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Summerlin West Village 22

Clowder Pass Way (Street H)

Desert Foothills Drive to Kettle Ridge Drive (Street J)

January 21, 2020

Addendum #1

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Addendum #1: Clowder Pass Way (Street H): Desert Foothills Drive to Kettle Ridge Drive (Street J) Date: January 21, 2020

Location of Development: a) Descriptive (Cross Streets) North/South: Desert Foothills Drive

East/West: Lake Mead Boulevard

b) Section: 23 and 14 Township: 20S Range: 59E

c) APN : 137-14-401-006, 137-23-101-002

Name of Owner: Howard Hughes Company, LLC

Telephone No.: (702) 791-4000 Fax No.: (702) 791-4450 E-Mail Address: chris.anderson@howardhughes.com

Address: 10801 West Charleston Blvd, Ste 300, Las Vegas, NV 89135

Contact Person-Name: Molly Anderson, PE **Telephone No.:** (702) 551-0330

* **E-Mail Address:** molly.anderson@atkinsglobal.com **Fax No.:** (702) 263-7200

Firm: Atkins

Address: 2270 Corporate Circle, Ste 200, Henderson, NV 89074

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	x	Roadway Improvements

1. Total Owned Land Area: At Site: +/- 446 acres Being Developed/Disturbed: 1.21 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.): Public - Roadway Improvements
5. Approximate upstream land area which drains to the subject site: None
6. Has the site drainage been evaluated in the past? ✓ **YES** **NO** If yes, please identify documentation: Update #2 to the Master Conceptual Drainage Study for Summerlin West Village 22
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Existing CC-215 Western Beltway Channel
8. Briefly describe your proposed schedule for the subject project: ASAP

PROFESSIONAL ENGINEER STATE OF NEVADA
MOLLY M. ANDERSON
EXP. 12/31/20
CIVIL
No. 24365
1/21/20

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.**

DS #5220

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Clowder Pass Way: Desert Foothills Drive to Kettle Ridge Drive	Map ID:
Firm Name: Atkins	Engineer: Molly Anderson, PE
Address: 2270 Corporate Circle, Ste 200 City: Henderson State: NV Zip: 89074	
Phone Number: (702) 551-0330	Fax Number: (702) 263-7200
Property Owner: Howard Hughes Company, LLC	
Address: 10801 West Charleston Blvd, Ste 300 City: Las Vegas State: NV Zip: 89135	

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	
x		Design Manual **Standard Form 1** with the engineer's seal and signature.
X		Design Manual **Standard Form 4**.
X		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	
X		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
X		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

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		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.
X		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).

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.
	N/A	Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
	N/A	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 x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 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.
	N/A	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.
	N/A	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

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

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

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

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

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

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Engineer's Certification

Atkins certifies that the information contained herein has been prepared in accordance with generally accepted engineering principles and practices, and to the best of our knowledge, is true and correct.

This letter certifies that all items in the **Addendum #1 to the Technical Drainage study for Clowder Pass Way (Street H): Desert Foothills Drive to Kettle Ridge Drive (Street J)** electronic submittal matches the paper version bound into the study.

PROFESSIONAL ENGINEER STATE OF NEVADA
MOLLY M. ANDERSON
EXP. 12/31/20
CIVIL
No. 24365

1/21/20

Molly M. Anderson, PE (NV #24365)
Senior Engineer

Comment Response Letter

Your reference: DS #5220

Albert Sung
City of Las Vegas Public Works
333 N. Rancho Dr, 7th Floor
Las Vegas, NV 89106

January 21, 2020

RE: ADDENDUM #1 TECHNICAL DRAINAGE STUDY FOR SUMMERLIN WEST VILLAGE 22 CLOWDER PASS WAY: DESERT FOOTHILLS DRIVE TO KETTLE RIDGE DRIVE (STREET J)

Dear Albert,

This letter and the attached documents have been prepared as an Addendum #1 to the *Technical Drainage Study (TDS) for Summerlin West Village 22 Clowder Pass Way: Desert Foothills Drive to Kettle Ridge Drive (Street J).*

Comment #1: The subject street improvement of *Clowder Pass Way* is premised on the existence of *Kettle Ridge Drive* on the west for flood cut-off protection. The subject drainage study will not be approved prior to the final approval of the technical drainage study of "*Summerlin West V22 – Kettle Ridge Drive (Street J) and Scurry Bend Drive (Street N) Street Improvements (Lake Mead Blvd. to Fleet Wing Ave.)*".

Comment response: Understood. This report uses the "Summerlin West V22 – Lake Mead Boulevard (Desert Foothills Drive to Kettle Ridge Drive)" and "Summerlin West V22 – Kettle Ridge Drive (Lake Mead Boulevard to Fleet Wing Avenue)" report hydrology and hydraulics as the existing condition to cut off flow upstream of the proposed project.

Comment #2: The project proposes to build temporary drainage facilities, i.e., berms/swales along the north and south side of *Clowder Pass Way* and two interim berms in *Parcel G* and *Parcel J* for interim flood protection. Prior to final plan approval the developer must complete a maintenance and liability agreement for the interim drainage improvements (berms or channels) and post a minimum maintenance bond of $50,000 or 50-percent of the construction cost for the improvements, whichever is greater. The engineer must submit an estimate of the quantities for constructing the facility and an exhibit that adequately shows the location and limits of the drainage facility to *City of Las Vegas Flood Control* for approval. Once the drainage study is conditionally approved, the engineer should contact the *City's Land Development Section* (229-6371) to begin the agreement process.

In order for the maintenance bond to be released in the future, a drainage update / letter will be required to justify that the offsite berms / channels are no longer necessary and can be removed.

Comment response: A drainage update will be submitted prior to offsite berms and channel removal.

Comment #3: Provide a soils map or soils reference to verify the soils used in the CN Calculation Summary.

Comment response: A soils map has been provided in Appendix B.

Comment #4: The precipitation values in the HEC-1 do not match the precipitation values provided in precipitation map. For example the HEC-1 uses 3.42 for all basins however, on the basin map denotes that STH is 3.41 and W14 (which looks like Parcel J) is 3.41. Revise accordingly.

Comment response: The precipitation value has been revised.

Comment #5: SDDI #1 and SDDI #2 are analyzed in Flowmaster with the appropriate flows (2 cfs from STH-2 basin + 0.46 bypass flow from inlets #3 and #4), however Figure 4: Hydraulic Workmap indicates 2.3 cfs going toward the inlets as surface flow. Either explain this further or update accordingly.

Comment response: Figure 4 values have been updated.

Comment #6: Provide bypass information for the upstream inlet at *Kettle Ridge Drive*.

Comment response: The bypass flow has been included in the revised drop inlet calculations. The upstream section of Kettle Ridge Drive discharges 2 cfs to the proposed Clowder Pass Way system. The 2 cfs has been added to the calculations and revised on the table accordingly. The hydraulics figure (Figure 4) from the Kettle Ridge Drive approved study has been included in Appendix B..

Comment #7: Portion of the mainline storm drain in *Clowder Pass Way* is too close to the curb & gutter of the street. Maintain a minimum 3'-clearance between the edge of the pipe and the lip of the curb. Review and revise accordingly.

Comment response: The storm drain has been revised to maintain minimum clearance between the edge of the pipe and the lip of the curb.

Comment #8: On all pertinent *Roadway Grading Plans* and *Plan & Profile* sheets, specify the minimum clearance distance between the lip of the curb and gutter of the street and the edge of the proposed storm drain.

Comment response: The Roadway Grading Plans and Plan & Profile sheets have been updated to include the minimum clearance between the lip of the curb and gutter of the street and the edge of the proposed storm drain.

Comment #9: Sheet 15/27 and **Sheet 16/27**: It is assumed that the sequence of construction is that the storm drain system at the intersection of *Desert Foothills Drive* and *Clowder Pass Way* to be installed prior to the subject improvements. Therefore the storm drains downstream of SDMH #1 should be existing in regard to the subject project. Revise the line type of the storm drain in *Desert Foothills Drive* to broken line to reflect "Existing" status and revise the word "FUTURE" *Desert Foothills Drive* to "EXISTING" in the next submittal.

Comment response: The storm drain has been revised to show as Existing.

Comment #10: *Storm Drain Construction Note #7* proposes Type "A" drop inlet. Delete this construction note as City of Las Vegas does not allow Type "A" drop inlet anymore.

Comment response: The construction note has been removed.

Molly M. Anderson, PE (NV #24365)
Senior Engineer

Additional Addendum #1 Revisions

In addition to the changes described in the Comment Response Letter, the following have also been revised with the proposed Addendum #1:

The parcel stub was removed from Parcel J. The parcel combinations of GH & JK were approved at City of Las Vegas Planning Commission on January 14, 2020 via Major Modification to the Village 22 Development Plan (MOD-77751) and update to the Village 22 Tentative Map (TMP-77752). The flows combined from parcels J and K were analyzed in the approved Desert Foothills Drive study as the “worst case scenario” to show that this change works. The total flow at the Desert Foothills Drive combination point CP1.1 is 54 cfs. The combined parcels J + K = 49 cfs. The roadway basins from Clowder Pass Way add up to 14 cfs. 49 cfs + 14 cfs = 53 cfs and therefore less than the flow from combination point CP1.1.

By removing the flow from the stub within the Clowder Pass Way proposed roadway means that the flow in the proposed improvement plan is only the flow within the roadway itself. Therefore the interim and ultimate condition flows are the same.

Also, removing the flow from the Parcel J stub allowed the mainline system to be downsized from a 36” RCP to a 24” RCP.

Appendices

Appendix A. Comment Letter

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM	DATE: December 23, 2019
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: **Summerlin West V22 - Clowder Pass Way (Street H)** **(from Desert Foothill Drive to Kettle Ridge Drive <Street J>)**	**COPIES TO:** Atkins
Cross Streets: Desert Foothill Drive & Clowder Pass Way	Howard Hughes Company, LLC
File Number: F:\Depot\DSMemos\DS5220A.doc	Bart Anderson, P.E., DevCo
Parcel Number: 137-14-401-006, 137-23-101-002	
Zoning Action: N/A	
FEMA Flood Zone YES NO **X**	
Proposed Storm Drain YES **X** NO	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	11/20/2019	12/23/2019	See Comments Below	$400.00	3652616: $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.

1. The subject street improvement of *Clowder Pass Way* is premised on the existence of *Kettle Ridge Drive* on the west for flood cut-off protection. The subject drainage study will not be approved prior to the final approval of the technical drainage study of "*Summerlin West V22 - Kettle Ridge Drive (Street J) and Scurry Bend Drive (Street N) Street Improvements (Lake Mead Blvd. to Fleet Wing Ave.)*".

