

DS #: 5409

APN: 139-25-301-001

PROJECT: Bonanza - Eastern Senior Apartments

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		February 9, 2021
TO: Land Development Services Department of Building & Safety		FROM: Jennifer Shinn, P.E. <i>JS</i> Flood Control, Engr. Associate Department of Public Works
SUBJECT:	Drainage Study for:	
Bonanza – Eastern Senior Apartments		Impulse
Cross Streets:	Eastern Ave. & Washington Ave	North Eastern LLC
File Number:	F:\Depot\DSMemos\DS5409A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	139-25-301-001	
Zoning Action:		
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	1/13/2021	2/4/2021	See Comments Below	\$400.00	4130227: \$400
TOTAL FEES (LDDRS):				\$400.00	----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

	is approved subject to conformance to all City standards and the following conditions:
X	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Public Works Department concurrence.

The following are comments pertaining to the subject site specific drainage study and grading plans:

1. Provide a copy of the zoning/planning conditions associated with this site with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. The Interim Ultimate Condition Basin Map indicates a higher flow discharging the site at the northeast corner than during the Existing Condition, thus adversely impacting the adjacent site to the east. Provide a notarized Permission to Discharge Letter from the adjacent property owner acknowledging and accepting the higher interim/ultimate flows of the proposed development.
3. Interim/Ultimate Condition Basin Map needs to provide proposed contours.
4. Section Sheet 3 detail O and N appear so have some sort of drainage pipe and aggregate at the foot of the retaining wall. Clarify the purpose of this pipe, show it on plan, and label it on the details.
5. Entrance hump does not meet 6" above the 100 year flow depth in Eastern Ave.
6. The grading plans show "Building 2 Future" but it is unclear what will be constructed in this location in the interim and how this location is intended to drain.

7. The grading plans appear to show arrow heads but not full arrows. Provide slope % along with arrows along swales and access roads.
8. The symbol for swale shown on the grading plan legend is not used on the plans. Show this for all swales. For example, on the east wall of the site, it is unclear where the swale begins.
9. Add a note to the Grading Plans: "All onsite storm drain facilities are privately owned and privately maintained."
10. Label the adjacent Assessor Parcel Numbers on the Grading Plans.

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm> or call (775) 687-9429.

END OF REMARKS
HDR/JKS

T/R/S: T19S/R60E/S07
AREA G-07

Pete Laas

From: Albert Sung [YSung@LasVegasNevada.GOV]
Sent: Monday, January 11, 2021 3:22 PM
To: Pete Laas
Subject: RE: Drainage Submittal

Pete,

Number one, we have moved to the City Hall at downtown (495 S. Main Street).

Under the pandemic situation, we have simplified submittal procedures. You just drop off the drainage study package with a CD, one set of everything only. Once you enter the City Hall, approach the security desk and they'll direct you to the right location to drop off your stuff.

You may drop off and go. No appointment needed. Anytime you want Monday to Thursday.

You don't need to include a check. At the end of the day, we'll pick up the studies, log into the system and will email you for online payment.

Hope this help!

Albert Y. Sung

Project Engineer
Public Works Dept. / Flood Control
(702) 229-6541
333 N. Rancho Dr. 7th Floor
Las Vegas, NV 89106



lasvegasnevada.gov



Your opinion is important! Click [here](#) to take a short survey.

From: Pete Laas <plaas@impulsecivil.net>
Sent: Monday, January 11, 2021 12:56 PM
To: Albert Sung <YSung@LasVegasNevada.GOV>
Subject: Drainage Submittal

CAUTION: This email originated from an **External Source**. Please **use caution** before opening attachments, clicking links, or responding to this email. **Do not sign-in with your City of Las Vegas account credentials.**

Albert, where and how do we submit drainage studies now??

Pete Laas, PE
NV, CA, AZ
Principal

TECHNICAL DRAINAGE STUDY
FOR
BONANZA-EASTERN SENIOR APARTMENTS

W.O. #CD-2003
January 5, 2021

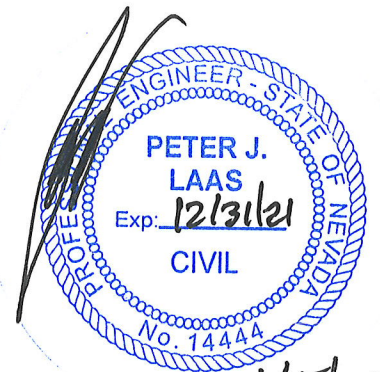
Prepared for:

Integrated Design and Architecture
906 ½ Park Avenue
Albuquerque, NM 87102
Phone: (505) 243-3499

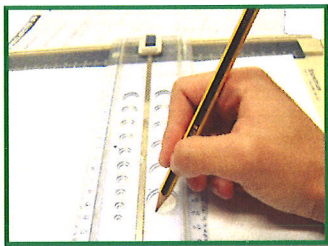
Prepared by:

Impulse

Civil Engineering & Planning
7485 West Azure Avenue, Suite 226
Las Vegas, NV 89130
Phone: 702-815-0720 · Fax: 702-478-8535



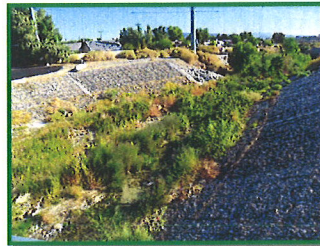
$$I = \int F \cdot dt$$



Civil Engineering



Land Planning



Flood Control



Utilities

January 5, 2021

City of Las Vegas
Public Works – Flood Control
333 North Rancho Drive
Las Vegas, Nevada 89107

**Re: *Technical Drainage Study*
 *Bonanza Eastern Senior Apartments***

Submitted for your approval is the ***Technical Drainage Study for Bonanza Eastern Senior Apartments*** a proposed 2.99 acre multi-family development. The site is affected by a FEMA Special Flood Hazard Area Shaded Zone X and is not adjacent to any Clark County Regional Flood Control District (CCRFCD) Master Planned Facilities according to the CCRFCD Master Plan Update, Figure F-25. So CCRFCD concurrence should not be required.

If you have any questions or require additional information, please call me at (702) 853-6702.

Sincerely,
IMPULSE CIVIL ENGINEERING



Peter J. Laas, P.E.
Principal

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Bonanza-Eastern Senior Apartments Date: 1/5/2021

Location of Development: a) Descriptive (Cross Streets) North/South: Eastern Avenue
 East/West: Washington Avenue

b) Section: 25 Township: 20S Range: 61E

c) APN : 139-25-301-001

Name of Owner: North Eastern LLC, c/o Neighborhood Housing Services of Southern Nevada

Telephone No.: (702) 649-0998 Fax No.: none E-Mail Address: mmerced@nwsn.org

Address: 1849 Civic Center Drive, North Las Vegas, NV 89030

Contact Person-Name: Peter Laas Telephone No.: 702-815-0720

* E-Mail Address: plaas@ImpulseCivil.net Fax No.: 702-478-8535

Firm: Impulse Civil Engineering

Address: 7485 West Azure Avenue, Suite 226, Las Vegas NV 89130

Type of Land Development/Land Disturbance Process:

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

- Total Owned Land Area: At Site: 2.99 AC+- Being Developed/Disturbed: 2.99 AC+-
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
- Proposed type of development (Residential, Commercial, Etc.): Single Family Residential
- Approximate upstream land area which drains to the subject site: 0 ACRES
- Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: _____
- If known, please briefly identify the proposed discharge point(s) of runoff from the site: _____
The northeast corner of the site into the existing drainage easement
- Briefly describe your proposed schedule for the subject project: As soon as possible
this project will begin construction around October of 2018

 Engineer's Seal	Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study. *New Required Field **Review and concurrence of the Clark County Regional Flood Control District is required. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;">Revision</th> <th style="width: 40%;">Date</th> </tr> </thead> <tbody> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table> DS- _____ Local Entity File No. _____	Revision	Date						
Revision	Date								
REFERENCE: $I = \int F \cdot dt$	STANDARD FORM 1								

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Bonanza - Eastern	Map ID:
Firm Name: Impulse Civil Engineering	Engineer: Peter Laas, P.E.
Address: 7485 West Azure Avenue, Suite 226	
City: Las Vegas	State: Nevada Zip: 89130
Phone Number: (702) 815-0720	Fax Number: (702) 478-8535
Property Owner: North Eastern LLC c/o WLB Group	
Address: 3663 E. Sunset Road	
City: Las Vegas	State: Nevada Zip: 89120
Reviewed By:	Date Received: Date Accepted for Review:

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT

- | | | |
|---------------------|---------------------|--|
| Yes
<u> X </u> | No
<u> </u> | Design Manual Standard Form 1 with the engineer's seal and signature. |
| <u> X </u> | <u> </u> | Design Manual Standard Form 4 . |
| <u> X </u> | <u> </u> | 2 copies of the 24" x 36" Drainage Plan. |
| <u> </u> | <u> X </u> | A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge. |

II. MAPS AND EXHIBITS

- | | | |
|---------------------|---------------------|---|
| Yes
<u> X </u> | No
<u> </u> | A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated. |
| <u> X </u> | <u> </u> | A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated. |

REFERENCE: $I = \int F \cdot dt$

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes	No	
<u>X</u>	☐	Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
<u>X</u>	☐	On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
<u>X</u>	☐	Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
<u>X</u>	☐	Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
<u>X</u>	☐	Minimum scale: 1" = 60'.
<u>X</u>	☐	Project name.
<u>X</u>	☐	Vicinity Map with local and major cross streets.
<u>X</u>	☐	Revision box.
<u>X</u>	☐	North arrow and bar scale.
<u>X</u>	☐	Engineer's/consultant's address and phone number.
<u>X</u>	☐	Elevation datum and benchmark.
<u>X</u>	☐	Legend for symbols and abbreviations.
<u>X</u>	☐	Cut/fill scarps, where applicable.
<u>X</u>	☐	Street names, grades, widths.
<u>X</u>	☐	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
<u>X</u>	☐	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
<u>X</u>	☐	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
<u>X</u>	☐	Proposed typical street sections.

REFERENCE: $I = \int F \cdot dt$

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☐	☒	Streets with off-set crowns.
☒	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	Property lines.
☒	☐	Right-of-way lines and widths, existing and proposed.
☒	☐	Existing improvements and their elevations.
☒	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
☒	☐	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	Location and cross-section of street capacity calculations.
☐	☒	Cross-sectional detail for channels, including cutoff wall locations.
☒	☐	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
☒	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
☒	☐	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
☒	☐	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
☒	☐	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
☒	☐	Building and/or lot numbers.
☒	☐	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☒	☐	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE: $I = \int F \cdot dt$

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☐	☒	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
☐	☒	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
☒	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
☐	☒	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes	No	
☒	☐	Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
☒	☐	Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	Use of correct precipitation values in and around the McCarran Airport rainfall area.
☒	☐	A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
☒	☐	A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
☒	☐	Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
☒	☐	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
☐	☒	Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE: $I = \int F \cdot dt$

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
☐	☒	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
☒	☐	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q ₁₀₀ and Q ₁₀ flows representing the worst case for interior and all perimeter streets. Q ₁₀₀ d x v ≤ 8. Q ₁₀ d x v ≤ 6 and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
☒	☐	A summary table of interior and exterior street capacity calculations showing the street name, Q ₁₀₀ flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
☒	☐	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
☒	☐	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
☒	☐	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q ₁₀₀ weir height or flow depth, whichever is greater.
☐	☒	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
☐	☒	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
☐	☒	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
☒	☐	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
☐	☒	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2

$$I = \int F \cdot dt$$



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

The following checklist is intended as a supplemental guide for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District (CCRFCD) Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCD Standard Form 2 prior to the City accepting a new drainage study for review. The engineer must contact the Flood Control Section at (702) 229-6541 to schedule a submittal appointment.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT		
Yes	No	
	N/A	A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
X		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
X		An electronic copy of the complete submittal is required to be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output device replicating your submittal. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats. If figures are in color, they must be scanned in color and saved as a separate file. by initial here, the engineer on record acknowledges that the electronic copy is an identical replicate of the original hard copy submitted to the City of Las Vegas.

II. GRADING PLAN INFORMATION		
Yes	No	
X		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
X		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
X		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet* around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
	N/A	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
X		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
X		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
X		Back of lot elevations and lot drainage pattern for all lots including common lots.
	N/A	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
X		This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
X		Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
X		Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
X		Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
X		Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
X		Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	N/A	Lots with "B and C Type Drainage" that drain from one lot to another through a drainage easement shall be required to install an underground nuisance drainage system or a 2-foot valley gutter. 16" x 24" minimum block wall openings are required for both options.
	N/A	Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36". Inlets must be sized to match the pipe size provided.

- Contact the Flood Control Section regarding the drainage study review fee. These fees are payable at the time of submittal.
- The Drainage Study must be conditionally approved prior to submitting improvement plans to the Civil and Planning Development of the Department of Building and Safety for review.

This document is intended as an **aid** in preparing Technical Drainage Studies for the City of Las Vegas. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all-inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

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1.0 GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

1.1 Scope

The purpose of this report is to provide detailed hydrologic and hydraulic analyses for the proposed development of parcel 139-25-301-001, generally located at the southeast corner of the Eastern Avenue and Constantine Avenue intersection, just south of the residential development, and to provide appropriate drainage mitigation recommendations. This report will address the existing, interim, and ultimate conditions which affect the onsite and off-site drainage. The criteria set forth in the Clark County Regional Flood Control District "Hydrologic Criteria and Drainage Design Manual" (CCRFCD Manual), was used as the technical basis for this study.

1.2 Location

The proposed Bonanza-Eastern Senior Apartment development is located within the City of Las Vegas, Nevada. The site is generally located at the southeast corner of the Eastern Avenue and Constantine Avenue intersection, just south of the residential development as shown in Figures 1 and 2. The site is bounded by existing residential to the north and west (with existing Eastern Avenue separating the site from the residential development to the west), an existing affordable senior housing development to the south, and the existing Robert Lunt Elementary School to the east. The site is specifically the north half (N 1/2) of the southwest quarter (SW 1/4) of the northwest quarter (NW 1/4) of the southwest quarter (SW 1/4) of Section 25, Township 20 South, Range 61 East.

1.3 Description of Property

The project site consists of approximately 2.99 acres of undeveloped desert land. The topography is relatively flat with a slope of approximately 2% to the northeast. The vegetation is classified as poor, with less than 50% ground cover.

BONANZA - EASTERN SENIOR APARTMENTS

APN: 139-25-301-001

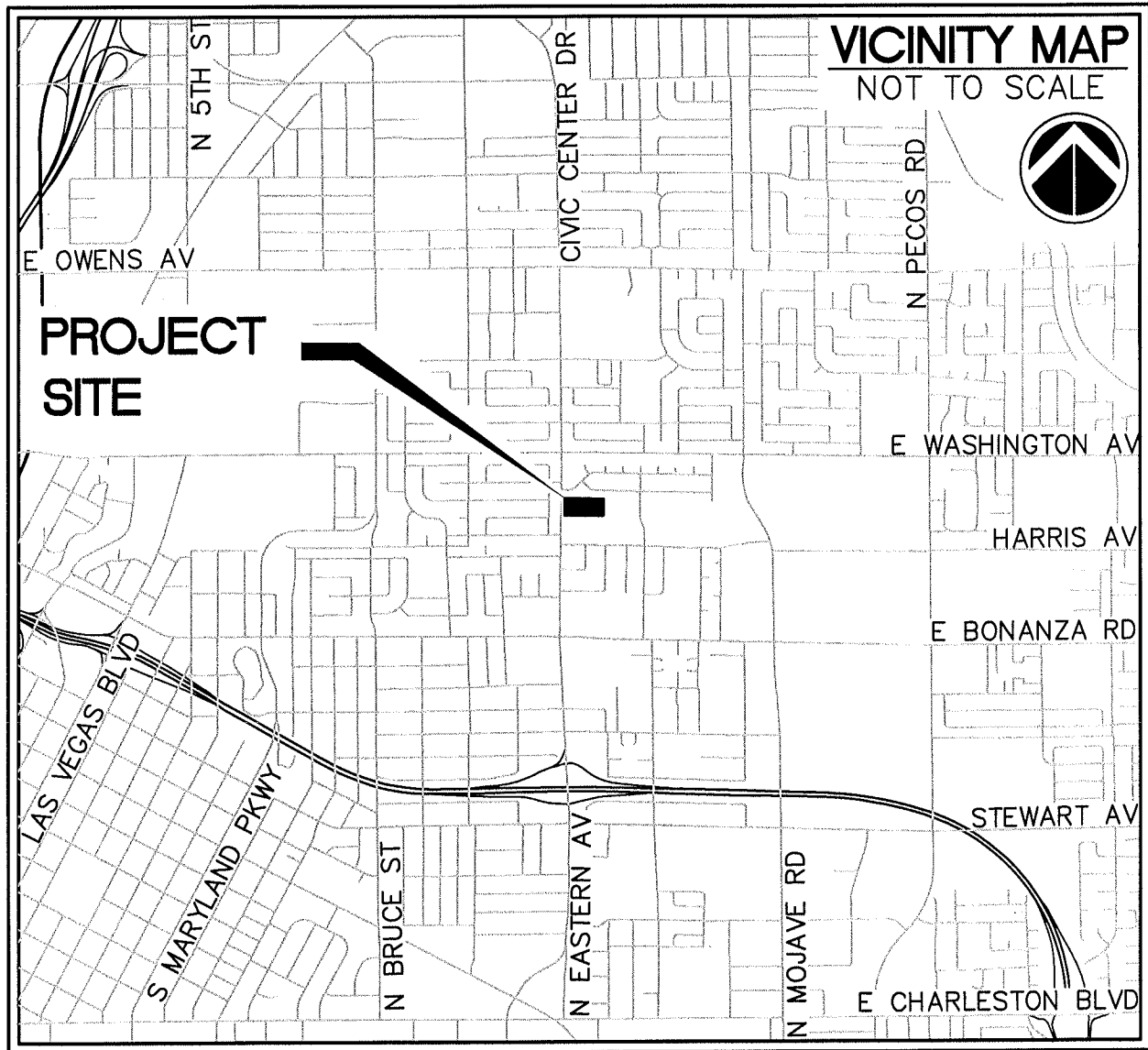


FIGURE 1

VICINITY MAP
NOT TO SCALE



Impulse

Civil Engineering & Planning

PLANNERS • CIVIL ENGINEERS

7485 WEST AZURE DRIVE, SUITE 226 • LAS VEGAS, NEVADA 89130 • (702) 308-7115

$$I = \int F \cdot dt$$

BONANZA - EASTERN SENIOR APARTMENTS

APN: 139-25-301-001

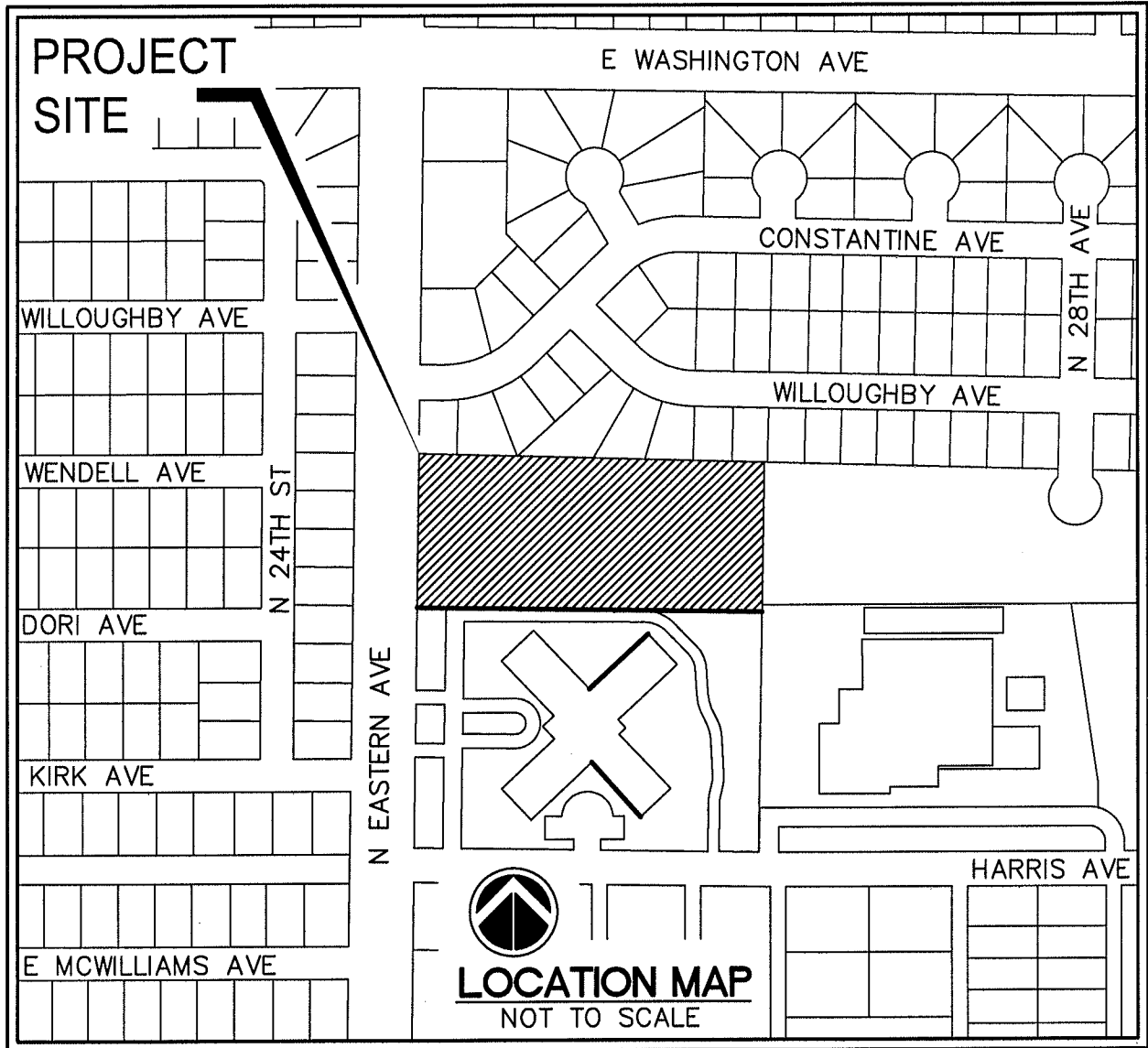


FIGURE 2
LOCATION MAP
NOT TO SCALE



Impulse

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$$I = \int F \cdot dt$$

2.0 DRAINAGE BASIN DESCRIPTION

2.1 Off-site Drainage Description

The general drainage pattern for this portion of valley is to the east.

NORTH There is no impact to the property from the north. Flow north of the site drains to the north and east. There is a high point in Eastern Avenue at the north property line of the site.

SOUTH There is no impact to the property from the south. The existing apartment development drains east and south.

EAST There is no impact to the property from the east. Flow east of the site drains to the south and east.

WEST Runoff from the area to the west drains to Eastern Avenue south of the site and then continues south away from the site.

An analysis of the offsite area was not performed but rather referenced from the previous study.

The City Wide Study has flow rates that contribute to Eastern Avenue but they enter Eastern Avenue at Kirk Avenue which is south of the site.

2.2 Onsite Drainage Description

The general drainage pattern for the site is to the northeast. In the developed condition, the existing condition drainage patterns were maintained as closely as possible.

In the existing condition, the site drains north east into the existing residences on the north property line.

In the interim/ultimate condition, the offsite area was treated the same as for the existing condition and only the site is developed. The design of the site prevents runoff from impacting the homes on the north property line.

The existing and interim/ultimate condition basin maps that may be found in the map pocket at the rear of this study as Figures 3 and 4 respectively.

2.3 FEMA Flood Hazard Zone

The Special Flood Hazard Areas for Clark County, Nevada are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), dated November 16, 2011. The site is affected by a designated Special Flood Hazard Area (SFHA) Shaded Zone X as shown on Figure 5, which is a replication of Community Panel No. 32003C2186F. A Shaded Zone X is an area determined to be areas of 0.2% annual chance flood.

2.4 Regional Flood Control Master Plan Update

The site is not adjacent to a regional facility as shown on Figure 6 which is a replication of Figure F-25 in the 2018 Clark County Regional Flood Control District Flood Control Master Plan Update for the Las Vegas Valley.

2.5 Previous Drainage Studies

The site has not been studied in the past. The following studies have been reviewed and are being referenced for pertinent information which may be found in Appendix D:

- *Technical Drainage Study for Center for Community*, by Integrity Engineering, dated December 2003 (DS-3470)
- *City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis*, by PBS&J, dated December 1997

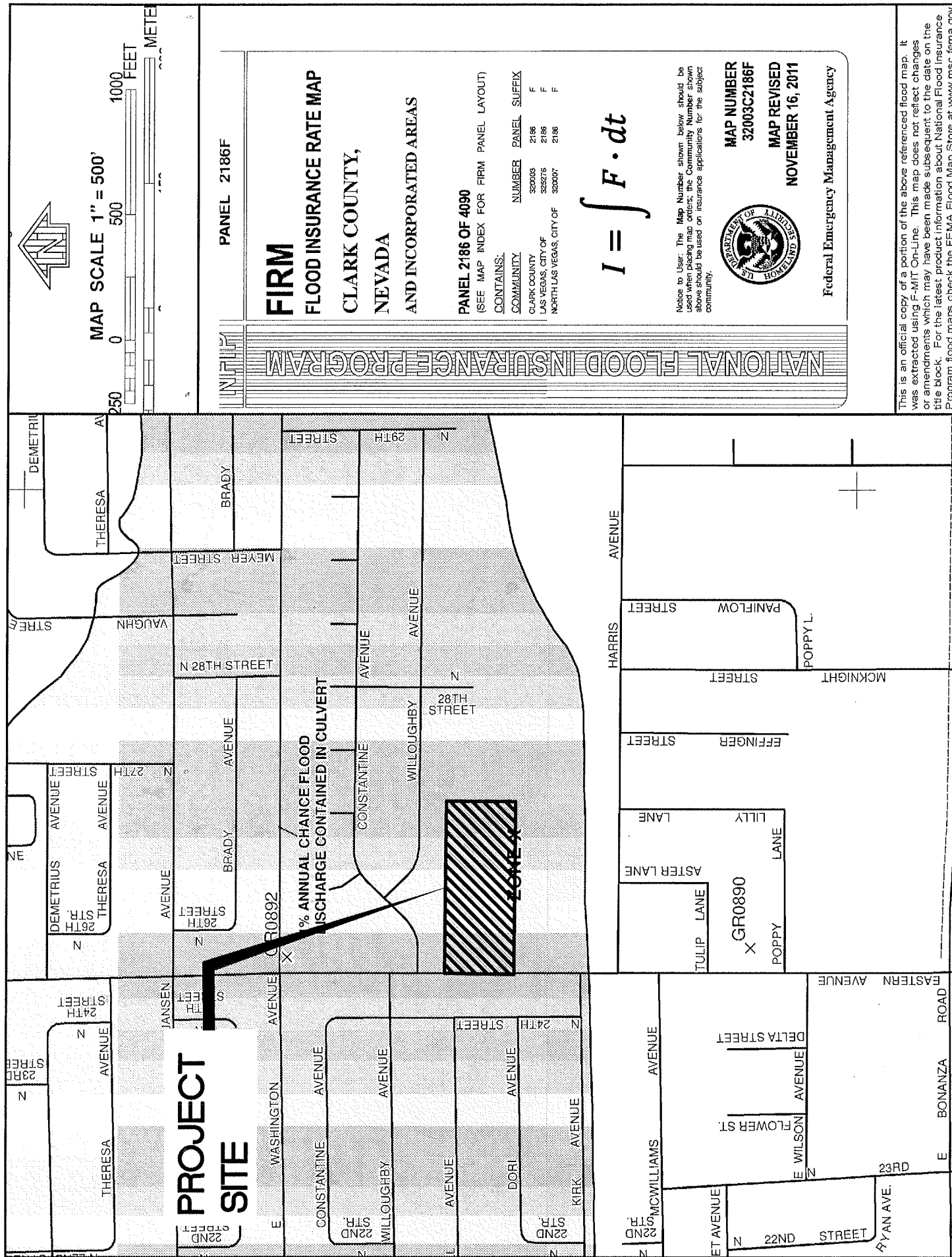


FIGURE 5

This aerial map of Las Vegas, NV, illustrates the proposed project site and its context within the city's infrastructure. The map features several key elements:

