 3.81 ACRES

20 0 20 40 60
SCALE IN FEET

PRELIMINARY STATUS LDE	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS LDE P. KHAN	DATE 01/24/07	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED 'HOLD' RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: MRS	
CHECKED BY: A.L. MERKEL	
LEAD DESIGNER: K.P. FEEG	
ENGINEER/TECH SPECIALIST: B. BURCHFIELD	
PROJECT ENGINEERING MANAGER: N/A	
PROJECT MANAGER: S.A. BLUE	

Zero Harm — Leadership, No Incidents, Safe Behavior

DRAWING/LIST PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PO.__ STATE__ LIC. NO.__ DATE__

WorleyParsons resources & energy

CLIENT/PROJECT TITLE

MMC ENERGY
CHULA VISTA
ENERGY EFFICIENCY UPGRADE PROJECT

POST DEVELOPMENT PLAN

SCALE 1"=20'	DRAWING SIZE ARCH D (24" x 36")
WORLEYPARSONS DWG. NO. CHUL-1-SK-024-735-002	REV 0

REV	DATE	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ. ENGR MANAGER	PROJECT MANAGER
0	01/24/07	MRS	ALM	KPF	BB	PK	N/A	SAB

ISSUED FOR PERMITTING

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

DWG-FILE: chul-1-sk-024-735-002.dgn
DWG-DATE: 24-Jan-07 08:30

ATTACHMENT L
POST-DEVELOPMENT CALCULATIONS, AREA A

Post Development A

-Total Area =0.99 ac contributing to Point A (see sketch CHUL-1-SK-024-735-002)

Asphalt: C*A = 0.85*0.23 ac = 0.19
Gravel = 0.80 * 0.25 = 0.20
Impervious: 0.95 * 0.136 ac = 0.13
Grassy = 0.37 * 0.367 = 0.14
$\sum CA = 0.66$

-Time of Concentration: See worksheet #3 = 6 minutes

- i_{2yr} = 2.6 in/hr (see figure 3-1, pg L4, of this Attachment)

-$Q_{2yr} = I \sum CA = 2.6 * 0.66 = 1.72$ cfs

-$V_{2yr} = (\sum CA/A) * (d*A)/12 = [(0.66/0.99)*(1.2 \text{ in} * 0.99 \text{ ac})]/12 = 0.066$ ac-ft = 2,875 ft^3

- i_{10yr} = 6.2 in/hr (see figure 3-1, pg L6, of this Attachment)
- $Q_{10yr} = i \sum CA = 6.2 * 0.66 = 4.09$ cfs
-$V_{10yr} = ((\sum CA/A) * (d*A)/12 = [(0.66/0.99)*(1.7 \text{ in} * 0.99 \text{ ac})]/12 =$
$=0.0935$ ac-ft = 4,075 ft^3

L2/7

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
MMC CHULA VISTA	B. Burchfield	01/10/07
Location	**Checked**	**Date**
Area 'A' Post-Development		

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID	A		
1.	Surface description (table 3-1)	gravel		
2.	Manning's roughness coefficient, n (table 3-1)	0.011		
3.	Flow length, L (total L † 300 ft) ft	32		
4.	Two-year 24-hour rainfall, P_2 in	1.8"		
5.	Land slope, s 59.25-59/32 ft/ft	0.008		
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.016	+	= 0.016

Shallow concentrated flow

	Segment ID			
7.	Surface description (paved or unpaved)			
8.	Flow length, L ft			
9.	Watercourse slope, s ft/ft			
10.	Average velocity, V (figure 3-1) ft/s			
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	= 0

