

DS #: 4906

APN: 125-27-411-007

PROJECT: Building Pad @ Centennial Gateway

SUBMITTAL: 1st

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		August 3, 2017
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	
	Building Pad @ Centennial Gateway	
Cross Streets:	NEC of Centennial Center Blvd. & Ann Road	
File Number:	F:\Depot\DSMemos\DS4906A.doc	
Parcel Number:	125-27-411-007	
Zoning Action:	SDR-70329	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X
COPIES TO:		
		Horrocks Engineers
		TAG Centennial Common Owners
		Bart Anderson, P.E., DevCo

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	7/17/2017	8/3/2017	See Comments Below	\$400.00	488559: \$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.

- Provide a copy of the zoning/planning conditions associated with this site (**SDR-70329**) 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.
- Fig. 5 (Drainage Plan):** In "*Hydraulic X-Section Summary Table*", Cross Section "E2 West" shows a 100-year depth of 2.04' seemingly is a typo. If not, then the proposed concrete flume is not capable of containing the flow. Review and revise accordingly.

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

ays

T/R/S: T19S/R60E/27
AREA G-27

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Centennial Gateway Building Pad Date: July 6, 2017
Location of Development: a) Descriptive (Cross Streets) North/South: Centennial Center Blvd
East/West: Ann Road
b) Section: 27 Township: 19 South Range: 60 East
c) APN: 125-27-411-007

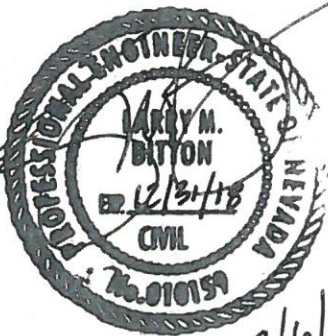
Name of Owner: TAG Centennial Common Owners
Telephone No.: (702) 888-3500 Fax No.: _____ E-Mail Address: agus@logicCRE.com
Address: 3900 S. Hualapai Way, Suite 200 Las Vegas, NV 89147

Contact Person-Name: Larry Bitton Telephone No.: 702-966-4063
* E-Mail Address: larryb@horrocks.com Fax No.: _____
Firm: Horrocks Engineers
Address: 1349 Galleria Drive, Suite 110 Henderson, NV 89014

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	

1. Total Owned Land Area: At Site: 8.88 acres Being Developed/Disturbed: 0.35 acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
4. Proposed type of development (Residential, Commercial, Etc.): Commercial
5. Approximate upstream land area which drains to the subject site: 0.95 acres
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation:
This building pad site is contained within Centennial Gateway Commercial Center (CLV DS #3569)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Existing Centennial Center Blvd
8. Briefly describe your proposed schedule for the subject project:
ASAP. This project will be processed using the City's expedited review process



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.**

Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: **Centennial Gateway Building Pad**

Map ID:

Firm Name: **Horrocks Engineers**

Engineer: **Larry Bitton, PE**

Address: **1349 Galleria Drive, Suite 110**

City: **Henderson**

State: **NV**

Zip: **89014**

Phone Number: **702-966-4063**

Fax Number:

Property Owner: **TAG Centennial Common Owners**

Address: **3900 S. Hualapai Way, Suite 200**

City: **Las Vegas**

State: **NV**

Zip: **89147**

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 ☒ No ☐ Design Manual **Standard Form 1** with the engineer's seal and signature.

☒ ☐ Design Manual **Standard Form 4**.

☒ ☐ 2 copies of the 24" x 36" Drainage Plan.

☐ ☒ N/A A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

II. MAPS AND EXHIBITS

Yes ☐ No ☒ N/A A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.

☐ ☒ N/A A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes No

- ☒ ☐ Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
- ☒ ☐ 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.
- ☒ ☐ Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes No

- ☒ ☐ Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada. ✓
- ☒ ☐ Minimum scale: 1" = 60'.
- ☒ ☐ Project name.
- ☒ ☐ Vicinity Map with local and major cross streets.
- ☒ ☐ Revision box.
- ☒ ☐ North arrow and bar scale.
- ☒ ☐ Engineer's/consultant's address and phone number.
- ☒ ☐ Elevation datum and benchmark.
- ☒ ☐ Legend for symbols and abbreviations.
- ☒ ☐ Cut/fill scarps, where applicable.
- ☒ ☐ Street names, grades, widths.
- ☒ ☐ 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.
- ☒ ☐ Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
- ☒ ☐ Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
- ☐ ☒ N/A Proposed typical street sections.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
	<u>N/A</u>	Streets with off-set crowns.
<u>X</u>		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
<u>X</u>		Property lines.
<u>X</u>		Right-of-way lines and widths, existing and proposed.
<u>X</u>		Existing improvements and their elevations.
<u>X</u>		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
<u>X</u>		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
<u>X</u>		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<u>X</u>		Location and cross-section of street capacity calculations.
<u>X</u>		Cross-sectional detail for channels, including cutoff wall locations.
<u>X</u>		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.
	<u>N/A</u>	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
	<u>N/A</u>	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.
	<u>N/A</u>	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
	<u>N/A</u>	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.
<u>X</u>		Building and/or lot numbers.
	<u>N/A</u>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
	<u>N/A</u>	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes No

☒ N/A 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.

☒ N/A 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.

☒ X Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

☒ X Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required) **(NOT REQUIRED)**

IV. HYDROLOGIC ANALYSIS

Yes No

☒ X Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.

☒ X 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.

☒ X 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.

☒ X Use of correct precipitation values in and around the McCarran Airport rainfall area.

☒ X A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.

☒ X A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.

☒ X Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.

☒ X On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.

☒ X Calculation for impervious area for parking lots and LIDs (if required) **(NOT REQUIRED)**

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes No

X _____ Flow split calculations and supporting documentation or reference for the method of flow split calculations used.

X _____ 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. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.

X _____ 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.

_____ N/A Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)

_____ N/A 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.

X _____ 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.

_____ N/A 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.

X _____ Provide a 50 percent clogging factor in the capacity calculation for drop inlets.

X _____ 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.

X _____ The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

WIP X Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

(NOT REQUIRED)

REFERENCE:

STANDARD FORM 2



JULY 2017 UPDATE

FOR THE

TECHNICAL DRAINAGE STUDY FOR
CENTENNIAL GATEWAY
(APN 125-27-411-007)

IN

THE CITY OF LAS VEGAS

PREPARED FOR



TAG Centennial Common Owners
3900 S. Hualapai Way, Suite 200
Las Vegas, NV 89147
702.888.3500
agus@logicCRE.com

SUBMITTED TO



City of Las Vegas

JULY 6, 2017

HORROCKS ENGINEERS PROJECT 811-1706

Horrocks Engineers
1349 Galleria Drive, Suite 110
Henderson, NV 89014
702.966.4063

HORROCKS

ENGINEERS

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Centennial Gateway Building Pad Date: July 6, 2017
Location of Development: a) Descriptive (Cross Streets) North/South: Centennial Center Blvd
East/West: Ann Road
b) Section: 27 Township: 19 South Range: 60 East
c) APN: 125-27-411-007

Name of Owner: TAG Centennial Common Owners
Telephone No.: (702) 888-3500 Fax No.: _____ E-Mail Address: agus@logicCRE.com
Address: 3900 S. Hualapai Way, Suite 200 Las Vegas, NV 89147

Contact Person-Name: Larry Bitton Telephone No.: 702-966-4063
* E-Mail Address: larryb@horrocks.com Fax No.: _____
Firm: Horrocks Engineers
Address: 1349 Galleria Drive, Suite 110 Henderson, NV 89014

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	☐	

1. Total Owned Land Area: At Site: 8.88 acres Being Developed/Disturbed: 0.35 acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
4. Proposed type of development (Residential, Commercial, Etc.): Commercial
5. Approximate upstream land area which drains to the subject site: 0.95 acres
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation:
This building pad site is contained within Centennial Gateway Commercial Center (CLV DS #3569)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Existing Centennial Center Blvd
8. Briefly describe your proposed schedule for the subject project:
ASAP. This project will be processed using the City's expedited review process

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***New Required Field**

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

Revision	Date

Engineer's Seal

Local Entity File No.

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

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East/West: Ann Road
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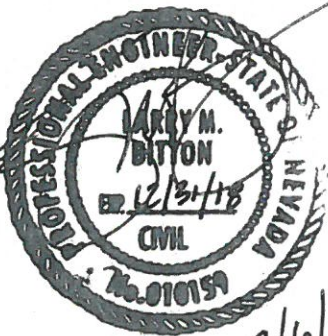
Name of Owner: TAG Centennial Common Owners
Telephone No.: (702) 888-3500 Fax No.: _____ E-Mail Address: agus@logicCRE.com
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Contact Person-Name: Larry Bitton Telephone No.: 702-966-4063
* E-Mail Address: larryb@horrocks.com Fax No.: _____
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Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: **Centennial Gateway Building Pad**

Map ID:

Firm Name: **Horrocks Engineers**

Engineer: **Larry Bitton, PE**

Address: **1349 Galleria Drive, Suite 110**

City: **Henderson**

State: **NV**

Zip: **89014**

Phone Number: **702-966-4063**

Fax Number:

Property Owner: **TAG Centennial Common Owners**

Address: **3900 S. Hualapai Way, Suite 200**

City: **Las Vegas**

State: **NV**

Zip: **89147**

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

II. MAPS AND EXHIBITS

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes No

- ☒ ☐ Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
- ☒ ☐ 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.
- ☒ ☐ Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes No

- ☒ ☐ Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada. ✓
- ☒ ☐ Minimum scale: 1" = 60'.
- ☒ ☐ Project name.
- ☒ ☐ Vicinity Map with local and major cross streets.
- ☒ ☐ Revision box.
- ☒ ☐ North arrow and bar scale.
- ☒ ☐ Engineer's/consultant's address and phone number.
- ☒ ☐ Elevation datum and benchmark.
- ☒ ☐ Legend for symbols and abbreviations.
- ☒ ☐ Cut/fill scarps, where applicable.
- ☒ ☐ Street names, grades, widths.
- ☒ ☐ 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.
- ☒ ☐ Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
- ☒ ☐ Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
- ☐ ☒ N/A Proposed typical street sections.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
	<u>N/A</u>	Streets with off-set crowns.
<u>X</u>		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
<u>X</u>		Property lines.
<u>X</u>		Right-of-way lines and widths, existing and proposed.
<u>X</u>		Existing improvements and their elevations.
<u>X</u>		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
<u>X</u>		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
<u>X</u>		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<u>X</u>		Location and cross-section of street capacity calculations.
<u>X</u>		Cross-sectional detail for channels, including cutoff wall locations.
<u>X</u>		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.
	<u>N/A</u>	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
	<u>N/A</u>	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.
	<u>N/A</u>	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
	<u>N/A</u>	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.
<u>X</u>		Building and/or lot numbers.
	<u>N/A</u>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
	<u>N/A</u>	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes No

☐ N/A 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.

☐ N/A 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) **(NOT 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) **(NOT REQUIRED)**

REFERENCE:

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. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ 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.

_____ N/A Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)

_____ N/A 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.

_____ N/A 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).

(NOT REQUIRED)

REFERENCE:

STANDARD FORM 2

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APPENDICES

Appendix A – Hydrologic Calculations

Appendix B – Hydraulic Calculations

Appendix C – Grading Plan

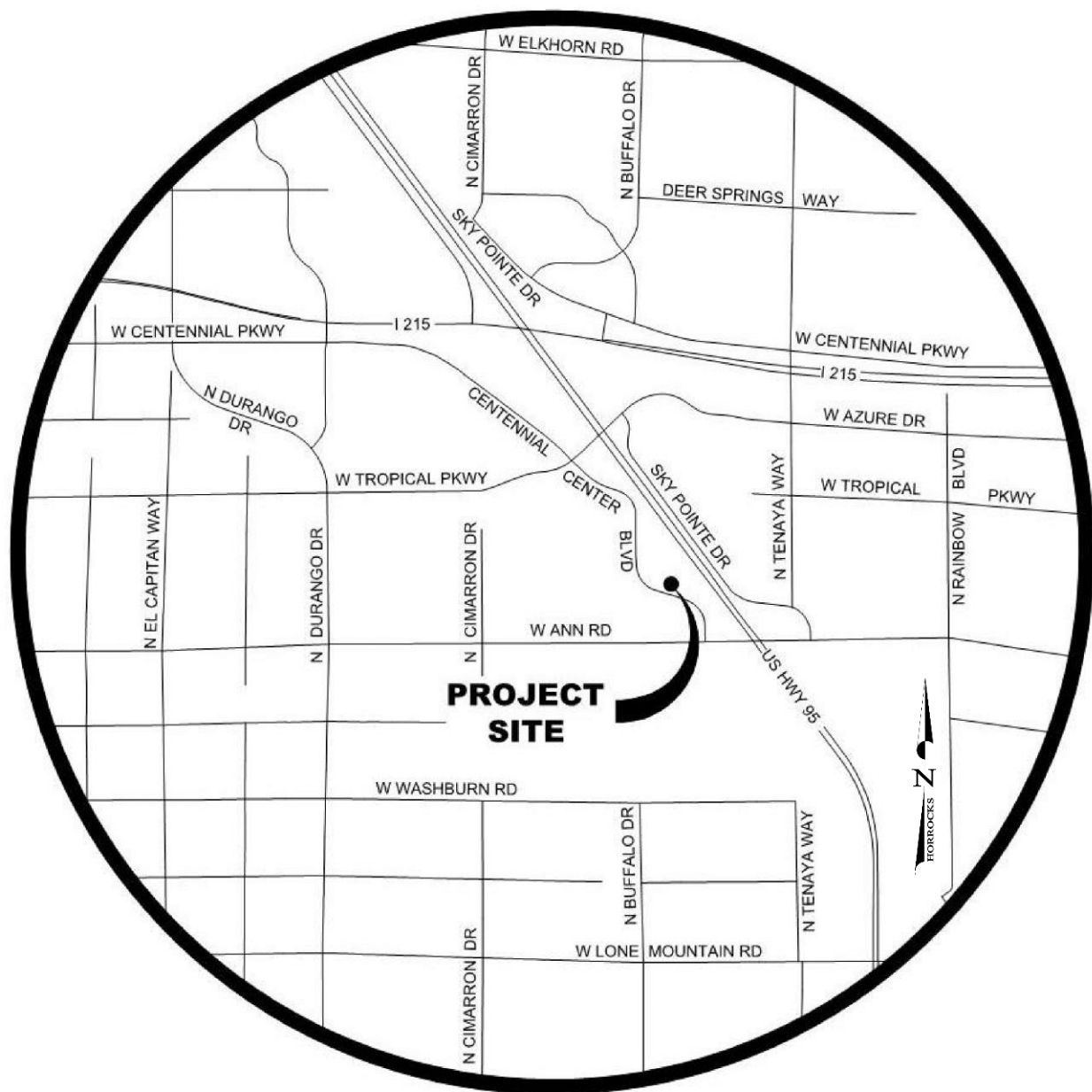
I. INTRODUCTION

TAG Centennial Common Owners, the owners of the Centennial Gateway shopping center, are proposing a new commercial building and associated parking lot modifications within their existing fully developed shopping center located on Centennial Center Blvd north of Ann Road. This report presents the results of a technical drainage study update to the previously approved studies for the Centennial Gateway shopping center. The purpose of the report is:

- To summarize the previous approved studies for the property
- To analyze and quantify the 10-yr and 100-yr peak runoff impacting the new commercial building & site improvements, and
- To confirm that the proposed building meets applicable drainage design standards of the City of Las Vegas and Clark County Regional Flood Control District.