2. The project proposes to build temporary drainage facilities, ie, berms/swales along the north and south sides of *Clowder Pass Way* and two interim berms in *Parcel G* and *Parcel J* for interim flood protection. Prior to final plan approval the developer must complete a maintenance and liability agreement for the interim drainage improvements (berms or channels) and post a minimum maintenance bond of $50,000 or 50-percent of the construction cost for the improvements, whichever is greater. The engineer must submit an estimate of the quantities for constructing the facility and an exhibit that adequately shows the location and limits of the drainage facility to *City of Las Vegas Flood Control* for approval. Once the drainage study is <u>conditionally approved</u>, the engineer should contact the *City's Land Development Section* (229-6371) to begin the agreement process.

   In order for the maintenance bond to be released in the future, a drainage update / letter will be required to justify that the offsite berms / channels are no longer necessary and can be removed.

3. Provide a soils map or soils reference to verify the soils used in the CN Calculation Summary.
4. The precipitation values in the HEC-1 do not match the precipitation values provided in precipitation map. For example the HEC-1 uses 3.42 for all basins however, on the basin map denotes that STH is 3.41 and W14 (which looks like Parcel J) is 3.41. Revise accordingly.
5. SDDI #1 and SDDI #2 are analyzed in Flowmaster with the appropriate flows (2 cfs from STH-1 basin + 0.46 bypass flow from inlets #3 and #4), however Figure 4: Hydraulic Workmap indicates 2.3 cfs going toward the inlets as surface flow. Either explain this further or update accordingly.
6. Provide bypass information for the upstream inlet at *Kettle Ridge Drive*.
7. Portion of the mainline storm drain in *Clowder Pass Way* is too close to the curb & gutter of the street. Maintain a minimum of 3'-clearance between the edge of the pipe and the lip of the curb. Review and revise accordingly.
8. On all pertinent *Roadway Grading Plans* and *Plan & Profile* sheets, specify the minimum clearance distance between the lip of the curb and gutter of the street and the edge of the proposed storm drain.
9. **Sheet 15/27** and **Sheet 16/27**: It is assumed that the sequence of construction is that the storm drain system at the intersection of *Desert Foothills Drive* and *Clowder Pass Way* to be installed prior to the subject improvements. Therefore the storm drains downstream of SDMH #1 should be existing in regard to the subject project. Revise the line type of the storm drains in *Desert Foothill Drive* to broken line to reflect "Existing" status and revise the word "FUTURE" Desert Foothill Drive to "EXISTING" in the next submittal.
10. *Storm Drain Construction Note #7* proposes Type "A" drop inlet. Delete this construction note as *City of Las Vegas* does not allow Type "A" drop inlet anymore.

In an effort to increase administrative efficiency, for all original and re-submittal packages including updates and the addenda, the City of Las Vegas Public Works Department requires both a hardcopy and a digital copy (PDF) on CD for the drainage study.

A letter sealed and signed by a Nevada registered civil engineer must be included in every submittal certifying documents on the electronic CD matches 100% of the hardcopy submittal. The new submittal requirement is effective on May 1, 2019. If there are any questions regarding these new requirements, please contact Albert Sung in the City Flood Control Section at (702) 229-6541.

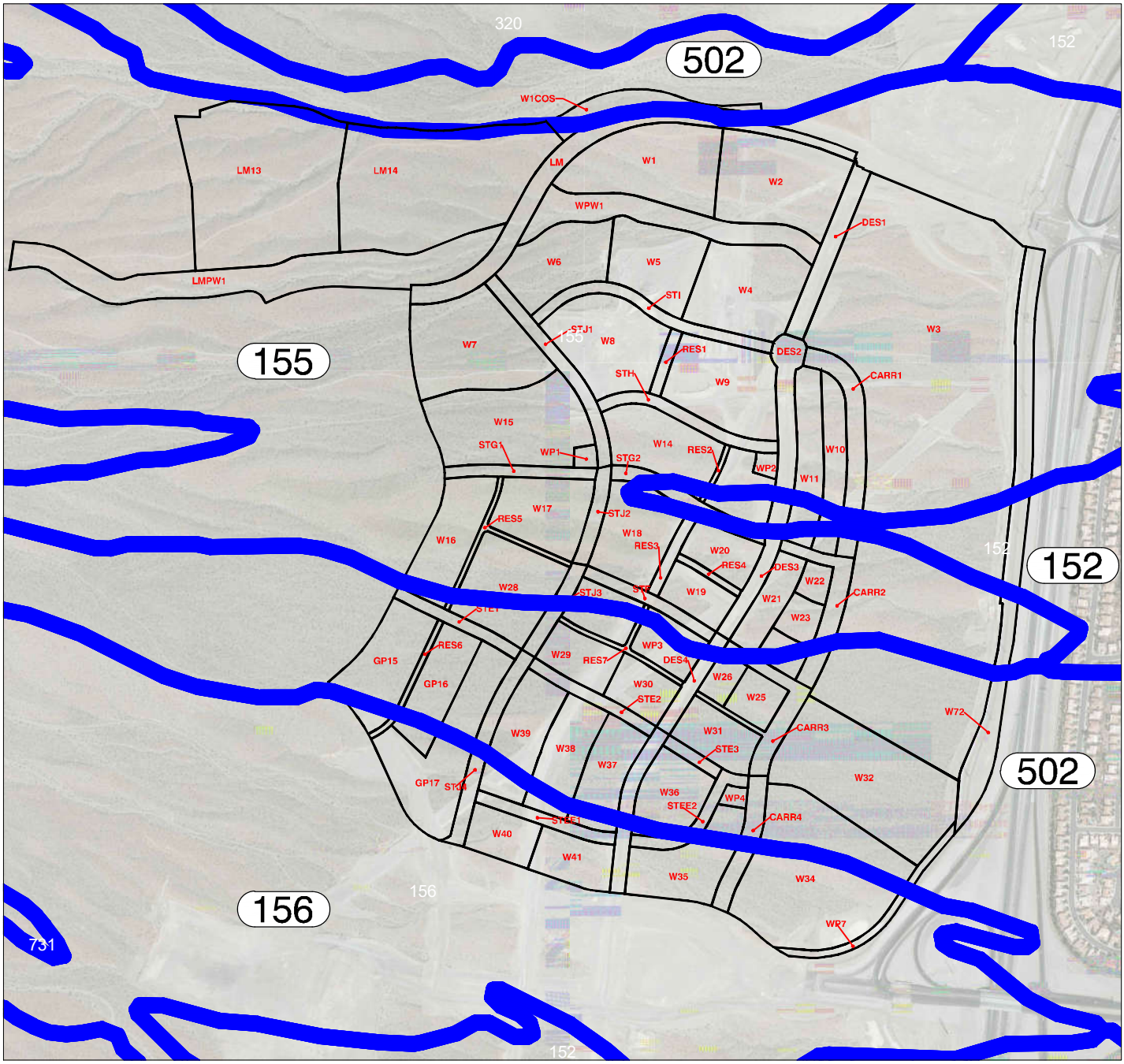
Sample Letter to certify CD.pdf

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

END OF REMARKS
HDR/AYS

T/R/S: T20S/R59E/14
AREA K-14

Appendix B. Reference Information



LEGEND

SITE BOUNDARY

300 SOIL NUMBER

SOIL BOUNDARY

NOTE:
1. This data was taken from the following website: http://soildatamart.nrcs.usda.gov
2. This data is in state plane coordinates

NORTH

GRAPHIC SCALE

1000 0 500 1000 2000

1" = 1000'

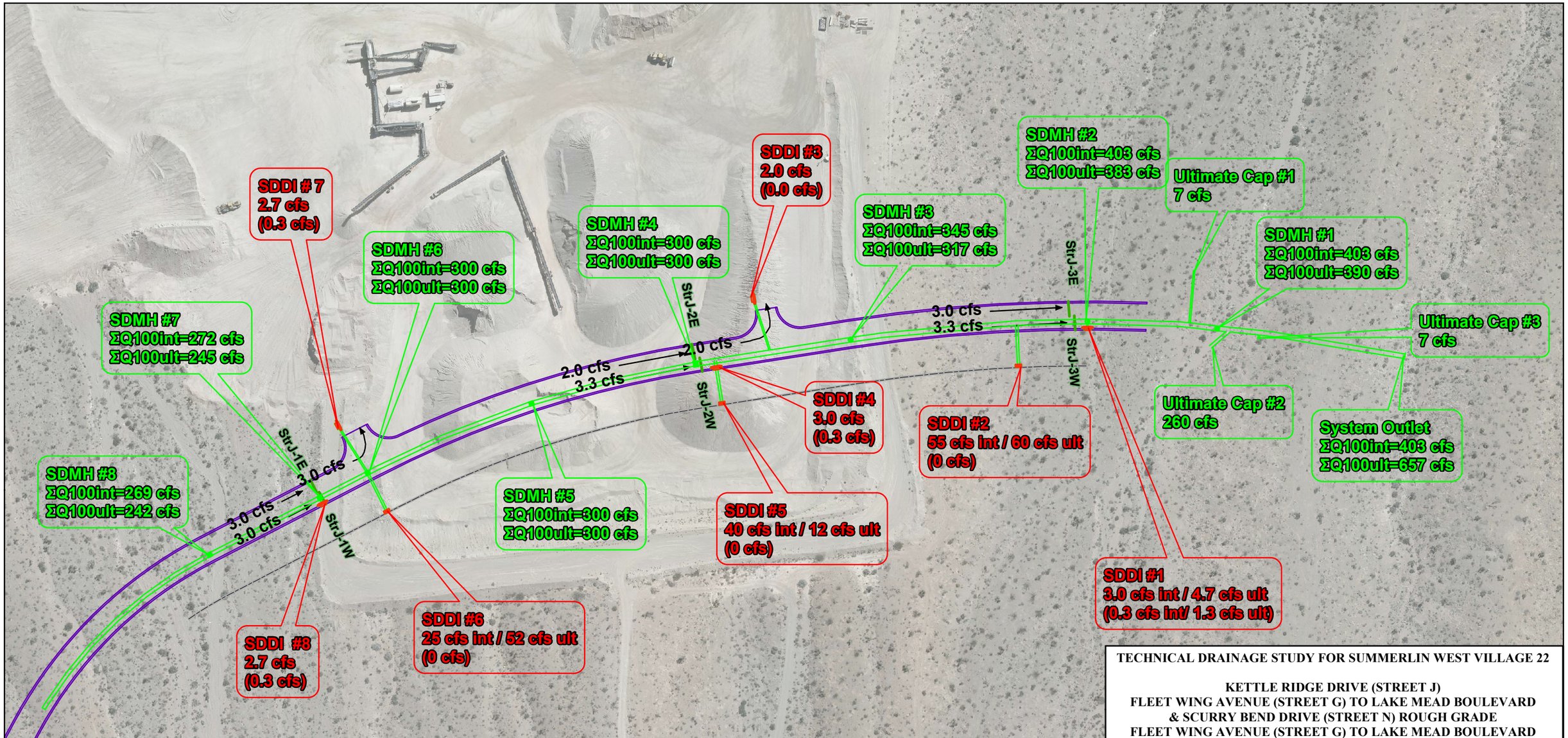
H:\7861\Village 22 Master\Drainage\A Figures\Figure 5A - Village 22 Soils Map.dwg

