DS # 4511

DS INDEX:

APN: PORTION OF 126-36-201-002

PROJECT: CCSD NORTHWEST SATELLITE TRANSPORTATION FACILITY

SUBMITTAL 1ST

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM			DATE: December 8, 2010
TO: **Land Development Services** Department of Public Works			FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **CCSD Northwest Satellite Transportation Facility**		**COPIES TO:** L. R. Nelson Consulting Engineers
Cross Streets:	NEC of Shaumber Road & Washburn Road		KGA Architecture
File Number:	F:\Depot\DSMemos\DS4511A.doc		Bart Anderson, P.E., DevCo
Parcel Number:	Portion of 126-36-201-002		Clark County School District Design Management
Zoning Action:	VAR-38553; GPA-38556 & SDR-38557		CCRFCD
FEMA Flood Zone	YES	NO **X**	CCPW
Proposed Storm Drain	YES **X**	NO	BLM

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1st Submittal	11/22/2010	12/8/2010	See Comments Below	N/C	N/C
			TOTAL FEES (LDDRS):	**N/C**	**----**

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. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.

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

3. The subject site is also adjacent to the *Clark County 215 Beltway* to the northeast and the jurisdiction of *Clark County* to the south. The engineer must coordinate with *Clark County Public Works Department* (CCPW) and incorporate any concerns for boundary conditions. CCPW concurrence is required prior to final acceptance of the study.

4. Provide a copy of the zoning/planning conditions associated with this site (**VAR-38553; GPA-38556 & SDR-38557**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.

5. Regarding the access road from Ann Road to the subject site and the overall site grading consisting of substantial elevation differential, it is recommended for the engineer to set up a meeting between the engineer/developer and the City officials such as Planning, Traffic, Flood Control and Land Development. This meeting should be set up and have the issues resolved prior to the submittal of the next addendum.

6. Regarding the Best Management Practices (BMP) criteria towards the stormwater quality management for the parking area of the subject development, the engineer must contact *Flood Control Section* to determine BMP prior to the final approval of the drainage study. — Look at local area.

7. Per Condition #14 of **SDR-38557**: Coordinate with City of Las Vegas Right-of-Way Section of the Department of Public Works to determine all materials and information needed to submit an application to the Bureau of Land Management (BLM) for an appropriate Right-of-Way Grant Easement for Washburn Road, Alpine Ridge, Hammer Lane and Cliff Shadows (Shaumber), including those portions required for the appropriate geometric connection of this site to Ann Road, prior to the issuance of any permits. In-Process with BLM

8. Per Condition #16 of **SDR-38557**: Coordinate with the property owner of Assessor Parcel Number 126-36-301-001 and the BLM to determine the final disposition of the existing truck haul route adjacent to this site with respect to the roadway designs proposed for this site. Provide written documentation that this property owner and/or the BLM agree with the final geometric design of the roadways shown on the approved site plan prior to the issuance of any permits. Once it is determined what portions of the truck haul route must be modified to accommodate the roadways being designed for this site, coordinate the final geometric traffic control and roadway design with the Traffic Engineering Section of Public Works Department.

9. **Sheet C3.01**:

   (i) Show the proposed access road to Ann Road.

   (ii) Label all the perimeter street names.

   (iii) Show the proposed onsite and offsite storm drains schematically on the general overall site plan.

10. Provide plan and profile for the proposed access road from the subject development to Ann Road.

11. **Figure 8 to Figure 10** (Existing, Interim and Ultimate Drainage Basin Maps):

   (i) It appears that a blue boxed area block off a big portion of Basin HLBW1-CA from impacting the subject development. Explain what the blue boxed areas are in the next submittal.

   (ii) The subject study assumes that the offsite areas remain undeveloped in the ultimate condition which is not correct. The areas adjacent to the west and south of the subject site are within the *Lone Mountain Pit Community Planning Area* and can be developed in the future. Revise the *Ultimate Drainage Basin Map* and all pertinent hydrologic and hydraulic calculations accordingly.

   (iii) Address how the ultimate drainage condition impacts the regional facilities within the Northwest Beltway right-of-way.

12. The hydraulic calculations portion of the drainage study presented only the interim condition for the streets. Provide street hydraulic calculations for the perimeter streets for future improved condition, ie, street sections with curb & gutter and sidewalk etc for the ultimate drainage condition. Note that street hydraulics criteria such as dry-lane and DV ratio in 10- and 100-year events must be met in all perimeter streets.

13. **Sheet C3.02**:

(i) For traffic reasons, remove the proposed cross valley gutters in Hammer Lane and the driveway entrance. A drop inlet shall be either relocated or provided at the upstream side of the curb return.

(ii) Provide a cross section at Shaumber Road. The section must include onsite features up to or beyond the chain link fence and offsite features to the proposed scarp.

(iii) Label the slope of the proposed scarp on the grading plan.

(iv) Show the design of a berm at the back of the sidewalk in Shaumber Road for onsite flood protection. Label the top of berm elevation (TB) at regular intervals.

(iv) Address the maintenance issue of the interim inlets on the west half of Shaumber Road. Provide riprap for erosion protection per riprap sizing calculations.

14. **Sheet C3.03**:

Provide a drop inlet at the upstream end of the driveway in Hammer Lane and remove the proposed valley gutter.

15. **Sheet C3.04**:

(i) According to Traffic Section, the 90-degree turn in Alpine Ridge Way appears to require a super-elevation cross section. Contact Mr. Victor Bolanos of traffic for the design criteria at 229-6901.

(ii) The two proposed drop inlets in Alpine Ridge Way are in a sump condition. The maximum allowable ponding depth is 1'. Provide drop inlet sizing calculation. Show an overflow path in case the inlets are totally clogged.

(iii) Remove the proposed valley gutter at the low point in Alpine Ridge Way.

(iv) Provide a cross section at Alpine Ridge Way. The section must extend to show how the grading daylight to the offsite Beltway area and the connection to the Beltway 215 Channel.

(v) Provide riprap protection at the two discharging points for erosion protection per riprap sizing calculations.

16. **Sheet C3.05**:

(i) Provide drop inlets at the upstream side of the driveways and remove the valley gutter.

(ii) Label the proposed slope of the scarp on the grading plan.

(iii) Show the design of a berm at the back of sidewalk in Shaumber Road for onsite flood protection. Label the top of berm elevation at regular intervals.

17. **Sheet C3.06**:

The proposed onsite inlet (DI#10) appears to be in a sump condition. Address whether an overflow path is provided in a worst case scenario that the inlet is totally clogged in the next submittal.

18. **Sheet C3.08**:

    (i) Relocate the drop inlet in Shaumber Road to the upstream side of the driveway and remove the proposed valley gutter.

    (ii) It appears that the proposed grades in Washburn Road has a huge disconnect with the existing grades as shown on the grading plan. Show the design of how proposed grades daylight into the existing grades in the next submittal. Provide a cross section to show as such.

    (iii) Show transition design of roadway at the intersection of Shaumber Road and Washburn Road.

    (iv) Show a berm as indicated in Section A/C3.09 with top of berm elevations at regular intervals.

    (v) Provide a 24" storm drain in Washburn Road.

19. **Sheet C3.09**:

    (i) Show the proposed berm on the plan along Washburn Road.

    (ii) Provide a drop inlet at the upstream end of the driveway and remove the valley gutter. Provide a 24" storm drain in Washburn Road.

20. **Sheet C3.10**:

    (i) Per the onsite drainage basin map, the onsite flows of the subject development are to be routed to the northeast corner of the site for discharge. However, the grading plan shows otherwise: a valley gutter is proposed across Alpine Ridge Way which will facilitate the outfall from the concrete channel to the east and continue in Washburn Road. This can be corrected by installing a drop inlet adjacent to the outfall connected to a storm drain in Washburn Road and Alpine Ridge Way.

    (ii) Remove the valley gutter in Alpine Ridge Way.

21. **Sheet C4.01 and Sheet C4.02**:

    Revise the drop inlets location and remove the valley gutters per previous comment.

22. **Sheet C4.03**:

    (i) The flow in Drop Inlet #4 has a velocity component against the main storm drain when it reaches SDMH #13. Extend SDMH #13 to a position to eliminate this situation.

    (ii) Provide riprap at the two discharging points in Station 23+50.73 and Station 23+68.81 for erosion protection per riprap sizing calculations.

    (iii) Per the profile of "Lateral at SDMH #13", the flow in the lateral is not "Nuisance Flow Only" as indicated. Review and revise accordingly.

23. **Sheet C4.05**: Revise the drop inlet location and remove the valley gutter per previous comment.

24. **Sheet C4.06**: Same comment.

25. **Sheet C4.07**: Extend the plan & profile design of the access road to Ann Road.

26. Revise all drop inlets to Type "CM" or Neenah Pre-cast inlets. The length of the inlets are in the multiple of ~~2'~~ 2.5' for Type "CM" or 3.0' for Neenah. Review and revise all callouts accordingly.

27. The engineer must consult with Land Development staff about the overpaving requirement on all perimeter street improvements.

28. **Standard Form 1**:

    (i) An engineer's seal is missing.

    (ii) Revise the Assessor Parcel Number (APN) of the subject property to "126-36-201-002 (portion of)".

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.

NOTES: This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

END OF REMARKS
ays

T/R/S: T19S/R59E/36
AREA F-36

Post-it® Fax Note 7671	Date 12/8/10	# of pages ▶ 5
To Jon Hayslip	From Albert SUNG	
Co./Dept. L-R. Nelson	Co. CLV	
Phone #	Phone # 229-200	
Fax # 451-2296	Fax #	

Rec'd : 11/22/10
DS4511
F-36
N/C

LARRY R. NELSON, P.E.
President

- STRUCTURAL
- CIVIL
- SURVEY
- PLANNING

SDR-38555
GPA-38556
VAR-38553

NEVADA

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TECHNICAL DRAINAGE STUDY FOR CCSD NORTHWEST TRANSPORTION FACILITY

Clark County, Nevada
Project Number: 032-085-092
November 2010

Prepared For:

KGA Architecture
9075 West Diablo Drive
Las Vegas, NV 89148

Prepared By:

L.R. Nelson Consulting Engineers
6765 W. Russell Rd., Suite 200
Las Vegas, Nevada 89118
(702) 798-7978

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: CCSD NORTHWEST SATELLITE TRANSPORTATION FACILITY Date: Nov 17, 2010

Location of Development: a) Descriptive (Cross Streets) North/South: Cliff Shadows

East/West: Washburn

b) Section: 36 Township: 19 South Range: 59 East

c) APN : 126-36-201-002 (portion of)

Name of Owner: USA / Clark County School District Design Management / Planning and Design

Telephone No.: 702-799-8710 Fax No.: 702-799-8745 E-Mail Address:

Address: 4170 McLeod Drive, Las Vegas, NV 89121

Contact Person-Name: Jon Hayslip **Telephone No.:** (702) -798-7978

*** E-Mail Address:** jon.hayslip@lrneng.com **Fax No.:** 451-2296

Firm: L. R. Nelson Consulting Engineers

Address: 6765 W. Russell Road, Suite 200, Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 131.7 Ac. (+/-) Being Developed/Disturbed: 40 Ac. (+/-)
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.): CCSD Transportation
5. Approximate upstream land area which drains to the subject site: 62 Ac. (+/-)
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: 90% Lone Mn Beltway Det. Basins/Gowan Beltway West-Western Clark County 215 Bruce Woodbury Beltway-Craig to Hualapai (Aug 2008) GCW for CCPW
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Adjacent roadway & existing Alpine Ridge low point into existing Beltway Channel
8. Briefly describe your proposed schedule for the subject project: As soon as possible.

Engineer's Seal EXP. 6/30/11

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

***New Required Field**

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

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: CCSD NORTHWEST SATELLITE TRANSPORTATION FACILITY	Map ID:
Firm Name: L.R. Nelson Counsulting Engineers	Engineer: Jon Hayslip, P.E., CFM
Address: 6765 West Russell Road, Suite 200	
City: Las Vegas	State: NV Zip: 89118
Phone Number: (702) 798-7978	Fax Number: (702) 451-2296
Property Owner: USA / CCSD Design Management / Planning & Design	
Address: 4170 McLeod Drive	
City: Las Vegas	State: NV Zip: 89121

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.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

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.
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.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
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.
N/A		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 basin s 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.
N/A		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.
N/A		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.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		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.
		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.
N/A		For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
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.

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.

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.)
X		Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
X		Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, which ever 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.

REFERENCE:	**STANDARD FORM 2**

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 06/06/01)

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 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 Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (Design Manual).

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.

II. GRADING PLAN INFORMATION		
Yes	No	
✓		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
✓		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.
✓		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.)
✓		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.
✓		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.
✓		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.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
N/A		Back of lot elevations and lot drainage pattern for all lots including common lots.
X		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. SEE EMAIL APP. E
✓		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.)
N/A		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.
✓		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	
		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.
N/A		Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
N/A		The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
✓		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.
N/A		Lots with "B and C Type Drainage" shall be required to install an underground nuisance drainage system or a 2-foot valley gutter through the lot. 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.

November 18, 2010

Mr. Robert Welch, P.E., CFM
Engineering Project Manager
Flood Control
Department of Public Works
Engineering Planning
731 S. Fourth Street
Las Vegas, Nevada 89101

Technical Drainage Study: **Clark County School District (CCSD)**
Northwest Transportation Facility

Dear Mr. Welch:

Submitted herewith for your review are two copies of the *Technical Drainage Study for Clark County School District Northwest Transportation Facility* project. The proposed project will serve the CCSD need for school bus operations in the northwest portion of the Las Vegas Valley.

This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by L.R. Nelson Consulting Engineers shall be without liability to L.R. Nelson Consulting Engineers.

If you have any questions regarding this Study, please contact our office at (702) 798-7978.

Sincerely,

Jon Hayslip, P.E., CFM
Flood Control Manager

TABLE OF CONTENTS

I. INTRODUCTION *1*
A. Study Overview and Purpose 1
B. Location 1
C. Existing Site Description 1
D. FEMA Flood Plain Information 2
E. CCRFCD Master Plan Information 2
F. Parking Lot BMP Criteria 3
G. Local Flood Control Master Plan 3
H. Referenced Drainage Studies 3
II. METHODOLOGY *5*
A. Compliance with Regulations 5
B. Hydrologic Criteria 5
III. Hydrologic Analysis *8*
A. Existing Drainage Conditions 8
B. Interim Drainage Description 11
C. Future Drainage Description 13
IV. Hydraulic Analysis *15*
A. Methodology 15
B. Street Conveyance Hydraulics 16
C. Entrance Elevations 16
D. Storm Drain Hydraulics 17
E. Drop Inlet Hydraulics 18
F. Low Point Overflow / Outlet Protection 19
V. RECOMMENDATIONS *21*
VI. CONCLUSIONS *21*
V. REFERENCES *22*

LIST OF TABLES

Table 1: Rainfall Depth-Duration-Frequency Values 5
Table 2: Depth-Duration-Frequency Values 5
Table 3: Hydrologic Soil Group and Sub-Groups Summary 7
Table 4: Existing 100-Year Hydrologic Runoff Summary - Offsite 9
Table 5: Existing 10 & 100 Year Hydrologic Runoff Summary - Onsite 9
Table 6: Estimated 10-Year Unit Flow Rate - Offsite 10
Table 7: Estimated 10- & 100-Year Flow Rates – Existing Condition 10
Table 8: Interim Onsite Runoff Summary 11
Table 9: Interim Offsite Runoff Summary 12
Table 10: Estimated 10- & 100-Year Flow Rates – Interim Condition 12
Table 11: Future Onsite Runoff Summary 13
Table 12: Future Offsite Runoff Summary 14
Table 13: Estimated 10- & 100-Year Flow Rates – Future Condition 14
Table 14: Offsite 100-Year Depth of Flow Summary 16
Table 15: Site Entrance/Exit Freeboard Summary 16
Table 16: Onsite 100-Year Depth of Flow Summary 17
Table 17: Drop Inlet Calculation Summary 19
Table 18: Weir Flow Rate Calculation Summary 19
Table 19: Weir Flow Rate Top Width Calculation Summary 20
Table 20: Weir Flow Rate Area & Velocity Calculation Summary 20

LIST OF PHOTOS

Photo 1: Existing Onsite Condition (looking Northeast across site) 2

LIST OF FIGURES

Figure 1: Vicinity Map

Figure 2: APN Map

Figure 3: FEMA FIRM Map

Figure 4: SCS Soils Survey Map

Figure 5: CCRFCD 2008 Las Vegas Valley Flood Control Facilities (MPU)

Figure 6: CCRFCD 2008 Las Vegas Valley Flood Control Hydrologic Summary (MPU)

Figure 7: Existing Onsite Drainage Basin Map

Figure 8: Existing (Overall) Drainage Basin Map

Figure 9: Interim Offsite Drainage Basin Map

Figure 10: Ultimate Offsite Drainage Basin Map

Figure 11: Proposed Onsite Drainage Basin Map

Figure 12: Alpine Ridge Irregular Weir Analysis X-Section

LIST OF APPENDICES

Appendix A: Figures

Appendix B: Hydrologic Analysis

Appendix C: Hydraulic Analysis

Appendix D: Referenced Information

Appendix E: Agency Development Conditions

I. INTRODUCTION

A. Study Overview and Purpose

This study is intended to serve as the technical hydrology study for the proposed *Clark County School District Regional Transportation Center*. Development of the proposed facility is approximately 40.8 acres (gross) that will include bus vehicle maintenance and storage facilities. Additionally, an access road will be connected to the Ann Road improvements for site access. Drainage facilities will provided based upon the hydrologic and hydraulic analysis specific for the site and access road to meet City of Las Vegas (CLV), Clark County Public Works (CCPW) and Clark County Regional Flood Control District (CCRFCD) criteria.

During the course of design for this project, meetings were held with members of CLV and CCPW to establish existing, interim and future conditions for the areas roadways, localized drainage and regional flood control facilities.

This study is a stand-alone document that presents the findings of a hydrologic analysis of the site and contributing watershed area. Flow rates are computed for the *10- and 100-Year Design Storm* to be used to in the design of flood protection facilities as recommended by current criteria and regulatory agency requirements. This study has been conducted in accordance with the criteria set forth by the CCRFCD *Hydrologic Criteria and Drainage Design Manual* (Reference #2).

B. Location

The project area is within the South (S 1/2) of the Northwest Quarter (NW 1/4) of Section 36, Township 19 South, Range 59 East, Mount Diablo Meridian, City of Las Vegas, Clark County, Nevada. The site is located west of the I-215 Beltway near the existing Nevada Ready Mix materials excavation pits within the Lone Mountain area. Specifically, the site is bound by pit on south side (Washburn alignment), existing haul access route pavement section (Alpine Ridge alignment), on the north by the undeveloped Hammer Lane alignment and west by the Cliff Shadows alignment. A general site Vicinity Map is shown on Figure 1 in Appendix A.

The Assessors Parcel Numbers (APN) for the proposed development is 126-36-201-002 and is located on the Clark County document shown on Figure 2 in Appendix A. The proposed development is located on BLM controlled acreage.

C. Existing Site Description

As determined in a site visit on September 26, 2010, the parcel and surrounding area are undeveloped with exception of the gravel haul route (Alpine Ridge) located on the east side. The area consists of steep slopes and numerous braided washes falling to the northeast where flow patterns well established. It is covered in typical Las Vegas Valley desert sage and creosote brush. The photo on the following page shows the typical hydrologic cover observed during the site visit.

Photo 1: Existing Onsite Condition (looking Northeast across site)



D. FEMA Flood Plain Information

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community-Panel Number 32003C 1750E, effective date September 27, 2002, the site is located within a Zone 'X'. A search for Letters of Map Revision (LOMR) affecting this panel was conducted and none were found. A Zone 'X' is described by FEMA as an area outside the 0.2% annual chance floodplain. A map depicting the FEMA flood zones in the vicinity of the site is included in Appendix A of this study. The site boundary has been provided on Figure 3, *Flood Insurance Rate Map*, located in Appendix A.

E. CCRFCD Master Plan Information

As shown on Figure 5 in Appendix A obtained from the *2008 Flood Control Master Plan Update of the Las Vegas Valley, Figure F-18*, the subject is not adjacent to an existing or proposed Master Plan Flood Control Facility. The *Hydrologic Summary* regional watershed boundary as shown on Figure 6 in Appendix A also obtained from the *2008 Flood Control Master Plan Update of the Las Vegas Valley, Figure H-18*, indicates the site is located within basin HLBW1-C.

F. Parking Lot BMP Criteria

Based upon discussions with Mr. Robert Welch, P.E., Engineering Project Manager with the Flood Control Section of the City of Las Vegas, development of the site must address parking lot runoff through Best Management Practices (BMP) associated with the ongoing draft work of the *Stormwater Quality Management Committee* sub-committee on Post Construction. Mr. Welch explained the criteria have been formulated by the sub-committee, but the adoption of such criteria has not been codified by any of the member agencies.

The discussion revolved around providing a BMP facility for approximately 75 percent of the sites' parking area. Based upon my meetings with the sub-committee and several emails, design criteria have yet to be solidified, but the discussion suggested either the 85th percentile storm (i.e. the storm that is equal to or greater than 85th percent of historical storms) or a 2-Year design storm, each based upon the rainfall criteria of the HC&DDM. A review of the current document cited in reference No. 7 indicates the former criteria will be presented to the Stormwater Quality Management Committee (SQMC) during the first quarter of next year for inclusion to MS4 permitting process under NDEP control. Additionally, the ongoing discussion within the sub-committee has not formulated the criteria for areas outside to the *McCarran Airport Rainfall Area*. This project is located outside of said area. At this time, the site design has proceeded without discussed BMP practices due to lack of established hydrologic criteria within the Las Vegas Valley with emphasis on areas outside of the *McCarran Airport Rainfall Area* and that development of the regional program proposed is subject to NDEP and EPA Region IX final ruling.

G. Local Flood Control Master Plan

The site has been identified to be not located within any local flood control master plan.

H. Referenced Drainage Studies

A search of the available documentation determined the adjacent area has been studied for future transportation alignments and regional flood control facilities. These planning documents identified provided hydrologic and hydraulic information for the proposed improvements around the subject site. The referenced drainage studies utilized in this Study are the following:

1. *90% Onsite Drainage Technical Memorandum – Western Clark County 215 Bruce Woodbury Beltway – Craig Road to Hualapai Way*, prepared for Clark County Department of Public Works, CH2MHill (July 2008).

2. *90% Design Submittal for the Lone Mountain/Beltway Detention Basins and the Gowan Beltway West Channel (Update to Original Design Report) – Western Clark County 215 Bruce Woodbury Beltway Craig Road to Hualapai Way*, prepared for Clark County Department of Public Works, Design Engineering, G.C. Wallace (August 2008).

These companion documents were provided to address the future flood control improvements for the 215 Beltway and areas located west of the 215 Beltway between Craig Road to Centennial Parkway. The former planning document provided the hydrologic and hydraulic analysis for the infrastructure needed to capture and convey the 100-Year design storm runoff to the future regional flood control facilities identified in the latter document.

The G.C. Wallace design report provided the hydrologic information that included delineated watersheds, hydrologic soils group analysis, 100-Year precipitation determinations, flood flow routing and detention basin design. The report quantified the 100-Year design storm flow rates along the 215 Beltway for the interim and future conditions. This document serves as the main reference establishing the 100-Year flow rate for the offsite existing, interim and future conditions; offsite interim condition; and offsite future condition. Specific elements referenced and utilized in hydrologic analysis are discussed appropriate section later in this Study. Based upon review of the reference documents, L.R. Nelson Consulting Engineers concurs with the hydrologic analysis except were noted.

The proposed *Clark County School District Regional Transportation Center* is located within the hydrologic watersheds identified in the G.C. Wallace design report. Specifically, two watershed basins in the referenced design report were identified to contain the offsite and onsite areas for the future facility. Basins HLBW1-CA and HLBW1-CB located near the Nevada Ready Mix Corporation existing gravel pits west of existing beltway between the Washburn Road and Ann Road alignments.

II. METHODOLOGY

A. Compliance with Regulations

This Study was conducted in accordance with the Clark County standards and the criteria set forth by CCRFCD *Hydrologic Criteria and Drainage Design Manual* (HC&DDM) including Section 1603, prepared by WRC Engineering and updated by Montgomery Watson, August 1999.

B. Hydrologic Criteria

i. Rainfall Criteria - Onsite

The project site is not located within the McCarran Airport Rainfall Area as indicated on Figure 513 of the HC&DDM, therefore the *Rainfall Depth-Duration-Frequency Values* for the 6-Hour, 10- and 100-Year storm events were obtained from Figure 503 and 506 summarized below in Table 1.

Table 1: Rainfall Depth-Duration-Frequency Values

Year Event	Depth (in)
10	1.4
100	2.2

The *Precipitation Adjustment Ratios* (PAR) shown in Table 501 of the HC&DDM are multiplied to Rainfall Depth-Duration-Frequency Values summarized below to obtain the design storm precipitation amount within the HEC-1 modeling system. These precipitation values were utilized for the onsite condition only.

Table 2: Depth-Duration-Frequency Values

Year Event	PAR Values	Depth (in)
10	1.24	1.74
100	1.43	3.15

Since the site encompasses less than 8-square miles a Storm Distribution Number Three (SDN #3) was used for the HEC-1 model. No Depth-Area-Reduction factors were used since the watershed onsite area is approximately 40 acres or 0.06 square miles.

The G.C. Wallace design report established 100-Year unit flow rates for basins HLBW1-CA and HLBW1-CB which incorporated the offsite and onsite areas for this site. Based upon review of their information, the values appear acceptable and have been utilized for the following hydrologic modeling scenarios, existing and developed offsite conditions.

ii. Runoff Computations

The **U.S. Army Corps of Engineers HEC-1,** ***Flood Hydrograph Package Computer Model,*** June 1998 Version 4.1, was used to evaluate watershed runoff. The HEC-1 models are used to simulate the rainfall-runoff process as it occurs in nature. The model is based on mathematical relationships, which are intended to represent individual meteorological, hydrologic, and hydraulic processes, which comprise the rainfall-runoff process. The Soils Conservation Service (SCS) Unit Hydrograph Method was utilized for the existing onsite condition. Curve Number estimations discussed in the next section were based upon the onsite soil types referenced from the cited document. Lag Time T_L is defined as the time measured from the centroid of effective rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time, and is a coherent property to basin length, slope, roughness characteristics and land use. The lag-times for this study were estimated by calculating the drainage basins' time of concentration, T_C. The time of concentration consists of two components; the initial overland flow time, t_i, and the gutter or channel flow time, t_t. The equation for the time of concentration is $T_C = t_i + t_t$. The equation for lag time is $T_L = 0.6T_C$. Computations for the onsite existing condition were performed with the aid of Standard Form 4. These calculations are included in Appendix B.

The **Muskingum-Cunge Rainfall-Runoff Method** option within the HEC-1 computer model software was used to analyze the onsite developed condition. This method was chosen since it does not require the direct calculation of the Time of Concentration, but is based upon the physical properties of the channel similar to the Kinematic Wave Method which is also available in the HEC-1 software. The Kinematic Wave Method is discussed in **Section 607** of the ***Hydrologic Criteria and Drainage Design Manual*** (HC&DDM) as another method to determine runoff typically used in urbanized watersheds analysis. The **Muskingum-Cunge Rainfall-Runoff Method** was used because it is noted to be more numerically stable than the Kinematic Wave Method. Section 3.6.10 of the **U.S. Army Corps of Engineers HEC-1 User's Manual** indicates due to these problems, **Muskingum-Cunge** may be the more preferable method. **Table 605** was used to estimate the parameters needed for the **UK Card in Field 3** within the **HEC-1 model** known as the *Resistance Factors for Overland Flow* that should not be confused with Manning's 'n' values. The value used in the model reflects the average numerical value for this surface to provide a conservative estimate of the initial travel flow characteristics and is noted in Table 605 in Appendix B.

The UK and RD card supply the HEC-1 computer program with the required information needed to compute the runoff for the minor and major storms per the criteria prescribed in the HC&DDM. A complete discussion of the methodology used in hydrological analysis can be found in the current version of U.S. Army Corps of Engineers User's Manual.

iii. Soils Classification

The United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey published for the Las Vegas Valley was consulted to establish the Hydrologic Soil Group (HSG) information for the watershed area. The SCS results indicate the soil is listed as *Dalian*, Unit 190; and *Tencee*, Unit 400. Figure 4 in Appendix A shows the project site on the SCS map.

CN values for the onsite and offsite drainage basins were determined using Tables 602 (pages 1 and 4 of 4) and Table 602A from the CCRFCD HC&DDM and summarized in Appendix B.

Table 3: Hydrologic Soil Group and Sub-Groups Summary

Soil No.:	**190**	**Dalian (very gravelly fine sandy loam)**					
Soil	**Percent**	**HSG**	**Undev. CN**	**Dev Com. CN***	**Newly Graded CN**	**Desert LS CN**	**Roadway CN**
Dalian	85%	B	77	92	86	77	98
Tencee	5%	D	88	95	94	88	98
Arizo	10%	A	63	89	77	63	98
	100%		76.2	91.9	85.5	76.2	98.0

* Used Commercial & Business (Table 1 of 4)

Soil No.:	**400**	**Tencee (very gravelly fine sandy loam)**					
Soil	**Percent**	**HSG**	**Undev. CN**	**Dev Com. CN***	**Newly Graded CN**	**Desert LS CN**	**Roadway CN**
Tencee	90%	D	88	95	94	88	98
Dalian	10%	B	77	92	86	77	98
	100%		86.9	94.7	93.2	86.9	98.0

* Used Commercial & Business (Table 1 of 4)

III. Hydrologic Analysis

A. Existing Drainage Conditions

The offsite watershed area impacting the proposed CCSD transportation site is undeveloped with the exception of the gravel extraction operations located on the southern boundary. Additionally, gravel operations are ongoing along the west edge of the watershed boundary or future Puli Road alignment. The existing gravel operations appear to be under use by the Nevada Ready Mix Corporation. The area as shown on Figure 8, *Existing (Overall) Drainage Basin Map*, is characterized by numerous braided washes and desert vegetation common within the Las Vegas Valley. Storm runoff in the area flows northeasterly crossing the existing gravel haul road located along the eastern boundary of the project. Runoff entering the haul route roadway known as North Alpine Ridge Way consists of a well worn asphalt section approximately 25 or more feet in width without, curb gutter and sidewalk. Runoff entering the haul route roadway area is conveyed northerly in the incised natural swales along each side of the asphalt section until reaching a low point where it turns northeasterly and flows into the existing semi-lined trapezoidal channel on the west side of the existing I-215 Beltway. The channel eastern bank is lined with large rip-rap while the bottom and western side slope is currently unlined.

The site is bounded by the following future roadway alignments on the west by Cliff Shadows, Hammer on the north, N. Alpine Ridge on the east and Washburn on the south. The existing offsite area located north of Hammer and west of Cliff Shadows contributes runoff flow to the existing haul route road known as Shaumber near the northeast corner of the site. The low point mentioned above combines the storm runoff from the north and south areas within the haul route roadway then proceeds into the existing I-215 Beltway previously discussed.

Please refer to Figure 7 in Appendix A, *Existing Offsite/OnsiteDrainage Basin Map*, which shows the 10- and 100- year flow rates, drainage patterns and watershed delineation. An existing condition HEC-1 analysis for the onsite drainage basins is included in Appendix B and summarized in the following table in hydrologic format. The offsite flow rates were established using the referenced drainage study, *90% Design Submittal for the Lone Mountain/Beltway Detention Basins and the Gowan Beltway West Channel (Update to Original Design Report) – Western Clark County 215 Bruce Woodbury Beltway Craig Road to Hualapai Way*, prepared for Clark County Department of Public Works, Design Engineering, G.C. Wallace (August 2008) listed in Section I(G). Offsite basins were delineated in the reference study and the proposed school site project boundary was placed on Figure 6, *Interim Conditions Drainage Map, Western Segment of the Las Vegas Beltway, Craig Road to Hualapai Way*, taken form the G.C. Wallace document. G.C. Wallace quantified the 100-Year unit flow rate and the table information has been summarized in Table 4. The two (2) basins taken from the reference figure are HLBW1-CA and HLBW1-CB and are shown on Figure 8 in Appendix A. The offsite basin areas were broken out into acreage and multiplied by the 100-Year flow rate per acre to establish the 100-Year flow rate along the project and watershed boundaries.

Table 4: Existing 100-Year Hydrologic Runoff Summary - Offsite

LRN BASIN NAME	LRN AREA (ac)	EXIST/ INTERIM GCW UNIT Q100 (cfs/ac)	EXIST LRN Q100 (cfs)	REMARKS
OFF1A	14.92	2.34	34.9	Portion of HLBW1-CA ref. basin
OFF1B	8.25	2.34	19.3	Portion of HLBW1-CA ref. basin
OFF2	21.33	2.34	49.9	Portion of HLBW1-CA ref. basin
OFF3A	10.89	2.34	25.5	Portion of HLBW1-CA ref. basin
OFF3B	4.58	2.34	10.7	Portion of HLBW1-CA ref. basin
OFF4A	17.28	2.05	35.4	Portion of HLBW1-CB ref. basin
OFF4B	2.35	2.05	4.8	Portion of HLBW1-CB ref. basin
OFF5A	5.90	2.34	13.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	2.05	0.5	Portion of HLBW1-CB ref. basin
OFF6	2.23	2.05	4.6	Portion of HLBW1-CB ref. basin

The existing onsite area was delineated into three basins and the HEC-1 is summarized in the following table. Within the boundary of the school site property the area is characterized braided washes and typical desert vegetation found in the undeveloped foothills throughout the valley. Flow patterns are generally to the northeast where it crosses the existing gravel haul road and into the semi-lined beltway channel located on the west side of I-215. The basin map, *Existing Onsite Drainage Basin Map*, is shown on Figure 7 in Appendix A.

Table 5: Existing 10 & 100 Year Hydrologic Runoff Summary - Onsite

HEC-1 ID/ Conc. Point	Area (ac)	CN Value	10-YR (cfs)	100-YR (cfs)	REMARKS
ONA	7.11	76.2	3	12	Area Flows to Alpine Ridge (haul route)
ONB	15.90	86.9	16	42	Area Flows to Alpine Ridge (haul route)
ONC	17.45	86.9	18	47	Area Flows to Alpine Ridge (haul route)

The G.C. Wallace referenced drainage study did not provide a 10-Year flow rate analysis for the watersheds depicted on Figure 8 in Appendix A for the existing/interim (or future) condition, therefore these flow rates were estimated using HLBW1-CA and HLBW1-CB HEC-1 data. The precipitation ratio was determined by reviewing referenced study for the 100-Year offsite watersheds location on Figure 506, *Rainfall Depth-Duration-Frequency 100-Year*, 6-Hour point rainfall and comparing its location on Figure 503 Rainfall Depth-Duration-Frequency 10-Year, 6-Hour point rainfall. Based upon the scale of Figure 503 and 506, the best precipitation ratio estimate for basin HLBW1-CA is 0.545 (unadjusted) and HLBW1-CB is 0.550 (unadjusted). An existing/interim and future condition HEC-1 model was prepared to establish the 10-Year Unit Flow Rate for the offsite watershed. The results of the HEC-1 analysis included in Appendix B are summarized in the following table.

Table 6: Estimated 10-Year Unit Flow Rate - Offsite

OFFSITE 10-YEAR FLOW RATE ANALYSIS					
GCW BASIN NAME	GCW BASIN AREA	INTERIM EST. BASIN Q10 (cfs)	INTERIM EST. UNIT Q10 (cfs/ac)	ULTIMATE EST. BASIN Q10 (cfs)	ULTIMATE EST. UNIT Q10 (cfs/ac)
HLBW1-CA	251.50	259	1.03	339	1.35
HLBW1-CB	74.95	56	0.75	110	1.47

The estimated 10- and 100-Year flow rates at the low point in Alpine Ridge were based upon the addition of the offsite and onsite flow rates and are summarized in the following table. The existing (overall) condition drainage basin map is shown on Figure 8 in Appendix A.

Table 7: Estimated 10- & 100-Year Flow Rates – Existing Condition

10 & 100 YEAR EXISTING CONDITION			
NODE	Q10 (cfs)	Q100 (cfs)	Remarks
CP1	121.4	300.5	Combined OFFSITE + ONSITE

B. Interim Drainage Description

The offsite watershed is NOT constructed and the proposed project is constructed in one (1) phase. The onsite hydrologic analysis is summarized in the following table and the HEC-1 analysis is included in Appendix B. The interim (overall) condition drainage basin map is shown on Figure 9.