Channel flow

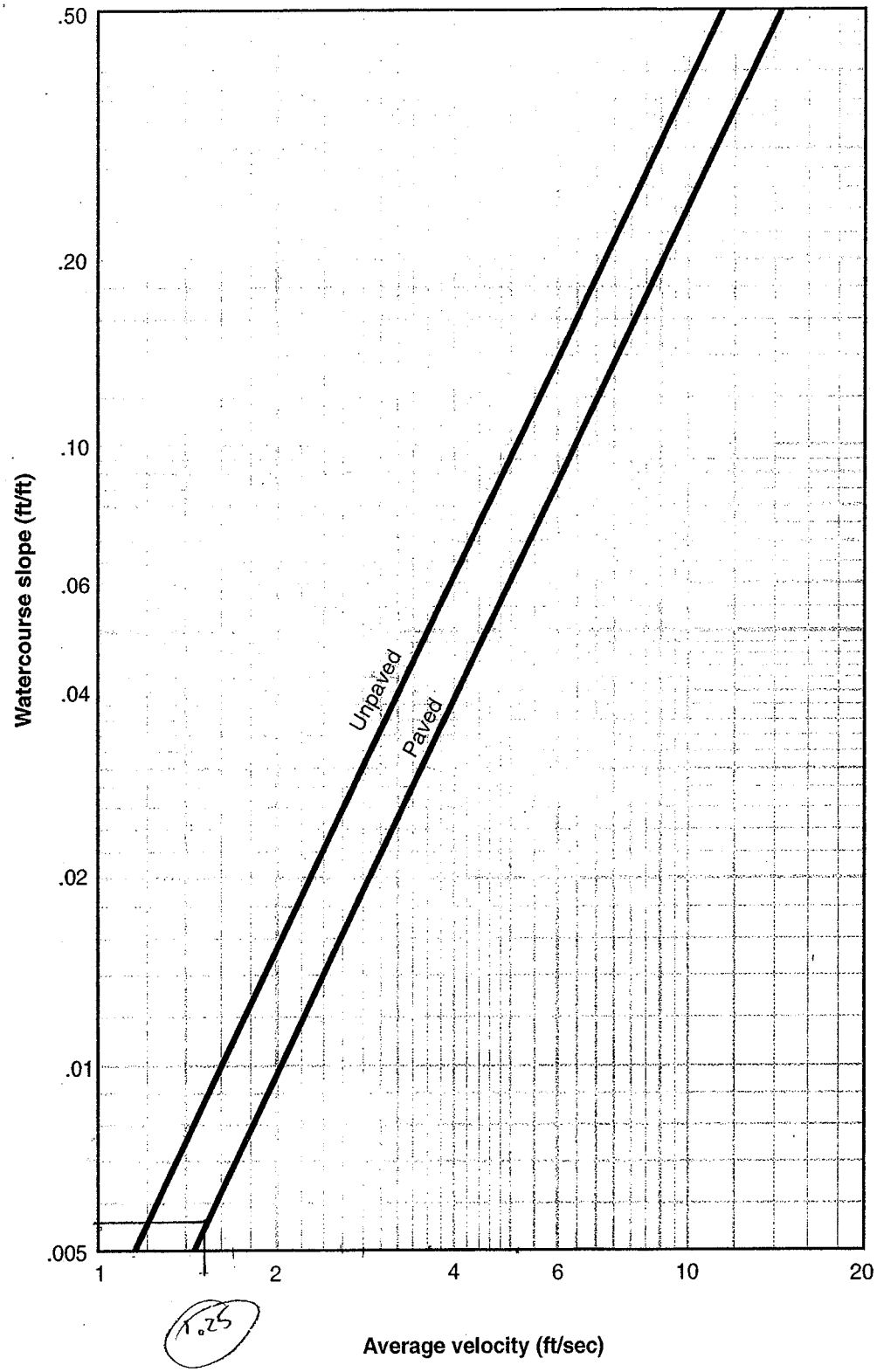
	Segment ID	B north ditch	C west ditch	
12.	Cross sectional flow area, a ft^2	see flow master	see flow master	
13.	Wetted perimeter, p_w ft	see flow master	see flow master	
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft	see flow master	see flow master	
15	Channel slope, s 59-57/293 ft/ft	0.007	0.018	57-50/380
16.	Manning's roughness coefficient, n	0.045	0.045	
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ see flow master ft/s	1.6	3.60	
18.	Flow length, L ft	293	380	
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.05	+ 0.029	= 0.079

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.095

Use 6 min

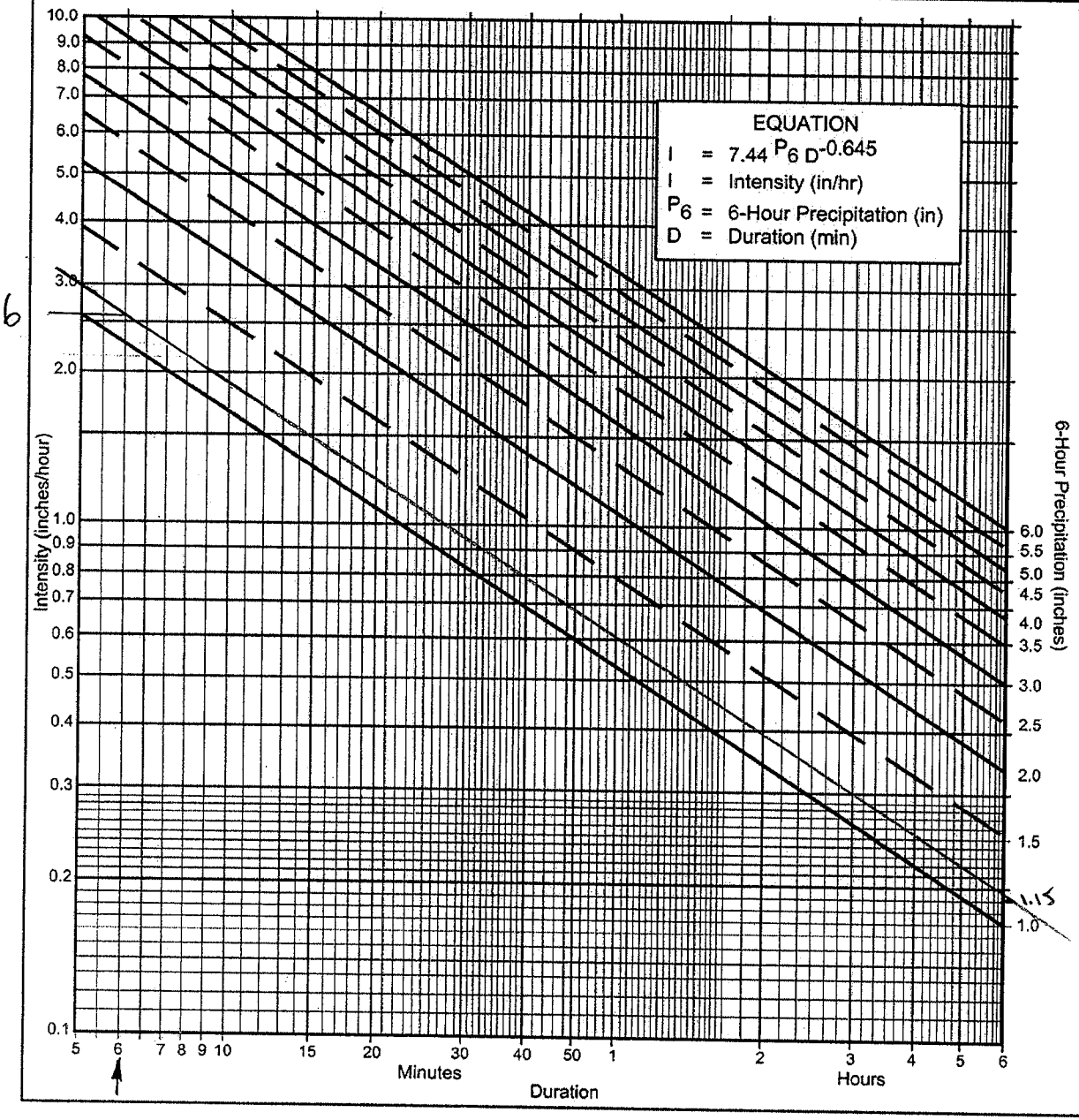
L3/7

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Post-Development - Area 'A'