II. PROJECT LOCATION AND DESCRIPTION

The project is located north of Centennial Center Blvd immediately west of the existing retail building at 5750 Centennial Center Blvd. in Section 27 Township 19 South, Range 60 East MDM in City of Las Vegas, Nevada. The site is within APN 125-27-411-007. Refer to Figure 1 – Vicinity Map. The site abuts Centennial Center Blvd and is currently fully developed on all sides. Refer to Figure 2 – Location Map. The new site improvements will include modifications to the existing parking area including minor modifications to onsite drainage collection and to discharge points onto Centennial Center Blvd.

**FIGURE 1 - VICINITY MAP**

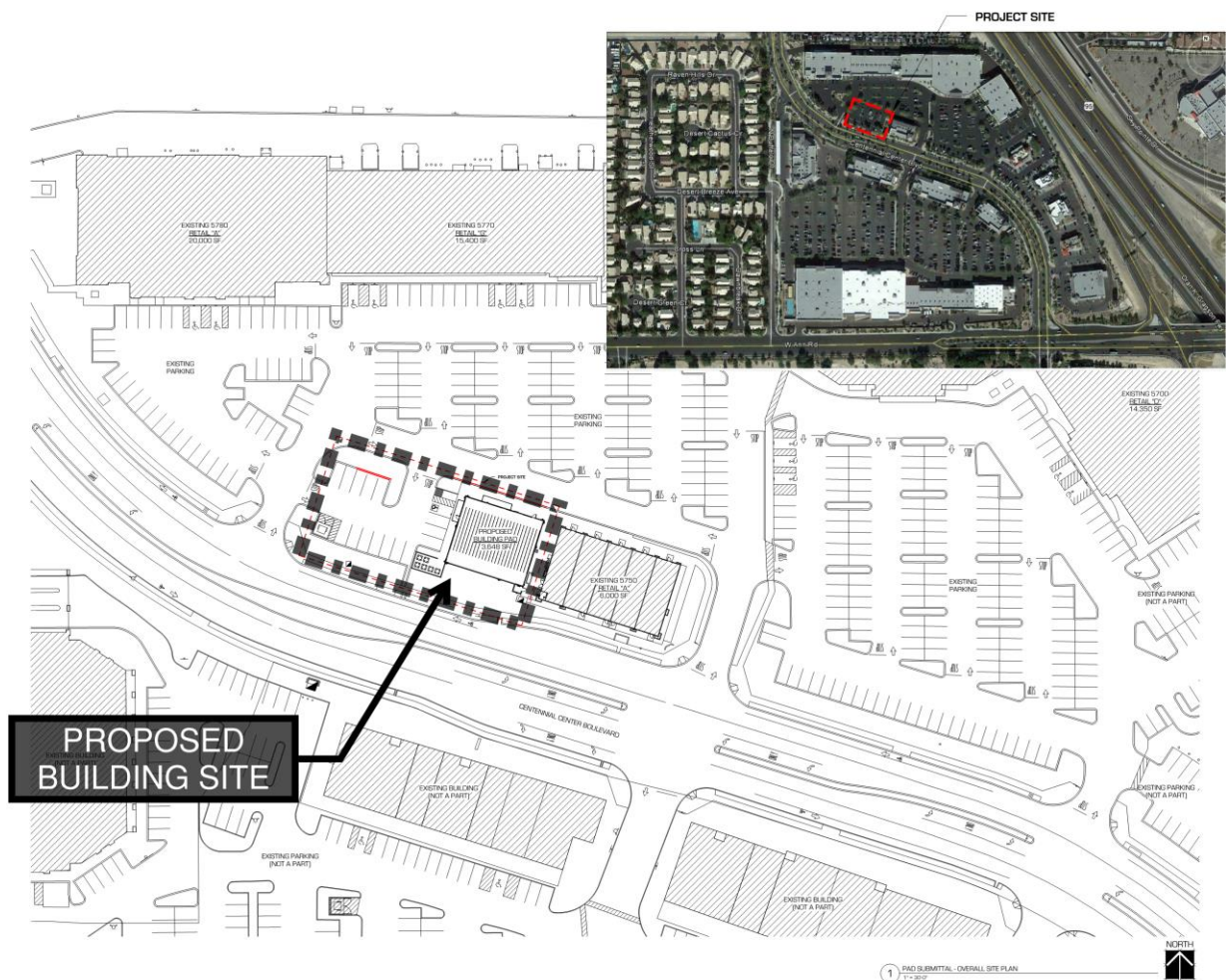


FIGURE 2 – LOCATION MAP

III. SUMMARY OF PRIOR STUDIES

The Technical Drainage Study for the Centennial Gateway Commercial Center was prepared by GCW and approved in 2004. There were several updates that were subsequently approved. The applicable portions of the studies are briefly summarized below and included in Appendix B. Other than confirming that the finished floor elevation of the proposed building is a minimum of 18" above the 100-yr flow depth in Centennial Center Blvd established in the previous studies, this July 2017 Update does not depend on the conclusions of the previous studies.

A. Technical Drainage Study for Centennial Gateway – April 2004 prepared by GC Wallace; Response to Comments on the Technical Drainage Study for Centennial Gateway – May 2004 prepared by GC Wallace (Reference 1)

This is the original study of the commercial center. It established offsite flows affecting the master site and the flows in Centennial Center Blvd under existing, proposed, and ultimate conditions. It

identified the flows prior to and after the Rancho Detention Basin was improved to capture, contain and discharge higher flows.

The study identified the flow rates and depths in Centennial Center Blvd under developed conditions pre- and post-improvements to the Rancho Detention Basin as shown in Tables 8 & 9 from that study (copied below). The City reviewed and issued comments on the original study and accepted the flow rates presented in the study.

Technical Drainage Study

Centennial Gateway

**TABLE 8
100-YEAR STREET FLOW CHARACTERISTICS
CENTENNIAL CENTER BLVD.
FUTURE CONDITIONS**

Location*	Slope (%)	Q ₁₀₀ (cfs)	Depth (ft)	Velocity (ft/s)	D*V
125+50	1.35	8	0.35	2.68	0.9
128+00	1.22	8	0.38	2.74	1.0
129+00	1.22	8	0.37	2.60	1.0
130+00	1.22	23	0.49	3.46	1.7
132+00	0.62	23	0.54	2.38	1.3
133+50	0.62	23	0.54	2.36	1.3
137+50	0.62	31	0.60	2.50	1.5
141+50	0.62	11	0.47	2.10	1.0

*See Figure 6A.

The street flow data based on proposed conditions in which the outflow of the Rancho Detention Basin is routed down Centennial Center Boulevard is presented in Table 9. The depth of flow within Centennial Center Boulevard is less than 2 feet, and the Finished Floor elevation of adjacent buildings is at least 1.5 feet above the depth of flow in the street. It should be noted that the proposed condition is temporary and the flow in the street will be significantly reduced upon the completion of future improvements to Rancho Detention Basin. Currently, 710 cfs overtops the Rancho Detention Basin spillway during a 100-year event. Future improvements to the Rancho Detention Basin by others will eliminate flow overtopping the spillway during a 100-year event.

**TABLE 9
100-YEAR STREET FLOW CHARACTERISTICS
CENTENNIAL CENTER BLVD
PROPOSED CONDITIONS**

Location*	Slope (%)	Q ₁₀₀ (cfs)	Depth (ft)	Flowline (ft)	HGL (ft)	Freeboard (ft)	Min FF (ft)
125+50	1.35	710	1.27	2378.82	2380.09	1.50	2381.6
128+00	1.22	710	1.36	2375.77	2377.13	1.50	2378.6
129+00	1.22	710	1.37	2374.55	2375.92	1.50	2377.4
130+00	1.22	710	1.40	2373.33	2374.73	1.50	2376.2
132+00	0.62	710	1.45	2371.63	2373.08	1.50	2374.6
133+50	0.62	710	1.49	2371.15	2372.64	1.50	2374.1
137+50	0.62	710	1.53	2368.66	2370.19	1.50	2371.7
141+50	0.62	710	1.48	2366.18	2367.66	1.50	2369.2

*See Figure 6A.

Duplicated from *Technical Drainage Study for Centennial Gateway - April 2004* by GC Wallace

GCW Table 8 & 9 is highlighted to identify the centerline stations in Centennial Center Blvd adjacent to the proposed building site in this July 2017 Update. The May 2004 Response to Comments addressed the City's comments and the study was conditionally approved by the City (subject to CCRFCD Concurrence) on June 30, 2004. CCRFCD concurrence was secured August 2004. Horrocks Engineers has reviewed the GC Wallace study and subsequent addendums and concurs with the conclusions. Copies of the applicable portions of the April 2004 Study and the May 2004 Response to Comments are included in Appendix B together with the associated City approvals.

B. (3rd & 4th Submittals) Updates to justify as-built finish floor elevations of "Furniture A", "Retail G", "Furniture B", "Furniture C", "La-Z-Boy" and "2-Story Office" Buildings – April 2007 prepared by GC Wallace (Reference 2)

The updates were submitted by GC Wallace to address final as-built elevations and minor discrepancies with the approved grading plans. The City issued comments in April 2007 and the response was submitted in May 2007 and approved by the City. Horrocks Engineers has reviewed the April 2007 Update and May 2007 Response and concurs with the conclusions. However, since Horrocks Engineers completed a topographical survey of the proposed building site, the as-built discrepancies from the approved plans don't apply since our analysis was done based on actual as-built conditions.

The above studies identified the soils conditions, summarized adjacent CCRFCD facilities and verified that the project area is not in a FEMA flood zone. Horrocks Engineers concurs with those conclusions and for brevity did not include that established information in this Update.

IV. TDS UPDATE METHODOLOGY

The methodology for hydrologic and hydraulic analyses used in this study are in compliance with the *Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual* (Reference 2) subsequently referred to as the 'Manual'. The drainage models use the SCS TR-55 methodology (Reference 3) as allowed per Section 304.3 of the Manual.

Rainfall –

The project lies within the McCarran Rainfall Area as delineated in the Manual on Figure 513 included in Appendix A. The 24-hr rainfall depths were determined to 1.8 and 2.96 inches from Figures 505 and 506 of the Manual (reference Appendix A). In accordance with Note 2 in Table 501 of the Manual, precipitation adjustment ratios were not applied.

Curve Numbers –

The drainage basins affecting the site are fully paved, therefore worst case condition Hydrologic Group D with weighted curve number of 98 was used in the analysis for all contributing basins.

Drainage Basins –

Drainage basins were identified by field observations, aerial photography, surveyed topography and referencing approved plans for the Centennial Gateway Center (CLV Drawing #107V4179-PH1) on file at City of Las Vegas. The drainage basins affecting the project site are limited to the parking lot south of the string of existing commercial buildings along the northerly boundary of the parcel (reference Location Map). Those existing buildings drain north. All flows generated on the existing parking lot sheet flow south ultimately exiting the parking lot through existing driveways and under-sidewalk drains onto Centennial Center Blvd. The drainage basins are further described in Sections V & VI and are depicted on the drainage basin maps (Figures 3 & 4).

Time of Concentration & Lag Time –

Time of Concentration T_c and Lag Time T_L were determined in accordance with Section 602 of the Manual and tabulated for each development condition on Standard Form 4 in Appendix A. The flow paths used for T_c are depicted on the drainage basin maps.

V. EXISTING CONDITION ANALYSIS

Existing conditions for the site are addressed in this section. Figure 4 depicts the existing condition drainage basin. All existing flows are parking lot sheet flow. **Basin A** discharges out the west driveway without affecting the project site. **Basin C(ex)** crosses the project site and discharges through an existing concrete flume and under-sidewalk drain into Centennial Center Blvd. **Basin D** discharges east of the existing highpoint in the drive aisle and out the driveway east of the site without impacting the project site. Existing condition flows are summarized on Figure 4 and in Table 1 below.

Existing condition flows in Centennial Center Blvd are referenced from Tables 8 & 9 of the GC Wallace April 2004 report.

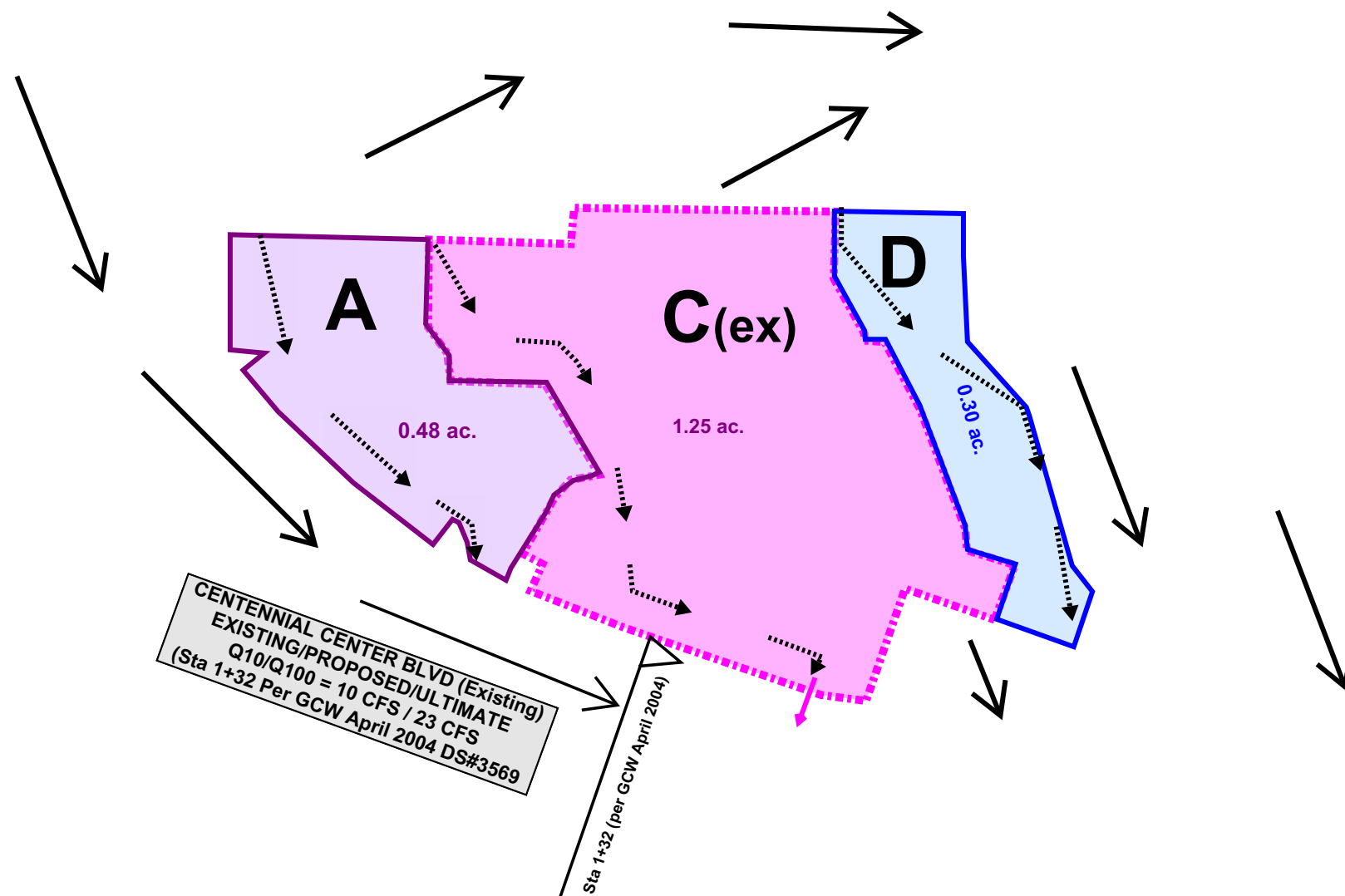


Table 1 – Summary of Existing Drainage			
Drainage Sub-basin	Existing Q ₁₀ cfs	Existing Q ₁₀₀ cfs	Notes
A	1.07	1.81	existing = proposed = ultimate
C(ex)	2.78	4.67	
D	0.67	1.13	existing = proposed = ultimate
CENT - OFFSITE	10	23	existing = proposed = ultimate

