Addendum to Technical Drainage Study
Update #1
For
Spanish Villas – Phase 1
(aka: Car Wash @ Sahara & Spanish Oaks)

Lochsa Job No. 221125

February 2023

Prepared for:

Neil Capin
1761 Hotel Circle South
San Diego, CA 92018
neilcapinjr@gmail.com
(619) 778-2088

Prepared by:

Lochsa Engineering
6345 South Jones Boulevard, Suite 100
Las Vegas, Nevada 89118
(702) 365-9312

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Car Wash at NEC of Sahara and Spanish Oaks Date: February 9, 2023

Location of Development: a) Descriptive (Cross Streets) North/South: Spanish Oaks Drive

East/West: Sahara Avenue

b) Section: 4 Township: 22 South Range: 60 East

c) APN : 162-05-403-001

Name of Owner: Neil Capin

Telephone No.: (619) 778-2088 Fax No.: E-Mail Address: neilcapinjr@gmail.com

Address: 1761 Hotel Circle South San Diego, CA 92018

Contact Person-Name: CHRIS BLAKE, E.I. **Telephone No.:** (702) 365-9312

* **E-Mail Address:** CHRIS.BLAKE@LOCHSA.COM **Fax No.:** (702) 365-9317

Firm: LOCHSA ENGINEERING

Address: 6345 S JONES BLVD., SUITE 100 LAS VEGAS NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 1.03 ACRES (+/-) Being Developed/Disturbed: 1.03 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 (Car Wash)
5. Approximate upstream land area which drains to the subject site: 0 ACRES (+/-) - only perimeter street flow (no direct impact to Site)
6. Has the site drainage been evaluated in the past? ☑ **YES** ☐ **NO** If yes, please identify documentation: TDS for Spanish Villas (DS#4202B)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: South to Sahara Avenue through a Sidewalk underdrain, following historical drainage patterns
8. Briefly describe your proposed schedule for the subject project: ASAP

Engineer's Seal

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

***New Required Field**

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

COMMENT LETTER

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: January 4, 2023
TO: **Land Development Services** Department of Public Works				FROM: Caitlyn Alcantara, P.E. CA Flood Control, Engr. Associate Department of Public Works
SUBJECT:	Drainage Study for: **Carwash West Sahara**			**COPIES TO:** Lochsa Engineering
Cross Streets:	NEC of Sahara Ave & Spanish Oaks Dr			Neil Capin
File Number:	F:\Depot\DSMemos\DS5634A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	162-05-403-001			CCRFCD
Zoning Action:				
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1st Submittal	12/13/2022	1/3/2023 Paid on 1/4/2023	See Comments Below	$400.00	5094315: $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 Department of Development Services concurrence.

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 site is adjacent to or crosses an existing or proposed *Clark County Regional Flood Control District* (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.

3. The grading plan indicates onsite flow going towards offsite properties. Secure a notarized letter of permission from the property owner allowing the flow. This letter is required prior to final acceptance of the drainage study.

4. The finished floors do not meet the Regional Flood Control District minimum criteria of twice the Q100 depth of flow up to 18-inches above the water surface (CCRFCD Manual Section 304.4.E.1) or 6-inch minimum above the highest adjacent top of curb (CCRFCD Manual Section 1602 304.4.E.1). Provide a flood wall in the landscape area adjacent to Spanish Oaks Drive or equivalent adequate flood protection for the building.

5. A recent site visit and contours indicate more flow approaching El Camino Avenue and Spanish Oaks Drive than offsite basin FD1 presumes. Provide either the reference material or justification for the delineation of the offsite basin, FD1.

6. The western driveway appears to not meet the requirements of a humped driveway. It is understood that there are limitations to the grading preventing the project site from meeting the requirements of a humped driveway. Provide as much freeboard possible to provide onsite flood protection for the building while still making the entryway drivable.

7. **Sheet C4.01:** Provide a section on the western border of the project site showing the landscape of the area and a regular section of Spanish Oaks Drive.

8. **Sheet C6.01, Section D:** Cap the space between the proposed wall and the existing wall so flow, debris, or animals cannot get into the space.