1/12/07



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 2 year

(b) P_6 = 1.2 in., P_{24} = 1.8, $\frac{P_6}{P_{24}}$ = 0.67 %(2)

(c) Adjusted P_6(2) = 1.15 in.

(d) t_x = 6 min.

(e) I = 2.6 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

4/7

L517

Worksheet for north ditch

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.00700	ft/ft
Normal Depth	0.88	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)

Results

Discharge	4.78	ft^3/s
Flow Area	3.06	ft^2
Wetted Perimeter	7.22	ft
Top Width	7.00	ft
Critical Depth	0.62	ft
Critical Slope	0.04550	ft/ft
Velocity	1.56	ft/s
Velocity Head	0.04	ft
Specific Energy	0.91	ft
Froude Number	0.42	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.88	ft
Critical Depth	0.62	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.04550	ft/ft

L6/7

Worksheet for west ditch

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.01800	ft/ft
Normal Depth	1.50	ft
Left Side Slope	4.50	ft/ft (H:V)
Right Side Slope	4.50	ft/ft (H:V)

Results

Discharge	36.44	ft^3/s
Flow Area	10.13	ft^2
Wetted Perimeter	13.83	ft
Top Width	13.50	ft
Critical Depth	1.32	ft
Critical Slope	0.03496	ft/ft
Velocity	3.60	ft/s
Velocity Head	0.20	ft
Specific Energy	1.70	ft
Froude Number	0.73	
Flow Type	Subcritical	

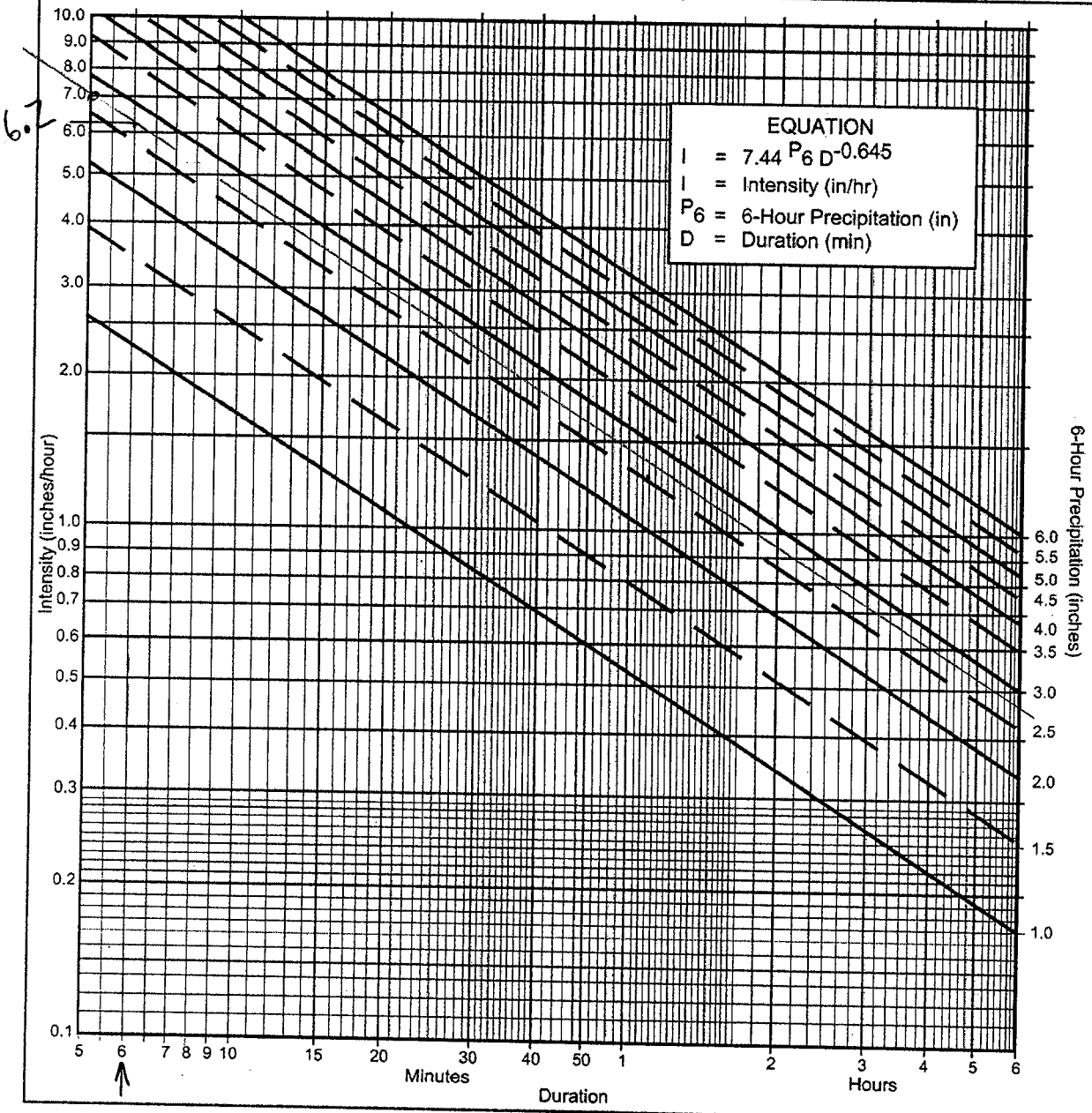
GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.32	ft
Channel Slope	0.01800	ft/ft
Critical Slope	0.03496	ft/ft