- Major Roads:** Las Vegas Blvd, Lake Mead Blvd, Washington Av, and Bonanza Rd are clearly visible. Other streets shown include Donna St, Bruce St, CMC Center Dr, and Pecos Rd.
- Water Features:** The map shows various water bodies and channels, including the Las Vegas River and several smaller canals, all highlighted in blue.
- Project Boundaries and Features:** Red lines and labels indicate specific project areas and features, such as LVCC (0035), LVLE (0047), LVQE (0085), and LVVZ (0000).
- Water Management Features:** Numerous labels for water management features are present, including LVMD (0001, 0004, 0007, 0008, 0011, 0015, 0019, 0024, 0029, 0034, 0036, 0038, 0040, 0042, 0044, 0046, 0048, 0050, 0052, 0054, 0056, 0058, 0060, 0062, 0064, 0066, 0068, 0070, 0072, 0074, 0076, 0078, 0080, 0082, 0084, 0086, 0088, 0090, 0092, 0094, 0096, 0098, 0100, 0102, 0104, 0106, 0108, 0110, 0112, 0114, 0116, 0118, 0120, 0122, 0124, 0126, 0128, 0130, 0132, 0134, 0136, 0138, 0140, 0142, 0144, 0146, 0148, 0150, 0152, 0154, 0156, 0158, 0160, 0162, 0164, 0166, 0168, 0170, 0172, 0174, 0176, 0178, 0180, 0182, 0184, 0186, 0188, 0190, 0192, 0194, 0196, 0198, 0200, 0202, 0204, 0206, 0208, 0210, 0212, 0214, 0216, 0218, 0220, 0222, 0224, 0226, 0228, 0230, 0232, 0234, 0236, 0238, 0240, 0242, 0244, 0246, 0248, 0250, 0252, 0254, 0256, 0258, 0260, 0262, 0264, 0266, 0268, 0270, 0272, 0274, 0276, 0278, 0280, 0282, 0284, 0286, 0288, 0290, 0292, 0294, 0296, 0298, 0300, 0302, 0304, 0306, 0308, 0310, 0312, 0314, 0316, 0318, 0320, 0322, 0324, 0326, 0328, 0330, 0332, 0334, 0336, 0338, 0340, 0342, 0344, 0346, 0348, 0350, 0352, 0354, 0356, 0358, 0360, 0362, 0364, 0366, 0368, 0370, 0372, 0374, 0376, 0378, 0380, 0382, 0384, 0386, 0388, 0390, 0392, 0394, 0396, 0398, 0400, 0402, 0404, 0406, 0408, 0410, 0412, 0414, 0416, 0418, 0420, 0422, 0424, 0426, 0428, 0430, 0432, 0434, 0436, 0438, 0440, 0442, 0444, 0446, 0448, 0450, 0452, 0454, 0456, 0458, 0460, 0462, 0464, 0466, 0468, 0470, 0472, 0474, 0476, 0478, 0480, 0482, 0484, 0486, 0488, 0490, 0492, 0494, 0496, 0498, 0500, 0502, 0504, 0506, 0508, 0510, 0512, 0514, 0516, 0518, 0520, 0522, 0524, 0526, 0528, 0530, 0532, 0534, 0536, 0538, 0540, 0542, 0544, 0546, 0548, 0550, 0552, 0554, 0556, 0558, 0560, 0562, 0564, 0566, 0568, 0570, 0572, 0574, 0576, 0578, 0580, 0582, 0584, 0586, 0588, 0590, 0592, 0594, 0596, 0598, 0600, 0602, 0604, 0606, 0608, 0610, 0612, 0614, 0616, 0618, 0620, 0622, 0624, 0626, 0628, 0630, 0632, 0634, 0636, 0638, 0640, 0642, 0644, 0646, 0648, 0650, 0652, 0654, 0656, 0658, 0660, 0662, 0664, 0666, 0668, 0670, 0672, 0674, 0676, 0678, 0680, 0682, 0684, 0686, 0688, 0690, 0692, 0694, 0696, 0698, 0700, 0702, 0704, 0706, 0708, 0710, 0712, 0714, 0716, 0718, 0720, 0722, 0724, 0726, 0728, 0730, 0732, 0734, 0736, 0738, 0740, 0742, 0744, 0746, 0748, 0750, 0752, 0754, 0756, 0758, 0760, 0762, 0764, 0766, 0768, 0770, 0772, 0774, 0776, 0778, 0780, 0782, 0784, 0786, 0788, 0790, 0792, 0794, 0796, 0798, 0800, 0802, 0804, 0806, 0808, 0810, 0812, 0814, 0816, 0818, 0820, 0822, 0824, 0826, 0828, 0830, 0832, 0834, 0836, 0838, 0840, 0842, 0844, 0846, 0848, 0850, 0852, 0854, 0856, 0858, 0860, 0862, 0864, 0866, 0868, 0870, 0872, 0874, 0876, 0878, 0880, 0882, 0884, 0886, 0888, 0890, 0892, 0894, 0896, 0898, 0900, 0902, 0904, 0906, 0908, 0910, 0912, 0914, 0916, 0918, 0920, 0922, 0924, 0926, 0928, 0930, 0932, 0934, 0936, 0938, 0940, 0942, 0944, 0946, 0948, 0950, 0952, 0954, 0956, 0958, 0960, 0962, 0964, 0966, 0968, 0970, 0972, 0974, 0976, 0978, 0980, 0982, 0984, 0986, 0988, 0990, 0992, 0994, 0996, 0998, 1000, 1002, 1004, 1006, 1008, 1010, 1012, 1014, 1016, 1018, 1020, 1022, 1024, 1026, 1028, 1030, 1032, 1034, 1036, 1038, 1040, 1042, 1044, 1046, 1048, 1050, 1052, 1054, 1056, 1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072, 1074, 1076, 1078, 1080, 1082, 1084, 1086, 1088, 1090, 1092, 1094, 1096, 1098, 1100, 1102, 1104, 1106, 1108, 1110, 1112, 1114, 1116, 1118, 1120, 1122, 1124, 1126, 1128, 1130, 1132, 1134, 1136, 1138, 1140, 1142, 1144, 1146, 1148, 1150, 1152, 1154, 1156, 1158, 1160, 1162, 1164, 1166, 1168, 1170, 1172, 1174, 1176, 1178, 1180, 1182, 1184, 1186, 1188, 1190, 1192, 1194, 1196, 1198, 1200, 1202, 1204, 1206, 1208, 1210, 1212, 1214, 1216, 1218, 1220, 1222, 1224, 1226, 1228, 1230, 1232, 1234, 1236, 1238, 1240, 1242, 1244, 1246, 1248, 1250, 1252, 1254, 1256, 1258, 1260, 1262, 1264, 1266, 1268, 1270, 1272, 1274, 1276,

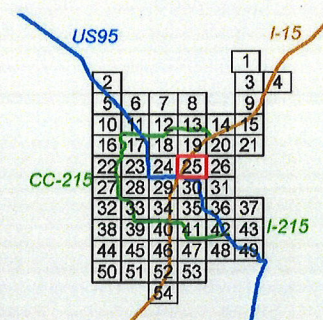


FIGURE 6

3.0 HYDROLOGIC/HYDRAULIC METHODOLOGY

3.1 General

The project site is to be developed into a single apartment building with a future phase 2 portion. The grading of the site will provide positive drainage through the site without creating a negative impact to neighboring properties and the site itself. The natural drainage patterns were maintained as close as possible.

3.2 Compliance with Regulations and Adopted Plans

The hydrologic parameter calculations for the local on-site basins are included in Appendix A. The hydrologic analyses for the existing and developed conditions are included in Appendix B. The hydraulic calculations for the proposed improvements are included in Appendix C. All calculations presented in this report are in accordance with the CCRFCD Manual.

3.3 Hydrologic Criteria

The watershed was modeled using the storm network computation capabilities of the U. S. Army Corps of Engineer's HEC-1 Flood Hydrograph computer model. The HEC-1 computer program has a wide range of capabilities in modeling gauged and un-gauged watersheds, with most of the latest techniques for simulating precipitation, rainfall distribution, runoff losses due to soil absorption, transpiration, evaporation and surface impoundment, flood routing, flow diversions and splits. Since

the study watershed is un-gauged, the analysis used to model the runoff incorporated the Soil Conservation Service (SCS) unit hydrograph method to develop a hypothetical flood hydrograph. The CCRFCD Manual was used to establish the point precipitation values, rainfall distribution (SDN 3), and depth area reduction factors. The point precipitation values were established from the NOAA precipitation Frequency Atlas (1973). The NOAA precipitation values were then adjusted by the recommended correction factors to develop point rainfall depths for storm events that best simulate the hydrologic area. The point precipitation values are shown in Table 1 for the six-hour duration storm event. The six-hour storm has been selected in accordance with the CCRFCD Manual.

TABLE 1 Depth-Duration-Frequency Values	
Return Period (year)	Precipitation (in)
10	1.58
100	2.77

The site is within the McCarran rainfall area, so the precipitation adjustment ratios are not applied. A depth area reduction factor was not applied to the rainfall values so the DARF = 1.00. Precipitation calculations are located in Appendix A.

The curve numbers were developed based on vegetation, soils group information, land use, and antecedent soil moisture conditions in accordance with the standard methods of the Soil Conservation Service (SCS). The curve numbers were adjusted accordingly to reflect the existing and developed conditions of the site.

The soils information was obtained from the United States Department of Agriculture Natural Resources Conservation Service Soil Survey dated August 22, 2014. It should be noted that the entire area is in map unit symbol 341 which is Paradise Silt Loam and is classified as hydrologic soil group B.

The time between a brief heavy rain and the maximum runoff rate is called lag time. Lag can be estimated from historical hydrographs or it can be estimated from specific watershed characteristics such as watershed length, slope and flow retardance. Based on studies of many storm events for a range of watershed conditions, the following empirical relationship between lag (L) and time of concentration (T_c) was derived:

$$L = 0.6 T_c$$

$$T_c = \frac{L_{ws}}{3600 \cdot V} + T_i$$

where: L_{ws} = Hydraulic length

V = Average velocity

T_i = Initial flow time

Average velocities for estimating travel time for surface flow were used to develop a time of concentration. Flow characteristics may be separated into three general categories: initial overland, shallow concentrated, and channelized. To determine initial flow times, the equation $T_i = 1.8 (1.1-K) L^{1/2}/S^{1/3}$ was used as outlined in the CCRFCD Manual. To determine shallow concentrated flow velocities and channelized flow velocities, the equations published in the CCRFCD Manual were utilized. The computations are included on the Standard Form 4. The results are shown on a version of Standard Form 4 and may be found in Appendix A.

3.4 Facility Design Calculations

Normal depth calculations were performed for areas of interest for the existing, interim, and ultimate conditions. All normal depth calculations may be found in Appendix C. The flow in Eastern Avenue is referenced based on the discussion in Section 2.1 of this study.

The flow depth onsite is below the top of curb. The finished floor elevation is more than twice the depth of flow.

There is an internal courtyard that will be drained with (3) 6-inch PVC drain pipes. Area drains will collect runoff from the roof and convey the flow to the BMP swale located at the northeast corner of the site. The area drain system is not needed in Phase 1 of the site but will be required when Phase 2 is constructed. We anticipate needed Phase 2 before Phase 1 is open.

4.0 RESULTS

The flow rates developed by this report are shown in Table 2. The development of the site does not substantially increase any of the adjacent flow rates.

TABLE 2 Summary of Flows		
BASIN	Existing (10yr/100yr) (cfs)	Developed (10 yr/100yr) (cfs)
EX1	1 / 4	- / -
PR1	- / -	4 / 8
Eastern	1 / 2	1 / 2

Table 3 summarizes the normal depth sections analyzed. All sections meet the velocity-depth product requirements and dry lane requirements.

TABLE 3 Normal Depth Sections									
Street Name	Q ₁₀ (cfs)	V ₁₀ (ft/s)	d ₁₀ (ft)	V ₁₀ * d ₁₀	Q ₁₀₀ (cfs)	V ₁₀₀ (ft/s)	d ₁₀₀ (ft)	V ₁₀₀ * d ₁₀₀	Dry Lane (ft)
Eastern Avenue	1.00	1.22	0.31	0.38	2.00	1.43	0.36	0.51	29.00
Drive Aisle	4.00	1.87	0.36	0.67	8.00	2.21	0.42	0.93	N/A
BMP Swale	4.00	2.36	0.65	1.53	8.00	2.52	0.87	2.19	N/A

5.0 CONCLUSIONS AND RECOMMENDATIONS

1. The site is located within a Special Flood Hazard Area Shaded Zone X. CCRFCD concurrence should not be required prior to final signature on the improvement plans.
2. The development of this site is has no impact on the Clark County Regional Flood Control District Flood Control Master Plan Update. The site is not adjacent to a CCRFCD facility.
3. The finished floor elevations were established as follows:
 - Six inches above the highest adjacent top of curb per CCRFCD HCDDM 304.4.E.1.
 - Finished floor elevations for buildings adjacent to public drainage easements are a minimum of 18 inches above the Q-100 weir or submerged weir elevation, whichever is greater.
 - Finished floor elevation calculations include allowances for super elevations on curves and velocity head (head loss) for tee intersections.
4. The grading plan is included in the pocket in the back of this report.
5. The design of this project does not negatively impact adjacent or downstream properties.
6. The proposed piping system to drain the courtyard should consist of (3) 6-inch PVC pipes at 1% minimum.

6.0 REFERENCES

"2008 Las Vegas Valley Flood Control Master Plan Update", September 2008.
Clark County Regional Flood Control District

"Drainage of Highway Pavements," U. S. Department of Transportation, Federal
Highway Administration, March 1984.

"HEC-1 Flood Hydrograph Package" Revised January 1985. U.S.Army Corps of
Engineers.

"Hydrologic Criteria and Drainage Design Manual", dated 1999. Clark County
Regional Flood Control District.

"Improvement Standards," Department of Public Works, Clark County, Nevada,
1993.

"Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County" dated July
1985. U.S. Department of Agriculture, Soil Conservation Service.

"Urban Hydrology for Small Watersheds", June 1986, U.S. Department of
Agriculture, Soil Conservation Service, Technical Release 55, TR-55.

Technical Drainage Study for Center for Community, by Integrity Engineering, dated
December 2003 (DS-3470)

City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis,
by PBS&J, dated December 1997

APPENDIX A

Hydrologic Parameter Development

$$I = \int F \cdot dt$$

[illegible]

[illegible]

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

NOTES

MAP LEGEND

- PARCEL BOUNDARY
- SUB BOUNDARY
- PMID BOUNDARY
- ROAD EASEMENT
- MATCH / LEADER LINE
- HISTORIC LOT LINE
- HISTORIC SUB BOUNDARY
- HISTORIC PMID BOUNDARY
- SECTION LINE

125 124 123 12

138 139 140 14

163 162 161 16

007 ROAD PARCEL NUMBER

001 PARCEL NUMBER

1.00 ACRES

202 PARCEL SUBSEQ NUMBER

PB 24-48 PLAY RECORDING NUMBER

5 BLOCK NUMBER

5 LOT NUMBER

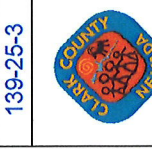
GLS GOV. LOT NUMBER

MAP

25

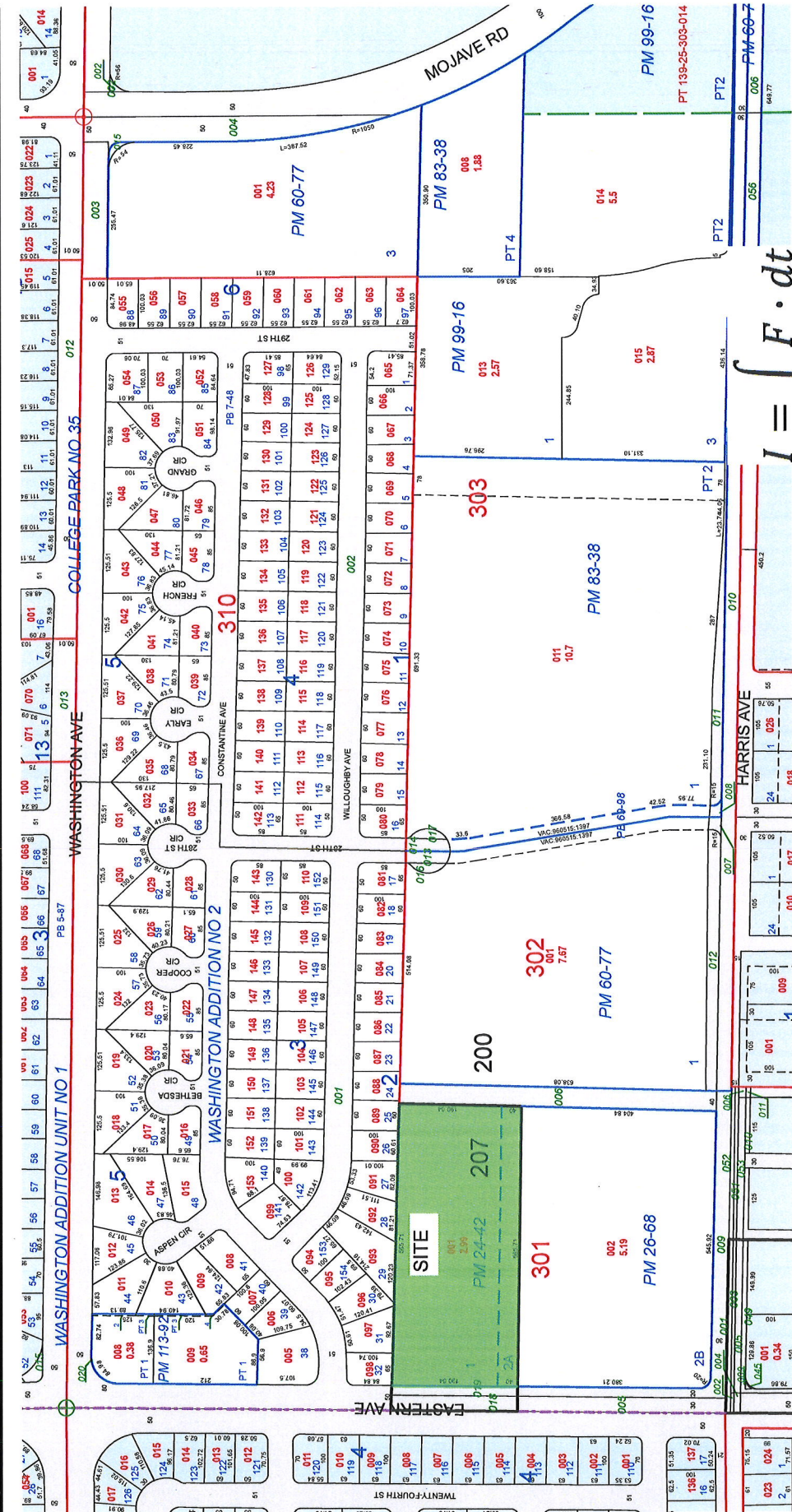
139-25-3

N 2 SW 4



Scale: 1" = 200'

Rev: 1/8/2019

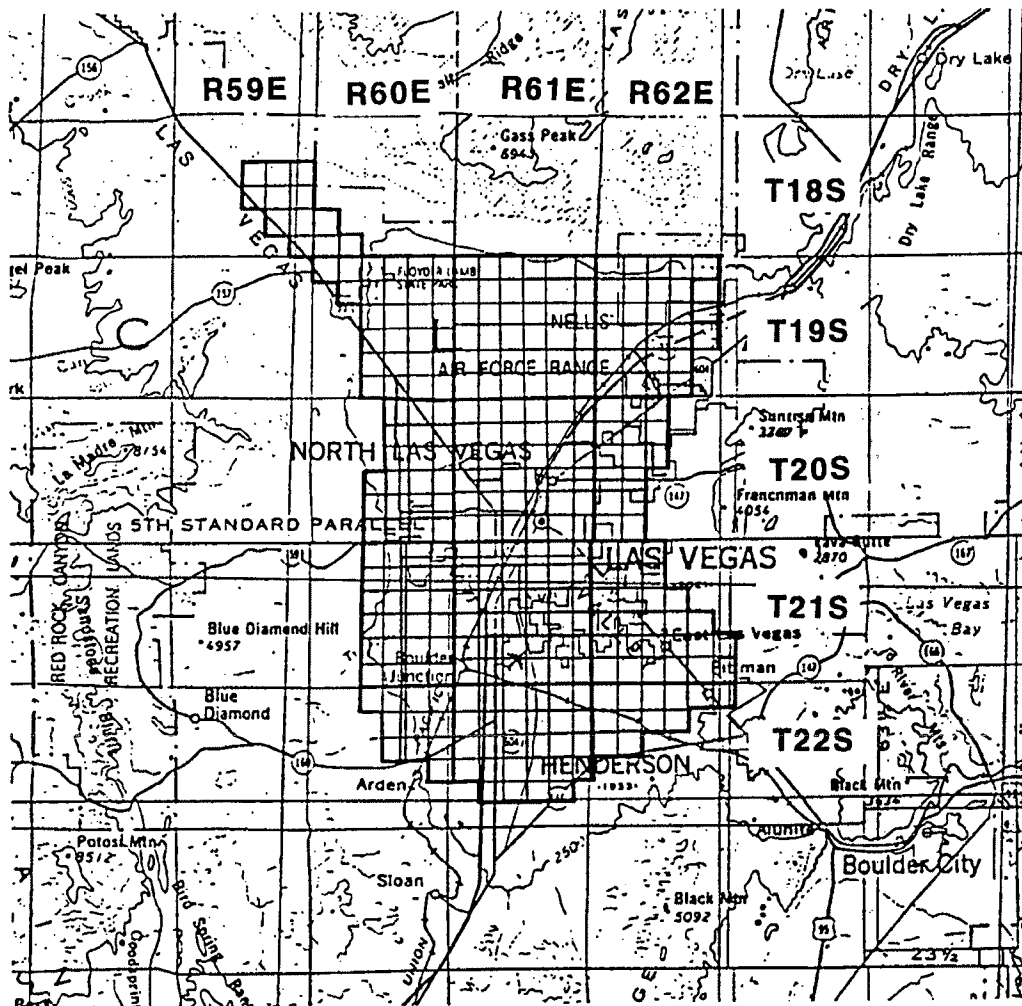


$$I = \int F \cdot dt$$

TAX DIST 207,200

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:

1. Refer to Table 505 and Figure 516 Depth-Duration-Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

$$I = \int F \cdot dt$$

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

PRECIPITATION ADJUSTMENT RATIOS

<u>Recurrence Interval</u>	<u>Ratio to NOAA Atlas 2</u>
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

- NOTE: 1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

$$I = \int F \cdot dt$$

<i>Revision</i>	<i>Date</i>

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 501

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
0.0	1.00
0.5	0.98
1.0	0.97
2.0	0.93
4.0	0.91
6.0	0.90
8.0	0.88
10.0	0.86
20.0	0.79
30.0	0.74
50.0	0.68
100.0	0.60
150.0	0.55
200.0	0.51
300.0	0.46
400.0	0.42
500.0	0.39

- NOTES: 1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

$$I = \int F \cdot dt$$

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

Percent of Total Storm Depth				Percent of Total Storm Depth			
Storm Time (In Minutes)	SDN3	SDN4	SDN5	Storm Time (In Minutes)	SDN3	SDN4	SDN5
0	0.0	0.0	0.0	185	32.2	37.6	43.0
5	2.0	2.0	2.0	190	35.2	41.5	47.7
10	5.7	5.8	5.9	195	40.9	46.2	51.4
15	7.0	7.5	8.0	200	49.9	53.0	56.1
20	8.7	9.9	11.0	205	59.0	61.0	63.0
25	10.8	12.6	14.4	210	71.0	71.0	71.0
30	12.4	13.7	15.0	215	74.4	73.2	72.0
35	13.0	14.5	16.0	220	78.1	75.6	73.1
40	13.0	14.9	16.8	225	81.2	78.2	75.2
45	13.0	15.1	17.1	230	81.9	79.9	77.9
50	13.0	15.5	18.0	235	83.5	81.3	79.0
55	13.0	15.6	18.2	240	85.1	82.3	79.5
60	13.0	15.9	18.7	245	85.6	83.0	80.4
65	13.3	16.2	19.0	250	86.0	83.5	81.0
70	14.0	16.9	19.7	255	86.8	84.4	82.0
75	14.2	17.2	20.2	260	87.6	85.1	82.6
80	14.8	17.9	21.0	265	88.8	86.4	84.0
85	15.8	18.9	22.0	270	91.0	88.5	85.9
90	17.2	20.1	23.0	275	92.6	90.8	88.9
95	18.1	21.1	24.1	280	93.7	92.4	91.0
100	19.0	22.0	25.0	285	95.0	94.4	93.8
105	19.7	22.8	25.9	290	97.0	96.8	96.6
110	19.9	23.2	26.5	295	97.6	97.3	97.0
115	20.0	24.0	28.0	300	98.2	97.8	97.4
120	20.1	24.6	29.0	305	98.5	98.2	97.9
125	20.4	25.2	30.0	310	98.7	98.4	98.1
130	21.4	26.0	30.5	315	98.9	98.6	98.3
135	22.9	26.9	30.9	320	99.0	98.8	98.5
140	24.1	27.6	31.0	325	99.3	99.1	98.9
145	24.9	28.3	31.7	330	99.3	99.2	99.0
150	25.1	28.6	32.1	335	99.4	99.3	99.2
155	25.6	29.2	32.7	340	99.5	99.4	99.3
160	27.0	30.2	33.3	345	99.8	99.7	99.6
165	27.8	31.2	34.6	350	99.8	99.8	99.7
170	28.1	32.1	36.1	355	99.9	99.9	99.9
175	28.3	33.2	38.1	360	100.0	100.0	100.0
180	29.5	35.2	40.8				

- Notes: 1. For drainage areas less than 8 square miles in size, use SDN 3.
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
 4. A graphical representation of these values is presented on Figure 515.

$$I = \int F \cdot dt$$

Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES)

TIME	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. The 24 hour values presented above are for use with TR-55 only.
3. Table 501 adjustments not required.

$$I = \int F \cdot dt$$

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 505

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME-INTENSITY-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES PER HOUR)

TIME (min)	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	1.80	3.24	4.20	5.52	6.48	7.56
10	1.50	2.64	3.42	4.44	5.34	6.12
15	1.32	2.28	2.96	3.88	4.60	5.28
30	0.88	1.56	2.02	2.62	3.10	3.58
60	0.52	0.89	1.15	1.50	1.78	2.06

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. Table 501 adjustments not required.

$$I = \int F \cdot dt$$

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 506

[illegible]

[illegible]

Impulse

Civil Engineering Planning

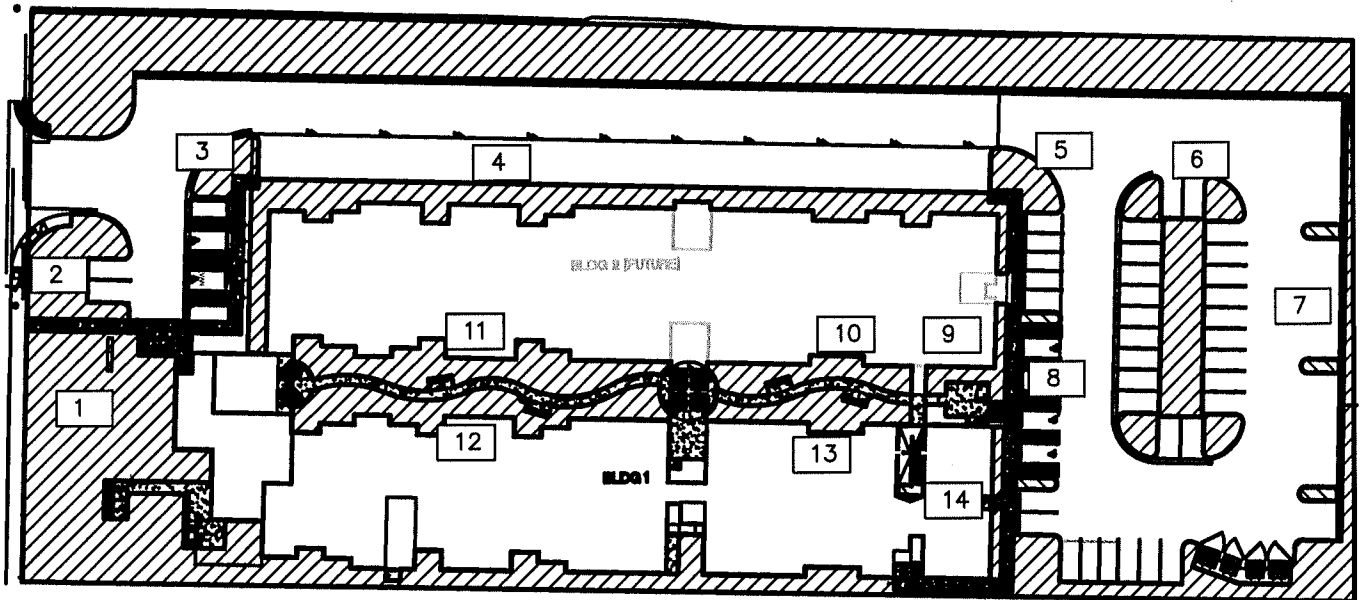
7485 West Azure Drive Suite 226
Las Vegas, NV 89130
PHONE 702-815-0720

$$I = \int F \cdot dt$$

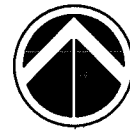
EXISTING CONDITION

				TOTAL
OF1	Area	%		130244.40
IMPERVIOUS	A 88,298.04	67.79%	98 w	
OPEN SPACE	A 41,946.36	32.21%	79	

Composite CN = 91.88



IMPERVIOUS CALCULATION



NOT TO SCALE

Total Site		
A=	130244.40	SF
Pervious		
1	26742.0249	SF
2	1348.3479	SF
3	481.5203	SF
4	3834.6967	SF
5	532.9915	SF
6	2452.3918	SF
7	274.1685	SF
8	163.1278	SF
9	425.9045	SF
10	847.7605	SF
11	1939.5007	SF
12	1763.133	SF
13	890.0182	SF
14	250.7712	SF
Pervious Area =		
	41946.36	32%
Impervious Area =		
	88298.04	68%

Impulse
Civil Engineering & Planning

PLANNERS • CIVIL ENGINEERS
7485 WEST AZURE AVENUE, SUITE 226 • LAS VEGAS, NEVADA 89130 • (702) 308-7115

$$I = \int F \cdot dt$$

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition ²	A ³	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	62	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

¹Average runoff condition, and $I_a = 0.2S$.

²Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

³Curve numbers for group A have been developed only for desert shrub.

$$I = \int F \cdot dt$$

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

SCS TR-55, USDA, June 1986.

**TABLE 602
4 of 4**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.): ³					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ⁴ ...		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas

Newly graded areas (pervious areas only, no vegetation) ⁵	77	86	91	94
--	----	----	----	----

1. Average runoff condition, and $I_p = 0.2S$.
2. The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.
3. CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
4. Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
5. Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

$$I = \int F \cdot dt$$

Revision	Date

**WRC
ENGINEERING**

REFERENCE:
SCS TR-55, USDA, June 1986.