9. **Sheet C6.01, Section E:** Provide a screen wall on top of the retaining wall for pedestrian safety and a ditch adjacent to the wall to direct flow away from it.

10. **Sheet C6.01:** Section A is missing the retaining wall placed along Sahara Avenue and Section B is missing the sidewalk west of the building. Check all the sections for consistency.

11. **Sheet C6.01:** Provide a range on how tall the proposed retaining walls will be.

12. **Sheet C6.01:** Show the minimum cross-slopes on all sections.

13. It is understood that there are restrictions to grading since it is developed on all sides of the project site. However, there is room to allow for more treatment with the LID BMPs. Like forcing a low point north of the proposed building or redirecting the valley gutter and providing a curb cut at either landscaping area. Provide more treatment of the water exiting the site and make sure it is to the specifications listed in the manual. This comment also applies to the landscape swale in the southern landscape, as the sloped length at 1% is too short.

14. The property line is extended north past the APN given. Clean up line work so that we can see the property line, the retaining walls, and the existing storm drain clearly.

15. Label the existing 36" storm drain in Sahara Avenue on the grading plan and label with City of Las Vegas recorded plan number. Identify all pertinent drop inlets and/or storm drain manholes.

16. Provide a Note on all Grading Plans: Post-Construction BMPs (PCBMPs) / Control Measures noted on the Grading Plans are mandatory permanent regulatory stormwater pollution controls. These PCBMPs must be installed per the approved plans and must be permanently maintained.

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
CAA/AYS

T/R/S: T22S/R60E/04
AREA R-04

Civil
Flood Control
Structural
Surveying
Traffic

Lochsa engineering

January 22, 2023

Caitlin Alcantara, P.E.
Flood Control, Engr. Associate
Department of Public Works
495 S. Main Street
Las Vegas, NV 89101

Subject: Addendum to Technical Drainage Study Update for Carwash West Sahara
APN: 162-05-403-001
DS5634A
(Lochsa Engineering Project No. 221125)

Dear Caitlin Alcantara,

Lochsa Engineering is in receipt of your comment letter, dated: January 4, 2023, for the above referenced project.

In response to your comments, the following responses are being offered:

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.

Response 1: Noted. This was already provided in the initial submittal. We have re-included the NOFA for your convenience.

2. The site is adjacent to or crosses an existing or proposed *Clark County Regional Flood Control District* (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.

Response 2: Noted.

3. The grading plan indicates onsite flow going towards offsite properties. Secure a notarized letter of permission from the property owner allowing the flow. This letter is required prior to final acceptance of the drainage study.

Response 3: Per our discussion over the phone on January 18, 2023, it was noted that the existing flow pattern from our Site already discharges east toward the offsite properties along the north and south drive aisles. It was mentioned our site may be discharging a little more flow in the north drive aisle than in existing conditions but it is considered negligible since it is so minor (maybe 0.50cfs). This was agreed to be OK and a notarized letter of permission is no longer needed.

4. The finished floors do not meet the Regional Flood Control District minimum criteria of twice the Q100 depth of flow up to 18-inches above the water surface (CCRFCD Manual Section 304.4.E.1) or 6-inch minimum above the highest adjacent top of curb (CCRFCD Manual Section 1602 304.4.E.1). Provide a flood wall in the landscape area adjacent to Spanish Oaks Drive or equivalent adequate flood protection for the building.

Response 4: Noted. Per Comment 5 below, we revised the offsite basin FD1 which increased flow. The revised 100yr depth of flow is now 0.79ft (previously 0.75ft) in Spanish Oaks Drive.

With this in mind, we have proposed a 2 course solid grouted wall at back of sidewalk to protect the site from offsite flows along Spanish Oaks Drive. This provides an additional 16-inches plus the curb height (6-inches) from the Flowline elevation in the street, which is more than twice the 100yr flow depth.

The FF elevation of the Car Wash does meet criteria for Sahara Avenue flows so no wall is needed here. However, we have provided a wall at back of sidewalk along our Site to convey the flow within the ROW and prevent the flow from getting into our landscaping and eroding the area. See revised Plans. Also the revised Spanish Oaks Drive hydraulic street section has been included with the revised FD1 flows.