Post Development - Area 'A' 1/12/07



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 10 year

(b) P_6 = 1.8 in., P_{24} = 2.75, $\frac{P_6}{P_{24}}$ = 0.65 %(2)

(c) Adjusted P_6(2) = 2.8 in.

(d) t_x = 6 min.

(e) I = 6.2 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

L-7/7

ATTACHMENT M
POST-DEVELOPMENT CALCULATIONS, AREA B

Post Development 'B'

-Total Area = 2.70 ac contributing to Point B.
(see sketch CHUL-1-SK-024-735-002)

- C*A
  Asphalt = 0.85 * 0.5 ac = 0.43
  Gravel areas = 0.80 * 1.21 = 0.97
  Impervious Areas = 0.95 * 0.11 = 0.105
  Grassy Area = 0.37 * 0.88 = 0.33

- $\sum CA = 1.84$

-Time of Concentration: see worksheet #3 = 5 minutes

- i_{2yr}= 3 in/hr (see figure 3-1, pg M6, of this Attachment)

- $Q_{2yr} = i \sum CA$ = 3 in/hr * 1.84 = 5.52 cfs

-V_{2yr} = (($\sum CA/A$) * (d*A)/12 =[(1.84 /2.70)*(1.2 in * 2.70 ac)]/12 = 0.184 ac-ft =8,015 ft^3

- i_{10yr} = 7 in/hr (see figure 3-1, pg M7, of this Attachment)

-$Q_{10yr} = i \sum CA$ = 7 * 1.84 = 12.88 cfs

-V_{10yr} = (($\sum CA/A$) * (d*A)/12 =[(1.84 /2.70)*(1.7 in * 2.70 ac)]/12 = 0.26 ac-ft =11,325 ft^3

M2/7

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
MMC CHULA VISTA	B. Burchfield	01/10/07
Location: Area 'B' Post-Development	Che: Gravel	Date

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID	A Across ISBL		
1. Surface description (table 3-1)				
2. Manning's roughness coefficient, n (table 3-1)		0.011		
3. Flow length, L (total L † 300 ft) ft		35		
4. Two-year 24-hour rainfall, P_2 in		1.8"		
5. Land slope, s 59.25-59/35 ft/ft		0.007		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr		0.018	+	= 0.018

Shallow concentrated flow

	Segment ID	B street flow		
7. Surface description (paved or unpaved)		paved		
8. Flow length, L ft		215		
9. Watercourse slope, s 59-55.5/215 ft/ft		0.016		
10. Average velocity, V (figure 3-1) ft/s		2.6		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		0.023	+	= 0.023

Channel flow

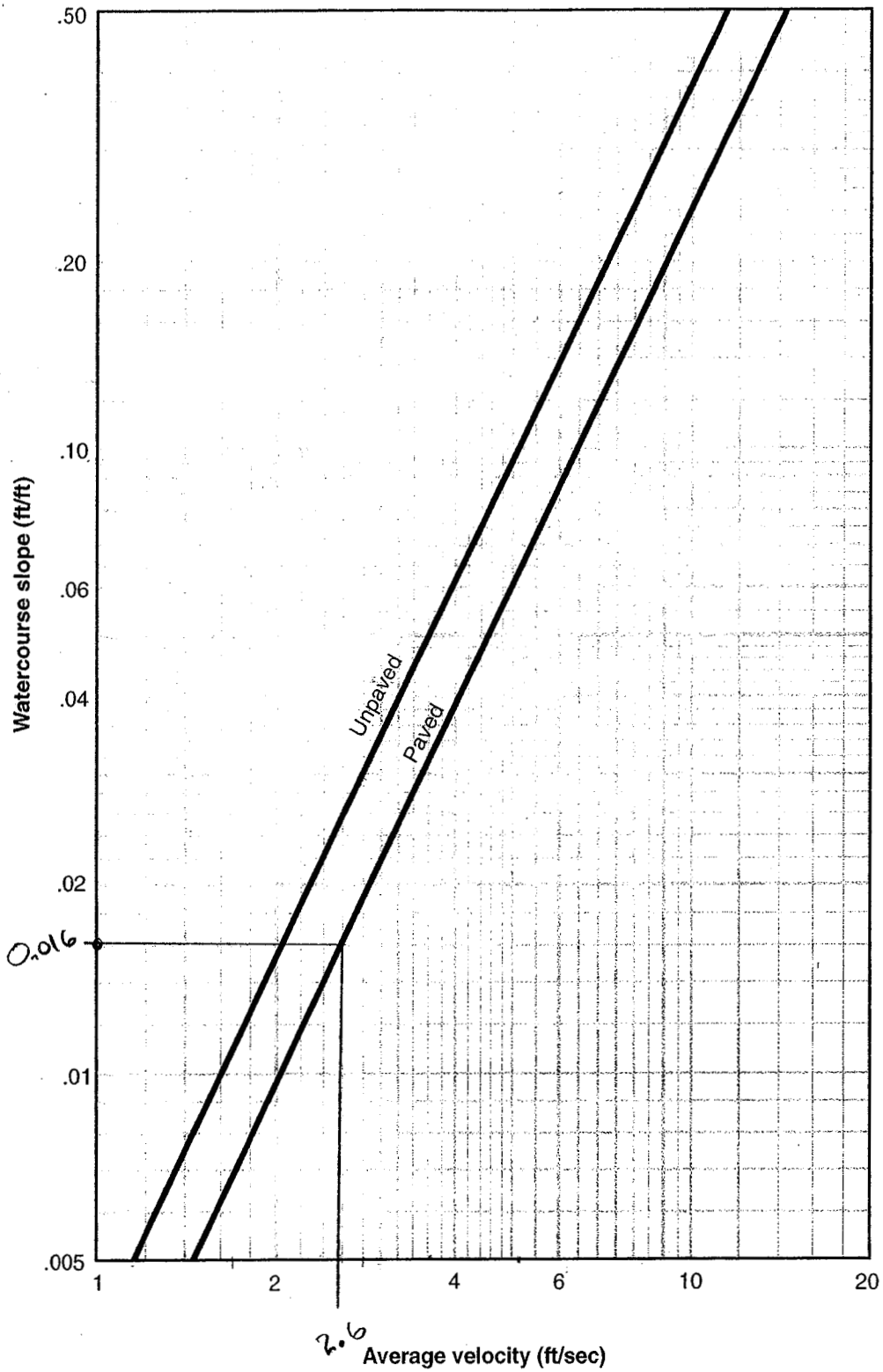
	Segment ID	C east road side to pnt B		
12. Cross sectional flow area, a ft^2		See Flowmaster output		
13. Wetted perimeter, p_w ft		See Flowmaster output		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft		See Flowmaster output		
15 Channel slope, s 55.5-51/273 ft/ft		0.016		
16. Manning's roughness coefficient, n Bare soil		0.02		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ See Flowmaster output ft/s		5.25		
18. Flow length, L ft		273		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		0.014	+	= 0.014