Table 8: Interim Onsite Runoff Summary

HEC-1 ID/ Conc. Point	Area (ac)	CN Value	10-YR (cfs)	100-YR (cfs)	REMARKS
ON3	3.27	87.8	4	11	Onsite Parking Area
R3	0.91	98.0	2	3	Washburn
ON4	2.43	94.2	4	10	Onsite Parking Area
COMB1	n/a	n/a	10	23	Combine Q @ Washburn & South Entrance
R4+	0.68	88.4	(1) 11	(2) 25	Washburn (U/S combined & routed -> R4)
R5+	1.65	86.6	(<1) 11	(3) 28	Alpine Ridge (U/S com & ->R5 to Low Point)
ON2	1.89	94.8	4	8	Onsite Parking Area
RTE1	n/a	n/a	3	7	Route ON2 through ON5
ON5	7.06	97.6	13	27	Onsite Parking Area
FUT1	3.34	94.7	6	12	Future area assumed to be paved
RTE2	n/a	n/a	5	12	Route FUT1 through ON5
COMB2	n/a	n/a	22	45	Combine Flow @ ON7/ON5 Boundary
RTE3	n/a	n/a	21	44	Route Flow to Exit in Hammer
ON1	4.14	95.5	7	15	Onsite Parking Area
ON6	1.34	96.7	3	5	Onsite Parking Area
COMB3	n/a	n/a	10	21	Combine Flow at Inlet Area
RTE4	n/a	n/a	9	20	Route through ON7
ON7	9.98	97.4	21	41	Onsite Parking Area
COMB4	n/a	n/a	51	104	Combine All Flow Leaving Hammer
R0	1.56	91.1	3	5	Cliff Shadows
R1+	0.37	94.1	(<1) 3	(1) 6	Cliff Shadows (U/S R0 routed -> R1)
R2+	1.90	91.6	(3) 6	(7) 13	Cliff Shadows (U/S R1 routed -> R2)
COMB5	n/a	n/a	57	117	Com Q on N½ of Alpine Ridge Low Point
COMBALL	n/a	n/a	68	145	Totals of Computed Q

+ 10-/100-Year flow rates are computed for the basin and combined w/upstream basin via RD.08 = "YES" in the HEC-1 model in Appendix B

Table 9: Interim Offsite Runoff Summary

LRN BASIN NAME	LRN AREA (ac)	INTERIM ESTIMATE UNIT Q10 (cfs/ac)	INTERIM LRN Q10 (cfs)	INTERIM GCW UNIT Q100 (cfs/ac)	INTERIM LRN Q100 (cfs)	REMARKS
OFF1A	11.31	1.03	11.7	2.34	26.5	Portion of HLBW1-CA ref. basin
OFF1A1	3.61	1.03	3.7	2.34	8.5	Portion of HLBW1-CA ref. basin
OFF1B1	5.89	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFFB1	2.37	1.03	2.4	2.34	5.5	Portion of HLBW1-CA ref. basin
OFF2	13.36	1.03	13.8	2.34	31.3	Portion of HLBW1-CA ref. basin
OFF21	7.97	1.03	8.2	2.34	18.6	Portion of HLBW1-CA ref. basin
OFF3A	10.89	1.03	11.2	2.34	25.5	Portion of HLBW1-CA ref. basin
OFF3B	4.58	1.03	4.7	2.34	10.7	Portion of HLBW1-CA ref. basin
OFF4A	17.28	0.75	12.9	2.05	35.4	Portion of HLBW1-CB ref. basin
OFF4B	2.35	0.75	1.8	2.05	4.8	Portion of HLBW1-CB ref. basin
OFF5A	5.90	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	0.75	0.2	2.05	0.5	Portion of HLBW1-CB ref. basin
OFF6	2.23	0.75	1.7	2.05	4.6	Portion of HLBW1-CB ref. basin
		Totals	84.4		199.5	Total Q10 & Q100 Estimate (cfs)

The estimated 10- and 100-Year flow rates at the low point in Alpine Ridge were based upon the addition of the offsite and onsite flow rates and are summarized in the following table.

Table 10: Estimated 10- & 100-Year Flow Rates – Interim Condition

NODE	10 & 100 YEAR INTERIM CONDITION Q10 (cfs)	Q100 (cfs)	Remarks
CP1	152.4	344.5	Combined OFFSITE + ONSITE

C. Future Drainage Description

Due to the current economic situation, it is not anticipated that development within the offsite area will occur in the very near future, therefore, the offsite watershed is assumed to be developed with similar drainage patterns. The unit flow rates established for the future condition were multiplied by the

Table 11: Future Onsite Runoff Summary

HEC-1 ID/ Conc. Point	Area (ac)	CN Value	10-YR (cfs)	100-YR (cfs)	REMARKS
ON3	3.27	87.8	4	11	Onsite Parking Area
R3	0.91	98.0	2	3	Washburn
ON4	2.43	94.2	4	10	Onsite Parking Area
COMB1	n/a	n/a	10	23	Combine Q @ Washburn & South Entrance
R4+	0.68	88.4	(1) 11	(2) 25	Washburn (U/S combined & routed -> R4)
R5+	1.65	86.6	(<1) 11	(3) 28	Alpine Ridge (U/S com & ->R5 to Low Point)
ON2	1.89	94.8	4	8	Onsite Parking Area
RTE1	n/a	n/a	3	7	Route ON2 through ON5
ON5	7.06	97.6	13	27	Onsite Parking Area
FUT1	3.34	94.7	6	12	Future area assumed to be paved
RTE2	n/a	n/a	5	12	Route FUT1 through ON5
COMB2	n/a	n/a	22	45	Combine Flow @ ON7/ON5 Boundary
RTE3	n/a	n/a	21	44	Route Flow to Exit in Hammer
ON1	4.14	95.5	7	15	Onsite Parking Area
ON6	1.34	96.7	3	5	Onsite Parking Area
COMB3	n/a	n/a	10	21	Combine Flow at Inlet Area
RTE4	n/a	n/a	9	20	Route through ON7
ON7	9.98	97.4	21	41	Onsite Parking Area
COMB4	n/a	n/a	51	104	Combine All Flow Leaving Hammer
R0	1.56	91.1	3	5	Cliff Shadows
R1+	0.37	94.1	(<1) 3	(1) 6	Cliff Shadows (U/S R0 routed -> R1)
R2+	1.90	91.6	(3) 6	(7) 13	Cliff Shadows (U/S R1 routed -> R2)
COMB5	n/a	n/a	57	117	Com Q on N½ of Alpine Ridge Low Point
COMBALL	n/a	n/a	68	145	Totals of Computed Q

+ 10-/100-Year flow rates are computed for the basin and combined w/upstream basin via RD.08 = "YES" in the HEC-1 model in Appendix B

Table 12: Future Offsite Runoff Summary

LRN BASIN NAME	LRN AREA (ac)	ULTIMATE ESTIMATE UNIT Q10 (cfs/ac)	ULTIMATE LRN Q10 (cfs)	ULTIMATE GCW UNIT Q100 (cfs/ac)	ULTIMATE LRN Q100 (cfs)	REMARKS
OFF1A	11.31	1.35	15.3	2.68	30.3	Portion of HLBW1-CA ref. basin
OFF1A1	3.61	1.35	4.9	2.68	9.7	Portion of HLBW1-CA ref. basin
OFF1B1	5.89	1.35	7.9	2.68	15.8	Portion of HLBW1-CA ref. basin
OFFB1	2.37	1.35	3.2	2.68	6.3	Portion of HLBW1-CA ref. basin
OFF2	13.36	1.35	18.0	2.68	35.8	Portion of HLBW1-CA ref. basin
OFF21	7.97	1.35	10.8	2.68	21.3	Portion of HLBW1-CA ref. basin
OFF3A	10.89	1.35	14.7	2.68	29.2	Portion of HLBW1-CA ref. basin
OFF3B	4.58	1.35	6.2	2.68	12.3	Portion of HLBW1-CA ref. basin
OFF4A	17.28	1.47	25.4	2.96	51.1	Portion of HLBW1-CB ref. basin
OFF4B	2.35	1.47	3.5	2.96	7.0	Portion of HLBW1-CB ref. basin
OFF5A	5.90	1.35	8.0	2.68	15.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	1.47	0.4	2.96	0.8	Portion of HLBW1-CB ref. basin
OFF6	2.23	1.47	3.3	2.96	6.6	Portion of HLBW1-CB ref. basin
		Totals	121.4		242.0	Total Q10 & Q100 Estimate (cfs)

The estimated 10- and 100-Year flow rates at the low point in Alpine Ridge were based upon the addition of the offsite and onsite flow rates and are summarized in the following table.

Table 13: Estimated 10- & 100-Year Flow Rates – Future Condition

10 & 100 YEAR FUTURE CONDITION			
NODE	Q10 (cfs)	Q100 (cfs)	Remarks
CP1	189.5	387.0	Combined OFFSITE + ONSITE

IV. Hydraulic Analysis

A. Methodology

Based upon the proposed site development, the onsite storm runoff will be allowed to sheet flow where some of it will be picked up via varying sizes of drop inlets and conveyed underground by a proposed storm drain system. Flow (onsite) not captured by the inlet will be conveyed by grade to their respective driveways. Offsite flow will be conveyed via proposed roadway typical sections where some will be picked up by series of inlets. Onsite flow conveyed underground will connect to the offsite storm drain system in the surrounding streets where it will ultimately be released back to the existing historic low point in Alpine Ridge at the northeast corner of the site.

i. Street Conveyance Analysis

Mannings Equation within Bentley FlowMaster v8i computer software was used to determine depth and velocity conditions of the computed design flow rates in the adjacent roadway and onsite locations as shown on the drainage basin maps. For the sump condition inlet, the estimated grate opening area was reduced by 50% and the headwater was computed by the standard orifice equation included in this software.

ii. Storm Drain Analysis

Los Angeles County Flood Control District Water Surface and Pressure Gradient model for Windows (WSPGW v14.06) as modified by CivilDesign Corporation was utilized to determine the hydraulic characteristics of the offsite and onsite storm drain system. There were a total of five (5) models prepared for the proposed systems, two (2) offsite and three (3) onsite for conveyance of storm water captured by the proposed drop inlets.

Bentleys CulvertMaster was used to compute the headwater depth along with recommended pipe sizing for the proposed storm drain laterals in Cliff Shadows. The laterals are connected to the main offsite storm drain system.

iii. Drop Inlet Analysis

Capture capacity for the existing and proposed drop inlets utilized the Federal Highway Administration, Hydraulic Toolbox v1.0, January 2010. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. Per HEC-22, Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side, is no greater than that of the grate alone. Capacity is computed neglecting the curb opening. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

B. Street Conveyance Hydraulics

The following table summarizes the offsite surface flow only the 100-Year storm and corresponding hydraulic calculations are included in Appendix C. Flow captured by the offsite drop inlets is reduced from the 100-Year flow estimate. The flow rates established along the Cliff Shadows and Hammer were prorated and the information is summarized within the notes section of the FlowMaster output.

Table 14: Offsite 100-Year Depth of Flow Summary

Section	Slope (%)	Q_{100} (cfs)	D_{100} (ft)	V_{100} (fps)	DV	REMARKS
DW #1	5.77	0.7	0.07	3.07	0.2	Cliff Shadows
DW #2	0.60	1.9	0.17	1.57	0.3	Cliff Shadows
DW #3	0.60	3.5	0.21	1.82	0.4	Cliff Shadows
DW #4	0.60	4.7	0.24	1.51	0.4	Cliff Shadows
DW #5	5.30	8.1	0.18	4.55	0.8	Hammer
DW #6	4.20	14	0.22	4.34	1.0	Washburn

The summary of the analysis shows the offsite streets are below the maximum criteria of 8 as prescribed in §304.4 of the HC&DDM for the *Depth times Velocity* (DV) product for the 100-year design storm.

C. Entrance Elevations

The offsite flow impacting the entrances around the site is summarized in the table below and shown on Figure 11 in Appendix A.

Table 15: Site Entrance/Exit Freeboard Summary

Location	Q_{100} (cfs)	D_{100} (ft)	100-YR WSE	Entry Elev.	Fb (ft)	REMARKS
DW #1	0.7	0.07	26.47	27.20	0.73	Cliff Shadows
DW #2	1.9	0.17	18.81	19.45	0.64	Cliff Shadows
DW #3	3.5	0.21	17.26	17.86	0.60	Cliff Shadows
DW #4	4.7	0.24	16.11	16.67	0.56	Cliff Shadows
DW #5	8.1	0.18	66.95	67.61	0.66	Hammer
DW #6	14	0.22	96.00	96.85	0.85	Washburn

The entrances along project site have been elevated to meet the criteria of §903.6 of the HC&DDM and are summarized in the following table. Hydraulic calculations are included in Appendix C.

The following table summarizes the 100-Year onsite flow conditions near the main building located within Basin ON1. A two foot valley gutter at the edge of the parking spaces will carry nuisance flow to the proposed onsite storm drain system. The parking area is graded to convey flow from Basin ON1 to the proposed 48-in by 48-in Jensen Precast Drop Inlet located near the north end of the building. Within the valley gutter are two (2) 2-ft by 2-ft Jensen Precast drop inlets to collect the nuisance flow. Depth of flow calculations assume the 100-year flow is conveyed in the valley gutter without any flow removed by the 2-ft by 2-ft Jensen Precast drop inlets.

Table 16: Onsite 100-Year Depth of Flow Summary

Section	Slope (%)	Q_{100} (cfs)	D_{100} (ft)	WSE	FF	Fb (ft)	V_{100} (fps)	V x D	REMARKS
X1	0.51	15	0.53	3.56	5.00	1.44	2.48	1.3	Basin ON1
X2	0.51	15	0.39	4.05	5.00	0.95	2.51	1.0	Basin ON1

The Finished Floor (FF) elevations are compared with the computed water surface elevation (WSE) in the preceding table shows the freeboard estimate assuming the entire 100-Year flow is conveyed in the parking area within the 2-ft valley water. The hydraulic calculations for Table 8 are located in Appendix C. FF elevations have been set to meet or exceed the minimum freeboard requirement of twice the depth of flow in non-SFHA per the requirements discussed in §304.4(E) of the CCRFCD HC&DDM.

D. Storm Drain Hydraulics

There were five (5) WSPG models prepared for the project, two (2) offsite and three (3) onsite. The offsite models are labeled on the T2 card in the WSPG models as *Main Line* and *Alpine Ridge*, while the onsite are listed as *Upper*, *Middle* and *Lower*.

The main offsite storm drain system (*Main Line*) begins at the southwest corner of the site where it's proposed to capture the prorated 100-Year flow rate from the existing dry wash tributary to the west of centerline into a 24-in RCP. Flow captured at this locating is routed north within the Cliff Shadows underground storm drain system. Additional offsite flow is picked up from another existing dry wash tributary west of centerline into 42-in RCP lateral near the northwest the corner. Two (2) varying size standard Type 'C' drop inlets are proposed along the east side of Cliff Shadows capture and convey storm water flow into the main line. The underground storm drain turns east in Hammer and continues until daylighting within the Hammer/Alpine Ridge low point as shown on the enclosed grading plans along with plan and profile sheets. Additional flow is added to the mainline from two (2) onsite storm drain systems as shown on the plans.

The secondary offsite storm drain system (*Alpine Ridge*) located in Alpine Ridge is a relatively short reach connected with two (2) modified Type 'C' drop inlets and one (1) nuisance inlet located at the design low point in Hammer/Alpine Ridge roadway.

The offsite hydraulic grade line (HGL) for the mainline and secondary storm drain systems located in public right-of-way (ROW) has been computed and corresponding HGL profiles placed on the included plan/profile sheets. WSPG stationing on these sheets called out at the center of the SDMH, while the hydraulic model included in Appendix C was stationed at the upstream (U/S, +2.5-ft) and downstream (D/S, -2.5-ft) ends of the SDMH to account for this structural feature.

The onsite storm drain systems are connected to the mainline in Hammer at two (2) locations shown on the plans. These three systems consist of the *Upper* storm drain that conveys flow from Basin ON1 as shown of Figure 11; the *Middle* which connects to the *Upper* near the 48-in by 48-in Jensen Precast and conveys the flow to the *Main Line* in Hammer; and the Lower which collects onsite runoff at the east edge of the site and delivers it to the *Main Line* out through Driveway (DW #5). The tailwater (TW) conditions are computed in the *Main Line* and used as the starting HGL control WSE at the junction for each onsite model joining the Hammer storm drain. The HGL for the onsite system was not profiled since it is a private storm drain system.

The results of the *Main Line* and *Alpine Ridge* 100-Year HGL plotted on the storm drain profile indicates the system meets the requirements of §802.1 (HC&DDM) for maintaining minimum of one (1) foot surcharging separation (HGL) below the final design grade. Additional, all the storm drain systems meet the flow velocity criteria of §802.2 (HC&DDM) for being less than the allowed maximum of 25 feet-per-second.

The raw input, formatted input and output file for each of the WSPG analyses are located in Appendix C for review.

HGL/Headwater (HW) calculations for the laterals were based upon the CulvertMaster software using the WSPG computed WSE at the specific junction node. The tailwater (TW) elevation was used in the hydraulic worksheet to compute the HW and verify the headwater/depth (HW/D) condition at the inlet and size the pipe so the HW/D is less than or equal to 1.5 in the Bentley models. The HGL was plotted for the laterals with the public ROW as shown on the profile sheets included with this Study. Lateral calculations are included in Appendix C for review.

E. Drop Inlet Hydraulics

Drop inlet calculations were computed using the FHWA Hydraulic Toolbox v1.0 (2010) software which is an update to the FHWA Visual Urban HY-22 calculator. Clogging factors (CF) of 50 percent were applied to grate and curb opening, then the inlet sized is increased to meet the capture capacity. Based upon review of HEC-22 3rd Edition (Sept. 2009), the following CF criteria have been applied to establish the recommended inlet sizes.

i. Inlets CF for grate are 50% and applied by reducing the width by this amount.

ii. Per Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side is no greater that that of the grate along. Capacity (interception) is computed neglecting the curb opening.

iii. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Reference material for FHWA Hydraulic Toolbox v1.0 software and portions of Chapter 4 from HEC-22 regarding drop inlet capture capacity calculations is included in Appendix E for review and support of the proposed software usage.

The following table summarizes results of the hydraulic calculations for the size and type of proposed inlet in the onsite and offsite locations as shown on the enclosed grading plans.

Table 17: Drop Inlet Calculation Summary

Inlet #	Offsite Location	Inlet Type	Q100 (cfs)	Total Curb Est. Length (ft)	Lg (ft)	Lc (ft)	Lc w/ 50%CF	Total Inlet Length (ft)	Q Captured (cfs)	Q Bypass (cfs)	Notes
1	Cliff Shadows	Sweeper	2.3	8	2.5	5.5	2.75	10.75	2.2	0.1	P&P Inlet #1
2	Cliff Shadows	Sweeper	4.8	10	2.5	7.5	3.75	13.75	4.6	0.2	P&P Inlet #2
3	Hammer	Sweeper	42	13.5	2.5	11	5.5	19	19.1	22.9	P&P Inlet #3
5	Alpine Ridge	Sweeper	12.42	11	2.5	8.5	4.25	15.25	8.4	4.0	P&P Inlet #5
6	Alpine Ridge	Sweeper	28	13.5	2.5	11	5.5	19	15.6	12.4	P&P Inlet #6

Inlet #	Onsite Location	Inlet Type	Q100 (cfs)	Total Curb Est. Length (ft)	Lg (ft)	Lc (ft)	Lc w/ 50%CF	Total Inlet Length (ft)	Q Captured (cfs)	Q Bypass (cfs)	Notes
10	ON2 Sump	Sweeper	8	10	2.5	7.5	*	10	8	0	*Sump Conditon w/50% CF applied
11	COMB2 Node	Sweeper	45	10	7.5	2.5	1.25	11.25	29.9	15.1	Onsite Inlet @ COMB2 node (U/S)
12	D/S - COMB2	Sweeper	29.3	10	7.5	2.5	1.25	11.25	21.1	8.2	15.1 cfs (bypass) + 14.2 = 29.3 cfs

Notes:
Lg = Length of Grate
Lc = Length of Curb
CF = Clogging Factor

F. Low Point Overflow / Outlet Protection

Flow not captured in the drop inlets around the site (or bypass flow) will be carried to the low point in Alpine Ridge. The total 100-Year onsite generated flow anticipated at this low point is expected to be 22.9 cfs from the north and 4.0 from the south or 26.9 cfs. An irregular weir analysis for the low point based upon the estimated flow rates is summarized in the table below and the corresponding cross-section layout is shown on Figure 12 in Appendix A. Tables were set up to compute the weir flow at different depths, top width and area need to compute the velocity.

Table 18: Weir Flow Rate Calculation Summary

LOW POINT WSE	FLOW DEPTH (ft)	WEIR # 1 (cfs)	2 (cfs)	3 (cfs)	4 (cfs)	5 (cfs)	6 (cfs)	TOTAL WEIR Q (cfs)
56.90	0.08	0.14	0.14	0.00	0.00	0.00	0.00	0.3
57.00	0.10	0.14	0.14	0.63	0.38	0.38	0.63	2.3
57.05	0.15	0.14	0.14	1.74	0.70	0.70	1.74	5.2
57.10	0.20	0.14	0.14	3.58	1.07	1.07	3.58	9.6
57.15	0.25	0.14	0.14	6.25	1.50	1.50	6.25	15.8
57.20	0.30	0.14	0.14	9.86	1.97	1.97	9.86	23.9
57.22	0.32	0.14	0.14	11.58	2.17	2.17	11.58	27.8

Table 19: Weir Flow Rate Top Width Calculation Summary

LOW POINT WSE	FLOW DEPTH (ft)	WEIR # 1 (ft)	2 (ft)	3 (ft)	4 (ft)	5 (ft)	6 (ft)	WEIR TOPWIDTH (ft)
56.90	0.08	4.0	4.0	0	0	0	0	8.0
57.00	0.10	4.0	4.0	6.67	0	0	6.67	21.3
57.05	0.15	4.0	4.0	10.00	0	0	10.00	28.0
57.10	0.20	4.0	4.0	13.33	0	0	13.33	34.7
57.15	0.25	4.0	4.0	16.66	0	0	16.66	41.3
57.20	0.30	4.0	4.0	20.00	0	0	20.00	48.0
57.22	0.32	4.0	4.0	21.33	0	0	21.33	50.6

Table 20: Weir Flow Rate Area & Velocity Calculation Summary

LOW POINT WSE	FLOW DEPTH (ft)	WEIR # 1 (sq ft)	2 (sq ft)	3 (sq ft)	4 (sq ft)	5 (sq ft)	6 (sq ft)	WEIR Q AREA (sq ft)	WEIR VELOCITY (fps)
56.90	0.08	0.08	0.08	0.00	0.00	0.00	0.00	0.16	1.70
57.00	0.10	0.08	0.08	0.17	0.40	0.40	0.17	1.29	1.77
57.05	0.15	0.08	0.08	0.37	0.60	0.60	0.37	2.11	2.44
57.10	0.20	0.08	0.08	0.67	0.80	0.80	0.67	3.09	3.09
57.15	0.25	0.08	0.08	1.04	1.00	1.00	1.04	4.24	3.72
57.20	0.30	0.08	0.08	1.50	1.20	1.20	1.50	5.56	4.30
57.22	0.32	0.08	0.08	1.71	1.28	1.28	1.71	6.13	4.53

Based upon the analysis, the 100-Year weir flow velocity will be approximately 4.5 feet-per-second with a top width of approximately 50-ft. The 100-Year controlling velocity exiting the 48-in RCP is 14.87 feet-per-second based upon the WSPG analysis in Appendix C.

The outlet protection as shown on the enclosed plans will be a grouted rip-rap section with minimum D_{50} of 12 inches, thickness to be 2 times D_{50} except on the upstream and downstream edge as shown on the grading plan detail to be 3 times D_{50}. Each layer is grouted rip-rap section shall be grouted solid.

V. RECOMMENDATIONS

The recommendations are based upon the design provided by L.R. Nelson Consulting Engineers.

1. The site entrances are elevated to prevent offsite runoff from entering the site and exceeds the minimum criteria of Section §903.6 in the HC&DDM.

2. Finished floor elevations have been set to meet or exceed the minimum freeboard requirement of twice the depth of flow in non-SFHA per the requirements discussed in §304.4(E) in the HC&DDM.

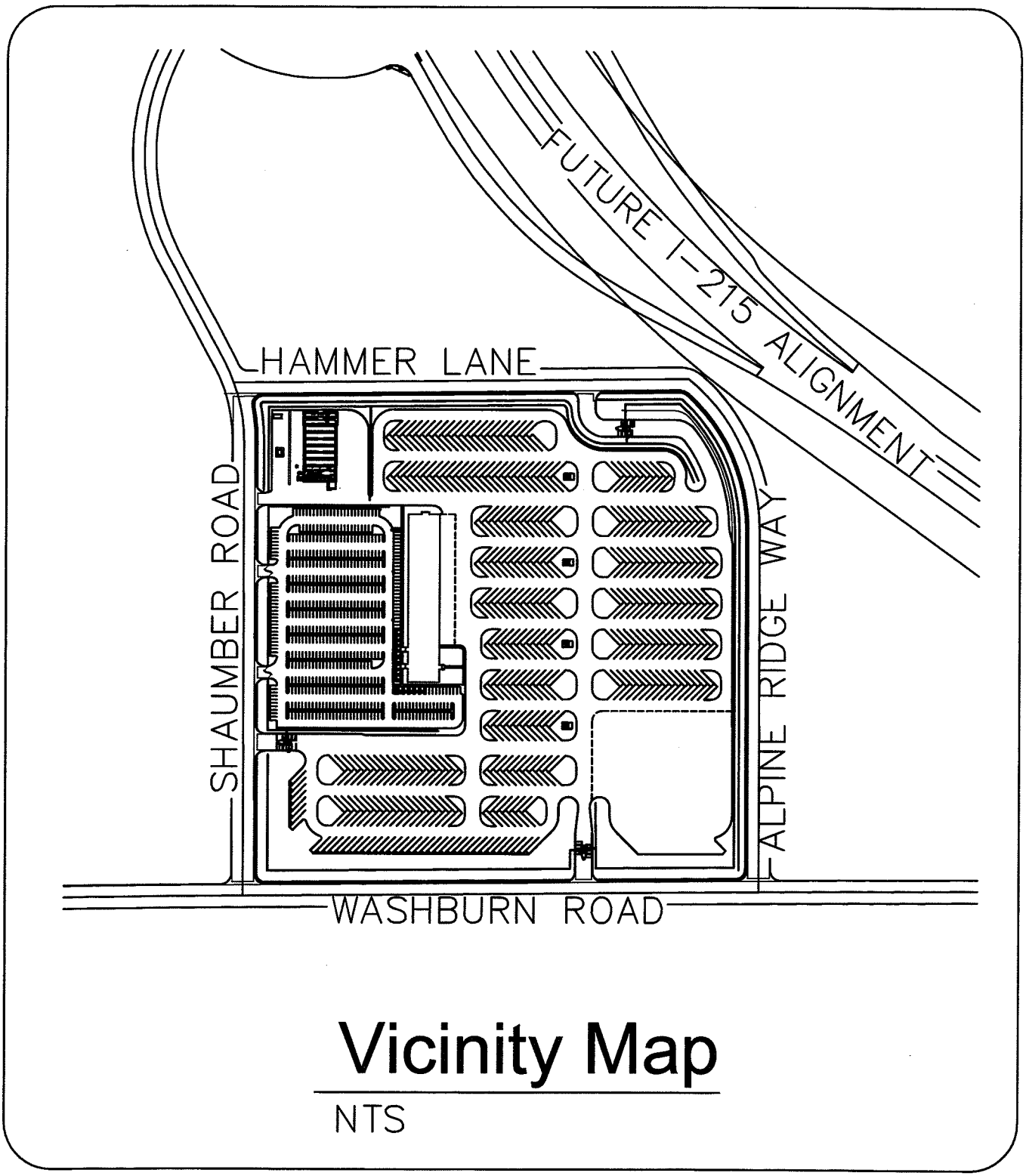
3. The storm drain systems meet the flow velocity criteria of §802.2 (HC&DDM) for being less than the allowed maximum of 25 feet-per-second.

4. The site will be developed in a single phase based upon the improvement plans provided with this technical drainage study.

VI. CONCLUSIONS

Based upon the design of the site, the minor and major storm flow rates determined within this Study show the area will be directed to there historic location and ultimately to the beltway channel. Flow rates due increase but are discharge with design components that meet the criteria of the HC&DDM.

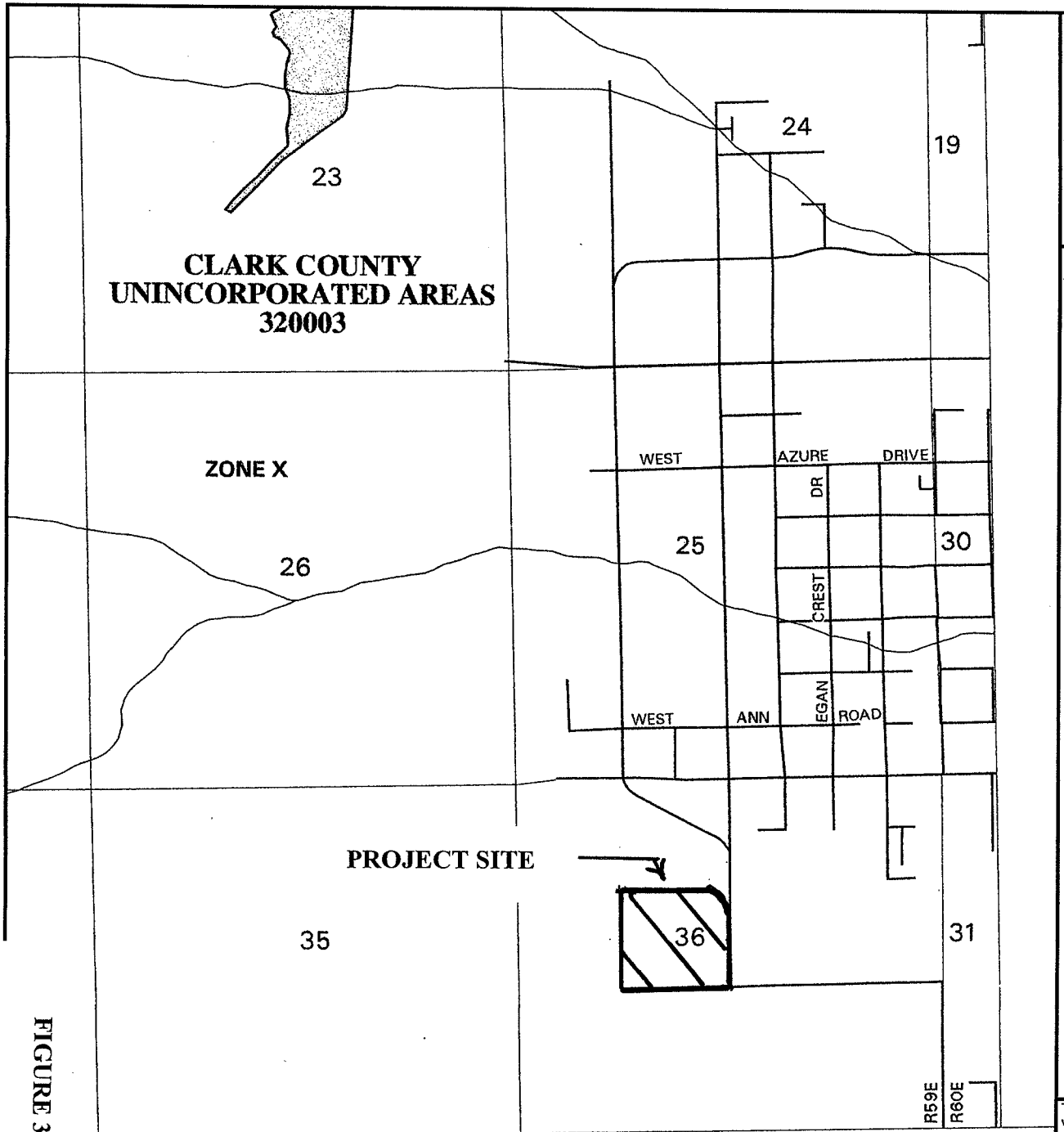
Appendix A: Figures



Vicinity Map

NTS

FIGURE 1



MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

ME

PANEL 1750 E

FIRM

FLOOD INSURANCE RATE MAP

CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 1750 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAS VEGAS, CITY OF	325276	1750	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1750	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

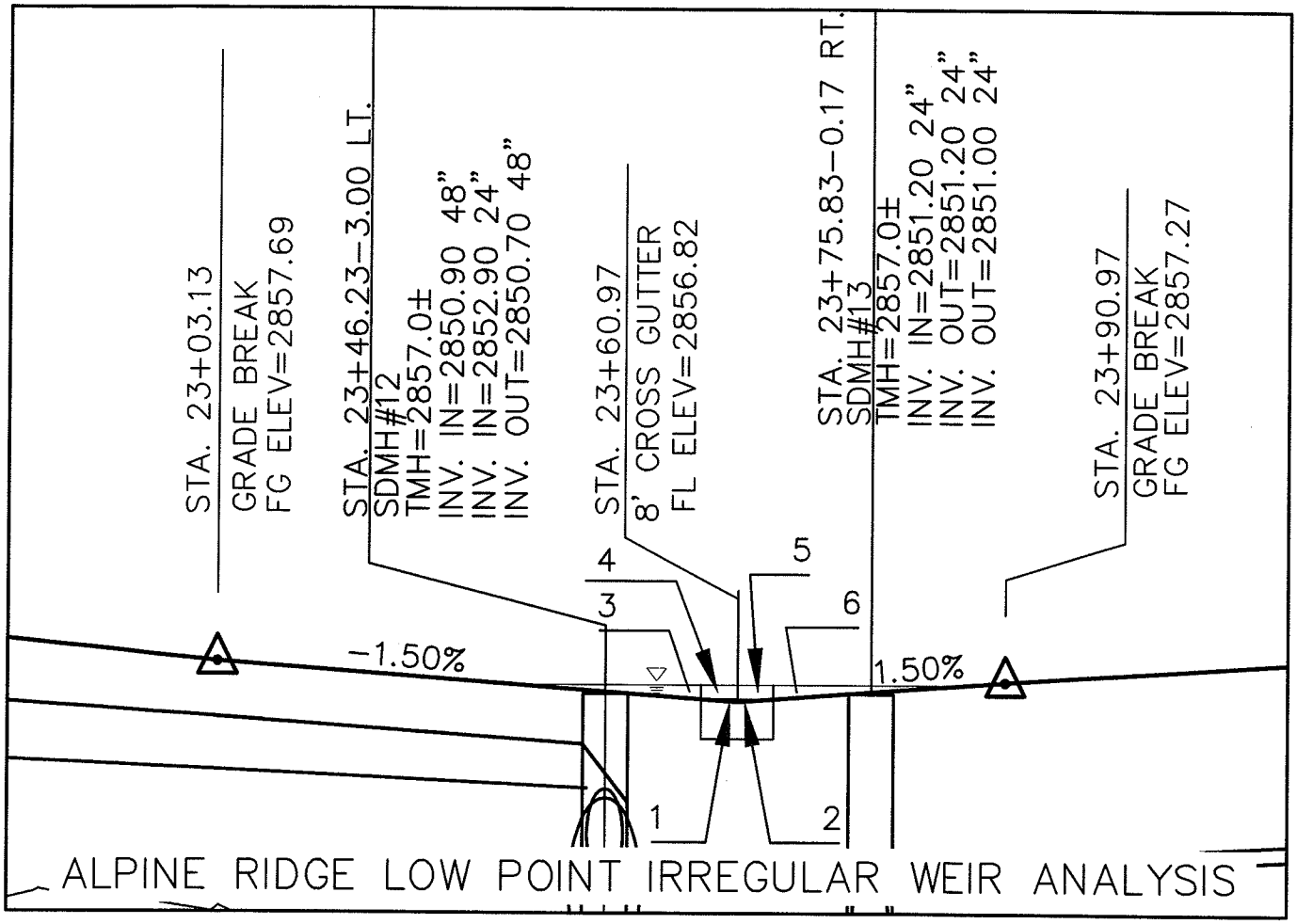
MAP NUMBER
32003C1750 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

FIGURE 3

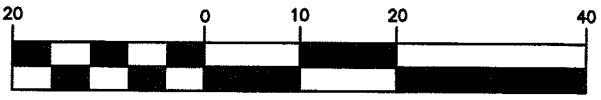


LOW POINT WSE	FLOW DEPTH (ft)	WEIR # 1 (cfs)	2 (cfs)	3 (cfs)	4 (cfs)	5 (cfs)	6 (cfs)	TOTAL WEIR Q (cfs)
56.90	0.08	0.14	0.14	0.00	0.00	0.00	0.00	0.3
57.00	0.10	0.14	0.14	0.63	0.38	0.38	0.63	2.3
57.05	0.15	0.14	0.14	1.74	0.70	0.70	1.74	5.2
57.10	0.20	0.14	0.14	3.58	1.07	1.07	3.58	9.6
57.15	0.25	0.14	0.14	6.25	1.50	1.50	6.25	15.8
57.20	0.30	0.14	0.14	9.86	1.97	1.97	9.86	23.9
57.22	0.32	0.14	0.14	11.58	2.17	2.17	11.58	27.8

LOW POINT WSE	FLOW DEPTH (ft)	WEIR # 1 (sq ft)	2 (sq ft)	3 (sq ft)	4 (sq ft)	5 (sq ft)	6 (sq ft)	WEIR Q AREA (sq ft)	WEIR VELOCITY (fps)
56.90	0.08	0.08	0.08	0.00	0.00	0.00	0.00	0.16	1.70
57.00	0.10	0.08	0.08	0.17	0.40	0.40	0.17	1.29	1.77
57.05	0.15	0.08	0.08	0.37	0.60	0.60	0.37	2.11	2.44
57.10	0.20	0.08	0.08	0.67	0.80	0.80	0.67	3.09	3.09
57.15	0.25	0.08	0.08	1.04	1.00	1.00	1.04	4.24	3.72
57.20	0.30	0.08	0.08	1.50	1.20	1.20	1.50	5.56	4.30
57.22	0.32	0.08	0.08	1.71	1.28	1.28	1.71	6.13	4.53

LOW POINT WSE	FLOW DEPTH (ft)	WEIR # 1 (ft)	2 (ft)	3 (ft)	4 (ft)	5 (ft)	6 (ft)	WEIR TOPWIDTH (ft)
56.90	0.08	4.0	4.0	0	0	0	0	8.0
57.00	0.10	4.0	4.0	6.67	0	0	6.67	21.3
57.05	0.15	4.0	4.0	10.00	0	0	10.00	28.0
57.10	0.20	4.0	4.0	13.33	0	0	13.33	34.7
57.15	0.25	4.0	4.0	16.66	0	0	16.66	41.3
57.20	0.30	4.0	4.0	20.00	0	0	20.00	48.0
57.22	0.32	4.0	4.0	21.33	0	0	21.33	50.6

GRAPHIC SCALE



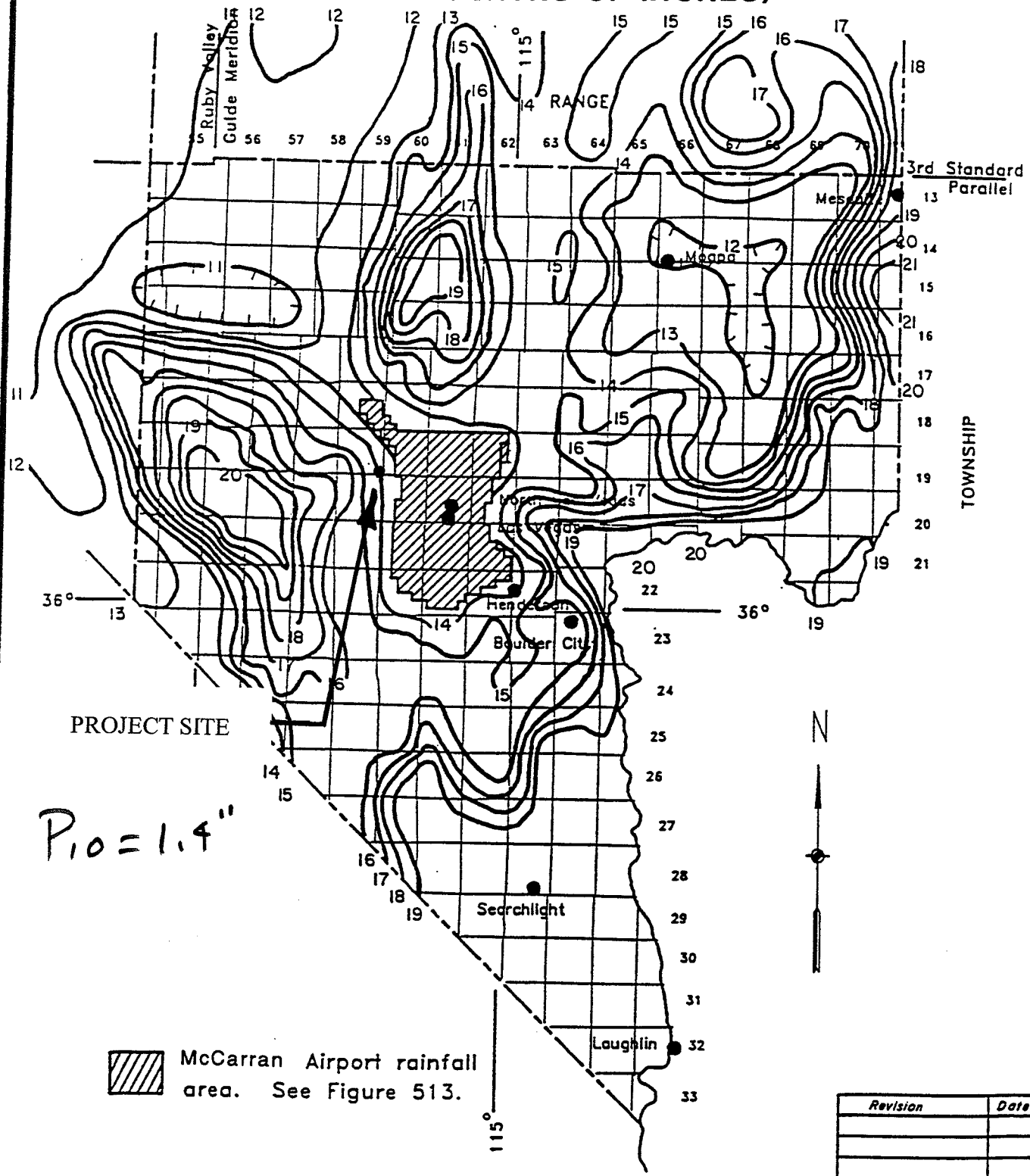
(IN FEET)
1 inch = 20 ft.