**TABLE 602
1 of 4**



United States
Department of
Agriculture

NRCS

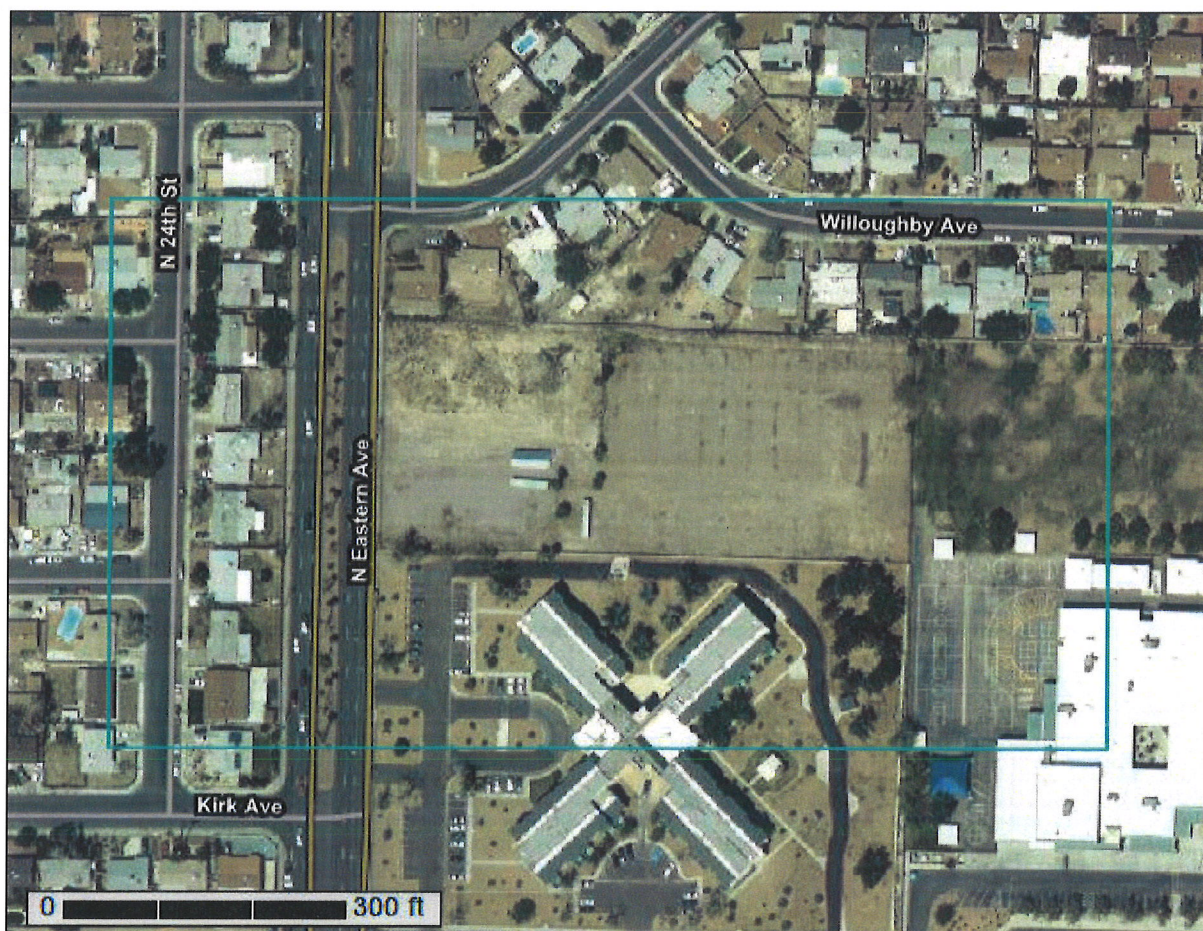
Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County

**Bonanza-Eastern Senior
Apartments**

$$I = \int F \cdot dt$$



December 28, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

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

Soil Map

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

Custom Soil Resource Report Soil Map



MAP LEGEND

- Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 16, Aug 26, 2020

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

Date(s) aerial images were photographed: Apr 3, 2019—May 14, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

10

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
341	Paradise silt loam	14.2	100.0%
Totals for Area of Interest		14.2	100.0%

Map Unit Descriptions

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

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

Las Vegas Valley Area, Nevada, Part of Clark County

341—Paradise silt loam

Map Unit Setting

National map unit symbol: hrbx
Elevation: 1,800 to 2,100 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 240 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Paradise and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paradise

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 39 inches: loam
H3 - 39 to 61 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 36 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0
Available water capacity: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B
Ecological site: R030XY023NV - SALINE MEADOW
Hydric soil rating: No

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industrial, heavy industrial and commercial areas (land use categories 8 through 11) are assumed 100% fair condition desert shrub for the open space distribution. Parks/golf courses and schools (land use categories 2 and 12) are assumed 70% open landscaping (grass) in good condition and 30% fair condition desert shrub for the open space distribution. This 70%-30% split was determined after reviewing the Spring 2016 aerial imagery.

4. All designated right-of-way areas were categorized as public facility (land use category 7) to be consistent throughout the Las Vegas Valley.

It should be noted that undeveloped land, open desert (land use category 1) will continue to use 100% poor condition desert shrub (<30% ground cover).

The directly connected impervious area percentages and corresponding open space distribution of each land use category is presented in **Table 2-2**:

Table 2-2 - Land Use Categories

Land Use Index	Land Use Description	Impervious* (%)	Open Landscape Good Condition Grass (%)	Open Desert Shrub Fair Condition <u>Natural Desert Landscaping</u> (%)
1	Undeveloped Land, Open Desert	0	0	100**
2	Parks, Golf Courses	5	66.5	28.5
3	Rural, 0.5-1 units per acre (uses 1 unit/acre)	20	40	40
4	Low-Density Residential, 1-2 units per acre (uses 2 units/acre)	25	37.5	37.5
5	Medium-Density Residential, 2-4 units per acre (uses 3 units/acre)	30	35	35
6	High-Density residential, 4-8 units per acre (uses 6 units/acre)	52	24	24
7	Public Facility and Residential, 8-12 units/acre	72	14	14
8	Very High-Density Residential, 12 units/acre or more	80	0	20
9	Commercial, Retail, Casino, High Rise Condominiums	85	0	15
10	Light Industrial	72	0	28
11	Heavy Industrial	85	0	15
12	Schools	50	35	15
13	Lakes	0	0	0

* Impervious areas are directly connected to the drainage system
 ** Open Desert Shrub Poor Condition is applied for Undeveloped Land, Open Desert (Land Use Index Number 1)

The land use data used with the 2018 MPU is shown on the W-Maps. **Figure 2-1** shows the geographic comparison between the 2018 and 2008 MPU land use coverages in terms of percent imperviousness. The increase or decrease in impervious area represents an increase or decrease, respectively, in the runoff potential for a given area.

Central Watershed

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE - COMPOSITE CURVE NUMBER BREAKDOWN											
WATERSHED	BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
Central	BN08-C	6	1270	88	800353	9468762	8.5%	9.8%	7.44	8.63	
Central	BN06-C	6	1341	83	4695941	9468762	49.6%	59.4%	41.16	49.79	
Central	BN08-C	7	1200	92	78842	9468762	0.8%	60.2%	0.77	50.56	
Central	BN06-C	7	1270	92	782241	9468762	8.3%	68.5%	7.60	58.16	
Central	BN08-C	7	1341	89	2605183	9468762	27.5%	96.0%	24.49	82.65	
Central	BN06-C	8	1270	95	11187	9468762	0.1%	96.1%	0.11	82.76	
Central	BN06-C	8	1341	93	6543	9468762	0.1%	96.2%	0.06	82.82	
Central	BN08-C	9	1200	95	831	9468762	0.0%	96.2%	0.01	82.83	
Central	BN06-C	9	1270	95	301246	9468762	3.2%	99.4%	3.02	85.85	
Central	BN08-C	9	1341	94	58036	9468762	0.6%	100.0%	0.58	86.43	86.4
Central	BN08	5	1341	76	198063	5851227	3.4%	3.4%	2.57	2.57	
Central	BN08	6	1341	83	309481	5851227	5.3%	8.7%	4.39	6.96	
Central	BN08	7	1270	92	28514	5851227	0.5%	9.2%	0.45	7.41	
Central	BN08	7	1282	92	526986	5851227	9.0%	18.2%	8.29	15.70	
Central	BN08	7	1341	89	1863746	5851227	31.9%	50.0%	28.35	44.05	
Central	BN08	8	1282	95	662016	5851227	11.3%	61.3%	10.75	54.79	
Central	BN08	8	1341	93	1106665	5851227	18.9%	80.2%	17.59	72.38	
Central	BN08	9	1270	95	33604	5851227	0.6%	80.8%	0.55	72.93	
Central	BN08	9	1282	95	265268	5851227	4.5%	85.4%	4.31	77.24	
Central	BN08	9	1341	94	125275	5851227	2.1%	87.5%	2.01	79.25	
Central	BN08	12	1341	81	731608	5851227	12.5%	100.0%	10.13	89.38	89.4
Central	BN09	2	1200	77	20551	6505029	0.3%	0.3%	0.24	0.24	
Central	BN09	2	1282	77	80051	6505029	1.2%	1.5%	0.95	1.19	
Central	BN09	2	1341	66	2907605	6505029	44.7%	46.2%	29.50	30.69	
Central	BN09	7	1200	92	55680	6505029	0.9%	47.1%	0.79	31.48	
Central	BN09	7	1282	92	1315221	6505029	20.2%	67.3%	18.60	50.08	
Central	BN09	7	1341	89	2125922	6505029	32.7%	100.0%	29.09	79.17	79.2
Central	BN10-C	6	1200	88	194718	7162678	2.7%	2.7%	2.39	2.39	
Central	BN10-C	6	1282	88	1503011	7162678	21.0%	23.7%	18.47	20.86	
Central	BN10-C	6	1341	83	161895	7162678	2.3%	26.0%	1.88	22.73	
Central	BN10-C	7	1200	92	209986	7162678	2.9%	28.9%	2.70	25.43	
Central	BN10-C	7	1282	92	584372	7162678	8.2%	37.1%	7.51	32.94	
Central	BN10-C	7	1341	89	864373	7162678	12.1%	49.1%	10.74	43.68	
Central	BN10-C	8	1282	95	190429	7162678	2.7%	51.8%	2.53	46.20	
Central	BN10-C	8	1341	93	365107	7162678	5.1%	56.9%	4.74	50.94	
Central	BN10-C	9	1200	95	16586	7162678	0.2%	57.1%	0.22	51.16	
Central	BN10-C	9	1282	95	366954	7162678	5.1%	62.2%	4.87	56.03	
Central	BN10-C	9	1341	94	164130	7162678	2.3%	64.5%	2.15	58.18	
Central	BN10-C	12	1200	87	946442	7162678	13.2%	77.7%	11.50	69.68	
Central	BN10-C	12	1282	87	1509750	7162678	21.1%	98.8%	18.34	88.02	
Central	BN10-C	12	1341	81	84924	7162678	1.2%	100.0%	0.96	88.98	89.0
Central	BN12-C	1	1200	85	208473	8992403	2.3%	2.3%	1.97	1.97	
Central	BN12-C	6	1200	88	4001861	8992403	44.5%	46.8%	39.16	41.13	
Central	BN12-C	6	1282	88	446355	8992403	5.0%	51.8%	4.37	45.50	
Central	BN12-C	7	1200	92	1824632	8992403	20.3%	72.1%	18.67	64.17	
Central	BN12-C	7	1282	92	505632	8992403	5.6%	77.7%	5.17	69.34	
Central	BN12-C	8	1282	95	571540	8992403	6.4%	84.1%	6.04	75.38	
Central	BN12-C	9	1200	95	1025895	8992403	11.4%	95.5%	10.84	86.22	
Central	BN12-C	9	1282	95	392504	8992403	4.4%	99.8%	4.15	90.36	

Curve Number Matrix

SOIL MAP UNIT	HYDROLOGIC SOIL GROUP					LAND USE CATEGORY INDEX NUMBER												
	A	B	C	D	ROCK OUTCROP	1	2	3	4	5	6	7	8	9	10	11	12	13
	CN →	CN →	CN →	CN →														
	%	%	%	%	%	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1301	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	30.0
1302	35	20	0	45	0	77.0	67.0	73.0	75.0	76.0	83.0	89.0	93.0	93.0	94.0	91.0	94.0	82.0
1305	5	0	35	60	0	86.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	95.0	96.0	94.0	96.0	88.0
1307	10	0	30	60	0	83.0	82.0	83.0	83.0	88.0	92.0	95.0	96.0	96.0	96.0	93.0	96.0	87.0
1313	8	68	0	24	0	79.0	68.0	75.0	76.0	78.0	84.0	90.0	93.0	93.0	94.0	91.0	94.0	82.0
1314	80	5	0	15	0	67.0	53.0	62.0	65.0	67.0	77.0	86.0	91.0	92.0	92.0	88.0	92.0	74.0
1320	0	2	0	83	15	88.0	83.0	87.0	87.0	88.0	91.0	94.0	96.0	96.0	96.0	95.0	96.0	90.0
1323	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	96.0	95.0	91.0	30.0
1325	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	89.0	92.0	86.0	92.0	71.0
1326	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	89.0	92.0	86.0	92.0	71.0
1340	9	0	0	71	20	86.0	81.0	85.0	85.0	86.0	90.0	93.0	95.0	95.0	96.0	94.0	96.0	89.0
1341	0	100	0	0	0	77.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	93.0	94.0	91.0	94.0	81.0
1342	0	7	0	78	15	88.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	96.0	95.0	96.0	90.0
1360	15	0	0	35	50	85.0	81.0	84.0	85.0	86.0	90.0	93.0	95.0	95.0	96.0	94.0	96.0	89.0
1380	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1390	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1400	0	0	100	0	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	96.0	95.0	96.0	90.0
1415	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1417	5	0	55	10	30	86.0	80.0	84.0	85.0	86.0	89.0	93.0	95.0	95.0	96.0	94.0	96.0	89.0
1419	35	0	55	10	0	78.0	67.0	74.0	75.0	77.0	83.0	89.0	93.0	93.0	94.0	91.0	94.0	82.0
1440	0	0	100	0	0	85.0	82.0	83.0	84.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1450	1	0	0	89	10	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	95.0	90.0	30.0
1484	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	96.0	95.0	96.0	90.0
1500	60	0	0	35	5	73.0	61.0	69.0	71.0	73.0	81.0	88.0	92.0	93.0	89.0	89.0	79.0	30.0
1501	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1502	60	0	0	40	0	73.0	61.0	69.0	71.0	72.0	80.0	88.0	92.0	93.0	89.0	89.0	79.0	30.0
1505	55	0	0	40	5	74.0	63.0	70.0	72.0	74.0	81.0	88.0	92.0	94.0	90.0	80.0	80.0	30.0
1506	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1508	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1510	10	0	0	55	35	86.0	82.0	85.0	86.0	87.0	90.0	93.0	95.0	95.0	94.0	96.0	89.0	30.0
1540	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1541	4	0	0	76	20	87.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	95.0	90.0	30.0
1542	60	0	30	10	0	72.0	59.0	67.0	69.0	71.0	80.0	87.0	92.0	93.0	89.0	89.0	78.0	30.0
1545	60	0	10	30	0	73.0	60.0	68.0	70.0	72.0	80.0	88.0	92.0	93.0	89.0	89.0	78.0	30.0
1600	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1605	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1610	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1615	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1630	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	95.0	90.0	30.0
1635	7	0	5	63	25	87.0	82.0	85.0	86.0	87.0	90.0	94.0	96.0	96.0	94.0	96.0	89.0	30.0
1640	0	0	0	10	90	90.0	90.0	91.0	91.0	92.0	94.0	96.0	96.0	97.0	96.0	97.0	94.0	30.0
1645	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1674	27	26	0	45	2	78.0	69.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	83.0	30.0
1700	0	0	3	93	4	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1731	10	2	0	88	0	85.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1732	3	0	0	96	1	87.0	82.0	85.0	86.0	87.0	90.0	94.0	96.0	96.0	94.0	96.0	89.0	30.0
1753	0	8	0	90	2	88.0	81.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1850	0	0	0	94	6	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1853	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1871	17	0	0	83	0	84.0	76.0	81.0	82.0	83.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1999	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0



Legend

- Flow Arrows
- Concentration Points
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Ultimate Development Boundary
- Watersheds
- Subwatersheds
- Soils
- Undeveloped Land, Open desert
- Place: Gall County
- Rural, 0.5 units per acre (uses 2 units per acre)
- Low-Density Residential, 2 units per acre (uses 2 units per acre)
- Medium-Density Residential, 2 units per acre (uses 2 units per acre)
- High-Density Residential, 2 units per acre (uses 2 units per acre)
- Public Facility and Residential, 8-12 units per acre
- Very High-Density Residential, 2 units per acre or more
- Commercial, Retail, Gas, etc.
- High-Rise Communities
- Light Industrial
- Heavy Industrial
- Semiconductors
- Leisure
- SHHA, Zone A
- SHHA, Zone A
- SHHA, Zone A
- Zone X (Shaded)

1 inch = 417 feet

0 215 430 Feet

REGIONAL FLOOD CONTROL DISTRICT

W-MAP

$$I = \int F \cdot dt$$

APPENDIX B

Hydrologic Analyses

$$I = \int F \cdot dt$$

Hydrologic Analysis

Existing Condition

$$I = \int F \cdot dt$$

Civil Engineering Planning

$$I = \int F \cdot dt$$
[illegible]

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*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* SEPTEMBER 1990
* VERSION 4.0
*
* RUN DATE 01/04/2021 TIME 10:41:07
*
*****

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

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

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

1

HEC-1 INPUT

PAGE 1

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1	ID
2	ID %%%%%%%%%%
3	ID %% BONANZA EASTERN SENIOR APARTMENTS %%
4	ID %% Input = BESAEX.HC1 %%
5	ID %% EXISTING CONDITION %%
6	ID %% WATERSHED ANALYSIS %%
7	ID %% SDN-3 6 HOUR STORM %%
8	ID %%
9	ID %% JR = 1.58/2.77 = 0.57 10 year %%
10	ID %% JR = 2.77/2.77 = 1.00 100 year %%
11	ID %%
12	ID %% Engineer = IMPULSE CIVIL ENGINEERING %%
13	ID %% Client = NEVADA HOUSING %%
14	ID %% Date = 1/4/2021 INITIAL STUDY %%
15	ID %%%%%%%%%%
16	ID
17	ID

*DIAGRAM


```

%% Client = NEVADA HOUSING
%% Date = 1/4/2021 INITIAL STUDY
%%
%%

```

19 IO OUTPUT CONTROL VARIABLES

```

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

```

IT HYDROGRAPH TIME DATA

```

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

```

```

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE      24.92 HOURS

```

ENGLISH UNITS

```

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

```

JP MULTI-PLAN OPTION

```

NPLAN      1 NUMBER OF PLANS

```

JR MULTI-RATIO OPTION

```

RATIOS OF PRECIPITATION
.57      1.00

```

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				.57	1.00
HYDROGRAPH AT					
+	EX1	.00	1	FLOW	1. 4.
				TIME	3.58 3.58

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

Hydrologic Analysis

Interim/Ultimate Condition

$$I = \int F \cdot dt$$

$$I = \int F \cdot dt$$

Bonanza Eastern Senior Apartments

[illegible]

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* SEPTEMBER 1990
* VERSION 4.0
*
* RUN DATE 01/04/2021 TIME 10:43:56
*
*****

```

```

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

```

```

X X XXXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXX XXXX X XXXX X
X X X X X
X X X X X
X X XXXXXXX XXXX XXX

```

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

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

1

HEC-1 INPUT

PAGE 1

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1	ID
2	ID %%%%%%%%%%
3	ID %% BONANZA EASTERN SENIOR APARTMENTS %%
4	ID %% Input = BESADV.HC1 %%
5	ID %% DEVELOPED CONDITION %%
6	ID %% WATERSHED ANALYSIS %%
7	ID %% SDN-3 6 HOUR STORM %%
8	ID %%
9	ID %% JR = 1.58/2.77 = 0.57 10 year %%
10	ID %% JR = 2.77/2.77 = 1.00 100 year %%
11	ID %%
12	ID %% Engineer = IMPULSE CIVIL ENGINEERING %%
13	ID %% Client = NEVADA HOUSING %%
14	ID %% Date = 1/4/2021 INITIAL STUDY %%
15	ID %%%%%%%%%%
16	ID
17	ID
	*DIAGRAM

18	IT	5	0	0	300						
19	IO	5	0	0							
20	IN	5	0	0							
21	JR	PREC	0.57	1.00							
22	KK	PR1									
23	BA	0.0047									
24	PB	2.77									
25	PC	0	.02	.057	.07	.087	.108	.124	.13	.13	.13
26	PC	.13	.13	.13	.133	.14	.142	.148	.158	.172	.181
27	PC	.19	.197	.199	.2	.201	.204	.214	.229	.241	.249
28	PC	.251	.256	.27	.278	.281	.283	.295	.322	.352	.409
29	PC	.499	.59	.71	.744	.781	.812	.819	.835	.851	.856
30	PC	.86	.868	.876	.888	.91	.926	.937	.95	.97	.976
31	PC	.982	.985	.987	.989	.99	.993	.993	.994	.995	.998
32	PC	.998	.999	1							
33	LS	0	91.88								
34	UD	.1090									
	*										
35	ZZ										

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
 LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
 22 PR1

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * SEPTEMBER 1990 *
 * VERSION 4.0 *
 * RUN DATE 01/04/2021 TIME 10:43:56 *

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

```

%% BONANZA EASTERN SENIOR APARTMENTS %%
%% Input = BESADV.HC1 %%
%% DEVELOPED CONDITION %%
%% WATERSHED ANALYSIS %%
%% SDN-3 6 HOUR STORM %%
%% JR = 1.58/2.77 = 0.57 10 year %%
%% JR = 2.77/2.77 = 1.00 100 year %%
%% Engineer = IMPULSE CIVIL ENGINEERING %%

```



```

%% Client = NEVADA HOUSING          %%
%% Date = 1/4/2021 INITIAL STUDY    %%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

19 IO OUTPUT CONTROL VARIABLES

```

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

```

IT HYDROGRAPH TIME DATA

```

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

```

```

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE      24.92 HOURS

```

ENGLISH UNITS

```

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

```

JP MULTI-PLAN OPTION

```

NPLAN      1 NUMBER OF PLANS

```

JR MULTI-RATIO OPTION

```

RATIOS OF PRECIPITATION
.57      1.00

```

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				.57	1.00
HYDROGRAPH AT					
+	PR1	.00	1	FLOW	4. 8.
				TIME	3.58 3.50

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

APPENDIX C

Hydraulic Analyses

$$I = \int F \cdot dt$$

Hydraulic Analysis

Existing Condition

$$I = \int F \cdot dt$$

$$I = \int F \cdot dt$$

[illegible]

Dry Lane Calculations:

For 80-foot Right of Way:

For 100-foot Right of Way:

Dry Lane = ((Crown - d₁₀) / Cross Slope) - (Center Turn Lane / 2)
$$\text{Dry Lane} = ((0.83 - d_{10}) / .02) - 7$$
$$\text{Dry Lane} = ((1.03 - d_{10}) / .02) - 7$$

*

Flow in Eastern Avenue is referenced from Center for Community DS 3470

Eastern Avenue 10-year Half Street
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.004000 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
Discharge	1.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.31	ft
Flow Area	0.82	ft ²
Wetted Perimeter	8.62	ft
Top Width	8.27	ft
Height	0.31	ft
Critical Depth	0.28	ft
Critical Slope	0.008932	ft/ft
Velocity	1.22	ft/s
Velocity Head	0.02	ft
Specific Energy	0.33	ft
Froude Number	0.68	
Flow is subcritical.		

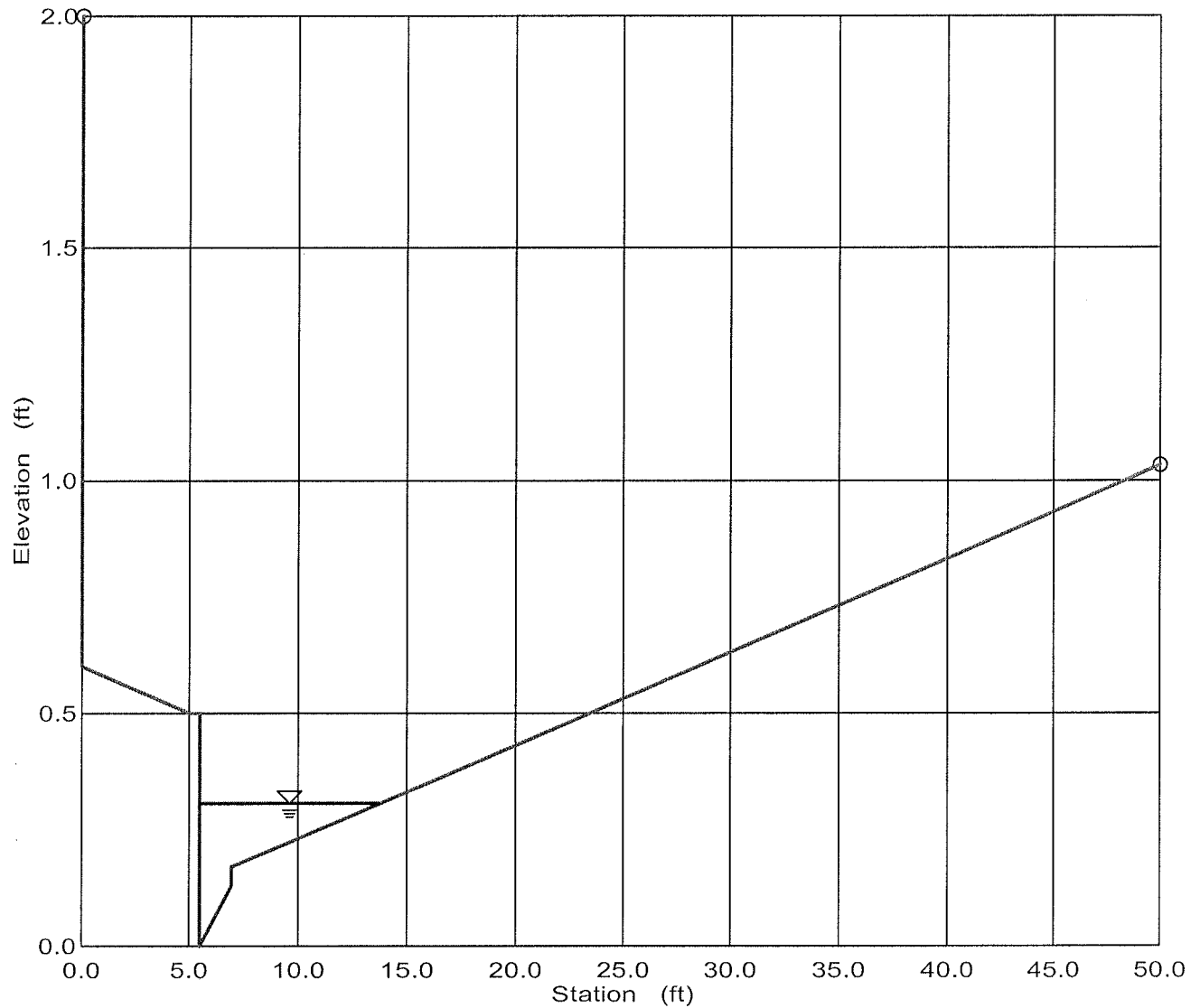
Cross Section
Cross Section for Irregular Channel

Project Description

Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data

Wtd. Mannings Coefficient	0.016
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.31 ft
Discharge	1.00 cfs



Eastern Avenue 100-year Half Street
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

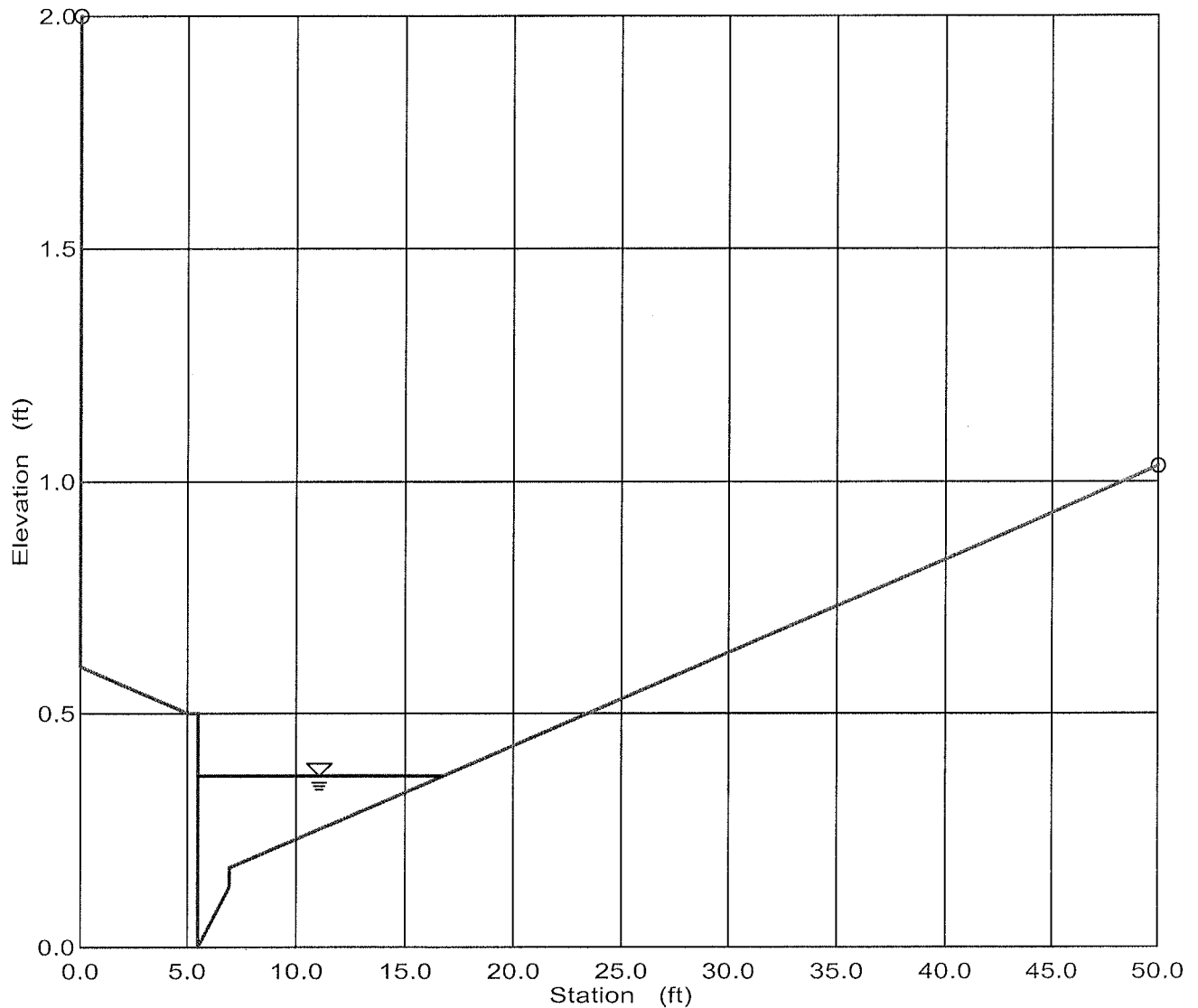
Input Data				
Channel Slope		0.004000 ft/ft		
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
Discharge	2.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.36	ft
Flow Area	1.40	ft ²
Wetted Perimeter	11.66	ft
Top Width	11.24	ft
Height	0.36	ft
Critical Depth	0.33	ft
Critical Slope	0.008190	ft/ft
Velocity	1.43	ft/s
Velocity Head	0.03	ft
Specific Energy	0.40	ft
Froude Number	0.71	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.36 ft
Discharge	2.00 cfs