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr 0.055

Use 5 min

m3/7

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



M4/7

Cross Section for east roadside flow

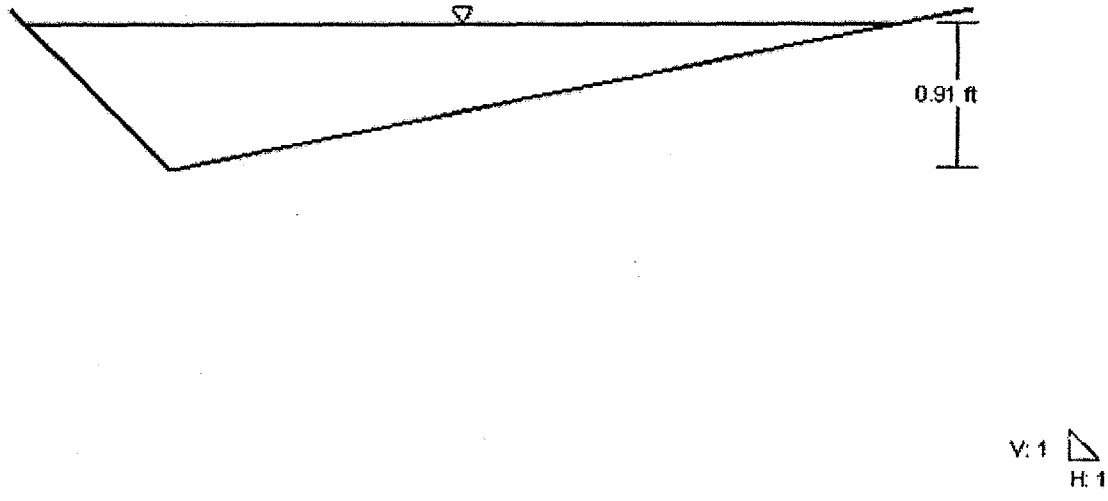
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.020	
Channel Slope	0.01600	ft/ft
Normal Depth	0.91	ft
Left Side Slope	1.00	ft/ft (H:V)
Right Side Slope	5.00	ft/ft (H:V)
Discharge	13.00	ft^3/s

Cross Section Image



M5/7

Worksheet for east roadside flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.020	
Channel Slope	0.01600	ft/ft
Left Side Slope	1.00	ft/ft (H:V)
Right Side Slope	5.00	ft/ft (H:V)
Discharge	13.00	ft^3/s

Results

Normal Depth	0.91	ft
Flow Area	2.47	ft^2
Wetted Perimeter	5.92	ft
Top Width	5.45	ft
Critical Depth	1.03	ft
Critical Slope	0.00811	ft/ft
Velocity	5.25	ft/s
Velocity Head	0.43	ft
Specific Energy	1.34	ft
Froude Number	1.37	
Flow Type	Supercritical	