FIGURE 12

T:\Drainage Studies\CCSD-TS\ACAD\SITE\lowpoint.dwg, 11/17/2010 2:55:02 PM

Appendix B: Hydrologic Analysis

RAINFALL DEPTH-DURATION-FREQUENCY
10-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



$P_{10} = 1.4''$

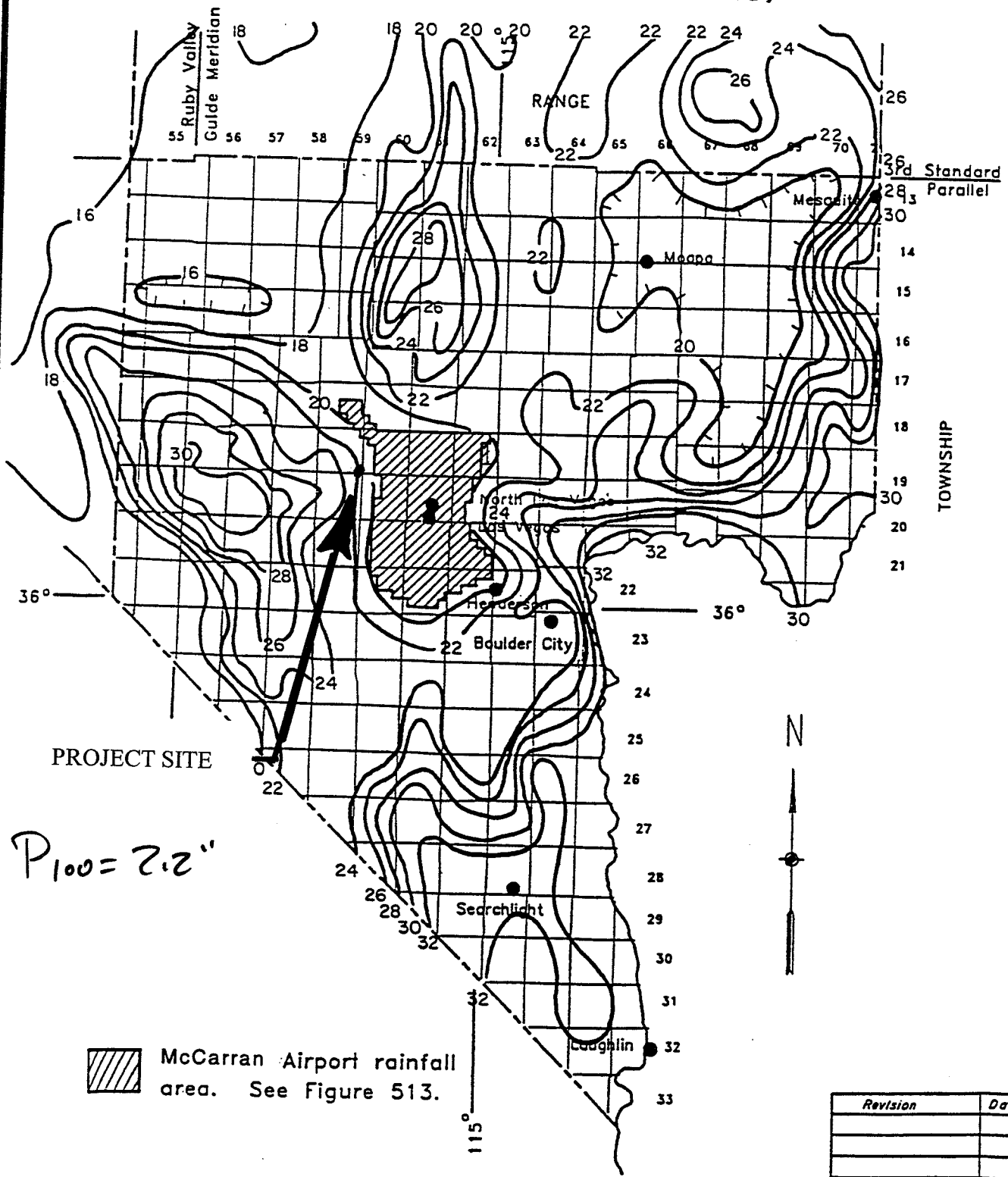
Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

RAINFALL DEPTH-DURATION-FREQUENCY
100-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



$P_{100} = 2.2''$

Revision	Date

WRC ENGINEERING	REFERENCE: NOAA ATLAS 2, VOLUME VII NEVADA, 1973	FIGURE 506

PRECIPITATION ADJUSTMENT RATIOS

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

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

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

HSG ANALYSIS - ONSITE

Soil No.:	190	Dalian (very gravelly fine sandy loam)					
Soil	Percent	HSG	Undev. CN	Dev Com. CN*	Newly Graded CN	Desert LS CN	Roadway CN
Dalian	85%	B	77	92	86	77	98
Tencee	5%	D	88	95	94	88	98
Arizo	10%	A	63	89	77	63	98
	100%		76.2	91.9	85.5	76.2	98.0

* Used Commercial & Business (Table 1 of 4)

Soil No.:	400	Tencee (very gravelly fine sandy loam)					
Soil	Percent	HSG	Undev. CN	Dev Com. CN*	Newly Graded CN	Desert LS CN	Roadway CN
Tencee	90%	D	88	95	94	88	98
Dalian	10%	B	77	92	86	77	98
	100%		86.9	94.7	93.2	86.9	98.0

* Used Commercial & Business (Table 1 of 4)

Notes:

1 LS = Desert Landscaping

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

L.R. NELSON CONSULTING ENGINEERS

File: STD_FORM_4

Project No.: 032-085-092

Project

CCSD NW Transportation Yard - Existing Onsite

CALCULATED BY : Staff

DATE: 9/29/10

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc CHECK URBANIZED BASINS		Tc	Tlag	REMARKS
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)	TOTAL LENGTH Ft (11)	Tc = (L/180)+10 Min (12)	Min (13)	Tlag= 0.6Tc/60 Hours	RAINFALL Q100/Q10 Inches
ONA	**E**	**76.2**	0.6158	7.11	**0.01111**	190.0	5.30	6.89	1100	5.50	3.47	6.89	3.85	1290	N/A	10.7	**0.107**	3.15 / 1.74
ONB	**E**	**86.9**	0.7571	15.90	**0.02484**	190.0	5.70	4.76	1580	5.50	3.47	6.89	5.01	1770	N/A	9.8	**0.098**	3.15 / 1.74
ONC	**E**	**86.9**	0.7571	17.45	**0.02727**	150.0	6.00	4.16	1520	4.79	3.24	6.43	5.21	1670	N/A	9.4	**0.094**	3.15 / 1.74

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

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

Existing V1 = 14.8*(S/100)^1/2 Developed V1 = 20.2*(S/100)^1/2

Per 602.1 of CCRFCD HC&DDM

Existing V2 = 29.4*(S/100)^1/2 Developed V2 = 30.6*(S/100)^1/2

REFERENCE :

STANDARD FORM 4

Tc VALUES LESS THAN 5 MINUTES ARE SET TO 5 MINUTES WITHIN THE HEC-1 MODEL SEC. 602.1, PAGE 606 PARAGRAPH 4 OF THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (1999)

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   18OCT10  TIME  14:36:20   *
*                                       *
*****************************************
```

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

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

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

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


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

   1          ID
   2          ID        TECHNICAL DRAINAGE STUDY FOR HOLLYWOOD AQUATIC PARK
   3          ID                        CLARK COUNTY, NEVADA
   4          ID
   5          ID    PREPARED BY:      L.R. NELSON CONSULTING ENGINEERS, INC.
   6          ID                        6765 W. RUSSELL ROAD, SUITE 200
   7          ID                             LAS VEGAS, NV  89118
   8          ID
   9          ID    FILENAME:CCSDONEX.DAT
  10          ID    JOB# 032-085-092
  11          ID    EXISTING ONSITE CONDITION
  12          ID    TECHNICAL DRAINAGE STUDY
  13          ID    JR.02 = 10-YR STORM - P10=1.74"
  14          ID    JR.03 = 100-YR STORM - P100=3.15
  15          ID
              *DIAGRAM
  16          IT       5       0       0     300
  17          IO       5
  18          IN       5
  19          JR    PREC   .5524       1

  20          KK     ONA
  21          KM   SUB BASIN ONA
  22          BA  .01111
  23          PB    3.15
  24          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
  25          PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
  26          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
  27          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
  28          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
  29          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
  30          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
  31          PC    .998    .999   1.00
  32          LS       0    76.2
  33          UD    .107
              *

  34          KK     ONB
  35          KM   SUB BASIN ONB
  36          BA  .02484
  37          LS       0    86.9
  38          UD    .098
              *

  39          KK     ONC
  40          KM   SUB BASIN ONC
  41          BA  .02727
  42          LS       0    86.9
  43          UD    .094
              *
  44          ZZ
```

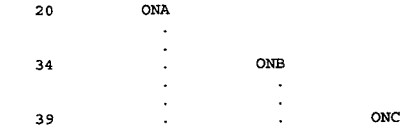
1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   18OCT10  TIME  14:36:20   *
*                                       *
*****************************************
```


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


TECHNICAL DRAINAGE STUDY FOR HOLLYWOOD AQUATIC PARK
CLARK COUNTY, NEVADA

PREPARED BY: L.R. NELSON CONSULTING ENGINEERS, INC.
6765 W. RUSSELL ROAD, SUITE 200
LAS VEGAS, NV 89118

FILENAME:CCSDONEX.DAT
JOB# 032-085-092
EXISTING ONSITE CONDITION
TECHNICAL DRAINAGE STUDY
JR.02 = 10-YR STORM - P10=1.74"
JR.03 = 100-YR STORM - P100=3.15

```
  17 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
                 .55      1.00
```

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.55	1.00
HYDROGRAPH AT						
+	ONA	.01	1	FLOW	3.	12.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	ONB	.02	1	FLOW	16.	42.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONC	.03	1	FLOW	18.	47.
				TIME	3.50	3.50

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

DEV BASIN NAME	ONSITE AREA (sf)	AREA DESERT LS (sf)	CN #190 % AREA DESERT LS	DESERT LS CN EST.	AREA DESERT LS (sf)	CN #400 % AREA DESERT LS	DESERT LS CN EST.	AREA RDWY (sf)	% AREA RDWY	RDWY CN	COMP CN	Q10 (cfs)	Q100 (cfs)	Remarks
ON1	180226.08	15434.74	8.56%	76.15	9728.41	5.40%	86.90	164791.34	86.04%	98.0	95.5	7	15	
ON2	82142.07	12182.65	14.83%	76.15	0.00	0.00%	86.90	69959.42	85.17%	98.0	94.8	4	8	
ON3	142224.11	67331.10	47.34%	76.15	0.00	0.00%	86.90	74893.01	52.66%	98.0	87.7	4	11	
ON4	105831.47	18561.66	17.54%	76.15	0.00	0.00%	86.90	87269.81	82.46%	98.0	94.2	4	10	
ON5	307461.14	5986.81	1.95%	76.15	0.00	0.00%	86.90	301474.33	98.05%	98.0	97.6	13	27	
ON6	58587.93	0.00	0.00%	76.15	6639.5	11.33%	86.90	51948.47	88.67%	98.0	96.7	3	5	Gas Station
ON7	434815.31	10991.76	2.53%	76.15	950.33	0.22%	86.90	422873.22	97.25%	98.0	97.4	21	41	
R0	67955.07	19809.89	29.15%	76.15	3254.66	4.79%	86.90	44890.52	66.06%	98.0	91.1	3	5	Cliff Shadows/Shaumber
R1	16240.79	0.00	0.00%	76.15	5641.67	34.74%	86.90	10599.12	65.26%	98.0	94.1	(<1) 3	(1) 5	Cliff Shadows/Shaumber
R2	82857.16	6076.58	7.33%	76.15	36072.56	43.54%	86.90	40708.02	49.13%	98.0	91.6	(3) 6	(7) 13	Hammer
R3	39534.07	0.00	0.00%	76.15	0.00	0.00%	86.90	39534.07	100.00%	98.0	98.0	2	3	Washburn
R4	29688.36	13059.08	43.99%	76.15	0.00	0.00%	86.90	16629.28	56.01%	98.0	88.4	(1) 11	(2) 25	Washburn
R5	71829.97	37508.82	52.22%	76.15	0.00	0.00%	86.90	34321.15	47.78%	98.0	86.6	(<1) 11	(3) 28	Alpine Ridge
FUT1	145655.74	26246.83	18.02%	76.15	0.00	0.00%	86.90	119408.91	81.98%	98.8	94.7	6	12	Future Parking Area
COMB1												10	23	Washburn D/W
COMB2												22	45	Onsite @ east edge @ DI
COMB3												10	21	Near 4' Gutter/DI Outlet Area
COMB4												51	104	Hammer D/W
COMBALL												68	145	Onsite (ALL) Flow Combination Pt

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*               JUN  1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   10NOV10  TIME  11:36:52  *
*                                      *
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

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

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

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

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   1          ID
   2          ID        TECHNICAL DRAINAGE STUDY FOR HOLLYWOOD AQUATIC PARK
   3          ID                          CLARK COUNTY, NEVADA
   4          ID
   5          ID    PREPARED BY:      L.R. NELSON CONSULTING ENGINEERS, INC.
   6          ID                        6765 W. RUSSELL ROAD, SUITE 200
   7          ID                             LAS VEGAS, NV  89118
   8          ID
   9          ID    FILENAME:CCSDONI1.DAT
  10          ID    JOB# 032-085-092
  11          ID    DEVELOPED ONSITE CONDITION
  12          ID    TECHNICAL DRAINAGE STUDY
  13          ID    JR.02 = 10-YR STORM - P10=1.74"
  14          ID    JR.03 = 100-YR STORM - P100=3.15"
  15          ID    SDN #3
  16          ID
              *DIAGRAM
  17          IT       5       0       0     300
  18          IO       5
  19          IN       5
  20          JR    PREC   .5524       1

  21          KK     ON3
  22          KM   ONSITE BASIN ON3 - DRAINS TO WASHBURN
  23          BA  .00510
  24          PB    3.15
  25          PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
  26          PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
  27          PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
  28          PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
  29          PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
  30          PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
  31          PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
  32          PC    .998    .999   1.00
  33          LS       0   87.7
  34          UK     140   .0286      .1     100
  35          RD     470   .0245    .016            TRAP       0      35
              *

  36          KK      R3
  37          KM   ROADWAY BASIN - WASHBURN HALF STREET SECTION
  38          BA  .00142
  39          LS       0      98
  40          UK    24.5     .02      .1     100
  41          RD     870     .05    .016            TRAP    24.5       0
              *

  42          KK     ON4
  43          KM   ONSITE BASIN ON4 - DRAINS TO WASHBURN
  44          BA  .00380
  45          LS       0    94.2
  46          UK     140   .0286      .1     100
  47          RD     560   .0245    .016            TRAP       0      35
              *
```

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

  48      KK   COMB1
  49      KM   COMBINE ON3+R3+ON4 IN WASHBURN AT SOUTHERN DW
  50      HC       3
          *

  51      KK      R4
  52      KM   ROADWAY BASIN - WASHBURN HALF STREET TO ALPINE RIDGE
  53      KM   U/S NODE COMB1 ROUTED THROUGH AND COMBINED WITH R4
  54      KM   VIA RD.08 = "YES"
  55      BA  .00106
  56      LS       0    88.4
  57      UK    24.5     .02      .1     100
  58      RD     400     .05    .016            TRAP    24.5       0     YES
          *

  59      KK      R5
  60      KM   ROADWAY BASIN - ALPINE RIDGE HALF STREET
  61      BA  .00258
  62      LS       0    86.6
  63      UK    24.5     .02      .1     100
  64      RD    1090     .02    .016            TRAP    24.5       0     YES
          *

  65      KK     ON2
  66      KM   ONSITE BASIN ON2
  67      BA  .00295
  68      LS       0    94.8
  69      UK      90     .02      .1     100
  70      RD     450   .0461    .016            TRAP      24       0
          *

  71      KK    RTE1
  72      KM   ROUTE ON2 THROUGH ON5
  73      RD     700   .0268    .016            TRAP      24       0
          *

  74      KK     ON5
  75      KM   ONSITE BASIN ON5
  76      BA  .01103
  77      LS       0    97.6
  78      UK     280    .025      .1     100
  79      RD     600   .0268    .016            TRAP      24       0
          *

  80      KK    FUT1
  81      KM   FUTURE ONSITE PORTION TO BE ASSUMED FULLY DEVELOPED
  82      BA  .00522
  83      LS       0    94.7
  84      UK     250    .025      .1     100
  85      RD     380    .005    .016            TRAP      20       0
          *
```

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

  86      KK    RTE2
  87      KM   ROUTE FUT1 THROUGH C&G IN ON5
  88      RD     280    .005    .016            TRAP      24       0
          *

  89      KK   COMB2
  90      KM   COMBINE ONSITE BASINS BEFORE ENTERING ON7
  91      HC       3
          *

  92      KK    RTE3
  93      KM   ROUTE COMB2 TO HAMMER ENTRANCE
  94      RD     750    .042    .016            TRAP      25       0
          *

  95      KK     ON1
  96      KM   ONSITE BASIN ON1
  97      BA  .00646
  98      LS       0    95.5
  99      UK     300     .04      .1     100
 100      RD     380    .005    .016            TRAP      24       0
          *

 101      KK     ON6
 102      KM   ONSITE BASIN ON6 - GAS STATION AREA
 103      BA  .00210
 104      LS       0    96.7
 105      UK      55     .04      .1     100
 106      RD     235   .0058    .016            TRAP      20       0
          *

 107      KK   COMB3
 108      KM   COMBINE BASINS AT OUTLET TO ON1
 109      HC       2
          *

 110      KK    RTE4
 111      KM   ROUTE COMB3 TO BEGINING OF ONSITE EXIT
 112      RD     840   .0256    .016            TRAP      24       0
          *

 113      KK     ON7
 114      KM   ONSITE BASIN ON7
 115      BA  .01560
 116      LS       0    97.4
 117      UK     140   .0286      .1     100
 118      RD     720   .0202    .016            TRAP      24       0
          *
```

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

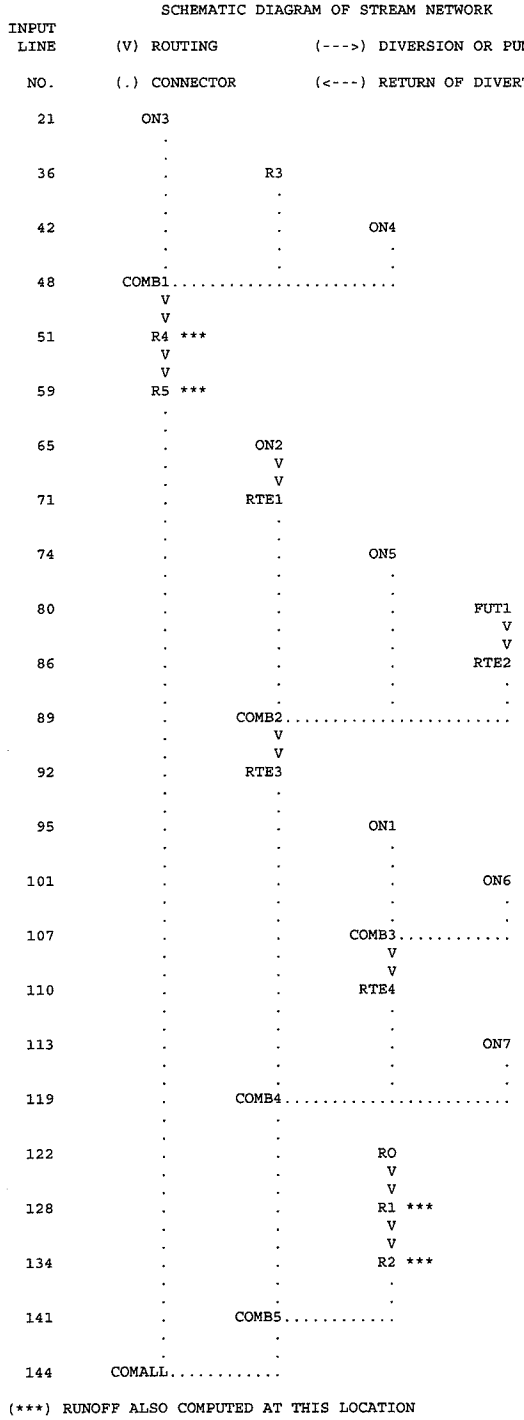
 119      KK   COMB4
 120      KM   COMBINE FLOW AT DW INTO HAMMER
 121      HC       3
          *
 122      KK      RO
 123      KM   ROADWAY BASIN - CLIFF SHADOWS/SHAUMBER
 124      BA  .00244
 125      LS       0    91.1
 126      UK    34.5     .02      .1     100
 127      RD     840    .024    .016            TRAP    34.5       0
          *
 128      KK      R1
 129      KM   ROADWAY BASIN - CLIFF SHADOWS/SHAUMBER
 130      BA  .00058
 131      LS       0    94.1
 132      UK    34.5     .02      .1     100
 133      RD     245    .006    .016            TRAP    34.5       0     YES
          *
 134      KK      R2
 135      KM   ROADWAY BASIN - HAMMER
 136      BA  .00297
 137      LS       0    91.6
 138      UK    24.5     .02      .1     100
 139      RD     900   .0560    .016            TRAP    24.5       0
 140      RD     250   .0256    .016            TRAP    24.5       0     YES
          *
 141      KK   COMB5
 142      KM   COMBINE DEVELOPED INTERIM FLOW AT LOW POINT IN ALPINE RIDGE
 143      HC       2
          *
 144      KK  COMALL
 145      KM   COMBINE ALL FLOW IN LOW POINT IN ALPINE RIDGE
 146      HC       2
          *
 147      ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING
(.) CONNECTOR
(---->) DIVERSION OR PUMP FLOW
(<----) RETURN OF DIVERTED OR PUMPED FLOW



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   10NOV10  TIME  11:36:52   *
*                                       *
*****************************************
```

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

TECHNICAL DRAINAGE STUDY FOR HOLLYWOOD AQUATIC PARK
CLARK COUNTY, NEVADA

PREPARED BY: L.R. NELSON CONSULTING ENGINEERS, INC.
6765 W. RUSSELL ROAD, SUITE 200
LAS VEGAS, NV 89118

FILENAME:CCSDONI1.DAT
JOB# 032-085-092
DEVELOPED ONSITE CONDITION
TECHNICAL DRAINAGE STUDY
JR.02 = 10-YR STORM - P10=1.74"
JR.03 = 100-YR STORM - P100=3.15"
SDN #3

```
 18 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
                    .55      1.00
```

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .55	RATIO 2 1.00
HYDROGRAPH AT						
+	ON3	.01	1	FLOW	4.	11.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	R3	.00	1	FLOW	2.	3.
				TIME	3.42	3.50
HYDROGRAPH AT						
+	ON4	.00	1	FLOW	4.	10.
				TIME	3.50	3.50
3 COMBINED AT						
+	COMB1	.01	1	FLOW	10.	23.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	R4	.01	1	FLOW	11.	25.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	R5	.01	1	FLOW	11.	28.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON2	.00	1	FLOW	4.	8.
				TIME	3.50	3.50
ROUTED TO						
+	RTE1	.00	1	FLOW	3.	7.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON5	.01	1	FLOW	13.	27.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	FUT1	.01	1	FLOW	6.	12.
				TIME	3.50	3.50
ROUTED TO						
+	RTE2	.01	1	FLOW	5.	12.
				TIME	3.50	3.50
3 COMBINED AT						
+	COMB2	.02	1	FLOW	22.	45.
				TIME	3.50	3.50
ROUTED TO						
+	RTE3	.02	1	FLOW	21.	44.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON1	.01	1	FLOW	7.	15.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON6	.00	1	FLOW	3.	5.
				TIME	3.50	3.50
2 COMBINED AT						
+	COMB3	.01	1	FLOW	10.	21.
				TIME	3.50	3.50
ROUTED TO						
+	RTE4	.01	1	FLOW	9.	20.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON7	.02	1	FLOW	21.	41.
				TIME	3.50	3.50
3 COMBINED AT						
+	COMB4	.04	1	FLOW	51.	104.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	RO	.00	1	FLOW	3.	5.
				TIME	3.50	3.42
HYDROGRAPH AT						
+	R1	.00	1	FLOW	3.	6.
				TIME	3.50	3.50

HYDROGRAPH AT						
+	R2	.01	1	FLOW	6.	13.
				TIME	3.50	3.50
2 COMBINED AT						
+	COMB5	.05	1	FLOW	57.	117.
				TIME	3.50	3.50
2 COMBINED AT						
+	COMALL	.06	1	FLOW	68.	145.
				TIME	3.50	3.50

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .55									
ON3	MANE	1.77	10.85	208.89	1.91	5.00	10.58	210.00	1.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .5242E+00 OUTFLOW= .5208E+00 BASIN STORAGE= .1814E-03 PERCENT ERROR= .6									
FOR PLAN = 1 RATIO= .55									
ON3	MANE	2.26	4.03	210.49	.74	5.00	3.99	210.00	.74
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2024E+00 OUTFLOW= .2020E+00 BASIN STORAGE= .1781E-03 PERCENT ERROR= .1									
FOR PLAN = 1 RATIO= 1.00									
ON3	MANE	1.77	10.85	208.89	1.91	5.00	10.58	210.00	1.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .5242E+00 OUTFLOW= .5208E+00 BASIN STORAGE= .1814E-03 PERCENT ERROR= .6									
FOR PLAN = 1 RATIO= .55									
R3	MANE	3.79	4.03	208.41	2.86	5.00	3.22	210.00	2.85
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2210E+00 OUTFLOW= .2169E+00 BASIN STORAGE= .7721E-03 PERCENT ERROR= 1.5									
FOR PLAN = 1 RATIO= .55									
R3	MANE	4.84	2.13	208.07	1.51	5.00	1.88	205.00	1.51
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1149E+00 OUTFLOW= .1141E+00 BASIN STORAGE= .7622E-03 PERCENT ERROR= .0									
FOR PLAN = 1 RATIO= 1.00									
R3	MANE	3.79	4.03	208.41	2.86	5.00	3.22	210.00	2.85
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2210E+00 OUTFLOW= .2169E+00 BASIN STORAGE= .7721E-03 PERCENT ERROR= 1.5									
FOR PLAN = 1 RATIO= .55									
ON4	MANE	2.17	9.72	210.20	2.50	5.00	9.68	210.00	2.51
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .5097E+00 OUTFLOW= .5075E+00 BASIN STORAGE= .2109E-03 PERCENT ERROR= .4									
FOR PLAN = 1 RATIO= .55									
ON4	MANE	2.61	4.54	208.79	1.17	5.00	4.41	210.00	1.17
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2373E+00 OUTFLOW= .2369E+00 BASIN STORAGE= .2090E-03 PERCENT ERROR= .1									
FOR PLAN = 1 RATIO= 1.00									
ON4	MANE	2.17	9.72	210.20	2.50	5.00	9.68	210.00	2.51
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .5097E+00 OUTFLOW= .5075E+00 BASIN STORAGE= .2109E-03 PERCENT ERROR= .4									
FOR PLAN = 1 RATIO= .55									
R4	MANE	1.11	12.20	209.36	1.09	5.00	12.09	210.00	1.09
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5526E+00 EXCESS= .1122E+00 OUTFLOW= .6633E+00 BASIN STORAGE= .3398E-03 PERCENT ERROR= .2									
FOR PLAN = 1 RATIO= .55									
R4	MANE	1.17	10.85	210.58	.98	5.00	10.81	210.00	.98
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5526E+00 EXCESS= .4424E-01 OUTFLOW= .5965E+00 BASIN STORAGE= .3421E-03 PERCENT ERROR= .0									
FOR PLAN = 1 RATIO= 1.00									
R4	MANE	.84	25.30	209.71	2.23	5.00	25.23	210.00	2.24
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1246E+01 EXCESS= .1122E+00 OUTFLOW= .1356E+01 BASIN STORAGE= .3375E-03 PERCENT ERROR= .1									
FOR PLAN = 1 RATIO= .55									

```
          R5  MANE         3.59     14.41    207.96      1.13      5.00     13.94    210.00        1.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5976E+00 EXCESS= .2530E+00 OUTFLOW= .8443E+00 BASIN STORAGE= .1251E-02 PERCENT ERROR=    .6

     FOR PLAN = 1  RATIO=  .55
          R5  MANE         3.93     11.49    212.42       .93      5.00     11.28    210.00         .93

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5976E+00 EXCESS= .9456E-01 OUTFLOW= .6922E+00 BASIN STORAGE= .1226E-02 PERCENT ERROR=   -.2

     FOR PLAN = 1  RATIO= 1.00
          R5  MANE         2.79     28.74    209.36      2.16      5.00     28.25    210.00        2.16

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1360E+01 EXCESS= .2530E+00 OUTFLOW= .1609E+01 BASIN STORAGE= .1223E-02 PERCENT ERROR=    .2

     FOR PLAN = 1  RATIO=  .55
          ON2  MANE         1.54      7.80    209.75      2.47      5.00      7.59    210.00        2.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4052E+00 OUTFLOW= .3885E+00 BASIN STORAGE= .4000E-03 PERCENT ERROR=   4.0

     FOR PLAN = 1  RATIO=  .55
          ON2  MANE         2.04      3.73    210.29      1.19      5.00      3.71    210.00        1.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1919E+00 OUTFLOW= .1868E+00 BASIN STORAGE= .4053E-03 PERCENT ERROR=   2.4

     FOR PLAN = 1  RATIO= 1.00
          ON2  MANE         1.54      7.80    209.75      2.47      5.00      7.59    210.00        2.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4052E+00 OUTFLOW= .3885E+00 BASIN STORAGE= .4000E-03 PERCENT ERROR=   4.0

     FOR PLAN = 1  RATIO=  .00
          RTE1  MANE         3.80      3.44    212.78      1.19      5.00      3.26    210.00        1.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1871E+00 EXCESS= .0000E+00 OUTFLOW= .1873E+00 BASIN STORAGE= .7272E-03 PERCENT ERROR=   -.5

     FOR PLAN = 1  RATIO=  .00
          RTE1  MANE         2.86      7.10    211.27      2.48      5.00      6.79    210.00        2.47

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3898E+00 EXCESS= .0000E+00 OUTFLOW= .3903E+00 BASIN STORAGE= .7111E-03 PERCENT ERROR=   -.3

     FOR PLAN = 1  RATIO=  .55
          ON5  MANE         1.46     27.23    208.67      2.68      5.00     26.78    210.00        2.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1690E+01 OUTFLOW= .1576E+01 BASIN STORAGE= .7240E-03 PERCENT ERROR=   6.7

     FOR PLAN = 1  RATIO=  .55
          ON5  MANE         1.92     13.48    211.00      1.39      5.00     13.48    210.00        1.39

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .8683E+00 OUTFLOW= .8164E+00 BASIN STORAGE= .7574E-03 PERCENT ERROR=   5.9

     FOR PLAN = 1  RATIO= 1.00
          ON5  MANE         1.46     27.23    208.67      2.68      5.00     26.78    210.00        2.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1690E+01 OUTFLOW= .1576E+01 BASIN STORAGE= .7240E-03 PERCENT ERROR=   6.7

     FOR PLAN = 1  RATIO=  .55
          FUT1  MANE         1.94     12.43    209.83      2.43      5.00     12.33    210.00        2.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7142E+00 OUTFLOW= .6752E+00 BASIN STORAGE= .6414E-03 PERCENT ERROR=   5.4

     FOR PLAN = 1  RATIO=  .55
          FUT1  MANE         2.65      5.65    209.20      1.17      5.00      5.63    210.00        1.17

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3373E+00 OUTFLOW= .3257E+00 BASIN STORAGE= .6404E-03 PERCENT ERROR=   3.3

     FOR PLAN = 1  RATIO= 1.00
          FUT1  MANE         1.94     12.43    209.83      2.43      5.00     12.33    210.00        2.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7142E+00 OUTFLOW= .6752E+00 BASIN STORAGE= .6414E-03 PERCENT ERROR=   5.4
```

```
          FOR PLAN = 1  RATIO=  .00
              RTE2  MANE         2.13      5.42    212.91      1.17      5.00      5.20    210.00        1.17

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3254E+00 EXCESS= .0000E+00 OUTFLOW= .3254E+00 BASIN STORAGE= .4695E-03 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
              RTE2  MANE         1.56     11.96    211.71      2.43      5.00     11.81    210.00        2.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6764E+00 EXCESS= .0000E+00 OUTFLOW= .6765E+00 BASIN STORAGE= .4675E-03 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
              RTE3  MANE         1.78     21.61    211.47      1.30      5.00     20.63    210.00        1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1329E+01 EXCESS= .0000E+00 OUTFLOW= .1329E+01 BASIN STORAGE= .6783E-03 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .00
              RTE3  MANE         1.33     44.78    211.29      2.58      5.00     44.05    210.00        2.59

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2643E+01 EXCESS= .0000E+00 OUTFLOW= .2644E+01 BASIN STORAGE= .6725E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .55
               ON1  MANE         1.90     15.79    208.77      2.49      5.00     15.42    210.00        2.49

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .9121E+00 OUTFLOW= .8579E+00 BASIN STORAGE= .6933E-03 PERCENT ERROR=   5.9

          FOR PLAN = 1  RATIO=  .55
               ON1  MANE         2.56      7.50    209.78      1.23      5.00      7.46    210.00        1.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .4408E+00 OUTFLOW= .4237E+00 BASIN STORAGE= .6971E-03 PERCENT ERROR=   3.7