UNDERLYING BACKGROUND FOR DRAINAGE
BASINS IS: GRADING PLAN - CENTENNIAL
GATEWAY BY GC WALLACE
(CLV DWG # 107V4179-PH1)

HORROCKS
ENGINEERS

**FIGURE 3 -
EXISTING
DRAINAGE
CONDITIONS**

Table 1 – Summary of Existing Drainage			
Drainage Sub-basin	Existing Q ₁₀ cfs	Existing Q ₁₀₀ cfs	Notes
A	1.07	1.81	existing = proposed = ultimate
C(ex)	2.78	4.67	
D	0.67	1.13	existing = proposed = ultimate
Cent – Offsite	10	23	existing = proposed = ultimate

VI. PROPOSED / ULTIMATE CONDITION ANALYSIS

Proposed development conditions are addressed in this section. The offsite basins upstream of the Centennial Gateway Center are built out and therefore considered in their ultimate condition. Similarly the onsite sub-basins contributing to the project site are developed and in their ultimate condition. Therefore for purposes of this study, the proposed & ultimate conditions are the same and will hereafter be referred to as the Ultimate condition.

Since the new development is almost entirely within the existing paved parking lot and the landscape area with the proposed commercial pad is slightly increased from the existing conditions, the generated flows remain essentially unchanged from the existing to the ultimate condition. The landscape areas were conservatively ignored for purposes of this study. The ultimate condition drainage is depicted on Figure 4 – Ultimate Conditions Map. The upstream conditions remain unchanged from the existing condition. Drainage **Basin C(ex)** is separated into four sub-basins for the Ultimate condition due to the split in flows as a result of the new commercial pad.

Basin B sheet flows and routes through and is combined with **Basin E** – which is the new commercial site. Flows sheet flow to a v-swale (*Swale E1*) which conveys flows to discharge point *Structure E2west* (a concrete u-curb channel) and ultimately through an under-sidewalk drain on Centennial Center Blvd.

Basin C sheet flows to the new L-curb along the drive aisle north of the new commercial pad. These **Basin C** flows continue east in the drive aisle to a slight curb depression at an under-sidewalk nuisance drain (*Structure C1*) and flows not captured by *Structure C1* continue flowing east in the drive aisle over a slight high point and then to the driveway and out to Centennial Center Blvd. Flows captured by *Structure C1* are conveyed between the new building and the existing building (comprising **Basin F**) within a concrete grated trench (*Structure C2*) and ultimately discharging through a new under-sidewalk drain in Centennial Center Blvd.

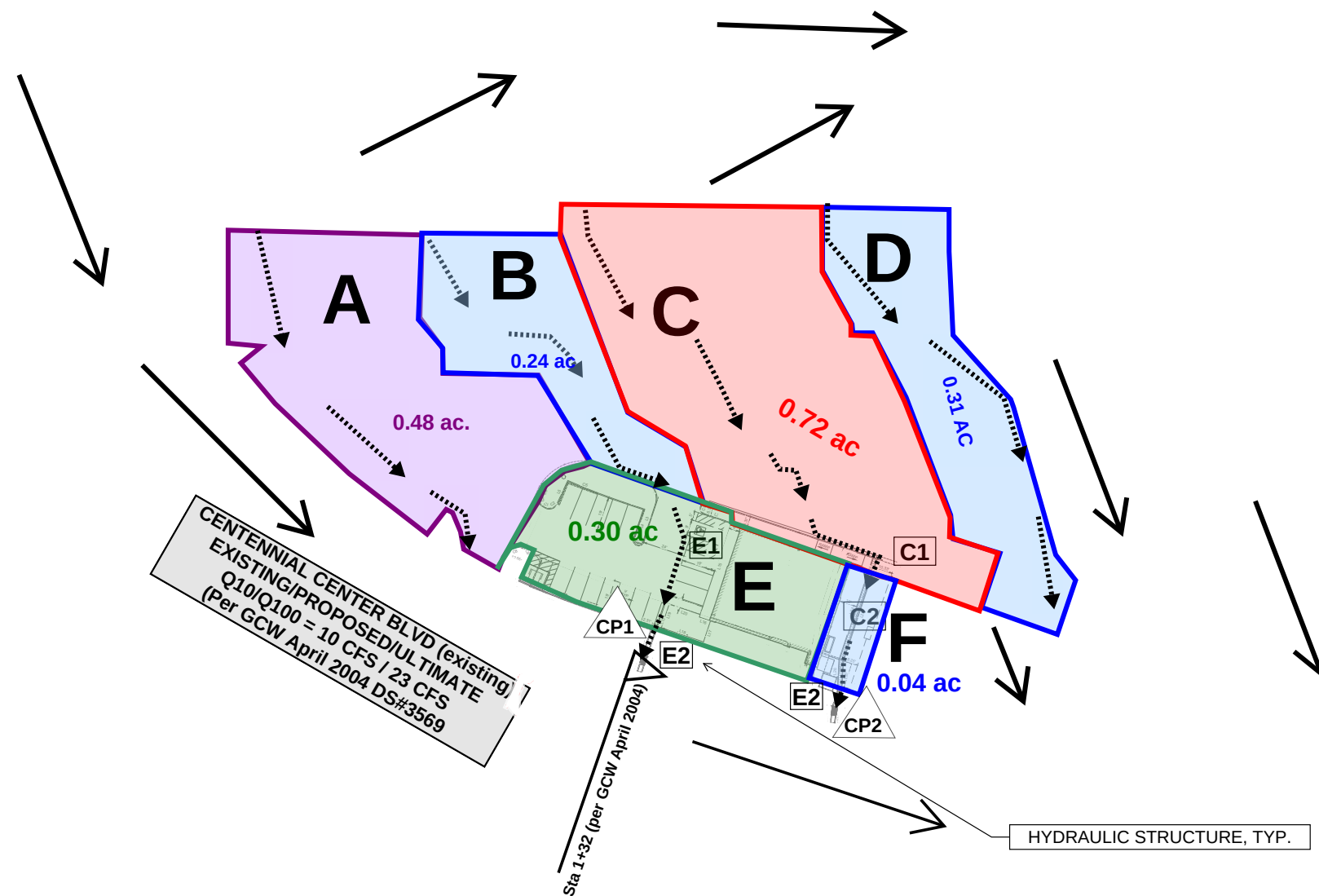


Table 2 - Summary of Ultimate Drainage			
Drainage Sub-basin	Ultimate Q ₁₀ cfs	Ultimate Q ₁₀₀ cfs	Notes
A	1.07	1.8	existing = proposed = ultimate
B	0.54	0.91	
C	1.51	2.54	
D	0.67	1.13	existing = proposed = ultimate
E	0.67	1.13	
CP1	1.21	2.04	B+E
CP2	1.6	2.68	C+F
F	0.09	0.14	
CENT - OFFSITE	10	23	existing = proposed = ultimate

UNDERLYING BACKGROUND FOR DRAINAGE BASINS IS: GRADING PLAN - CENTENNIAL GATEWAY BY GC WALLACE (CLV DWG # 107V4179-PH1)

Centennial Gateway Building Pad
by TAG Centennial Common Owners

HORROCKS
ENGINEERS

**FIGURE 4 -
ULTIMATE DRAINAGE
CONDITIONS**

Table 2 summarizes the Ultimate Drainage Condition Flows. Hydraulic analyses for the structures are addressed in Section VII of this report and are included in Appendix B.

Table 2 – Summary of Ultimate Drainage				
Drainage Sub-basin or Combination Point	Area (ac)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Notes & Reference
A	0.48	1.07	1.80	existing = proposed = ultimate
B	0.24	0.54	0.91	–
C	0.72	1.51	2.54	–
D	0.30	0.67	1.13	existing = proposed = ultimate
E	0.30	0.67	1.13	Proposed Commercial Site
F	0.04	0.09	0.14	–
CP1	0.54	1.21	2.04	
CP2	0.76	1.6	2.68	Ignoring spill over high point
Cent – Offsite		10	23	existing = proposed = ultimate

Hydraulic calculations are discussed in Section VII and included in Appendix B of this report.

VII. HYDRAULICS

This section discusses the hydraulic calculations for the drainage structures, street sections and swales conveying flow from the drainage basins. Ultimate conditions Q₁₀₀ were used for the hydraulic calculations. Normal depth calculations were utilized for all open channel calculations. Inlet calculations include a 50% clogging factor in accordance with the requirements of the Manual. Analyses were completed using Bentley FlowMaster V8i (Reference 4). Per the Manual, proposed finished floor elevations are to be set a vertical distance of twice the depth of flow in the gutter up to a maximum of 18 inches above the Q₁₀₀ water surface. Reference Figure 5 – Drainage Plan. Calculations and x-sections are included in Appendix B.

Structure E1 –

This feature consists of a paved v-swale conveying flows from Basin B through Basin E to the inlet of *Structure E2*. Q₁₀₀ is 0.91 cfs, D₁₀₀ is 0.2 ft and V₁₀₀ is 1.4 fps. Applying the criteria that minimum finished floor elevation is 2x depth of flow and using the flow depth of 0.2 ft at the high end of *Structure E1*, the

minimum FF should be 2375.90'. The proposed finished floor elevation is 2376.25'. The minimum finished floor criteria is satisfied.

Structure E2 –

This feature consists of a 2' wide by 6" deep concrete u-curb channel that conveys the combined flows from Basins B and E (for *E2 west*) to an under-sidewalk drain on Centennial Center Blvd. A similar structure (*E2 east*) conveys flows from the trench drain fed by Basins C and F out to an under-sidewalk drain in Centennial Center Blvd. For *E2 west* Q_{100} is 2.04 cfs, D_{100} is 0.14 ft and V_{100} is 7.14 fps. For *E2 east* Q_{100} is 2.68 cfs, D_{100} is 0.2 ft and V_{100} is 6.79 fps. The minimum adjacent finished floor elevation is not applicable for these structures.

Structure C1 –

This structure is an under-sidewalk drain modified to incorporate a 1-inch depressed flowline providing a curb face of 7 inches. Per Clark County Area Uniform Standard Drawing #236 the heightened curb face consists of a 6-3/8 inch high opening and a 5/8 inch thick cover plate. The sidewalk drain inlet invert is 2374.43'. The drive aisle high point curb flowline east of the inlet is 2374.66'. Therefore the depression at *Structure C1* will only pond to a depth of 0.23 ft before spilling east over the drive aisle high point. At a water surface elevation (WSE) of 2373.95' (below the top cover plate) *Structure C1* (including a 50% clogging factor) will divert 1.54 cfs south into the trench drain *Structure C2*. The balance will continue east within the drive aisle.

Normal depth calculations at the high point (X-Section B) show the full Q_{100} of 2.54 cfs from **Basin C** can flow at a depth of 0.27' (WSE 2374.93') over the high point. Since *Structure S1* diverts some flows to the south and the drive aisle conveys the balance, the Q_{100} of 2.54 cfs from **Basin C** will be sufficiently conveyed through a combination of *Structure C1* and the overflow east in the drive aisle at a maximum water surface elevation of 2374.93'

As described above, without considering any diversion from the sidewalk drain, the Q_{100} passes over the high point at a depth of 0.27'. Applying the criteria that the minimum finished floor elevation shall be 2x depth of flow, then the adjacent existing finished floor should be 0.54' above the high point flowline or 2375.2'. The existing floor was surveyed at 2375.2' and therefore it meets the criteria under the worst case scenario.

Structure C2 –

This structure consists of a 1.67 ft wide x .83 ft (minimum) deep trench drain conveying flows from **Basin C** between the new building and the existing building. The trench drain will include top grates along the entire reach between the two buildings. The grates will function as a relief in the event the trench drain is clogged, for maintenance access and also as a continuous trench drain for surface flows between the buildings. Conservatively, assuming worst case of conveying the full Q_{100} from **Basins C**, the trench drain carries 2.54 cfs at a D_{100} of 0.37 ft at a V_{100} of 4.53 fps. Applying the criteria that minimum finished floor elevation is 2x depth of flow and using the flow depth of 0.37 ft at the high end of *Structure C2*, the minimum FF should be 0.74' above the 2374.2' flowline or 2374.94'. The proposed finished floor elevation is 2376.25'. The existing finished floor for is 2375.2. Therefore minimum finished floor criteria is satisfied.

Reference Figure 5 - Drainage Plan for x-section locations and hydraulic summary table. Reference Appendix B for hydraulic calculations.

VIII. PARKING LOT LOW IMPACT DEVELOPMENT (LID) BEST MANAGEMENT PRACTICES (BMP)

The project disturbs less than one-half acre of existing commercial developed parking lot. Per Section 1500 of the HCDDM, new and redeveloped projects larger than 1.0 acre require low impact development (LID) per the Storm Water Management Plan. Therefore, this project is not required to implement BMP for LID.

IX. CONCLUSIONS & RECOMMENDATIONS

As a result of completing the analysis of the drainage conditions associated with the development, Horrocks Engineers concludes the following:

1. The analysis used in this study is in compliance with the City of Las Vegas and Clark County Regional Flood Control District's Hydrologic Criteria & Drainage Design Manual.
2. Flows generated by and impacting the project site can be safely routed through and around the project to return to the natural flow path in accordance with the criteria of the Manual
3. Finished floor elevations are established in accordance with the Manual.