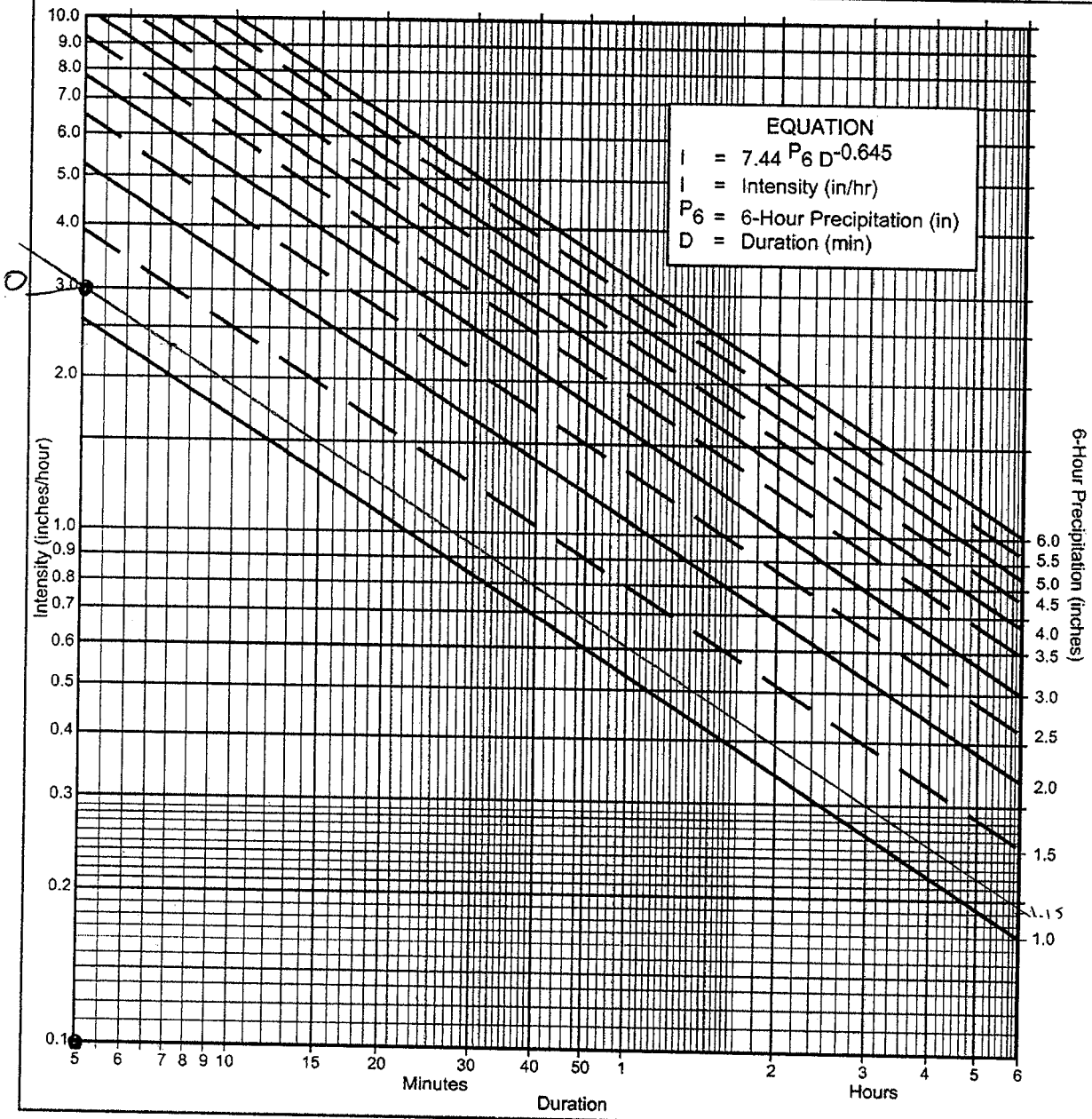
GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.91	ft
Critical Depth	1.03	ft
Channel Slope	0.01600	ft/ft
Critical Slope	0.00811	ft/ft

Post-Development - Area 'B' 1/12/07



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 2 year

(b) P_6 = 1.2 in., P_{24} = 1.8, $\frac{P_6}{P_{24}}$ = 0.67 %(2)

(c) Adjusted P_6(2) = 1.15 in.

(d) t_x = 5 min.

(e) I = 3.0 in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

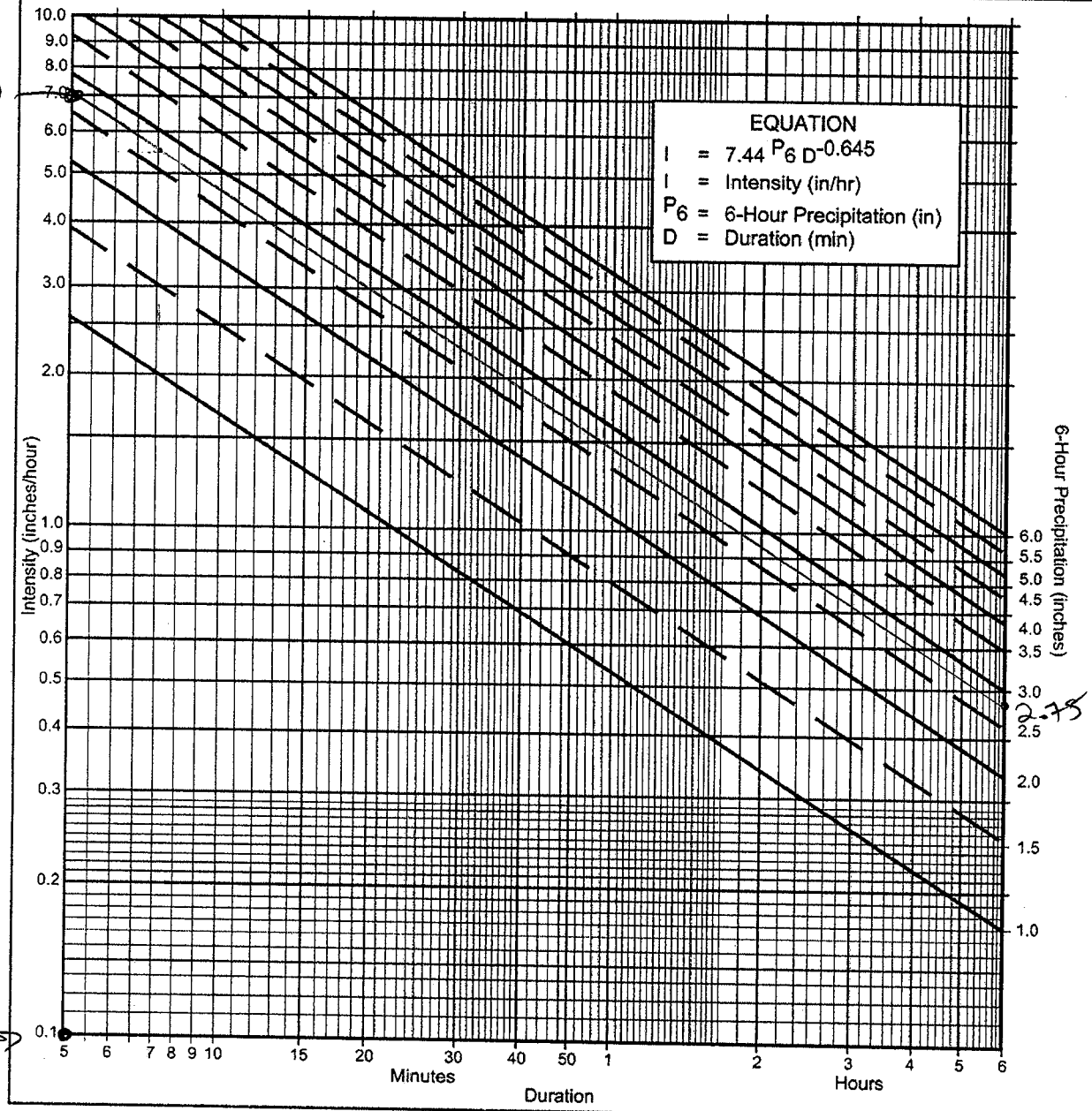
P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
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 3-1G