          FOR PLAN = 1  RATIO= 1.00
               ON1  MANE         1.90     15.79    208.77      2.49      5.00     15.42    210.00        2.49

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .9121E+00 OUTFLOW= .8579E+00 BASIN STORAGE= .6933E-03 PERCENT ERROR=   5.9

          FOR PLAN = 1  RATIO=  .55
               ON6  MANE         1.55      6.02    209.14      2.69      5.00      5.41    210.00        2.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3107E+00 OUTFLOW= .3008E+00 BASIN STORAGE= .3593E-03 PERCENT ERROR=   3.1

          FOR PLAN = 1  RATIO=  .55
               ON6  MANE         2.01      3.13    208.81      1.36      5.00      2.87    210.00        1.35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1555E+00 OUTFLOW= .1518E+00 BASIN STORAGE= .3684E-03 PERCENT ERROR=   2.1

          FOR PLAN = 1  RATIO= 1.00
               ON6  MANE         1.55      6.02    209.14      2.69      5.00      5.41    210.00        2.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .3107E+00 OUTFLOW= .3008E+00 BASIN STORAGE= .3592E-03 PERCENT ERROR=   3.1

          FOR PLAN = 1  RATIO=  .00
              RTE4  MANE         3.07      9.80    211.86      1.26      5.00      9.25    210.00        1.26

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5745E+00 EXCESS= .0000E+00 OUTFLOW= .5748E+00 BASIN STORAGE= .8687E-03 PERCENT ERROR=   -.2

          FOR PLAN = 1  RATIO=  .00
              RTE4  MANE         2.32     19.91    211.08      2.54      5.00     19.52    210.00        2.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1157E+01 EXCESS= .0000E+00 OUTFLOW= .1158E+01 BASIN STORAGE= .8648E-03 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO=  .55
               ON7  MANE         1.61     41.93    208.93      2.66      5.00     40.75    210.00        2.66

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2372E+01 OUTFLOW= .2209E+01 BASIN STORAGE= .8679E-03 PERCENT ERROR=   6.8

          FOR PLAN = 1  RATIO=  .55
               ON7  MANE         2.10     21.55    209.61      1.36      5.00     21.05    210.00        1.36
```

```
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1211E+01 OUTFLOW= .1133E+01 BASIN STORAGE= .8553E-03 PERCENT ERROR=   6.4

          FOR PLAN = 1  RATIO= 1.00
               ON7  MANE         1.61     41.93    208.93      2.66      5.00     40.75    210.00        2.66

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2372E+01 OUTFLOW= .2209E+01 BASIN STORAGE= .8679E-03 PERCENT ERROR=   6.8

          FOR PLAN = 1  RATIO=  .55
                RO  MANE         4.42      5.88    207.59      2.15      5.00      5.15    205.00        2.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2889E+00 OUTFLOW= .2802E+00 BASIN STORAGE= .1106E-02 PERCENT ERROR=   2.6

          FOR PLAN = 1  RATIO=  .55
                RO  MANE         5.00      2.65    210.00       .93      5.00      2.65    210.00         .93

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1231E+00 OUTFLOW= .1211E+00 BASIN STORAGE= .1082E-02 PERCENT ERROR=    .8

          FOR PLAN = 1  RATIO= 1.00
                RO  MANE         4.42      5.88    207.59      2.15      5.00      5.15    205.00        2.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2889E+00 OUTFLOW= .2802E+00 BASIN STORAGE= .1106E-02 PERCENT ERROR=   2.6

          FOR PLAN = 1  RATIO=  .55
                R1  MANE         2.29      3.94    210.29      1.22      5.00      3.92    210.00        1.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1211E+00 EXCESS= .7749E-01 OUTFLOW= .1971E+00 BASIN STORAGE= .4476E-03 PERCENT ERROR=    .5

          FOR PLAN = 1  RATIO=  .55
                R1  MANE         2.49      3.15    209.29       .97      5.00      3.12    210.00         .97

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1211E+00 EXCESS= .3597E-01 OUTFLOW= .1566E+00 BASIN STORAGE= .4622E-03 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO= 1.00
                R1  MANE         1.93      6.66    208.42      2.21      5.00      6.27    210.00        2.21

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2790E+00 EXCESS= .7749E-01 OUTFLOW= .3552E+00 BASIN STORAGE= .4653E-03 PERCENT ERROR=    .2

          FOR PLAN = 1  RATIO=  .55
                R2  MANE          .91     10.38    209.30      1.53      5.00      9.54    210.00        1.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1566E+00 EXCESS= .3589E+00 OUTFLOW= .4903E+00 BASIN STORAGE= .1040E-02 PERCENT ERROR=   4.7

          FOR PLAN = 1  RATIO=  .55
                R2  MANE         1.14      5.93    207.74       .96      5.00      5.74    210.00         .96

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1566E+00 EXCESS= .1552E+00 OUTFLOW= .3069E+00 BASIN STORAGE= .1054E-02 PERCENT ERROR=   1.2

          FOR PLAN = 1  RATIO= 1.00
                R2  MANE          .82     13.92    208.83      2.16      5.00     12.66    210.00        2.16

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3552E+00 EXCESS= .3589E+00 OUTFLOW= .6914E+00 BASIN STORAGE= .1040E-02 PERCENT ERROR=   3.0


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

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   11OCT10  TIME  10:35:14   *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  1           ID
  2           ID                TECHNICAL DRAINAGE STUDY FOR CCSD-TS
  3           ID                      10-YEAR STORM ESTIMATE
  4           ID                       CLARK COUNTY, NEVADA
  5           ID
  6           ID    PREPARED BY:      L.R. NELSON CONSULTING ENGINEERS, INC.
  7           ID                        6765 W. RUSSELL ROAD, SUITE 200
  8           ID                             LAS VEGAS, NV  89118
  9           ID
 10           ID    FILENAME:CCSD10EI.DAT
 11           ID    JOB# 032-085-092
 12           ID    EXISTING/INTERIM CONDITION
 13           ID    TECHNICAL DRAINAGE STUDY
 14           ID
 15           ID
 16           ID   RECREATED 100-YEAR BASIN MODELS FOR HLBW1-CA & HLBW1-CB TO ESTIMATE 10-YEAR
 17           ID   FLOW RATE FOR WATERSHED DETERMINED BY GCW IN 90% DESIGN FOR LONE MTN/BELTWAY
 18           ID   AND GOWAN BELTWAY WEST CHANNEL AUGUST 2008
 19           ID
 20           ID            RATIO 1 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 21           ID            RATIO 2 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 22           ID            RATIO 3 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 23           ID            RATIO 4 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 24           ID            RATIO 5 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 25           ID            RATIO 6 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 26           ID            RATIO 7 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 27           ID            RATIO 8 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 28           ID
 29           ID
              *DIAGRAM
 30           IT       5       0       0     300
 31           IO       5
 32           IN       5
 33           JR    PREC   0.545     1.0    .550     1.0    .544     .99    .540     .99

 34           KK      CA
 35           KM   UNDEVELOPED OFFSITE BASIN HLBW1-CA
 36           BA   .3930
 37           PB    3.30
 38           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
 39           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
 40           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
 41           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
 42           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
 43           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
 44           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
 45           PC    .998    .999   1.00
 46           LS       0      91
 47           UD    .271
              *
```

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

            48          KK      CB
            49          KM   UNDEVELOPED OFFSITE BASIN HLBW1-CB
            50          PB    3.22
            51          BA   .1171
            52          LS       0    85.6
            53          UD    .210
                        *
            54          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    34          CA
                 .
                 .
    48           .          CB

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   11OCT10  TIME  10:35:14   *
*                                       *
*****************************************
```

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

TECHNICAL DRAINAGE STUDY FOR CCSD-TS
10-YEAR STORM ESTIMATE
CLARK COUNTY, NEVADA

PREPARED BY: L.R. NELSON CONSULTING ENGINEERS, INC.
6765 W. RUSSELL ROAD, SUITE 200
LAS VEGAS, NV 89118

FILENAME:CCSD10EI.DAT
JOB# 032-085-092
EXISTING/INTERIM CONDITION
TECHNICAL DRAINAGE STUDY

RECREATED 100-YEAR BASIN MODELS FOR HLBW1-CA & HLBW1-CB TO ESTIMATE 10-YEAR FLOW RATE FOR WATERSHED DETERMINED BY GCW IN 90% DESIGN FOR LONE MTN/BELTWAY AND GOWAN BELTWAY WEST CHANNEL AUGUST 2008

RATIO 1 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 2 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 3 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
RATIO 4 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
RATIO 5 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 6 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 7 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB
RATIO 8 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB

```
 31 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
                   .55      1.00       .55      1.00       .54       .99       .54       .99
```

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8
					.55	1.00	.55	1.00	.54	.99	.54	.99
HYDROGRAPH AT												
+	CA	.39	1	FLOW	260.	596.	263.	596.	259.	589.	256.	589.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT												
+	CB	.12	1	FLOW	57.	156.	58.	156.	57.	154.	56.	154.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67

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

10-YR FLOW RATE ESTIMATES - EXISTING

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   11OCT10  TIME  10:37:06  *
*                                      *
****************************************
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```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

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

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID
  2           ID                TECHNICAL DRAINAGE STUDY FOR CCSD-TS
  3           ID                      10-YEAR STORM ESTIMATE
  4           ID                       CLARK COUNTY, NEVADA
  5           ID
  6           ID    PREPARED BY:      L.R. NELSON CONSULTING ENGINEERS, INC.
  7           ID                        6765 W. RUSSELL ROAD, SUITE 200
  8           ID                             LAS VEGAS, NV  89118
  9           ID
 10           ID    FILENAME:CCSD10F.DAT
 11           ID    JOB# 032-085-092
 12           ID    FUTURE CONDITION
 13           ID    TECHNICAL DRAINAGE STUDY
 14           ID
 15           ID
 16           ID   RECREATED 100-YEAR BASIN MODELS FOR HLBW1-CA & HLBW1-CB TO ESTIMATE 10-YEAR
 17           ID   FLOW RATE FOR WATERSHED DETERMINED BY GCW IN 90% DESIGN FOR LONE MTN/BELTWAY
 18           ID   AND GOWAN BELTWAY WEST CHANNEL AUGUST 2008
 19           ID
 20           ID            RATIO 1 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 21           ID            RATIO 2 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 22           ID            RATIO 3 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 23           ID            RATIO 4 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 24           ID            RATIO 5 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 25           ID            RATIO 6 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
 26           ID            RATIO 7 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 27           ID            RATIO 8 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB
 28           ID
 29           ID
              *DIAGRAM
 30           IT       5       0       0     300
 31           IO       5
 32           IN       5
 33           JR    PREC   0.545     1.0    .550     1.0    .544     .99    .540     .99

 34           KK      CA
 35           KM   DEVELOPED OFFSITE BASIN HLBW1-CA
 36           BA   .3933
 37           PB    3.30
 38           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
 39           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
 40           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
 41           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
 42           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
 43           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
 44           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
 45           PC    .998    .999   1.00
 46           LS       0   95.4
 47           UD    .261
              *
```

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

            48          KK      CB
            49          KM   DEVELOPED OFFSITE BASIN HLBW1-CB
            50          PB    3.22
            51          BA   .1171
            52          LS       0    95.4
            53          UD    .187
                        *
            54          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

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

    34          CA
                 .
                 .
    48           .          CB

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   11OCT10  TIME  10:37:06   *
*                                       *
*****************************************
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*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*        DAVIS, CALIFORNIA 95616    *
*            (916) 756-1104         *
*                                   *
*************************************
```

TECHNICAL DRAINAGE STUDY FOR CCSD-TS
10-YEAR STORM ESTIMATE
CLARK COUNTY, NEVADA

PREPARED BY: L.R. NELSON CONSULTING ENGINEERS, INC.
6765 W. RUSSELL ROAD, SUITE 200
LAS VEGAS, NV 89118

FILENAME:CCSD10F.DAT
JOB# 032-085-092
FUTURE CONDITION
TECHNICAL DRAINAGE STUDY

RECREATED 100-YEAR BASIN MODELS FOR HLBW1-CA & HLBW1-CB TO ESTIMATE 10-YEAR
FLOW RATE FOR WATERSHED DETERMINED BY GCW IN 90% DESIGN FOR LONE MTN/BELTWAY
AND GOWAN BELTWAY WEST CHANNEL AUGUST 2008

RATIO 1 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 2 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 3 = 10-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
RATIO 4 = 100-YEAR (UNADJUSTED) FOR OFFSITE BASIN HLBW1-CB
RATIO 5 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 6 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CA
RATIO 7 = 10-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB
RATIO 8 = 100-YEAR (ADJUSTED) FOR OFFSITE BASIN HLBW1-CB

```
 31 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
                    .55      1.00       .55      1.00       .54       .99       .54       .99
```

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 .55	RATIO 2 1.00	RATIO 3 .55	RATIO 4 1.00	RATIO 5 .54	RATIO 6 .99	RATIO 7 .54	RATIO 8 .99
HYDROGRAPH AT												
+	CA	.39	1	FLOW	340.	681.	344.	681.	339.	673.	336.	673.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT												
+	CB	.12	1	FLOW	112.	224.	113.	224.	111.	222.	110.	222.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58

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

10-YR FLOWRATE ESTIMATES - FUTURE

Appendix C: Hydraulic Analysis

Cross Section for DW #1 - Cliff Shadows - Interim & Future

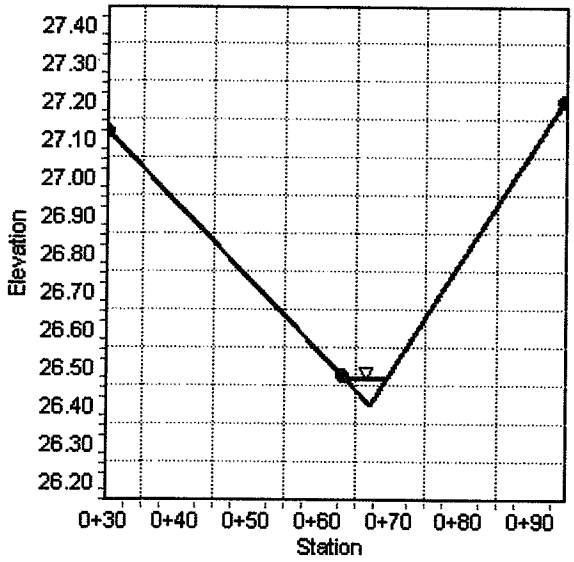
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.05770	ft/ft
Normal Depth	0.07	ft
Discharge	0.70	ft^3/s

Cross Section Image



Worksheet for DW #1 - Cliff Shadows - Interim & Future

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.05770	ft/ft
Discharge	0.70	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+30.00	27.12
0+63.00	26.48
0+67.00	26.40
0+94.00	27.20

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+30.00, 27.12)	(0+63.00, 26.48)	0.016
(0+63.00, 26.48)	(0+94.00, 27.20)	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	0.07	ft
Elevation Range	26.40 to 27.20 ft	
Flow Area	0.23	ft^2
Wetted Perimeter	6.18	ft
Hydraulic Radius	0.04	ft
Top Width	6.18	ft
Normal Depth	0.07	ft
Critical Depth	0.11	ft

Worksheet for DW #1 - Cliff Shadows - Interim & Future

Results

Critical Slope		0.00645	ft/ft
Velocity		3.07	ft/s
Velocity Head		0.15	ft
Specific Energy		0.22	ft
Froude Number		2.81	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.07	ft
Critical Depth	0.11	ft
Channel Slope	0.05770	ft/ft
Critical Slope	0.00645	ft/ft

Messages

Notes

EAST SIDE STREET (CLIFF SHADOWS) ESTIMATED Q100 (2.3 cfs) FROM BASIN RO (Q100=6 cfs), WHERE FRONTAGE LENGTH OF BASIN RO IS APPROXIMATELY 1005 LF OR UNIT Q100 = 6 CFS / 1005 LF = 0.006 CFS/LF.

CLIFF SHADOWS DROP INLET PICKS UP 2.2 CFS AND BYPASS Q100 (0.1 cfs) + FRONTAGE LENGTH BETWEEN CLIFF SHADOWS DROP INLET TO SECTION DW #1 1/2 STREET SECTION IS 100 LF X 0.006 CFS/LF (0.6 CFS) = 0.7 cfs

Cross Section for DW #2 - Cliff Shadows - Interim & Future

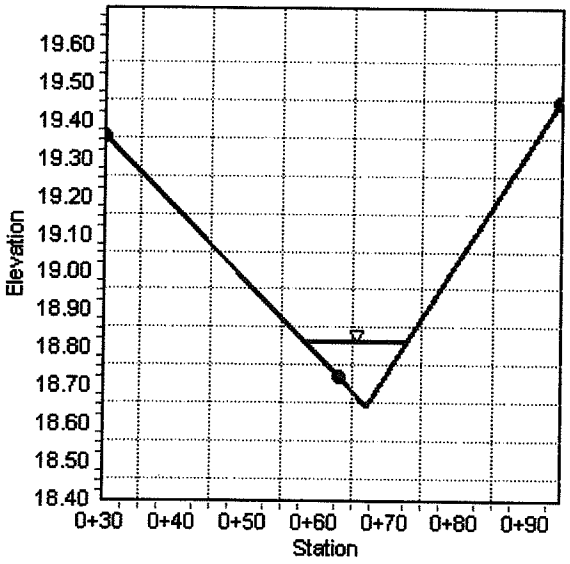
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.17	ft
Discharge	1.90	ft^3/s

Cross Section Image



Worksheet for DW #2 - Cliff Shadows - Interim & Future

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	1.90	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+30.00	19.36
0+63.00	18.72
0+67.00	18.64
0+94.00	19.45

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+30.00, 19.36)	(0+63.00, 18.72)	0.016
(0+63.00, 18.72)	(0+94.00, 19.45)	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	0.17	ft
Elevation Range	18.64 to 19.45 ft	
Flow Area	1.21	ft²
Wetted Perimeter	14.29	ft
Hydraulic Radius	0.08	ft
Top Width	14.29	ft
Normal Depth	0.17	ft
Critical Depth	0.17	ft

Worksheet for DW #2 - Cliff Shadows - Interim & Future

Results

Critical Slope		0.00659	ft/ft
Velocity		1.57	ft/s
Velocity Head		0.04	ft
Specific Energy		0.21	ft
Froude Number		0.95	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.17	ft
Critical Depth	0.17	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00659	ft/ft

Messages

Notes

EAST SIDE STREET (CLIFF SHADOWS) ESTIMATED Q100 (2.3 cfs) FROM BASIN RO (Q100=6 cfs), WHERE FRONTAGE LENGTH OF BASIN RO IS APPROXIMATELY 1005 LF OR UNIT Q100 = 6 CFS / 1005 LF = 0.006 CFS/LF.

CLIFF SHADOWS DROP INLET PICKS UP 2.2 CFS AND BYPASS Q100 (0.1 cfs) + FRONTAGE LENGTH BETWEEN CLIFF SHADOWS DROP INLET TO SECTION DW #1 1/2 STREET SECTION IS 100 LF X 0.006 CFS/LF (0.6 CFS) = 0.7 cfs
+
FRONTAGE BETWEEN DW#1 AND DW#2 IS APPROXIMATE 200 LF, THEREFORE 200LF X 0.006 CFS/AC = 1.2 CFS AND GRAND TOTAL AT DW #2 IS 0.7 CFS + 1.2 CFS = 1.9 CFS

Cross Section for DW #3 - Cliff Shadows - Interim & Future

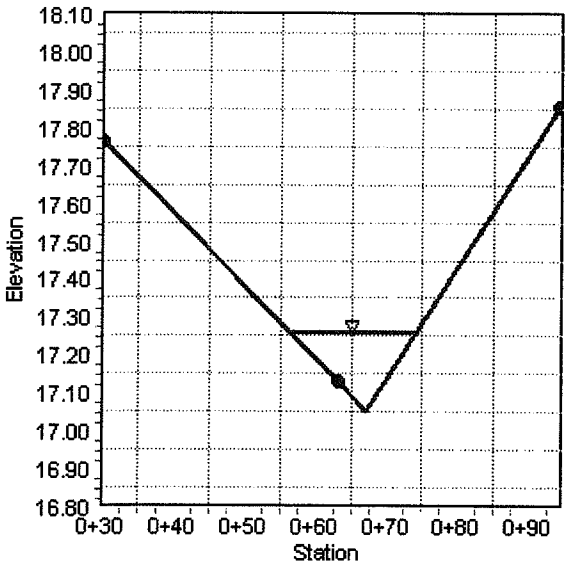
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.21	ft
Discharge	3.50	ft^3/s

Cross Section Image



Worksheet for DW #3 - Cliff Shadows - Interim & Future

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	3.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+30.00	17.77
0+63.00	17.13
0+67.00	17.05
0+94.00	17.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+30.00, 17.77)	(0+63.00, 17.13)	0.016
(0+63.00, 17.13)	(0+94.00, 17.86)	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	0.21	ft
Elevation Range	17.05 to 17.86 ft	
Flow Area	1.92	ft²
Wetted Perimeter	18.05	ft
Hydraulic Radius	0.11	ft
Top Width	18.04	ft
Normal Depth	0.21	ft
Critical Depth	0.21	ft

Worksheet for DW #3 - Cliff Shadows - Interim & Future

Results

Critical Slope		0.00624	ft/ft
Velocity		1.82	ft/s
Velocity Head		0.05	ft
Specific Energy		0.27	ft
Froude Number		0.98	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.21	ft
Critical Depth	0.21	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00624	ft/ft

Messages

Notes

EAST SIDE STREET (CLIFF SHADOWS) ESTIMATED Q100 (2.3 cfs) FROM BASIN RO (Q100=6 cfs), WHERE FRONTAGE LENGTH OF BASIN RO IS APPROXIMATELY 1005 LF OR UNIT Q100 = 6 CFS / 1005 LF = 0.006 CFS/LF.

CLIFF SHADOWS DROP INLET PICKS UP 2.2 CFS AND BYPASS Q100 (0.1 cfs) + FRONTAGE LENGTH BETWEEN CLIFF SHADOWS DROP INLET TO SECTION DW #1 1/2 STREET SECTION IS 100 LF X 0.006 CFS/LF (0.6 CFS) = 0.7 cfs
+
FRONTAGE BETWEEN DW#1 AND DW#2 IS APPROXIMATE 200 LF, THEREFORE 200LF X 0.006 CFS/AC = 1.2 CFS AND GRAND TOTAL AT DW #2 IS 0.7 CFS + 1.2 CFS = 1.9 CFS
+
FRONTAGE BETWEEN DW#2 AND DW#3 IS APPROXIMATE 265 LF, THEREFORE 265LF X 0.006 CFS/AC = 1.6 CFS AND GRAND TOTAL AT DW #3 IS 1.6 CFS + 1.9 CFS = 3.5 CFS

Cross Section for DW #4 - Cliff Shadows - Interim & Future

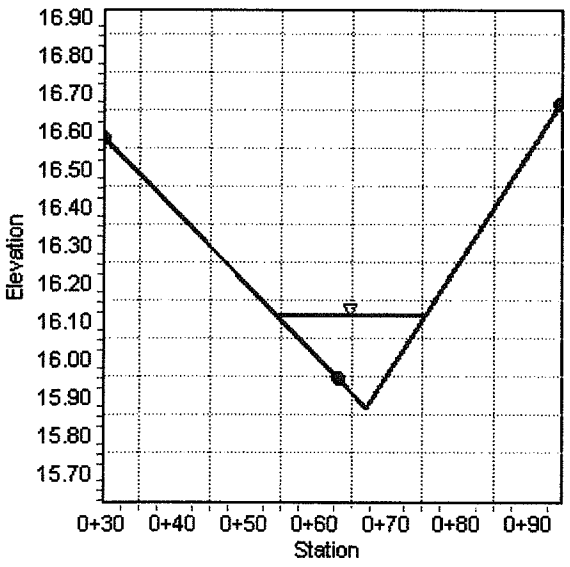
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.24	ft
Discharge	4.70	ft^3/s

Cross Section Image



Worksheet for DW #4 - Cliff Shadows - Interim & Future

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	4.70	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+30.00	16.58
0+63.00	15.95
0+67.00	15.87
0+94.00	16.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+30.00, 16.58)	(0+63.00, 15.95)	0.016
(0+63.00, 15.95)	(0+94.00, 16.67)	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	0.24	ft
Elevation Range	15.87 to 16.67 ft	
Flow Area	2.42	ft²
Wetted Perimeter	20.38	ft
Hydraulic Radius	0.12	ft
Top Width	20.37	ft
Normal Depth	0.24	ft
Critical Depth	0.24	ft

Worksheet for DW #4 - Cliff Shadows - Interim & Future

Results

Critical Slope		0.00607	ft/ft
Velocity		1.94	ft/s
Velocity Head		0.06	ft
Specific Energy		0.30	ft
Froude Number		1.00	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.24	ft
Critical Depth	0.24	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00607	ft/ft

Messages

Notes

EAST SIDE STREET (CLIFF SHADOWS) ESTIMATED Q100 (2.3 cfs) FROM BASIN RO (Q100=6 cfs), WHERE FRONTAGE LENGTH OF BASIN RO IS APPROXIMATELY 1005 LF OR UNIT Q100 = 6 CFS / 1005 LF = 0.006 CFS/LF.

CLIFF SHADOWS DROP INLET PICKS UP 2.2 CFS AND BYPASS Q100 (0.1 cfs) + FRONTAGE LENGTH BETWEEN CLIFF SHADOWS DROP INLET TO SECTION DW #1 1/2 STREET SECTION IS 100 LF X 0.006 CFS/LF (0.6 CFS) = 0.7 cfs
+
FRONTAGE BETWEEN DW#1 AND DW#2 IS APPROXIMATE 200 LF, THEREFORE 200LF X 0.006 CFS/AC = 1.2 CFS AND GRAND TOTAL AT DW #2 IS 0.7 CFS + 1.2 CFS = 1.9 CFS
+
FRONTAGE BETWEEN DW#2 AND DW#3 IS APPROXIMATE 265 LF, THEREFORE 265LF X 0.006 CFS/AC = 1.6 CFS AND GRAND TOTAL AT DW #3 IS 1.6 CFS + 1.9 CFS = 3.5 CFS
+
FRONTAGE BETWEEN DW#3 AND DW#4 IS APPROXIMATE 195 LF, THEREFORE 195LF X 0.006 CFS/AC = 1.2 CFS AND GRAND TOTAL AT DW #4 IS 3.5 CFS + 1.2 CFS = 4.7 CFS

Cross Section for DW #5 - Hammer - Interim & Future

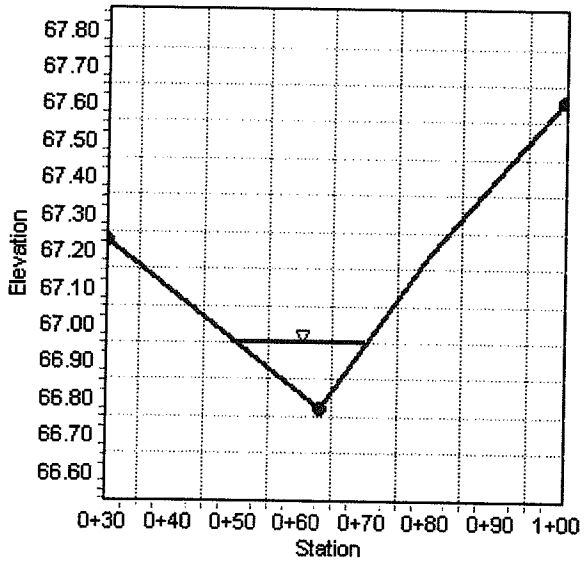
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.05300	ft/ft
Normal Depth	0.18	ft
Discharge	8.10	ft³/s

Cross Section Image



Worksheet for DW #5 - Hammer - Interim & Future

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.05300	ft/ft
Discharge	8.10	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+30.00	67.23
0+63.00	66.77
0+80.00	67.19
1+00.32	67.61

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+30.00, 67.23)	(0+63.00, 66.77)	0.016
(0+63.00, 66.77)	(1+00.32, 67.61)	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	0.18	ft
Elevation Range	66.77 to 67.61 ft	
Flow Area	1.78	ft^2
Wetted Perimeter	19.98	ft
Hydraulic Radius	0.09	ft
Top Width	19.98	ft
Normal Depth	0.18	ft
Critical Depth	0.26	ft

Worksheet for DW #5 - Hammer - Interim & Future

Results

Critical Slope		0.00643	ft/ft
Velocity		4.55	ft/s
Velocity Head		0.32	ft
Specific Energy		0.50	ft
Froude Number		2.69	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.18	ft
Critical Depth	0.26	ft
Channel Slope	0.05300	ft/ft
Critical Slope	0.00643	ft/ft

Messages

Notes

Q100 FOR DW #5 (HAMMER) IS BASED UPON:

DW #4 Q100 = 4.7 CFS - DROP INLET #2 Q100 CAPTURED = 4.6 CFS LEAVING Q100 BYPASS FLOW = 0.1 CFS + BASIN R1 Q100 = 1 CFS + BASIN R2 Q100 = 7 CFS OR (4.7 - 4.6) + 1 + 7 = 8.1 CFS

Cross Section for DW#6 - Washburn - Interim & Future

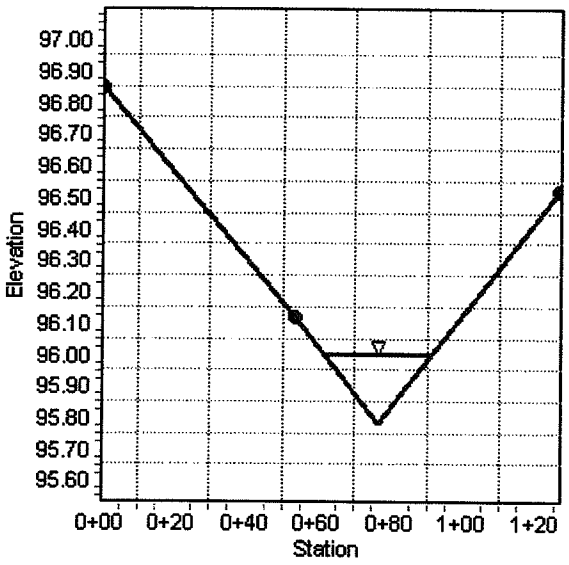
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04200	ft/ft
Normal Depth	0.22	ft
Discharge	14.00	ft^3/s

Cross Section Image



Worksheet for DW#6 - Washburn - Interim & Future

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04200	ft/ft
Discharge	14.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	96.85
0+53.11	96.12
0+76.11	95.78
1+26.23	96.52

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 96.85)	(0+53.11, 96.12)	0.013
(0+53.11, 96.12)	(1+26.23, 96.52)	0.016

Options

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

Results

Normal Depth	0.22	ft
Elevation Range	95.78 to 96.85 ft	
Flow Area	3.22	ft²
Wetted Perimeter	29.54	ft
Hydraulic Radius	0.11	ft
Top Width	29.54	ft
Normal Depth	0.22	ft
Critical Depth	0.31	ft

Worksheet for DW#6 - Washburn - Interim & Future

Results

Critical Slope		0.00698	ft/ft
Velocity		4.34	ft/s
Velocity Head		0.29	ft
Specific Energy		0.51	ft
Froude Number		2.32	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.31	ft
Channel Slope	0.04200	ft/ft
Critical Slope	0.00698	ft/ft

Messages

Notes

DW#6 100-YEAR FLOW RATE FROM BASIN ON3 = 11 CFS + R3 = 3 CFS = 14 CFS (OFFSITE) IN HAMMER

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T1 CCSD NW Transportation                                                
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FILE: CCSD2.WSW

W S P G W - EDIT LISTING - Version 14.06 Date:11-15-2010 Time:11:56:16
WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		3.500														
CD	2	4	1		3.500														
CD	3	4	1		3.500														
CD	4	4	1		3.500														
CD	5	4	1		2.000														
CD	6	4	1		3.000														
CD	7	4	1		3.000														
CD	8	4	1		2.000														
CD	9	4	1		3.000														
CD	10	4	1		3.000														
CD	11	4	1		3.000														
CD	12	4	1		3.500														
CD	13	4	1		1.500														
CD	14	4	1		3.000														
CD	15	4	1		3.000														
CD	16	4	1		2.000														
CD	17	4	1		2.000														
CD	18	4	1		2.000														
CD	19	4	1		4.000														

W S P G W
WATER SURFACE PROFILE - TITLE CARD LISTING PAGE NO 1

HEADING LINE NO 1 IS -

CCSD NW Transportation

HEADING LINE NO 2 IS -

Main Line - CCSD2.DAT

HEADING LINE NO 3 IS -

October 2010

W S P G W
WATER SURFACE PROFILE - ELEMENT CARD LISTING PAGE NO 2

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT
	1000.000	2850.500	19

W S ELEV
2850.500

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	1012.240	2850.700	19	.013

RADIUS .000 ANGLE .000 ANG PT 32.402 MAN H 1

ELEMENT NO 3 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1017.240	2850.900	19	5	0	.013	19.100	.000	2852.900	.000	45.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	1173.210	2852.380	19	.013

RADIUS .000 ANGLE .000 ANG PT -22.300 MAN H 1

ELEMENT NO 5 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1178.210	2852.580	19	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	1338.080	2854.260	19	.013

RADIUS .000 ANGLE .000 ANG PT -22.300 MAN H 1

ELEMENT NO 7 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1343.080	2854.460	19	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	1446.480	2856.400	19	.013

RADIUS .000 ANGLE .000 ANG PT .000 MAN H 1

W S P G W
WATER SURFACE PROFILE - ELEMENT CARD LISTING PAGE NO 3

ELEMENT NO 9 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1451.480	2856.900	3	6	0	.013	51.000	.000	2858.400	.000	-90.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 10 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	1686.690	2871.000	3	.013

RADIUS .000 ANGLE .000 ANG PT .000 MAN H 1

ELEMENT NO 11 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1691.690	2871.200	3	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 12 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	1926.900	2886.000	3	.013

RADIUS .000 ANGLE .000 ANG PT .000 MAN H 1

ELEMENT NO 13 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1931.900	2886.200	3	8	0	.013	23.000	.000	2887.700	.000	-90.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 14 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N
	2140.830	2899.300	3	.013

RADIUS .000 ANGLE .000 ANG PT .000 MAN H 1

ELEMENT NO 15 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	2145.830	2899.500	3	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS .000 ANGLE .000

ELEMENT NO 16 IS A REACH

U/S DATA	STATION	INVERT	SECT			N
	2354.760	2902.100	3			.013

RADIUS	ANGLE	ANG PT	MAN H
.000	.000	-90.000	1

ELEMENT NO 17 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4
	2359.760	2902.300	3	0	0	.013	.000	.000

INVERT-3	INVERT-4	PHI 3	PHI 4
.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 18 IS A REACH

U/S DATA	STATION	INVERT	SECT	N
	2541.530	2904.140	3	.013

RADIUS	ANGLE	ANG PT	MAN H
.000	.000	.000	1

ELEMENT NO 19 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4
	2546.530	2905.840	16	12	13	.013	71.600	4.600

INVERT-3	INVERT-4	PHI 3	PHI 4
2904.340	2906.340	45.000	-45.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 20 IS A REACH

U/S DATA	STATION	INVERT	SECT	N
	2836.030	2908.760	16	.013

RADIUS	ANGLE	ANG PT	MAN H
.000	.000	.000	1

ELEMENT NO 21 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4
	2841.400	2908.960	16	0	0	.013	.000	.000

INVERT-3	INVERT-4	PHI 3	PHI 4
.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 22 IS A REACH

U/S DATA	STATION	INVERT	SECT	N
	3210.150	2912.680	16	.013

RADIUS	ANGLE	ANG PT	MAN H
.000	.000	.000	1

ELEMENT NO 23 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4
	3215.150	2912.880	16	0	0	.013	.000	.000

INVERT-3	INVERT-4	PHI 3	PHI 4
.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 24 IS A REACH

U/S DATA	STATION	INVERT	SECT	N
	3425.030	2923.000	16	.013

RADIUS	ANGLE	ANG PT	MAN H
.000	.000	.000	1

ELEMENT NO 25 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4
	3430.030	2923.200	18	13	0	.013	2.200	.000

INVERT-3	INVERT-4	PHI 3	PHI 4
2923.700	.000	45.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 26 IS A REACH