5. A recent site visit and contours indicate more flow approaching El Camino Avenue and Spanish Oaks Drive than offsite basin FD1 presumes. Provide either the reference material or justification for the delineation of the offsite basin, FD1.

Response 5: Per our discussion over the phone on January 18, 2023, it was noted that an additional 3 acres should be added to the offsite FD1 basin. Therefore, we have revised our offsite basin and exhibit OFF to represent the revised FD1 basin. We have provided revised hydrology with a new Developed Condition HEC-1 Analysis showing the revised flows from offsite basin FD1. Offsite basin FD1 now discharges 29 and 53cfs in the 10yr and 100yr storm events. Please note that there are 4 separate drop inlets within El Camino Avenue that we have ignored which would reduce the flow in Spanish Oaks. However, we have chosen to assume they are 100% clogged to be conservative with the design of our Site. See revised Hydrology and the necessary exhibits with the changes.

6. The western driveway appears to not meet the requirements of a humped driveway. It is understood that there are limitations to the grading preventing the project site from meeting the requirements of a humped driveway. Provide as much freeboard possible to provide onsite flood protection for the building while still making the entryway drivable.

Response 6: Noted. With the 100yr depth increasing to 0.79ft within Spanish Oaks Drive, we have provided as much freeboard as possible above the 100yr depth on both sides of the driveway. The north side of the driveway has 0.22ft of freeboard. The south side of the driveway has 0.08ft of freeboard. This is the best we could do with the Site limitations.

Please do note that four (4) upstream existing drop inlets were ignored. Also, the entire 100yr flow is shown to be on the east side of Spanish Oaks Drive which may not be completely accurate. Also, any flow overtopping the hump will go directly south and through our swale back into Sahara Avenue which is where the flow ultimately goes in existing conditions.

7. **Sheet C4.01:** Provide a section on the western border of the project site showing the landscape of the area and a regular section of Spanish Oaks Drive.

Response 7: Noted. See revised Plans.

8. **Sheet C6.01, Section D:** Cap the space between the proposed wall and the existing wall so flow, debris, or animals cannot get into the space.

Response 8: The space between the proposed wall and existing wall is 3-inches. The capping is only needed for spaces bigger than this. See detail section for dimension of the open space between the walls.

9. **Sheet C6.01, Section E:** Provide a screen wall on top of the retaining wall for pedestrian safety and a ditch adjacent to the wall to direct flow away from it.

Response 9: Noted. See revised Plans.

10. **Sheet C6.01:** Section A is missing the retaining wall placed along Sahara Avenue and Section B is missing the sidewalk west of the building. Check all the sections for consistency.

Response 10: Noted. See revised Plans.

11. **Sheet C6.01:** Provide a range on how tall the proposed retaining walls will be.

Response 11: Noted.

12. **Sheet C6.01:** Show the minimum cross-slopes on all sections.

Response 12: Noted.

13. It is understood that there are restrictions to grading since it is developed on all sides of the project site. However, there is room to allow for more treatment with the LID BMPs. Like forcing a low point north of the proposed building or redirecting the valley gutter and providing a curb cut at either landscaping area. Provide more treatment of the water exiting the site and make sure it is to the specifications listed in the manual. This comment also applies to the landscape swale in the southern landscape, as the sloped length at 1% is too short.

Response 13: Noted. A valley gutter has been provided in the north area to direct flow to an additional BMP swale through a proposed 2ft curb cut. This conforms that a majority of the Site is being treated.

The Swale along the north has been extended to be a minimum of 40ft long with a 0.50% slope. See revised Plans.

14. The property line is extended north past the APN given. Clean up line work so that we can see the property line, the retaining walls, and the existing storm drain clearly.

Response 14: Noted.

15. Label the existing 36" storm drain in Sahara Avenue on the grading plan and label with City of Las Vegas recorded plan number. Identify all pertinent drop inlets and/or storm drain manholes.

Response 15: Noted.

16. Provide a Note on all Grading Plans: Post-Construction BMPs (PCBMPs) / Control Measures noted on the Grading Plans are mandatory permanent regulatory stormwater pollution controls. These PCBMPs must be installed per the approved plans and must be permanently maintained.