1/9W

Post-Development - Area 'B' 1/12/07



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 10 year

(b) P_6 = 1.7 in., P_{24} = 2.75, $\frac{P_6}{P_{24}}$ = 0.62 %(2)

(c) Adjusted P_6(2) = 2.75 in.

(d) t_x = 5 min.

(e) I = 7 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

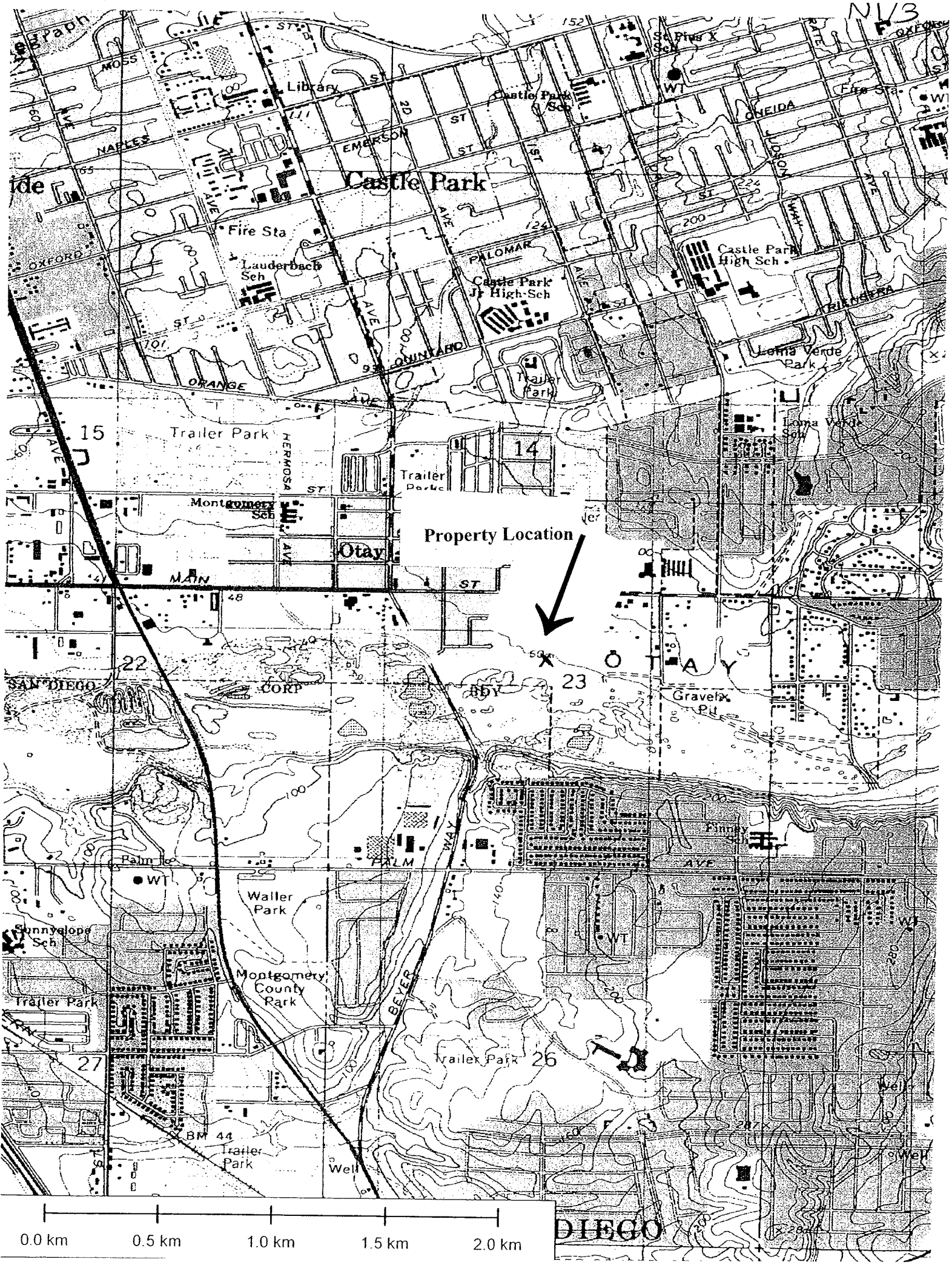
Intensity-Duration Design Chart - Template