U/S DATA	STATION	INVERT	SECT	N
	3485.460	2925.970	18	.013

RADIUS	ANGLE	ANG PT	MAN H
.000	.000	45.000	1

ELEMENT NO 27 IS A SYSTEM HEADWORKS

U/S DATA	STATION	INVERT	SECT
	3485.460	2925.970	18

W S ELEV
2925.770

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
1000.000	2850.500	3.577	2854.077	176.30	14.87	3.43	2857.51	.00	3.76	2.46	4.000	.000	.00	1 .0
12.240	.0163					.0132	.16	3.58	1.19	3.14	.013	.00	.00	PIPE
1012.240	2850.700	3.758	2854.458	176.30	14.39	3.21	2857.67	.00	3.76	1.91	4.000	.000	.00	1 .0
JUNCT STR	.0400					.0125	.06	3.76	1.00		.013	.00	.00	PIPE
1017.240	2850.900	4.841	2855.741	157.20	12.51	2.43	2858.17	.00	3.65	.00	4.000	.000	.00	1 .0
155.970	.0095					.0120	1.87	4.84	.00	4.00	.013	.00	.00	PIPE
1173.210	2852.380	5.529	2857.909	157.20	12.51	2.43	2860.34	.00	3.65	.00	4.000	.000	.00	1 .0
JUNCT STR	.0400					.0120	.06	5.53	.00		.013	.00	.00	PIPE
1178.210	2852.580	5.389	2857.969	157.20	12.51	2.43	2860.40	.00	3.65	.00	4.000	.000	.00	1 .0
159.870	.0105					.0120	1.91	5.39	.00	3.62	.013	.00	.00	PIPE
1338.080	2854.260	5.924	2860.184	157.20	12.51	2.43	2862.61	.00	3.65	.00	4.000	.000	.00	1 .0
JUNCT STR	.0400					.0120	.06	5.92	.00		.013	.00	.00	PIPE
1343.080	2854.460	5.784	2860.244	157.20	12.51	2.43	2862.67	.00	3.65	.00	4.000	.000	.00	1 .0
103.400	.0188					.0120	1.24	5.78	.00	2.70	.013	.00	.00	PIPE
1446.480	2856.400	5.204	2861.604	157.20	12.51	2.43	2864.03	.00	3.65	.00	4.000	.000	.00	1 .0
JUNCT STR	.1000					.0116	.06	5.20	.00		.013	.00	.00	PIPE
1451.480	2856.900	6.985	2863.885	106.20	11.04	1.89	2865.78	.00	3.13	.00	3.500	.000	.00	1 .0
5.456	.0599					.0111	.06	6.99	.00	1.61	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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 or "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1456.936	2857.227	6.721	2863.948	106.20	11.04	1.89	2865.84	.00	3.13	.00	3.500	.000	.00	1 .0
HYDRAULIC JUMP														
1456.936	2857.227	1.606	2858.833	106.20	24.65	9.44	2868.27	.00	3.13	3.49	3.500	.000	.00	1 .0
10.300	.0599					.0599	.62	1.61	3.91	1.61	.013	.00	.00	PIPE
1467.236	2857.844	1.606	2859.451	106.20	24.65	9.44	2868.89	.00	3.13	3.49	3.500	.000	.00	1 .0
219.453	.0599					.0584	12.82	1.61	3.91	1.61	.013	.00	.00	PIPE
1686.690	2871.000	1.631	2872.631	106.20	24.18	9.08	2881.71	.00	3.13	3.49	3.500	.000	.00	1 .0
JUNCT STR	.0400					.0572	.29	1.63	3.80		.013	.00	.00	PIPE
1691.690	2871.200	1.624	2872.824	106.20	24.30	9.17	2881.99	.00	3.13	3.49	3.500	.000	.00	1 .0
14.688	.0629					.0573	.84	1.62	3.83	1.58	.013	.00	.00	PIPE
1706.378	2872.124	1.630	2873.754	106.20	24.18	9.08	2882.83	.00	3.13	3.49	3.500	.000	.00	1 .0
80.879	.0629					.0535	4.32	1.63	3.80	1.58	.013	.00	.00	PIPE
1787.257	2877.213	1.692	2878.905	106.20	23.06	8.25	2887.16	.00	3.13	3.50	3.500	.000	.00	1 .0
43.259	.0629					.0471	2.04	1.69	3.54	1.58	.013	.00	.00	PIPE
1830.516	2879.935	1.756	2881.691	106.20	21.98	7.50	2889.20	.00	3.13	3.50	3.500	.000	.00	1 .0
28.630	.0629					.0414	1.19	1.76	3.30	1.58	.013	.00	.00	PIPE
1859.146	2881.737	1.823	2883.560	106.20	20.96	6.82	2890.38	.00	3.13	3.50	3.500	.000	.00	1 .0
20.819	.0629					.0365	.76	1.82	3.07	1.58	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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 or "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip Type Ch
1879.965	2883.047	1.894	2884.941	106.20	19.98	6.20	2891.14	.00	3.13	3.49	3.500	.000	.00	1 .0
15.943	.0629					.0322	.51	1.89	2.85	1.58	.013	.00	.00	PIPE
1895.908	2884.050	1.969	2886.018	106.20	19.05	5.64	2891.66	.00	3.13	3.47	3.500	.000	.00	1 .0
12.594	.0629					.0285	.36	1.97	2.65	1.58	.013	.00	.00	PIPE
1908.502	2884.842	2.047	2886.889	106.20	18.17	5.13	2892.01	.00	3.13	3.45	3.500	.000	.00	1 .0
10.142	.0629					.0252	.26	2.05	2.46	1.58	.013	.00	.00	PIPE
1918.644	2885.480	2.130	2887.611	106.20	17.32	4.66	2892.27	.00	3.13	3.42	3.500	.000	.00	1 .0
8.256	.0629					.0223	.18	2.13	2.28	1.58	.013	.00	.00	PIPE
1926.900	2886.000	2.218	2888.218	106.20	16.52	4.24	2892.45	.00	3.13	3.37	3.500	.000	.00	1 .0
JUNCT STR	.0400					.0387	.19	2.22	2.11		.013	.00	.00	PIPE
1931.900	2886.200	1.424	2887.625	83.20	22.62	7.95	2895.57	.00	2.84	3.44	3.500	.000	.00	1 .0
17.612	.0627					.0559	.99	1.42	3.86	1.38	.013	.00	.00	PIPE
1949.512	2887.304	1.433	2888.737	83.20	22.45	7.83	2896.56	.00	2.84	3.44	3.500	.000	.00	1 .0
61.525	.0627					.0520	3.20	1.43	3.81	1.38	.013	.00	.00	PIPE
2011.037	2891.162	1.485	2892.647	83.20	21.41	7.11	2899.76	.00	2.84	3.46	3.500	.000	.00	1 .0
34.748	.0627					.0457	1.59	1.49	3.56	1.38	.013	.00	.00	PIPE
2045.785	2893.341	1.540	2894.881	83.20	20.41	6.47	2901.35	.00	2.84	3.47	3.500	.000	.00	1 .0
23.511	.0627					.0401	.94	1.54	3.32	1.38	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El.	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
2069.297	2894.815	1.597	2896.412	83.20	19.46	5.88	2902.29	.00	2.84	3.49	3.500	.000	.00	1 .0
17.313	.0627					.0353	.61	1.60	3.10	1.38	.013	.00	.00	PIPE
2086.609	2895.900	1.657	2897.557	83.20	18.55	5.35	2902.90	.00	2.84	3.50	3.500	.000	.00	1 .0
13.373	.0627					.0310	.42	1.66	2.89	1.38	.013	.00	.00	PIPE
2099.982	2896.739	1.719	2898.458	83.20	17.69	4.86	2903.32	.00	2.84	3.50	3.500	.000	.00	1 .0
10.633	.0627					.0273	.29	1.72	2.69	1.38	.013	.00	.00	PIPE
2110.615	2897.406	1.785	2899.190	83.20	16.87	4.42	2903.61	.00	2.84	3.50	3.500	.000	.00	1 .0
8.613	.0627					.0241	.21	1.78	2.50	1.38	.013	.00	.00	PIPE
2119.228	2897.946	1.854	2899.799	83.20	16.08	4.02	2903.82	.00	2.84	3.49	3.500	.000	.00	1 .0
7.058	.0627					.0212	.15	1.85	2.33	1.38	.013	.00	.00	PIPE
2126.286	2898.388	1.926	2900.314	83.20	15.33	3.65	2903.97	.00	2.84	3.48	3.500	.000	.00	1 .0
5.816	.0627					.0187	.11	1.93	2.16	1.38	.013	.00	.00	PIPE
2132.102	2898.753	2.002	2900.755	83.20	14.62	3.32	2904.07	.00	2.84	3.46	3.500	.000	.00	1 .0
4.794	.0627					.0166	.08	2.00	2.01	1.38	.013	.00	.00	PIPE
2136.896	2899.053	2.083	2901.136	83.20	13.94	3.02	2904.15	.00	2.84	3.44	3.500	.000	.00	1 .0
3.934	.0627					.0146	.06	2.08	1.86	1.38	.013	.00	.00	PIPE
2140.830	2899.300	2.168	2901.468	83.20	13.29	2.74	2904.21	.00	2.84	3.40	3.500	.000	.00	1 .0
JUNCT STR	.0400					.0131	.07	2.17	1.73		.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
2145.830	2899.500	2.243	2901.743	83.20	12.77	2.53	2904.28	.00	2.84	3.36	3.500	.000	.00	1 .0
12.120	.0124					.0124	.15	2.24	1.62	2.24	.013	.00	.00	PIPE
2157.950	2899.651	2.243	2901.894	83.20	12.77	2.53	2904.43	.00	2.84	3.36	3.500	.000	.00	1 .0
196.810	.0124					.0120	2.36	2.24	1.62	2.24	.013	.00	.00	PIPE
2354.760	2902.100	2.302	2904.402	83.20	12.40	2.39	2906.79	.00	2.84	3.32	3.500	.000	.00	1 .0
JUNCT STR	.0400					.0107	.05	2.30	1.54		.013	.00	.00	PIPE
2359.760	2902.300	2.433	2904.733	83.20	11.66	2.11	2906.84	.00	2.84	3.22	3.500	.000	.00	1 .0
85.347	.0101					.0097	.83	2.43	1.38	2.42	.013	.00	.00	PIPE
2445.107	2903.164	2.469	2905.633	83.20	11.47	2.04	2907.68	.00	2.84	3.19	3.500	.000	.00	1 .0
68.140	.0101					.0091	.62	2.47	1.34	2.42	.013	.00	.00	PIPE
2513.247	2903.854	2.582	2906.436	83.20	10.93	1.86	2908.29	.00	2.84	3.08	3.500	.000	.00	1 .0
22.571	.0101					.0081	.18	2.58	1.23	2.42	.013	.00	.00	PIPE
2535.818	2904.082	2.706	2906.788	83.20	10.43	1.69	2908.48	.00	2.84	2.93	3.500	.000	.00	1 .0
5.712	.0101					.0073	.04	2.71	1.11	2.42	.013	.00	.00	PIPE
2541.530	2904.140	2.844	2906.984	83.20	9.94	1.53	2908.52	.00	2.84	2.73	3.500	.000	.00	1 .0
JUNCT STR	.3400					.0040	.02	2.84	1.00		.013	.00	.00	PIPE
2546.530	2905.840	3.507	2909.347	7.00	2.23	.08	2909.42	.00	.94	.00	2.000	.000	.00	1 .0
165.279	.0101					.0009	.16	3.51	.00	.76	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
2711.809	2907.507	2.000	2909.507	7.00	2.23	.08	2909.58	.00	.94	.00	2.000	.000	.00	1 .0
19.209	.0101					.0009	.02	2.00	.00	.76	.013	.00	.00	PIPE
2731.018	2907.701	1.815	2909.516	7.00	2.34	.08	2909.60	.00	.94	1.16	2.000	.000	.00	1 .0
10.762	.0101					.0009	.01	1.81	.26	.76	.013	.00	.00	PIPE
2741.781	2907.810	1.707	2909.517	7.00	2.45	.09	2909.61	.00	.94	1.41	2.000	.000	.00	1 .0
8.688	.0101					.0009	.01	1.71	.30	.76	.013	.00	.00	PIPE
2750.468	2907.897	1.618	2909.515	7.00	2.57	.10	2909.62	.00	.94	1.57	2.000	.000	.00	1 .0
7.460	.0101					.0010	.01	1.62	.34	.76	.013	.00	.00	PIPE
2757.928	2907.972	1.540	2909.513	7.00	2.70	.11	2909.63	.00	.94	1.68	2.000	.000	.00	1 .0
6.567	.0101					.0011	.01	1.54	.38	.76	.013	.00	.00	PIPE
2764.496	2908.039	1.470	2909.509	7.00	2.83	.12	2909.63	.00	.94	1.77	2.000	.000	.00	1 .0
5.868	.0101					.0013	.01	1.47	.42	.76	.013	.00	.00	PIPE
2770.364	2908.098	1.406	2909.504	7.00	2.97	.14	2909.64	.00	.94	1.83	2.000	.000	.00	1 .0
5.274	.0101					.0014	.01	1.41	.46	.76	.013	.00	.00	PIPE
2775.638	2908.151	1.347	2909.498	7.00	3.11	.15	2909.65	.00	.94	1.88	2.000	.000	.00	1 .0
4.752	.0101					.0016	.01	1.35	.50	.76	.013	.00	.00	PIPE
2780.390	2908.199	1.292	2909.490	7.00	3.26	.17	2909.66	.00	.94	1.91	2.000	.000	.00	1 .0
4.264	.0101					.0018	.01	1.29	.54	.76	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
2784.654	2908.242	1.240	2909.481	7.00	3.42	.18	2909.66	.00	.94	1.94	2.000	.000	.00	1 .0
3.809	.0101					.0020	.01	1.24	.59	.76	.013	.00	.00	PIPE
2788.462	2908.280	1.191	2909.471	7.00	3.59	.20	2909.67	.00	.94	1.96	2.000	.000	.00	1 .0
1.358	.0101					.0023	.00	1.19	.63	.76	.013	.00	.00	PIPE
2789.820	2908.294	1.145	2909.439	7.00	3.76	.22	2909.66	.00	.94	1.98	2.000	.000	.00	1 .0
HYDRAULIC JUMP														
2789.820	2908.294	.734	2909.028	7.00	6.70	.70	2909.72	.00	.94	1.93	2.000	.000	.00	1 .0
14.187	.0101					.0116	.16	.73	1.60	.76	.013	.00	.00	PIPE
2804.006	2908.437	.734	2909.171	7.00	6.70	.70	2909.87	.00	.94	1.93	2.000	.000	.00	1 .0
19.129	.0101					.0124	.24	.73	1.60	.76	.013	.00	.00	PIPE
2823.135	2908.630	.709	2909.339	7.00	7.02	.77	2910.10	.00	.94	1.91	2.000	.000	.00	1 .0
12.895	.0101					.0141	.18	.71	1.71	.76	.013	.00	.00	PIPE
2836.030	2908.760	.684	2909.444	7.00	7.37	.84	2910.29	.00	.94	1.90	2.000	.000	.00	1 .0
JUNCT STR	.0372					.0126	.07	.68	1.83		.013	.00	.00	PIPE
2841.399	2908.960	.762	2909.722	7.00	6.37	.63	2910.35	.00	.94	1.94	2.000	.000	.00	1 .0
214.554	.0101					.0101	2.16	.76	1.49	.76	.013	.00	.00	PIPE
3055.953	2911.125	.762	2911.887	7.00	6.37	.63	2912.52	.00	.94	1.94	2.000	.000	.00	1 .0
50.977	.0101					.0105	.53	.76	1.49	.76	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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 or "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip Type Ch
3106.931	2911.639	.747	2912.386	7.00	6.54	.66	2913.05	.00	.94	1.93	2.000	.000	.00	1 .0
26.307	.0101					.0116	.31	.75	1.55	.76	.013	.00	.00	PIPE
3133.237	2911.905	.721	2912.625	7.00	6.86	.73	2913.36	.00	.94	1.92	2.000	.000	.00	1 .0
15.208	.0101					.0133	.20	.72	1.66	.76	.013	.00	.00	PIPE
3148.445	2912.058	.696	2912.754	7.00	7.20	.80	2913.56	.00	.94	1.91	2.000	.000	.00	1 .0
11.219	.0101					.0151	.17	.70	1.78	.76	.013	.00	.00	PIPE
3159.664	2912.171	.672	2912.844	7.00	7.55	.88	2913.73	.00	.94	1.89	2.000	.000	.00	1 .0
9.111	.0101					.0173	.16	.67	1.90	.76	.013	.00	.00	PIPE
3168.775	2912.263	.649	2912.912	7.00	7.92	.97	2913.89	.00	.94	1.87	2.000	.000	.00	1 .0
7.819	.0101					.0197	.15	.65	2.03	.76	.013	.00	.00	PIPE
3176.594	2912.342	.627	2912.969	7.00	8.30	1.07	2914.04	.00	.94	1.86	2.000	.000	.00	1 .0
6.898	.0101					.0225	.16	.63	2.17	.76	.013	.00	.00	PIPE
3183.492	2912.411	.606	2913.017	7.00	8.71	1.18	2914.20	.00	.94	1.84	2.000	.000	.00	1 .0
6.228	.0101					.0257	.16	.61	2.32	.76	.013	.00	.00	PIPE
3189.720	2912.474	.586	2913.060	7.00	9.13	1.30	2914.36	.00	.94	1.82	2.000	.000	.00	1 .0
5.692	.0101					.0294	.17	.59	2.48	.76	.013	.00	.00	PIPE
3195.413	2912.531	.566	2913.097	7.00	9.58	1.42	2914.52	.00	.94	1.80	2.000	.000	.00	1 .0
5.258	.0101					.0336	.18	.57	2.65	.76	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
3200.670	2912.584	.547	2913.131	7.00	10.05	1.57	2914.70	.00	.94	1.78	2.000	.000	.00	1 .0
4.895	.0101					.0384	.19	.55	2.83	.76	.013	.00	.00	PIPE
3205.565	2912.634	.529	2913.162	7.00	10.54	1.72	2914.89	.00	.94	1.76	2.000	.000	.00	1 .0
4.585	.0101					.0439	.20	.53	3.03	.76	.013	.00	.00	PIPE
3210.150	2912.680	.511	2913.191	7.00	11.05	1.90	2915.09	.00	.94	1.74	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0475	.24	.51	3.23		.013	.00	.00	PIPE
3215.150	2912.880	.507	2913.387	7.00	11.17	1.94	2915.32	.00	.94	1.74	2.000	.000	.00	1 .0
82.484	.0482					.0482	3.98	.51	3.28	.51	.013	.00	.00	PIPE
3297.634	2916.857	.507	2917.364	7.00	11.17	1.94	2919.30	.00	.94	1.74	2.000	.000	.00	1 .0
52.115	.0482					.0472	2.46	.51	3.28	.51	.013	.00	.00	PIPE
3349.748	2919.370	.513	2919.883	7.00	11.00	1.88	2921.76	.00	.94	1.75	2.000	.000	.00	1 .0
31.158	.0482					.0433	1.35	.51	3.21	.51	.013	.00	.00	PIPE
3380.906	2920.873	.530	2921.403	7.00	10.49	1.71	2923.11	.00	.94	1.77	2.000	.000	.00	1 .0
13.256	.0482					.0379	.50	.53	3.01	.51	.013	.00	.00	PIPE
3394.162	2921.512	.549	2922.061	7.00	10.00	1.55	2923.61	.00	.94	1.78	2.000	.000	.00	1 .0
8.107	.0482					.0331	.27	.55	2.81	.51	.013	.00	.00	PIPE
3402.269	2921.903	.568	2922.470	7.00	9.54	1.41	2923.88	.00	.94	1.80	2.000	.000	.00	1 .0
5.651	.0482					.0290	.16	.57	2.63	.51	.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE	Super Elev / 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
3407.920	2922.175	.588	2922.762	7.00	9.09	1.28	2924.05	.00	.94	1.82	2.000	.000	.00	1 .0
4.214	.0482					.0254	.11	.59	2.46	.51	.013	.00	.00	PIPE
3412.134	2922.378	.608	2922.986	7.00	8.67	1.17	2924.15	.00	.94	1.84	2.000	.000	.00	1 .0
3.262	.0482					.0222	.07	.61	2.31	.51	.013	.00	.00	PIPE
3415.396	2922.535	.629	2923.165	7.00	8.27	1.06	2924.23	.00	.94	1.86	2.000	.000	.00	1 .0
2.582	.0482					.0195	.05	.63	2.16	.51	.013	.00	.00	PIPE
3417.978	2922.660	.652	2923.312	7.00	7.88	.96	2924.28	.00	.94	1.87	2.000	.000	.00	1 .0
2.075	.0482					.0171	.04	.65	2.02	.51	.013	.00	.00	PIPE
3420.053	2922.760	.675	2923.435	7.00	7.51	.88	2924.31	.00	.94	1.89	2.000	.000	.00	1 .0
1.674	.0482					.0149	.03	.67	1.89	.51	.013	.00	.00	PIPE
3421.727	2922.841	.699	2923.539	7.00	7.16	.80	2924.34	.00	.94	1.91	2.000	.000	.00	1 .0
1.354	.0482					.0131	.02	.70	1.76	.51	.013	.00	.00	PIPE
3423.081	2922.906	.723	2923.629	7.00	6.83	.72	2924.35	.00	.94	1.92	2.000	.000	.00	1 .0
1.088	.0482					.0115	.01	.72	1.65	.51	.013	.00	.00	PIPE
3424.169	2922.958	.749	2923.708	7.00	6.51	.66	2924.37	.00	.94	1.94	2.000	.000	.00	1 .0
.861	.0482					.0101	.01	.75	1.54	.51	.013	.00	.00	PIPE
3425.030	2923.000	.776	2923.776	7.00	6.21	.60	2924.38	.00	.94	1.95	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0281	.14	.78	1.44		.013	.00	.00	PIPE

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
3430.030	2923.199	.423	2923.623	4.80	9.90	1.52	2925.14	.00	.77	1.63	2.000	.000	.00	1 PIPE	.0
13.011	.0500					.0453	.59	.42	3.20	.42	.013	.00	.00		
3443.041	2923.850	.430	2924.280	4.80	9.68	1.45	2925.73	.00	.77	1.64	2.000	.000	.00	1 PIPE	.0
13.227	.0500					.0411	.54	.43	3.10	.42	.013	.00	.00		
3456.268	2924.511	.445	2924.955	4.80	9.23	1.32	2926.28	.00	.77	1.66	2.000	.000	.00	1 PIPE	.0
7.478	.0500					.0359	.27	.44	2.91	.42	.013	.00	.00		
3463.746	2924.885	.460	2925.344	4.80	8.80	1.20	2926.55	.00	.77	1.68	2.000	.000	.00	1 PIPE	.0
5.034	.0500					.0314	.16	.46	2.72	.42	.013	.00	.00		
3468.780	2925.136	.476	2925.612	4.80	8.39	1.09	2926.70	.00	.77	1.70	2.000	.000	.00	1 PIPE	.0
3.689	.0500					.0275	.10	.48	2.55	.42	.013	.00	.00		
3472.469	2925.320	.492	2925.812	4.80	8.00	.99	2926.81	.00	.77	1.72	2.000	.000	.00	1 PIPE	.0
2.828	.0500					.0240	.07	.49	2.39	.42	.013	.00	.00		
3475.297	2925.462	.509	2925.970	4.80	7.63	.90	2926.87	.00	.77	1.74	2.000	.000	.00	1 PIPE	.0
2.230	.0500					.0210	.05	.51	2.24	.42	.013	.00	.00		
3477.527	2925.573	.526	2926.099	4.80	7.27	.82	2926.92	.00	.77	1.76	2.000	.000	.00	1 PIPE	.0
1.786	.0500					.0184	.03	.53	2.09	.42	.013	.00	.00		
3479.313	2925.663	.544	2926.207	4.80	6.93	.75	2926.95	.00	.77	1.78	2.000	.000	.00	1 PIPE	.0
1.445	.0500					.0161	.02	.54	1.96	.42	.013	.00	.00		

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
3480.758	2925.735	.563	2926.298	4.80	6.61	.68	2926.98	.00	.77	1.80	2.000	.000	.00	1 .0
1.172	.0500					.0141	.02	.56	1.83	.42	.013	.00	.00	PIPE
3481.930	2925.793	.583	2926.376	4.80	6.30	.62	2926.99	.00	.77	1.82	2.000	.000	.00	1 .0
.950	.0500					.0123	.01	.58	1.72	.42	.013	.00	.00	PIPE
3482.881	2925.841	.603	2926.444	4.80	6.01	.56	2927.01	.00	.77	1.84	2.000	.000	.00	1 .0
.763	.0500					.0108	.01	.60	1.61	.42	.013	.00	.00	PIPE
3483.643	2925.879	.624	2926.503	4.80	5.73	.51	2927.01	.00	.77	1.85	2.000	.000	.00	1 .0
.601	.0500					.0094	.01	.62	1.50	.42	.013	.00	.00	PIPE
3484.244	2925.909	.646	2926.555	4.80	5.46	.46	2927.02	.00	.77	1.87	2.000	.000	.00	1 .0
.464	.0500					.0083	.00	.65	1.41	.42	.013	.00	.00	PIPE
3484.708	2925.932	.669	2926.602	4.80	5.21	.42	2927.02	.00	.77	1.89	2.000	.000	.00	1 .0
.342	.0500					.0072	.00	.67	1.31	.42	.013	.00	.00	PIPE
3485.050	2925.949	.693	2926.642	4.80	4.97	.38	2927.03	.00	.77	1.90	2.000	.000	.00	1 .0
.232	.0500					.0063	.00	.69	1.23	.42	.013	.00	.00	PIPE
3485.282	2925.961	.718	2926.679	4.80	4.74	.35	2927.03	.00	.77	1.92	2.000	.000	.00	1 .0
.134	.0500					.0056	.00	.72	1.15	.42	.013	.00	.00	PIPE
3485.416	2925.968	.743	2926.711	4.80	4.52	.32	2927.03	.00	.77	1.93	2.000	.000	.00	1 .0
.044	.0500					.0049	.00	.74	1.07	.42	.013	.00	.00	PIPE

Program Package Serial Number: 3057

WATER SURFACE PROFILE LISTING Date:11-15-2010 Time:11:56:25

CCSD NW Transportation
Main Line - CCSD2.DAT
October 2010

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
3485.460	2925.970	.771	2926.741	4.80	4.30	.29	2927.03	.00	.77	1.95	2.000	.000	.00	1 .0

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T1 CCSD NW TRANSPORTATION                                                    0
T2 ALPINE RIDGE STORM DRAIN  FILE:  CCSD2AR.DAT
T3  NOV 2010
SO   5000.0002850.500  1                          2850.500
R    5016.1002851.000  1      .013                                .000 -50.301 1
JX   5021.1002851.200  3  2   .013      .100          2851.200    -45.0         .000
R    5103.2102852.100  3      .013                                .000   5.000 1
JX   5108.2102852.300  7  6.  .013     8.400          2852.300     90.0         .000
R    5183.3102853.100  7      .013                                .000  78.461 1
JX   5188.3102853.300  9      .013
R    5208.8602853.800  9      .013                                .000    .000 1
SH   5208.8602853.800  9                          2853.800
CD   1  4   1    .000   2.000     .000  .000  .000   .00
CD   2  4   1    .000   2.000     .000  .000  .000   .00
CD   3  4   1    .000   2.000     .000  .000  .000   .00
CD   4  4   1    .000   2.000     .000  .000  .000   .00
CD   5  4   1    .000   2.000     .000  .000  .000   .00
CD   6  4   1    .000   2.000     .000  .000  .000   .00
CD   7  4   1    .000   2.000     .000  .000  .000   .00
CD   8  4   1    .000   2.000     .000  .000  .000   .00
CD   9  4   1    .000   2.000     .000  .000  .000   .00
Q            15.600   .0
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FILE: CCSD2AR.WSW W S P G W - EDIT LISTING - Version 14.06 Date:11-11-2010 Time: 3: 0:58

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		2.000														
CD	2	4	1		2.000														
CD	3	4	1		2.000														
CD	4	4	1		2.000														
CD	5	4	1		2.000														
CD	6	4	1		2.000														
CD	7	4	1		2.000														
CD	8	4	1		2.000														
CD	9	4	1		2.000														

W S P G W PAGE NO 1

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

CCSD NW TRANSPORTATION

HEADING LINE NO 2 IS -

ALPINE RIDGE STORM DRAIN FILE: CCSD2AR.DAT

HEADING LINE NO 3 IS -

NOV 2010

W S P G W PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	5000.000	2850.500	1	2850.500

ELEMENT NO 2 IS A REACH * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	5016.100	2851.000	1	.013	.000	.000	-50.301	1

ELEMENT NO 3 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	5021.100	2851.200	3	2	0	.013	.100	.000	2851.200	.000	-45.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 4 IS A REACH * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	5103.210	2852.100	3	.013	.000	.000	5.000	1

ELEMENT NO 5 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	5108.210	2852.300	7	6	0	.013	8.400	.000	2852.300	.000	90.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 6 IS A REACH * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	5183.310	2853.100	7	.013	.000	.000	78.461	1

ELEMENT NO 7 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	5188.310	2853.300	9	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 8 IS A REACH * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	5208.860	2853.800	9	.013	.000	.000	.000	1

W S P G W PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 9 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	5208.860	2853.800	9	2853.800

Program Package Serial Number: 3057

WATER SURFACE PROFILE LISTING Date:11-11-2010 Time: 3: 1: 3

CCSD NW TRANSPORTATION
ALPINE RIDGE STORM DRAIN FILE: CCSD2AR.DAT
NOV 2010

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
5000.000	2850.500	1.326	2851.826	24.10	10.90	1.84	2853.67	.00	1.74	1.89	2.000	.000	.00	1 .0
3.844	.0311					.0183	.07	1.33	1.78	1.12	.013	.00	.00	PIPE
5003.844	2850.619	1.350	2851.970	24.10	10.68	1.77	2853.74	.00	1.74	1.87	2.000	.000	.00	1 .0
7.140	.0311					.0169	.12	1.35	1.71	1.12	.013	.00	.00	PIPE
5010.984	2850.841	1.410	2852.251	24.10	10.18	1.61	2853.86	.00	1.74	1.82	2.000	.000	.00	1 .0
5.116	.0311					.0151	.08	1.41	1.57	1.12	.013	.00	.00	PIPE
5016.100	2851.000	1.474	2852.474	24.10	9.71	1.46	2853.94	.00	1.74	1.76	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0126	.06	1.47	1.44		.013	.00	.00	PIPE
5021.100	2851.200	1.664	2852.864	24.00	8.59	1.15	2854.01	.00	1.73	1.49	2.000	.000	.00	1 .0
58.022	.0110					.0110	.64	1.66	1.11	1.66	.013	.00	.00	PIPE
5079.122	2851.836	1.664	2853.500	24.00	8.59	1.15	2854.65	.00	1.73	1.49	2.000	.000	.00	1 .0
24.088	.0110					.0106	.26	1.66	1.11	1.66	.013	.00	.00	PIPE
5103.210	2852.100	1.735	2853.835	24.00	8.29	1.07	2854.90	.00	1.73	1.36	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0075	.04	1.73	1.00		.013	.00	.00	PIPE
5108.210	2852.300	2.823	2855.123	15.60	4.97	.38	2855.51	.00	1.42	.00	2.000	.000	.00	1 .0
75.100	.0107					.0048	.36	2.82	.00	1.20	.013	.00	.00	PIPE
5183.310	2853.100	2.498	2855.598	15.60	4.97	.38	2855.98	.00	1.42	.00	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0048	.02	2.50	.00		.013	.00	.00	PIPE

Program Package Serial Number: 3057

WATER SURFACE PROFILE LISTING Date:11-11-2010 Time: 3: 1: 3

CCSD NW TRANSPORTATION
ALPINE RIDGE STORM DRAIN FILE: CCSD2AR.DAT
NOV 2010

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
5188.310	2853.300	2.322	2855.622	15.60	4.97	.38	2856.01	.00	1.42	.00	2.000	.000	.00	1 .0
17.280	.0243					.0047	.08	2.32	.00	.93	.013	.00	.00	PIPE
5205.590	2853.720	2.000	2855.720	15.60	4.97	.38	2856.10	.00	1.42	.00	2.000	.000	.00	1 .0
3.270	.0243					.0044	.01	2.00	.00	.93	.013	.00	.00	PIPE
5208.860	2853.800	1.924	2855.724	15.60	5.03	.39	2856.12	.00	1.42	.76	2.000	.000	.00	1 .0

```
T1 CCSD TRANSPORTATION SITE                                                    0
T2 UPPER ONSITE SD SYSTEM - CCSDU1.DAT
T3 OCT 2010
SO    1000.0002891.200  1                          2893.917
R     1035.4702895.700  1       .013                                .000  21.104 0
JX    1040.4702896.200  3  2    .013      .001          2896.200     -74.1          .000
R     1049.6002896.370  3       .013                                .000    .000 1
SH    1049.6002896.370  3                          2902.840
CD    1  4    1     .000    2.000      .000  .000  .000    .00
CD    2  4    1     .000    1.500      .000  .000  .000    .00
CD    3  4    1     .000    2.000      .000  .000  .000    .00
Q             15.000    .0
```

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		2.000														
CD	2	4	1		1.500														
CD	3	4	1		2.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -
CCSD TRANSPORTATION SITE

HEADING LINE NO 2 IS -
UPPER ONSITE SD SYSTEM - CCSDU1.DAT

HEADING LINE NO 3 IS -
OCT 2010

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1000.000	2891.200	1	2893.917

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1035.470	2895.700	1	.013	.000	.000	21.104	0

ELEMENT NO 3 IS A JUNCTION * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1040.470	2896.200	3	2	0	.013	.001	.000	2896.200	.000	-74.100	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1049.600	2896.370	3	.013	.000	.000	.000	1

ELEMENT NO 5 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1049.600	2896.370	3	2902.840

CCSD TRANSPORTATION SITE
UPPER ONSITE SD SYSTEM - CCSDU1.DAT
OCT 2010

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
1000.000	2891.200	.652	2891.852	15.00	16.88	4.42	2896.27	.00	1.40	1.87	2.000	.000	.00	1 .0
5.533	.1269					.0799	.44	.65	4.32	.58	.013	.00	.00	PIPE
1005.533	2891.902	.667	2892.568	15.00	16.36	4.16	2896.73	.00	1.40	1.89	2.000	.000	.00	1 .0
6.433	.1269					.0718	.46	.67	4.14	.58	.013	.00	.00	PIPE
1011.966	2892.718	.690	2893.408	15.00	15.60	3.78	2897.19	.00	1.40	1.90	2.000	.000	.00	1 .0
4.988	.1269					.0629	.31	.69	3.87	.58	.013	.00	.00	PIPE
1016.954	2893.351	.715	2894.066	15.00	14.88	3.44	2897.50	.00	1.40	1.92	2.000	.000	.00	1 .0
3.999	.1269					.0551	.22	.71	3.61	.58	.013	.00	.00	PIPE
1020.952	2893.858	.740	2894.599	15.00	14.18	3.12	2897.72	.00	1.40	1.93	2.000	.000	.00	1 .0
3.279	.1269					.0484	.16	.74	3.38	.58	.013	.00	.00	PIPE
1024.231	2894.274	.767	2895.041	15.00	13.52	2.84	2897.88	.00	1.40	1.94	2.000	.000	.00	1 .0
2.728	.1269					.0424	.12	.77	3.16	.58	.013	.00	.00	PIPE
1026.959	2894.620	.795	2895.415	15.00	12.89	2.58	2898.00	.00	1.40	1.96	2.000	.000	.00	1 .0
2.296	.1269					.0372	.09	.79	2.95	.58	.013	.00	.00	PIPE
1029.256	2894.912	.824	2895.735	15.00	12.29	2.35	2898.08	.00	1.40	1.97	2.000	.000	.00	1 .0
1.945	.1269					.0327	.06	.82	2.75	.58	.013	.00	.00	PIPE
1031.201	2895.158	.854	2896.012	15.00	11.72	2.13	2898.15	.00	1.40	1.98	2.000	.000	.00	1 .0
1.655	.1269					.0287	.05	.85	2.57	.58	.013	.00	.00	PIPE

CCSD TRANSPORTATION SITE
UPPER ONSITE SD SYSTEM - CCSDU1.DAT
OCT 2010

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
1032.856	2895.368	.885	2896.254	15.00	11.18	1.94	2898.19	.00	1.40	1.99	2.000	.000	.00	1 .0
1.411	.1269					.0252	.04	.89	2.40	.58	.013	.00	.00	PIPE
1034.267	2895.547	.918	2896.466	15.00	10.66	1.76	2898.23	.00	1.40	1.99	2.000	.000	.00	1 .0
1.203	.1269					.0222	.03	.92	2.23	.58	.013	.00	.00	PIPE
1035.470	2895.700	.953	2896.653	15.00	10.16	1.60	2898.26	.00	1.40	2.00	2.000	.000	.00	1 .0
JUNCT STR	.1000					.0156	.08	.95	2.08		.013	.00	.00	PIPE
1040.470	2896.200	1.177	2897.377	15.00	7.80	.95	2898.32	.00	1.40	1.97	2.000	.000	.00	1 .0
.648	.0186					.0103	.01	1.18	1.39	.98	.013	.00	.00	PIPE
1041.118	2896.212	1.182	2897.395	15.00	7.76	.93	2898.33	.00	1.40	1.97	2.000	.000	.00	1 .0
4.068	.0186					.0096	.04	1.18	1.38	.98	.013	.00	.00	PIPE
1045.187	2896.288	1.231	2897.519	15.00	7.40	.85	2898.37	.00	1.40	1.95	2.000	.000	.00	1 .0
2.560	.0186					.0085	.02	1.23	1.28	.98	.013	.00	.00	PIPE
1047.746	2896.336	1.282	2897.618	15.00	7.05	.77	2898.39	.00	1.40	1.92	2.000	.000	.00	1 .0
1.407	.0186					.0076	.01	1.28	1.18	.98	.013	.00	.00	PIPE
1049.154	2896.362	1.337	2897.698	15.00	6.72	.70	2898.40	.00	1.40	1.88	2.000	.000	.00	1 .0
.446	.0186					.0067	.00	1.34	1.09	.98	.013	.00	.00	PIPE
1049.600	2896.370	1.396	2897.766	15.00	6.41	.64	2898.40	.00	1.40	1.84	2.000	.000	.00	1 .0