Response 16: Noted.

If you have any questions or further comments, please contact our office at your convenience.

Sincerely,
Lochsa Engineering

Chris Blake, EI
Hydrologist

COMMENT #1

NOFA

October 12, 2022

Mr. Christopher J. Rodenfels
Sahara West Executive Park LLC
2704 Botticelli Drive
Henderson, Nevada 89052

RE: 22-0429-SUP1 AND 22-0429-SDR1
PLANNING COMMISSION MEETING OF OCTOBER 11, 2022

Dear Applicant:

The Planning Commission at a regular meeting held on *October 11, 2022* voted to recommend ***APPROVAL*** of the following Land Use Entitlement project requests on 1.73 acres at the northeast corner of Sahara Avenue and Spanish Oaks Drive (APN 162-05-403-001), C-1 (Limited Commercial) Zone, Ward 1 (Knudsen).

22-0429-SUP1 - SPECIAL USE PERMIT - FOR A PROPOSED CAR WASH, FULL SERVICE OR AUTO DETAILING USE

22-0429-SDR1 - SITE DEVELOPMENT PLAN REVIEW - FOR A PROPOSED 3,936 SQUARE-FOOT CAR WASH DEVELOPMENT

This approval is subject to the following conditions:

22-0429-SUP1 CONDITIONS

Planning

1. Conformance to all Minimum Requirements under LVMC Title 19.12 for a Car Wash, Full Service use.

2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.

3. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building & Safety.

4. These conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit, as well as submitted as part of any business license application.

5. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

22-0429-SDR1 CONDITIONS

Planning

1. Approval of and conformance to the Conditions of Approval for Special Use Permit (22-0429-SUP1).

2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.

3. All development shall be in conformance with the site plan date stamped 09/14/22; landscape plan date stamped 09/14/22 and building elevations date stamped 08/17/22, except as amended by conditions herein.

4. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.

5. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.

6. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structure.

8. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

Public Works

9. Remove all substandard public street improvements and unused driveway cuts adjacent to this site and replace with new improvements meeting current City Standards concurrent with development of this site. All adjacent sidewalks shall meet Public Right-of-Way Accessibility Guidelines (PROWAG) in accordance with code requirements of Title 13.56.040 to the satisfaction of the City Engineer concurrent with development of this site. Grant any Pedestrian Access Easement needed to complete this requirement.

10. Concurrent with the development of this site, the median in Spanish Oaks shall be modified to regulate left-turn movements into/out from this site to meet the approval of the City Traffic Engineer.

11. Coordinate with the Environmental Compliance & Enforcement staff of the Department of Public Works to locate any required grease interceptor and sand/oil interceptors in acceptable locations prior to submittal of sewer-related plans. Comply with the recommendations and requirements of the Environmental Compliance & Enforcement staff prior to issuance of permits. The team may be contacted at 702-229-2338 or emailed at ece@lasvegasnevada.gov.

12. All landscaping and private improvements installed with this project shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.

13. An update to the previously approved Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to submittal of any construction drawings or the issuance of any building or grading permits, whichever may occur first. Provide and improve all drainage ways recommended in the approved drainage study update.

This item will be considered by the City Council on ***November 16, 2022***. This meeting will be held at 9:00 A.M. at the Council Chambers of City Hall, 495 South Main Street, Las Vegas, Nevada. ***The Council requires that you or your representative be present at this meeting.*** If you or your representative chooses not to attend, the City Council may act in your absence without your input.