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

FIGURE 5: SOILS MAP

SUMMERLIN WEST VILLAGE 22

SCALE	HORZ.	1"=1000'
	VERT.	n/a
W.O. NO.		7861
DRAWN BY:		AH
DATE:		MAY 2018
SHEET		OF



Interim Condition (100-Year) Street Flow and Drop Inlet Calculations Summary Table

XS ID	Improvement Plans Station (ft)	Total Discharge (cfs)	Total Discharge Source	Drop Inlet			Flow Depth in Street (ft)	Velocity of Flow in Street (ft/s)	Depth*Velocity (must be less than 8)
				Intercepted Flow (cfs)	Intercepted Facility	Bypass Flow (cfs)			
StrJ-ST1W	68+83	3.0	StrJ-1W	N/A	N/A	N/A	0.3	4.8	1.3
StrJ-ST1E	68+83	3.0	StrJT1E	N/A	N/A	N/A	0.3	4.8	1.3
StrJ-ST2W	63+57	3.3	StrJ-2W + bypass SDDI #8	N/A	N/A	N/A	0.4	1.8	0.7
StrJ-ST2E	63+57	2.0	StrJ-2E	N/A	N/A	N/A	0.3	1.6	0.5
StrJ-ST3W	58+77	3.3	StrJ-3W + bypass SDDI#4	N/A	N/A	N/A	0.4	1.8	0.6
StrJ-ST3E	58+29	3.0	StrJ-3E	N/A	N/A	N/A	0.4	1.7	0.6
SDDI #1	58+76	3.3	StrJ-3E + bypass SDDI #4	3.0	24-inch RCP	0.3	N/A	N/A	N/A
SDDI #2	59+67	55.0	INT-J3	55.0	36-inch RCP	0.0	N/A	N/A	N/A
SDDI #3	62+86	2.0	StrJ-2E	2.0	24-inch RCP	0.0	N/A	N/A	N/A
SDDI #4	63+58	3.3	StrJ-2W + bypass SDDI #8	3.0	36-inch RCP	0.3	N/A	N/A	N/A
SDDI #5	63+58	40.0	INT-J2	40.0	36-inch RCP	0.0	N/A	N/A	N/A
SDDI #6	68+31	25.0	INT-J1	25.0	30-inch RCP	0.0	N/A	N/A	N/A
SDDI #7	68+31	3.0	StrJ-1E	2.7	24-inch RCP	0.3	N/A	N/A	N/A
SDDI #8	69+00	3.0	StrJ-1W	2.7	24-inch RCP	0.3	N/A	N/A	N/A

Ultimate Condition (100-Year) Street Flow and Drop Inlet Calculations Summary Table

XS ID	Improvement Plans Station (ft)	Total Discharge (cfs)	Total Discharge Source	Drop Inlet			Flow Depth in Street (ft)	Velocity of Flow in Street (ft/s)	Depth*Velocity (must be less than 8)
				Intercepted Flow (cfs)	Intercepted Facility	Bypass Flow (cfs)			
StrJ-ST1W	68+83	3.0	StrJ-1W	N/A	N/A	N/A	0.3	4.8	1.3
StrJ-ST1E	68+83	3.0	StrJT1E	N/A	N/A	N/A	0.3	4.8	1.3
StrJ-ST2W	63+57	3.3	StrJ-2W + bypass SDDI #8	N/A	N/A	N/A	0.4	1.8	0.7
StrJ-ST2E	63+57	2.0	StrJ-2E	N/A	N/A	N/A	0.4	1.6	0.6
StrJ-ST3W	58+77	3.3	StrJ-3W + bypass SDDI#4	N/A	N/A	N/A	0.4	1.6	0.6
StrJ-ST3E	58+29	3.0	StrJ-3E	N/A	N/A	N/A	0.4	1.6	0.5
SDDI #1	58+76	6.0	StrJ-3E + bypass SDDI #4	4.7	24-inch RCP	1.3	N/A	N/A	N/A
SDDI #2	59+67	60.0	Parcel F	60.0	36-inch RCP	0.0	N/A	N/A	N/A
SDDI #3	62+86	2.0	StrJ-2E	2.0	24-inch RCP	0.0	N/A	N/A	N/A
SDDI #4	63+58	3.3	StrJ-2W + bypass SDDI #8	3.0	36-inch RCP	0.3	N/A	N/A	N/A
SDDI #5	63+58	12.0	NP-2 + 10% Parcel E	40.0	36-inch RCP	0.0	N/A	N/A	N/A
SDDI #6	68+31	52.0	90% Parcel E	25.0	30-inch RCP	0.0	N/A	N/A	N/A
SDDI #7	68+31	3.0	StrJ-1E	2.7	24-inch RCP	0.3	N/A	N/A	N/A
SDDI #8	69+00	3.0	StrJ-1W	2.7	24-inch RCP	0.3	N/A	N/A	N/A
Ult-Cap#1	57+08	7.0	StrJ-3E + Offsite	N/A	24-inch RCP	N/A	N/A	N/A	N/A
Ult-Cap#2	57+15	260.0	Offsite	N/A	48-inch RCP	N/A	N/A	N/A	N/A
Ult-Cap#3	56+59	7.0	Offsite	N/A	24-inch RCP	N/A	N/A	N/A	N/A

TECHNICAL DRAINAGE STUDY FOR SUMMERLIN WEST VILLAGE 22

KETTLE RIDGE DRIVE (STREET J)
FLEET WING AVENUE (STREET G) TO LAKE MEAD BOULEVARD
& SCURRY BEND DRIVE (STREET N) ROUGH GRADE
FLEET WING AVENUE (STREET G) TO LAKE MEAD BOULEVARD

FIGURE 4: HYDRAULIC WORKMAP

Legend

- Proposed Drop Inlets
- Proposed Storm Drain
- Street Cross Section
- Street Flow
- Proposed Roadway
- Proposed Swale

Intercepted Flow
(Bypass Flow)

N

ATKINS
Member of the SNC-Lavalin Group

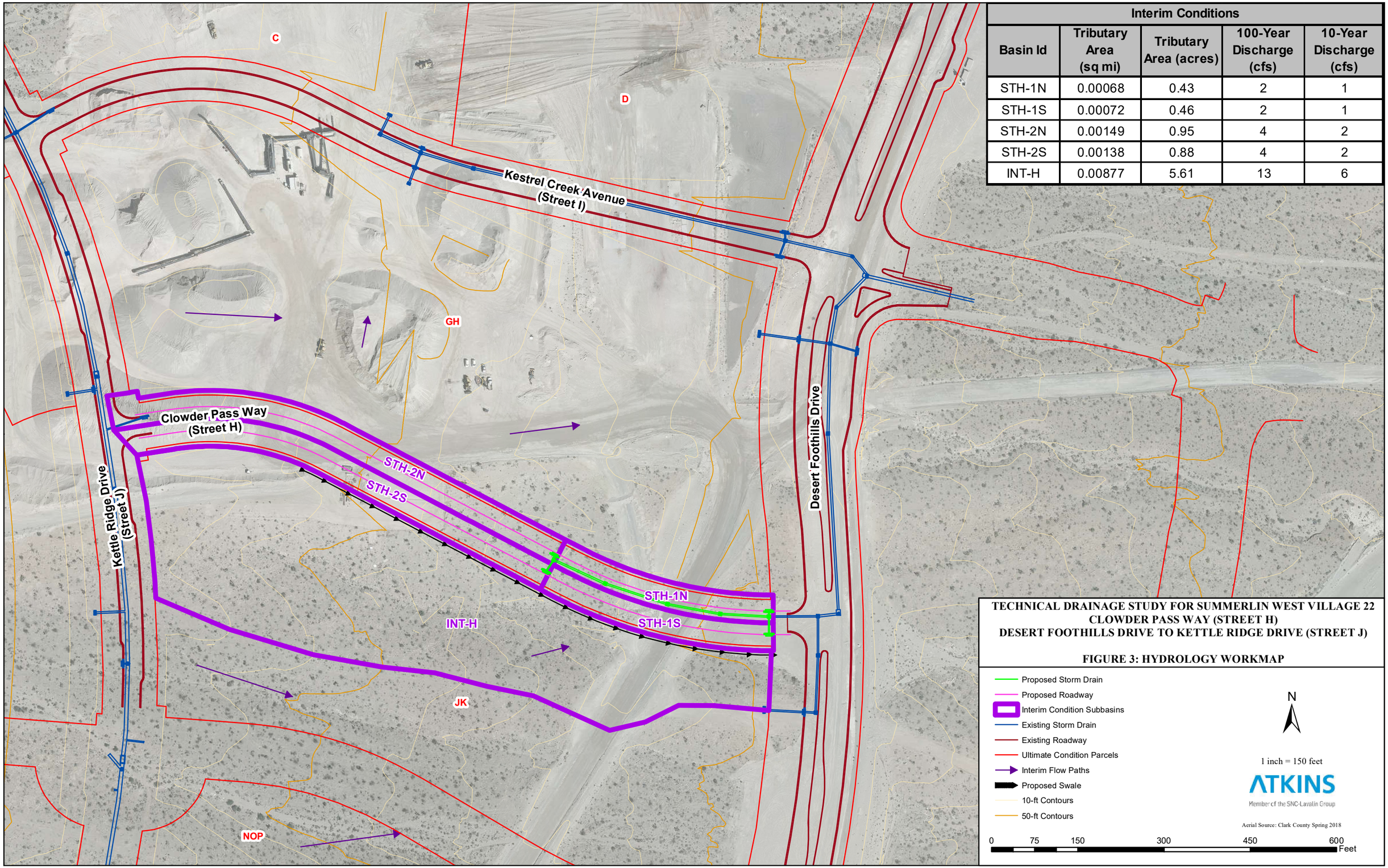
0 50 100 200
Feet
1 inch = 125 feet

The 100-year D*V for all street cross-sections is less than 6.
Therefore, the10-year D*V is also less than 6.
To minimize redundancy, the 10-year calculations are not included.