X. REFERENCES

References

1. *Technical Drainage Study for Centennial Gateway, April 2004 GC Wallace and addenda*
2. *Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual – Adopted August 12, 1999*
3. Win-TR55 Watershed Hydrology Natural Resources Conservation Service
4. FlowMaster Version 8i, Bentley Systems, Inc. Haestad Methods Solution Center, Watertown CT

APPENDIX

A

Appendix A – Hydrologic Calculations

Rainfall References

Existing Condition Hydrologic Calculations

Figure 4 – Existing Conditions Map

Standard Form 4

Peak Runoff Calculations (TR55)

Ultimate Condition

Figure 5 – Ultimate Conditions Map

Figure 6 – Drainage Plan

Standard Form 4

Peak Runoff Calculations (TR55)

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:

June 30, 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:
Centennial Gateway

COPIES TO:

G. C. Wallace, Inc.
Centennial Gateway, LLC.

Cross Streets:

NWC of Ann Road & US 95

File Number:

F:\Depot\DSMemos\DS3569B.doc

Bart Anderson, P.E., DevCo

Parcel Number:

125-27-401-009, -011 & -012

CCRFCD

Zoning Action:

NDOT

FEMA Flood Zone

YES

NO

X

Proposed Storm Drain

YES

X

NO

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID G.R. No.
1 st Submittal	4/28/2004	5/12/2004	Not Approved	\$400.00	123977: \$400
2 nd Submittal	5/25 & 6/28/2004	6/30/2004	See Comments Below	\$400.00	125669: \$400
			TOTAL FEES (LDDRS):	\$800.00	—

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:
	must be resubmitted or supplemented including the following:
X	is conditionally approved subject to Clark County Regional Flood Control District concurrence.

- This drainage study is acceptable in concept**, however, the City of Las Vegas will not formally accept the study until the Clark County Regional Flood Control District (CCRFCD) has issued a letter of concurrence. The Engineer should contact the CCRFCD to confirm that they have begun their review.
- The project proposes to construct facilities and/or increase flows within Nevada Department of Transportation (NDOT) right-of-way. The engineer must contact NDOT for encroachment permit and concurrence for the proposed project.*
- The proposed 20'-public drainage easement (privately maintained) along Ann Road must be dedicated in the final map of the commercial subdivision.
- This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.*
- All drainage facilities within a public drainage easement must be bonded and inspected.
- Sheet C-3: Show and label an existing culvert crossing Ann Road to the south.

7. Sheet C-10: Revise all drop inlets to Modified Type CM or Neenah Pre-cast inlets. Contact Rosa Cortez at 229-6171 for an AutoCAD detail to be included within the improvement plans if Modified Type CM inlets are used. Note that a horizontal protection bar at the curb inlet is not allowed any more.

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

ays

T/R/S: T19S/R60E/27

AREA G-27

Rec'd 5/25/04
DS3569
G-27
\$400.00

**RESPONSE TO COMMENTS
ON THE
TECHNICAL DRAINAGE STUDY
FOR
CENTENNIAL GATEWAY**

822.002

May 2004

Prepared for:

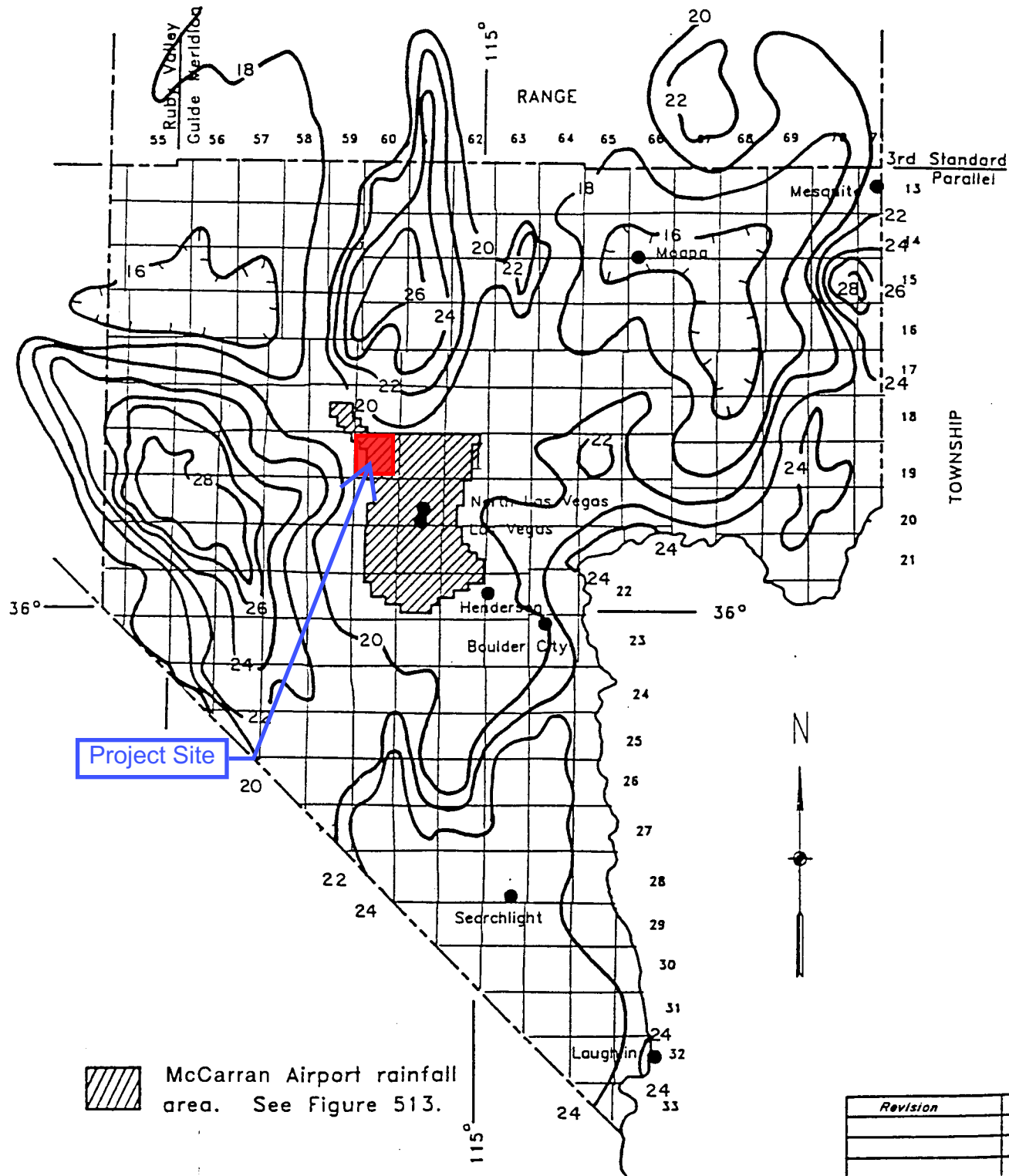
**Centennial Gateway L.L.C.
7448 West Sahara Avenue
Las Vegas, Nevada 89117
Phone: (702) 222-1410
Fax: (702) 227-0746**



G. C. WALLACE, INC.
Engineers/Planners/Surveyors

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

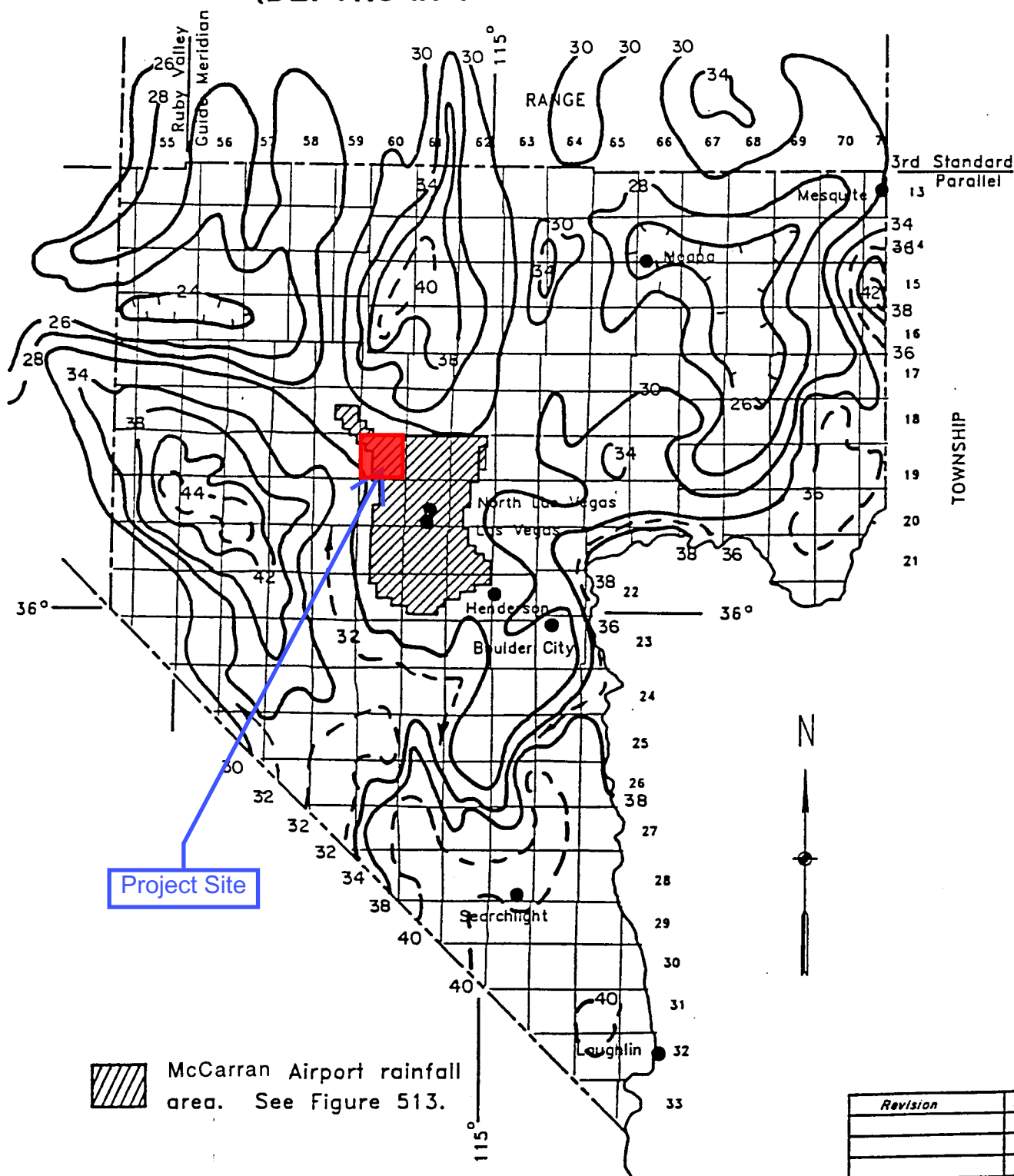
RAINFALL DEPTH-DURATION-FREQUENCY 10-YEAR, 24-HOUR (DEPTHS IN TENTHS OF INCHES)



Revision	Date

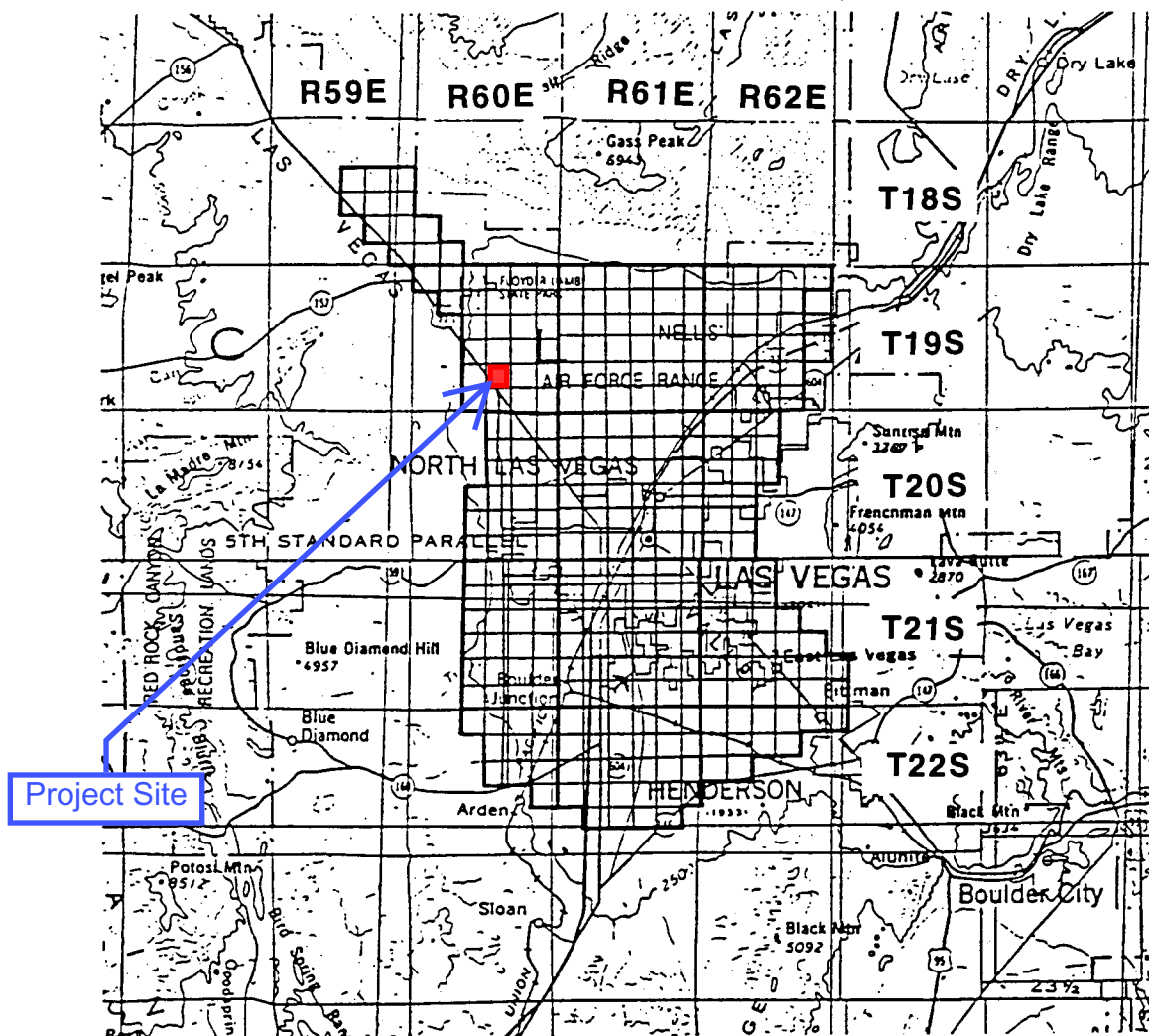
HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 100-YEAR, 24-HOUR (DEPTHS IN TENTHS OF INCHES)



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.

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

HORROCKS ENGINEERS

CENTENNIAL GATEWAY COMMERCIAL PAD (ZUPAS)

Sub-Basin Data						Initial/Overland Time (t _i)			Travel Time (t _t)						(Urbanized Basins) (Urbanized Basins)		Calc t _c	Min t _c	Calc t _{lag}	
Desig: (1)	Exist or Dev? (16)	CN (2)	K (3)	Area Ac (4)	Area Sq Mi (5)	Length Ft (6)	Slope % (7)	t _i Min (8)	Length Ft (9)	Slope % (10)	V1 _{Exist} FPS (11)	V2 _{Exist} FPS (12)	V1 _{Dev} FPS (13)	V2 _{Dev} FPS (14)	t _t Min (15)	Total Length Ft (16)	t _o Min (17)	Min (18)	Min (19)	Hrs (20)

EXISTING COND.