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T1 CCSD TRANSPORTATION SITE                                                    0
T2 MIDDLE ONSITE SD SYSTEM - CCSDM1.DAT
T3 OCT 2010
SO   1000.0002887.700  1                          2888.218
R    1324.6502891.000  1      .013                                .000 -90.000 1
JX   1329.6502891.200  4  3   .013   15.000          2891.200     45.0          .000
R    1481.3002893.270  4      .013                                .000  90.000 1
JX   1486.3002893.470  5      .013
R    1725.0002895.910  5      .013                                .000    .000 1
JX   1730.0002896.110  6      .013
R    1968.7002898.550  6      .013                                .000  90.000 1
JX   1973.7002898.750  7      .013
R    2037.7002899.420  7      .013                                .000    .000 1
SH   2037.7002899.420  7                          2898.560
CD   1  4   1     .000   2.000      .000  .000  .000   .00
CD   2  4   1     .000   2.000      .000  .000  .000   .00
CD   3  4   1     .000   2.000      .000  .000  .000   .00
CD   4  4   1     .000   2.000      .000  .000  .000   .00
CD   5  4   1     .000   2.000      .000  .000  .000   .00
CD   6  4   1     .000   2.000      .000  .000  .000   .00
CD   7  4   1     .000   2.000      .000  .000  .000   .00
Q             8.000   .0
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FILE: CCSDM1.WSW

W S P G W - EDIT LISTING - Version 14.06 Date:11-11-2010 Time:10:28:43

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		2.000														
CD	2	4	1		2.000														
CD	3	4	1		2.000														
CD	4	4	1		2.000														
CD	5	4	1		2.000														
CD	6	4	1		2.000														
CD	7	4	1		2.000														

W S P G W

WATER SURFACE PROFILE - TITLE CARD LISTING PAGE NO 1

HEADING LINE NO 1 IS -

CCSD TRANSPORTATION SITE

HEADING LINE NO 2 IS -

MIDDLE ONSITE SD SYSTEM - CCSDM1.DAT

HEADING LINE NO 3 IS -

OCT 2010

W S P G W

WATER SURFACE PROFILE - ELEMENT CARD LISTING PAGE NO 2

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	N
	1000.000	2887.700	1	

W S ELEV
2888.218

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1324.650	2891.000	1	.013	.000	.000	-90.000	1

ELEMENT NO 3 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1329.650	2891.200	4	3	0	.013	15.000	.000	2891.200	.000	45.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1481.300	2893.270	4	.013	.000	.000	90.000	1

ELEMENT NO 5 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1486.300	2893.470	5	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1725.000	2895.910	5	.013	.000	.000	.000	1

ELEMENT NO 7 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1730.000	2896.110	6	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1968.700	2898.550	6	.013	.000	.000	90.000	1

W S P G W

WATER SURFACE PROFILE - ELEMENT CARD LISTING PAGE NO 3

ELEMENT NO 9 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1973.700	2898.750	7	0	0	.013	.000	.000	.000	.000	.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 10 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2037.700	2899.420	7	.013	.000	.000	.000	1

ELEMENT NO 11 IS A SYSTEM HEADWORKS *

U/S DATA	STATION	INVERT	SECT
	2037.700	2899.420	7

W S ELEV
2898.560

Program Package Serial Number: 3057

WATER SURFACE PROFILE LISTING Date:11-11-2010 Time:10:28:49

CCSD TRANSPORTATION SITE
MIDDLE ONSITE SD SYSTEM - CCSDM1.DAT
OCT 2010

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
1000.000	2887.700	1.655	2889.355	23.00	8.27	1.06	2890.42	.00	1.71	1.51	2.000	.000	.00	1 .0
308.055	.0102					.0102	3.13	1.65	1.08	1.65	.013	.00	.00	PIPE
1308.055	2890.831	1.655	2892.486	23.00	8.27	1.06	2893.55	.00	1.71	1.51	2.000	.000	.00	1 .0
16.595	.0102					.0099	.16	1.65	1.08	1.65	.013	.00	.00	PIPE
1324.650	2891.000	1.706	2892.706	23.00	8.06	1.01	2893.71	.00	1.71	1.42	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0055	.03	1.71	1.00		.013	.00	.00	PIPE
1329.650	2891.200	2.717	2893.917	8.00	2.55	.10	2894.02	.00	1.01	.00	2.000	.000	.00	1 .0
60.425	.0137					.0012	.07	2.72	.00	.75	.013	.00	.00	PIPE
1390.075	2892.025	2.000	2894.025	8.00	2.55	.10	2894.13	.00	1.01	.00	2.000	.000	.00	1 .0
13.957	.0137					.0012	.02	2.00	.00	.75	.013	.00	.00	PIPE
1404.032	2892.215	1.815	2894.030	8.00	2.67	.11	2894.14	.00	1.01	1.16	2.000	.000	.00	1 .0
7.719	.0137					.0011	.01	1.81	.29	.75	.013	.00	.00	PIPE
1411.751	2892.321	1.707	2894.028	8.00	2.80	.12	2894.15	.00	1.01	1.41	2.000	.000	.00	1 .0
6.167	.0137					.0012	.01	1.71	.35	.75	.013	.00	.00	PIPE
1417.917	2892.405	1.618	2894.023	8.00	2.94	.13	2894.16	.00	1.01	1.57	2.000	.000	.00	1 .0
5.235	.0137					.0013	.01	1.62	.39	.75	.013	.00	.00	PIPE
1423.152	2892.476	1.540	2894.017	8.00	3.08	.15	2894.16	.00	1.01	1.68	2.000	.000	.00	1 .0
4.547	.0137					.0015	.01	1.54	.44	.75	.013	.00	.00	PIPE

CCSD TRANSPORTATION SITE
MIDDLE ONSITE SD SYSTEM - CCSDM1.DAT
OCT 2010

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
1427.699	2892.538	1.470	2894.009	8.00	3.23	.16	2894.17	.00	1.01	1.77	2.000	.000	.00	1 .0
3.997	.0137					.0017	.01	1.47	.48	.75	.013	.00	.00	PIPE
1431.696	2892.593	1.406	2893.999	8.00	3.39	.18	2894.18	.00	1.01	1.83	2.000	.000	.00	1 .0
3.520	.0137					.0019	.01	1.41	.53	.75	.013	.00	.00	PIPE
1435.216	2892.641	1.347	2893.988	8.00	3.55	.20	2894.18	.00	1.01	1.88	2.000	.000	.00	1 .0
1.167	.0137					.0021	.00	1.35	.57	.75	.013	.00	.00	PIPE
1436.383	2892.657	1.292	2893.948	8.00	3.73	.22	2894.16	.00	1.01	1.91	2.000	.000	.00	1 .0
HYDRAULIC JUMP														
1436.383	2892.657	.736	2893.392	8.00	7.63	.90	2894.30	.00	1.01	1.93	2.000	.000	.00	1 .0
44.917	.0137					.0150	.67	.74	1.82	.75	.013	.00	.00	PIPE
1481.300	2893.270	.736	2894.006	8.00	7.63	.90	2894.91	.00	1.01	1.93	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0126	.06	.74	1.82		.013	.00	.00	PIPE
1486.300	2893.470	.817	2894.286	8.00	6.63	.68	2894.97	.00	1.01	1.97	2.000	.000	.00	1 .0
146.608	.0102					.0102	1.50	.82	1.49	.82	.013	.00	.00	PIPE
1632.908	2894.969	.817	2895.785	8.00	6.63	.68	2896.47	.00	1.01	1.97	2.000	.000	.00	1 .0
55.651	.0102					.0109	.61	.82	1.49	.82	.013	.00	.00	PIPE
1688.560	2895.537	.790	2896.327	8.00	6.94	.75	2897.07	.00	1.01	1.96	2.000	.000	.00	1 .0
22.012	.0102					.0124	.27	.79	1.59	.82	.013	.00	.00	PIPE

CCSD TRANSPORTATION SITE
MIDDLE ONSITE SD SYSTEM - CCSDM1.DAT
OCT 2010

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
1710.572	2895.762	.762	2896.524	8.00	7.28	.82	2897.35	.00	1.01	1.94	2.000	.000	.00	1 .0
14.428	.0102					.0141	.20	.76	1.70	.82	.013	.00	.00	PIPE
1725.000	2895.910	.736	2896.646	8.00	7.63	.90	2897.55	.00	1.01	1.93	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0126	.06	.74	1.82		.013	.00	.00	PIPE
1730.000	2896.110	.817	2896.927	8.00	6.63	.68	2897.61	.00	1.01	1.97	2.000	.000	.00	1 .0
146.608	.0102					.0102	1.50	.82	1.49	.82	.013	.00	.00	PIPE
1876.608	2897.609	.817	2898.425	8.00	6.63	.68	2899.11	.00	1.01	1.97	2.000	.000	.00	1 .0
55.651	.0102					.0109	.61	.82	1.49	.82	.013	.00	.00	PIPE
1932.260	2898.177	.790	2898.967	8.00	6.94	.75	2899.71	.00	1.01	1.96	2.000	.000	.00	1 .0
22.012	.0102					.0124	.27	.79	1.59	.82	.013	.00	.00	PIPE
1954.271	2898.403	.762	2899.165	8.00	7.28	.82	2899.99	.00	1.01	1.94	2.000	.000	.00	1 .0
14.428	.0102					.0141	.20	.76	1.70	.82	.013	.00	.00	PIPE
1968.700	2898.550	.736	2899.286	8.00	7.63	.90	2900.19	.00	1.01	1.93	2.000	.000	.00	1 .0
JUNCT STR	.0400					.0126	.06	.74	1.82		.013	.00	.00	PIPE
1973.700	2898.750	.816	2899.567	8.00	6.64	.68	2900.25	.00	1.01	1.97	2.000	.000	.00	1 .0
34.145	.0105					.0098	.33	.82	1.49	.81	.013	.00	.00	PIPE
2007.845	2899.108	.837	2899.945	8.00	6.42	.64	2900.58	.00	1.01	1.97	2.000	.000	.00	1 .0
16.073	.0105					.0088	.14	.84	1.42	.81	.013	.00	.00	PIPE

CCSD TRANSPORTATION SITE
MIDDLE ONSITE SD SYSTEM - CCSDM1.DAT
OCT 2010

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width	Height/Dia.-FT "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip Type Ch
2023.918	2899.276	.868	2900.144	8.00	6.12	.58	2900.73	.00	1.01	1.98	2.000	.000	.00	1 .0
7.448	.0105				.0077	.06	.87	1.33	.81	.013	.00	.00	PIPE	
2031.367	2899.354	.900	2900.254	8.00	5.83	.53	2900.78	.00	1.01	1.99	2.000	.000	.00	1 .0
3.898	.0105				.0068	.03	.90	1.24	.81	.013	.00	.00	PIPE	
2035.265	2899.395	.934	2900.328	8.00	5.56	.48	2900.81	.00	1.01	2.00	2.000	.000	.00	1 .0
1.896	.0105				.0060	.01	.93	1.15	.81	.013	.00	.00	PIPE	
2037.161	2899.414	.969	2900.383	8.00	5.30	.44	2900.82	.00	1.01	2.00	2.000	.000	.00	1 .0
.539	.0105				.0052	.00	.97	1.08	.81	.013	.00	.00	PIPE	
2037.700	2899.420	1.007	2900.427	8.00	5.05	.40	2900.82	.00	1.01	2.00	2.000	.000	.00	1 .0

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T1 CCSD NW TRANSPORTATION SITE                                                  0
T2 LOWER ONSITE SD SYSTEM - CCSDL1.DAT
T3 OCT 2010
SO    1000.0002857.400  1                          2863.885
R     1099.5002859.490  1       .013                                .000 -90.000 1
JX    1104.5002859.690  2       .013
R     1197.9502861.660  2       .013                                .000  27.273 1
JX    1202.9502861.860  3       .013
R     1390.3402869.540  3       .013                                .000  22.216 1
JX    1395.3402869.740  4       .013
R     1584.3402875.560  4       .013                                .000    .000 1
JX    1589.3302875.760  6  7    .013   21.100          2876.260     -59.6          .000
R     1845.8202878.310  6       .013                                .000 -45.000 1
JX    1850.8202878.810  7       .013
R     1855.4402878.880  7       .013                                .000 -59.583 1
SH    1855.4402878.880  7                          2885.000
CD    1  4   1    .000   3.000     .000  .000  .000   .00
CD    2  4   1    .000   3.000     .000  .000  .000   .00
CD    3  4   1    .000   3.000     .000  .000  .000   .00
CD    4  4   1    .000   3.000     .000  .000  .000   .00
CD    5  4   1    .000   3.000     .000  .000  .000   .00
CD    6  4   1    .000   3.000     .000  .000  .000   .00
CD    7  4   1    .000   2.500     .000  .000  .000   .00
Q            29.900   .0
```

FILE: CCSDL1.WSW W S P G W - EDIT LISTING - Version 14.06 Date:11-11-2010 Time: 1:27:51

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		3.000														
CD	2	4	1		3.000														
CD	3	4	1		3.000														
CD	4	4	1		3.000														
CD	5	4	1		3.000														
CD	6	4	1		3.000														
CD	7	4	1		2.500														

W S P G W PAGE NO 1

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

CCSD NW TRANSPORTATION SITE

HEADING LINE NO 2 IS -

LOWER ONSITE SD SYSTEM - CCSDL1.DAT

HEADING LINE NO 3 IS -

OCT 2010

W S P G W PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA STATION INVERT SECT
1000.000 2857.400 1

W S ELEV
2863.885

ELEMENT NO 2 IS A REACH * * *

U/S DATA STATION INVERT SECT N
1099.500 2859.490 1 .013

RADIUS ANGLE ANG PT MAN H
.000 .000 -90.000 1

ELEMENT NO 3 IS A JUNCTION * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
1104.500 2859.690 2 0 0 .013 .000 .000 .000 .000 .000 .000

RADIUS ANGLE
.000 .000

ELEMENT NO 4 IS A REACH * * *

U/S DATA STATION INVERT SECT N
1197.950 2861.660 2 .013

RADIUS ANGLE ANG PT MAN H
.000 .000 27.273 1

ELEMENT NO 5 IS A JUNCTION * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
1202.950 2861.860 3 0 0 .013 .000 .000 .000 .000 .000 .000

RADIUS ANGLE
.000 .000

ELEMENT NO 6 IS A REACH * * *

U/S DATA STATION INVERT SECT N
1390.340 2869.540 3 .013

RADIUS ANGLE ANG PT MAN H
.000 .000 22.216 1

ELEMENT NO 7 IS A JUNCTION * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
1395.340 2869.740 4 0 0 .013 .000 .000 .000 .000 .000 .000

RADIUS ANGLE
.000 .000

ELEMENT NO 8 IS A REACH * * *

U/S DATA STATION INVERT SECT N
1584.340 2875.560 4 .013

RADIUS ANGLE ANG PT MAN H
.000 .000 .000 1

W S P G W PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 9 IS A JUNCTION * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
1589.330 2875.760 6 7 0 .013 21.100 .000 2876.260 .000 -59.600 .000

RADIUS ANGLE
.000 .000

ELEMENT NO 10 IS A REACH * * *

U/S DATA STATION INVERT SECT N
1845.820 2878.310 6 .013

RADIUS ANGLE ANG PT MAN H
.000 .000 -45.000 1

ELEMENT NO 11 IS A JUNCTION * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
1850.820 2878.810 7 0 0 .013 .000 .000 .000 .000 .000 .000

RADIUS ANGLE
.000 .000

ELEMENT NO 12 IS A REACH * * *

U/S DATA STATION INVERT SECT N
1855.440 2878.880 7 .013

RADIUS ANGLE ANG PT MAN H
.000 .000 -59.583 1

ELEMENT NO 13 IS A SYSTEM HEADWORKS *

U/S DATA STATION INVERT SECT
1855.440 2878.880 7

W S ELEV
2885.000

CCSD NW TRANSPORTATION SITE
LOWER ONSITE SD SYSTEM - CCSDL1.DAT
OCT 2010

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
1000.000	2857.400	6.485	2863.885	51.00	7.22	.81	2864.69	.00	2.32	.00	3.000	.000	.00	1 .0
99.500	.0210					.0058	.58	6.49	.00	1.55	.013	.00	.00	PIPE
1099.500	2859.490	5.257	2864.747	51.00	7.22	.81	2865.56	.00	2.32	.00	3.000	.000	.00	1 .0
JUNCT STR	.0400					.0058	.03	5.26	.00		.013	.00	.00	PIPE
1104.500	2859.690	5.087	2864.776	51.00	7.22	.81	2865.58	.00	2.32	.00	3.000	.000	.00	1 .0
80.328	.0211					.0058	.47	5.09	.00	1.55	.013	.00	.00	PIPE
1184.828	2861.383	3.960	2865.343	51.00	7.22	.81	2866.15	.00	2.32	.00	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1184.828	2861.383	1.311	2862.694	51.00	17.18	4.59	2867.28	.00	2.32	2.98	3.000	.000	.00	1 .0
13.122	.0211					.0387	.51	1.31	3.03	1.55	.013	.00	.00	PIPE
1197.950	2861.660	1.286	2862.946	51.00	17.61	4.82	2867.76	.00	2.32	2.97	3.000	.000	.00	1 .0
JUNCT STR	.0400					.0400	.20	1.29	3.14		.013	.00	.00	PIPE
1202.950	2861.860	1.287	2863.147	51.00	17.61	4.81	2867.96	.00	2.32	2.97	3.000	.000	.00	1 .0
85.552	.0410					.0389	3.33	1.29	3.14	1.28	.013	.00	.00	PIPE
1288.501	2865.366	1.307	2866.673	51.00	17.25	4.62	2871.29	.00	2.32	2.98	3.000	.000	.00	1 .0
67.927	.0410					.0355	2.41	1.31	3.05	1.28	.013	.00	.00	PIPE
1356.428	2868.150	1.355	2869.506	51.00	16.44	4.20	2873.70	.00	2.32	2.99	3.000	.000	.00	1 .0
33.912	.0410					.0312	1.06	1.36	2.84	1.28	.013	.00	.00	PIPE

CCSD NW TRANSPORTATION SITE
LOWER ONSITE SD SYSTEM - CCSDL1.DAT
OCT 2010

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
1390.340	2869.540	1.406	2870.946	51.00	15.68	3.82	2874.76	.00	2.32	2.99	3.000	.000	.00	1 .0
JUNCT STR	.0400					.0289	.14	1.41	2.65		.013	.00	.00	PIPE
1395.340	2869.740	1.416	2871.155	51.00	15.54	3.75	2874.91	.00	2.32	3.00	3.000	.000	.00	1 .0
24.027	.0308					.0282	.68	1.42	2.62	1.39	.013	.00	.00	PIPE
1419.367	2870.480	1.426	2871.906	51.00	15.39	3.68	2875.59	.00	2.32	3.00	3.000	.000	.00	1 .0
60.245	.0308					.0261	1.57	1.43	2.58	1.39	.013	.00	.00	PIPE
1479.612	2872.335	1.480	2873.815	51.00	14.68	3.34	2877.16	.00	2.32	3.00	3.000	.000	.00	1 .0
31.799	.0308					.0230	.73	1.48	2.40	1.39	.013	.00	.00	PIPE
1511.412	2873.314	1.537	2874.851	51.00	13.99	3.04	2877.89	.00	2.32	3.00	3.000	.000	.00	1 .0
20.644	.0308					.0203	.42	1.54	2.24	1.39	.013	.00	.00	PIPE
1532.055	2873.950	1.596	2875.546	51.00	13.34	2.76	2878.31	.00	2.32	2.99	3.000	.000	.00	1 .0
14.628	.0308					.0179	.26	1.60	2.08	1.39	.013	.00	.00	PIPE
1546.684	2874.400	1.658	2876.059	51.00	12.72	2.51	2878.57	.00	2.32	2.98	3.000	.000	.00	1 .0
10.837	.0308					.0158	.17	1.66	1.93	1.39	.013	.00	.00	PIPE
1557.521	2874.734	1.724	2876.458	51.00	12.13	2.28	2878.74	.00	2.32	2.97	3.000	.000	.00	1 .0
8.204	.0308					.0139	.11	1.72	1.80	1.39	.013	.00	.00	PIPE
1565.724	2874.987	1.794	2876.781	51.00	11.57	2.08	2878.86	.00	2.32	2.94	3.000	.000	.00	1 .0
6.250	.0308					.0123	.08	1.79	1.66	1.39	.013	.00	.00	PIPE

CCSD NW TRANSPORTATION SITE
LOWER ONSITE SD SYSTEM - CCSDL1.DAT
OCT 2010

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
1571.975	2875.179	1.867	2877.046	51.00	11.03	1.89	2878.93	.00	2.32	2.91	3.000	.000	.00	1 .0
4.707	.0308					.0109	.05	1.87	1.54	1.39	.013	.00	.00	PIPE
1576.682	2875.324	1.945	2877.270	51.00	10.51	1.72	2878.99	.00	2.32	2.86	3.000	.000	.00	1 .0
3.442	.0308					.0097	.03	1.95	1.42	1.39	.013	.00	.00	PIPE
1580.124	2875.430	2.029	2877.459	51.00	10.02	1.56	2879.02	.00	2.32	2.81	3.000	.000	.00	1 .0
2.360	.0308					.0086	.02	2.03	1.31	1.39	.013	.00	.00	PIPE
1582.484	2875.503	2.119	2877.621	51.00	9.56	1.42	2879.04	.00	2.32	2.73	3.000	.000	.00	1 .0
1.390	.0308					.0077	.01	2.12	1.21	1.39	.013	.00	.00	PIPE
1583.873	2875.546	2.215	2877.761	51.00	9.11	1.29	2879.05	.00	2.32	2.64	3.000	.000	.00	1 .0
.467	.0308					.0069	.00	2.22	1.10	1.39	.013	.00	.00	PIPE
1584.340	2875.560	2.323	2877.883	51.00	8.69	1.17	2879.05	.00	2.32	2.51	3.000	.000	.00	1 .0
JUNCT STR	.0401					.0043	.02	2.32	1.00		.013	.00	.00	PIPE
1589.330	2875.760	3.443	2879.203	29.90	4.23	.28	2879.48	.00	1.77	.00	3.000	.000	.00	1 .0
61.425	.0099					.0020	.12	3.44	.00	1.41	.013	.00	.00	PIPE
1650.755	2876.371	3.000	2879.371	29.90	4.23	.28	2879.65	.00	1.77	.00	3.000	.000	.00	1 .0
30.879	.0099					.0019	.06	3.00	.00	1.41	.013	.00	.00	PIPE
1681.635	2876.677	2.722	2879.399	29.90	4.44	.31	2879.71	.00	1.77	1.74	3.000	.000	.00	1 .0
16.121	.0099					.0018	.03	2.72	.40	1.41	.013	.00	.00	PIPE

CCSD NW TRANSPORTATION SITE
LOWER ONSITE SD SYSTEM - CCSDL1.DAT
OCT 2010

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
1697.755	2876.838	2.560	2879.398	29.90	4.65	.34	2879.73	.00	1.77	2.12	3.000	.000	.00	1 .0
12.503	.0099					.0020	.02	2.56	.47	1.41	.013	.00	.00	PIPE
1710.258	2876.962	2.427	2879.389	29.90	4.88	.37	2879.76	.00	1.77	2.36	3.000	.000	.00	1 .0
10.240	.0099					.0022	.02	2.43	.53	1.41	.013	.00	.00	PIPE
1720.499	2877.064	2.311	2879.374	29.90	5.12	.41	2879.78	.00	1.77	2.52	3.000	.000	.00	1 .0
3.724	.0099					.0023	.01	2.31	.59	1.41	.013	.00	.00	PIPE
1724.223	2877.101	2.266	2879.367	29.90	5.22	.42	2879.79	.00	1.77	2.58	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1724.223	2877.101	1.365	2878.466	29.90	9.55	1.42	2879.88	.00	1.77	2.99	3.000	.000	.00	1 .0
1.917	.0099					.0111	.02	1.36	1.65	1.41	.013	.00	.00	PIPE
1726.139	2877.120	1.365	2878.485	29.90	9.55	1.42	2879.90	.00	1.77	2.99	3.000	.000	.00	1 .0
47.268	.0099					.0119	.56	1.36	1.64	1.41	.013	.00	.00	PIPE
1773.407	2877.590	1.316	2878.906	29.90	10.02	1.56	2880.47	.00	1.77	2.98	3.000	.000	.00	1 .0
30.248	.0099					.0136	.41	1.32	1.76	1.41	.013	.00	.00	PIPE
1803.655	2877.891	1.269	2879.160	29.90	10.51	1.71	2880.88	.00	1.77	2.96	3.000	.000	.00	1 .0
23.081	.0099					.0154	.36	1.27	1.89	1.41	.013	.00	.00	PIPE
1826.736	2878.120	1.225	2879.345	29.90	11.02	1.89	2881.23	.00	1.77	2.95	3.000	.000	.00	1 .0
19.084	.0099					.0176	.34	1.22	2.03	1.41	.013	.00	.00	PIPE

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1845.820	2878.310	1.182	2879.492	29.90	11.56	2.07	2881.57	.00	1.77	2.93	3.000	.000	.00	1 .0
JUNCT STR	.1000					.0135	.07	1.18	2.17		.013	.00	.00	PIPE
1850.820	2878.810	1.697	2880.508	29.90	8.43	1.10	2881.61	.00	1.86	2.33	2.500	.000	.00	1 .0
.471	.0151					.0082	.00	1.70	1.20	1.39	.013	.00	.00	PIPE
1851.290	2878.817	1.705	2880.522	29.90	8.39	1.09	2881.61	.00	1.86	2.33	2.500	.000	.00	1 .0
3.174	.0151					.0077	.02	1.70	1.19	1.39	.013	.00	.00	PIPE
1854.464	2878.865	1.780	2880.646	29.90	8.00	.99	2881.64	.00	1.86	2.26	2.500	.000	.00	1 .0
.975	.0151					.0069	.01	1.78	1.10	1.39	.013	.00	.00	PIPE
1855.440	2878.880	1.864	2880.743	29.90	7.62	.90	2881.65	.00	1.86	2.18	2.500	.000	.00	1 .0

Culvert Calculator Report
Inlet #5 to SDMH #14

Comments:

1. TW Elevation from WSPG Sta. 5103.21 = 2853.835 Q100 = 8.4 cfs (Alpine Ridge model)

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	2,858.20 ft	Headwater Depth/Height	0.82
Computed Headwater Elev	2,854.45 ft	Discharge	8.40 cfs
Inlet Control HW Elev.	2,854.29 ft	Tailwater Elevation	2,853.84 ft
Outlet Control HW Elev.	2,854.45 ft	Control Type	Entrance Control

Grades			
Upstream Invert	2,852.80 ft	Downstream Invert	2,852.30 ft
Length	24.10 ft	Constructed Slope	0.020747 ft/ft

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	1.53 ft
Slope Type	Steep	Normal Depth	0.69 ft
Flow Regime	N/A	Critical Depth	1.03 ft
Velocity Downstream	3.25 ft/s	Critical Slope	0.004945 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	2,854.45 ft	Upstream Velocity Head	0.41 ft
Ke	0.50	Entrance Loss	0.20 ft

Inlet Control Properties			
Inlet Control HW Elev.	2,854.29 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
Inlet #3 to SDMH #12

Comments:

1. TW Elevation from WSPG Sta. 1012.240 = 2,854.458, Q100 = 19.1 cfs

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	2,857.00 ft	Headwater Depth/Height	1.40
Computed Headwater Elev	2,856.05 ft	Discharge	19.10 cfs
Inlet Control HW Elev.	2,856.05 ft	Tailwater Elevation	2,854.46 ft
Outlet Control HW Elev.	2,856.03 ft	Control Type	Inlet Control

Grades			
Upstream Invert	2,853.25 ft	Downstream Invert	2,852.90 ft
Length	29.66 ft	Constructed Slope	0.011800 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.38 ft
Slope Type	Steep	Normal Depth	1.33 ft
Flow Regime	Supercritical	Critical Depth	1.57 ft
Velocity Downstream	8.28 ft/s	Critical Slope	0.007729 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	2,856.03 ft	Upstream Velocity Head	0.81 ft
Ke	0.50	Entrance Loss	0.40 ft

Inlet Control Properties			
Inlet Control HW Elev.	2,856.05 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
Sta. 21+35.91-35 R to SDMH #4 - East 1/2 Lateral

Comments:

1. TW Elevation from WSPG Sta. 2541.53 = 2,906.84, Q100 = 4.6 cfs

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	2,915.00 ft	Headwater Depth/Height	0.88
Computed Headwater Elev	2,907.92 ft	Discharge	4.60 cfs
Inlet Control HW Elev.	2,907.82 ft	Tailwater Elevation	2,906.84 ft
Outlet Control HW Elev.	2,907.92 ft	Control Type	Entrance Control

Grades			
Upstream Invert	2,906.60 ft	Downstream Invert	2,906.34 ft
Length	25.40 ft	Constructed Slope	0.010236 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.70 ft
Slope Type	Steep	Normal Depth	0.69 ft
Flow Regime	Supercritical	Critical Depth	0.82 ft
Velocity Downstream	5.65 ft/s	Critical Slope	0.005622 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	2,907.92 ft	Upstream Velocity Head	0.33 ft
Ke	0.50	Entrance Loss	0.17 ft

Inlet Control Properties			
Inlet Control HW Elev.	2,907.82 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
Sta. 21+20.90-35 L to SDMH #4 - West 1/2 Lateral

Comments:

1. Ke = 1.0 (Maximum Entrance Inlet Loss Coeff. applied at entrance of 42")

2. TW Elevation from WSPG Sta. 2541.53 = 2,906.84, Q100 = 83.2 cfs

3. Pipe size increase to 42" so HW/D less than or equal to 1.5

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	2,915.00	ft	Headwater Depth/Height	1.50	
Computed Headwater Elev	2,912.76	ft	Discharge	71.60	cfs
Inlet Control HW Elev.	2,911.95	ft	Tailwater Elevation	2,906.84	ft
Outlet Control HW Elev.	2,912.76	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	2,907.50	ft	Downstream Invert	2,904.34	ft
Length	55.43	ft	Constructed Slope	0.057009	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.58	ft
Slope Type	Steep		Normal Depth	1.31	ft
Flow Regime	Supercritical		Critical Depth	2.65	ft
Velocity Downstream	16.98	ft/s	Critical Slope	0.005953	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	ft
Section Size	42 inch		Rise	3.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	2,912.76	ft	Upstream Velocity Head	1.30	ft
Ke	1.00		Entrance Loss	1.30	ft

Inlet Control Properties					
Inlet Control HW Elev.	2,911.95	ft	Flow Control	Transition	
Inlet Type	Square edge w/headwall		Area Full	9.6	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
Sta. 12+59.91-35 R to SDMH #1 - East 1/2 Lateral

Comments:

1. TW Elevation from WSPG Sta. 2923.00 = 2923.776, Q100 = 2.2 cfs

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	2,931.90 ft	Headwater Depth/Height	0.58
Computed Headwater Elev	2,925.07 ft	Discharge	2.20 cfs
Inlet Control HW Elev.	2,924.97 ft	Tailwater Elevation	2,923.78 ft
Outlet Control HW Elev.	2,925.07 ft	Control Type	Entrance Control

Grades			
Upstream Invert	2,924.20 ft	Downstream Invert	2,923.70 ft
Length	25.40 ft	Constructed Slope	0.019685 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.40 ft
Slope Type	Steep	Normal Depth	0.39 ft
Flow Regime	Supercritical	Critical Depth	0.56 ft
Velocity Downstream	5.77 ft/s	Critical Slope	0.004972 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	2,925.07 ft	Upstream Velocity Head	0.21 ft
Ke	0.50	Entrance Loss	0.10 ft

Inlet Control Properties			
Inlet Control HW Elev.	2,924.97 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Inlet #	Offsite Location	Inlet Type	Q100 (cfs)	Total Curb Est. Length (ft)	Lg (ft)	Lc (ft)	Lc w/ 50%CF	Total Inlet Length (ft)	Q Captured (cfs)	Q Bypass (cfs)	Notes
1	Cliff Shadows	Sweeper	2.3	8	2.5	5.5	2.75	10.75	2.2	0.1	P&P Inlet #1
2	Cliff Shadows	Sweeper	4.8	10	2.5	7.5	3.75	13.75	4.6	0.2	P&P Inlet #2
3	Hammer	Sweeper	42	13.5	2.5	11	5.5	19	19.1	22.9	P&P Inlet #3
5	Alpine Ridge	Sweeper	12.42	11	2.5	8.5	4.25	15.25	8.4	4.0	P&P Inlet #5
6	Alpine Ridge	Sweeper	28	13.5	2.5	11	5.5	19	15.6	12.4	P&P Inlet #6

Inlet #	Onsite Location	Inlet Type	Q100 (cfs)	Total Curb Est. Length (ft)	Lg (ft)	Lc (ft)	Lc w/ 50%CF	Total Inlet Length (ft)	Q Captured (cfs)	Q Bypass (cfs)	Notes
10	ON2 Sump	Sweeper	8	10	2.5	7.5	*	10	8	0	*Sump Conditon w/50% CF applied
11	COMB2 Node	Sweeper	45	10	7.5	2.5	1.25	11.25	29.9	15.1	Onsite Inlet @ COMB2 node (U/S)
12	D/S - COMB2	Sweeper	29.3	10	7.5	2.5	1.25	11.25	21.1	8.2	15.1 cfs (bypass) + 14.2 = 29.3 cfs

Notes:

Lg = Length of Grate
Lc = Length of Curb
CF = Clogging Factor

Hydraulic Analysis Report

Project Data

Project Title: CCSD – NW Transportation

Designer: Staff

Project Date: Tuesday, November 09, 2010

Project Units: U.S. Customary Units

Notes: Offsite Inlets Only

Curb and Gutter Analysis: Cliff Shadows - Inlet #1

Notes:
I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. --
II. Per HEC-22, Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side, is no greater than that of the grate alone. Capacity is computed neglecting the curb opening. --
III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0577 (ft/ft)
Cross-Slope of Pavement:	0.0200 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	2.3000 (cfs)
Width of Spread:	6.0851 (ft)
Gutter Depression:	1.2006 (in)
Area of Flow:	0.4453 (ft^2)
Eo (Gutter Flow to Total Flow):	0.6882
Gutter Depth at Curb:	2.6610 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	2.5000 (ft)
Length of Inlet:	8.0000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	2.1670 (cfs)
Bypass Flow:	0.1330 (cfs)
Approach Velocity:	5.1648 (ft/s)
Splash-over Velocity:	9.1077 (ft/s)
Efficiency:	0.9422

Curb and Gutter Analysis: Cliff Shadows Inlet #2

Notes:

I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. –

II. Per HEC-22, Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side, is no greater than that of the grate alone. Capacity is computed neglecting the curb opening. –

III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0060 (ft/ft)
Cross-Slope of Pavement:	0.0200 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	4.8000 (cfs)
Width of Spread:	13.8214 (ft)
Gutter Depression:	1.2006 (in)
Area of Flow:	1.9853 (ft^2)
Eo (Gutter Flow to Total Flow):	0.3264
Gutter Depth at Curb:	4.5177 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	2.5000 (ft)
Length of Inlet:	10.0000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	4.5567 (cfs)
Bypass Flow:	0.2433 (cfs)
Approach Velocity:	2.4177 (ft/s)
Splash-over Velocity:	9.1077 (ft/s)
Efficiency:	0.9493

Hydraulic Analysis Report

Project Data

Project Title: CCSD NW Transportation

Designer: Staff

Project Date: Tuesday, November 09, 2010

Project Units: U.S. Customary Units

Notes: Hammer - Inlet #3

Curb and Gutter Analysis: Hammer - Inlet #3

Notes: I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. --II. Per Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side is no greater that that of the grate along. Capacity (interception) is computed neglecting the curb opening. -- III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0150 (ft/ft)
Cross-Slope of Pavement:	0.0200 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	42.0000 (cfs)
Width of Spread:	26.8978 (ft)
Gutter Depression:	1.2006 (in)
Area of Flow:	7.3100 (ft^2)
Eo (Gutter Flow to Total Flow):	0.1620
Gutter Depth at Curb:	7.6561 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	2.5000 (ft)
Length of Inlet:	13.5000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	19.0775 (cfs)
Bypass Flow:	22.9225 (cfs)
Approach Velocity:	5.7456 (ft/s)
Splash-over Velocity:	9.1077 (ft/s)
Efficiency:	0.4542

Curb and Gutter Analysis: Alpine Ridge - Inlet #5

Notes:

I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. –

II. Per HEC-22, Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side, is no greater than that of the grate alone. Capacity is computed neglecting the curb opening. –

III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0134 (ft/ft)
Cross-Slope of Pavement:	0.0200 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	28.0000 (cfs)
Width of Spread:	23.5341 (ft)
Gutter Depression:	1.2006 (in)
Area of Flow:	5.6136 (ft^2)
Eo (Gutter Flow to Total Flow):	0.1866
Gutter Depth at Curb:	6.8488 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	2.5000 (ft)
Length of Inlet:	13.5000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	15.5805 (cfs)
Bypass Flow:	12.4195 (cfs)
Approach Velocity:	4.9879 (ft/s)
Splash-over Velocity:	9.1077 (ft/s)
Efficiency:	0.5564

Curb and Gutter Analysis: Alpine Ridge - Inlet #6

Notes:

I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. –

II. Per HEC-22, Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side, is no greater than that of the grate alone. Capacity is computed neglecting the curb opening. –

III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0134 (ft/ft)
Cross-Slope of Pavement:	0.0200 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	12.4200 (cfs)
Width of Spread:	17.1774 (ft)
Gutter Depression:	1.2006 (in)
Area of Flow:	3.0257 (ft^2)
Eo (Gutter Flow to Total Flow):	0.2603
Gutter Depth at Curb:	5.3232 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	2.5000 (ft)
Length of Inlet:	11.0000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	8.4027 (cfs)
Bypass Flow:	4.0173 (cfs)
Approach Velocity:	4.1049 (ft/s)
Splash-over Velocity:	9.1077 (ft/s)
Efficiency:	0.6765

Worksheet for COMB3 Sump Inlet

Project Description

Solve For	Headwater Elevation

Input Data

Discharge	15.00	ft^3/s
Centroid Elevation	2.37	ft
Tailwater Elevation	0.00	ft
Discharge Coefficient	0.60	
Opening Area	5.62	ft^2

Results

Headwater Elevation	2.68	ft
Headwater Height Above Centroid	0.31	ft
Tailwater Height Above Centroid	-2.37	ft
Velocity	2.67	ft/s

Messages

Notes

JENSEN PRECAST 48"X48" DROP INLET

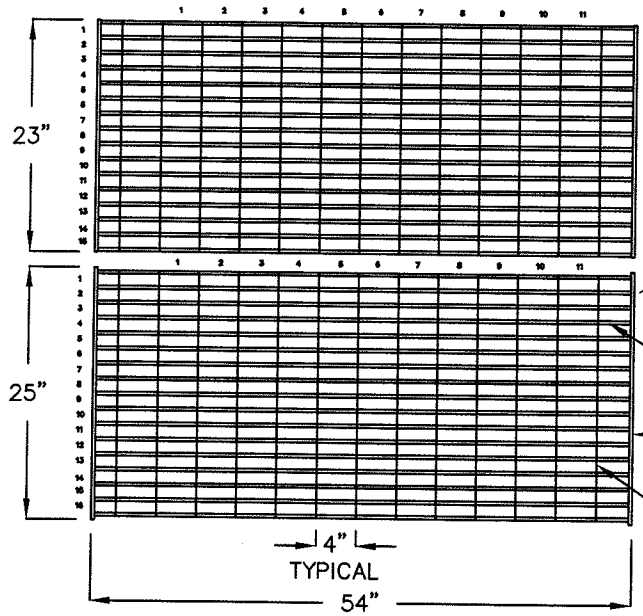
15 (DOWN) X 11 (ACROSS) = 165 OPENINGS
165 X 4.75 SQ IN = 783.75 SQ IN = 5.4427 SQ FT
50% REDUCTION IN AREA = 2.7214 SQ FT

16 (DOWN) X 11 (ACROSS) = 176 OPENINGS
176 X 4.75 SQ IN = 836 SQ IN = 5.8056 SQ FT
50% REDUCTION IN AREA = 2.9028 SQ FT

TOTAL AREA (W/50% REDUCTION)= 5.6241 SQ FT

FRAME & GRATE

4848 DROP INLETS
H-20 TRAFFIC RATED



GRATES

15 (DOWN) X 11 (ACROSS) = 165 OPENINGS
165 X 4.75 SQ IN = 783.75 SQ IN = 5.4427 SQ FT
50% REDUCTION IN AREA = 2.7214 SQ FT

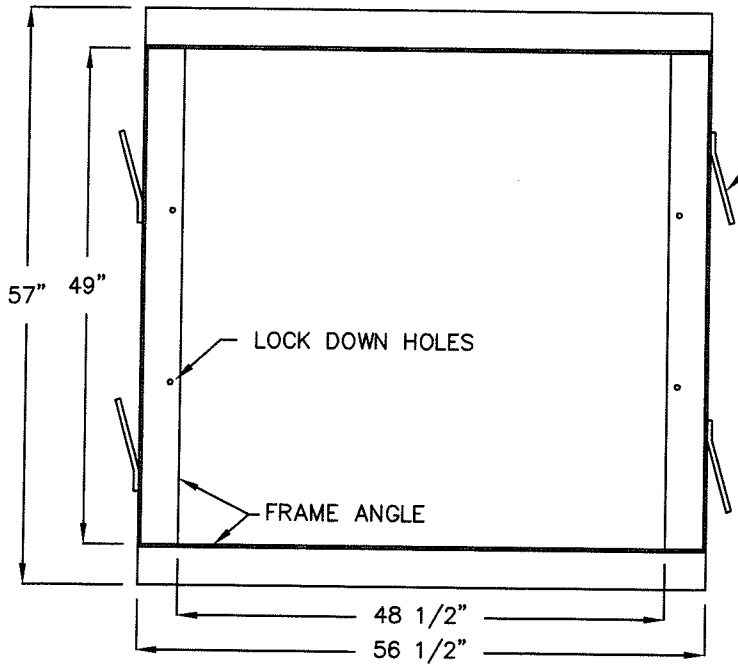
16 (DOWN) X 11 (ACROSS) = 176 OPENINGS
176 X 4.75 SQ IN = 836 SQ IN = 5.8056 SQ FT
50% REDUCTION IN AREA = 2.9028 SQ FT

TOTAL AREA (W/50% REDUCTION)= 5.6241 SQ FT

5" X 3/8"
BEARING BARS
1 1/2" O.C.

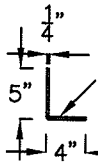
4 1/2" X 3/8" BANDING BAR
EACH END

CROSS RODS 4" O.C.



FRAME

1/2"ø ANCHORS



FORMED ANGLE

5/11/05
G4848H_A.dwg
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Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Tuesday, November 09, 2010

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: Onsite - Inlet #11 @ COMB2 (U/S)

Notes: I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. --II. Per Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side is no greater that that of the grate along. Capacity (interception) is computed neglecting the curb opening. -- III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0050 (ft/ft)
Cross-Slope of Pavement:	0.0250 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	45.0000 (cfs)
Width of Spread:	29.6037 (ft)
Gutter Depression:	1.1106 (in)
Area of Flow:	11.0241 (ft^2)
Eo (Gutter Flow to Total Flow):	0.1419
Gutter Depth at Curb:	9.9917 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7400 (ft)
Grate Length:	7.5000 (ft)
Length of Inlet:	10.0000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	29.9226 (cfs)
Bypass Flow:	15.0774 (cfs)
Approach Velocity:	4.0820 (ft/s)
Splash-over Velocity:	19.3872 (ft/s)
Efficiency:	0.6649

Curb and Gutter Analysis: Onsite - Inlet #12 @ COMB2 (D/S)

Notes: I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. -- II. Bypass Q100 = 15.1 cfs + prorated flow area (3.46 acres) from ON7 (41 cfs/9.98 ac = 4.11 cfs/ac) contributing flow (14.2 cfs) to 2nd inlet D/S of 29.3 cfs. III. Per Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side is no greater that that of the grate along. Capacity (interception) is computed neglecting the curb opening. -- IV. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0050 (ft/ft)
Cross-Slope of Pavement:	0.0250 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	1.5000 (ft)
Design Flow:	29.3000 (cfs)
Width of Spread:	25.1521 (ft)
Gutter Depression:	1.1106 (in)
Area of Flow:	7.9773 (ft^2)
Eo (Gutter Flow to Total Flow):	0.1680
Gutter Depth at Curb:	8.6562 (in)
Inlet Location:	Inlet on Grade
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	7.5000 (ft)
Length of Inlet:	10.0000 (ft)
Local Depression:	2.0000 (in)
Intercepted Flow:	21.0924 (cfs)
Bypass Flow:	8.2076 (cfs)
Approach Velocity:	3.6729 (ft/s)
Splash-over Velocity:	19.3872 (ft/s)
Efficiency:	0.7199

Curb and Gutter Analysis: Onsite - Inlet #10 in ON2 Sump

Notes: I. Inlet calculation clogging factors (CF) for grate are 50% and applied by reducing the width by this amount. -- II. Per Sec. 4.4.4.4, inlet interception capacity of a curb opening and grate placed side-by-side is no greater that that of the grate along. Capacity (interception) is computed neglecting the curb opening. -- III. Curb opening inlet calculation CF is 50% and size is computed for curb opening only (no grate located side-by-side).

Parameters

Longitudinal Slope of Road:	0.0200 (ft/ft)
Cross-Slope of Pavement:	0.0250 (ft/ft)
Cross-Slope of Gutter:	0.0867 (ft/ft)
Mannings:	0.0160
Gutter Width:	2.0000 (ft)
Design Flow:	8.0000 (cfs)
Width of Spread:	11.2783 (ft)
Gutter Depression:	1.4808 (in)
Area of Flow:	1.7134 (ft^2)
Eo (Gutter Flow to Total Flow):	0.4979
Gutter Depth at Curb:	4.8643 (in)
Inlet Location:	Inlet in Sag
Percent Clogging:	50.0000 %
Inlet Type:	Sweeper Combo
Grate Type:	P - 1-7/8
Grate Width:	0.7500 (ft)
Grate Length:	2.5000 (ft)
Length of Inlet:	10.0000 (ft)
Curb opening height:	6.0000 (in)
Local Depression:	2.0000 (in)
Perimeter:	12.8500 (ft)
Effective Perimeter:	6.4250 (ft)
Area:	8.3542 (ft^2)
Effective Area:	4.1771 (ft^2)
Depth at curb face (upstream of local depression):	0.3952 (ft)
Computed Width of Spread at Sag:	10.8717 (ft)
Flow type:	Weir Flow
Efficiency:	1.0000

Appendix D: Reference

90% DESIGN SUBMITTAL
FOR THE
LONE MOUTAIN/BELTWAY DETENTION BASINS
AND THE
GOWAN BELTWAY WEST CHANNEL
(UPDATE TO ORIGINAL DESIGN REPORT)

WESTERN CLARK COUNTY 215
BRUCE WOODBURY BELTWAY
CRAIG ROAD TO HUALAPAI WAY

451.002.001

August 2008

Prepared For:

Clark County Department of Public Works
Design Engineering
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Prepared By:

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SUMMARY OF HEC-1 MODEL INTERIM CONDITIONS		
BASIN ID	AREA (acres)	Q_{100} (cfs)
CAMDK2	215.7	558
CAMDK3	202.2	531
CCAMDK3	417.9	1045
CAM-10A	810.2	2270
CAM-10B	1157.8	2953
DETCAM10	29.4	77
CAM10IN	2415.4	6024
CAM10DB	2415.4	158
INT6	148.2	258
CTROP	2563.5	339
CDMNA3	215.7	428
CDMNA2	80.0	218
CMNA2	295.7	624
INT1	12.4	40
INT2	48.7	113
INT3	40.4	88
COM1	397.2	822
INT4	9.2	23
INT5	11.6	20
COM2	2833.4	1106
INT7	77.2	158
INT8	18.1	43
INT9	37.7	84
W3	200.1	453
COM3	3166.5	1737
HLBW1-CA	251.5	589
COM4	3418.0	2254
HLBW1-CB	75.0	154
COM5	3492.9	2373
WRBW1	208.4	417
COM6	3701.3	2686

REF. INTERIM BASINS Q100

See Figure 6, *Interim Conditions Drainage Map.*

The interim condition model allows for the identifications of the inflow locations of the Beltway Channel and the sizing of the interim interceptor facilities (inlets and laterals) for the interim flows. Also, the interim condition model provides a comparison to the ultimate condition model to allow the drainage facilities to be designed under the worst condition between the two models.

Ultimate Condition Hydrologic Analysis

The ultimate condition hydrologic analyses have been revised from the original design report to reflect current hydrology using refined detention basin parameters and most current information available for the future Sheep Mountain Parkway, the Ann Road Interchange, and the ultimate land-use conditions. In addition, G.C. Wallace has coordinated with PBS&J to incorporate the 2008 MPU

LMBW Detention Basins since the total watershed area of the LMBW Detention Basin is 10.80 square miles, greater than the 8 square miles limit for SDN3. All other facilities are designed based on flows from the SDN3 models (Model #1 and Model #2). The following flow summary table shows the results of the revised ultimate condition HEC-1 models.

SUMMARY OF HEC-1 MODEL ULTIMATE CONDITIONS			
BASIN ID	AREA (acres)	Q_{100} (cfs)	MODEL #
CAMDK2	215.68	558	1
CAMDK3	202.24	531	1
CCAMDK3	417.92	1045	1
CAM-10A	810.24	2270	1
CAM-10B	1157.76	2953	1
DETCAM10	29.44	77	1
CAM10IN	2415.36	6024	1
CAM10DB	2415.36	158	1
W1	94.1	268	1
W2	108.06	331	1
CP1	2517.52	626	1
CDMNA3	193.09	505	1
CDMNA2	80	218	1
CMNA2	273.09	702	1
EFPOA1	95	264	1
COM1	368.09	900	1
EFPOA2	91.6	239	1
COM2	459.69	1114	1
EFPOB1	42.1	116	1
W3	200.14	630	1
COM3	3219.45	2311	2
WBCA	38.18	80	1
HLBW1-CA	251.5	673	1
COM4	3509.13	2938	2
HLBW1-CB	74.95	222	1
COM5	3584.08	3132	2
WBAW	36.46	80	1
WRBW1	208.37	554	1
COM6	3828.91	3619	2
LWBW1C	36.49	113	1
LMDBN	15.17	33	1
CLMDBN	3880.57	3703	2

SUMMARY OF HEC-1 MODEL ULTIMATE CONDITIONS			
BASIN ID	AREA (acres)	Q_{100} (cfs)	MODEL #
BOXCANYO	2182.4	4334	1
BOXDET	2182.4	40	1
LWBW1A	153.69	436	1
UVB1-2A	157	467	1
EDIV2A	157	363	1
NDIV2A	157	185	1
COM7	2493.09	535	2
UVB1-2B	12.28	41	1
LWBW1B	48.34	149	1
COM8	2553.71	693	2
UVB1-2C	20.65	64	1
COM9	2574.36	1095	2
COM10	20.65	420	1
UVB1-1C	11.86	39	1
UVB1-1B	7.92	26	1
COM11	19.78	62	1
UVB1-1A	140.66	421	1
UVB1-1D	22.72	72	1
COM12	163.38	482	1
UVB1-1E	17.89	58	1
COM13	201.05	590	1
WBCL	19.98	59	1
LMBW1	53.84	149	1
COM14	274.87	790	1
LMDBS	37.69	91	1
CLMDBS	2886.92	1896	2
CLMBWCDB	6767.49	4302	SDN4
LMBWCDB	6767.49	116	SDN4
WBLM	51.55	127	1
COM15	6819.04	145	SDN4

REF
ULTIMATE BASINS Q100

See Figure 5, *Ultimate Conditions Drainage Map.*

Due to the higher curve numbers and additional drainage areas to the watershed as a result of coordinating with the 2008 MPU, the revised ultimate condition HEC-1 models yield significantly higher flows impacting most of the facilities than what they were designed for in the original design report. All facilities have been re-evaluated based on the higher flows and re-designed accordingly to accommodate the increased flows. The following table shows a comparison for flows (at concentration points) between the original design report (based on the 2002 MPU) and this report (based on the 2008 MPU).

U4	Sta. 824+00	50	34	16	(1) 15' & (1) 5' Type "CM" Drop Inlets	Portion of EFPOA1 (264 cfs)
U5	Sta. 822+00	50	34	16	(1) 15' & (1) 5' Type "CM" Drop Inlets	Portion of EFPOA1 (264 cfs)
U6	Azure	230	220	10	(2) 25' Type "CM" Drop Inlets + Trench Drain	Portion of EFPOA1 (264 cfs)
U7	Sta. 817+00	50	31	19	(1) 15' & (1) 5' Type "CM" Drop Inlets	Portion of EFPOA2 (239 cfs)
U8	Sta. 812+50	50	31	19	(1) 15' & (1) 5' Type "CM" Drop Inlets	Portion of EFPOA2 (239 cfs)
U9	Sta. 809+00	100	100	-	(1) 25' & (1) 20' Type "CM" Drop Inlets	Portion of EFPOA2 (239 cfs)
U10	Tropical	239	237	2	(2) 30' Type "CM" Drop Inlets + Mod. Trench Drain	EFPOA2 (239 cfs)
U11	Sta. 805+50	50	38	12	(1) 15' & (1) 5' Type "CM" Drop Inlets	Portion of EFPOB1 (116 cfs)
U12	Sta. 795+00	116	116	-	(1) 27.5' & (1) 20' Type "CM" Drop Inlets	EFPOB1 (116 cfs)
U13	Sta. 792+50	50	38	12	(1) 15' & (1) 5' Type "CM" Drop Inlets	Portion of EFPOB1 (116 cfs)
U14	La Mancha	210	198	12	(2) 30' Type "CM" Drop Inlets + Trench Drain	Portion of W2 (331 cfs) + Portion of W3A-U (207 cfs)
U15	La Mancha	538	-	-	78" RCP Lateral	W2 (331 cfs) + W3A-U (207 cfs)
U16	Sta. 787+50	100	100	-	(1) 17.5' & (1) 10' Type "CM" Drop Inlets in sump	Bypass DIs/ Trench Drains
U17	Sta. 785+00	50	40	10	(1) 20' & (1) 15' Type "CM" Drop Inlets	Portion of W3 (630 cfs)
U18	Sta. 785+00	423	-	-	78" RCP Lateral	W3B-U (423 cfs)
U19	W. of SB On-ramp	673	-	-	8'-Wide X 6'-Deep Rect. Concrete Channel	HLBW1-CA (673 cfs)
U20	Sta. 762+00 to Sta. 745+00	222	-	-	3' Wide X 2' Deep Rect. Concrete Channel	HLBW1-CB
U21	Washburn	298	-	-	48" RCP Lateral	CB2-U (67 cfs) + W1A-U (231 cfs)

Interim Conditions Collection Facilities Summary

Facility	Location	Q_{int} (cfs)	$Q_{intercept}$ (cfs)	Q_{bypass} (cfs)	Facility	Tributary
I1	Shaumber	8	8	-	(2) 12' Mod. Type "C" Drop Inlets	Bypass from Facility E1 (8 cfs)
I2	Centennial	280	280	-	(2) 27.5' & (2) 25' Type "CM" Drop Inlets	CDMNA3 (428 cfs) - 10-Yr Storm Drain (148 cfs)*
I3	Sta. 829+50	40	-	-	36" Block-out on DI	INT1 (40 cfs)
I4	Sta. 824+00	113	-	-	3'-High X 5'-Wide Block-out on DI	INT2 (113 cfs)
I5	Azure	88	88	-	(2) 25' Mod. Type "C" Drop Inlets + Trench Drain	INT3 (88 cfs)
I6	Sta. 817+00	23	-	-	36" Block-out on DI	INT4 (23 cfs)
I7	Sta. 812+50	20	-	-	36" Block-out on DI	INT5 (20 cfs)
I8	Tropical	339	315	24	(2) 30' Mod. Type "C" Drop Inlets + Mod. Trench Drain	CTROP (339 cfs)

I9	Sta. 795+00	158	-	-	3'-High X 8'-Wide Block-out on DI	INT7 (158 cfs)
I10	Sta. 792+50	43	-	-	36" Block-out on DI	INT8 (43 cfs)
I11	La Mancha (North DI)	84	-	-	3'-High X 8'-Wide Block-out on DI	INT9 (84 cfs)
I12	Sta. 785+00	453	-	-	5'-High X 15'-Wide Block-out on DI	W3 (453 cfs)
I13	W. of SB On-ramp	589	-	-	8'-Wide X 6'-Deep Rect. Concrete Channel	HLBW1-CA (589 cfs)
I14	Barden	107	-	-	3' Wide X 3' Deep Channel with 48" Lateral	CB1-I (107 cfs)
I15	Sta. 762+00 to Sta. 745+00	154	-	-	3' Wide X 2' Deep Channel with 36" Laterals	HLBW1-CB (154 cfs)
I16	Washburn	119	-	-	3' Wide X 2' Deep Channel with 36" Laterals	W1B-I (119 cfs)

REF. BELTWAY LATERAL Q100 @ NEC OF SITE

Existing Collection Facilities Summary						
Facility	Location	Q_{int} (cfs)	$Q_{intercept}$ (cfs)	Q_{bypass} (cfs)	Facility	Tributary
E1	Shaumber North of Centennial	81	-	-	42" RCP	Referenced from Cliffs Edge
E2	Shaumber North of Centennial	137	129	8	(2) 21' and (2) 12' Type "CM-2" Drop Inlets	CDMNA2 (218) - Fac. E1 (81)
E3	Centennial	63	-	-	36" RCP	Referenced from Cliffs Edge

Ultimate Conditions

North of Centennial: The future Cliffs Edge development has planned a collection system for the 10-year flow only (existing Facilities E1-E3). In addition, GCW has calculated higher 100-year flows than those shown in the Cliffs Edge Study due to higher curve numbers associated with anticipated development. RCP laterals and drop inlets within Centennial west of Shaumber and Shaumber north of Centennial are proposed to provide adequate capacity for the calculated 100-year flows near the intersection of Shaumber Road and Centennial Parkway (proposed Facilities U1-U2).

Centennial to Ann: A combination of drop inlets and trench drains will be provided within the major cross street alignments connecting to Shaumber Road between Ann Road and Centennial Parkway (Azure Street, Tropical Parkway, and La Mancha Avenue; Facilities U6, U10, and U14, respectively). In each case, the system was designed to collect the anticipated street flow capacity with minimal bypass. In addition, a stub is proposed in Tropical Parkway to provide for anticipated future flows (Facility U15). A series of drop inlets will also be provided in Shaumber Road between Centennial Parkway and Ann Road (Facilities U3-U5, U7-U9, U11-U13, and U16-U17). As exact ultimate discharge locations are unknown, the collection has been conservatively designed. Although no lateral is provided for the future Sheep Mountain Parkway due to the exact alignment of the crossing being unknown, the mainline storm drain has been adequately sized for

CURVE NUMBER CALCULATIONS

INTERIM CONDITIONS CURVE NUMBERS								
CONDITION 1:	---------->	Desert Shrub: Poor Hydrologic Condition						
CONDITION 2:	---------->	Open Space: Good Condition						
CONDITION 3:	---------->	Urban District: Commercial and business						
CONDITION 4:	---------->	Graded						
CN VALUES								
		HYDROLOGIC SOIL GROUP						
CONDITION		A	B	C	D	ROCK		
1	---------->	63	77	85	88	90		
2	---------->	39	61	74	80	90		
3	---------->	89	92	94	95	90		
4	---------->	77	86	91	94	90		
	MAP	HYDROLOGIC SOIL GROUP						COMPOSITE
	UNIT	%A	%B	%C	%D	%ROCK		GROUP
	190	10	85	0	5	0		B
	191	5	85	0	10	0		B
	360	0	15	0	35	50		D
	400	0	10	0	90	0		D
	Composite Curve Number							
Soil Type	Cond. 1	Cond. 2	Cond. 3	Cond. 4				
190	76.2	59.8	91.9	85.5				
191	77.4	61.8	92.2	86.4				
360	87.4	82.2	92.1	90.8				
400	86.9	78.1	94.7	93.2				
	Percentage Soil Type					Composite		
Basin	190 C1	191 C1	360 C1	400 C1	400 C3	CN		
INT1	0.0%	0.0%	0.0%	45.0%	55.0%	91.2		
INT2	0.0%	0.0%	0.0%	70.0%	30.0%	89.2		
INT3	2.0%	0.0%	0.0%	88.0%	10.0%	87.4		
INT4	1.2%	0.0%	0.0%	98.8%	0.0%	86.8		
INT5	76.1%	0.0%	0.0%	23.9%	0.0%	78.7		
INT6	26.7%	0.0%	0.0%	73.3%	0.0%	84.0		
INT7	12.9%	0.0%	0.0%	87.1%	0.0%	85.5		
INT8	0.0%	0.0%	0.0%	100.0%	0.0%	86.9		
INT9	0.0%	0.0%	0.0%	100.0%	0.0%	86.9		
W3	0.0%	0.0%	43.1%	56.9%	0.0%	87.1		
	Percentage Soil Type				Composite			
Basin	190 C4	191 C4	360 C4	400 C4	CN			
HLBW1-CA	1.8%	0.8%	85.0%	12.4%	91.0	←	REF CN VALUES	
HLBW1-CB	98.5%	0.0%	0.0%	1.5%	85.6	←	FOR OFFSITE	
WRBW1	85.7%	0.0%	0.0%	14.3%	86.6		BASINS	

STANDARD FORM 4

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   03JUN08  TIME  08:34:14   *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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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