Aerial Source: Clark County Spring 2018

Appendix C. Revised Hydrology

C.1. Revised Hydrology Workmap



Interim Conditions				
Basin Id	Tributary Area (sq mi)	Tributary Area (acres)	100-Year Discharge (cfs)	10-Year Discharge (cfs)
STH-1N	0.00068	0.43	2	1
STH-1S	0.00072	0.46	2	1
STH-2N	0.00149	0.95	4	2
STH-2S	0.00138	0.88	4	2
INT-H	0.00877	5.61	13	6

TECHNICAL DRAINAGE STUDY FOR SUMMERLIN WEST VILLAGE 22
CLOWDER PASS WAY (STREET H)
DESERT FOOTHILLS DRIVE TO KETTLE RIDGE DRIVE (STREET J)

FIGURE 3: HYDROLOGY WORKMAP

- Proposed Storm Drain
- Proposed Roadway
- Interim Condition Subbasins
- Existing Storm Drain
- Existing Roadway
- Ultimate Condition Parcels
- Interim Flow Paths
- Proposed Swale
- 10-ft Contours
- 50-ft Contours

C.2. Revised Hydrology Parameters

Summerlin West Village 22

Clowder Pass Way

Collection Subbasins

CN Calculation Summary

BASIN ID	LAND USE INDEX NUMBER	LAND USE DESCRIPTION	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
STH-1N	7	Public Facility and Residential, 8-12 units/acre	1155	94	18841	18841	100.0%	100.0%	94.00	94.00	**94.0**
STH-1S	7	Public Facility and Residential, 8-12 units/acre	1155	94	19966	19966	100.0%	100.0%	94.00	94.00	**94.0**
STH-2N	7	Public Facility and Residential, 8-12 units/acre	1155	94	41402	41402	100.0%	100.0%	94.00	94.00	**94.0**
STH-2S	7	Public Facility and Residential, 8-12 units/acre	1155	94	38427	38427	100.0%	100.0%	94.00	94.00	**94.0**
INT-H	1	Undeveloped Land, Open Desert	1155	88	244370	244370	100.0%	100.0%	88.00	88.00	**88.0**

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HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Summerlin West Village 22
Clowder Pass Way (Street H)
Desert Foothills Drive to Kettle Ridge Drive (Street J)
INTERIM CONDITION

BY: MMA
DATE: 1/15/20

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag
DESIG: (1)	DEV./EX. (D or E)	CN	K (2)	AREA Ac (3)	AREA Mi^2	INITIAL LENGTH Feet (4)	SLOPE % (5)	Ti Min (6)	TRAVEL LENGTH Feet (7)	SLOPE % (8)	V1 VELOCITY FPS (9a)	V2 VELOCITY FPS (9b)	Tt Min (10)	Min (13)	Min (14)	Tlag= 0.6Tc/60 Hours
SH-1N	D	94.0	0.851	0.43	0.00068	19.0	2.0	1.6	390	8.0	5.7	8.7	1.1	2.7	12.3	**0.05***
SH-1S	D	94.0	0.851	0.46	0.00072	19.0	2.0	1.6	390	8.0	5.7	8.7	1.1	2.7	12.3	**0.05***
SH-2N	D	94.0	0.851	0.95	0.00149	19.0	2.0	1.6	850	8.0	5.7	8.7	2.1	3.7	14.8	**0.05***
SH-2S	D	94.0	0.851	0.88	0.00138	19.0	2.0	1.6	850	8.0	5.7	8.7	2.1	3.7	14.8	**0.05***
INT-H	E	88.0	0.772	5.61	0.00877	100.0	3.9	3.8	9171	7.5	4.1	8.1	20.0	23.8	N/A	**0.238**

Tc = Ti + Tt Tlag = 0.6 Tc
Ti = 1.8 (1.1 - K) L^1/2 / S^1/3
K = 0.0132 (CN) - 0.39
Tc Check = L/180+10

For the travel time (Tt) calculations,
V1 applies to the first 500 feet of travel distance;
V2 applies to the remaining travel distance.

V1 = 14.8*(S/100)^1/2 Developed V1 = 20.2*(S/100)^1/2
V2 = 29.4*(S/100)^1/2 Developed V2 = 30.6*(S/100)^1/2

REFERENCE : **STANDARD FORM 4**

*Minimum recommended Tc for developed subbasins is 5 mins. A value of 0.05 was use for the Tlag where the calculated Tc was less than 5 mins.

C.3. Revised HEC-1

```
1****************************************                                                    ****************************************
 *                                      *                                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                                    *          609 SECOND STREET           *
 *                                      *                                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   16JAN20  TIME  08:20:22  *                                                    *           (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

                        *DIAGRAM
 *** FREE ***
             1          ID  TECHNICAL DRAINAGE STUDY
             2          ID  SUMMERLIN WEST VILLAGE 22
             3          ID  CLOWDER PASS WAY (STREET H)
             4          ID  DESERT FOOTHILLS DRIVE TO KETTLE RIDGE DRIVE (STREET J)
             5          ID  DESIGN STORM 100-YEAR 6 HOUR
             6          ID
             7          ID  JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES
             8          ID
             9          ID    AREA (SQUARE MILES)           DARF
            10          ID
            11          ID          0 - 0.5                0.99
            12          ID          Estimated 10-year      0.57
            13          ID
            14          IT       5       0       0     300
            15          IO       5       0       0
            16          IN       5       0       0
            17          JR    PREC    0.99    0.57
                        *

            18          KK   SH-1N
            19          BA 0.00068
            20          PB    3.42
            21          PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
            22          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
            23          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
            24          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
            25          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
            26          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
            27          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
            28          PC   0.998   0.999   1.000
            29          LS       0    94.0
            30          UD   0.050
                        *

            31          KK   SH-2N
            32          BA 0.00149
            33          PB    3.42
            34          LS       0    94.0
            35          UD   0.050
                        *
                        *

            36          KK   SH-1S
            37          BA 0.00072
            38          PB    3.42
            39          LS       0    94.0
            40          UD   0.050
                        *
                        *
1                                                   HEC-1 INPUT                                                PAGE  2
```

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


            41          KK   SH-2S
            42          BA 0.00138
            43          PB    3.42
            44          LS       0    94.0
            45          UD   0.050
                        *

            46          KK   INT-H
            47          BA 0.00877
            48          PB    3.41
            49          LS       0    88.0
            50          UD   0.238
                        *
            51          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    18       SH-1N
                 .
                 .
    31           .       SH-2N
                 .           .
                 .           .
    36           .           .       SH-1S
                 .           .           .
                 .           .           .
    41           .           .           .       SH-2S
                 .           .           .           .
                 .           .           .           .
    46           .           .           .           .       INT-H

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                                    ****************************************
 *                                      *                                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *               JUN   1998             *                                                    *    HYDROLOGIC ENGINEERING CENTER     *
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 *                                      *                                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   16JAN20  TIME  08:20:22  *                                                    *           (916) 756-1104             *
 *                                      *                                                    *                                      *
 ****************************************                                                    ****************************************


                           TECHNICAL DRAINAGE STUDY
                           SUMMERLIN WEST VILLAGE 22
                           CLOWDER PASS WAY (STREET H)
                           DESERT FOOTHILLS DRIVE TO KETTLE RIDGE DRIVE (STREET J)
                           DESIGN STORM 100-YEAR 6 HOUR

                           JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES

                             AREA (SQUARE MILES)           DARF

                                   0 - 0.5                 0.99
                                   Estimated 10-year       0.57


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

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

                     COMPUTATION INTERVAL     .08 HOURS
                          TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
```
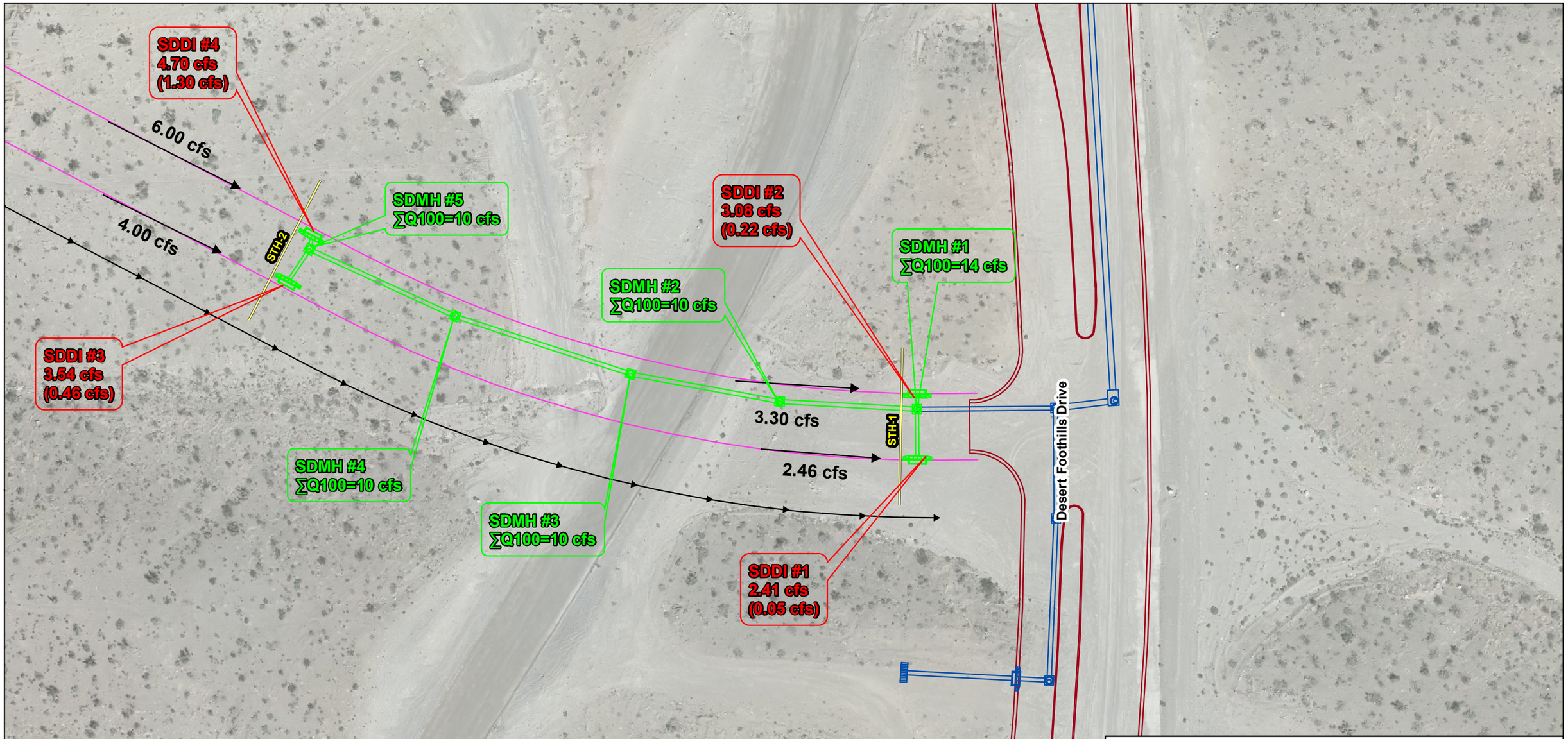

```
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .99       .57
1

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


                                                          RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                         .99      .57

 HYDROGRAPH AT
+                  SH-1N       .00     1   FLOW           2.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  SH-2N       .00     1   FLOW           4.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  SH-1S       .00     1   FLOW           2.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  SH-2S       .00     1   FLOW           4.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  INT-H       .01     1   FLOW          13.       6.
                                           TIME         3.67     3.67