Existing Condition North Perimeter
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	north perimeter existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

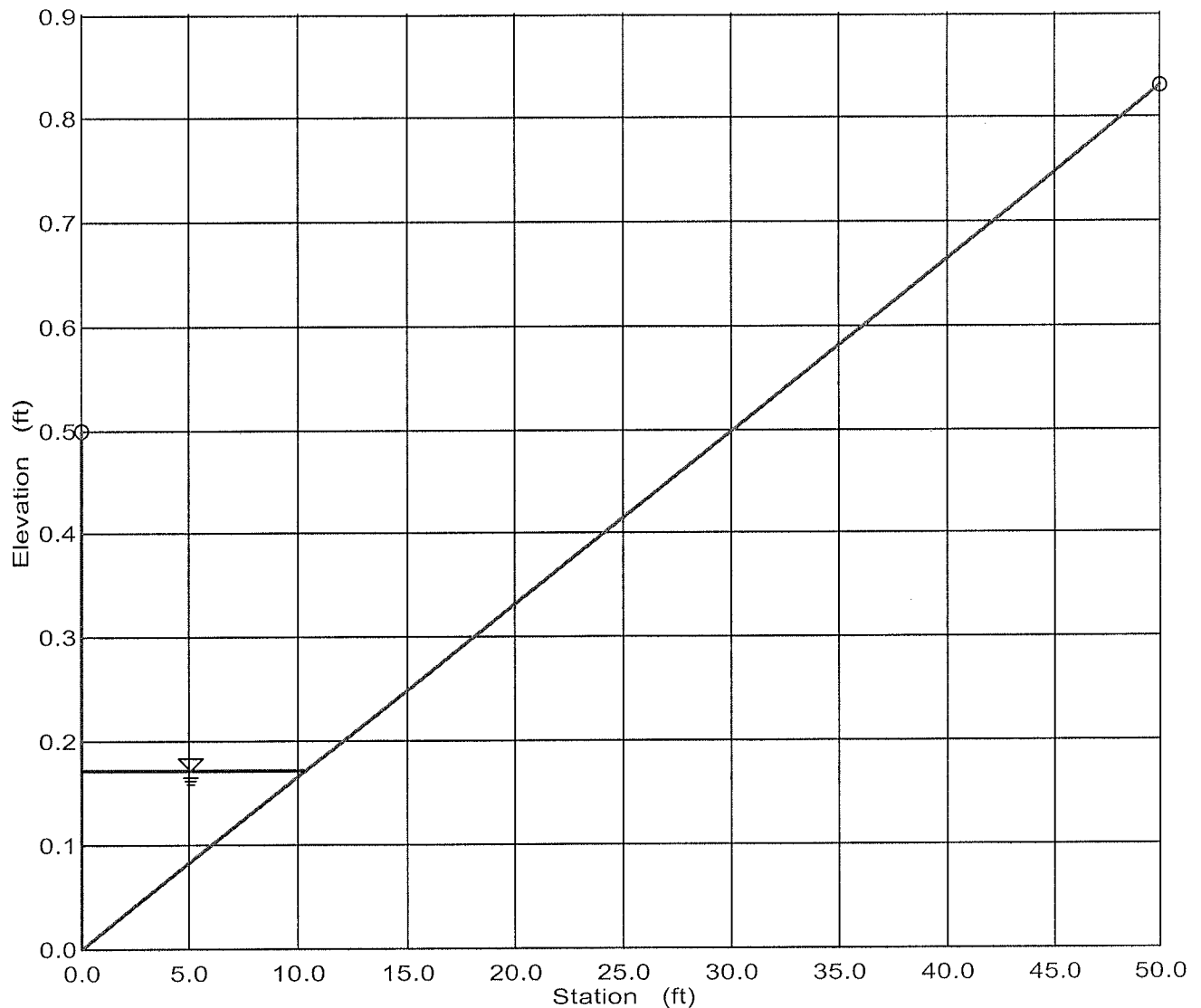
Input Data				
Channel Slope	0.007700 ft/ft			
Elevation range: 0.00 ft to 0.83 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.50	0.00	50.00	0.022
0.00	0.00			
50.00	0.83			
Discharge	1.00	cfs		

Results		
Wtd. Mannings Coefficient	0.022	
Water Surface Elevation	0.17	ft
Flow Area	0.88	ft ²
Wetted Perimeter	10.47	ft
Top Width	10.29	ft
Height	0.17	ft
Critical Depth	0.15	ft
Critical Slope	0.017216	ft/ft
Velocity	1.14	ft/s
Velocity Head	0.02	ft
Specific Energy	0.19	ft
Froude Number	0.69	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	north perimeter existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.022
Channel Slope	0.007700 ft/ft
Water Surface Elevation	0.17 ft
Discharge	1.00 cfs



Existing Condition N Perimeter 100-year
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	north perimeter existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

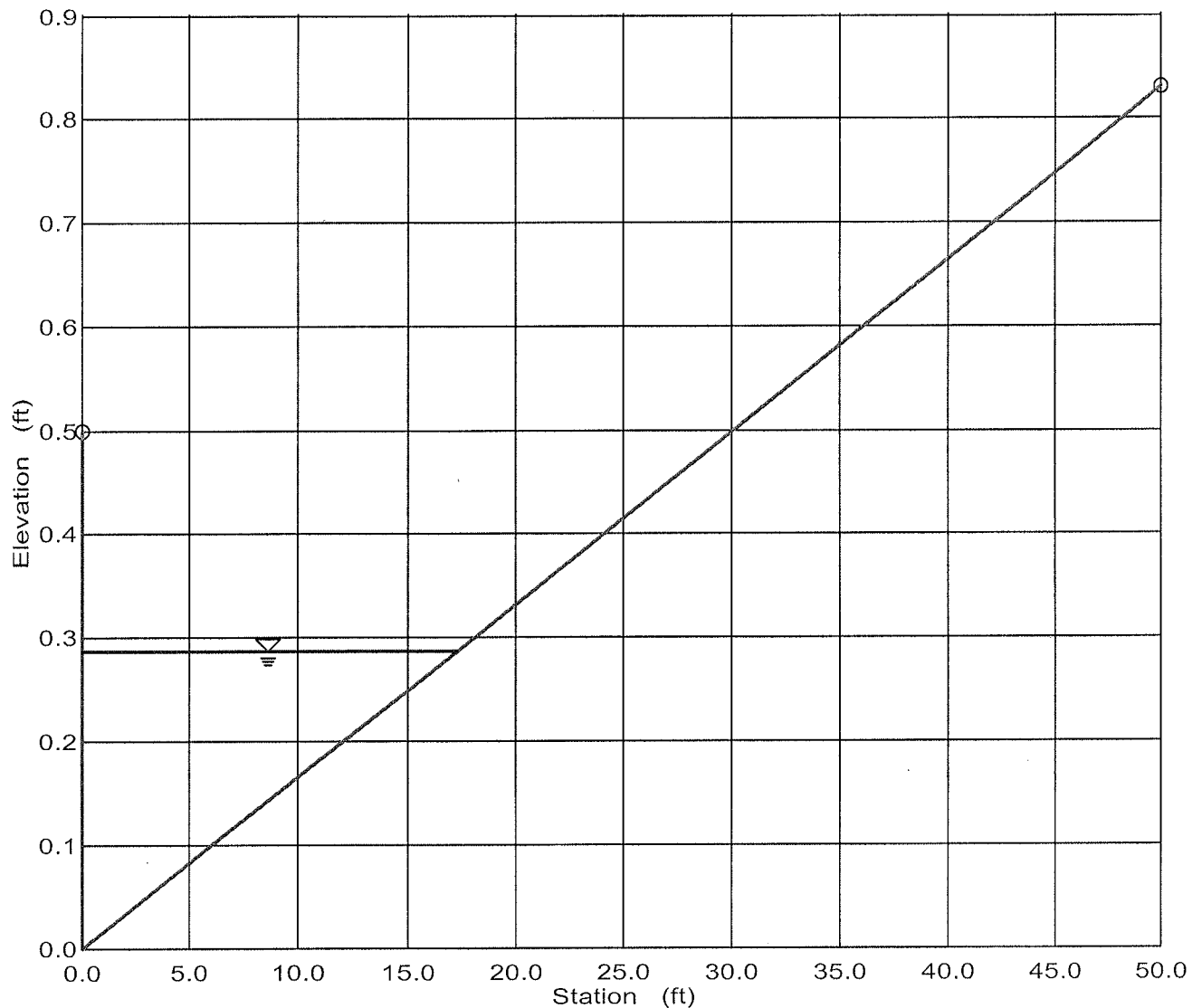
Input Data				
Channel Slope	0.007700 ft/ft			
Elevation range: 0.00 ft to 0.83 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.50	0.00	50.00	0.022
0.00	0.00			
50.00	0.83			
Discharge	4.00	cfs		

Results		
Wtd. Mannings Coefficient	0.022	
Water Surface Elevation	0.29	ft
Flow Area	2.49	ft ²
Wetted Perimeter	17.60	ft
Top Width	17.31	ft
Height	0.29	ft
Critical Depth	0.26	ft
Critical Slope	0.014310	ft/ft
Velocity	1.61	ft/s
Velocity Head	0.04	ft
Specific Energy	0.33	ft
Froude Number	0.75	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	north perimeter existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.022
Channel Slope	0.007700 ft/ft
Water Surface Elevation	0.29 ft
Discharge	4.00 cfs



Hydraulic Analysis

Interim/Ultimate Condition

$$I = \int F \cdot dt$$

$$I = \int F \cdot dt$$

[illegible]

Dry Lane Calculations:

For 80-foot Right of Way:

For 100-foot Right of Way:

$$\text{Dry Lane} = ((\text{Crown} - d_{10}) / \text{Cross Slope}) - (\text{Center Turn Lane} / 2)$$
$$\text{Dry Lane} = ((0.83 - d_{10}) / .02) - 7$$
$$\text{Dry Lane} = ((1.03 - d_{10}) / .02) - 7$$

*

Flow in Eastern Avenue is referenced from Center for Community DS 3470

Eastern Avenue 10-year Half Street
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.004000 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
Discharge	1.00	cfs		

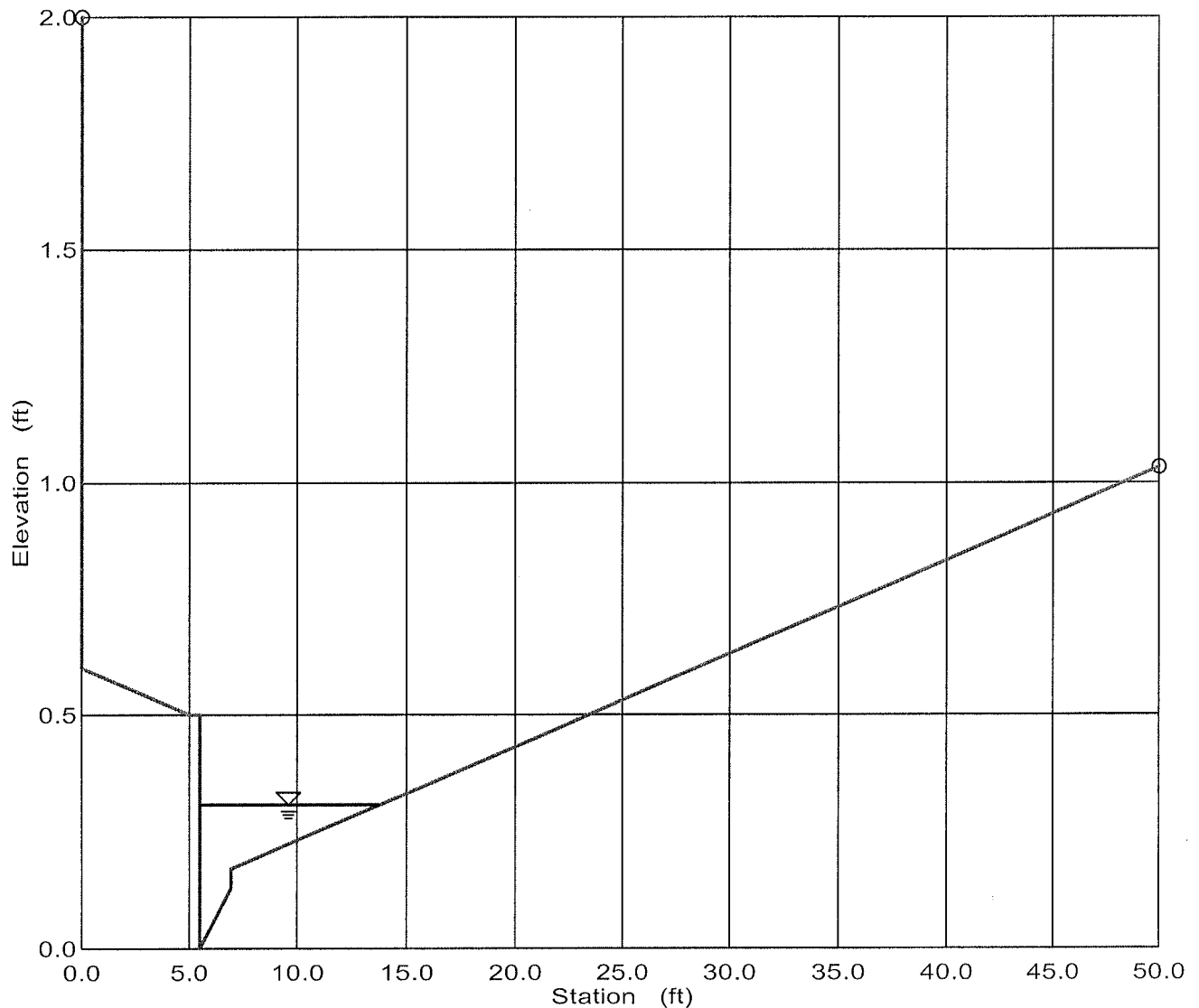
Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.31	ft
Flow Area	0.82	ft ²
Wetted Perimeter	8.62	ft
Top Width	8.27	ft
Height	0.31	ft
Critical Depth	0.28	ft
Critical Slope	0.008932	ft/ft
Velocity	1.22	ft/s
Velocity Head	0.02	ft
Specific Energy	0.33	ft
Froude Number	0.68	
Flow is subcritical.		

Cross Section

Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.31 ft
Discharge	1.00 cfs



Eastern Avenue 100-year Half Street
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

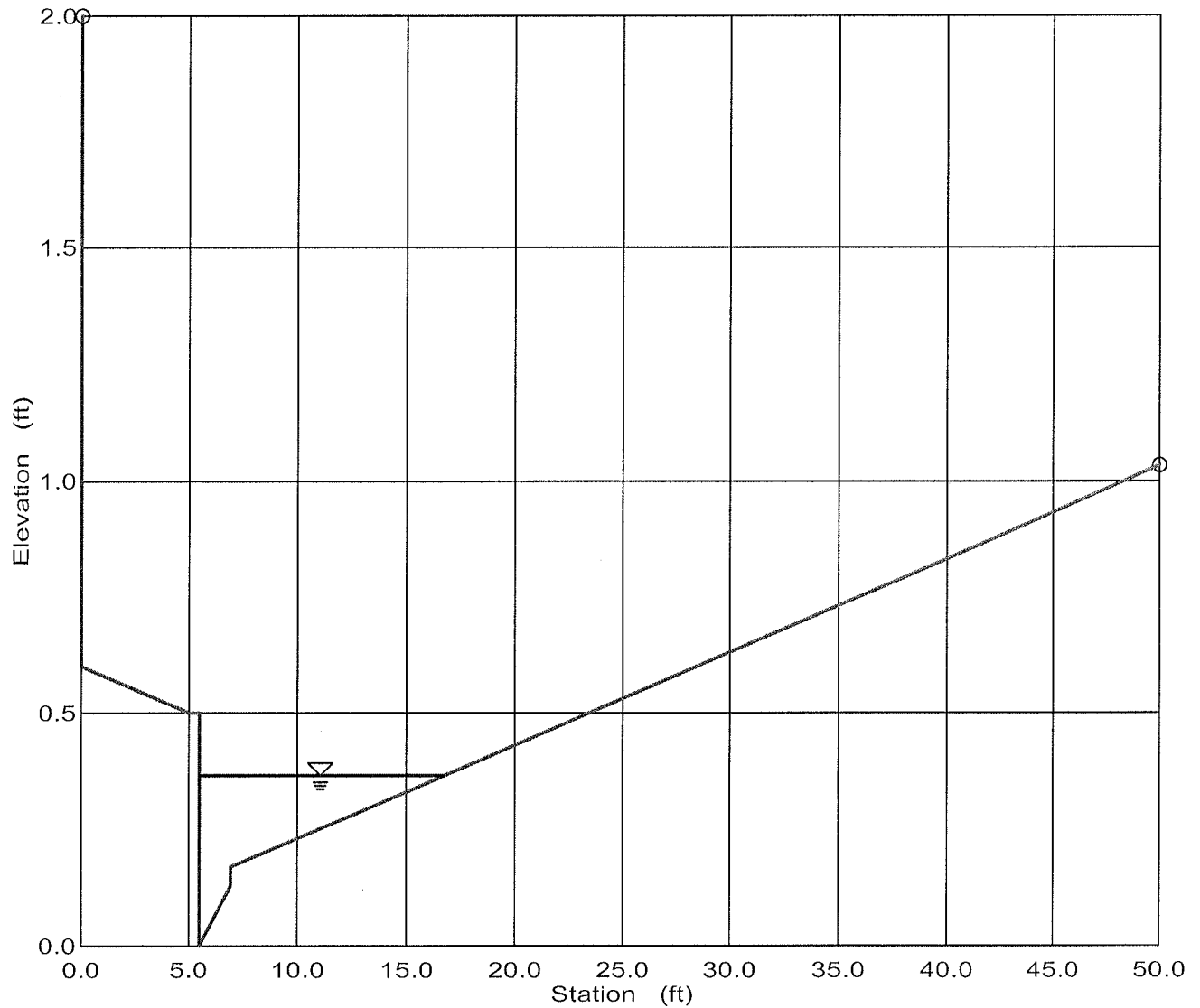
Input Data				
Channel Slope	0.004000 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	50.00	0.016
0.00	0.60			
5.00	0.50			
5.50	0.50			
5.50	0.00			
7.00	0.13			
7.00	0.17			
50.00	1.03			
Discharge	2.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.36	ft
Flow Area	1.40	ft ²
Wetted Perimeter	11.66	ft
Top Width	11.24	ft
Height	0.36	ft
Critical Depth	0.33	ft
Critical Slope	0.008190	ft/ft
Velocity	1.43	ft/s
Velocity Head	0.03	ft
Specific Energy	0.40	ft
Froude Number	0.71	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	Eastern Avenue Half Street
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.004000 ft/ft
Water Surface Elevation	0.36 ft
Discharge	2.00 cfs



Onsite Flow Depth 10-year
Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	DRIVE AISLE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

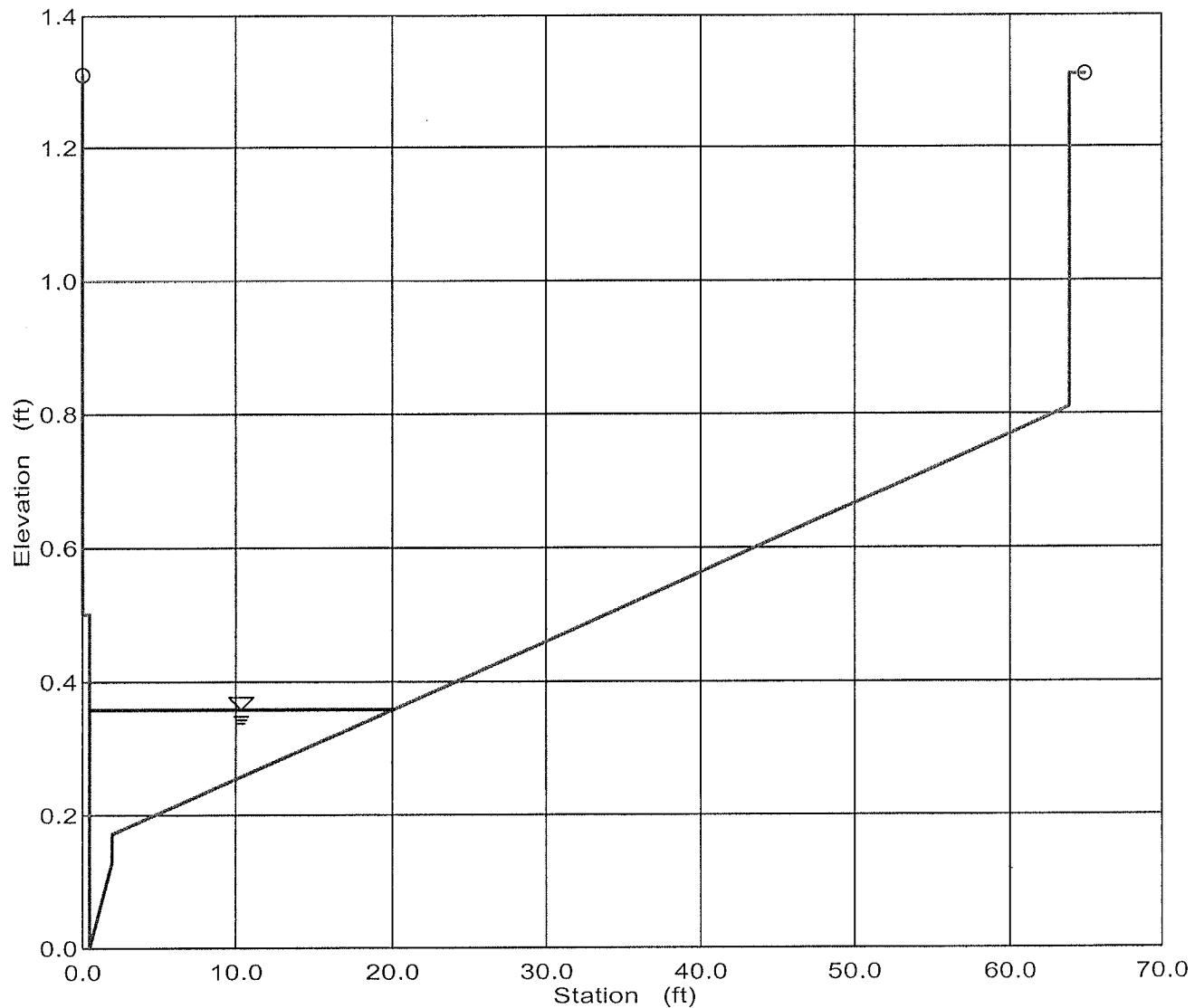
Input Data				
Channel Slope	0.008000 ft/ft			
Elevation range: 0.00 ft to 1.31 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.31	0.00	65.00	0.016
0.00	0.50			
0.50	0.50			
0.50	0.00			
2.00	0.13			
2.00	0.17			
64.00	0.81			
64.00	1.31			
65.00	1.31			
Discharge	4.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.36	ft
Flow Area	2.14	ft ²
Wetted Perimeter	20.06	ft
Top Width	19.66	ft
Height	0.36	ft
Critical Depth	0.36	ft
Critical Slope	0.008028	ft/ft
Velocity	1.87	ft/s
Velocity Head	0.05	ft
Specific Energy	0.41	ft
Froude Number	1.00	
Flow is subcritical.		

Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	DRIVE AISLE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.008000 ft/ft
Water Surface Elevation	0.36 ft
Discharge	4.00 cfs



Onsite Flow Depth 100-year Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	DRIVE AISLE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

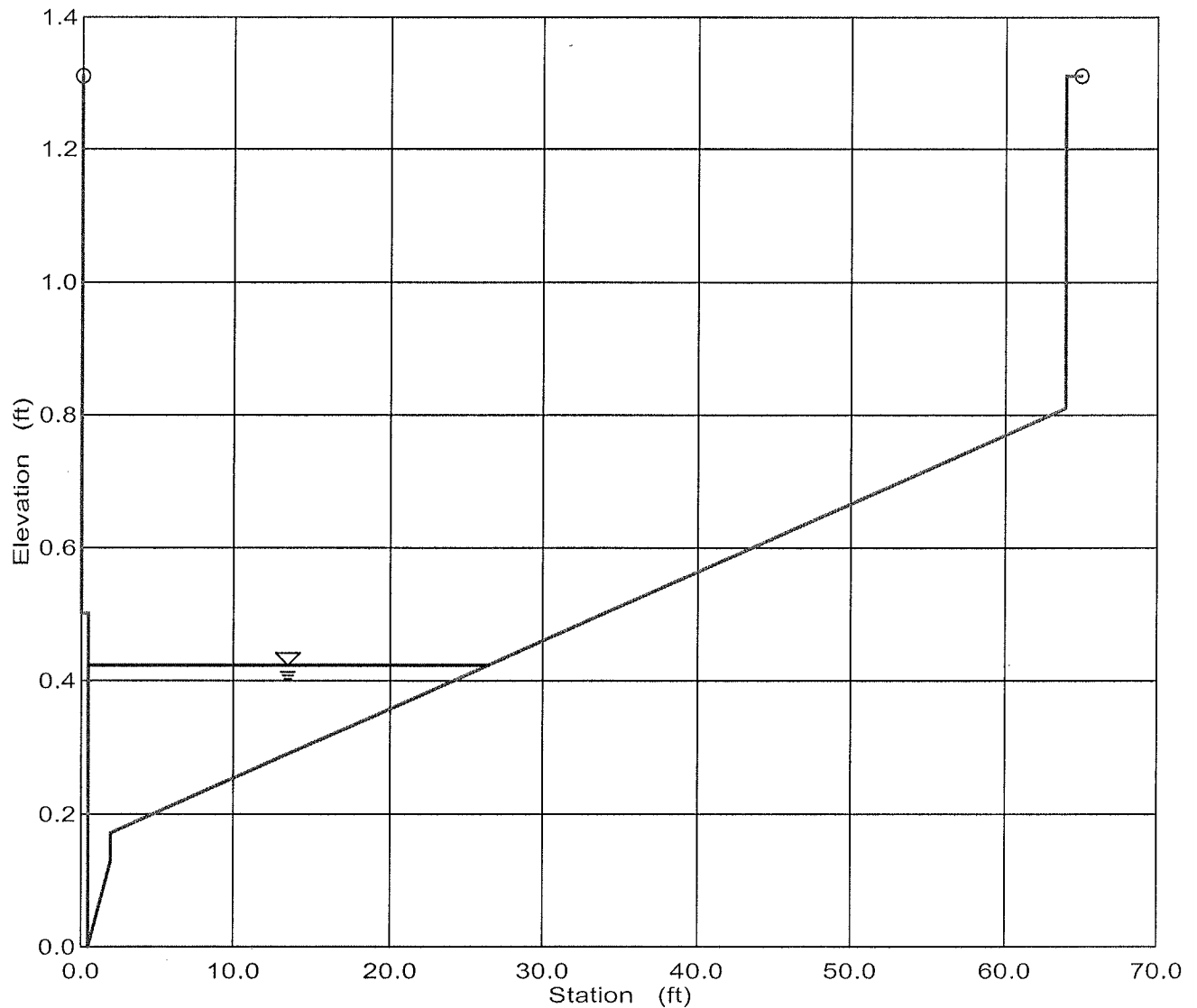
Input Data				
Channel Slope	0.008000 ft/ft			
Elevation range: 0.00 ft to 1.31 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1.31	0.00	65.00	0.016
0.00	0.50			
0.50	0.50			
0.50	0.00			
2.00	0.13			
2.00	0.17			
64.00	0.81			
64.00	1.31			
65.00	1.31			
Discharge	8.00	cfs		

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.42	ft
Flow Area	3.62	ft ²
Wetted Perimeter	26.42	ft
Top Width	25.95	ft
Height	0.42	ft
Critical Depth	0.43	ft
Critical Slope	0.007324	ft/ft
Velocity	2.21	ft/s
Velocity Head	0.08	ft
Specific Energy	0.50	ft
Froude Number	1.04	
Flow is supercritical.		

Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	DRIVE AISLE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.008000 ft/ft
Water Surface Elevation	0.42 ft
Discharge	8.00 cfs



BMP Swale 10-year Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	BMP SWALE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

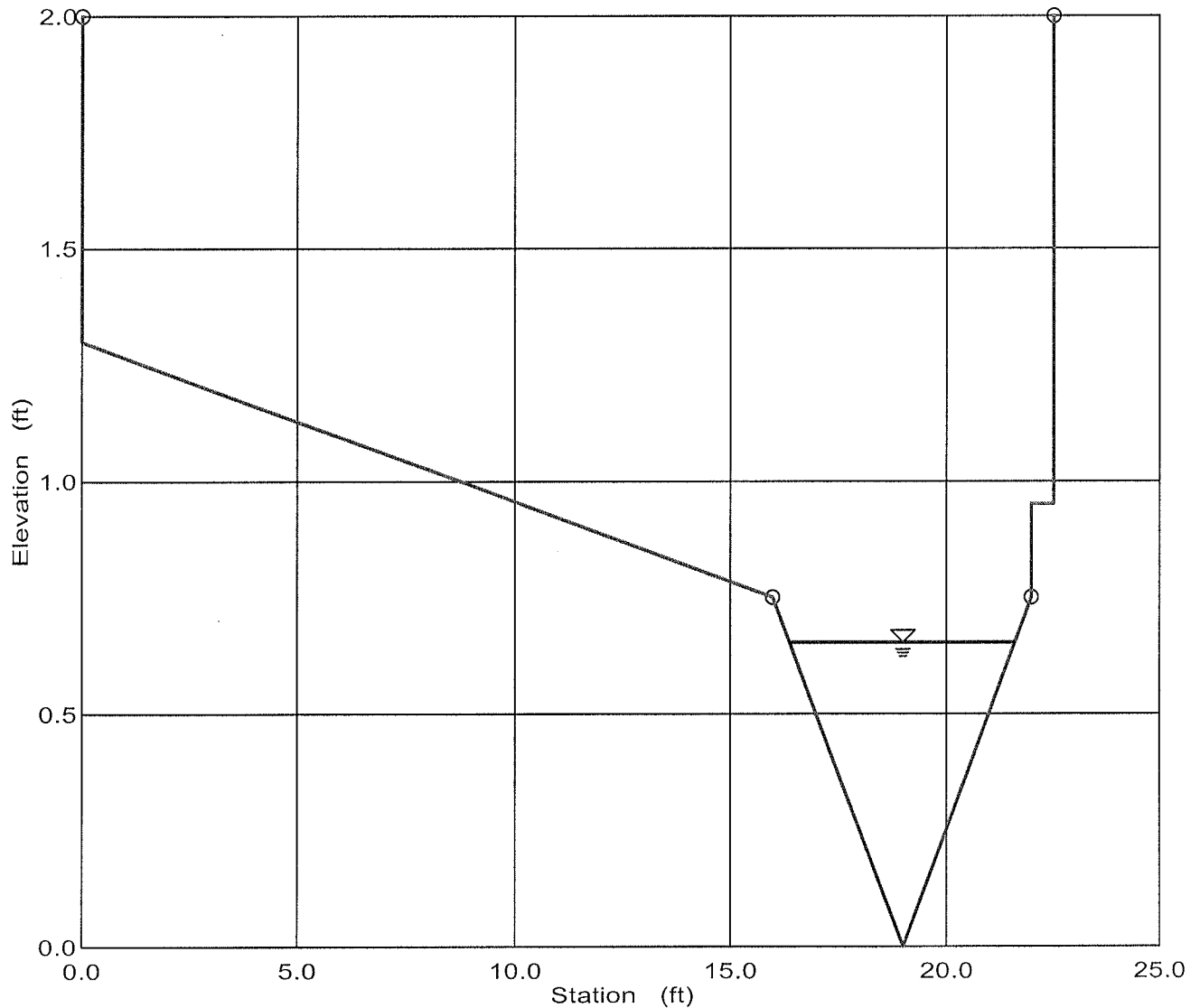
Input Data				
Channel Slope	0.007300 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	16.00	0.022
0.00	1.30	16.00	22.00	0.025
16.00	0.75	22.00	22.50	0.013
19.00	0.00			
22.00	0.75			
22.00	0.95			
22.50	0.95			
22.50	2.00			
Discharge	4.00	cfs		

Results		
Wtd. Mannings Coefficient	0.025	
Water Surface Elevation	0.65	ft
Flow Area	1.70	ft ²
Wetted Perimeter	5.37	ft
Top Width	5.21	ft
Height	0.65	ft
Critical Depth	0.57	ft
Critical Slope	0.014379	ft/ft
Velocity	2.36	ft/s
Velocity Head	0.09	ft
Specific Energy	0.74	ft
Froude Number	0.73	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	BMP SWALE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.025
Channel Slope	0.007300 ft/ft
Water Surface Elevation	0.65 ft
Discharge	4.00 cfs



BMP Swale Worksheet for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	BMP SWALE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

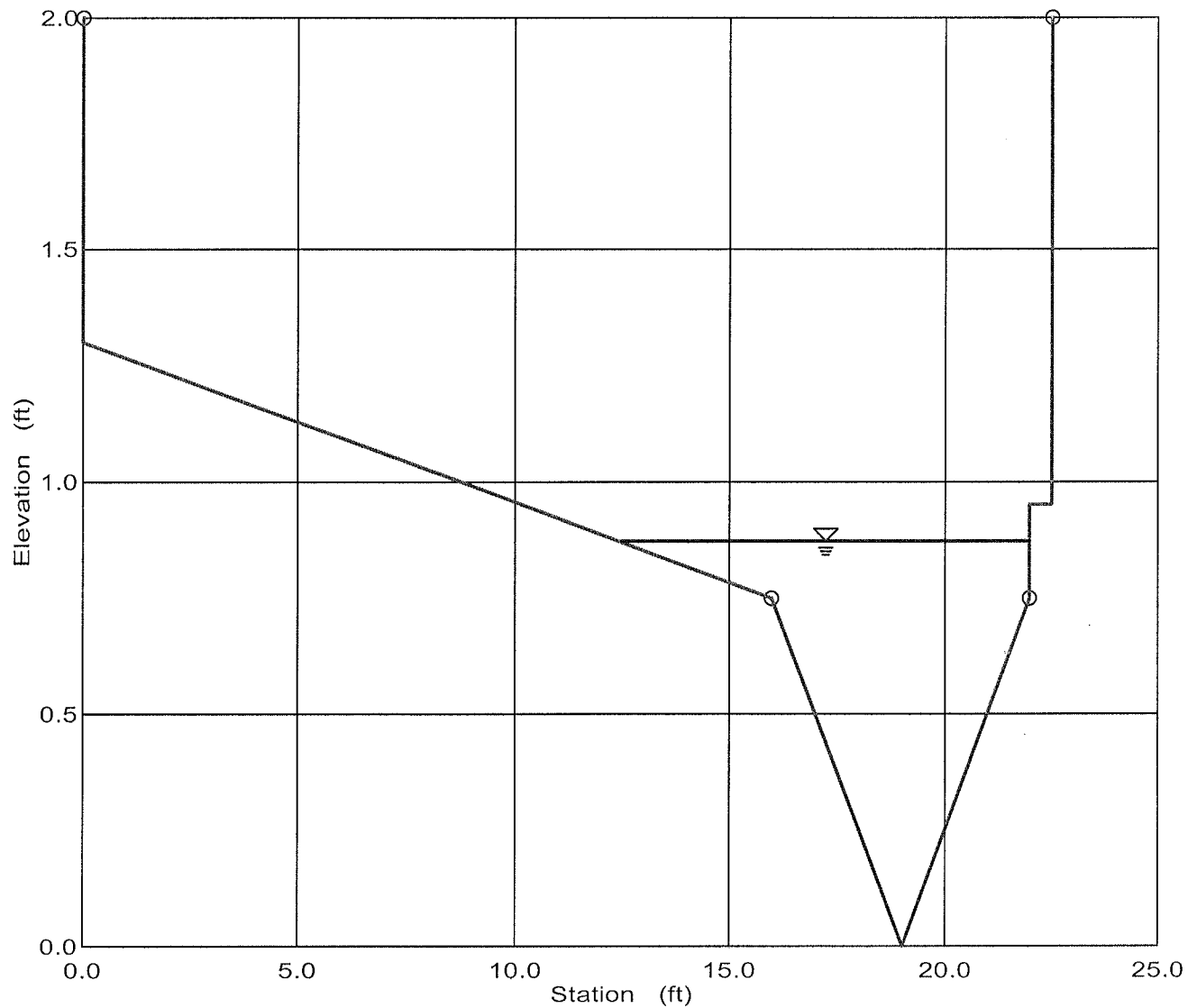
Input Data				
Channel Slope	0.007300 ft/ft			
Elevation range: 0.00 ft to 2.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	16.00	0.022
0.00	1.30	16.00	22.00	0.025
16.00	0.75	22.00	22.50	0.013
19.00	0.00			
22.00	0.75			
22.00	0.95			
22.50	0.95			
22.50	2.00			
Discharge	8.00	cfs		

Results		
Wtd. Mannings Coefficient	0.024	
Water Surface Elevation	0.87	ft
Flow Area	3.18	ft ²
Wetted Perimeter	9.80	ft
Top Width	9.49	ft
Height	0.87	ft
Critical Depth	0.76	ft
Critical Slope	0.012241	ft/ft
Velocity	2.52	ft/s
Velocity Head	0.10	ft
Specific Energy	0.97	ft
Froude Number	0.77	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	p:\clients\creative design\bonanza-eastern\hydrology\besa.fm2
Worksheet	BMP SWALE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.024
Channel Slope	0.007300 ft/ft
Water Surface Elevation	0.87 ft
Discharge	8.00 cfs



Impulse

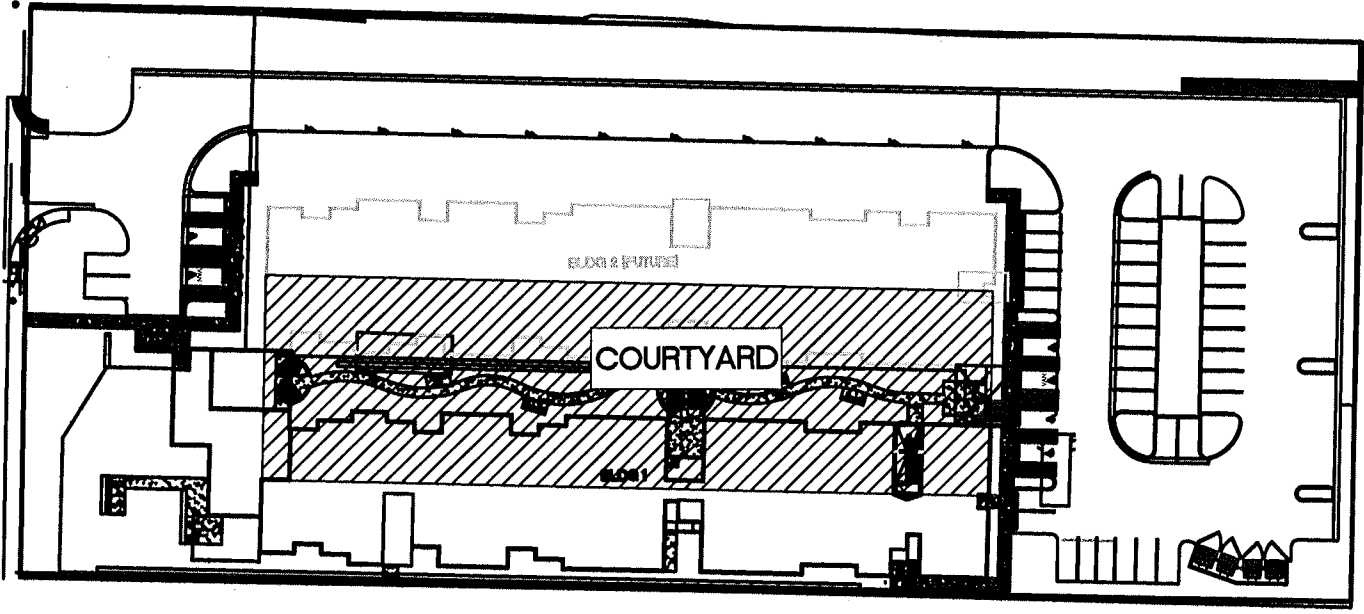
Civil Engineering Planning

7485 West Azure Drive Suite 226
Las Vegas, NV 89130
PHONE 702-815-0720

$$I = \int F \cdot dt$$

Bonanza Eastern Senior Apartments			
		Q10 (cfs)	Q100 (cfs)
Proration Calculation			
PR1	130244.40 SF	4	8
Courtyard	25741.322 SF	0.8	1.6

File: P:\Clients\Creative Design\Bonanza-Eastern\Hydrology\VICINITY AND LOCATION MAPS.dwg Sheet: PRORATION Date: 04-Jan-21 11:53:23am



PRORATION CALCULATION



NOT TO SCALE

Impulse

Civil Engineering & Planning

PLANNERS • CIVIL ENGINEERS

7485 WEST AZURE AVENUE, SUITE 226 • LAS VEGAS, NEVADA 89130 • (702) 308-7115

$$I = \int F \cdot dt$$

Storm Drain Hydraulics Calculations

Bonanza Eastern Senior Apartments

DATE 01/04/21

[illegible]

Summary of Results							
					(Optional)		
STATION	INVERT	SOFFIT	EGL	HGL	GRADE	LOCATION	DESCRIPTION
50.00	35.00	35.50	35.78	35.67	36.49	TC	Outlet
50.00	35.00	35.50	35.80	35.80			
111.32	35.61	36.11	36.35	36.24	37.80	FL	Inlet #1
111.32	35.61	36.11	36.37	36.37			
176.69	36.26	36.76	36.96	36.85	38.40	FL	Inlet #2
176.69	36.26	36.76	37.07	37.07			
104.12	37.30	37.80	37.91	37.80	38.20	FL	Inlet #3
104.12	37.30	37.80	37.94	37.94			
183.49	38.09	38.59	38.70	38.59	39.00	FL	Inlet #4
183.49	38.09	38.59	38.73	38.73			
238.65	38.60	39.10	39.22	39.11	38.80	FL/HP	Inlet
238.65	38.60	39.10	39.24	39.24			

APPENDIX D

References

$$I = \int F \cdot dt$$

Reference Information

Center for Community DS-3470

$$I = \int F \cdot dt$$

Rec'd 12/12/03
DS 3470
M-25
\$400.00

TECHNICAL DRAINAGE STUDY
FOR
CENTER FOR COMMUNITY

Prepared for:
Golden Rule, Inc.

December 2003

INTEGRITY
ENGINEERING

plans, site visits, and available survey data. There are no existing offsite flows that enter the site.

Figure H-13 and F-13 of the City of Las Vegas, *City Wide Hydrology Update 1997* was reviewed and included in Appendix D of this report. Figure 13 shows a flow rate in Eastern Avenue to be 47 cfs and 109 cfs for the 10-year and 100-year storm event, respectively. After a site visit and review of the existing topography, it was determined that the majority of the storm water runoff described in the *City Wide Hydrology Update* is generated by the development west of the proposed site and discharges onto Eastern Avenue south of the site. The only offsite basin draining adjacent to the project site is basin OND4 (Eastern Avenue, 1/2 street). Runoff generated from basin OND4 discharges to a Type A Inlet south of the site. A high point within Eastern Avenue adjacent to the northwest property line keeps storm water runoff, generated by existing residences to the east, from discharging south along Eastern adjacent to the site, (see Figure 3 – Existing Conditions Basin Map). Drainage patterns for offsite flows will not significantly change for both the existing and proposed conditions (See Figure 4 – Developed Conditions Basin Map).

DISCUSSION ON BASIN
DELINEATION

2.2 Onsite Drainage Description

Existing Conditions

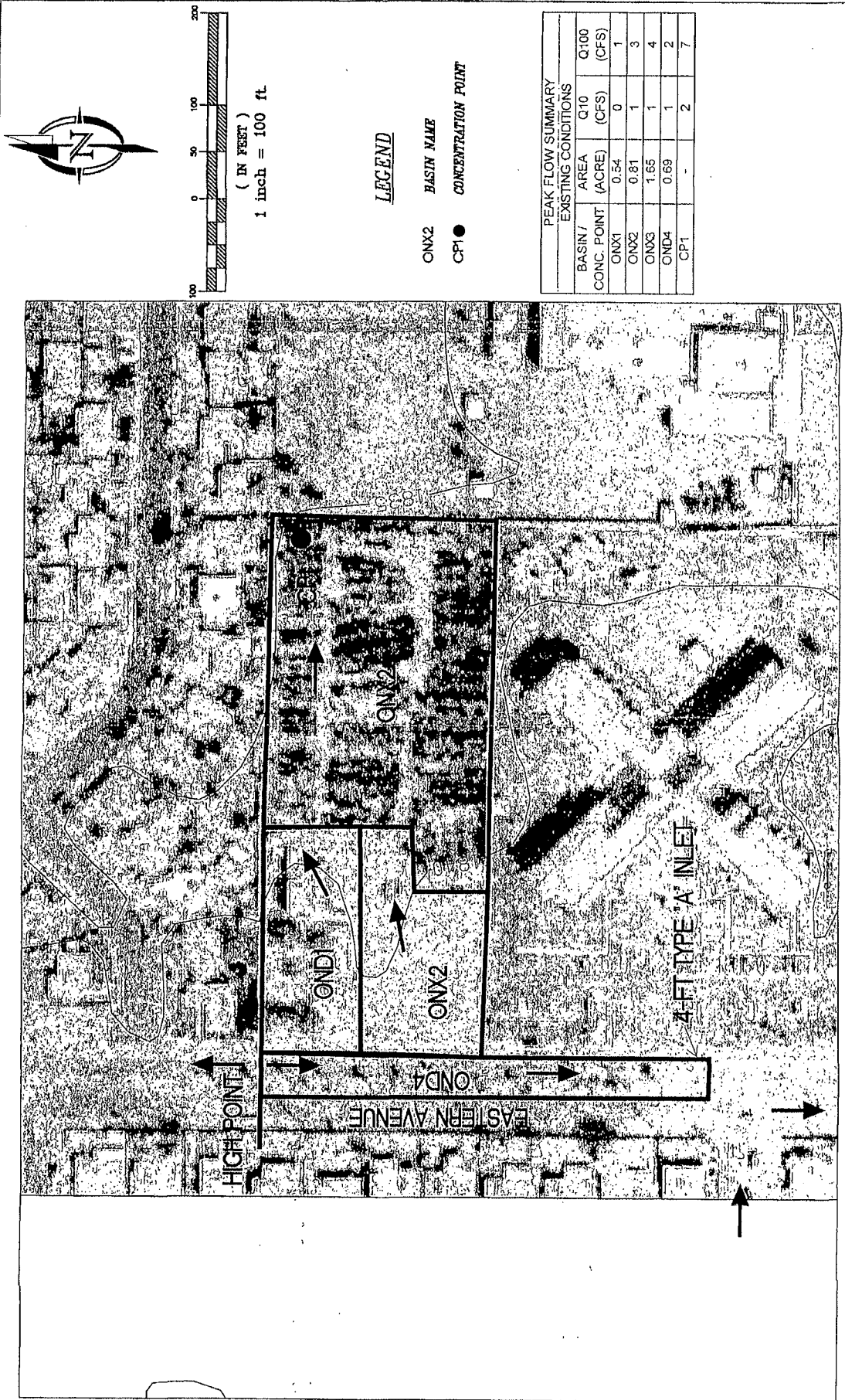
The existing site consists of a church (basin ONX1), a vacant parking lot (basin ONX2) and a plant nursery (basin ONX3) which will combine at combination point CP1 and discharge into an existing easement to the east (see Figure 3 – *Existing Conditions Basin Map*). The existing conditions results of the peak flow summary are shown on Table 1 in Section 4.0 of this report.

Interim Condition

Runoff generated by basins ONX1 OND2 and OND3 combine at concentration point CP1 and discharges through an easement east of the site. Basin OND4 discharges to a Type "A" inlet south of the site on Eastern Avenue. The interim condition results of the peak flow summary are shown on Table 2 in Section 4.0 of this report. Figure 4, *Interim Conditions Basin Map*, is provided in Appendix D of this report.

Future Condition

The future condition was analyzed in the assumption that the church and vacant area will be developed as commercial/business. Runoff generated by basins OND1, OND2, and OND3 combine at concentration point CP1 (see Figure 5 – *Future Conditions Basin Map*). A u-gutter and block wall opening was designed to accept the future condition flow rates during the 100-year storm event. The future condition results of the peak flow summary are shown on Table 3 in Section 4.0 of this report.



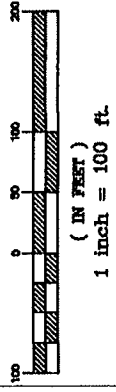
LEGEND

- ONX2 BASIN NAME
- CP1 CONCENTRATION POINT

PEAK FLOW SUMMARY				
EXISTING CONDITIONS				
BASIN / CONC. POINT	AREA (ACRE)	Q10 (CFS)	Q100 (CFS)	
ONX1	0.54	0	1	
ONX2	0.81	1	3	
ONX3	1.65	1	4	
OND4	0.69	1	2	
CP1	-	2	7	

EXISTING CONDITIONS BASIN MAP
CENTER FOR COMMUNITY

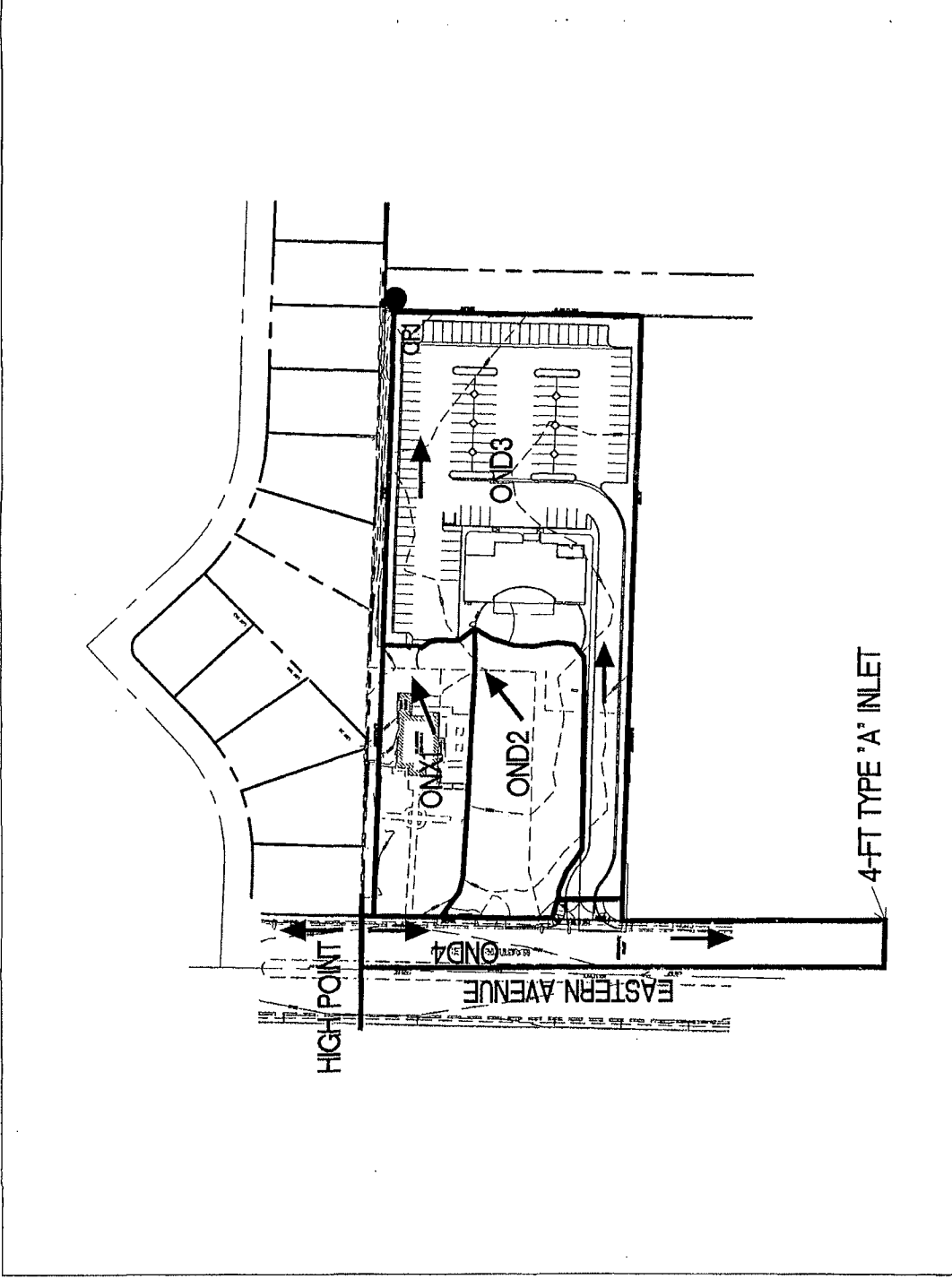
FIGURE 3



LEGEND

- ONX2 BASIN NAME
- CP1 • CONCENTRATION POINT
- FLOW DIRECTION

PEAK FLOW SUMMARY				
INTERIM CONDITIONS				
BASIN / CONC. POINT	AREA (ACRE)	Q10 (CFS)	Q100 (CFS)	
ONX1	0.54	0	1	
OND2	0.63	1	2	
OND3	1.85	3	6	
OND4	0.69	1	2	
CP1	-	4	9	



INTERIM CONDITIONS BASIN MAP
CENTER FOR COMMUNITY

FIGURE 4

APPENDIX B

CENTER FOR COMMUNITY

8

Integrity Project #:

11/10/03

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMET INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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

*DIAGRAM

1 ID
2 ID
3 ID
4 ID
5 ID
6 ID
7 ID
8 ID
9 ID
10 ID
11 ID
12 ID
13 ID

EXISTING CONDITIONS

BASINS MODELED WITH 6-HOUR STORM DISTRIBUTION #3

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

18 OFX1
31 ONX2
35 ONX3
39 CPI
42 OND4

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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TECHNICAL DRAINAGE STUDY FOR CENTER FOR COMMUNITY

EXISTING CONDITIONS

BASINS MODELED WITH 6-HOUR STORM DISTRIBUTION #3

15 IO OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
IT HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL

IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
HYDROGRAPH AT	OPX1	.00	1	0.	1.
+				3.58	3.50
HYDROGRAPH AT	ONX2	.00	1	1.	3.
+				3.50	3.50
HYDROGRAPH AT	ONX3	.00	1	1.	4.
+				3.50	3.50
3 COMBINED AT	CPI	.00	1	3.	7.
+				3.50	3.50

HYDROGRAPH AT

+

CND4

.00

1

FLOW
TIME

1.
3.50

2.
3.50

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

Development: _____
 Calculated by: _____
 Integrity Project #: _____
 Date: 11/10/03

CENTER FOR COMMUNITY
 CG

TIME OF CONCENTRATION																
SUB-BASIN DATA			INITIAL / OVERLAND TIME: (t _i)				TRAVEL TIME (t _t)				CONCENTRATION TIME (t _c)					
DESIG.	AREA Sq. Mi.	EXDEV EX = 1 DEV = 2	CN	K	LENGTH FL	SLOPE %	(t _i) Min	LENGTH FL	SLOPE %	VEL. 1 FPS	VEL. 2 FPS	(t _t) Min	T _L FL	(t _c) URBANIZED = (L/180)+10 Min	FINAL (t _c)	(t ₂₄₀) = (0.6 T _L)/60 Hr
INTERIM CONDITIONS																
UNDEVELOPED CONDITIONS																
DEVELOPED CONDITIONS																
ONX1	0.0098	2	80	0.8680	100	1.0	7.81	200	2.0	2.9	N/A	1.17	300	11.87	8.98	0.0898
OND2	0.0010	2	64	0.8508	100	1.0	4.49	200	2.0	2.9	N/A	1.17	300	11.87	5.85	0.0585
OND3	0.0028	2	94	0.8508	20	1.0	2.01	550	2.0	2.9	4.3	3.11	570	13.17	5.12	0.0512
OND4	0.0011	2	98	0.9036	50	2.0	1.98	650	0.4	1.3	1.9	7.81	700	13.89	9.80	0.0980


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* (916) 756-1104
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DS, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIME- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

PAGE 1

HEC-1 INPUT

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

*DIAGRAM

1 ID
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13 ID

TECHNICAL DRAINAGE STUDY FOR CENTER FOR COMMUNITY

INTERIM CONDITIONS

BASINS MODELED WITH 6-HOUR STORM DISTRIBUTION #3

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

18 OFX1

31 . OND2

35 . OND3

39 CPI.....

42 . OND4

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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TECHNICAL DRAINAGE STUDY FOR CENTER FOR COMMUNITY

INTERIM CONDITIONS

BASINS MODELED WITH 6-HOUR STORM DISTRIBUTION #3

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

IT HYDROGRAPH TIME DATA
NMN 5 MINUTES IN COMPUTATION INTERVAL

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 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK
 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
HYDROGRAPH AT +	OFX1	.00	1	0.	1.
				3.58	3.50
HYDROGRAPH AT +	OND2	.00	1	1.	2.
				3.50	3.50
HYDROGRAPH AT +	CND3	.00	1	3.	6.
				3.50	3.50
3 COMBINED AT +	CPI	.00	1	4.	9.
				3.50	3.50

HYDROGRAPH AT

+

OND4

.00

1

FLOW
TIME

1.
3.50

2.
3.50

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

Development: CENTER FOR COMMUNITY
 Calculated by: CG
 Integrity Project #: 11/10/03
 Date:

TIME OF CONCENTRATION															
SUB-BASIN DATA			INITIAL / OVERLAND TIME: t _i				TRAVEL TIME t _t				CONCENTRATION TIME				
DESIG:	AREA Sq. Mi.	EX/DEV EX = 1 DEV = 2	CN	K	LENGTH FL	SLOPE %	t _i Min	LENGTH FL	SLOPE %	VEL 1 FPS	VEL 2 FPS	t _t Min	(t _c) URBANIZED = (L/1180)*10 Min	FINAL t _c	t _c (HR) =0.67 t _c (60) Hr
FUTURE CONDITIONS															
UNDEVELOPED CONDITIONS															
DEVELOPED CONDITIONS															
OND1	0.0008	2	94	0.8508	100	1.0	4.48	155	0.5	1.4	N/A	1.81	255	11.42	6.29
OND2	0.0010	2	94	0.8508	100	1.0	4.48	200	2.0	2.9	N/A	1.17	300	11.67	5.65
OND3	0.0029	2	94	0.8508	20	1.0	2.01	550	2.0	2.9	4.3	3.11	570	13.17	5.12
OND4	0.0011	2	98	0.9038	50	2.0	1.98	650	0.4	1.3	1.9	7.81	700	13.89	9.90
														FINAL t _c	FINAL t _c
														(t _c) URBANIZED = (L/1180)*10 Min	FINAL t _c
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* HYDROLOGIC ENGINEERING CENTER
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* DAVIS, CALIFORNIA 95616
* (916) 756-1104
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X X X X X
X X XXXXXX XXXX XXX

```

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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

*DIAGRAM

1 ID
2 ID
3 ID
4 ID
5 ID
6 ID
7 ID
8 ID
9 ID
10 ID
11 ID
12 ID
13 ID

FUTURE CONDITIONS

BASINS MODELED WITH 6-HOUR STORM DISTRIBUTION #3

LINE	IF	IO	IN	JR	PREC	5	0	0	300
14	IF					5	0	0	300
15	IO					5	0	0	
16	IN					5	0	0	
17	JR				PREC	0.57	1		
18	KK	OND1							
19	BA	.0008							
20	PB	2.77							
21	PC	0.000				0.020	0.057	0.070	0.087
22	PC	0.130				0.130	0.130	0.133	0.140
23	PC	0.190				0.197	0.199	0.200	0.201
24	PC	0.251				0.256	0.270	0.278	0.281
25	PC	0.499				0.590	0.710	0.744	0.781
26	PC	0.860				0.868	0.876	0.888	0.910
27	PC	0.982				0.985	0.987	0.989	0.990
28	PC	0.998				0.999	1.000		
29	LS	0				94			
30	UD	.0629							
	*								

LINE	IF	IO	IN	JR	PREC	5	0	0	300
31	KK	OND2							
32	BA	.0010							
33	LS	0				94			
34	UD	.0565							
	*								
35	KK	OND3							
36	BA	.0029							
37	LS	0				94			
38	UD	.0512							
	*								
39	KK	CF1							
40	KM	COMBINE BASINS OND1, OND2 AND OND3							
41	HC	3							
	*								

LINE	ID	1	2	3	4	5	6	7	8	9	10
42	KK	OND4									
43	BA	.0011									
44	LS	0									
45	UD	.0980									
	*										
46	ZZ										

SCHEMATIC DIAGRAM OF STREAM NETWORK
(V) ROUTING (--->) DIVERSION OR PUMP FLOW

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

18 OFD1

31 OND2

35 OND3

39 CPI

42 OND4

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

TECHNICAL DRAINAGE STUDY FOR CENTER FOR COMMUNITY

FUTURE CONDITIONS

BASINS MODELED WITH 6-HOUR STORM DISTRIBUTION #3

15 10 OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL

IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION 1 NUMBER OF PLANS
 NPLAN

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

1

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

RATIOS APPLIED TO PRECIPITATION

RATIO 1 RATIO 2
 .57 1.00

OPERATION STATION AREA PLAN

HYDROGRAPH AT

+ OFD1 .00 1 FLOW 1. 2.
 TIME 3.50 3.50

HYDROGRAPH AT

+ OND2 .00 1 FLOW 1. 2.
 TIME 3.50 3.50

HYDROGRAPH AT

+ OND3 .00 1 FLOW 3. 6.
 TIME 3.50 3.50

3 COMBINED AT

+ CP1 .00 1 FLOW 5. 10.
 TIME 3.50 3.50

+ HYDROGRAPH AT

OND4

.00

1

FLOW
TIME

1.
3.50

2.
3.50

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

APPENDIX C

1-1

EASTERN AVENUE (Q10=1CFS) HALF STREET

Worksheet for Irregular Channel

Project Description	
Worksheet	eastern avenue (Q10=1cfs)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.004000 ft/ft
Discharge	1.00 cfs

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

Results	
Mannings Coefficient	0.016
Water Surface Elevation	0.31 ft
Elevation Range	0.00 to 1.03
Flow Area	0.8 ft ²
Wetted Perimeter	8.66 ft
Top Width	8.31 ft
Actual Depth	0.31 ft
Critical Elevation	0.28 ft
Critical Slope	0.009142 ft/ft
Velocity	1.21 ft/s
Velocity Head	0.02 ft
Specific Energy	0.33 ft
Froude Number	0.68
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.0	0+07.0	0.013
0+07.0	0+50.0	0.017

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.0	0.60
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	1.03

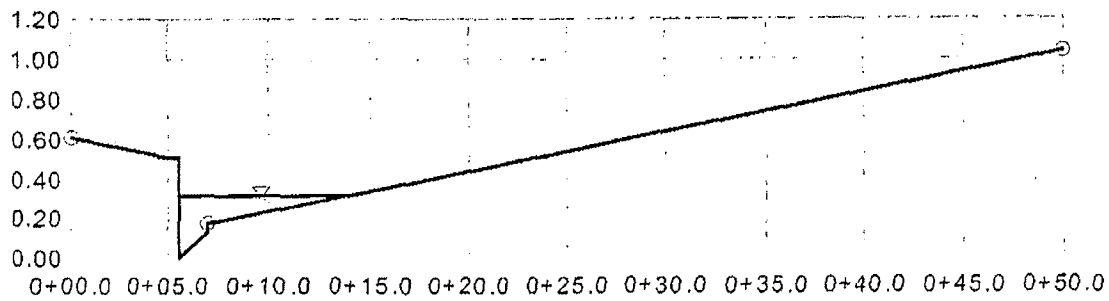
1-1

EASTERN AVENUE (Q10=1CFS) HALF STREET

Cross Section for Irregular Channel

Project Description	
Worksheet	eastern avenue (Q10=1cfs)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Slope	0.004000 ft/ft
Water Surface Elevation	0.31 ft
Elevation Range	0.00 to 1.03
Discharge	1.00 cfs



V:10.0
H:1
NTS

1-1

EASTERN AVENUE (Q100=2CFS) HALF STREET

Worksheet for Irregular Channel

Project Description

Worksheet	Eastern avenue (Q101=2cfs)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	0.004000 ft/ft
Discharge	2.00 cfs

Options

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

Results

Mannings Coefficient	0.013
Water Surface Elevation	0.35 ft
Elevation Range	0.00 to 1.03
Flow Area	1.2 ft ²
Wetted Perimeter	10.78 ft
Top Width	10.39 ft
Actual Depth	0.35 ft
Critical Elevation	0.33 ft
Critical Slope	0.005658 ft/ft
Velocity	1.65 ft/s
Velocity Head	0.04 ft
Specific Energy	0.39 ft
Froude Number	0.85
Flow Type	Subcritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.0	0+07.0	0.013
0+07.0	0+50.0	0.017

Natural Channel Points

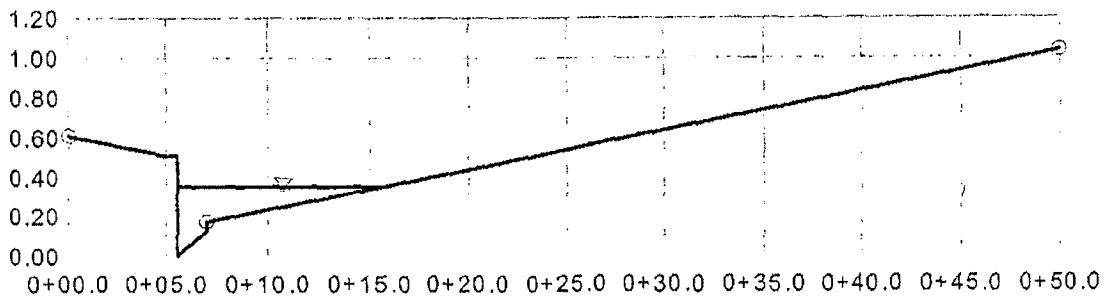
Station (ft)	Elevation (ft)
0+00.0	0.60
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	1.03

1-1

EASTERN AVENUE (Q100=2CFS) HALF STREET Cross Section for Irregular Channel

Project Description	
Worksheet	Eastern avenue (Q101=2cfs)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.013