AREA A	Dev	98	0.90	0.48	0.0007	100	1.90	2.9	140	1.90	-	-	2.8	4.2	0.8	240	11.3	3.7	5.0	0.1	*Min T _C = 5.0 Mins
AREA C (ex)	Dev	98	0.90	1.25	0.0020	100	1.95	2.8	284	1.95	-	-	2.8	4.3	1.7	384	12.1	4.5	5.0	0.1	*Min T _C = 5.0 Mins
AREA D	Dev	98	0.90	0.30	0.0005	100	1.48	3.1	193	1.48	-	-	2.5	3.7	1.3	293	11.6	4.4	5.0	0.1	*Min T _C = 5.0 Mins

PROPOSED COND.

AREA A	Dev	98	0.90	0.48	0.0007	100	1.90	2.9	140	1.90	-	-	2.8	4.2	0.8	240	11.3	3.7	5.0	0.1	*Min T _C = 5.0 Mins
AREA B	Dev	98	0.90	0.24	0.0004	100	2.24	2.7	129	2.24	-	-	3.0	4.6	0.7	229	11.3	3.4	5.0	0.1	*Min T _C = 5.0 Mins
AREA C	Dev	98	0.90	0.68	0.0011	100	1.74	2.9	196	1.74	-	-	2.7	4.0	1.2	296	11.6	4.2	5.0	0.1	*Min T _C = 5.0 Mins
AREA D	Dev	98	0.90	0.30	0.0005	100	1.48	3.1	193	1.48	-	-	2.5	3.7	1.3	293	11.6	4.4	5.0	0.1	*Min T _C = 5.0 Mins
AREA E	Dev	98	0.90	0.30	0.0005	100	1.68	3.0	21	1.68	-	-	2.6	4.0	0.1	121	10.7	3.1	5.0	0.1	*Min T _C = 5.0 Mins
AREA F	Dev	98	0.90	0.04	0.0001	67	1.54	2.5	0	0.00	-	-	0.0	0.0	0.0	67	10.4	2.5	5.0	0.1	*Min T _C = 5.0 Mins

$$t_c = t_i + t_t$$

$$t_i = 1.8(1.1 - K)L^{1/2}/S^{1/3}$$

$$K = 0.0132(CN) - 0.39$$

$$t_{lag} = 0.6t_c$$

$$t_c \text{ Check (Dev)} = L/180 + 10$$

For the travel time (t_t) calculations,

V1 applies to the first 500 feet of travel distance;

V2 applies to the remaining travel distance

$$\text{Existing } V1 = 14.8(S/100)^{1/2}$$

$$\text{Existing } V2 = 29.4(S/100)^{1/2}$$

Min T_c (Exist)=10 Min per section 602

$$\text{Developed } V1 = 20.2(S/100)^{1/2}$$

$$\text{Developed } V1 = 30.6(S/100)^{1/2}$$

*Min T_c (Dev)=5 Min per section**Min T_c (Dev)=6 Min (0.10 hr)

TR-55 - EXISTING CONDITIONS

WinTR-55 Current Data Description

--- Identification Data ---

User:	J Clegg	Date:	6/29/2017
Project:	Centennial Gateway	Units:	English
SubTitle:	Existing Conditions	Areal Units:	Acres
State:	Nevada		
County:	Las Vegas-S		
Filename:	H:\!2017\LV-811-1706 Zupa Site Civil Engineering\Project Data\Design\Hydraulics\Analysis\TR-55		

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	Tc

C (ex)		Outlet	1.25	98	0.1

Total area: 1.25 (ac)

--- Storm Data ---

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)

1.2	1.6	1.8	2.4	2.7	2.96	.0

Storm Data Source:	User-provided custom storm data
Rainfall Distribution Type:	Type II
Dimensionless Unit Hydrograph:	<standard>

TR-55 - EXISTING CONDITIONS

J Clegg

Centennial Gateway
Existing Conditions
Las Vegas-S County, Nevada

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
1.2	1.6	1.8	2.4	2.7	2.96	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

TR-55 - EXISTING CONDITIONS

J Clegg

Centennial Gateway
Existing Conditions
Las Vegas-S County, Nevada

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period	
	10-Yr (cfs)	100-Yr (cfs)

SUBAREAS		
C (ex)	2.78	4.67
REACHES		
OUTLET	2.78	4.67

TR-55 - EXISTING CONDITIONS

J Clegg

Centennial Gateway
Existing Conditions
Las Vegas-S County, Nevada

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow 10-Yr (cfs) (hr)	Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
------------------------------------	-------------------------------------	---

SUBAREAS

C (ex)	2.78	4.67
	11.93	11.92

REACHES

OUTLET	2.78	4.67
--------	------	------

TR-55 - EXISTING CONDITIONS

J Clegg

Centennial Gateway
Existing Conditions
Las Vegas-S County, Nevada

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description

C (ex)	1.25	0.100	98	Outlet	
Total Area: 1.25 (ac)					

TR-55 - EXISTING CONDITIONS

J Clegg

Centennial Gateway
Existing Conditions
Las Vegas-S County, Nevada

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)

C (ex)							
SHEET	100	0.0195	0.011				0.033
SHALLOW	284	0.0195	0.025				0.028
Time of Concentration							0.1
							=====

TR-55 - EXISTING CONDITIONS

J Clegg

Centennial Gateway
Existing Conditions
Las Vegas-S County, Nevada

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
C (ex)	Paved parking lots, roofs, driveways	D	1.251	98
Total Area / Weighted Curve Number			1.25	98
			====	==

TR-55 - PROPOSED / ULTIMATE CONDITIONS

WinTR-55 Current Data Description

--- Identification Data ---

User: J Clegg Date: 6/28/2017
Project: Centennial Gateway Units: English
SubTitle: Areal Units: Acres
State: Nevada
County: Las Vegas-S
Filename: C:\Users\JClegg\Desktop\Centennial Gateway\20170627 Centennial Gateway.w55

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	Tc
C		Basin F	0.68	98	0.1
A		Outlet	0.48	98	0.1
B		Basin E	0.24	98	0.1
D		Outlet	0.3	98	0.1
E		Outlet	0.3	98	0.1
F		Outlet	0.04	98	0.1

Total area: 2.04 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
1.2	1.6	1.8	2.4	2.7	2.96	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
1.2	1.6	1.8	2.4	2.7	2.96	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period	
	10-Yr (cfs)	100-Yr (cfs)

SUBAREAS		
C	1.51	2.54
A	1.07	1.80
B	0.54	0.91
D	0.67	1.13
E	0.67	1.13
F	0.09	0.14
REACHES		
Basin E	0.54	0.91
Down	0.54	0.91
Basin F	1.51	2.54
Down	1.51	2.54
OUTLET		
	4.54	7.64

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow 10-Yr (cfs) (hr)	Peak Time (hr) by Rainfall Return Period 100-Yr (cfs) (hr)
------------------------------------	-------------------------------------	---

SUBAREAS

C	1.51	2.54
	11.93	11.92
A	1.07	1.80
	11.93	11.92
B	0.54	0.91
	11.93	11.92
D	0.67	1.13
	11.93	11.92
E	0.67	1.13
	11.93	11.92
F	0.09	0.14
	11.93	11.92

REACHES

Basin E	0.54	0.91
	11.93	11.92
Down	0.54	0.91
	11.93	11.93
Basin F	1.51	2.54
	11.93	11.92
Down	1.51	2.54
	11.93	11.93

OUTLET	4.54	7.64
--------	------	------

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
C	.68	0.100	98	Basin F	
A	.48	0.100	98	Outlet	
B	.24	0.100	98	Basin E	
D	.30	0.100	98	Outlet	
E	.30	0.100	98	Outlet	
F	.04	0.100	98	Outlet	

Total Area: 2.04 (ac)

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Basin E	Outlet	79	CHANNEL
Basin F	Outlet	67	CHANNEL

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)

C							
SHEET	100	0.0174	0.011				0.035
SHALLOW	196	0.0174	0.025				0.020
					Time of Concentration		0.1
							=====
A							
SHEET	100	0.0190	0.011				0.034
SHALLOW	140	0.0190	0.025				0.014
					Time of Concentration		0.1
							=====
B							
SHEET	100	0.0224	0.011				0.032
SHALLOW	129	0.0224	0.025				0.012
					Time of Concentration		0.1
							=====
D							
SHEET	100	0.0148	0.011				0.037
SHALLOW	193	0.0148	0.025				0.022
					Time of Concentration		0.1
							=====
E							
SHEET	100	0.0168	0.011				0.035
SHALLOW	21	0.0168	0.025				0.002
					Time of Concentration		0.1
							=====
F							
SHEET	67	0.0154	0.011				0.027
					Time of Concentration		0.1
							=====

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
C	Paved parking lots, roofs, driveways	D	.677	98
	Total Area / Weighted Curve Number		.68 ===	98 ==
A	Paved parking lots, roofs, driveways	D	.476	98
	Total Area / Weighted Curve Number		.48 ===	98 ==
B	Paved parking lots, roofs, driveways	D	.236	98
	Total Area / Weighted Curve Number		.24 ===	98 ==
D	Paved parking lots, roofs, driveways	D	.298	98
	Total Area / Weighted Curve Number		.3 ==	98 ==
E	Paved parking lots, roofs, driveways	D	.301	98
	Total Area / Weighted Curve Number		.3 ==	98 ==
F	Paved parking lots, roofs, driveways	D	.038	98
	Total Area / Weighted Curve Number		.04 ===	98 ==

TR-55 - PROPOSED / ULTIMATE CONDITIONS

J Clegg

Centennial Gateway

Las Vegas-S County, Nevada

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Basin E	79	0.013	0.016	2	50 :1
Basin F	67	0.013	0.015	2	.1 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Basin E	0.0	0.000	0	2	0.016
	0.5	62.792	13.5	52	
	1.0	379.278	52	102	
	2.0	2346.934	204	202	
	5.0	26597.015	1260	502	
	10.0	167988.180	5020	1002	
	20.0	1063827.22	20040	2002	
Basin F	0.0	0.000	0	2	0.015
	0.5	8.089	1	2.1	
	1.0	22.056	2.1	2.2	
	2.0	57.714	4.4	2.4	
	5.0	207.071	12.5	3	
	10.0	594.567	30	4	
	20.0	1980.929	80	6	

APPENDIX B

Appendix B – Hydraulic Calculations

Structure C1

Structure C2

Structure E1

Structure E2

Street Section – Centennial Center Blvd

Street Section – Drive Aisle High Point

Street Section – Drive Aisle @ High Side Proposed Building

Worksheet for Drive Aisle (West) - 1.1 pct cross slope w 100-yr 2.54

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.100	%
Discharge	2.54	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
0+00.00	2376.2
0+06.50	2376.1
0+06.54	2375.6
0+08.04	2375.8
0+29.50	2376.0
0+30.00	2376.5
0+32.13	2376.5
0+38.51	2376.5

Roughness Segment Definitions

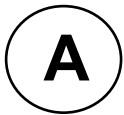
Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2376.25)	(0+38.51, 2376.58)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.354	ft
Elevation Range	2375.63 to 2376.58 ft	
Flow Area	1.31	ft²
Wetted Perimeter	14.78	ft
Hydraulic Radius	0.089	ft



Worksheet for Drive Aisle (West) - 1.1 pct cross slope w 100-yr 2.54

Results

Top Width	14.44	ft
Normal Depth	0.354	ft
Critical Depth	0.36	ft
Critical Slope	0.00843	ft/ft
Velocity	1.94	ft/s
Velocity Head	0.06	ft
Specific Energy	0.41	ft
Froude Number	1.13	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.354	ft
Critical Depth	0.36	ft
Channel Slope	1.100	%
Critical Slope	0.00843	ft/ft

Messages

Notes

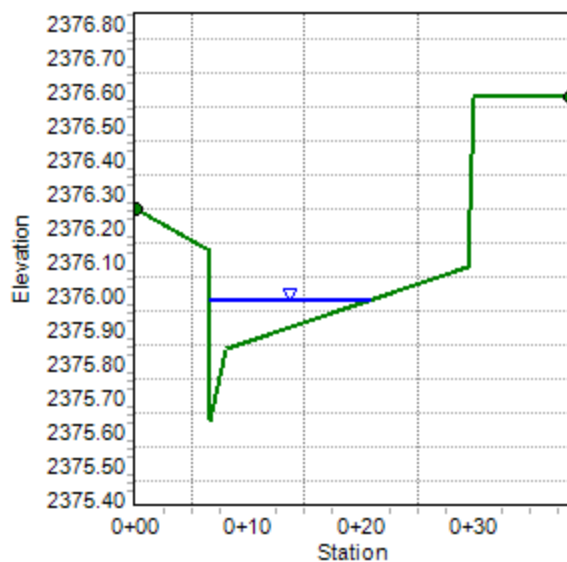
This is a cross section of the curb and gutters and road between them to calculate the normal depth of the 100 Yr flow of 2.54 cfs

Cross Section for Drive Aisle (West) - 1.1 pct cross slope w 100-yr 2.54**Project Description**

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.100	%
Normal Depth	0.354	ft
Discharge	2.54	ft ³ /s

Cross Section Image

Project Description

**Overflow @
drive aisle high
point**

Manning Formula

Normal Depth

Input Data

0.100 %

2.54 ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2375.26
0+06.50	2375.16
0+06.54	2374.66
0+08.04	2374.78
0+29.50	2374.80
0+30.00	2375.49
0+32.13	2375.49
0+38.51	2375.49

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2375.26)	(0+38.51, 2375.49)	0.016

Options

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

Results

0.266 ft

2374.66 to 2375.49 ft

3.23 ft²

23.39 ft

0.138 ft

Horrocks Engineers

Worksheet for Drive Aisle - 0.1 pct cross slope w 100-yr 2.54 cfs

Results

Top Width	23.07	ft
Normal Depth	0.266	ft
Critical Depth	0.20	ft
Critical Slope	0.00907	ft/ft
Velocity	0.79	ft/s
Velocity Head	0.01	ft
Specific Energy	0.28	ft
Froude Number	0.37	
Flow Type	Subcritical	

**Overflow @
drive aisle high
point**

GVF Input Data

Downstream Depth	0.000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.266	ft
Critical Depth	0.20	ft
Channel Slope	0.100	%
Critical Slope	0.00907	ft/ft

Messages

B

Project Description

Manning Formula

Normal Depth

**Overflow @
drive aisle high
point**

Channel Slope

0.100 %

0.266 ft

 $2.54 \text{ ft}^3/\text{s}$

The profile view graph shows the vertical alignment of the road. The green line represents the existing ground profile, which starts at an elevation of approximately 2375.25 at station 0+00, drops to a minimum of about 2374.68 at station 0+05, and then rises to 2375.50 at station 0+20. The blue horizontal line represents the proposed grade, which is constant at an elevation of 2374.90 from station 0+00 to 0+20. The magenta dashed line represents the existing ground profile, which starts at an elevation of approximately 2374.78 at station 0+00 and rises to about 2374.82 at station 0+20.