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

Appendix D. Revised Hydraulics

D.1. Revised Hydraulic Workmap



XS/SD ID	Total Discharge (cfs)	Total Discharge Source	Drop Inlet			Flow Depth in Street (ft)	Velocity of Flow in Street (ft/s)	Depth*Velocity (must be less than 8)
			Intercepted Flow (cfs)	Bypass Flow (cfs)	Sump Depth (ft)			
STH 1	5.76	STH 1 + Bypass SDDI #3 & 4	N/A	N/A	N/A	0.21	5.21	1.09
STH 2	10.00	STH 2	N/A	N/A	N/A	0.25	5.93	1.48
SDDI #1	2.46	STH 1S + Bypass SDDI #3	2.41	0.05	N/A	N/A	N/A	N/A
SDDI #2	3.30	STH 1N + Bypass SDDI #4	3.08	0.22	N/A	N/A	N/A	N/A
SDDI #3	4.00	STH 2S	3.54	0.46	N/A	N/A	N/A	N/A
SDDI #4	6.00	STH 2N + Kettle Ridge Drive bypass	4.70	1.30	N/A	N/A	N/A	N/A

TECHNICAL DRAINAGE STUDY FOR SUMMERLIN WEST VILLAGE 22
CLOWDER PASS WAY (STREET H)
DESERT FOOTHILLS DRIVE TO KETTLE RIDGE DRIVE (STREET J)

FIGURE 4: HYDRAULIC WORKMAP

Street H Cross Sections
Proposed Storm Drain
Existing Storm Drain
Street Flows
Existing Roadway
Proposed Roadway
Proposed Swale

Drop Inlet #
Intercepted Flow
(Bypass Flow)

Manhole #
100-yr flow at MH

N

ATKINS
Member of the SNC-Lavalin Group

Aerial Source: Clark County Spring 2018

0 30 60 120 Feet

1 inch = 60 feet

D.2. Revised Drop Inlet Calculations

Worksheet for SDDI #1 10' Combo Inlet On Grade at 3% 100 yr

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.46 cfs
Slope	0.030 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.080 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.016
Local Depression	4.0 in
Local Depression Width	24.0 in
Grate Width	1.50 ft
Grate Length	7.5 ft
Grate Type	Curved Vaned
Clogging	50.0 %
Curb Opening Length	10.0 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	98.04 %
Intercepted Flow	2.41 cfs
Bypass Flow	0.05 cfs
Spread	7.5 ft
Depth	0.2 ft
Flow Area	0.6 ft²
Gutter Depression	1.1 in
Total Depression	5.1 in
Velocity	3.92 ft/s
Splash Over Velocity	8.05 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.193
Grate Flow Ratio	0.573
Equivalent Cross Slope	0.141 ft/ft
Active Grate Length	3.8 ft
Length Factor	0.528
Total Interception Length	11.8 ft

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for SDDI #1 10' Combo Inlet On Grade at 3% 100 yr

Messages

Worksheet for SDDI #2 10' Combo Inlet On Grade at 3% 100 yr

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.30 cfs
Slope	0.030 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.080 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.016
Local Depression	4.0 in
Local Depression Width	24.0 in
Grate Width	1.50 ft
Grate Length	7.5 ft
Grate Type	Curved Vaned
Clogging	50.0 %
Curb Opening Length	10.0 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	93.31 %
Intercepted Flow	3.08 cfs
Bypass Flow	0.22 cfs
Spread	8.5 ft
Depth	0.3 ft
Flow Area	0.8 ft²
Gutter Depression	1.1 in
Total Depression	5.1 in
Velocity	4.15 ft/s
Splash Over Velocity	8.05 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.177
Grate Flow Ratio	0.511
Equivalent Cross Slope	0.128 ft/ft
Active Grate Length	3.8 ft
Length Factor	0.441
Total Interception Length	14.2 ft

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for SDDI #2 10' Combo Inlet On Grade at 3% 100 yr

Messages

Worksheet for SDDI #3 10' Combo Inlet On Grade at 8% 100 yr

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.00 cfs
Slope	0.080 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.080 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.016
Local Depression	4.0 in
Local Depression Width	24.0 in
Grate Width	1.50 ft
Grate Length	7.5 ft
Grate Type	Curved Vaned
Clogging	50.0 %
Curb Opening Length	10.0 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	88.48 %
Intercepted Flow	3.54 cfs
Bypass Flow	0.46 cfs
Spread	7.5 ft
Depth	0.2 ft
Flow Area	0.6 ft²
Gutter Depression	1.1 in
Total Depression	5.1 in
Velocity	6.39 ft/s
Splash Over Velocity	8.05 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.090
Grate Flow Ratio	0.574
Equivalent Cross Slope	0.141 ft/ft
Active Grate Length	3.8 ft
Length Factor	0.321
Total Interception Length	19.5 ft

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for SDDI #3 10' Combo Inlet On Grade at 8% 100 yr

Messages

Worksheet for SDDI #4 10' Combo Inlet On Grade at 8% 100 yr

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.00 cfs
Slope	0.080 ft/ft
Gutter Width	1.50 ft
Gutter Cross Slope	0.080 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.016
Local Depression	4.0 in
Local Depression Width	24.0 in
Grate Width	1.50 ft
Grate Length	7.5 ft
Grate Type	Curved Vaned
Clogging	50.0 %
Curb Opening Length	10.0 ft

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results	
Efficiency	78.33 %
Intercepted Flow	4.70 cfs
Bypass Flow	1.30 cfs
Spread	8.9 ft
Depth	0.3 ft
Flow Area	0.9 ft²
Gutter Depression	1.1 in
Total Depression	5.1 in
Velocity	6.92 ft/s
Splash Over Velocity	8.05 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.079
Grate Flow Ratio	0.490
Equivalent Cross Slope	0.124 ft/ft
Active Grate Length	3.8 ft
Length Factor	0.250
Total Interception Length	25.0 ft

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for SDDI #4 10' Combo Inlet On Grade at 8% 100 yr

Messages

D.3. Revised Street Flow Calculations

Worksheet for Clowder Pass Way -STH 1 -100 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.080 ft/ft
Discharge	5.76 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.50
0+00.5	0.50
0+00.6	0.00
0+02.0	0.08
0+02.0	0.10
0+16.5	0.39
0+31.0	0.10
0+31.0	0.08
0+32.4	0.00
0+32.5	0.50
0+33.0	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.50)	(0+02.0, 0.08)	0.013
(0+02.0, 0.08)	(0+31.0, 0.08)	0.015
(0+31.0, 0.08)	(0+33.0, 0.50)	0.013

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	0.2 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	1.1 ft²
Wetted Perimeter	14.4 ft
Hydraulic Radius	0.1 ft
Top Width	14.04 ft
Normal Depth	0.2 ft
Critical Depth	0.3 ft
Critical Slope	0.006 ft/ft
Velocity	5.21 ft/s

Worksheet for Clowder Pass Way -STH 1 -100 yr

Results	
Velocity Head	0.42 ft
Specific Energy	0.64 ft
Froude Number	3.271
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.2 ft
Critical Depth	0.3 ft
Channel Slope	0.080 ft/ft
Critical Slope	0.006 ft/ft

Worksheet for Clowder Pass Way - STH 2 - 100 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.080 ft/ft
Discharge	10.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.50
0+00.5	0.50
0+00.6	0.00
0+02.0	0.10
0+02.0	0.10
0+16.5	0.40
0+31.0	0.10
0+31.0	0.10
0+32.4	0.00
0+32.5	0.50
0+33.0	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.50)	(0+02.0, 0.10)	0.013
(0+02.0, 0.10)	(0+31.0, 0.10)	0.015
(0+31.0, 0.10)	(0+33.0, 0.50)	0.013

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	0.3 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	1.7 ft²
Wetted Perimeter	18.0 ft
Hydraulic Radius	0.1 ft
Top Width	17.54 ft
Normal Depth	0.3 ft
Critical Depth	0.4 ft
Critical Slope	0.006 ft/ft
Velocity	5.93 ft/s

Worksheet for Clowder Pass Way - STH 2 - 100 yr

Results	
Velocity Head	0.55 ft
Specific Energy	0.80 ft
Froude Number	3.374
Flow Type	Supercritical

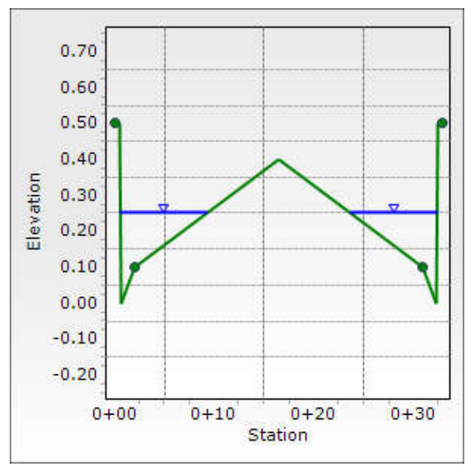
GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.3 ft
Critical Depth	0.4 ft
Channel Slope	0.080 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for Clowder Pass Way - STH 2 - 100 yr

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.080 ft/ft
Normal Depth	0.3 ft
Discharge	10.00 cfs



D.4. Revised WSPG-W Model

```
T1 SUMMERLIN WEST VILLAGE 22                                                0
T2 CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)
T3 ATKINS
SO   2103.34 3335.74  24                        3338.074
REM  Tailwater from Desert Foothills Drive Addendum #1
R    2103.34 3335.74  24     .013                                  .000  02.0   0
REM  Downstream of SDMH #1 (Junction with Lateral SDDI#1, 2)
JX   2106.34 3335.84  24 24 24.013    2.0      2.0  3335.94 3335.94  90.0-90.0    .000
R    2109.34 3335.94  24     .013                                  .000  02.0   0
REM  Upstream of SDMH #1 (Junction with Lateral SDDI#1, 2)
REM  84.67 foot Reach
R    2189.21 3339.12  24     .013                                  .000  00.0   0
REM  Downstream of SDMH #2
R    2192.21 3339.22  24     .013                                  .000  07.0   0
R    2195.21 3339.32  24     .013                                  .000  00.0   0
REM  Upstream of SDMH #2
REM  93.45 foot Reach
R    2283.92 3343.52  24     .013                                  .000  04.0   0
REM  Downstream of SDMH #3
R    2286.92 3343.62  24     .013                                  .000  08.0   0
R    2289.92 3343.72  24     .013                                  .000  04.0   0
REM  Upstream of SDMH #3
REM  114.02 foot Reach
REM  Downstream of SDMH #4
R    2399.53 3352.56  24     .013                                  .000  00.0   0
R    2402.53 3352.66  24     .013                                  .000  08.0   0
REM  Upstream of SDMH #4
R    2405.53 3352.76  24     .013                                  .000  00.0   0
REM  98.52 foot Reach
REM  Downstream of SDMH #5 (Junction with SDDI #4)
R    2499.90 3360.40  24     .013                                  .000  15.0   0
R    2500.90 3360.45  24     .013                                  .000  15.0   0
JX   2501.90 3360.50  24      .013    6.0           3360.60          90.0         .000
R    2502.90 3360.55  24     .013                                  .000  15.0   0
R    2503.90 3360.60  24     .013                                  .000  15.0   0
REM  Upstream of SDMH#5 (Junction with SDDI #4)
REM  24.69 foot Reach
R    2526.59 3361.53  24     .013
REM  Downstream of SDDI #3
SH   2526.59 3361.53  24
CD  24  4   1    .000   2.000     .000  .000  .000   .00
Q              4.0     .0
```