Slope	0.004000 ft/ft
Water Surface Elevation	0.35 ft
Elevation Range	0.00 to 1.03
Discharge	2.00 cfs



V:10.0
H:1
NTS

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		January 27, 2004
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT: Drainage Study for: Center for Community		COPIES TO: Integrity Engineering
Cross Streets:	East of Eastern Av. & South of Washington	Golden Rule, Inc.
File Number:	F:\Depot\DSMemos\DS3470B.doc	Bart Anderson, P.E., DevCo
Parcel Number:	139-25-301-001	
Zoning Action:		
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID G.R. No.
1 st Submittal	12/12/2003	12/26/2003	Not Approved	\$400.00	116057: \$400
2 nd Submittal	1/9/2004	1/23/2004	See Comments Below	\$400.00	117305: \$400
TOTAL FEES (LDDRS):				\$800.00	----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

X	is approved subject to conformance to all City standards and the following conditions:
	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.

- The wrought iron fence must be constructed per *City of Las Vegas Standard Drawing #421B*.
Revise Construction Note 11 and the detail accordingly.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the City of Las Vegas Flood Control Section. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the City of Las Vegas reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

Note: All land surface area disturbances over 1 acre require a stormwater discharge permit issued by the Nevada Division of Environmental Protection (NDEP). A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. A stormwater discharge permit application and associated information may be downloaded from the web site:

<http://www.state.nv.us/ndep/bwpc/storm01.htm>

Projects that disturb more than one acre of land must submit to NDEP a "Notice of Intent" for inclusion under Stormwater Permit No. NVR100000 along with the appropriate filling fee.

END OF REMARKS

ays

T/R/S: T20S/R61E/25
AREA M-25

Reference Information

Citywide Study

$$I = \int F \cdot dt$$



CITY WIDE
HYDROLOGY STUDY
UPDATE - 1997

LEGEND

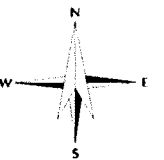
SUB-BASIN BOUNDARY

FLOW ARROW

250 10-YEAR EXISTING FLOW
500 100-YEAR EXISTING FLOW
300 10-YEAR ULTIMATE FLOW
800 100-YEAR ULTIMATE FLOW

(FLOWS IN CFS)

NOTE:
Facility flows must be
subtracted from flows shown
to determine surface flows.
(See "F" sheets for facility flows)



1 INCH = 1600 FEET

FIGURE H-15

1	2		
3	4		
5	6		
7	8	9	10
11	12	13	14
15	16	17	18

PBSJ
POST,
BUCKLEY,
SCHUH &
JERNIGAN, INC.

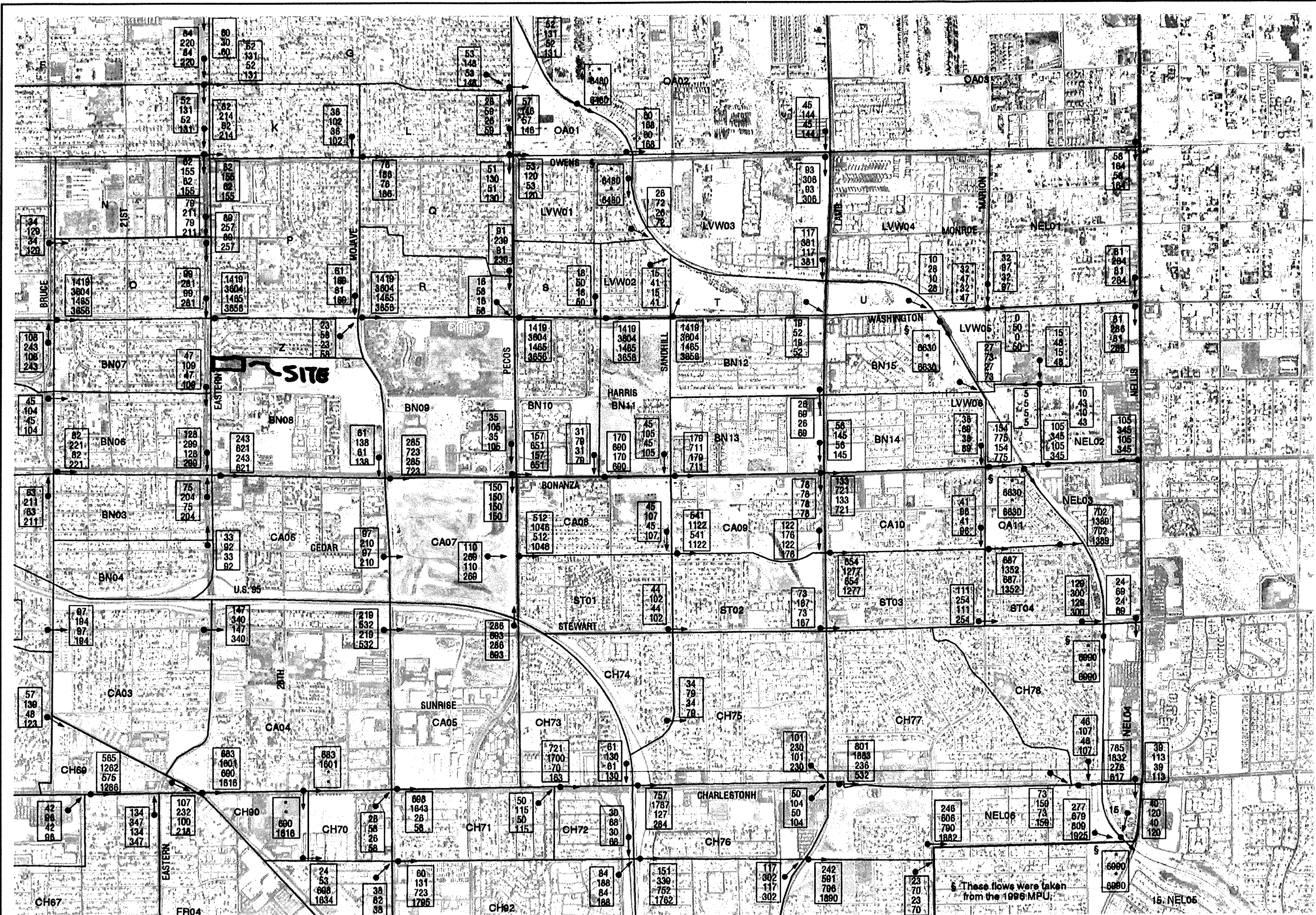


PHOTO DATE: APRIL 1996



City of Las Vegas
CITY - WIDE HYDROLOGY
ANALYSIS

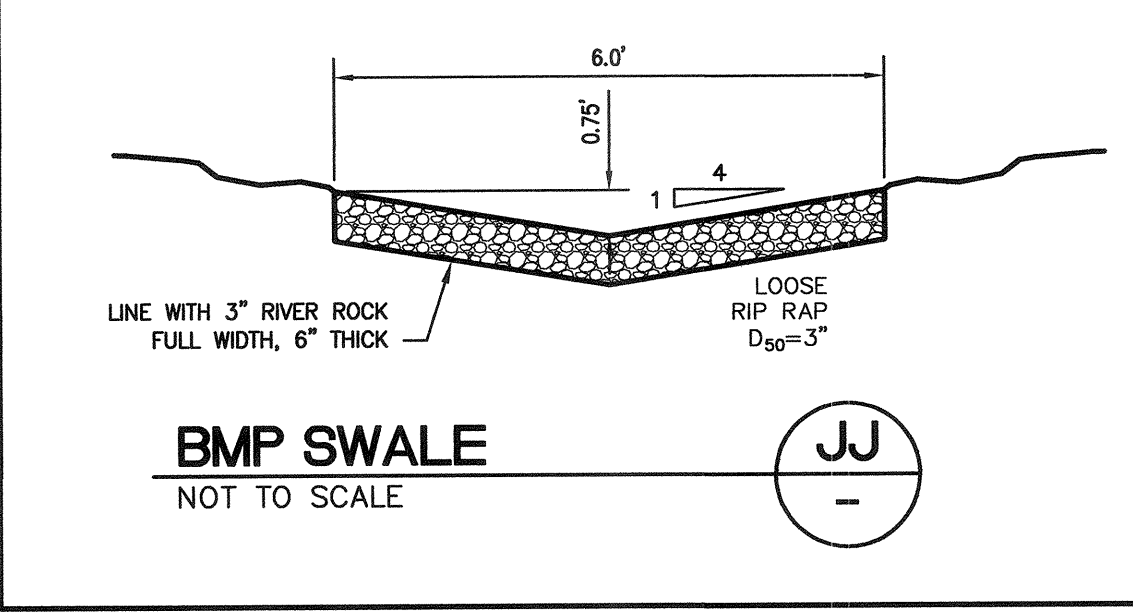
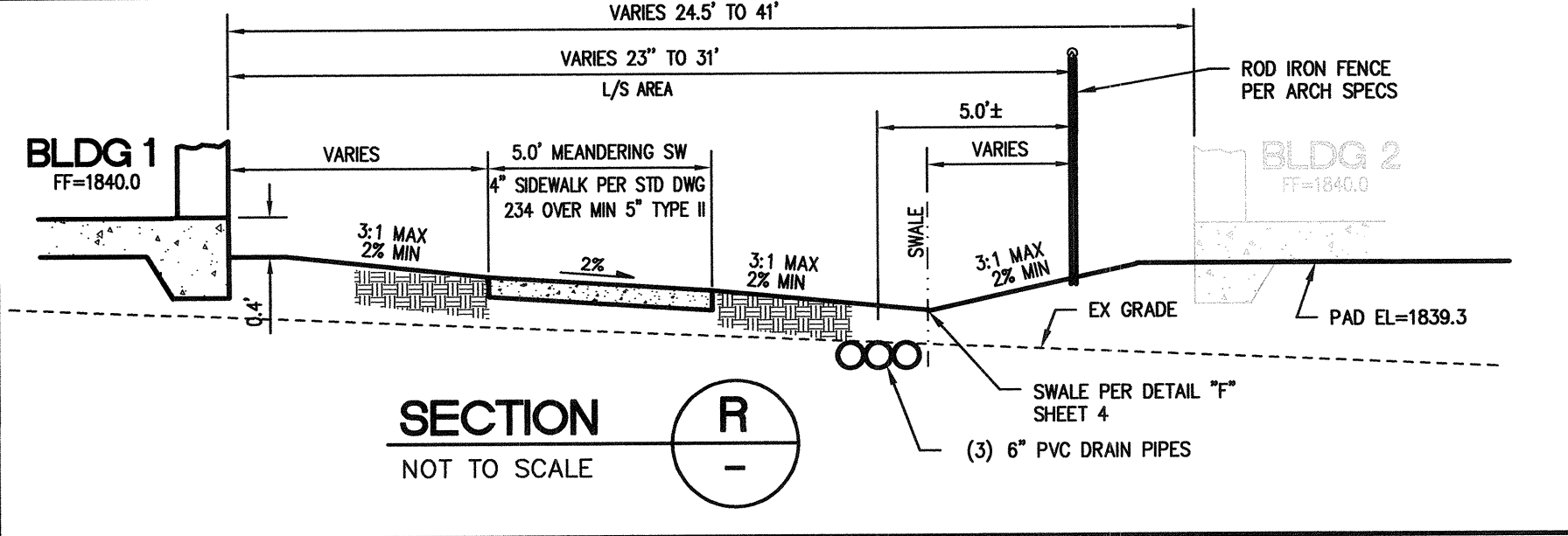
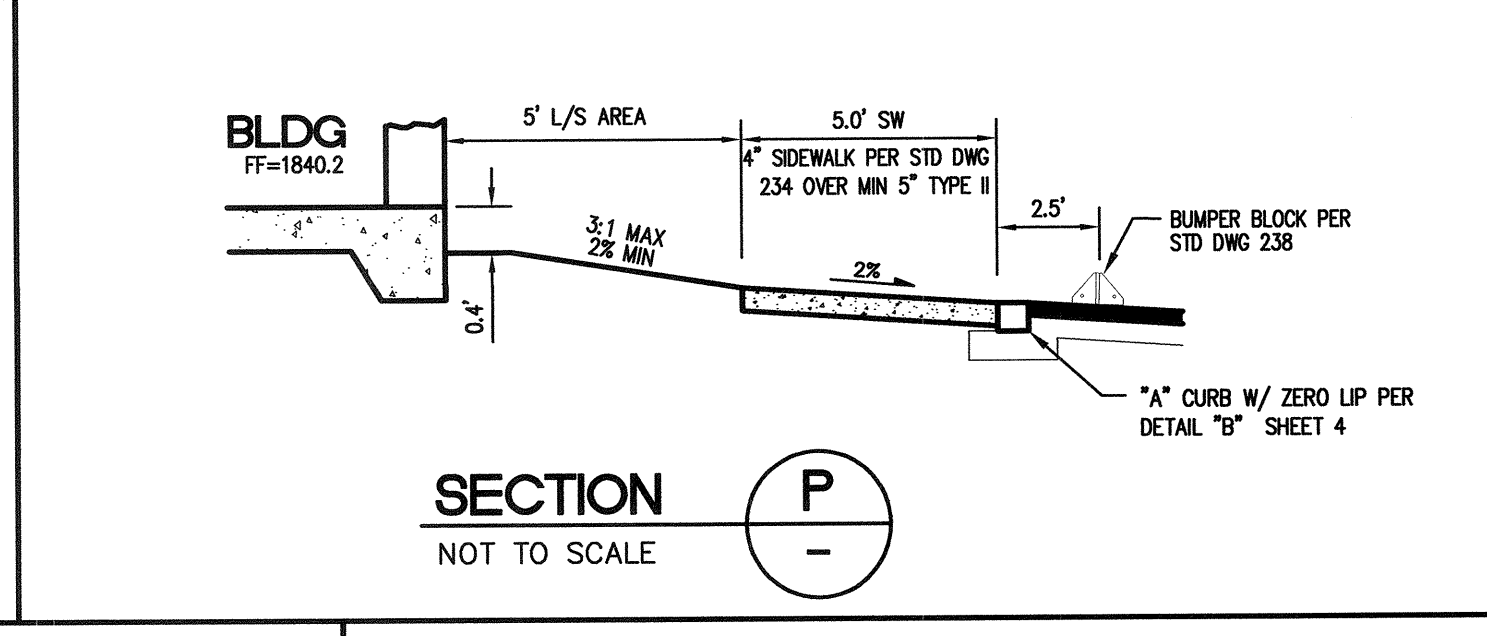
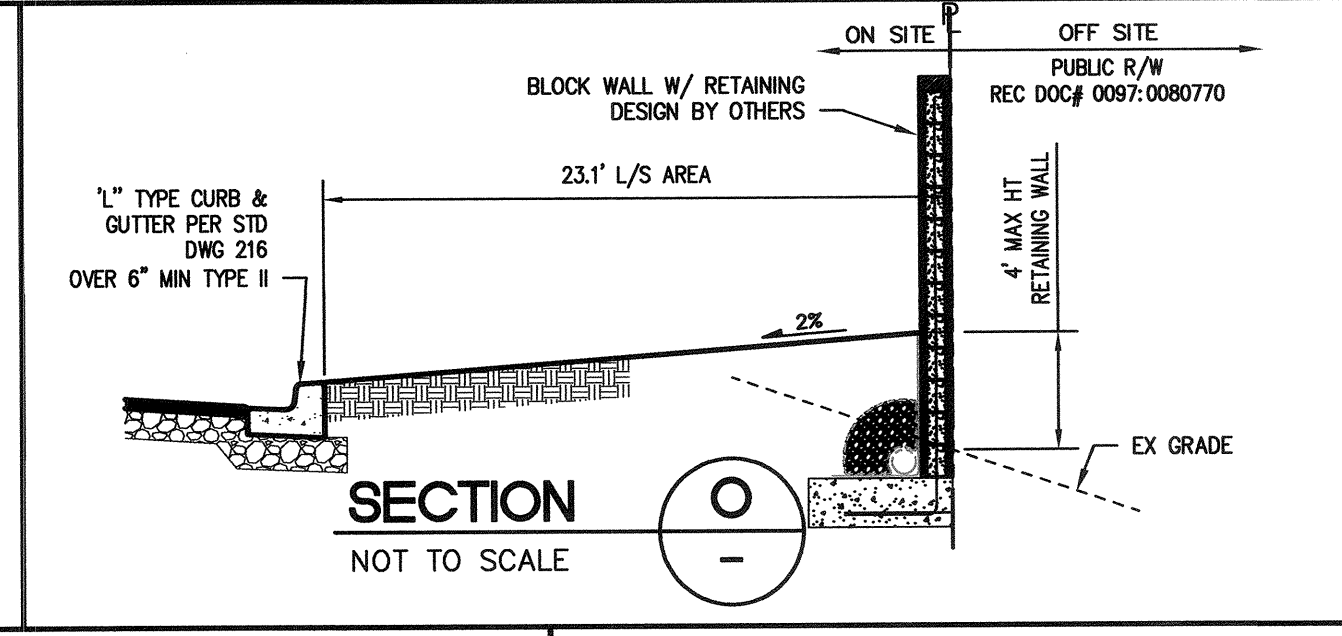
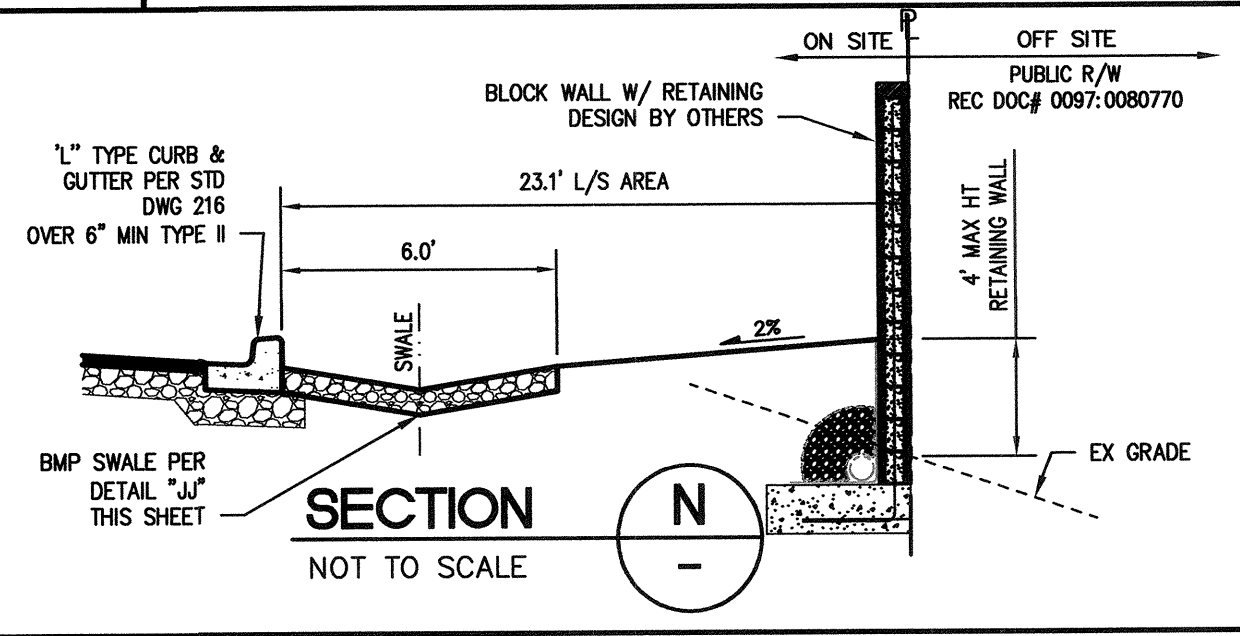
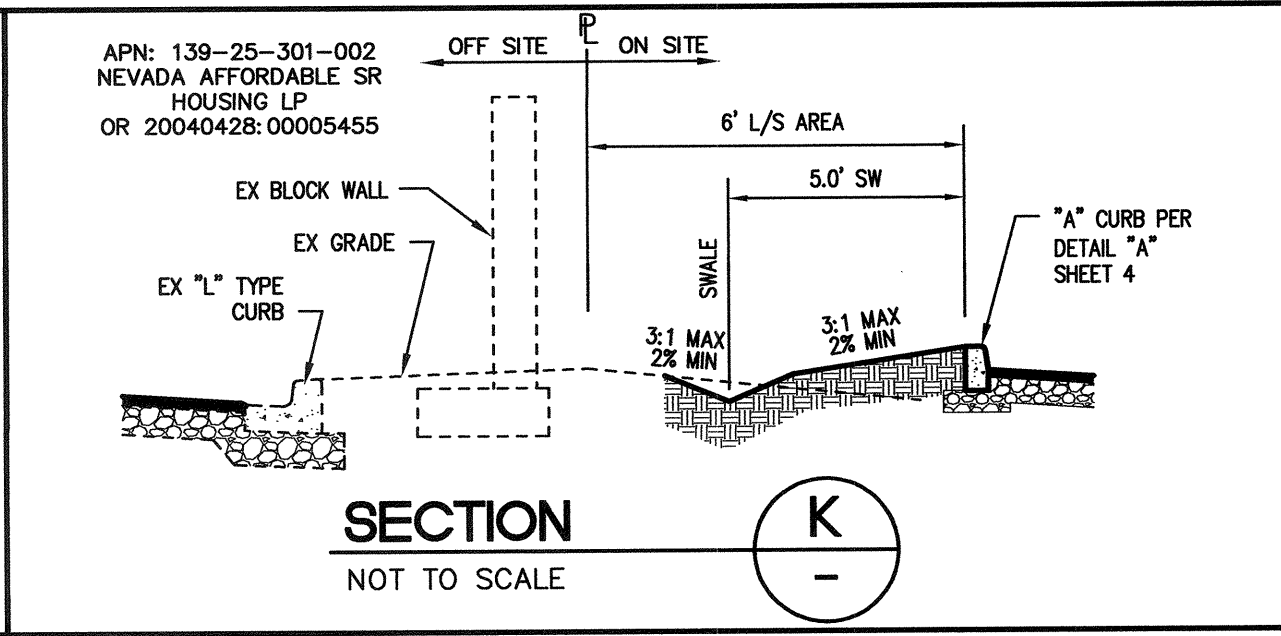
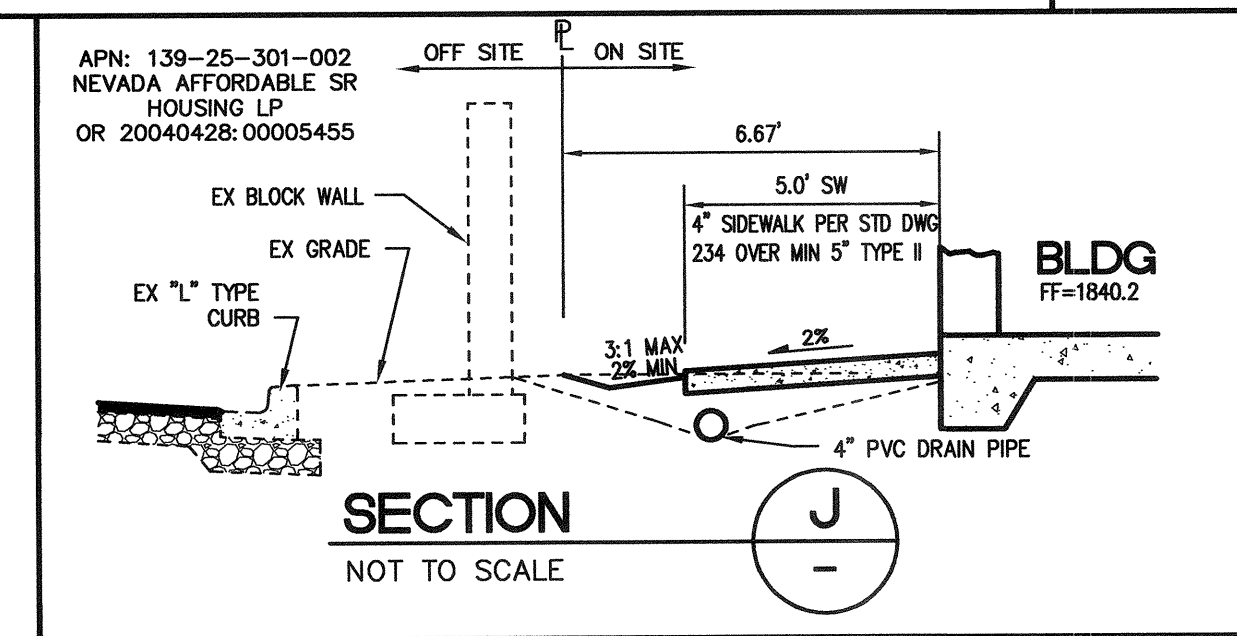
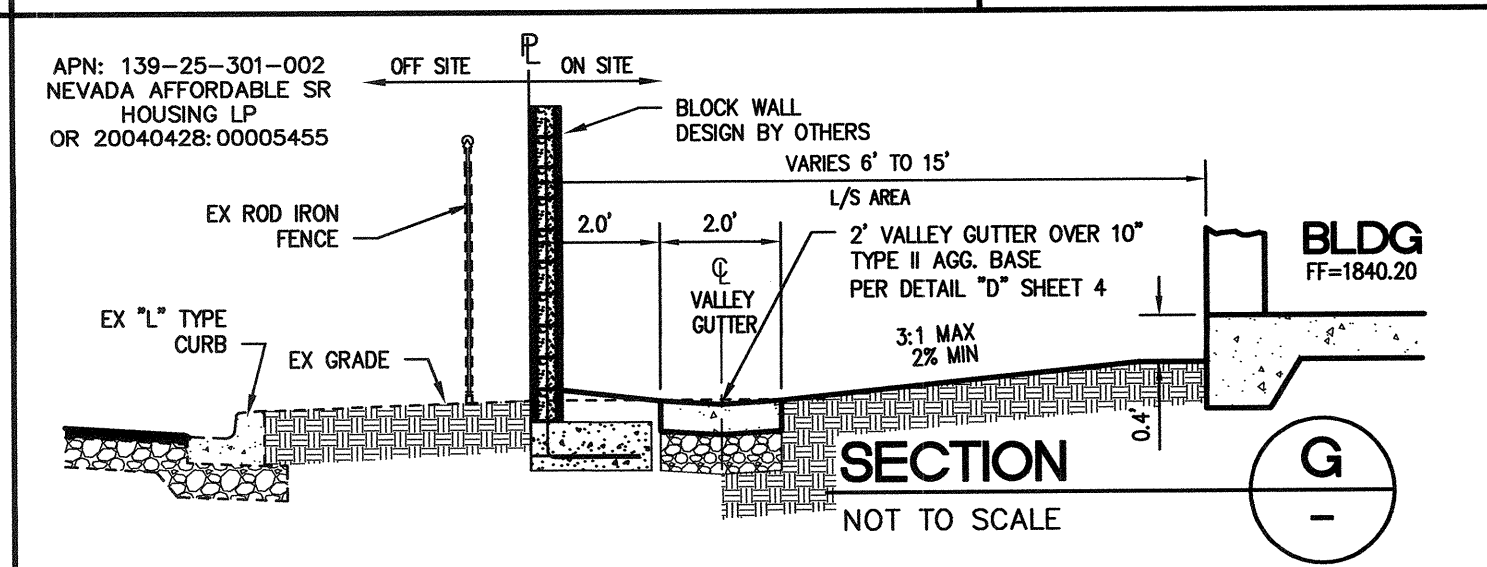
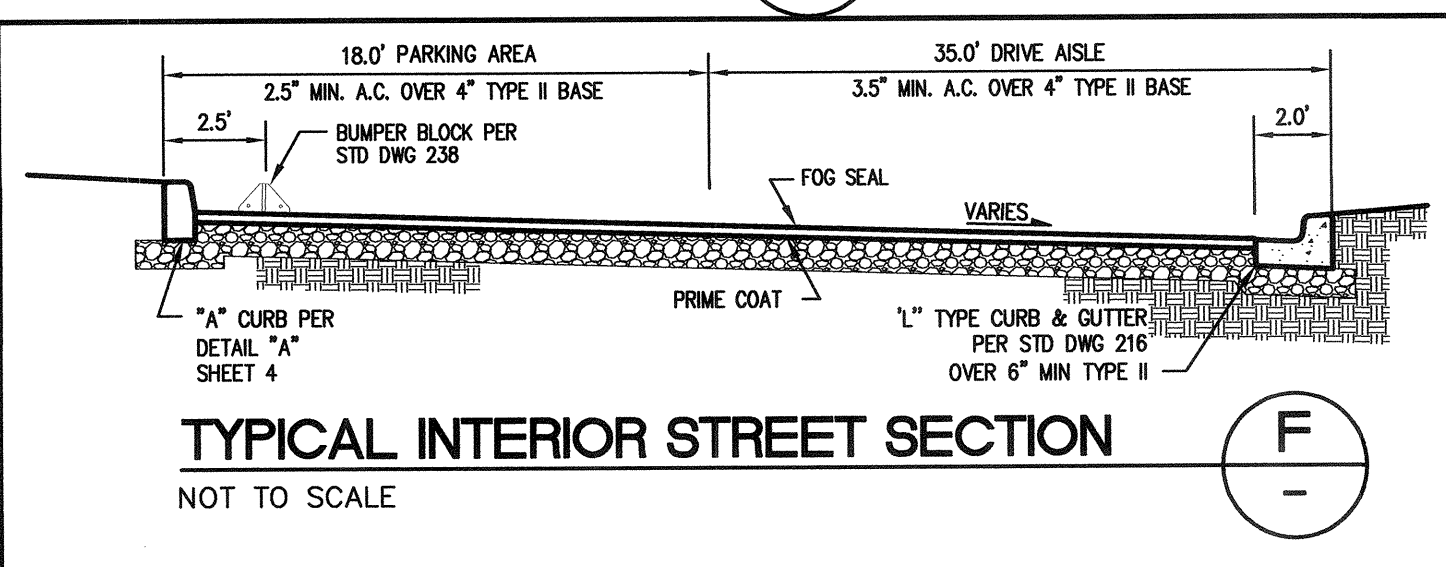
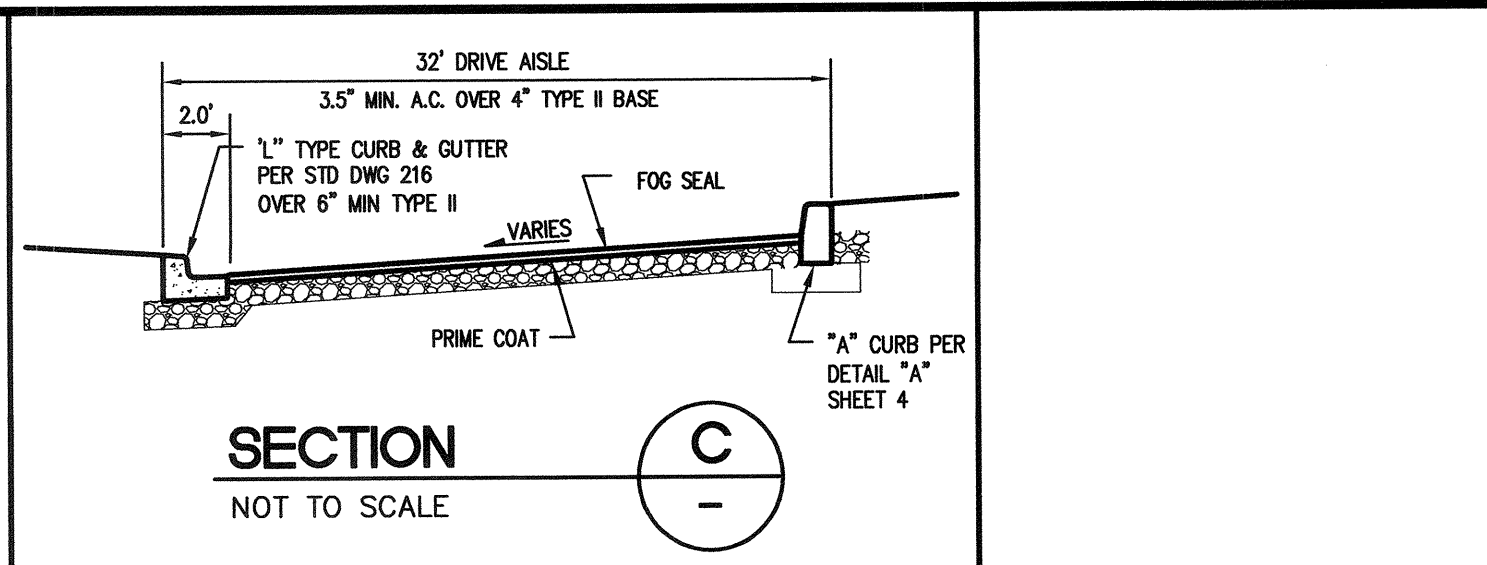
	EXISTING REGIONAL DETENTION BASIN
	PROPOSED REGIONAL DETENTION BASIN
	EXISTING LOCAL DETENTION BASIN
	EXISTING REGIONAL BRIDGES
	PROPOSED REGIONAL BRIDGES
	EXISTING LOCAL BRIDGES
	EXISTING REGIONAL CULVERT
	PROPOSED REGIONAL CULVERT
	EXISTING LOCAL CULVERT
	EXISTING REGIONAL PIPELINE
	PROPOSED REGIONAL PIPELINE
	EXISTING LOCAL PIPELINE
	EXISTING REGIONAL CHANNEL
	PROPOSED REGIONAL CHANNEL
	EXISTING LOCAL CHANNEL
	EXISTING REGIONAL DIKE/LEEVE
	PROPOSED REGIONAL DIKE/LEEVE
	EXISTING LOCAL DIKE/LEEVE
	EXISTING STORM WATER PUMPING STATION
	PROPOSED BELTWAY ALIGNMENT

	1	2		
	3	4		
	5	6		
7	8	9	10	
11	12	13	14	15
	16	17	18	19

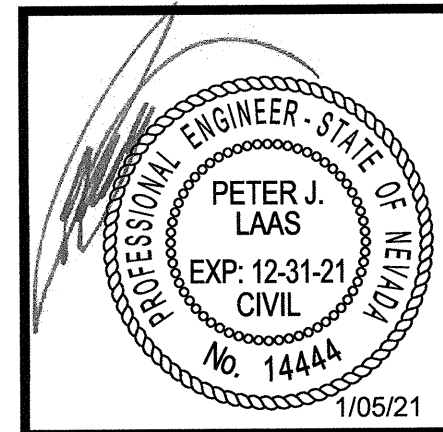


FLOOD CONTROL FACILITIES

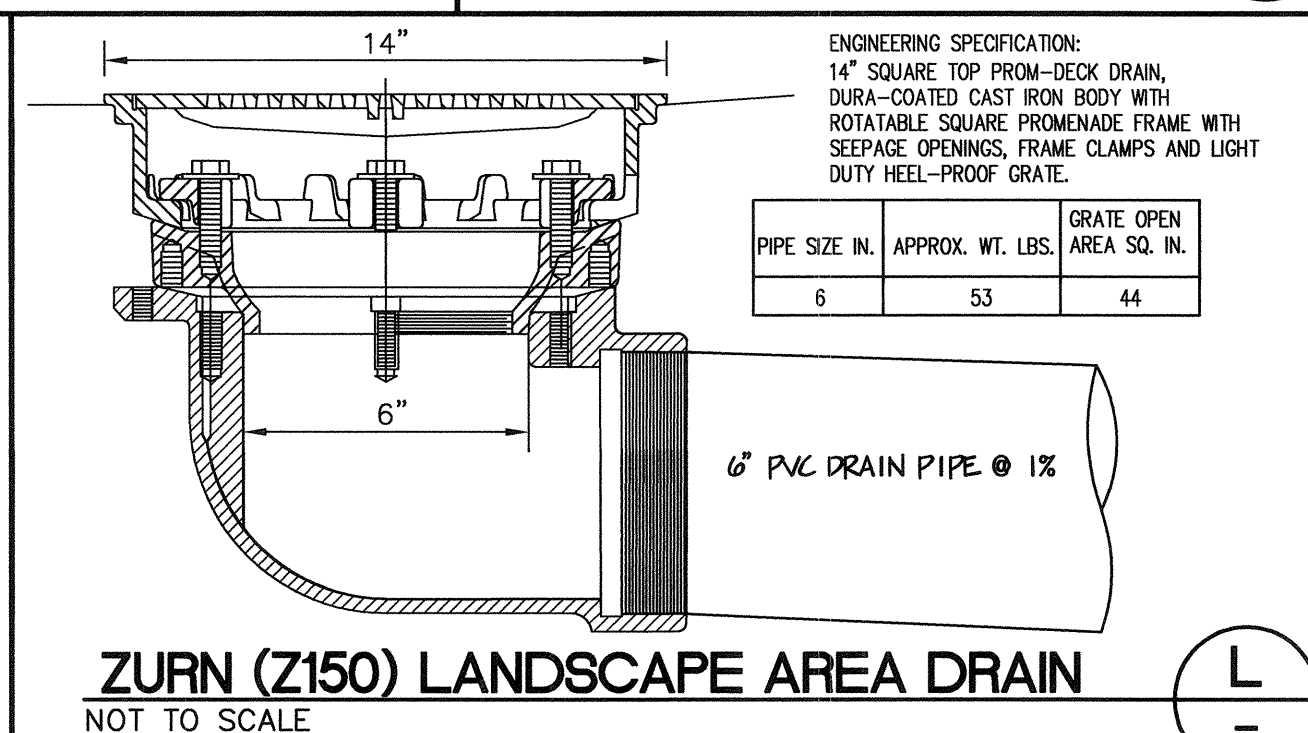
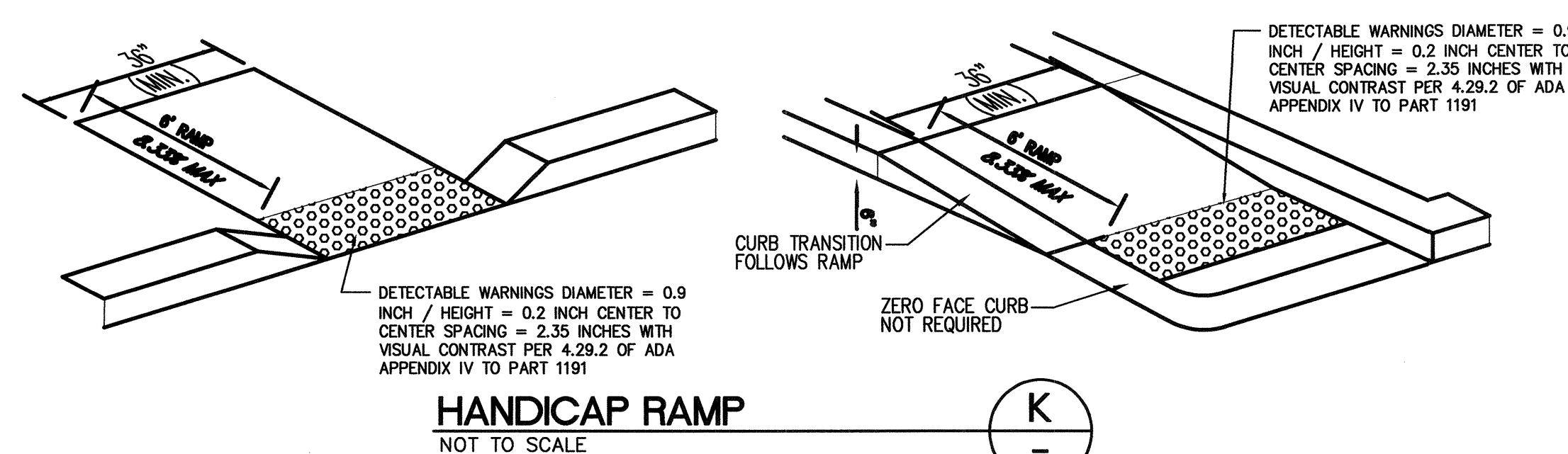
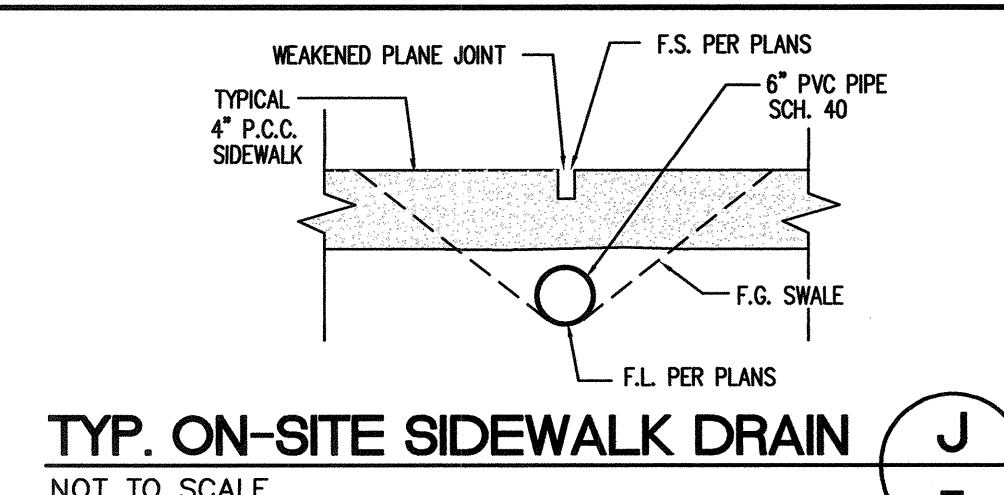
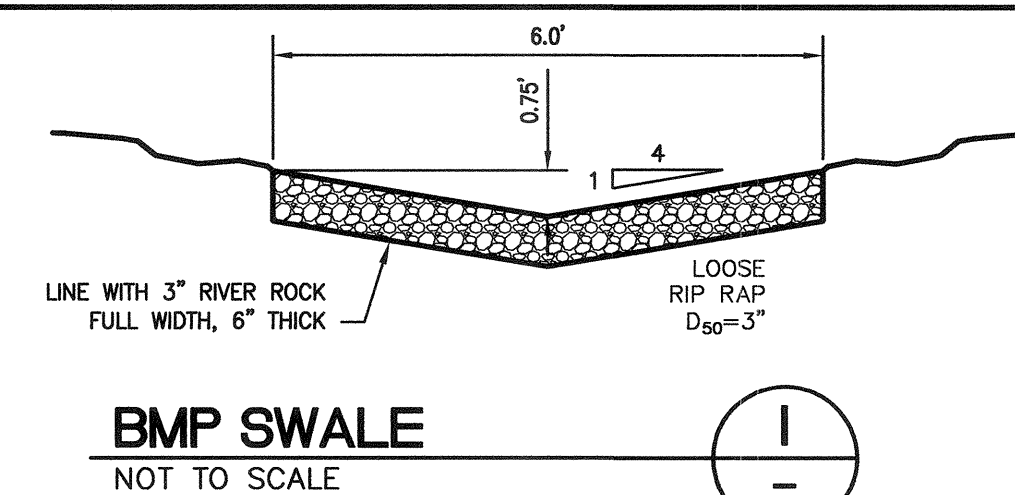
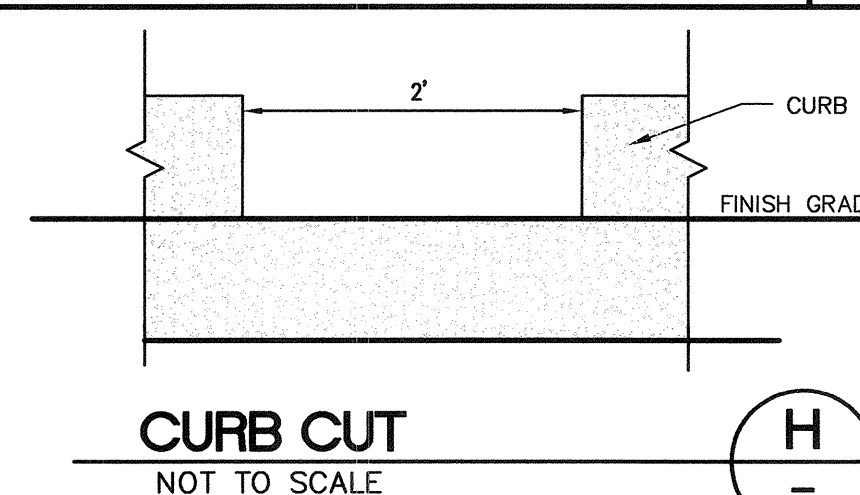
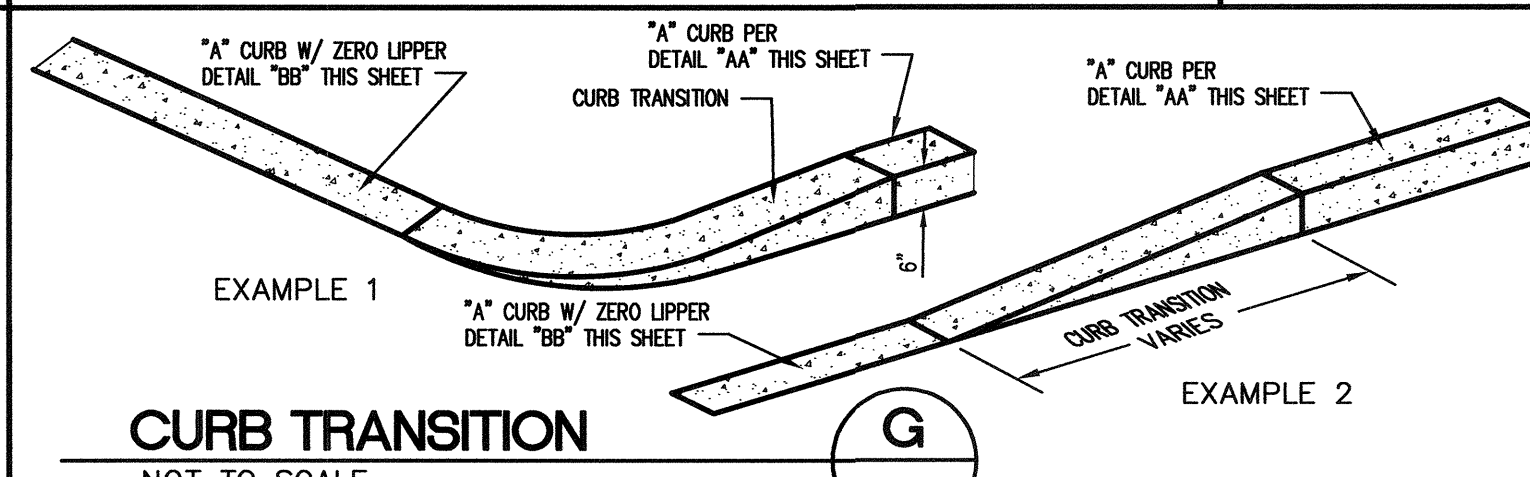
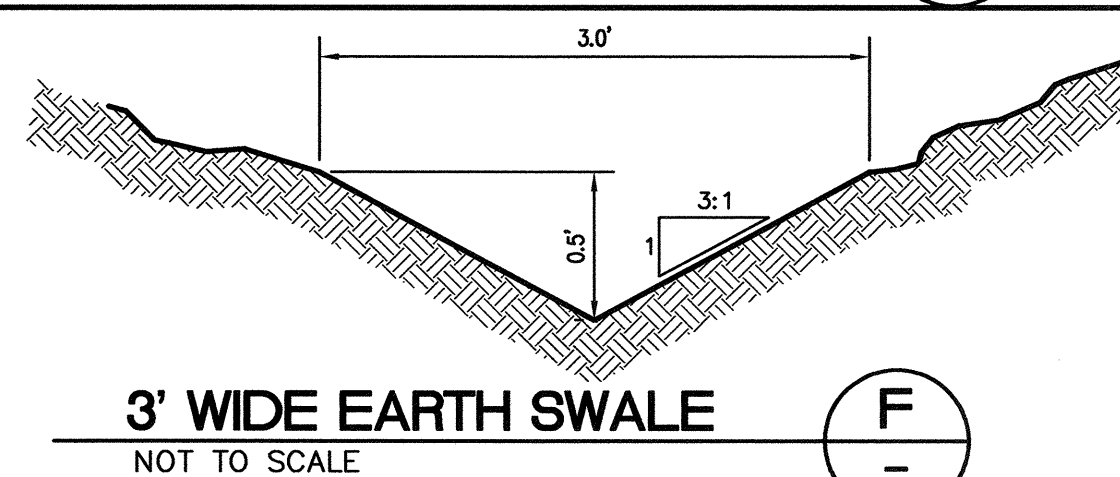
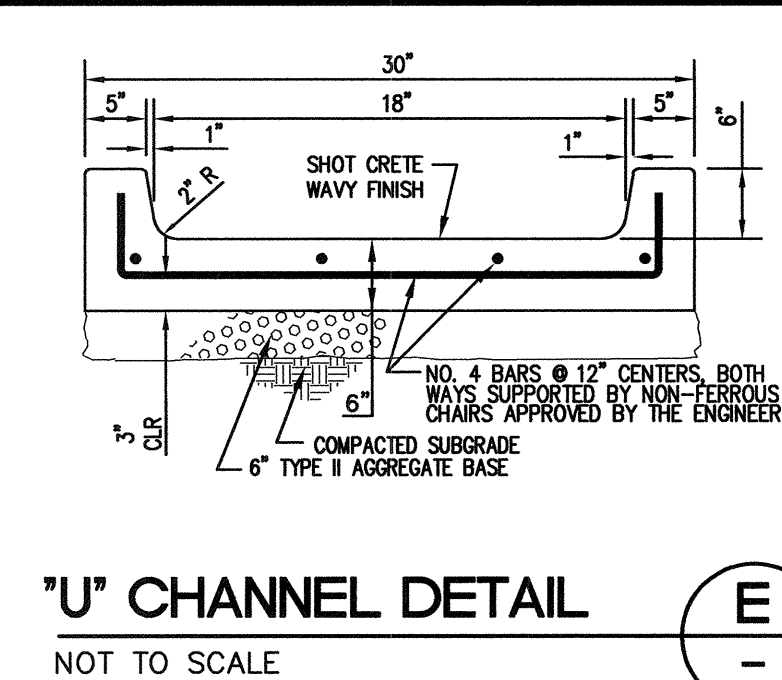
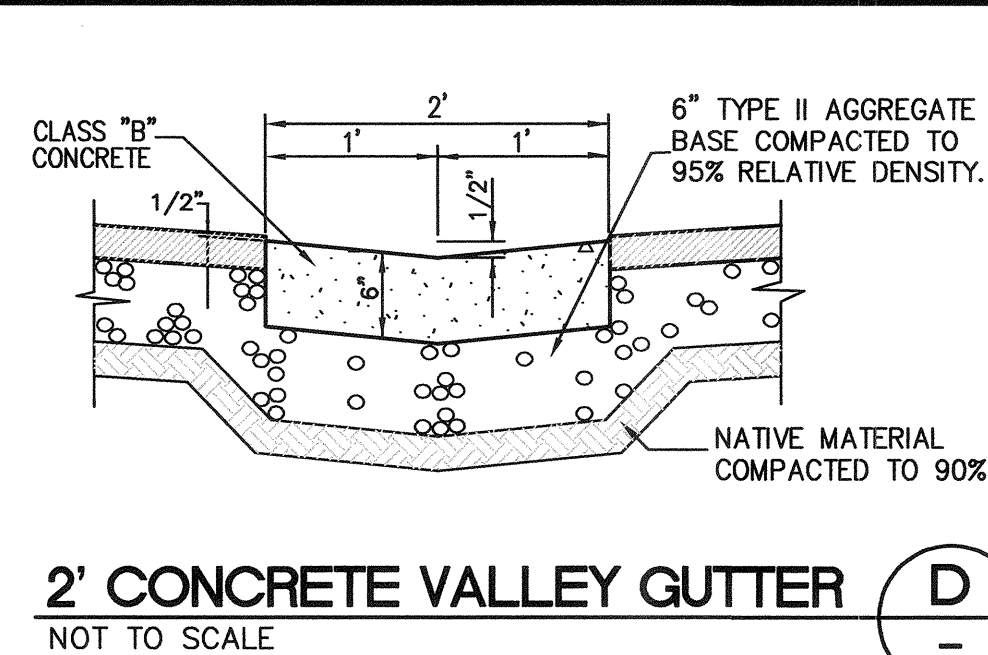
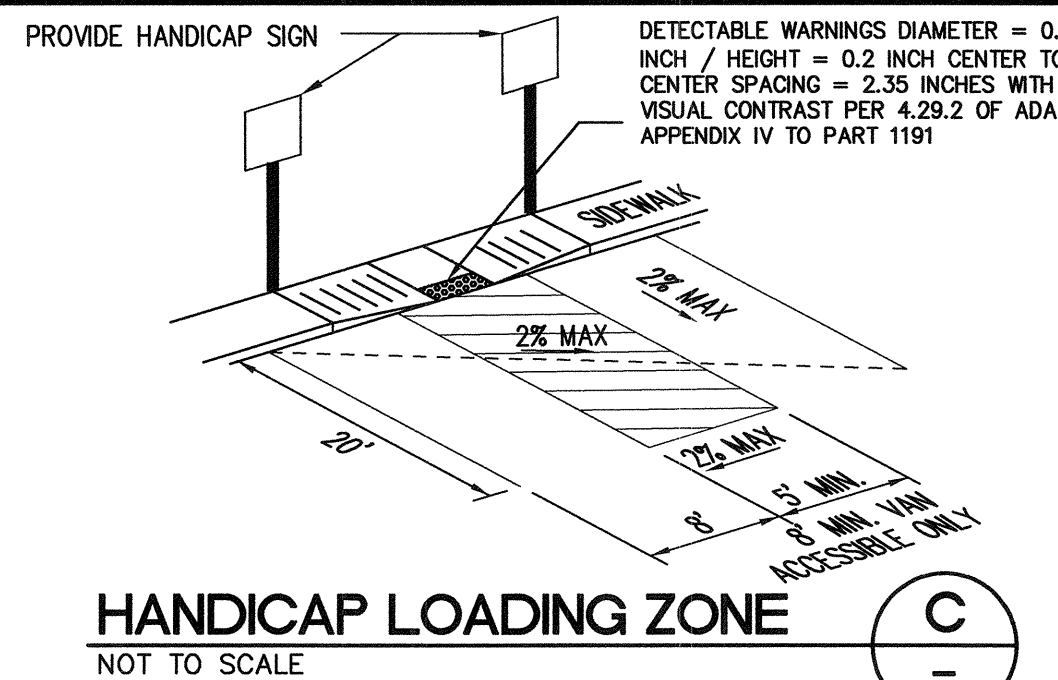
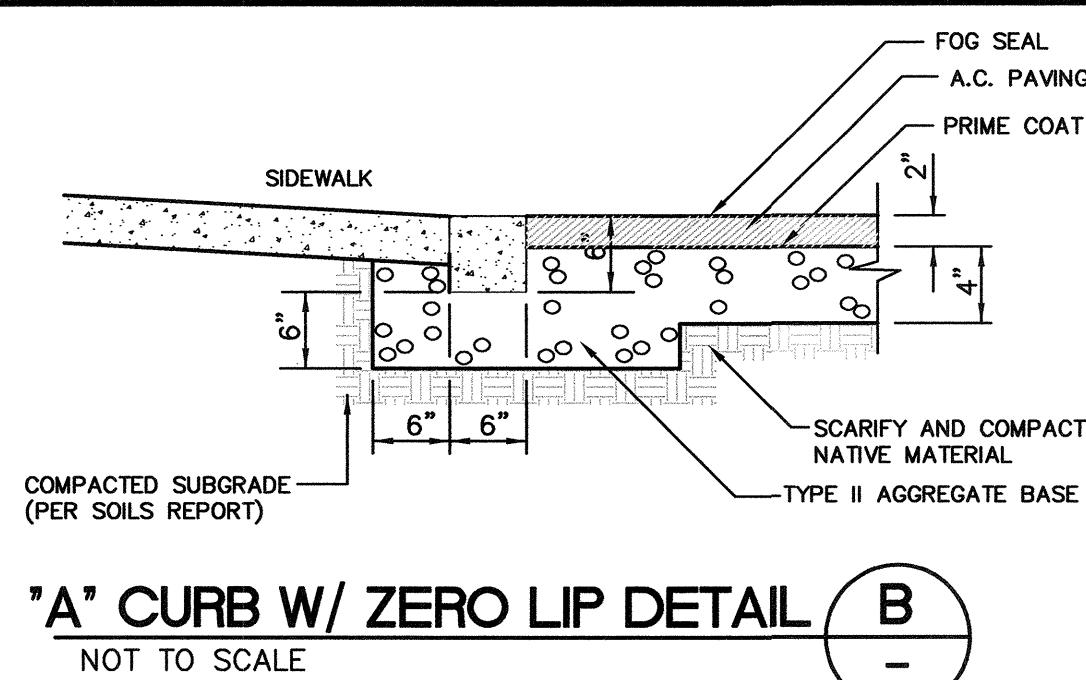
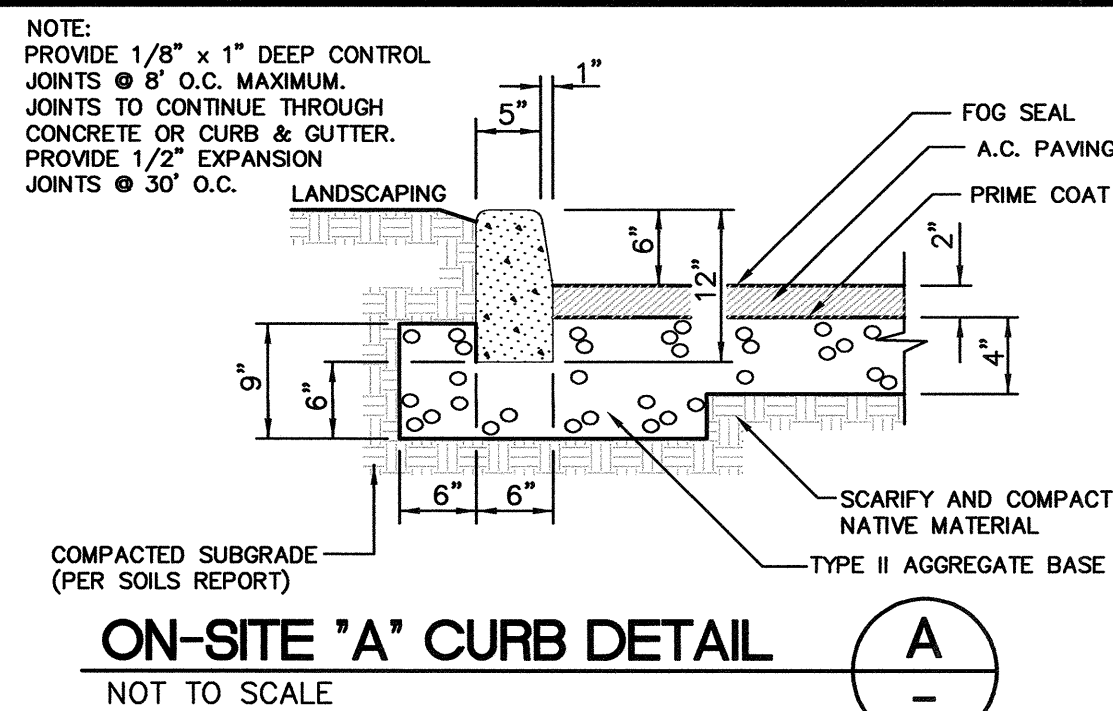


[illegible]

**EASTERN - BONANZA SENIOR APARTMENTS
CITY OF LAS VEGAS, NEVADA**



SHEET	NO. #:	CIVIL ENGINEERS - PLANNERS 1435 LEGAS AVE., SUITE 102B HOUSTON, TEXAS 77050-8835 PHONE (713) 815-0720 FAX (713) 478-8535
DATE:	REVISIONS:	
DRAWN BY:	SCALE:	
CHECKED BY:	NOT TO SCALE:	

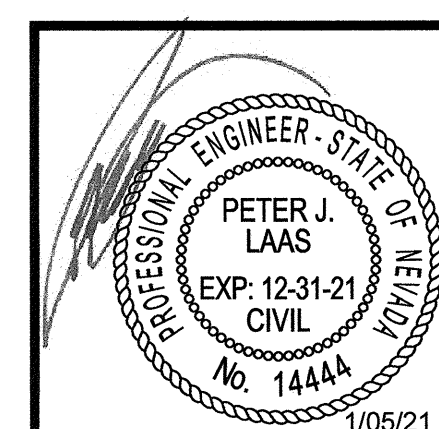


PIPE SIZE IN.	APPROX. WT. LBS.	GRATE OPEN AREA SQ. IN.
6	53	44

6" PVC DRAIN PIPE @ 1%

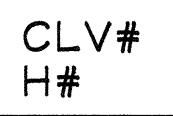
DETAIL SHEET

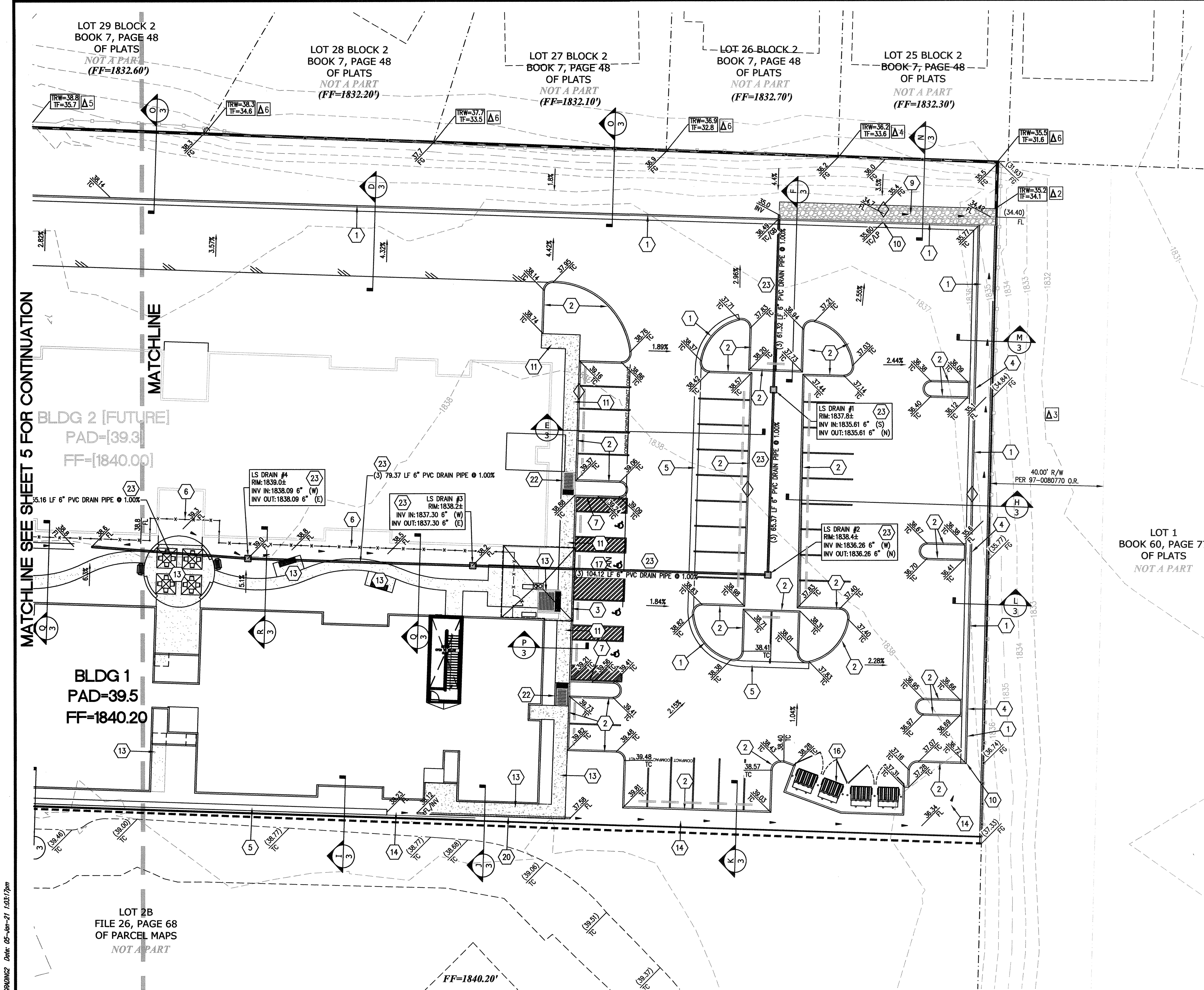
**EASTERN - BONANZA SENIOR APARTMENTS
CITY OF LAS VEGAS, NEVADA**



Impulse	I = ∫ F · dt
Civil Engineers & Planners	CIVIL ENGINEERS - PLANNERS
7405 WEST AURIE ST., SUITE 226	7405 WEST AURIE ST., SUITE 226
LAS VEGAS, NEVADA 89130	LAS VEGAS, NEVADA 89130
PHONE (702) 86-4720	PHONE (702) 86-4720
FAX (702) 86-6335	FAX (702) 86-6335

CLV#
H#





BASIS OF BEARINGS

THE SITE IS SPECIFICALLY THE NORTH HALF (N 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 25, TOWNSHIP 20 SOUTH, RANGE 61 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF LAS VEGAS MONUMENT ID 2V01225SWW6, RIVET AND PLATE IN TOP OF CURB AT NE CORNER OF EASTERN AVENUE AND HARRIS AVENUE.

ELEVATION = 561.04 METERS
ELEVATION = 1,840.69 FEET (U.S. FEET) (NAD 83)

FLOOD HAZARD ZONE