Sincerely,

Nicole Eddowes
Community Development Coordinator
Case Planning Division

NE:nl

cc:

Mr. Neil Capin
1761 Hotel Circle, Ste. 240
San Diego, CA 91208

Levene Ohene
Jay Brown
520 South 4th Street
Las Vegas, Nevada 89101

COMMENT #4

REVISED SPANISH OAKS DRIVE HYDRAULIC STREET SECTION

Street Flow Summary
(Developed Condition)

10-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-Year Velocity [v] (fps)	10-Year Flow Depth [d] (ft)	10-Year Velocity x Depth [v x d]	Dry Lane Width (within 1/2 ROW) (ft)
Spanish Oaks	75	1	29	2.89	0.66	1.91	N/A
Sahara Avenue (North half)	75	2	210	9.46	0.99	9.37	N/A

Street Flow Summary
(Developed Condition)

100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-Year Velocity [v] (fps)	100-Year Flow Depth [d] (ft)	100-Year Velocity x Depth [v x d]
Spanish Oaks	75	1	53	3.65	0.79	2.88
Sahara Avenue (North half)	75	2	455	11.72	1.26	14.77

Street Section 1 - Spanish Oaks Drive - Developed Condition - 10year
Worksheet for Irregular Channel

Project Description	
Worksheet	Street Section 1 - Spanish Oaks Drive - Developed Con
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

d. (10yr)

Input Data		
Slope	.005000	ft/ft
Discharge	29.00	cfs

FD1 Flow

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	33.59	ft
Elevation Range	1.93 to 34.40	
Flow Area	10.0	ft²
Wetted Perimeter	36.48	ft
Top Width	35.50	ft
Actual Depth	0.66	ft
Critical Elevation	33.58	ft
Critical Slope	0.005487	ft/ft
Velocity	2.89	ft/s
Velocity Head	0.13	ft
Specific Energy	33.72	ft
Froude Number	0.96	
Flow Type	Subcritical	

d_{10}

V_{10}

$d \times v < 6$ OK

Calculation Messages:
Water elevation exceeds lowest end station by 0.16031446 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+34.00	0.016
0+34.00	0+42.00	0.013
0+42.00	0+64.00	0.016
0+64.00	0+66.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	33.43
0+00.50	33.43
0+00.50	32.93
0+02.00	33.06
0+02.00	33.10
0+34.00	33.53

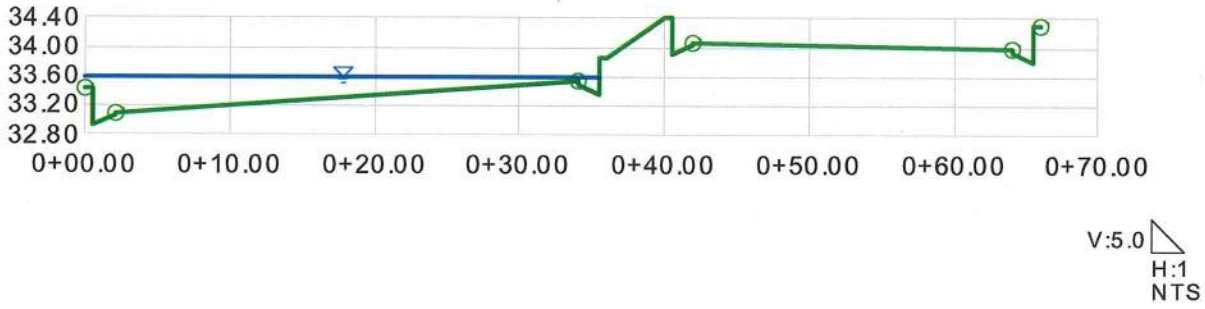
Street Section 1 - Spanish Oaks Drive - Developed Condition - 10year
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+34.00	33.49
0+35.50	33.36
0+35.50	33.86
0+36.00	33.86
0+40.00	34.40
0+40.50	34.40
0+40.50	33.90
0+42.00	34.03
0+42.00	34.07
0+64.00	33.98
0+64.00	33.94
0+65.50	33.81
0+65.50	34.31
0+66.00	34.31

Street Section 1 - Spanish Oaks Drive - Developed Condition - 10year
Cross Section for Irregular Channel

Project Description	
Worksheet	Street Section 1 - Spanish Oaks Drive - Developed Con
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	33.59	ft
Elevation Range	².93 to 34.40	
Discharge	29.00	cfs



Street Section 1 - Spanish Oaks Drive - Developed Condition - 100year
Worksheet for Irregular Channel

Project Description	
Worksheet	Street Section 1 - Spanish Oaks Drive - Developed Cond. (100 yr)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.005000	ft/ft
Discharge	53.00	cfs