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SUMMERLIN WEST VILLAGE 22
CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)
ATKINS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2103.340	3335.740	2.336	3338.076	14.00	4.46	.31	3338.38	.00	1.35	.00	2.000	.000	.00	1 .0
JUNCT STR	.0334					.0029	.01	2.34	.00		.013	.00	.00	PIPE
2106.340	3335.840	2.547	3338.387	10.00	3.18	.16	3338.54	.00	1.13	.00	2.000	.000	.00	1 .0
3.000	.0333					.0020	.01	2.55	.00	.67	.013	.00	.00	PIPE
2109.340	3335.940	2.454	3338.394	10.00	3.18	.16	3338.55	.00	1.13	.00	2.000	.000	.00	1 .0
11.982	.0398					.0019	.02	2.45	.00	.64	.013	.00	.00	PIPE
2121.322	3336.417	2.000	3338.417	10.00	3.18	.16	3338.57	.00	1.13	.00	2.000	.000	.00	1 .0
2.664	.0398					.0018	.00	2.00	.00	.64	.013	.00	.00	PIPE
2123.987	3336.523	1.891	3338.414	10.00	3.25	.16	3338.58	.00	1.13	.91	2.000	.000	.00	1 .0
HYDRAULIC JUMP														
2123.987	3336.523	.640	3337.163	10.00	11.55	2.07	3339.23	.00	1.13	1.87	2.000	.000	.00	1 .0
65.223	.0398					.0426	2.78	.64	2.99	.64	.013	.00	.00	PIPE
2189.210	3339.120	.618	3339.739	10.00	12.10	2.27	3342.01	.00	1.13	1.85	2.000	.000	.00	1 .0
3.000	.0333					.0460	.14	.62	3.19	.67	.013	.00	.00	PIPE
2192.210	3339.220	.614	3339.834	10.00	12.22	2.32	3342.15	.00	1.13	1.84	2.000	.000	.00	1 .0
3.000	.0334					.0473	.14	.61	3.23	.67	.013	.00	.00	PIPE
2195.210	3339.320	.609	3339.929	10.00	12.36	2.37	3342.30	.00	1.13	1.84	2.000	.000	.00	1 .0
3.006	.0473					.0481	.14	.61	3.28	.61	.013	.00	.00	PIPE

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SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2198.216	3339.462	.609	3340.071	10.00	12.36	2.37	3342.44	.00	1.13	1.84	2.000	.000	.00	1 .0
51.410	.0473					.0516	2.65	.61	3.29	.61	.013	.00	.00	PIPE
2249.626	3341.896	.588	3342.485	10.00	12.96	2.61	3345.09	.00	1.13	1.82	2.000	.000	.00	1 .0
20.866	.0473					.0589	1.23	.59	3.51	.61	.013	.00	.00	PIPE
2270.491	3342.884	.569	3343.453	10.00	13.60	2.87	3346.32	.00	1.13	1.80	2.000	.000	.00	1 .0
13.428	.0473					.0673	.90	.57	3.75	.61	.013	.00	.00	PIPE
2283.920	3343.520	.549	3344.070	10.00	14.26	3.16	3347.23	.00	1.13	1.79	2.000	.000	.00	1 .0
3.000	.0334					.0739	.22	.55	4.01	.67	.013	.00	.00	PIPE
2286.920	3343.620	.542	3344.162	10.00	14.55	3.29	3347.45	.00	1.13	1.78	2.000	.000	.00	1 .0
3.000	.0333					.0783	.23	.54	4.12	.67	.013	.00	.00	PIPE
2289.920	3343.720	.533	3344.253	10.00	14.87	3.43	3347.69	.00	1.13	1.77	2.000	.000	.00	1 .0
6.229	.0807					.0807	.50	.53	4.25	.53	.013	.00	.00	PIPE
2296.149	3344.222	.533	3344.756	10.00	14.87	3.43	3348.19	.00	1.13	1.77	2.000	.000	.00	1 .0
57.617	.0807					.0800	4.61	.53	4.25	.53	.013	.00	.00	PIPE
2353.766	3348.869	.536	3349.405	10.00	14.78	3.39	3352.79	.00	1.13	1.77	2.000	.000	.00	1 .0
45.764	.0807					.0743	3.40	.54	4.21	.53	.013	.00	.00	PIPE
2399.530	3352.560	.554	3353.114	10.00	14.09	3.08	3356.20	.00	1.13	1.79	2.000	.000	.00	1 .0
3.000	.0333					.0713	.21	.55	3.94	.67	.013	.00	.00	PIPE

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SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope				SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch	
2402.530	3352.660	.547	3353.207	10.00	14.36	3.20	3356.41	.00	1.13	1.78	2.000	.000	.00	1 .0
3.000	.0334					.0755	.23	.55	4.05	.67	.013	.00	.00	PIPE
2405.530	3352.760	.539	3353.298	10.00	14.67	3.34	3356.64	.00	1.13	1.77	2.000	.000	.00	1 .0
16.039	.0810					.0766	1.23	.54	4.17	.53	.013	.00	.00	PIPE
2421.569	3354.058	.542	3354.601	10.00	14.52	3.27	3357.87	.00	1.13	1.78	2.000	.000	.00	1 .0
27.426	.0810					.0708	1.94	.54	4.11	.53	.013	.00	.00	PIPE
2448.995	3356.279	.561	3356.840	10.00	13.84	2.98	3359.82	.00	1.13	1.80	2.000	.000	.00	1 .0
13.209	.0810					.0619	.82	.56	3.85	.53	.013	.00	.00	PIPE
2462.204	3357.348	.581	3357.929	10.00	13.20	2.71	3360.63	.00	1.13	1.82	2.000	.000	.00	1 .0
8.442	.0810					.0542	.46	.58	3.60	.53	.013	.00	.00	PIPE
2470.646	3358.031	.601	3358.633	10.00	12.59	2.46	3361.09	.00	1.13	1.83	2.000	.000	.00	1 .0
6.051	.0810					.0475	.29	.60	3.37	.53	.013	.00	.00	PIPE
2476.697	3358.521	.622	3359.144	10.00	12.00	2.24	3361.38	.00	1.13	1.85	2.000	.000	.00	1 .0
4.605	.0810					.0416	.19	.62	3.15	.53	.013	.00	.00	PIPE
2481.303	3358.894	.644	3359.538	10.00	11.44	2.03	3361.57	.00	1.13	1.87	2.000	.000	.00	1 .0
3.639	.0810					.0364	.13	.64	2.95	.53	.013	.00	.00	PIPE
2484.942	3359.189	.667	3359.855	10.00	10.91	1.85	3361.70	.00	1.13	1.89	2.000	.000	.00	1 .0
2.944	.0810					.0319	.09	.67	2.76	.53	.013	.00	.00	PIPE

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WATER SURFACE PROFILE LISTING Date: 1-20-2020 Time:11: 5:38

SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2487.886	3359.427	.690	3360.117	10.00	10.40	1.68	3361.80	.00	1.13	1.90	2.000	.000	.00	1 .0
2.418	.0810					.0280	.07	.69	2.58	.53	.013	.00	.00	PIPE
2490.303	3359.623	.715	3360.338	10.00	9.92	1.53	3361.87	.00	1.13	1.92	2.000	.000	.00	1 .0
2.006	.0810					.0245	.05	.71	2.41	.53	.013	.00	.00	PIPE
2492.310	3359.785	.740	3360.526	10.00	9.46	1.39	3361.91	.00	1.13	1.93	2.000	.000	.00	1 .0
1.676	.0810					.0215	.04	.74	2.25	.53	.013	.00	.00	PIPE
2493.985	3359.921	.767	3360.688	10.00	9.02	1.26	3361.95	.00	1.13	1.94	2.000	.000	.00	1 .0
1.402	.0810					.0189	.03	.77	2.10	.53	.013	.00	.00	PIPE
2495.387	3360.035	.795	3360.829	10.00	8.60	1.15	3361.98	.00	1.13	1.96	2.000	.000	.00	1 .0
1.169	.0810					.0165	.02	.79	1.97	.53	.013	.00	.00	PIPE
2496.557	3360.129	.824	3360.953	10.00	8.20	1.04	3362.00	.00	1.13	1.97	2.000	.000	.00	1 .0
.975	.0810					.0145	.01	.82	1.83	.53	.013	.00	.00	PIPE
2497.531	3360.208	.854	3361.062	10.00	7.82	.95	3362.01	.00	1.13	1.98	2.000	.000	.00	1 .0
.802	.0810					.0128	.01	.85	1.71	.53	.013	.00	.00	PIPE
2498.333	3360.273	.885	3361.158	10.00	7.45	.86	3362.02	.00	1.13	1.99	2.000	.000	.00	1 .0
.652	.0810					.0112	.01	.89	1.60	.53	.013	.00	.00	PIPE
2498.986	3360.326	.918	3361.244	10.00	7.10	.78	3362.03	.00	1.13	1.99	2.000	.000	.00	1 .0
.517	.0810					.0099	.01	.92	1.49	.53	.013	.00	.00	PIPE

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SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2499.502	3360.368	.953	3361.320	10.00	6.77	.71	3362.03	.00	1.13	2.00	2.000	.000	.00	1 .0
.397	.0810					.0087	.00	.95	1.39	.53	.013	.00	.00	PIPE
2499.900	3360.400	.989	3361.388	10.00	6.46	.65	3362.04	.00	1.13	2.00	2.000	.000	.00	1 .0
.286	.0500					.0079	.00	.99	1.29	.60	.013	.00	.00	PIPE
2500.186	3360.414	1.008	3361.422	10.00	6.30	.62	3362.04	.00	1.13	2.00	2.000	.000	.00	1 .0
.404	.0500					.0072	.00	1.01	1.25	.60	.013	.00	.00	PIPE
2500.590	3360.434	1.047	3361.481	10.00	6.01	.56	3362.04	.00	1.13	2.00	2.000	.000	.00	1 .0
.234	.0500					.0063	.00	1.05	1.16	.60	.013	.00	.00	PIPE
2500.824	3360.446	1.088	3361.534	10.00	5.73	.51	3362.04	.00	1.13	1.99	2.000	.000	.00	1 .0
.076	.0500					.0056	.00	1.09	1.08	.60	.013	.00	.00	PIPE
2500.900	3360.450	1.132	3361.582	10.00	5.46	.46	3362.04	.00	1.13	1.98	2.000	.000	.00	1 .0
JUNCT STR	.0500					.0027	.00	1.13	1.00		.013	.00	.00	PIPE
2501.900	3360.500	1.729	3362.229	4.00	1.39	.03	3362.26	.00	.70	1.37	2.000	.000	.00	1 .0
1.000	.0500					.0003	.00	1.73	.17	.38	.013	.00	.00	PIPE
2502.900	3360.550	1.678	3362.228	4.00	1.42	.03	3362.26	.00	.70	1.47	2.000	.000	.00	1 .0
1.000	.0500					.0003	.00	1.68	.18	.38	.013	.00	.00	PIPE
2503.900	3360.600	1.627	3362.227	4.00	1.46	.03	3362.26	.00	.70	1.56	2.000	.000	.00	1 .0
1.858	.0410					.0003	.00	1.63	.19	.40	.013	.00	.00	PIPE