Analyzed condition CONSERVATIVE
(cross slope = 0.1%)

As-built condition (cross slope = - 0.2%)

Drive aisle actually flows drain away from curb in vicinity of drive aisle high point. Therefore modeled condition is conservative and flow depths are actually lower in the field

C1

Worksheet for 19.5" wide Curb Inlet - no clog - balance overflow

Project Description

Solve For Spread **condition**Solve For Spread **condition**

***free flow
condition***

Input Data

Discharge	2.30	ft³/s
Gutter Width	1.50	ft
Gutter Cross Slope	8.33	%
Road Cross Slope	1.36	%
Curb Opening Length	1.62	ft
Opening Height	6.25	in
Curb Throat Type	Horizontal	
Local Depression	1.000	in
Local Depression Width	1.50	ft
Throat Incline Angle	90.00	degrees

Results

Spread	30.84	ft
Depth	0.524	ft
Gutter Depression	1.255	in
Total Depression	2.25	in

Messages

Notes

Cross Section for 19.5" wide Curb Inlet - no clog - balance overflow

Project Description

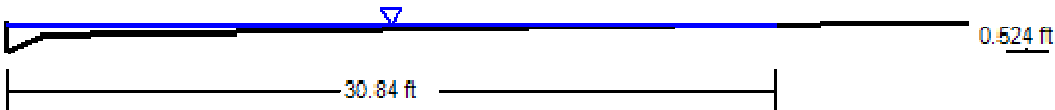
Solve ForSpread

free flow condition

Input Data

Discharge		2.30	ft³/s
Spread		30.84	ft
Gutter Width		1.50	ft
Gutter Cross Slope		8.33	%
Road Cross Slope		1.36	%
Curb Opening Length		1.62	ft
Opening Height		6.25	in
Curb Throat Type	Horizontal		
Local Depression		1.000	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

Cross Section Image



V: 2

H: 1

Worksheet for 19.5" wide Curb Inlet - w 50 pct clog factor 1.54 cfs -**Project Description**

Solve For

Spread

w/ 50% clog factor**Input Data**

Discharge		1.54	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		8.33	%
Road Cross Slope		1.36	%
Curb Opening Length		1.10	ft
Opening Height		6.30	in
Curb Throat Type	Horizontal		
Local Depression		1.000	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

Results

Spread	30.42	ft
Depth	0.518	ft
Gutter Depression	1.255	in
Total Depression	2.25	in

Messages

Notes

Flow is fixed at 2.54 cfs for the 100 Yr storm event.
 Max water surface elevation is 2 inches below Top Back Curb.

Cross Section for 19.5" wide Curb Inlet - w 50 pct clog factor 1.54 cfs

Project Description

Solve For

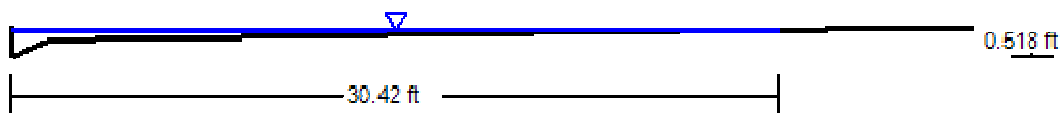
Spread

w/ 50% clog factor

Input Data

Discharge	1.54	ft ³ /s
Spread	30.42	ft
Gutter Width	1.50	ft
Gutter Cross Slope	8.33	%
Road Cross Slope	1.36	%
Curb Opening Length	1.10	ft
Opening Height	6.30	in
Curb Throat Type	Horizontal	
Local Depression	1.000	in
Local Depression Width	1.50	ft
Throat Incline Angle	90.00	degrees

Cross Section Image

**SW Drain Clogging Factor Calculation:** **$w = \text{modeled width}$** **$w * 150\% = 19.75''$ (width of standard SW Drain)** **$w = 13.2'' = 1.1 \text{ ft}$ allowing 50% increase for clogging**

V: 2
H: 1

Worksheet for C2 - Trench Nuisance Drain 18" wide

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Bottom Width	1.50	ft
Discharge	2.54	ft ³ /s

Results

Normal Depth	0.37	ft
Flow Area	0.56	ft ²
Wetted Perimeter	2.25	ft
Hydraulic Radius	0.25	ft
Top Width	1.50	ft
Critical Depth	0.45	ft
Critical Slope	0.00601	ft/ft
Velocity	4.53	ft/s
Velocity Head	0.32	ft
Specific Energy	0.69	ft
Froude Number	1.31	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.37	ft
Critical Depth	0.45	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00601	ft/ft

Worksheet for C2 - Trench Nuisance Drain 18" wide

Messages

Notes

Concrete trench drain conveying flows from structure C1

Cross Section for C2 - Trench Nuisance Drain 18" wide

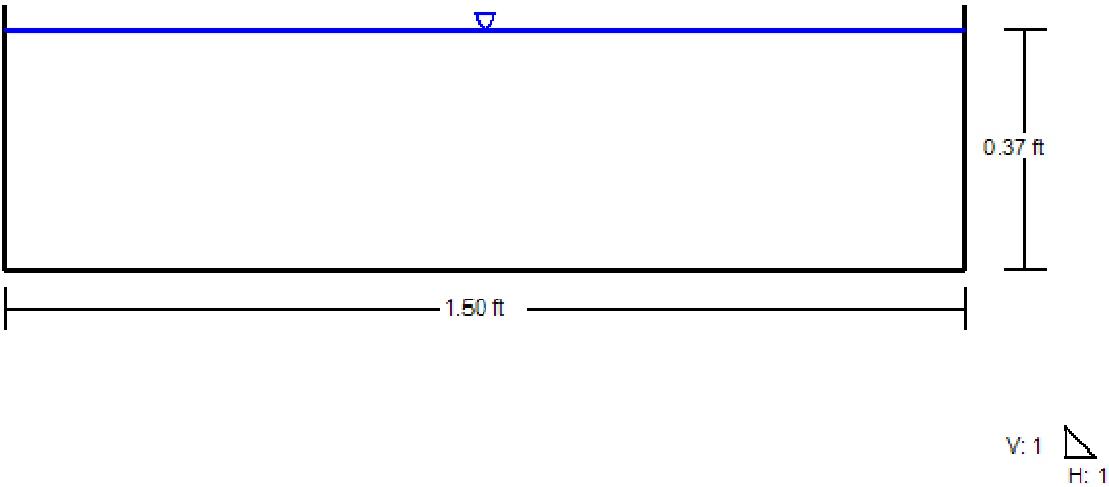
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	0.37	ft
Bottom Width	1.50	ft
Discharge	2.54	ft³/s

Cross Section Image



Worksheet for D - paved V-swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.00900	ft/ft
Left Side Slope	67.00	ft/ft (H:V)
Right Side Slope	100.00	ft/ft (H:V)
Discharge	0.91	ft ³ /s

Results

Normal Depth	0.10	ft
Flow Area	0.78	ft ²
Wetted Perimeter	16.12	ft
Hydraulic Radius	0.05	ft
Top Width	16.12	ft
Critical Depth	0.09	ft
Critical Slope	0.01034	ft/ft
Velocity	1.17	ft/s
Velocity Head	0.02	ft
Specific Energy	0.12	ft
Froude Number	0.94	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.10	ft
Critical Depth	0.09	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.01034	ft/ft

Cross Section for D - paved V-swale

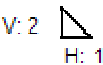
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.00900	ft/ft
Normal Depth	0.10	ft
Left Side Slope	67.00	ft/ft (H:V)
Right Side Slope	100.00	ft/ft (H:V)
Discharge	0.91	ft³/s

Cross Section Image



Worksheet for E2 - Concrete U-curb 2.68 cfs

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03900	ft/ft
Bottom Width	2.00	ft
Discharge	2.68	ft³/s

Results

Normal Depth	0.20	ft
Flow Area	0.39	ft²
Wetted Perimeter	2.39	ft
Hydraulic Radius	0.16	ft
Top Width	2.00	ft
Critical Depth	0.38	ft
Critical Slope	0.00522	ft/ft
Velocity	6.79	ft/s
Velocity Head	0.72	ft
Specific Energy	0.91	ft
Froude Number	2.70	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.38	ft
Channel Slope	0.03900	ft/ft
Critical Slope	0.00522	ft/ft

Cross Section for E2 - Concrete U-curb 2.68 cfs

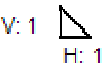
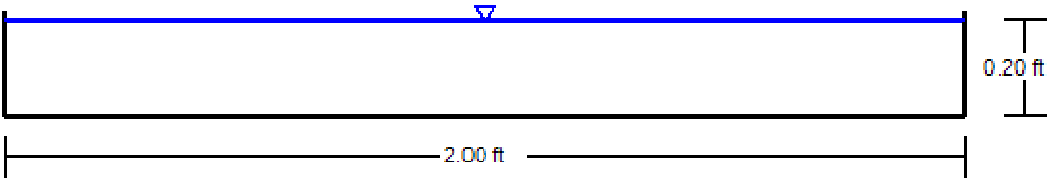
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03900	ft/ft
Normal Depth	0.20	ft
Bottom Width	2.00	ft
Discharge	2.68	ft³/s

Cross Section Image



Worksheet for E2 - Concrete U-curb 2.04 cfs

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.06700	ft/ft
Bottom Width	2.00	ft
Discharge	2.04	ft ³ /s

Results

Normal Depth	0.14	ft
Flow Area	0.28	ft ²
Wetted Perimeter	2.28	ft
Hydraulic Radius	0.12	ft
Top Width	2.00	ft
Critical Depth	0.32	ft
Critical Slope	0.00521	ft/ft
Velocity	7.30	ft/s
Velocity Head	0.83	ft
Specific Energy	0.97	ft
Froude Number	3.44	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.32	ft
Channel Slope	0.06700	ft/ft
Critical Slope	0.00521	ft/ft

Cross Section for E2 - Concrete U-curb 2.04 cfs

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Roughness Coefficient

0.013

Channel Slope

0.06700

ft/ft

Normal Depth

0.14

ft

Bottom Width

2.00

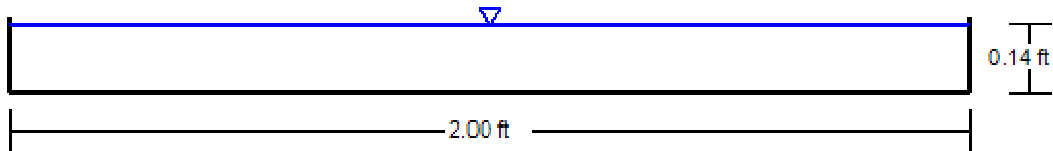
ft

Discharge

2.04

ft³/s

Cross Section Image



V: 1

H: 1



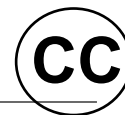
Friction Method	Manning Formula
Solve For	Normal Depth

Channel Slope	0.00700	ft/ft
Discharge	23.00	ft³/s
Section Definitions		

Roughness Segment Definitions

Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method



Worksheet for Centennial Ctr X-section 23 cfs

Results

Normal Depth		0.56	ft
Elevation Range	9.50 to 15.00 ft		
Flow Area		9.07	ft ²
Wetted Perimeter		48.68	ft
Hydraulic Radius		0.19	ft
Top Width		47.83	ft
Normal Depth		0.56	ft
Critical Depth		0.56	ft
Critical Slope		0.00664	ft/ft
Velocity		2.54	ft/s
Velocity Head		0.10	ft
Specific Energy		0.66	ft
Froude Number		1.03	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.56	ft
Critical Depth	0.56	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00664	ft/ft

Cross Section for Centennial Ctr X-section 23 cfs

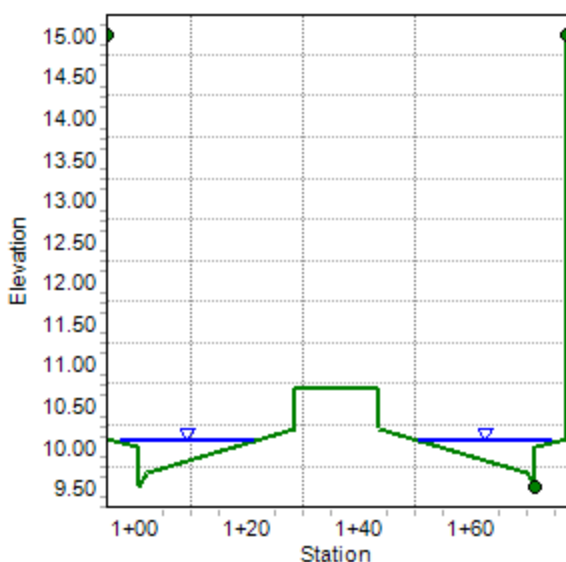
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00700	ft/ft
Normal Depth	0.56	ft
Discharge	23.00	ft ³ /s

Cross Section Image



APPENDIX C

Appendix C – Inserts

Grading Plan

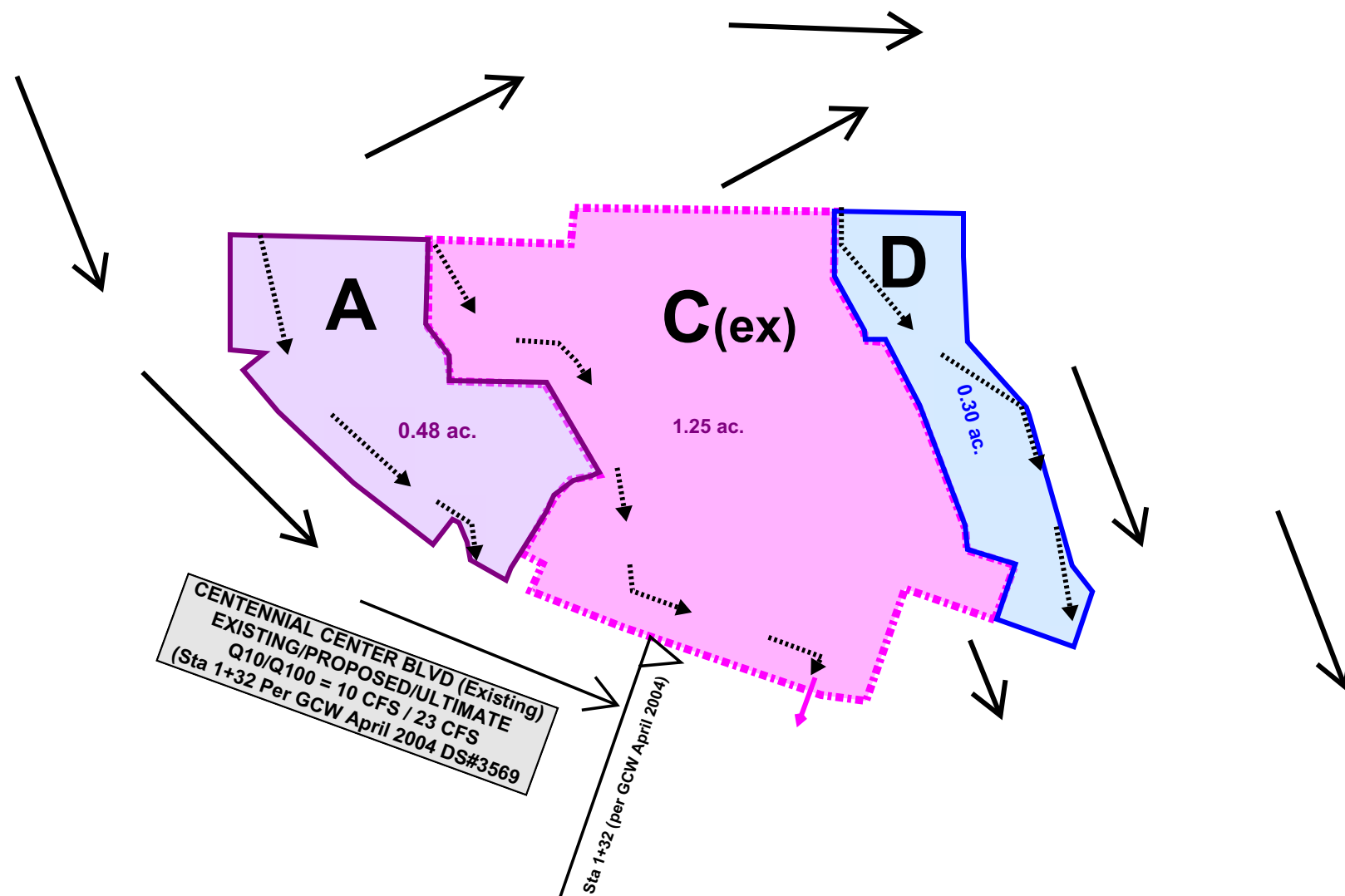


Table 1 – Summary of Existing Drainage			
Drainage Sub-basin	Existing Q ₁₀ cfs	Existing Q ₁₀₀ cfs	Notes
A	1.07	1.81	existing = proposed = ultimate
C(ex)	2.78	4.67	
D	0.67	1.13	existing = proposed = ultimate
CENT - OFFSITE	10	23	existing = proposed = ultimate