FD1 Flow

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	33.72	ft
Elevation Range	.93 to 34.40	
Flow Area	14.5	ft²
Wetted Perimeter	36.74	ft
Top Width	35.50	ft
Actual Depth	0.79	ft
Critical Elevation	33.72	ft
Critical Slope	0.004939	ft/ft
Velocity	3.65	ft/s
Velocity Head	0.21	ft
Specific Energy	33.92	ft
Froude Number	1.01	
Flow Type	Supercritical	

d_{100}

V_{100}

$d \times v < 8$ OKV

Calculation Messages:
Water elevation exceeds lowest end station by 0.2869328 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+34.00	0.016
0+34.00	0+42.00	0.013
0+42.00	0+64.00	0.016
0+64.00	0+66.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	33.43
0+00.50	33.43
0+00.50	32.93
0+02.00	33.06
0+02.00	33.10
0+34.00	33.53

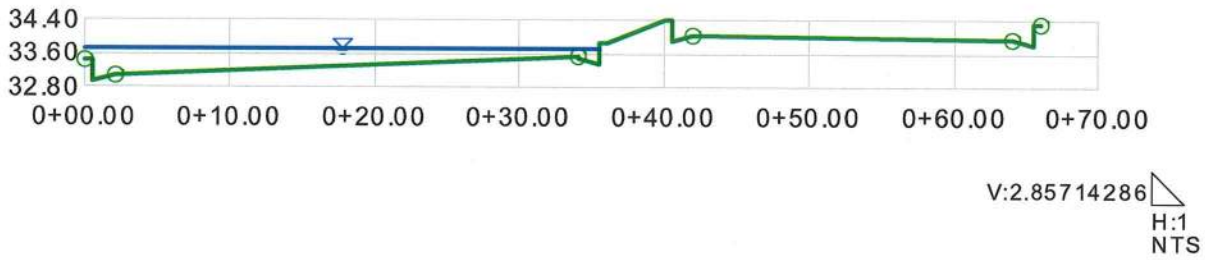
Street Section 1 - Spanish Oaks Drive - Developed Condition - 100year
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+34.00	33.49
0+35.50	33.36
0+35.50	33.86
0+36.00	33.86
0+40.00	34.40
0+40.50	34.40
0+40.50	33.90
0+42.00	34.03
0+42.00	34.07
0+64.00	33.98
0+64.00	33.94
0+65.50	33.81
0+65.50	34.31
0+66.00	34.31

Street Section 1 - Spanish Oaks Drive - Developed Condition - 100year
Cross Section for Irregular Channel

Project Description	
Worksheet	Street Section 1 - Spanish Oaks Drive - Developed Conc
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Slope	0.005000	ft/ft
Water Surface Elev	33.72	ft
Elevation Range	.93 to 34.40	
Discharge	53.00	cfs



COMMENT #5

REVISED HYDROLOGY AND OFFSITE MAP

DEVELOPMENT: Car Wash @ Sahara and Spanish Oaks
CALCULATED BY: CB
PROJECT NUMBER: 221125

DATE: January 18, 2023

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)			TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL tc	REMARKS			
DESIGN (1)	K (2)	AREA Ac (3)	AREA Sq. Mile (4)	LENGTH Ft (5)	SLOPE % (6)	ti Min (7)	LENGTH Ft (8)	SLOPE % (9)	VELOCITY FPS (10)	tt Min (11)	TOTAL LENGTH Ft (12)	tc =(L/180)+10 Min (13)	Min (14)	CN (15)	tL Hrs (16)	Urbanized? (17)	Soil Type (18)
ND1	0.8640	0.64	0.00100	50	2.3	2.3	180	3.2	1.9	1.6	230	11.3	3.8	95.0	0.050	YES	D
ND2	0.8640	0.39	0.00061	30	4.0	1.5	190	1.8	1.3	2.4	220	11.2	3.9	95.0	0.050	YES	D
FD1	0.8904	18.61	0.02908	35	2.0	1.8	2,620	1.0	4.0	11.0	2,655	24.8	12.8	97.0	0.128	YES	D

ti = 1.8 (1.1 - K) L^(0.5) / S^(1/3)