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SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2505.758	3360.676	1.548	3362.224	4.00	1.53	.04	3362.26	.00	.70	1.67	2.000	.000	.00	1 .0
1.651	.0410					.0004	.00	1.55	.22	.40	.013	.00	.00	PIPE
2507.409	3360.744	1.478	3362.221	4.00	1.61	.04	3362.26	.00	.70	1.76	2.000	.000	.00	1 .0
1.496	.0410					.0004	.00	1.48	.24	.40	.013	.00	.00	PIPE
2508.905	3360.805	1.413	3362.218	4.00	1.69	.04	3362.26	.00	.70	1.82	2.000	.000	.00	1 .0
1.367	.0410					.0005	.00	1.41	.26	.40	.013	.00	.00	PIPE
2510.271	3360.861	1.353	3362.214	4.00	1.77	.05	3362.26	.00	.70	1.87	2.000	.000	.00	1 .0
1.254	.0410					.0005	.00	1.35	.28	.40	.013	.00	.00	PIPE
2511.525	3360.913	1.297	3362.210	4.00	1.85	.05	3362.26	.00	.70	1.91	2.000	.000	.00	1 .0
1.160	.0410					.0006	.00	1.30	.31	.40	.013	.00	.00	PIPE
2512.685	3360.960	1.245	3362.205	4.00	1.95	.06	3362.26	.00	.70	1.94	2.000	.000	.00	1 .0
1.069	.0410					.0007	.00	1.25	.33	.40	.013	.00	.00	PIPE
2513.755	3361.004	1.196	3362.200	4.00	2.04	.06	3362.26	.00	.70	1.96	2.000	.000	.00	1 .0
.992	.0410					.0007	.00	1.20	.36	.40	.013	.00	.00	PIPE
2514.747	3361.045	1.150	3362.195	4.00	2.14	.07	3362.27	.00	.70	1.98	2.000	.000	.00	1 .0
.914	.0410					.0008	.00	1.15	.39	.40	.013	.00	.00	PIPE
2515.661	3361.082	1.106	3362.188	4.00	2.24	.08	3362.27	.00	.70	1.99	2.000	.000	.00	1 .0
.846	.0410					.0010	.00	1.11	.42	.40	.013	.00	.00	PIPE

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SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2516.508	3361.117	1.064	3362.181	4.00	2.35	.09	3362.27	.00	.70	2.00	2.000	.000	.00	1 .0
.777	.0410					.0011	.00	1.06	.45	.40	.013	.00	.00	PIPE
2517.284	3361.149	1.025	3362.173	4.00	2.47	.09	3362.27	.00	.70	2.00	2.000	.000	.00	1 .0
.710	.0410					.0012	.00	1.02	.48	.40	.013	.00	.00	PIPE
2517.995	3361.178	.987	3362.165	4.00	2.59	.10	3362.27	.00	.70	2.00	2.000	.000	.00	1 .0
.196	.0410					.0014	.00	.99	.52	.40	.013	.00	.00	PIPE
2518.190	3361.186	.951	3362.137	4.00	2.72	.11	3362.25	.00	.70	2.00	2.000	.000	.00	1 .0
HYDRAULIC JUMP														
2518.190	3361.186	.480	3361.666	4.00	6.89	.74	3362.40	.00	.70	1.71	2.000	.000	.00	1 .0
1.200	.0410					.0183	.02	.48	2.08	.40	.013	.00	.00	PIPE
2519.391	3361.235	.497	3361.732	4.00	6.57	.67	3362.40	.00	.70	1.73	2.000	.000	.00	1 .0
1.753	.0410					.0160	.03	.50	1.95	.40	.013	.00	.00	PIPE
2521.144	3361.307	.514	3361.821	4.00	6.26	.61	3362.43	.00	.70	1.75	2.000	.000	.00	1 .0
1.396	.0410					.0140	.02	.51	1.83	.40	.013	.00	.00	PIPE
2522.540	3361.364	.532	3361.896	4.00	5.97	.55	3362.45	.00	.70	1.77	2.000	.000	.00	1 .0
1.111	.0410					.0122	.01	.53	1.71	.40	.013	.00	.00	PIPE
2523.651	3361.410	.550	3361.960	4.00	5.69	.50	3362.46	.00	.70	1.79	2.000	.000	.00	1 .0
.881	.0410					.0107	.01	.55	1.60	.40	.013	.00	.00	PIPE

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SUMMERLIN WEST VILLAGE 22

CLOWDER PASS WAY (STREET H) DFD TO KETTLE RIDGE DRIVE (STREET J)

ATKINS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2524.532	3361.446	.569	3362.015	4.00	5.43	.46	3362.47	.00	.70	1.80	2.000	.000	.00	1 .0
.687	.0410					.0094	.01	.57	1.50	.40	.013	.00	.00	PIPE
2525.219	3361.474	.589	3362.063	4.00	5.18	.42	3362.48	.00	.70	1.82	2.000	.000	.00	1 .0
.529	.0410					.0082	.00	.59	1.40	.40	.013	.00	.00	PIPE
2525.747	3361.496	.610	3362.105	4.00	4.94	.38	3362.48	.00	.70	1.84	2.000	.000	.00	1 .0
.384	.0410					.0072	.00	.61	1.31	.40	.013	.00	.00	PIPE
2526.131	3361.511	.631	3362.142	4.00	4.71	.34	3362.49	.00	.70	1.86	2.000	.000	.00	1 .0
.261	.0410					.0063	.00	.63	1.23	.40	.013	.00	.00	PIPE
2526.392	3361.522	.653	3362.175	4.00	4.49	.31	3362.49	.00	.70	1.88	2.000	.000	.00	1 .0
.150	.0410					.0055	.00	.65	1.15	.40	.013	.00	.00	PIPE
2526.542	3361.528	.676	3362.204	4.00	4.28	.28	3362.49	.00	.70	1.89	2.000	.000	.00	1 .0
.048	.0410					.0048	.00	.68	1.07	.40	.013	.00	.00	PIPE
2526.590	3361.530	.701	3362.231	4.00	4.07	.26	3362.49	.00	.70	1.91	2.000	.000	.00	1 .0

```
T1 SUMMERLIN WEST VILLAGE 22                                                0
T2 CLOWDER PASS WAY (STREET H) SDDI #1
T3 ATKINS / ULTIMATE CONDITIONS
SO      0.00 3335.94  24                          3338.40
R       0.00 3335.94  24      .013                                .000  00.0   0
R      31.36 3336.57  24      .013                                .000  00.0   0
SH     31.36 3336.57  24
CD  24  4   1    .000   2.000     .000  .000  .000   .00
Q              2.0     .0
```

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FILE: STH-Lat-SDDI1-ULT.WSW                W S P G W - CIVILDESIGN Version 14.08                                    PAGE    1
                                 Program Package Serial Number: 7271
                                              WATER SURFACE PROFILE LISTING                    Date: 1-20-2020  Time:11:18:28
                          SUMMERLIN WEST VILLAGE 22
                            CLOWDER PASS WAY (STREET H) SDDI #1
                              ATKINS / ULTIMATE CONDITIONS
************************************************************************************************************************ ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |               |         |       |        |        |       |       |      |
     .000  3335.940    2.460  3338.400      2.00     .64     .01  3338.41     .00     .49      .00    2.000     .000  .00   1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
   22.981    .0201                                        .0001      .00     2.46     .00     .34    .013       .00  .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
   22.981  3336.402    2.000  3338.402      2.00     .64     .01  3338.41     .00     .49      .00    2.000     .000  .00   1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
    8.379    .0201                                        .0001      .00     2.00     .00     .34    .013       .00  .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
   31.360  3336.570    1.831  3338.401      2.00     .66     .01  3338.41     .00     .49     1.11    2.000     .000  .00   1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
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```
T1 SUMMERLIN WEST VILLAGE 22                                                0
T2 CLOWDER PASS WAY (STREET H) SDDI #2
T3 ATKINS / ULTIMATE CONDITIONS
SO      0.00 3335.94  24                         3338.40
R       0.00 3335.94  24      .013                                .000  00.0   0
R       9.65 3336.43  24      .013                                .000  00.0   0
SH      9.65 3336.43  24
CD  24  4   1    .000   2.000     .000  .000  .000   .00
Q              2.0     .0
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FILE: STH-Lat-SDDI2-ULT.WSW                W S P G W - CIVILDESIGN Version 14.08                                    PAGE    1
                                 Program Package Serial Number: 7271
                                              WATER SURFACE PROFILE LISTING                    Date: 1-20-2020  Time:11:18:48
                          SUMMERLIN WEST VILLAGE 22
                            CLOWDER PASS WAY (STREET H) SDDI #2
                              ATKINS / ULTIMATE CONDITIONS
************************************************************************************************************************ ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |               |         |       |        |        |       |       |      |
     .000  3335.940    2.460  3338.400      2.00     .64     .01  3338.41     .00     .49      .00    2.000     .000  .00   1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    |-
    9.073    .0508                                        .0001      .00     2.46     .00     .27    .013       .00  .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
    9.073  3336.401    2.000  3338.401      2.00     .64     .01  3338.41     .00     .49      .00    2.000     .000  .00   1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    |-
     .577    .0508                                        .0001      .00     2.00     .00     .27    .013       .00  .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
    9.650  3336.430    1.970  3338.400      2.00     .64     .01  3338.41     .00     .49      .49    2.000     .000  .00   1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    |-
```