UNDERLYING BACKGROUND FOR DRAINAGE
BASINS IS: GRADING PLAN - CENTENNIAL
GATEWAY BY GC WALLACE
(CLV DWG # 107V4179-PH1)

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**FIGURE 3 -
EXISTING
DRAINAGE
CONDITIONS**

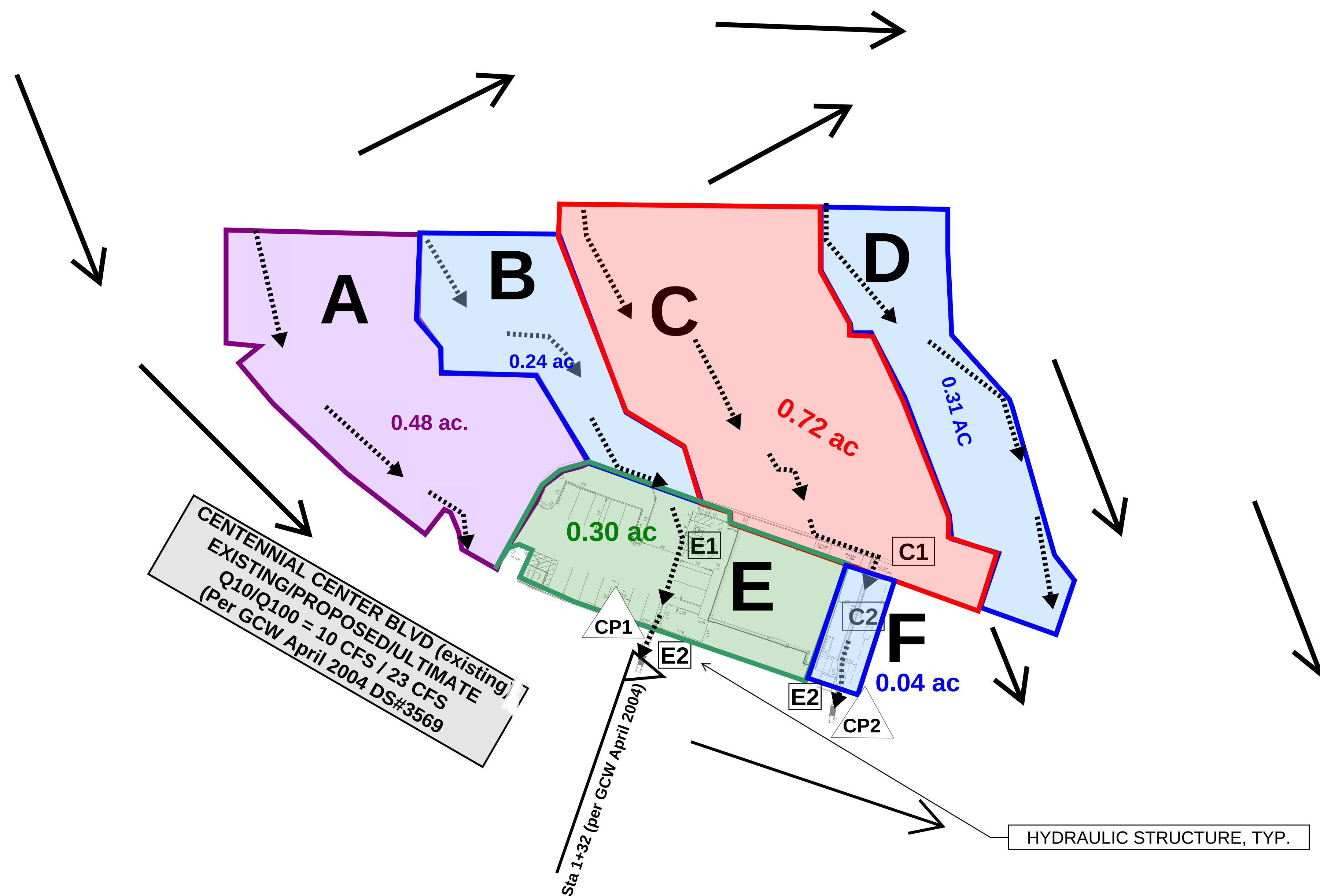


Table 2 – Summary of Ultimate Drainage			
Drainage Sub-basin	Ultimate Q ₁₀ cfs	Ultimate Q ₁₀₀ cfs	Notes
A	1.07	1.8	existing = proposed = ultimate
B	0.54	0.91	
C	1.51	2.54	
D	0.67	1.13	existing = proposed = ultimate
E	0.67	1.13	
CP1	1.21	2.04	B+E
CP2	1.6	2.68	C+F
F	0.09	0.14	
CENT - OFFSITE	10	23	existing = proposed = ultimate

UNDERLYING BACKGROUND FOR DRAINAGE
BASINS IS: GRADING PLAN - CENTENNIAL
GATEWAY BY GC WALLACE
(CLV DWG # 107V4179-PH1)

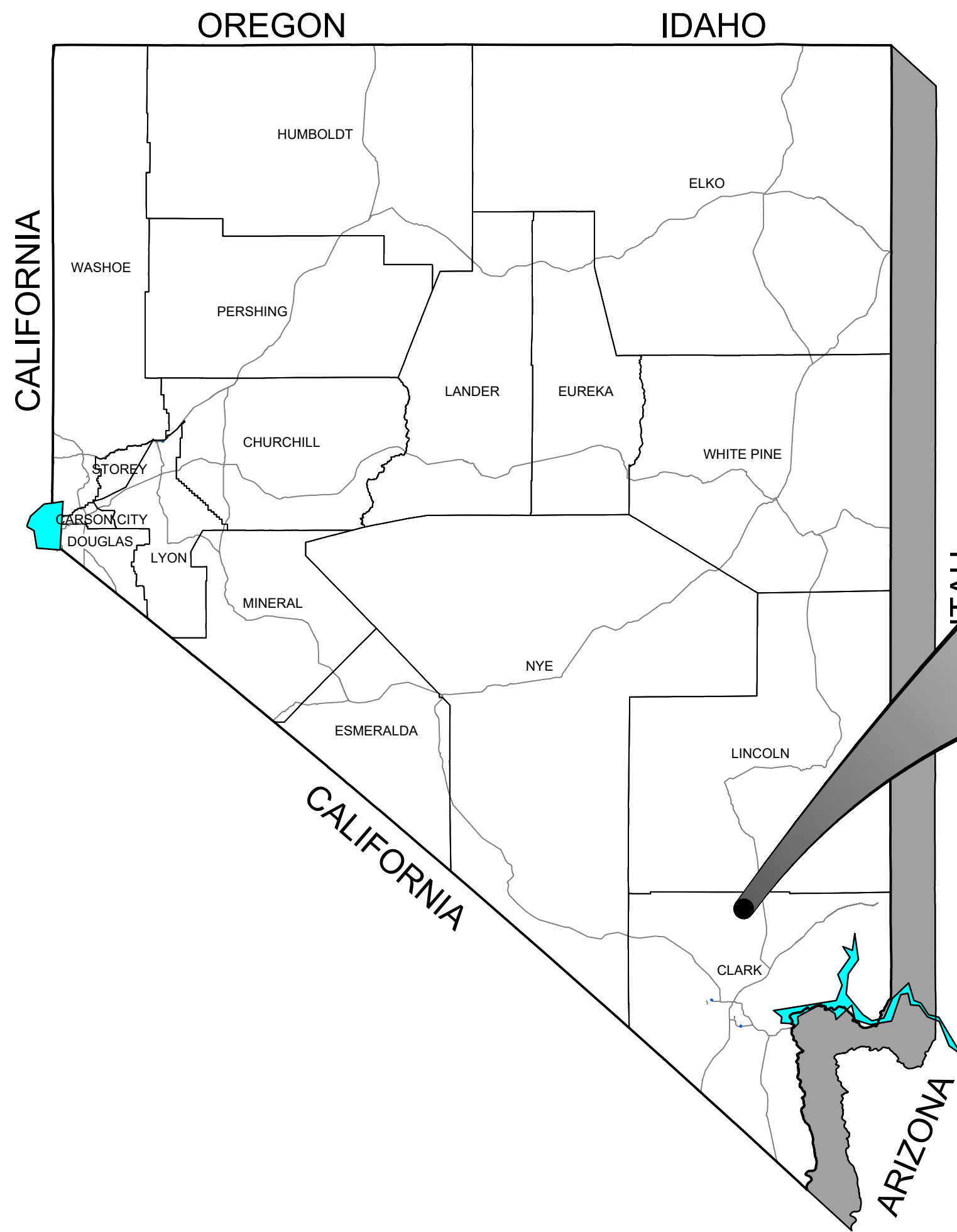
Centennial Gateway Building Pad
by TAG Centennial Common Owners

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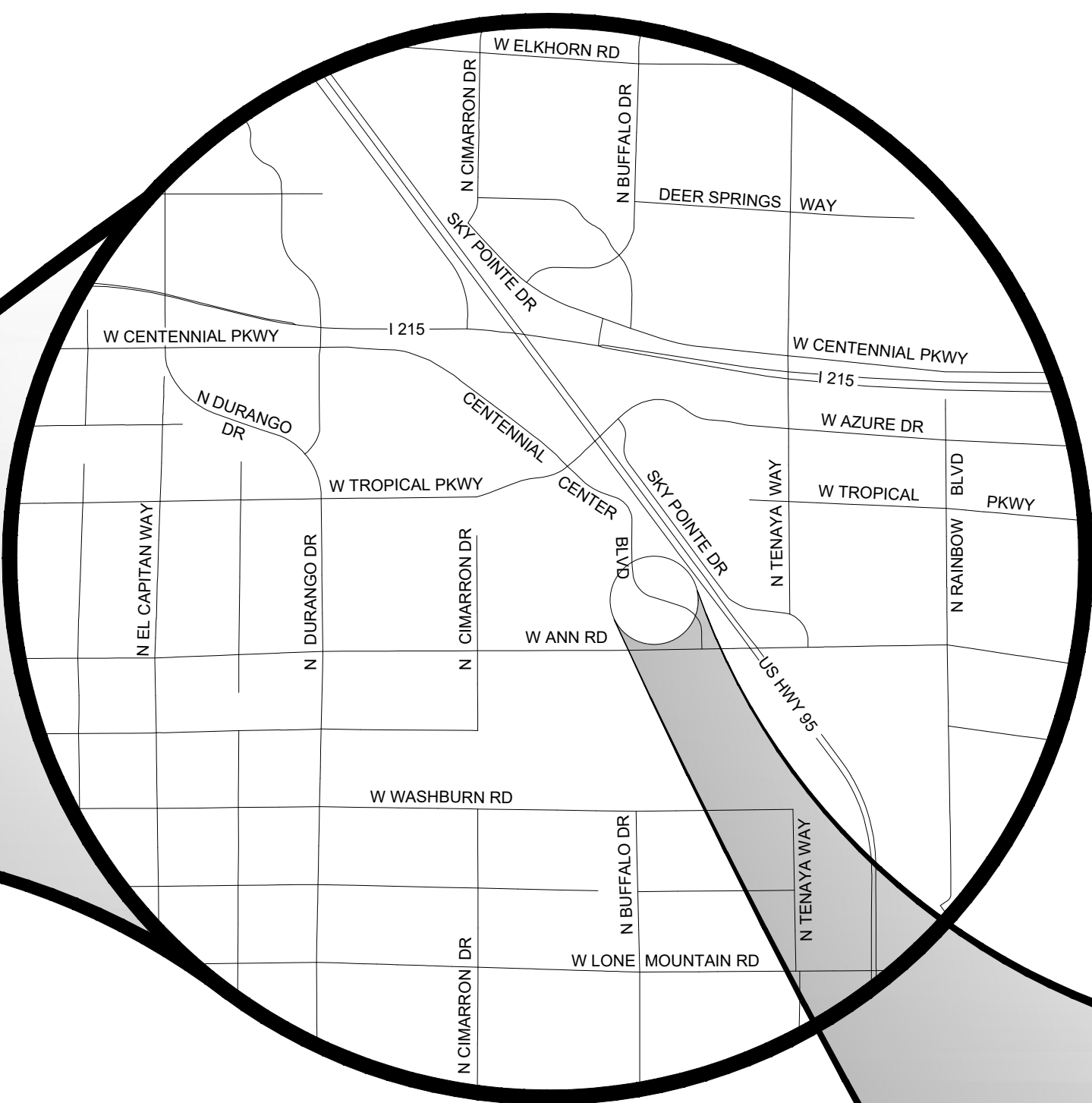
**FIGURE 4 -
ULTIMATE DRAINAGE
CONDITIONS**

IMPROVEMENT DRAWINGS
FOR
CENTENNIAL GATEWAY BUILDING PAD

CENTENNIAL GATEWAY
LAS VEGAS, NV 89149
APN #125-27-411-007



STATE MAP



VICINITY MAP

SHEET INDEX		
PAGE #	SHEET #	SHEET TITLE
1	C0.0	COVER SHEET
2	C0.1	NOTES
3	C2.0	GRADING PLAN
4	C5.0	DETAILS

ENGINEER:
HORROCKS ENGINEERS
1349 Galleria Dr., Suite 110
Henderson, NV 89014
(702) 966-4063
CONTACT: LARRY BITTON, PE

UTILITIES:
POWER- NEVADA ENERGY
GAS- SOUTHWEST GAS
SEWER- CITY OF LAS VEGAS
WATER- LVWWD

APPLICANT:
BABCOCK DESIGN
52 EXCHANGE PLACE
SALT LAKE CITY, UT 84111
(801) 531-1144
CONTACT: JAMIN KUNZ

OWNER:
TAG CENTENNIAL COMMON
3900 S HUALAPAI WAY, SUITE 200
LAS VEGAS, NV 89147
(702) 888-3500
CONTACT: AGUS ALAMSJAH

BENCHMARK

CITY OF LAS VEGAS BENCHMARK
ID NO. 6LV9027SWW6
RIVET AND PLATE IN TOP OF CURB ON
THE WEST SIDE OF CENTENNIAL CENTER BOULEVARD
1320. +/- NORTH OF ANN ROAD

ELEVATION 724.838 METERS (NAVD88)
2374.69 FEET

PROJECT DATUM IS +0.91 FEET FROM CITY DATUM

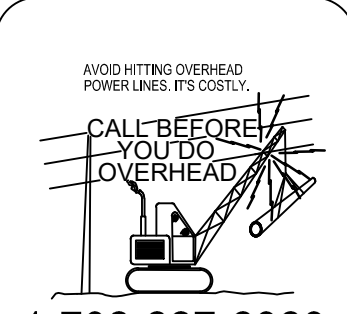
BASIS OF BEARING

NORTH 00° 18' 05" WEST

BEING THE WEST LINE OF THE SOUTHWEST QUARTER OF
THE SOUTHWEST QUARTER OF SECTION 27, TOWNSHIP 19
SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS,
CLARK COUNTY, NEVADA, AS SHOWN ON THE RECORDED
FINAL MAP OF CENTENNIAL GATEWAY, BOOK 124, PAGE 44
OF "PLATS, OFFICIAL RECORDS OF CLARK COUNTY,
NEVADA.