K = 0.0132 CN - 0.39

tt = L / (60 V)

tc = ti + tt

tL= tLAG = 0.6 tc

LOCATION: Onsite/Offsite
HYDROLOGIC CONDITION: DEVELOPED

TRIAL: Final Iteration

increased AREA

Curve Number Calculations
Car Wash @ Sahara and Spanish Oaks

Sub-Basin: **ND1**
Total Area: 0.64 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Commercial and buisness	0.64	D	100%	95	95.0
Total:	0.64	-	100%	-	95.0

Curve Number Calculations
Car Wash @ Sahara and Spanish Oaks

Sub-Basin: **ND2**
Total Area: 0.39 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Commercial and buisness	0.39	D	100%	95	95.0
Total:	0.39	-	100%	-	95.0

Curve Number Calculations
Car Wash @ Sahara and Spanish Oaks

Sub-Basin: **FD1**
Total Area: 18.61 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	16.75	D	90%	98	88.2
Natural desert landscaping (pervious areas only)	1.86	D	10%	88	8.8
Total:	18.61	-	100%	-	97.0

AVERAGE VELOCITY

Input Variables	Basin ND1	Basin ND2		Basin FD1												
Bottom Width, B, (ft):	3.0	3.0		2.0												
Right Side Slope, Zr:	100	100		50												
Left Side Slope, Zl:	100	100		0												
Manning's n:	0.015	0.015		0.015												
Geometric Slope, So (ft/ft):	0.032	0.018	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Flowrate, Q (cfs) *:	1	0.5		26.5												
							Output Variables									
Normal Depth, Yn (ft):	0.06	0.05		0.48												
Area of Flow, A, (sf):	0.52	0.38		6.67												
Velocity, V (fps):	1.92	1.30		3.97												
Wetted Perimeter, p (ft):	14.74	12.77		26.39												
Hydraulic Radius, Rh (ft):	0.04	0.03		0.25												
Free SurfaceTop Width, T (ft):	14.74	12.77		25.91												
Centroid, Y*, (ft):	0.02	0.02		0.17												

*** NOTE : HALF OF THE 100-YEAR STORM RUNOFF FLOWS IS USED TO DETERMINE THE BASIN TRAVEL VELOCITY REQUIRED FOR THE LAG TIME CALCULATIONS**

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   18JAN23  TIME  10:04:32   *
*                                       *
*****************************************
```

d

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

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

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

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

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   1          ID        UPDATE #1 FOR CAR WASH AT SAHARA & SPANISH OAKS
   2          ID        ********** TECHNICAL DRAINAGE STUDY UPDATE #1 *****************
   3          ID        DEVELOPED CONDITIONS - ONSITE AND OFFSITE
   4          ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
   5          ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
   6          ID
   7          ID        LOCHSA JOB # 221125
   8          ID
   9          ID
  10          ID        INPUT FILE NAME:  D.DAT
  11          ID
  12          ID        DECEMBER 2022
  13          ID
  14          ID        ************************************************************************
  15          ID        ************************************************************************
  16          ID             McCARRAN AIRPORT RAINFALL AREA
  17          ID             10 & 100 YEAR - 6 HOUR STORM EVENT
  18          ID             PRECIPITATION:
  19          ID                 10-YEAR          : 1.58 INCHES
  20          ID                 100-YEAR         : 2.77 INCHES
  21          ID                 10-YEAR/100-YEAR : 1.58/2.77= 0.5704
  22          ID
  23          ID        ************************************************************************
  24          ID        ************************************************************************
              *DIAGRAM
  25          IT       5          200
  26          IO       5        0
  27          IN       5
  28          JR    PREC   .5704     1.0

  29          KK     FD1
  30          KM   DEVELOPED OFFSITE BASIN ALONG WEST BOUNDARY OF SITE (SPANISH OAKS), DISCHARGE
  31          KM   SOUTH TO SAHARA AVENUE
  32          PB   2.770
  33          PC     0.0     .02    .057     .07    .087    .108    .124     .13     .13     .13
  34          PC     .13     .13     .13    .133     .14    .142    .148    .158    .172    .181
  35          PC     .19    .197    .199      .2    .201    .204    .214    .229    .241    .249
  36          PC    .251    .256     .27    .278    .281    .283    .295    .322    .352    .409
  37          PC    .499     .59     .71    .744    .781    .812    .819    .835    .851    .856
  38          PC     .86    .868    .876    .888     .91    .926    .937     .95     .97    .976
  39          PC    .982    .985    .987    .989     .99    .993    .993    .994    .995    .998
  40          PC    .998    .999     1.0
  41          BA  .02908
  42          LS       0    97.0
  43          UD    .128
              *

  44          KK     ND2
  45          KM   SOUTH HALF OF SITE, ONSITE BASIN DISCHARGES SOUTH TO SAHARA AVENUE THRU SW DR
  46          BA  .00061
  47          LS       0    95.0
  48          UD   0.050
              *
```