SPECIFICALLY THE NORTH HALF (N 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 25, TOWNSHIP 20 SOUTH, RANGE 61 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

A SFHA SHADDED ZONE "X" IS DEFINED AS: AN AREA DETERMINED TO BE WITHIN THE 0.2% ANNUAL CHANCE (500-YEAR) FLOODPLAIN, AREA OF 1% ANNUAL CHANCE (100-YEAR) INUNDATION LESS THAN A FOOT, OR AREAS PROTECTED BY LEVEES.

CAUTION TO SUBCONTRACTOR

EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE SUBCONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

LEGAL DESCRIPTION

SPECIFICALLY THE NORTH HALF (N 1/2) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 25, TOWNSHIP 20 SOUTH, RANGE 61 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

ADA TABLE		
RAMP	"A"	"B"
R1	8.0'	8.0'
R2	8.0'	8.0'

HANDICAP RAMP ARE TO BE CONSTRUCTED PER CLARK COUNTY AREA STANDARD DRAWINGS, STD DWG 235, CASE 1, UNLESS OTHERWISE SPECIFIED



Call Before You Dig
CALL
811
1-800-227-2600



Call before you UnderGround
1-702-432-5300

GENERAL NOTES

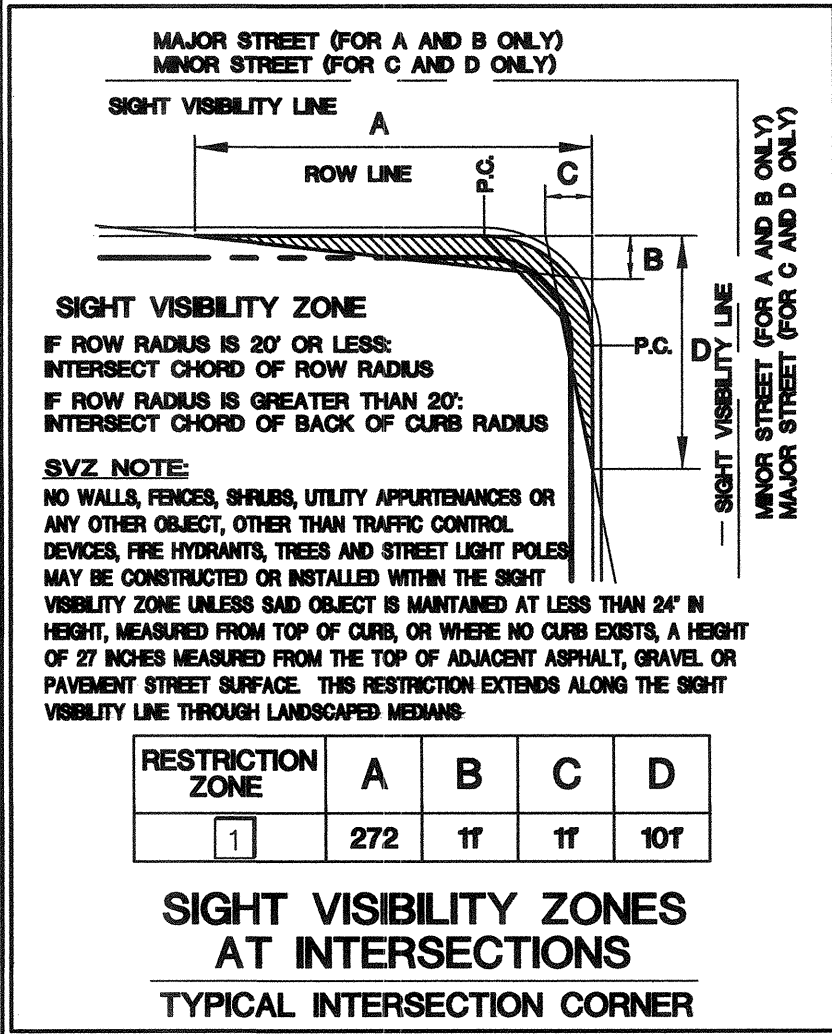
- SEE IMPROVEMENT PLANS FOR STREET SECTIONS AND DETAILS. SEE HORIZONTAL CONTROL FOR EXACT BEARINGS AND DISTANCES.
- THE QUANTITIES SHOWN HEREON ARE ESTIMATES ONLY AND ARE NOT TO BE USED FOR BIDDING PURPOSES.
- CONTRACTORS SHALL VERIFY ALL CONDITIONS AND DIMENSIONS AND SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF WORK.
- THE SITE SHALL BE GRADED IN ACCORDANCE WITH THE APPROVED SOILS REPORT BY NAVA GEOTECHNICAL, DATED: DECEMBER 23, 2020, PROJECT NO. G-20-172.
- ADD 1800 TO ALL GRADES SHOWN HERE ON EXCEPT FINISHED FLOOR ELEVATIONS.
- THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHER STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE. (APPENDIX SECTION J10.1 AS AMENDED.)
- ALL WORK PERFORMED UNDER THIS GRADING PERMIT REQUIRES SPECIAL INSPECTION PER SECTION 1704 (APPENDIX SECTION J10.2).
- ALL CUT/FILL SLOPES SHALL BE TREATED WITH LANDSCAPE ROCK. ALL CUT/FILL SLOPES SHALL BE MAINTAINED TO CONTROL EROSION. THESE MEASURES SHALL BE INSTALLED AS SOON AS POSSIBLE AND PRIOR TO CALLING FOR FINAL INSPECTION. (APPENDIX SECTION J10.1).
- ALL GRADING SHALL DRAIN AWAY FROM ALL BUILDING FOUNDATIONS. SEE SECTIONS ON SHEET 4.
- SEE FLOOD HAZARD ZONE NOTE THIS SHEET.

DISTURBED AREA

TOTAL PARCEL ACREAGE = 2.48 AC
ONSITE DISTURBED = 2.48 AC
OFFSITE DISTURBED = 0.05 AC

LEGEND

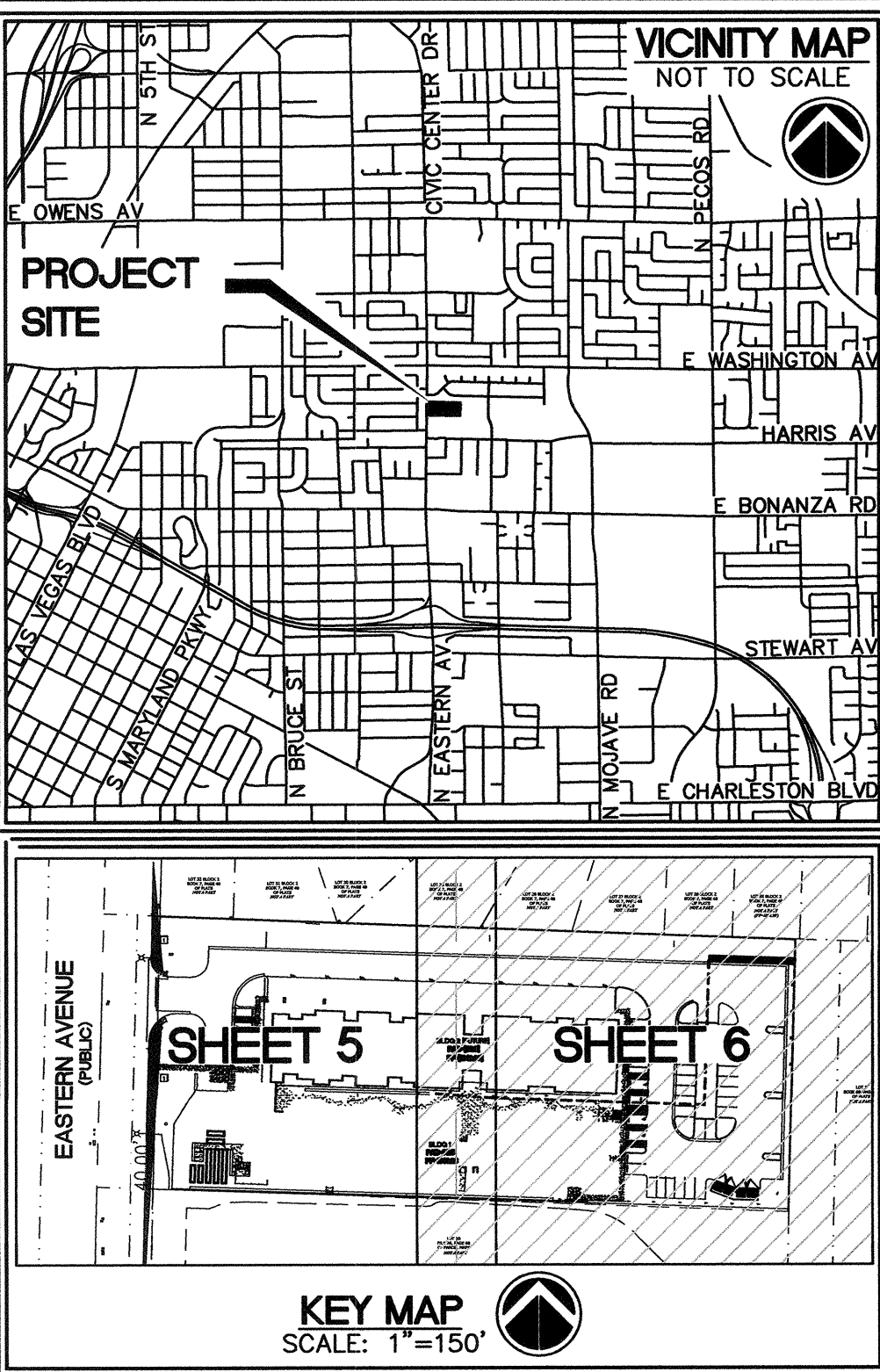
SYMBOLS		DESCRIPTION
EXISTING	PROPOSED	
---	---	RIGHT-OF-WAY
---	---	CENTERLINE
---	---	BOUNDARY
---	---	PROPERTY LINE
---	---	EASEMENT
---	---	CURB & GUTTER
---	---	SET BACK
---	---	SCREEN WALL
---	---	RETAINING WALL
---	---	SWALE
---	---	CONTOUR
---	---	3:1 SCARP
---	---	EDGE OF PAVEMENT
---	---	SIDEWALK RAMP
---	---	SAWCUT & MATCH
---	---	FIRE HYDRANT
---	---	STREET LIGHT
---	---	CABLE TV BOX
---	---	TELEPHONE BOX
---	---	FF=2700.00
---	---	PAD=2700.0
---	---	TRW
---	---	FS



CONSTRUCTION NOTES

- CONSTRUCT "L" TYPE CURB PER CCAUSD #216
- CONSTRUCT TYPE "A" CURB PER DETAIL "A" SHEET 4
- CONSTRUCT TYPE "A" CURB W/ ZERO UP PER DETAIL "B" SHEET 4
- CONSTRUCT 30" WIDE "U" CHANNEL PER DETAIL "C" SHEET 4
- CONSTRUCT 2" WIDE CONC. VALLEY GUTTER PER DETAIL "D" SHEET 3
- INSTALL WROUGHT IRON FENCE/GATE PER ARCHITECTURAL DETAILS
- CONSTRUCT CURB TRANSITION FROM "O" FACE TO "F" FACE PER DETAIL "G" SHEET 4
- CONSTRUCT 8" GROSS GUTTER PER C.C. AREA STD. DWG. #228
- CONSTRUCT 6" WIDE ROCK LINED CHANNEL 40' LONG PER DETAIL "J"
- CONSTRUCT CURB OUT PER DETAIL "H" SHEET 4
- CONSTRUCT 5" WIDE CONC. SIDEWALK PER C.C. AREA STD. DWG. #234
- CONSTRUCT CASE 1 HANDICAP RAMP PER CCAUSD #235
- CONSTRUCT WALKWAYS, PATIOS, STEPS AND DRIVEWAY PER ARCH. SPEC.
- CONSTRUCT EARTHEN SWALE PER DETAIL "F" SHEET 4
- PROTECT IN PLACE AND ADJUST EXISTING UTILITY BOXES TO INCLUDE NEW CONCRETE COLLARS.
- CONSTRUCT TRASH ENCLOSURE PER ARCH. PLANS
- CONSTRUCT HANDICAP LOADING ZONE PER DETAIL "C" SHEET 4
- SAWCUT EXISTING ASPHALT PAVING, CURB OR WALK AND MATCH WITH NEW CONSTRUCTION
- TRENCH AND PAVEMENT RESTORATION PER C.C. AREA STD. DWG. #500.5, #503 & 500.3
- INSTALL 4" PVC LANDSCAPE DRAIN PIPE @ 1.00%
- SAWCUT EXISTING AC PAVEMENT, REMOVE AND REPLACE PER SOILS REPORT
- CONSTRUCT HANDICAP RAMP PER DETAIL "K" SHEET 4
- INSTALL 6" ZURN (2150) LANDSCAPE AREA DRAIN (OR SIMILAR) AND (3) 6" PVC LANDSCAPE DRAIN PIPES @ 1% PER DETAIL "L" SHEET 4 (ALTERNATE DRAIN CONNECTIONS)

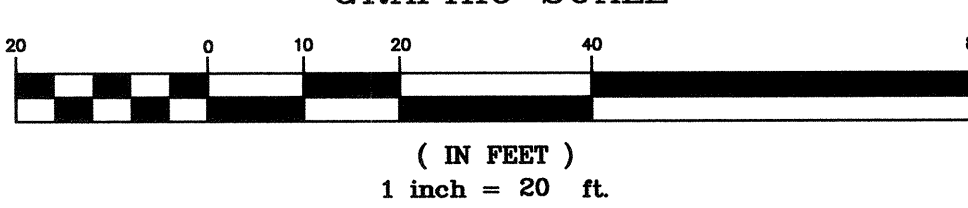
RETAINING WALLS			
SYMBOL	COURSES	HEIGHT	QUANTITY
A1	1	0.67'	- LF
A2	2	1.34'	- LF
A3	3	2.01'	- LF
A4	4	2.68'	- LF
A5	5	3.35'	- LF
A6	6	4.02'	- LF
A7	7	4.69'	- LF
A8	8	5.36'	- LF



OWNER/DEVELOPER

NORTH EASTERN LLC
C.O. NEIGHBORHOOD HOUSING
SERVICES OF SOUTHERN NEVADA
1849 CIVIC CENTER DRIVE
NORTH LAS VEGAS, NV 89030
702-649-0988 (PHONE)
EMAIL: MMERCE@NENH.ORG

GRAPHIC SCALE



CUT/FILL QUANTITY

TOTAL PROJECT
CUT = 850 CY
FILL = 3,300 CY
THESE QUANTITIES ARE RAW QUANTITIES BASED ON THE DIFFERENCE BETWEEN DESIGN SUBGRADE AND EXISTING GROUND ONLY. THEY DO NOT ACCOUNT FOR SHRINKAGE OR SUBSIDENCE. CONTRACTORS ARE RESPONSIBLE FOR THEIR OWN QUANTITIES.

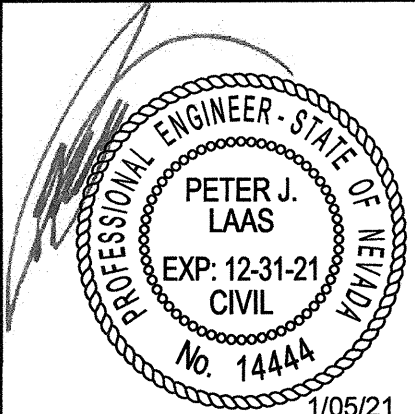
I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH CITY OF LAS VEGAS, NV.

PETE LAAS, P.E. #14444 DATE

CLV#
H#

GRADING PLAN 2

EASTERN - BONANZA SENIOR APARTMENTS
CITY OF LAS VEGAS, NEVADA



Impulse
Civil Engineering & Planning
I = F · dt
CIVIL ENGINEERS - PLANNERS
1445 WEST ADAMS DRIVE, SUITE 228
LAS VEGAS, NEVADA 89102
PHONE: (702) 815-0720
FAX: (702) 478-8335

W.O. # :
BY : REH
DATE : 07/16/20
SCALE : 1"=20'

SHEET 6 of 10