FIGURE 3-1H

1/12/07

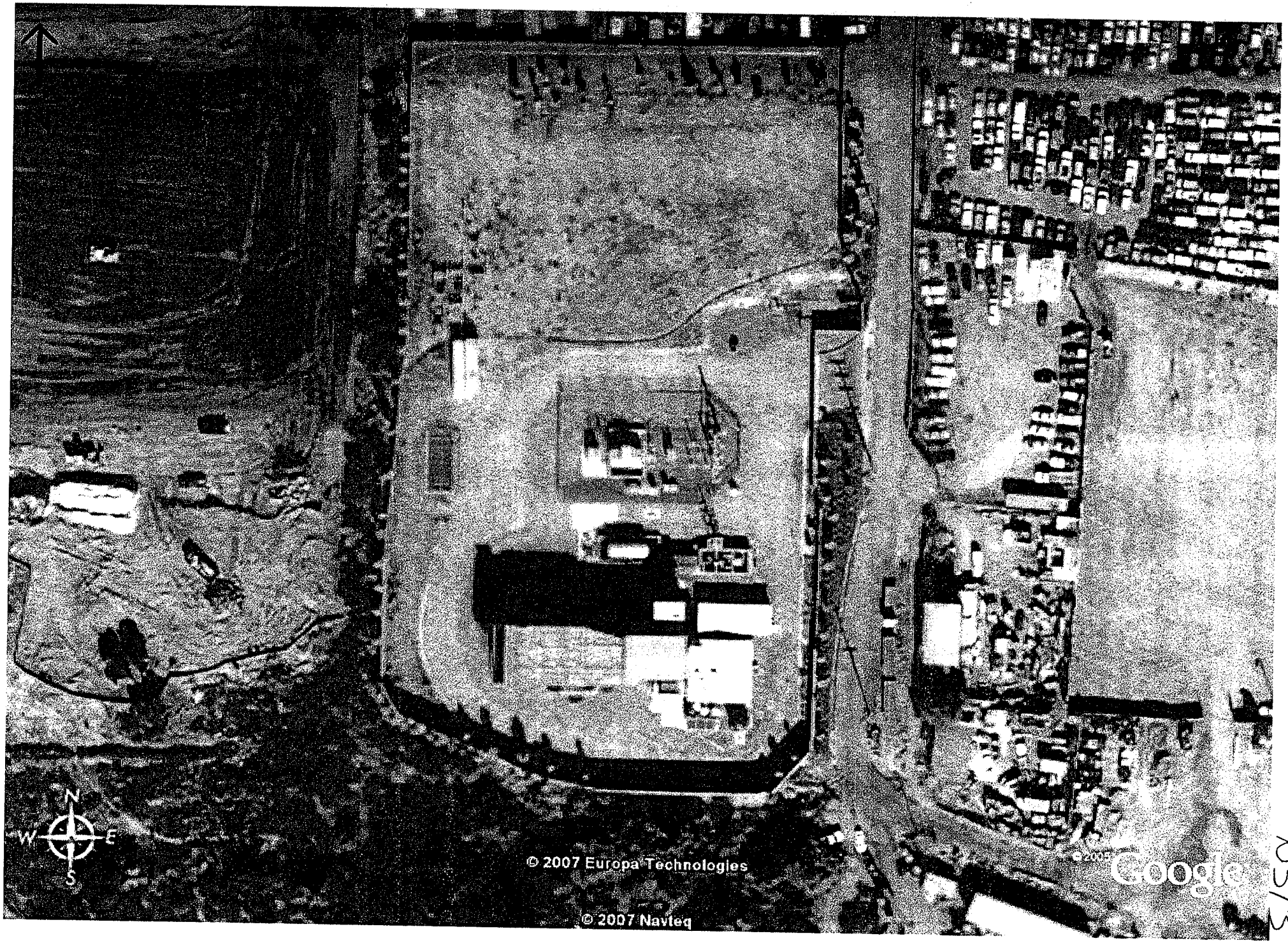
ATTACHMENT N
TOPOGRAPHIC MAP OF THE OTAY RIVER VALLEY

N/3


Property Location
Castle Park
Fire Sta
Lauderbach Sch
Castle Park Jr High Sch
Castle Park High Sch
Loma Verde Park
Trailer Park
Montgomery Sch
Otay
Gravel Pit
Waller Park
Sunnyslope Sch
Montgomery County Park
Finney Sch
Library
Fire Sta
Well
0.0 km
0.5 km
1.0 km
1.5 km
2.0 km

N&13

CHULA VISTA
SAN DIEGO BAY
Harbor Side
Pacific Park
SALT EVAPORATORS
Otay
South San Diego
Palm City
Nestor
SAN DIEGO
IMPERIAL BEACH
NAVAL AIR STATION
Tijuana
Telegraph
Bonita
Sunnyvale
Lynwood Hills
Rice
Canyon
San Ysidro
0.0 km
1.0 km
2.0 km
3.0 km
4.0 km
5.0 km



03/3