1 HEC-1 INPUT PAGE 2

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

  49          KK     ND1
  50          KM   NORTH HALF OF SITE, DISCHARGES NORTHEASTERLY TO ADJACENT SITE
  51          BA  .00100
  52          LS       0    95.0
  53          UD   0.050
              *
  54          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   29        FD1
             .
```

d

```
                .
   44           .          ND2
                .           .
                .           .
   49           .           .          ND1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   18JAN23  TIME  10:04:32   *
*                                       *
*****************************************
```

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

UPDATE #1 FOR CAR WASH AT SAHARA & SPANISH OAKS
********** TECHNICAL DRAINAGE STUDY UPDATE #1 **********
DEVELOPED CONDITIONS - ONSITE AND OFFSITE
USING SCS METHODS AND KINEMATIC WAVE ROUTING
MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

LOCHSA JOB # 221125

INPUT FILE NAME: D.DAT

DECEMBER 2022

****
****
McCARRAN AIRPORT RAINFALL AREA
10 & 100 YEAR - 6 HOUR STORM EVENT
PRECIPITATION:
10-YEAR : 1.58 INCHES
100-YEAR : 2.77 INCHES
10-YEAR/100-YEAR : 1.58/2.77= 0.5704

****
****

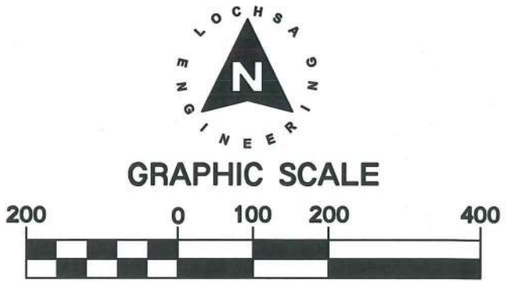
```
   26 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0200  STARTING TIME
                          NQ         101  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1    0  ENDING DATE
                      NDTIME        1020  ENDING TIME
                       ICENT          19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                        TOTAL TIME BASE    8.33 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 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	FD1	.03	1	FLOW	29.	53.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	ND2	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ND1	.00	1	FLOW	1.	2.
				TIME	3.50	3.50

REVISED

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



Peak Flow Summary
Developed Condition

HEC-1 ID	Area (acres)	10-year Flow	100-year Flow
FD1	18.61	29	53
ND2	0.39	1	1
ND1	0.64	1	2

***REFERENCED CLV MPU (210/455)**

DRAWN BY: JD	SCALE: 1"=200'
CHECKED BY: CB	DATE: 1/18/23

LOCHSA ENGINEERING
6345 SOUTH JONES BLVD., SUITE 100
LAS VEGAS, NV 89118
P: 702 365-9312, F: 702 365-9317

FILE NAME: C-221125-OFF.dwg

LEGEND
FOUND MONUMENTATION
CENTER LINE
ROW LINE
EASEMENT LINE
SECTION LINE
PROPERTY LINE
ADJACENT PROPERTY LINE

OFFSITE BASIN MAP (DEVELOPED CONDITION)

CAR WASH WEST SAHARA

PROJECT No.: 221125

SHEET No. **OFF**

SHEET 1 OF 1