```
T1 SUMMERLIN WEST VILLAGE 22                                                0
T2 CLOWDER PASS WAY (STREET H) SDDI #4
T3 ATKINS / ULTIMATE CONDITIONS
SO      0.00 3360.60  24                          3362.23
R       0.00 3360.60  24      .013                                .000  00.0   0
R       8.96 3361.53  24      .013                                .000  00.0   0
SH      8.96 3361.53  24
CD  24  4   1    .000   2.000     .000  .000  .000   .00
Q              6.0     .0
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FILE: STH-Lat-SDDI4-ULT.WSW                W S P G W - CIVILDESIGN Version 14.08                                    PAGE    1
                                   Program Package Serial Number: 7271
                                              WATER SURFACE PROFILE LISTING                    Date: 1-20-2020  Time:11:19: 3
                            SUMMERLIN WEST VILLAGE 22
                              CLOWDER PASS WAY (STREET H) SDDI #4
                                ATKINS / ULTIMATE CONDITIONS
*********************************************************************************************************************************** ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
     .000  3360.600    1.630  3362.230      6.00    2.19     .07  3362.30     .00     .87     1.55    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .696    .1038                                     .0007      .00     1.63     .29     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
     .696  3360.672    1.551  3362.223      6.00    2.29     .08  3362.31     .00     .87     1.67    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .610    .1038                                     .0008      .00     1.55     .32     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    1.306  3360.736    1.480  3362.216      6.00    2.41     .09  3362.31     .00     .87     1.75    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .543    .1038                                     .0009      .00     1.48     .36     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    1.850  3360.792    1.415  3362.207      6.00    2.52     .10  3362.31     .00     .87     1.82    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .488    .1038                                     .0010      .00     1.42     .39     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    2.337  3360.843    1.355  3362.198      6.00    2.65     .11  3362.31     .00     .87     1.87    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .221    .1038                                     .0012      .00     1.36     .42     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    2.558  3360.865    1.299  3362.165      6.00    2.78     .12  3362.28     .00     .87     1.91    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
HYDRAULIC JUMP
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    2.558  3360.865     .531  3361.396      6.00    8.99    1.25  3362.65     .00     .87     1.77    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .735    .1038                                     .0278      .02      .53    2.58     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    3.293  3360.942     .549  3361.491      6.00    8.57    1.14  3362.63     .00     .87     1.79    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
    1.064    .1038                                     .0243      .03      .55    2.41     .39    .013       .00  .00  PIPE
         |         |        |         |         |       |       |         |       |        |        |       |       |      |
    4.357  3361.052     .568  3361.621      6.00    8.17    1.04  3362.66     .00     .87     1.80    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
     .901    .1038                                     .0213      .02      .57    2.26     .39    .013       .00  .00  PIPE
```

FILE: STH-Lat-SDDI4-ULT.WSW W S P G W - CIVILDESIGN Version 14.08 PAGE 2

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING Date: 1-20-2020 Time:11:19: 3

SUMMERLIN WEST VILLAGE 22
CLOWDER PASS WAY (STREET H) SDDI #4
ATKINS / ULTIMATE CONDITIONS

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
5.258	3361.146	.588	3361.734	6.00	7.79	.94	3362.68	.00	.87	1.82	2.000	.000	.00	1 .0
.764	.1038					.0186	.01	.59	2.11	.39	.013	.00	.00	PIPE
6.023	3361.225	.608	3361.834	6.00	7.42	.86	3362.69	.00	.87	1.84	2.000	.000	.00	1 .0
.645	.1038					.0163	.01	.61	1.97	.39	.013	.00	.00	PIPE
6.668	3361.292	.630	3361.922	6.00	7.08	.78	3362.70	.00	.87	1.86	2.000	.000	.00	1 .0
.543	.1038					.0143	.01	.63	1.85	.39	.013	.00	.00	PIPE
7.211	3361.349	.652	3362.000	6.00	6.75	.71	3362.71	.00	.87	1.87	2.000	.000	.00	1 .0
.452	.1038					.0125	.01	.65	1.73	.39	.013	.00	.00	PIPE
7.663	3361.396	.675	3362.070	6.00	6.44	.64	3362.71	.00	.87	1.89	2.000	.000	.00	1 .0
.372	.1038					.0110	.00	.67	1.62	.39	.013	.00	.00	PIPE
8.035	3361.434	.699	3362.133	6.00	6.14	.58	3362.72	.00	.87	1.91	2.000	.000	.00	1 .0
.299	.1038					.0096	.00	.70	1.51	.39	.013	.00	.00	PIPE
8.334	3361.465	.724	3362.189	6.00	5.85	.53	3362.72	.00	.87	1.92	2.000	.000	.00	1 .0
.235	.1038					.0084	.00	.72	1.41	.39	.013	.00	.00	PIPE
8.569	3361.490	.750	3362.239	6.00	5.58	.48	3362.72	.00	.87	1.94	2.000	.000	.00	1 .0
.176	.1038					.0074	.00	.75	1.32	.39	.013	.00	.00	PIPE
8.745	3361.508	.777	3362.284	6.00	5.32	.44	3362.72	.00	.87	1.95	2.000	.000	.00	1 .0
.121	.1038					.0065	.00	.78	1.23	.39	.013	.00	.00	PIPE

```
FILE: STH-Lat-SDDI4-ULT.WSW                W S P G W - CIVILDESIGN Version 14.08                                    PAGE    3
                                 Program Package Serial Number: 7271
                                              WATER SURFACE PROFILE LISTING                    Date: 1-20-2020  Time:11:19: 3
                          SUMMERLIN WEST VILLAGE 22
                            CLOWDER PASS WAY (STREET H) SDDI #4
                              ATKINS / ULTIMATE CONDITIONS
************************************************************************************************************************ ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |               |         |       |        |        |       |       |      |
    8.865  3361.520     .805  3362.325      6.00    5.07     .40  3362.72     .00     .87     1.96    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
     .071    .1038                                        .0057      .00      .80    1.15     .39    .013       .00  .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
    8.937  3361.528     .834  3362.362      6.00    4.84     .36  3362.72     .00     .87     1.97    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
     .023    .1038                                        .0050      .00      .83    1.07     .39    .013       .00  .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
    8.960  3361.530     .866  3362.396      6.00    4.60     .33  3362.73     .00     .87     1.98    2.000     .000  .00   1   .0
       -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
```

```
T1 SUMMERLIN WEST VILLAGE 22                                                    0
T2 T2 DESERT FOOTHILLS DRIVE - CLOWDER PASS WAY TO KESTREL CREEK AVENUE ADDENDUM #1
T3 ATKINS / CRITICAL CONDITIONS  Cap #2
SO    646.21 3331.14  42                        3332.60
REM  ################## JX DS SDMH#16
R     649.21 3331.24  30     .013                                  .000  00.00  1
REM  ################## JX US SDMH#16
REM  ################## JX DS Cap#2
R     731.48 3335.74  30     .013                                  .000  00.00  1
SH    734.48 3335.74  30
CD  24  4   0    .000   2.000     .000  .000  .000   .00
CD  30  4   0    .000   2.500     .000  .000  .000   .00
CD  36  4   0    .000   3.000     .000  .000  .000   .00
CD  42  4   0    .000   3.500     .000  .000  .000   .00
CD  48  4   0    .000   4.000     .000  .000  .000   .00
CD  54  4   0    .000   4.500     .000  .000  .000   .00
CD  60  4   0    .000   5.000     .000  .000  .000   .00
CD  66  3   0   0.000   6.000    6.000
CD 106  3   0   0.000   10.00    6.000
Q           053.00    .0
```

FILE: DFD2KCA_Cap2.WSW W S P G W - CIVILDESIGN Version 14.08 PAGE 1

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING Date: 1-18-2020 Time: 8: 4:36

SUMMERLIN WEST VILLAGE 22

T2 DESERT FOOTHILLS DRIVE - CLOWDER PASS WAY TO KESTREL CREEK AVENUE ADD

EN ATKINS / CRITICAL CONDITIONS Cap #2

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope				SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch	
646.210	3331.140	1.469	3332.609	53.00	17.67	4.85	3337.46	.00	2.33	2.46	2.500	.000	.00	0 .0
3.000	.0334					.0396	.12	1.47	2.82	1.55	.013	.00	.00	PIPE
649.210	3331.240	1.466	3332.706	53.00	17.72	4.87	3337.58	.00	2.33	2.46	2.500	.000	.00	0 .0
18.187	.0547					.0379	.69	1.47	2.83	1.33	.013	.00	.00	PIPE
667.397	3332.235	1.512	3333.747	53.00	17.07	4.52	3338.27	.00	2.33	2.44	2.500	.000	.00	0 .0
16.883	.0547					.0340	.57	1.51	2.67	1.33	.013	.00	.00	PIPE
684.281	3333.158	1.575	3334.733	53.00	16.27	4.11	3338.85	.00	2.33	2.41	2.500	.000	.00	0 .0
12.539	.0547					.0302	.38	1.57	2.47	1.33	.013	.00	.00	PIPE
696.820	3333.844	1.641	3335.485	53.00	15.52	3.74	3339.22	.00	2.33	2.37	2.500	.000	.00	0 .0
9.644	.0547					.0268	.26	1.64	2.28	1.33	.013	.00	.00	PIPE
706.464	3334.372	1.712	3336.083	53.00	14.79	3.40	3339.48	.00	2.33	2.32	2.500	.000	.00	0 .0
7.553	.0547					.0239	.18	1.71	2.10	1.33	.013	.00	.00	PIPE
714.017	3334.785	1.788	3336.573	53.00	14.11	3.09	3339.66	.00	2.33	2.26	2.500	.000	.00	0 .0
5.941	.0547					.0214	.13	1.79	1.93	1.33	.013	.00	.00	PIPE
719.958	3335.110	1.871	3336.981	53.00	13.45	2.81	3339.79	.00	2.33	2.17	2.500	.000	.00	0 .0
4.627	.0547					.0192	.09	1.87	1.76	1.33	.013	.00	.00	PIPE
724.585	3335.363	1.962	3337.325	53.00	12.82	2.55	3339.88	.00	2.33	2.05	2.500	.000	.00	0 .0
3.485	.0547					.0173	.06	1.96	1.59	1.33	.013	.00	.00	PIPE

```
FILE: DFD2KCA_Cap2.WSW                    W S P G W - CIVILDESIGN Version 14.08                                    PAGE    2
                              Program Package Serial Number: 7271
                                          WATER SURFACE PROFILE LISTING                   Date: 1-18-2020  Time: 8: 4:36
                        SUMMERLIN WEST VILLAGE 22
                          T2 DESERT FOOTHILLS DRIVE - CLOWDER PASS WAY TO KESTREL CREEK AVENUE ADD
                        EN  ATKINS / CRITICAL CONDITIONS  Cap #2
*************************************************************************************************************************** ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |               |         |       |        |        |       |       |      |
  728.070  3335.553    2.064  3337.617     53.00   12.23    2.32  3339.94     .00    2.33     1.90    2.500     .000   .00   0   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    2.381    .0547                                        .0158      .04     2.06    1.43    1.33    .013       .00   .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
  730.451  3335.684    2.182  3337.866     53.00   11.66    2.11  3339.98     .00    2.33     1.67    2.500     .000   .00   0   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    1.029    .0547                                        .0148      .02     2.18    1.24    1.33    .013       .00   .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |      |
  731.480  3335.740    2.334  3338.074     53.00   11.11    1.92  3339.99     .00    2.33     1.24    2.500     .000   .00   0   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
         |         |        |         |         |               |         |       |        |        |       |       |      |
  734.480  3335.740    2.334  3338.074     53.00   11.11    1.92  3339.99     .00    2.33     1.24    2.500     .000   .00   0   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
```

Appendix E. CD-ROM

2270 Corporate Circle
Suite 200
Henderson NV 89074-7755
Tel: 702.263.7275
www.atkinsglobal.com/northamerica

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