PROJECT SITE



HORROCKS

ENGINEERS

1349 Galleria Dr., Suite 110

Henderson, NV 89014

(702) 966-4063

www.horrock.com

WARNING

0 1 2

IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

REVISIONS

REV # DATE

DRAWING INFO

DATE 12 JULY 2017

DESIGNED MDP

DRAWN MDP

CHECKED LMB

PROJECT LV-811-1706

PROFESSIONAL ENGINEER - STATE OF NEVADA

LARRY M. BITTON

EXP. 12-31-18

CIVIL

7/12/17

CENTENNIAL GATEWAY BUILDING PAD

CENTENNIAL GATEWAY

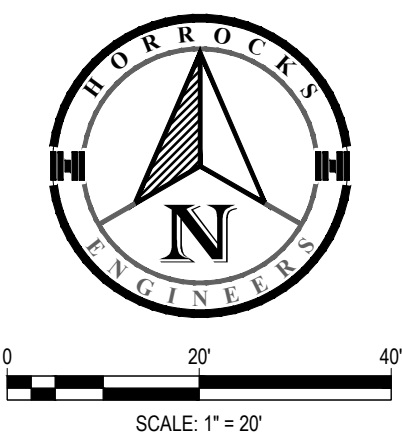
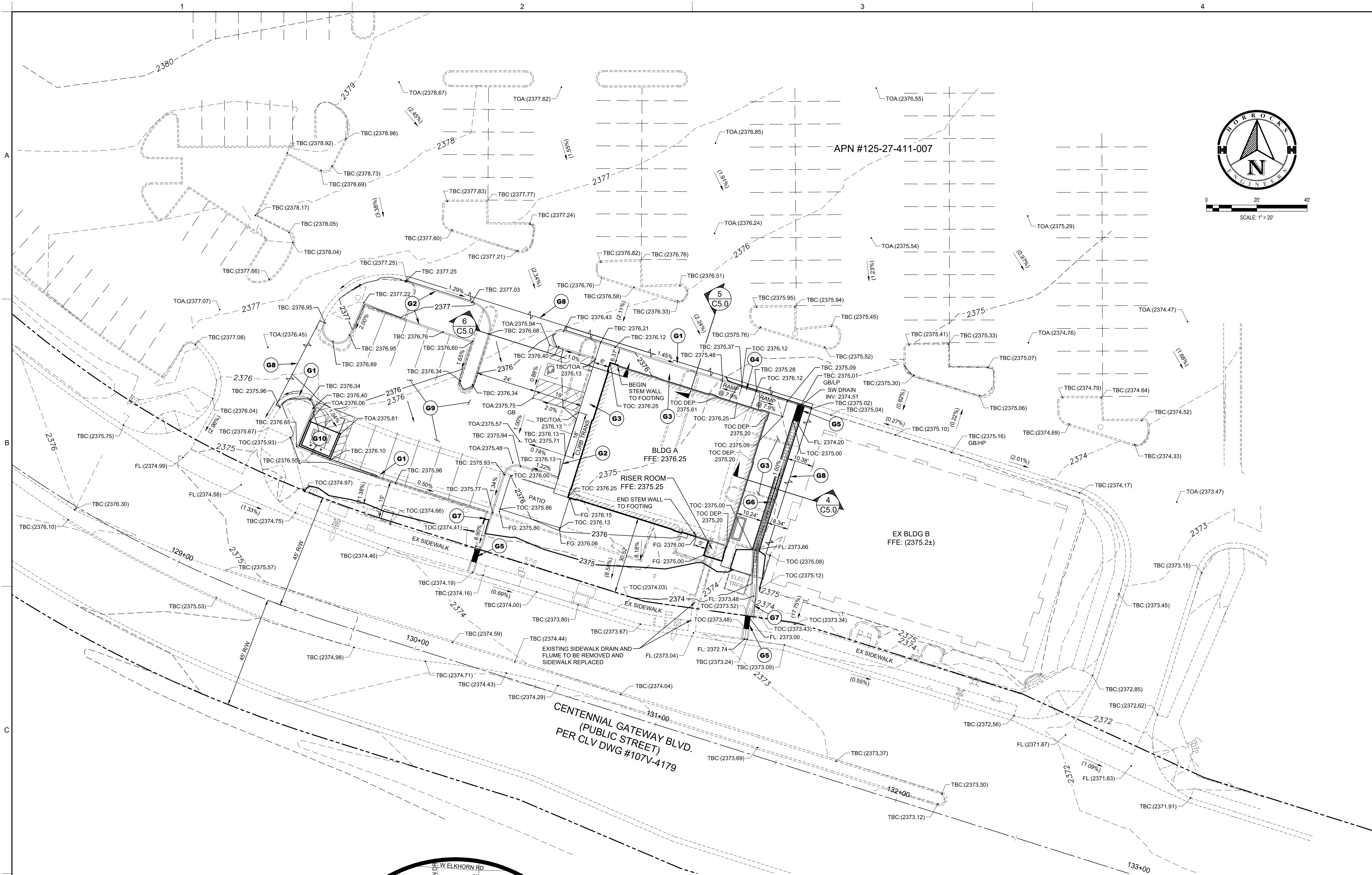
LAS VEGAS, NV

COVER SHEET

APN #125-27-411-007

C0.0

PAGE 1 of 4



LEGEND:			
	EXISTING MAJOR CONTOURS		TOP OF CONCRETE
	EXISTING MINOR CONTOURS		TOP OF CONCRETE DEPRESSED
	MAJOR CONTOURS		TOP OF ASPHALT
	MINOR CONTOURS		TOP BACK CURB
	CURB & GUTTER		FINISH GRADE
	EXISTING CURB & GUTTER		FLOW LINE
	EXISTING ASPHALT		EXISTING TOP BACK CURB
	RIGHT OF WAY		EXISTING TOP OF ASPHALT
	FLOW LINE		
	EXISTING 10" SANITARY SEWER		
	EXISTING 48" WATER MAIN		
	EXISTING 10" WATER MAIN		
	EXISTING 36" STORM DRAIN		
	EXISTING 24" STORM DRAIN		
	EXISTING SANITARY SEWER MANHOLE		
	EXISTING SANITARY SEWER CLEANOUT		
	EXISTING FIRE HYDRANT		
	EXISTING WATER GATE VALVE		
	RETAINING OR SCREEN WALL		

- GRADING KEY NOTES:**
- G1 CONSTRUCT "L" CURB AND GUTTER PER CCAUSD #216
 - G2 CONSTRUCT "A" CURB PER CCAUSD #219
 - G3 CONSTRUCT CONCRETE SIDEWALK PER CCAUSD #234
 - G4 CONSTRUCT TURNDOWN CONCRETE SIDEWALK PER DETAIL 3 SHEET C5.0
 - G5 CONSTRUCT SIDEWALK DRAIN PER CCAUSD #236
 - G6 CONSTRUCT TRENCH DRAIN PER DETAIL 1 SHEET C5.0
 - G7 CONSTRUCT CONCRETE FLUME PER DETAIL 2 SHEET C5.0
 - G8 SAWCUT AND MATCH EXISTING PAVEMENT.
 - G9 CONSTRUCT 2" AC PAVEMENT OVER 10" TYPE II AGG BASE
 - G10 CONSTRUCT TRASH ENCLOSURE (SEE ARCHITECTURAL PLANS FOR DETAILS)

- ENGINEER'S NOTES:**
- CONTRACTOR IS RESPONSIBLE FOR EROSION AND DUST CONTROL DURING CONSTRUCTION
 - SEE HORIZONTAL CONTROL PLAN FOR EXACT DIMENSIONS
 - ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES BETWEEN THESE PLANS AND FIELD CONDITIONS IMMEDIATELY.
 - THESE PLANS SHALL NOT IN PART, OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY GOVERNING AGENCIES.
 - ALL GRADING SHALL CONFORM TO SOILS REPORT RECOMMENDATIONS.
 - DURING CONSTRUCTION, SURVEYORS AND CONTRACTORS MUST VERIFY THAT ALL STREETS AND LOTS HAVE POSITIVE DRAINAGE. SAME MUST UTILIZE AT LEAST THREE GRADES ON VERTICAL TANGENTS TO VERIFY SLOPES.
 - SOILS REPORT NOTE:
GRADING SHALL BE IN ACCORDANCE WITH THE ADDENDUM TO GEOTECHNICAL EXPLORATION REPORT PREPARED BY:
GEOTECHNICAL ENGINEER: NOVA GEOTECHNICAL
PROJECT NAME: CENTENNIAL GATEWAY - PHASE 2
PROJECT NO.: E-06-036
DATE: JUNE 12, 2017
 - CUT/FILL ESTIMATES:
EXISTING TO FINISH GRADE ELEVATIONS
NET CUT: 180 CY
NET FILL: 100 CY
 - FOR STORMWATER MANAGEMENT NOTES, REFER TO SHEET C0.2

FLOOD ZONE:
THIS SITE IS LOCATED IN A ZONE "X", AREAS OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN. PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32063C1745 E. CLARK COUNTY, NEVADA DATED SEPTEMBER 27, 2002.

BENCHMARK:
CITY OF LAS VEGAS BENCHMARK
ID NO. 6LV80275SWW6
RIVET AND PLATE IN TOP OF CURB ON
THE WEST SIDE OF CENTENNIAL CENTER BOULEVARD
1320. +/- NORTH OF ANN ROAD
ELEVATION 724.838 METERS (NAVDS88)
2374.69 FEET
PROJECT DATUM IS +0.91 FEET FROM CITY DATUM

BASIS OF BEARING:
NORTH 00° 18' 05" WEST
BEING THE WEST LINE OF THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 27, TOWNSHIP 19 SOUTH, RANGE 69 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN ON THE RECORDED FINAL MAP OF CENTENNIAL GATEWAY, BOOK 124, PAGE 44 OF PLATS, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

HORROCKS

ENGINEERS

1349 Galleria Dr, Suite 110
Henderson, NV 89014
(702) 966-4063
www.horrock.com

WARNING

IF THIS BAR DOES NOT MEASURE 2" THEN DRAWING IS NOT TO SCALE

DRAWING INFO	REVISIONS
DATE: 12 JULY 2017	REV #
DESIGNED: LMB	DATE
DRAWN: MDP	
CHECKED: LMB	
PROJECT: LV-811-1706	

STATE OF NEVADA

LARRY M. BITTON

PROFESSIONAL ENGINEER

EXPIRATION DATE: 12-31-18

NO. 0089

CENTENNIAL GATEWAY BUILDING PAD

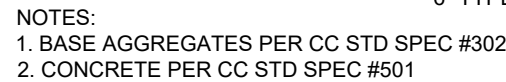
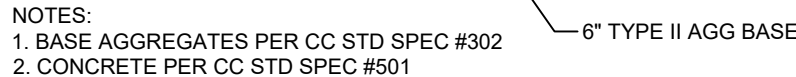
CENTENNIAL GATEWAY
LAS VEGAS, NV 89149

GRADING PLAN

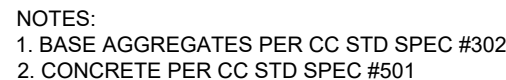
APN #125-27-411-007

C2.0

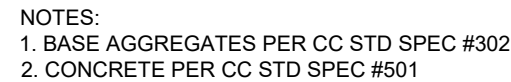
PAGE 3 of 4



SCALE: NTS



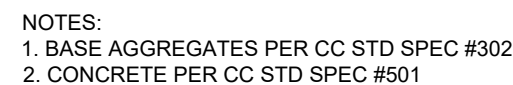
SCALE: NTS



SCALE: NTS



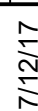
SCALE: NTS



1. CONTRACTOR IS RESPONSIBLE FOR EROSION AND DUST CONTROL DURING CONSTRUCTION.
2. SEE HORIZONTAL CONTROL PLAN FOR EXACT DIMENSIONS
3. ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES BETWEEN THESE PLANS AND FIELD CONDITIONS IMMEDIATELY.
4. THESE PLANS SHALL NOT IN PART, OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY GOVERNING AGENCIES.
5. ALL GRADING SHALL CONFORM TO SOILS REPORT RECOMMENDATIONS.
6. DURING CONSTRUCTION, SUBCONTRACTORS AND CONTRACTORS MUST VERIFY THAT ALL STREETS AND LOTS HAVE POSITIVE DRAINAGE. SAME MUST UTILIZE AT LEAST THREE GRADES ON VERTICAL TANGENTS TO VERIFY SLOPES.
7. SOILS REPORT NOTE:
GRADING SHALL BE IN ACCORDANCE WITH THE ADDENDUM TO GEOTECHNICAL EXPLORATION REPORT PREPARED BY:
GEOTECHNICAL ENGINEER: NOVA GEOTECHNICAL
PROJECT NAME: CAMDEN GATEWAY - PHASE 2
PROJECT NO.: E-96-0005
DATE: JUNE 12, 2017
8. CUT/FILL ESTIMATES:
EXISTING TO FINISH GRADE ELEVATIONS
NET CUT: 180 CY
NET FILL: 100 CY
9. FOR STORMWATER MANAGEMENT NOTES, REFER TO SHEET CO.2

1. 2" A.C. PAVEMENT OVER 10" TYPE II AGG BASE COMPACTED TO 95% OF LABORATORY STANDARD OVER SCARIFIED SUBGRADE COMPACTED TO 90% OF LABORATORY MAXIMUM (ASTM D-1557).
2. REFER TO SOILS REPORT BY NOVA GEOTECHNICAL, PROJECT #E-06-036, DATED JUNE 12, 2017.

*SEE 2nd SHEET FOR LISTING



APN #125-27-411-007