```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                    *DIAGRAM
*** FREE ***
               1    ID    LONE MOUNTAIN/WESTERN BELTWAY DETENTION BASINS
               2    ID    DRAINAGE IMPACT IN ULTIMATE CONDITION DEVELOPMENT
               3    ID    DRAFT 2007 MPU WAS USED AS REFERENCED HYDROLOGIC MODEL
               4    ID    INPUT FILE = WBMOD1-SDN3.H1
               5    ID    LAST MODIFIED = 05/13/08
               6    ID    DESIGN STORM = 100-YEAR 6-HOUR STORM
               7    ID    STORM DISTRIBUTION = SDN3
               8    ID    MODELED BY = JTL/JYL/MGK
               9    ID    JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
              10    ID
              11    ID                          AREA    DARF
              12    ID                          SQ. MI.
              13    ID                          0-0.5   0.99
              14    ID                          0.5-1   0.975
              15    ID                          1-2     0.95
              16    ID                          2-3     0.925
              17    ID                          3-4     0.915
              18    ID                          4-5     0.908
              19    ID                          5-6     0.903
              20    ID                          6-7     0.895
              21    ID                          7-8     0.885
              22    ID
              23    ID  JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
              24    ID
              25    IT       5       0       0     500
              26    IO       5       0       0
              27    IN       5       0       0
              28    JR    PREC    0.99   0.975    0.95   0.925   0.915   0.908   0.903   0.895   0.885
                    *
              29    KK  CAMDK2
              30    KM   BASIN PARAMETERS TAKEN FROM CAM-10 ALTERNATIVES SUMMARY, APPENDIX A-3 BY LBG
              31    BA   0.337
              32    PB    3.28
              33    PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
              34    PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
              35    PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
              36    PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
              37    PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
              38    PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
              39    PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
              40    PC   0.998   0.999   1.000
              41    LS       0    92.1
              42    UD0.213342
                    *
              43    KK RCAMDK2
              44    KM  ROUTE RCAMDK2 TO CAMDK3 ALONG COLLECTOR DIKE
              45    KM  FACILITY = GOWAN ANN ROAD DETENTION BASIN FACILITIES
              46    KM  FACILITY # = GOAN 0065, 0067, 0068, 0070
              47    KM  LINING = SOIL CEMENT
              48    RD     1400  0.0321   0.025       0    TRAP      10       4
                    *
```



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          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
              49    KK  CAMDK3
              50    BA   0.316
              51    PB    3.32
              52    LS       0    90.3
              53    UD0.193556
                    *
              54    KK CCAMDK3
              55    KM  COMBINE RCAMDK2 AND CAMDK3
              56    HC       2
                    *
              57    KK CAM-10A
              58    BA   1.266
              59    PB    3.41
```

INTERIM CONDITION

```
   60          LS       0    94.8
   61          UD0.209967
               *

   62          KK CAM-10B
   63          BA   1.809
   64          PB    3.39
   65          LS       0    91.8
   66          UD0.211495
               *

   67          KKDETCAM10
   68          BA   0.046
   69          PB   3.294
   70          LS       0    86.9
   71          UD0.137401
               *

   72          KK CAM10IN
   73          KM  COMBINE CCAMDK3, CAM-10A, CAM-10B AND DETCAM10
   74          KM  TOTAL INFLOW TO CAM10 DETENTION BASIN
   75          HC       4
               *

   76          KK CAM10DB
   77          KM  DETENTION BASIN PARAMETERS FROM 2008 MPU BY PBS&J
   78          KM  FACILITY = GOWAN ANN ROAD DETENTION BASIN FACILITIES
   79          KM  FACILITY # = GOAN 0058
   80          KM  STORAGE VOLUME = 429.52 AC-FT (BERGER 5-05 VOLUME = 364 AC-FT; 18% INCREASE)
   81          KM  OUTLET = 33" ORIFICE WITH 54" RCP
   82          KM  100-YEAR DISCHARGE = 156 CFS
   83          KM  SPILLWAY LENGTH = 1360 FT
   84          KM  SPILLWAY HEIGHT = 27.7 FT
   85          KM  SPILLWAY CREST ELEVATION = 3000'
   86          KM  SPILLWAY TYPE =
   87          KM  PMF DISCHARGE = 24,614 CFS
   88          KM  TOP OF EMBANKMENT ELEVATION = 3004.5'
   89          KM  INFORMATION TAKEN FROM "ANN ROAD (CAM-10) DETENTION BASIN PLANS"
   90          KM  BY THE LOUIS BERGER GROUP (5-05)
1                                        HEC-1 INPUT                                        PAGE  3

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

   91          RS       1    STOR      -1
               *        0       0       0    0.67    3.33    8.33   26.67   43.33     110       2
               *      280   347.2     364     396
   92          SV    0.00    0.00    0.00    0.79    3.93    9.83   31.47   51.13  129.80  236.00
   93          SV  330.40  409.70  429.52  467.28
   94          SE  2972.6  2973.8  2974.5  2975.0  2976.0  2976.7  2978.8  2980.0  2985.0  2990.0
   95          SE  2995.0  2999.0  3000.0  3003.4
   96          SQ    0.00    6.67   17.78   27.78   45.56   54.44   64.44   82.22   93.33  117.78
   97          SQ  138.39  156.00  160.40   24614
               *

   98          KK  RCAM10
   99          RD    3200    .019   0.013       0    CIRC     4.0
               *
               * END BASINS AND PARAMETERS TAKEN FROM 2008 MPU
               *

  100          KK    INT6
  101          PB    3.25
  102          BA  .23151
  103          LS       0    84.0
  104          UD   0.278
               *

  105          KK   CTROP
  106          KM  COMBINE DB OUTFALL AND INT6 AT TROP
  107          HC       2
               *

  108          KK  CDMNA3
  109          BA  0.3370
  110          PB    3.21
  111          LS       0    86.9
  112          UD   0.264
               *

  113          KK   RMNA3
  114          KM  ROUTE CDMNA3 TO CMNA2
  115          KM  FACILITY = GOWAN BELTWAY WEST
  116          KM  FACILITY ID-MILE = GOBW 0322, 0326
  117          KM  LINING = RCB
  118          RD    1615    0.01   0.015       0    TRAP      10       0
               *

  119          KK  CDMNA2
  120          BA  0.1250
  121          PB    3.18
  122          LS       0    92.8
  123          UD   0.188
               *
1                                        HEC-1 INPUT                                        PAGE  4

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

  124          KK   CMNA2
  125          KM  COMBINE RMNA3 AND CDMNA2
  126          KM  RANCHO ROAD SYSTEM-BELTWAY CHANNEL @ SHAUMBER
  127          HC       2
               *

  128          KK   RMNA2
  129          KM  ROUTE CMNA2 TO COM1
  130          KM  FACILITY = GOWAN BELTWAY WEST
  131          RD    1400   0.015   0.015       0    TRAP      10       0
               *

  132          KK    INT1
  133          PB    3.19
  134          BA  .01933
```

```
135          LS       0    91.2
136          UD   0.080
             *

137          KK    INT2
138          PB    3.22
139          BA  .07611
140          LS       0    89.2
141          UD   0.212
             *

142          KK    INT3
143          PB    3.23
144          BA  .06319
145          LS       0    87.4
146          UD   0.221
             *

147          KK    COM1
148          HC       4
             *

149          KK    INT4
150          PB    3.21
151          BA  .01431
152          LS       0    86.8
153          UD   0.123
             *

154          KK    INT5
155          PB    3.22
156          BA  .01814
157          LS       0    78.7
158          UD   0.169
             *
```

1 HEC-1 INPUT PAGE 5

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

159          KK    COM2
160          HC       4
             *

161          KK    INT7
162          PB    3.25
163          BA  .12065
164          LS       0    85.5
165          UD   0.225
             *

166          KK    INT8
167          PB    3.25
168          BA  .02831
169          LS       0    86.9
170          UD   0.175
             *

171          KK    INT9
172          PB    3.26
173          BA  .05884
174          LS       0    86.9
175          UD   0.200
             *

176          KK      W3
177          PB    3.29
178          BA  .31272
179          LS       0    87.1
180          UD   0.203
             *

181          KK    COM3
182          HC       5
             *

183          KK   RCOM3
184          KM  ROUTE COM3 TO COM4
185          KM  FACILITY = GOWAN BELTWAY WEST
186          RD    1080    0.01   0.015       0    TRAP      14       0
             *

187          KKHLBW1-CA
188          BA  0.3930
189          PB    3.30
190          LS       0    91.0
191          UD   0.271
             *
```

REFERENCED BASINS

1 HEC-1 INPUT PAGE 6

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

192          KK    COM4
193          KM  COMBINE COM3 AND HLBW1-CA
194          KM  LAS VEGAS BELTWAY @ ANN ROAD
195          HC       2
             *

196          KK   RCOM4
197          KM  ROUTE COM4 TO HLBW1-CB
198          RD    1800  0.0250   0.015       0    TRAP      14       0
             *

199          KKHLBW1-CB
200          BA  0.1171
201          PB    3.22
202          LS       0    85.6
203          UD   0.210
             *

204          KK    COM5
205          KM  COMBINE RCOM4 & HLBW1-CB
```

```
206           HC       2
              *
207           KK   RCOM5
208           KM  ROUTE COM5 TO WRBW1
209           RD    2000   0.050   0.015       0    TRAP      14        0
              *
210           KK   WRBW1
211           BA  0.3256
212           PB    3.23
213           LS       0    86.6
214           UD   0.258
              *
215           KK    COM6
216           KM  COMBINE RCOM5 & WRBW1
217           KM  LAS VEGAS BELTWAY @ WASHBURN ROAD
218           HC       2
              *
219           ZZ
```

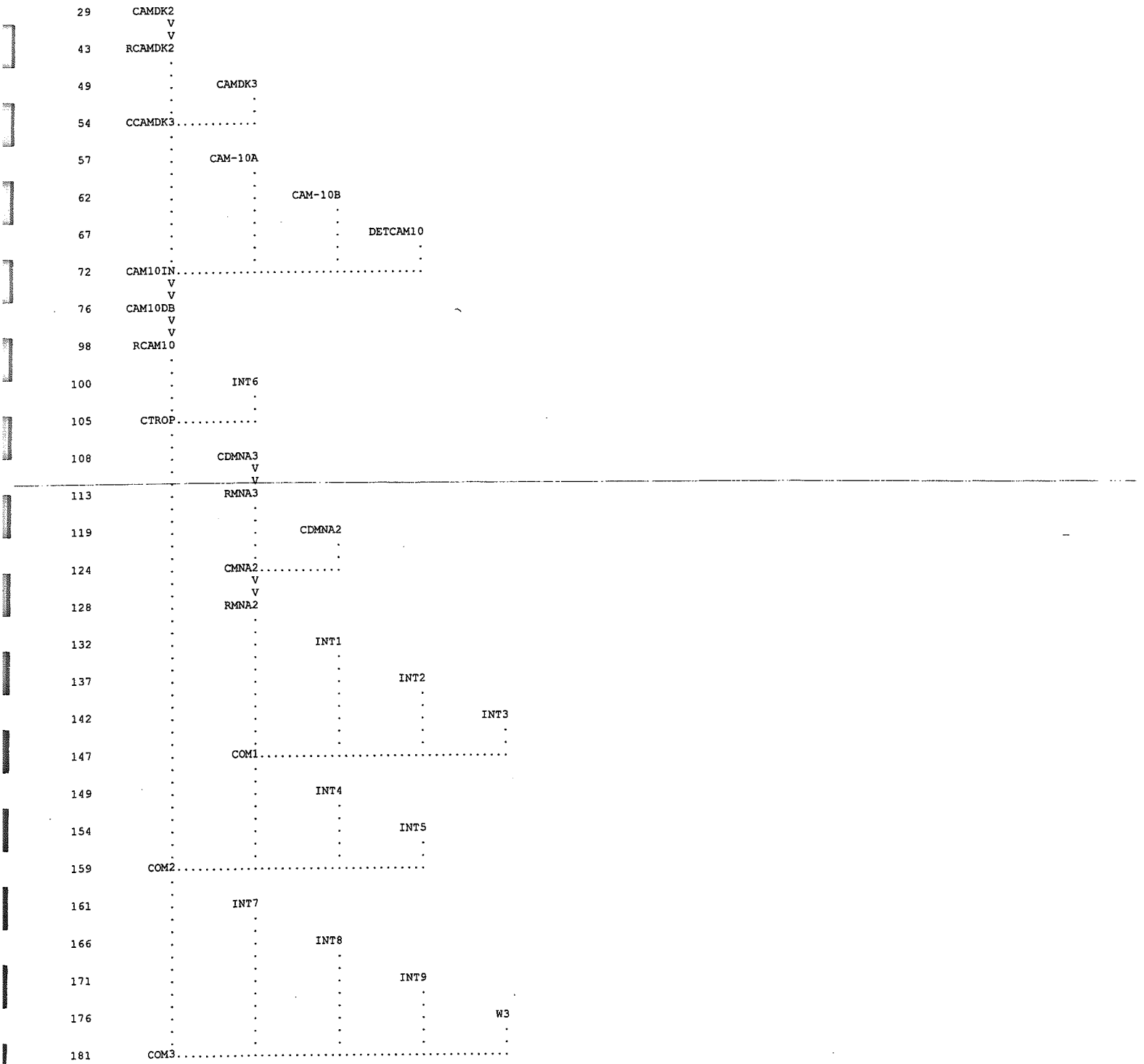
1

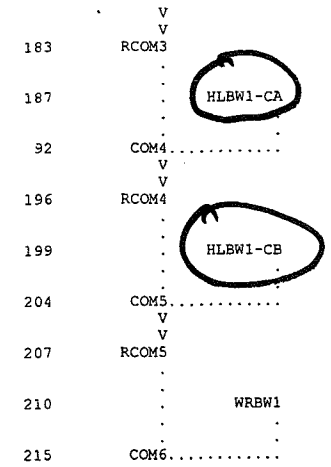
SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW





REFERENCED BASINS

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   03JUN08  TIME  08:34:14   *
*                                       *
*****************************************
```

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

LONE MOUNTAIN/WESTERN BELTWAY DETENTION BASINS
DRAINAGE IMPACT IN ULTIMATE CONDITION DEVELOPMENT
DRAFT 2007 MPU WAS USED AS REFERENCED HYDROLOGIC MODEL
INPUT FILE = WBMOD1-SDN3.H1
LAST MODIFIED = 05/13/08
DESIGN STORM = 100-YEAR 6-HOUR STORM
STORM DISTRIBUTION = SDN3
MODELED BY = JTL/JYL/MGK
JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA SQ. MI.	DARF
0-0.5	0.99
0.5-1	0.975
1-2	0.95
2-3	0.925
3-4	0.915
4-5	0.908
5-6	0.903
6-7	0.895
7-8	0.885

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

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

      IT           HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        500  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      NDTIME       1735  ENDING TIME
                       ICENT         19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                        TOTAL TIME BASE    41.58 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       .98       .95       .93       .92       .91       .90       .89       .88
1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .99	RATIO 2 .98	RATIO 3 .95	RATIO 4 .93	RATIO 5 .92	RATIO 6 .91	RATIO 7 .90	RATIO 8 .89	RATIO 9 .88
HYDROGRAPH AT													
+	CAMDK2	.34	1	FLOW	558.	547.	531.	514.	507.	502.	499.	494.	487.

				TIME	3.58	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RCAMDK2	.34	1	FLOW	556.	546.	529.	512.	505.	501.	496.	492.	485.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
	CAMDK3	.32	1	FLOW	531.	521.	504.	487.	480.	475.	472.	466.	459.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CCAMDK3	.65	1	FLOW	1065.	1045.	1012.	979.	966.	957.	949.	940.	926.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	CAM-10A	1.27	1	FLOW	2377.	2337.	2270.	2204.	2177.	2158.	2145.	2123.	2097.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	CAM-10B	1.81	1	FLOW	3106.	3049.	2953.	2857.	2819.	2792.	2773.	2742.	2704.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	DETCAM10	.05	1	FLOW	77.	75.	73.	70.	69.	68.	67.	67.	66.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
4 COMBINED AT													
+	CAM10IN	3.77	1	FLOW	6621.	6502.	6303.	6104.	6024.	5968.	5929.	5865.	5785.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO													
+	CAM10DB	3.77	1	FLOW	1585.	1346.	648.	159.	158.	157.	156.	155.	154.
				TIME	4.92	5.00	5.25	5.67	5.67	5.67	5.67	5.67	5.67
			** PEAK STAGES IN FEET **										
			1	STAGE	3000.20	3000.16	3000.07	2999.74	2999.43	2999.22	2999.06	2998.82	2998.51
				TIME	4.92	5.00	5.25	5.67	5.67	5.67	5.67	5.67	5.67
ROUTED TO													
+	RCAM10	3.77	1	FLOW	1299.	1124.	636.	159.	158.	157.	156.	155.	154.
				TIME	5.00	5.08	5.25	5.67	5.67	5.67	5.67	5.67	5.67
HYDROGRAPH AT													
+	INT6	.23	1	FLOW	258.	252.	242.	232.	228.	226.	224.	221.	217.
				TIME	3.67	3.67	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	CTROP	4.01	1	FLOW	1364.	1181.	673.	347.	343.	339.	337.	333.	328.
				TIME	5.00	5.08	5.25	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	CDMNA3	.34	1	FLOW	428.	419.	403.	388.	382.	377.	374.	369.	363.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
	RMNA3	.34	1	FLOW	419.	409.	394.	379.	373.	369.	365.	360.	355.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75
HYDROGRAPH AT													
+	CDMNA2	.13	1	FLOW	218.	214.	207.	201.	198.	196.	195.	193.	190.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CMNA2	.46	1	FLOW	624.	610.	589.	568.	559.	554.	549.	542.	533.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RMNA2	.46	1	FLOW	618.	605.	583.	562.	553.	548.	543.	536.	528.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT1	.02	1	FLOW	40.	40.	38.	37.	37.	36.	36.	36.	35.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT													
+	INT2	.08	1	FLOW	113.	111.	107.	103.	102.	101.	100.	99.	97.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT3	.06	1	FLOW	88.	86.	83.	80.	79.	78.	77.	76.	75.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
4 COMBINED AT													
+	COM1	.62	1	FLOW	840.	822.	793.	765.	753.	745.	739.	730.	718.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT4	.01	1	FLOW	23.	23.	22.	21.	21.	21.	20.	20.	20.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT5	.02	1	FLOW	20.	19.	18.	17.	17.	17.	17.	16.	16.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
4 COMBINED AT													
+	COM2	4.66	1	FLOW	1553.	1344.	1176.	1135.	1118.	1106.	1097.	1084.	1067.
				TIME	5.00	5.08	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	INT7	.12	1	FLOW	158.	154.	148.	142.	140.	139.	137.	136.	133.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
	INT8	.03	1	FLOW	43.	42.	41.	39.	39.	38.	38.	37.	37.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	INT9	.06	1	FLOW	84.	82.	79.	76.	75.	74.	74.	73.	71.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT													
+	W3	.31	1	FLOW	453.	443.	427.	411.	404.	400.	397.	391.	385.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58

5 COMBINED AT													
+	COM3	5.18	1	FLOW	1973.	1932.	1864.	1797.	1770.	1751.	1737.	1715.	1689.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RCOM3	5.18	1	FLOW	1966.	1924.	1857.	1789.	1762.	1743.	1730.	1709.	1681.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	HLBW1-CA	.39	1	FLOW	589.	578.	559.	540.	533.	528.	524.	518.	510.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	COM4	5.57	1	FLOW	2555.	2502.	2416.	2330.	2295.	2271.	2254.	2227.	2191.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RCOM4	5.57	1	FLOW	2540.	2486.	2399.	2315.	2279.	2255.	2239.	2210.	2176.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	HLBW1-CB	.12	1	FLOW	154.	150.	145.	139.	137.	135.	134.	132.	130.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	COM5	5.69	1	FLOW	2693.	2636.	2544.	2454.	2416.	2391.	2373.	2343.	2307.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RCOM5	5.69	1	FLOW	2677.	2619.	2527.	2438.	2398.	2374.	2356.	2326.	2290.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	WRBW1	.33	1	FLOW	417.	408.	393.	378.	372.	368.	365.	360.	354.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	COM6	6.01	1	FLOW	3094.	3027.	2920.	2816.	2770.	2741.	2721.	2686.	2644.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67

REF. INTERIM Q100

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.54	559.87	217.41	2.40	5.00	556.45	220.00	2.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4322E+02 EXCESS= .0000E+00 OUTFLOW= .4322E+02 BASIN STORAGE= .6644E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.55	549.26	218.56	2.36	5.00	545.72	220.00	2.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4238E+02 EXCESS= .0000E+00 OUTFLOW= .4238E+02 BASIN STORAGE= .5757E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.56	532.39	217.39	2.28	5.00	529.37	220.00	2.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4098E+02 EXCESS= .0000E+00 OUTFLOW= .4098E+02 BASIN STORAGE= .6592E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.58	516.14	217.82	2.20	5.00	512.01	220.00	2.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3958E+02 EXCESS= .0000E+00 OUTFLOW= .3959E+02 BASIN STORAGE= .5628E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.58	508.27	218.65	2.17	5.00	505.24	220.00	2.17

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3903E+02 EXCESS= .0000E+00 OUTFLOW= .3903E+02 BASIN STORAGE= .5563E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.59	504.08	217.64	2.15	5.00	500.84	220.00	2.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3863E+02 EXCESS= .0000E+00 OUTFLOW= .3864E+02 BASIN STORAGE= .5899E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.59	501.61	218.06	2.13	5.00	496.44	220.00	2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3837E+02 EXCESS= .0000E+00 OUTFLOW= .3837E+02 BASIN STORAGE= .6686E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.60	494.36	218.74	2.11	5.00	491.87	220.00	2.11

NTINUITY SUMMARY (AC-FT) - INFLOW= .3791E+02 EXCESS= .0000E+00 OUTFLOW= .3791E+02 BASIN STORAGE= .6880E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.60	489.03	218.00	2.08	5.00	484.55	220.00	2.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3736E+02 EXCESS= .0000E+00 OUTFLOW= .3736E+02 BASIN STORAGE= .6767E-03 PERCENT ERROR= .0

ULTIMATE CONDITIONS HYDROLOGY

HEC-1 ANALYSIS MODEL #1 – SDN3

```
*****************************************
*                                       *
*    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*                JUN  1998              *
*              VERSION 4.1              *
*                                       *
*    RUN DATE   28MAY08  TIME  09:06:52 *
*                                       *
*****************************************
```

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

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

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

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


```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                    *DIAGRAM
*** FREE ***
               1    ID    LONE MOUNTAIN/WESTERN BELTWAY DETENTION BASINS
               2    ID    DRAINAGE IMPACT IN ULTIMATE CONDITION DEVELOPMENT
               3    ID    DRAFT 2007 MPU WAS USED AS REFERENCED HYDROLOGIC MODEL
               4    ID    INPUT FILE = WBMOD1-SDN3.H1
               5    ID    LAST MODIFIED = 05/13/08
               6    ID    DESIGN STORM = 100-YEAR 6-HOUR STORM
               7    ID    STORM DISTRIBUTION = SDN3
               8    ID    MODELED BY = JTL/JYL/MGK
               9    ID    JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
              10    ID
              11    ID                          AREA    DARF
              12    ID                          SQ. MI.
              13    ID                          0-0.5   0.99
              14    ID                          0.5-1   0.975
              15    ID                          1-2     0.95
              16    ID                          2-3     0.925
              17    ID                          3-4     0.915
              18    ID                          4-5     0.908
              19    ID                          5-6     0.903
              20    ID                          6-7     0.895
              21    ID                          7-8     0.885
              22    ID
              23    ID  JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
              24    ID
              25    IT       5       0       0     500
              26    IO       5       0       0
              27    IN       5       0       0
              28    JR    PREC    0.99   0.975    0.95   0.925   0.915   0.908   0.903   0.895   0.885
                    *
              29    KK  CAMDK2
              30    KM   BASIN PARAMETERS TAKEN FROM CAM-10 ALTERNATIVES SUMMARY, APPENDIX A-3 BY LBG
              31    BA   0.337
              32    PB    3.28
              33    PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
              34    PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
              35    PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
              36    PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
              37    PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
              38    PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
              39    PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
              40    PC   0.998   0.999   1.000
              41    LS       0    92.1
              42    UD0.213342
                    *
              43    KK RCAMDK2
              44    KM  ROUTE RCAMDK2 TO CAMDK3 ALONG COLLECTOR DIKE
              45    KM  FACILITY = GOWAN ANN ROAD DETENTION BASIN FACILITIES
              46    KM  FACILITY # = GOAN 0065, 0067, 0068, 0070
              47    KM  LINING = SOIL CEMENT
              48    RD    1400  0.0321   0.025       0    TRAP      10       4
                    *
```



```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
              49    KK  CAMDK3
              50    BA   0.316
              51    PB    3.32
              52    LS       0    90.3
              53    UD0.193556
                    *
              54    KK CCAMDK3
              55    KM  COMBINE RCAMDK2 AND CAMDK3
              56    HC       2
                    *
              57    KK CAM-10A
              58    BA   1.266
              59    PB    3.41
```

REF. ULTIMATE CONDITION

```
   60          LS       0    94.8
   61          UD0.209967
               *

   62          KK CAM-10B
   63          BA   1.809
   64          PB    3.39
   65          LS       0    91.8
   66          UD0.211495
               *

   67          KKDETCAM10
   68          BA   0.046
   69          PB   3.294
   70          LS       0    86.9
   71          UD0.137401
               *

   72          KK CAM10IN
   73          KM  COMBINE CCAMDK3, CAM-10A, CAM-10B AND DETCAM10
   74          KM  TOTAL INFLOW TO CAM10 DETENTION BASIN
   75          HC       4
               *

   76          KK CAM10DB
   77          KM  DETENTION BASIN PARAMETERS FROM 2008 MPU BY PBS&J
   78          KM  FACILITY = GOWAN ANN ROAD DETENTION BASIN FACILITIES
   79          KM  FACILITY # = GOAN 0058
   80          KM  STORAGE VOLUME = 429.52 AC-FT (BERGER 5-05 VOLUME = 364 AC-FT; 18% INCREASE)
   81          KM  OUTLET = 33" ORIFICE WITH 54" RCP
   82          KM  100-YEAR DISCHARGE = 156 CFS
   83          KM  SPILLWAY LENGTH = 1360 FT
   84          KM  SPILLWAY HEIGHT = 27.7 FT
   85          KM  SPILLWAY CREST ELEVATION = 3000'
   86          KM  SPILLWAY TYPE =
   87          KM  PMF DISCHARGE = 24,614 CFS
   88          KM  TOP OF EMBANKMENT ELEVATION = 3004.5'
   89          KM  INFORMATION TAKEN FROM "ANN ROAD (CAM-10) DETENTION BASIN PLANS"
   90          KM  BY THE LOUIS BERGER GROUP (5-05)
1                                        HEC-1 INPUT                                        PAGE  3

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

   91          RS       1    STOR      -1
               *        0       0       0    0.67    3.33    8.33   26.67   43.33     110     2
               *      280   347.2     364     396
   92          SV    0.00    0.00    0.00    0.79    3.93    9.83   31.47   51.13  129.80  236.00
   93          SV  330.40  409.70  429.52  467.28
   94          SE  2972.6  2973.8  2974.5  2975.0  2976.0  2976.7  2978.8  2980.0  2985.0  2990.0
   95          SE  2995.0  2999.0  3000.0  3003.4
   96          SQ    0.00    6.67   17.78   27.78   45.56   54.44   64.44   82.22   93.33  117.78
   97          SQ  138.39  156.00  160.40   24614
               *

   98          KK  RCAM10
   99          RD    3200    .019   0.013       0    CIRC     4.0
               *
               * END BASINS AND PARAMETERS TAKEN FROM 2008 MPU
               *

  100          KK      W1
  101          PB    3.25
  102          BA  .14700
  103          LS       0    94.5
  104          UD   0.198
               *

  105          KK     RW1
  106          RD    2850     .03   0.013       0    CIRC     5.0
               *

  107          KK      W2
  108          PB    3.26
  109          BA  .16880
  110          LS       0    94.0
  111          UD   0.161
               *

  112          KK     CP1
  113          HC       3
               *

  114          KK    RCP1
  115          RD     760    .028   0.013       0    CIRC     6.0
               *

  116          KK  CDMNA3
  117          BA  0.3017
  118          PB    3.21
  119          LS       0    95.3
  120          UD0.254836
               *
1                                        HEC-1 INPUT                                        PAGE  4

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

  121          KK   RMNA3
  122          KM  ROUTE CDMNA3 TO CMNA2
  123          KM  FACILITY = GOWAN BELTWAY WEST
  124          KM  FACILITY ID-MILE = GOBW 0322, 0326
  125          KM  LINING = RCB
  126          RD    1615    0.01   0.015       0    TRAP      10       0
               *

  127          KK  CDMNA2
  128          BA  0.1250
  129          PB    3.18
  130          LS       0    92.8
  131          UD   0.188
               *

  132          KK   CMNA2
  133          KM  COMBINE RMNA3 AND CDMNA2
```

```
          134          KM  RANCHO ROAD SYSTEM-BELTWAY CHANNEL @ SHAUMBER
          135          HC       2
                       *

          136          KK   RMNA2
          137          KM  ROUTE CMNA2 TO COM1
          138          KM  FACILITY = GOWAN BELTWAY WEST
          139          RD    1400   0.015   0.015       0    TRAP      10       0
                       *

          140          KK  EFPOA1
          141          PB    3.22
          142          BA  .14340
          143          LS       0    91.2
          144          UD   0.143
                       *

          145          KK    COM1
          146          HC       2
                       *

          147          KK   RCOM1
          148          KM  ROUTE COM1 TO COM2
          149          KM  FACILITY = GOWAN BELTWAY WEST
          150          RD    1350    0.01   0.015       0    TRAP      10       0
                       *

          151          KK  EFPOA2
          152          PB    3.23
          153          BA  .12750
          154          LS       0    91.7
          155          UD   0.144
                       *
1                                                  HEC-1 INPUT                                                PAGE  5
        LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          156          KK    COM2
          157          HC       2
                       *

          158          KK   RCOM2
          159          KM  ROUTE COM2 TO COM3
          160          KM  FACILITY = GOWAN BELTWAY WEST
          161          RD    2300    0.02   0.015       0    TRAP      14       0
                       *

          162          KK  EFPOB1
          163          PB    3.23
          164          BA  .06580
          165          LS       0    91.7
          166          UD   0.178
                       *

          167          KK  REFPB1
          168          KM  ROUTE EFPOB1 TO COM3
          169          KM  FACILITY = GOWAN BELTWAY WEST
          170          RD     760   0.028   0.015       0    TRAP      14       0
                       *

          171          KK      W3
          172          PB    3.29
          173          BA  .31270
          174          LS       0    95.8
          175          UD   0.172
                       *

          176          KK    COM3
          177          HC       4
                       *

          178          KK   RCOM3
          179          KM  ROUTE COM3 TO COM4
          180          KM  FACILITY = GOWAN BELTWAY WEST
          181          RD    1080    0.01   0.015       0    TRAP      14       0
                       *

          182          KK    WBCA
          183          KM   BASIN FROM CENT TO ANN
          184          BA  0.0647
          185          PB    3.20
          186          LS       0    92.0
          187          UD   0.394
                       *

          188          KKHLBW1-CA
          189          BA  0.3933
          190          PB    3.30
          191          LS       0    95.4
          192          UD   0.261
                       *
1                                                  HEC-1 INPUT                                                PAGE  6
        LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          193          KK    COM4
          194          KM  COMBINE COM3, WBCA, AND HLBW1-CA
          195          KM  LAS VEGAS BELTWAY @ ANN ROAD
          196          HC       3
                       *

          197          KK   RCOM4
          198          KM  ROUTE COM4 TO HLBW1-CB
          199          RD    1800  0.0250   0.015       0    TRAP      14       0
                       *

          200          KKHLBW1-CB
          201          BA  0.1171
          202          PB    3.22
          203          LS       0    95.4
          204          UD   0.187
                       *
```

REF.

BASINS

```
205          KK    COM5
206          KM  COMBINE RCOM4 & HLBW1-CB
207          HC       2
             *

208          KK   RCOM5
209          KM  ROUTE COM5 TO WRBW1
210          RD    2000   0.050   0.015       0    TRAP      14       0
             *

211          KK    WBAW
212          BA  0.0570
213          PB    3.20
214          LS       0    88.0
215          UD   0.223
             *

216          KK   WRBW1
217          BA  0.3256
218          PB    3.23
219          LS       0    94.8
220          UD   0.239
             *

221          KK    COM6
222          KM  COMBINE RCOM5, WBAW, & WRBW1
223          KM  LAS VEGAS BELTWAY @ WASHBURN ROAD
224          HC       3
             *

225          KK   RCOM6
226          KM  ROUTE COM6 TO CLMDBN
227          RD    1600  0.0050   0.015       0    TRAP      14       0
             *
1                                        HEC-1 INPUT                                                    PAGE  7

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

228          KK  LWBW1C
229          BA  0.0570
230          PB    3.20
231          LS       0    93.5
232          UD   0.114
             *

233          KK   LMDBN
234          BA  0.0237
235          PB    3.18
236          LS       0    84.8
237          UD   0.161
             *

238          KK  CLMDBN
239          KM  COMBINE LMDBN AND RCOM6
240          HC       3
             *

241          KKBOXCANYON
242          BA   3.410
243          PB    3.55
244          LS       0    88.7
245          UD0.326658
             *

246          KK  BOXDET
247          KM  BOX CANYON DETENTION BASIN
248          KM  FACILITY = GOWAN BOX CANYON
249          KM  FACILITY # = GOBX 0118
250          KM  OUTLET = GOBX 0016: 18" RCP
251          RS       1    STOR      -1
252          SV     0.0    35.4    71.5   108.4   146.0   184.3   223.4   263.3   304.0   345.4
253          SV   387.6
254          SE       0       2       4       6       8      10      12      14      16      18
255          SE      20
256          SQ     0.0    10.3    16.6    21.1    24.8    28.0    30.9    33.5    36.0    38.3
257          SQ    40.4
             *

258          KK RBOXDET
259          KM  ROUTE THRU LWBW1A
260          KM  LONE MOUNTAIN
261          RD    7000  0.0647   0.013       0    CIRC     5.5
             *

262          KK  LWBW1A
263          BA  0.2401
264          PB    3.31
265          LS       0    93.5
266          UD   0.198
             *
1                                        HEC-1 INPUT                                                    PAGE  8

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

267          KK UVB1-2A
268          BA  0.2453
269          PB    3.30
270          LS       0    93.3
271          UD   0.174
             *

272          KK  NDIV2A
273          KM  DIVERT 363 CFS FROM UVB1-2A TO PEACEFUL DAWN
274          DT  EDIV2A
275          DI       0     467    5000
276          DQ       0     363     363
             *

277          KKRUVB1-2A
278          RD     700  0.0050   0.016       0    TRAP      80       0
             *
```

```
 279          KK    COM7
 280          KM  COMBINE RBOXDET, LWBW1A, AND RUVB1-2A
 281          HC        3
              *

 282          KK   RCOM7
 283          KM  ROUTE COM7 TO COM8
 284          RD    1000  0.0600   0.016       0    TRAP      80       0
              *

 285          KK UVB1-2B
 286          BA  0.0192
 287          PB    3.23
 288          LS       0    93.3
 289          UD   0.094
              *

 290          KK  LWBW1B
 291          BA  0.0755
 292          PB    3.24
 293          LS       0    93.5
 294          UD   0.143
              *

 295          KK    COM8
 296          KM  COMBINE LWBW1B, RCOM7, UVB1-2B
 297          KM  LAS VEGAS BELTWAY @ LONE MOUNTAIN
 298          HC        3
              *

 299          KK   RCOM8
 300          RD    1300  0.0500   0.015       0    CIRC      5       0
              *
1                                        HEC-1 INPUT                                        PAGE  9

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

 301          KKRETDIV2A
 302          KM  RETRIEVE DIVERSION AT PEACEFUL DAWN
 303          DR  EDIV2A
              *

 304          KK  RDIV2A
 305          KM  ROUTE DIV2A TO CUVB1-2C
 306          RD    1000  0.0700   0.016       0    TRAP      50       0
              *

 307          KK UVB1-2C
 308          BA  0.0323
 309          PB    3.23
 310          LS       0    93.3
 311          UD   0.118
              *

 312          KK   COM10
 313          KM  COMBINE RDIV2A AND UVB1-2C
 314          KM
 315          HC        2
              *

 316          KK    COM9
 317          KM  COMBINE RCOM8 & COM10
 318          HC        2
              *

 319          KK UVB1-1C
 320          BA  0.0185
 321          PB    3.23
 322          LS       0    92.0
 323          UD   0.088
              *

 324          KKRUVB1-1C
 325          KM  ROUTE UVB1-1C TO COM11
 326          RD     900   0.050   0.016       0    TRAP      50       0
              *

 327          KK UVB1-1B
 328          BA  0.0124
 329          PB    3.20
 330          LS       0    91.0
 331          UD   0.080
              *

 332          KK   COM11
 333          KM  COMBINE RUVB1-1C AND UVB1-1B
 334          HC        2
              *
1                                        HEC-1 INPUT                                        PAGE 10

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

 335          KK UVB1-1A
 336          BA  0.2198
 337          PB    3.28
 338          LS       0    92.0
 339          UD   0.147
              *

 340          KKRUVB1-1A
 341          RD    1300   0.040   0.015       0    TRAP      10       0
              *

 342          KK UVB1-1D
 343          BA  0.0355
 344          PB    3.20
 345          LS       0    92.0
 346          UD   0.097
              *

 347          KK   COM12
```

```
 348          KM  COMBINE RUVB1-1A AND UVB1-1D
 349          HC       2
              *

 350          KK  RCOM12
 351          KM  ROUTE COM12 TO COM13
 352          RD    1200   0.042   0.015       0    TRAP      10       0
              *

 353          KK UVB1-1E
 354          BA  0.0280
 355          PB    3.24
 356          LS       0    92.0
 357          UD   0.097
              *

 358          KKRUVB1-1E
 359          RD    2000   0.033   0.015       0    TRAP      10       0
              *

 360          KK   COM13
 361          KM  COMBINE RCOM11, RCOM12, & RUVB1-1E
 362          HC       3
              *

 363          KK    WBCL
 364          BA  0.0312
 365          PB    3.21
 366          LS       0    92.0
 367          UD   0.126
              *
1                                        HEC-1 INPUT                                        PAGE 11

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

 368          KK   LMBW1
 369          BA  0.0841
 370          PB    3.18
 371          LS       0    88.6
 372          UD   0.102
              *

 373          KK   COM14
 374          KM  COMBINE LMBW1, WBCL, RCOM13
 375          HC       3
              *

 376          KK   LMDBS
 377          BA  0.0589
 378          PB    3.20
 379          LS       0    84.8
 380          UD   0.102
              *

 381          KK  CLMDBS
 382          KM  COMBINE COM9, COM10, COM14, & LMDBS
 383          KM  COMBINE INFLOW INTO LONE MOUNTAIN - BELTWAY DETENTION BASIN
 384          HC       3
              *

 385          KKCLMBWCDB
 386          KM  COMBINE CLMDBS & CLMDBN
 387          HC       2
              *

 388          KK LMBWCDB
 389          KM  LONE MOUNTAIN/BELTWAY DETENTION BASINS (COMBINED)
 390          KM  ROUTE COMBINED INFLOWS TO OUTFALL IN BALANCING CONDUIT
 391          KM  DUAL LEVEL OUTFALL WITH LOWER LEVEL (BELOW ELEVATION 2730)
 392          KM  23" ORIFICE AND SECOND LEVEL (ABOVE ELEVATION 2730) 26" ORIFICE
 393          KM  OUTFALL PEAK OUTFLOW OF 168 CFS AT ELEVATION 2738
 394          RS       1    STOR      -1
 395          SV     0.0     7.4    29.8    81.0   150.8   233.1   352.9   493.7   585.4   617.3
 396          SQ     0.0    26.9    37.8    46.1    53.2    59.4    65.0   114.0   118.8   120.3
 397          SE    2699    2705    2710    2715    2720    2725    2730    2735    2738    2739
              *

 398          KK    WBLM
 399          BA  0.0805
 400          PB    3.17
 401          LS       0    90.0
 402          UD   0.190
              *
1                                        HEC-1 INPUT                                        PAGE 12

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

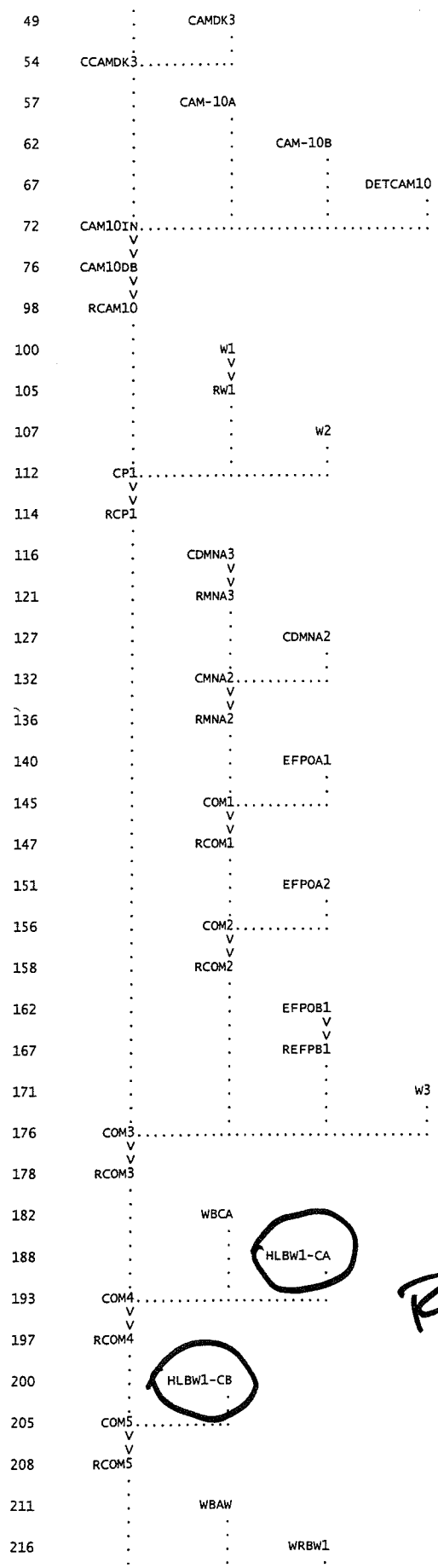
 403          KK   COM15
 404          KM  COMBINE WBLM & LMBWCDB
 405          HC       2
              *

 406          KK RLMBWDB
 407          KM  ROUTE LMBWDB TO LMBW2-C
 408          KM  FACILITY = GOWAN BELTWAY WEST
 409          KM  FACILITY # = GOBW 0000
 410          KM  LINING = RCP
 411          RD    2700   0.019   0.013       0    TRAP       5       0
              *
 412          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

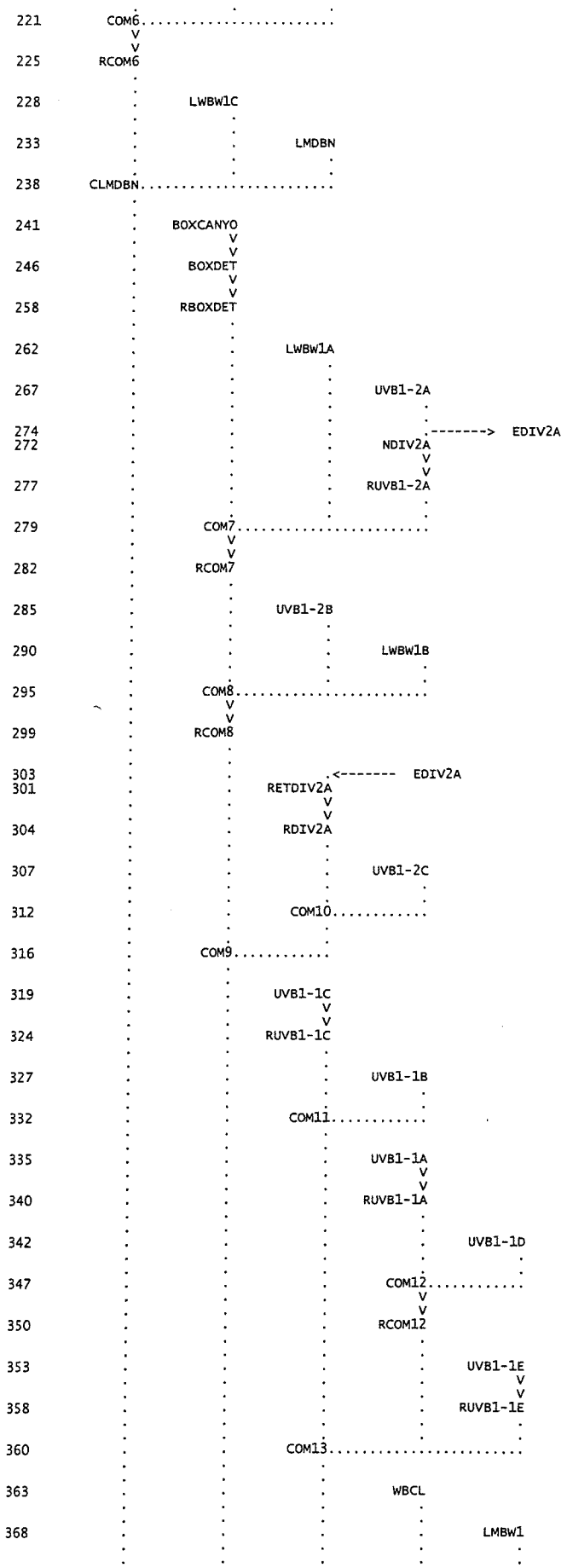
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

     29     CAMDK2
              V
              V
     43     RCAMDK2
              .
```



REFERENCED BASINS


221 COM6
225 RCOM6
228 LWBW1C
233 LMDBN
238 CLMDBN
241 BOXCANYO
246 BOXDET
258 RBOXDET
262 LWBW1A
267 UVB1-2A
274 EDIV2A
272 NDIV2A
277 RUVB1-2A
279 COM7
282 RCOM7
285 UVB1-2B
290 LWBW1B
295 COM8
299 RCOM8
303 EDIV2A
301 RETDIV2A
304 RDIV2A
307 UVB1-2C
312 COM10
316 COM9
319 UVB1-1C
324 RUVB1-1C
327 UVB1-1B
332 COM11
335 UVB1-1A
340 RUVB1-1A
342 UVB1-1D
347 COM12
350 RCOM12
353 UVB1-1E
358 RUVB1-1E
360 COM13
363 WBCL
368 LMBW1

```
  373          .           .       COM14.....................
               .           .           .
  376          .           .           .       LMDBS
               .           .           .         .
               .           .           .         .
  381          .       CLMDBS.....................
               .           .
               .           .
  385     CLMBWCDB.........
               V
               V
  388      LMBWCDB
               .
               .
  398          .         WBLM
               .           .
               .           .
  403        COM15.........
               V
               V
  406      RLMBWDB

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   28MAY08  TIME  09:06:52  *
*                                      *
****************************************

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

LONE MOUNTAIN/WESTERN BELTWAY DETENTION BASINS
DRAINAGE IMPACT IN ULTIMATE CONDITION DEVELOPMENT
DRAFT 2007 MPU WAS USED AS REFERENCED HYDROLOGIC MODEL
INPUT FILE = WBMOD1-SDN3.H1
LAST MODIFIED = 05/13/08
DESIGN STORM = 100-YEAR 6-HOUR STORM
STORM DISTRIBUTION = SDN3
MODELED BY = JTL/JYL/MGK
JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

                                  AREA     DARF
                                  SQ. MI.
                                  0-0.5    0.99
                                  0.5-1    0.975
                                  1-2      0.95
                                  2-3      0.925
                                  3-4      0.915
                                  4-5      0.908
                                  5-6      0.903
                                  6-7      0.895
                                  7-8      0.885

              JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

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

    IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        500  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2   0  ENDING DATE
                    NDTIME       1735  ENDING TIME
                     ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE   41.58 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       .98       .95       .93       .92       .91       .90       .89       .88

WARNING --- ROUTED OUTFLOW (     40.) IS GREATER THAN MAXIMUM OUTFLOW (     40.) IN STORAGE-OUTFLOW TABLE

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WARNING --- ROUTED OUTFLOW (     42.) IS GREATER THAN MAXIMUM OUTFLOW (     40.) IN STORAGE-OUTFLOW TABLE

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WARNING --- ROUTED OUTFLOW (121.) IS GREATER THAN MAXIMUM OUTFLOW (120.) IN STORAGE-OUTFLOW TABLE
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HYDROGRAPH AT	CAMDK2	.34	1	FLOW	558.	547.	531.	514.	507.	502.	499.	494.	487.
				TIME	3.58	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RCAMDK2	.34	1	FLOW	556.	546.	529.	512.	505.	501.	496.	492.	485.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	CAMDK3	.32	1	FLOW	531.	521.	504.	487.	480.	475.	472.	466.	459.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	CCAMDK3	.65	1	FLOW	1065.	1045.	1012.	979.	966.	957.	949.	940.	926.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	CAM-10A	1.27	1	FLOW	2377.	2337.	2270.	2204.	2177.	2158.	2145.	2123.	2097.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	CAM-10B	1.81	1	FLOW	3106.	3049.	2953.	2857.	2819.	2792.	2773.	2742.	2704.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	DETCAM10	.05	1	FLOW	77.	75.	73.	70.	69.	68.	67.	67.	66.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
4 COMBINED AT	CAM10IN	3.77	1	FLOW	6621.	6502.	6303.	6104.	6024.	5968.	5929.	5865.	5785.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	CAM10DB	3.77	1	FLOW	1585.	1346.	648.	159.	158.	157.	156.	155.	154.
				TIME	4.92	5.00	5.25	5.67	5.67	5.67	5.67	5.67	5.67
			** PEAK STAGES IN FEET **										
			1	STAGE	3000.20	3000.16	3000.07	2999.74	2999.43	2999.22	2999.06	2998.82	2998.51
				TIME	4.92	5.00	5.25	5.67	5.67	5.67	5.67	5.67	5.67
ROUTED TO	RCAM10	3.77	1	FLOW	1299.	1124.	636.	159.	158.	157.	156.	155.	154.
				TIME	5.00	5.08	5.25	5.67	5.67	5.67	5.67	5.67	5.67
HYDROGRAPH AT	W1	.15	1	FLOW	268.	264.	256.	248.	245.	243.	242.	239.	236.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RW1	.15	1	FLOW	260.	254.	248.	241.	237.	235.	233.	232.	229.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	W2	.17	1	FLOW	331.	325.	315.	306.	302.	300.	298.	295.	291.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	CP1	4.09	1	FLOW	1398.	1201.	677.	638.	631.	626.	622.	616.	609.
				TIME	5.00	5.08	5.25	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RCP1	4.09	1	FLOW	1385.	1191.	663.	632.	625.	620.	616.	610.	603.
				TIME	5.00	5.08	5.25	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	CDMNA3	.30	1	FLOW	505.	496.	482.	468.	463.	459.	456.	452.	446.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RMNA3	.30	1	FLOW	498.	490.	476.	462.	456.	453.	449.	446.	440.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	CDMNA2	.13	1	FLOW	218.	214.	207.	201.	198.	196.	195.	193.	190.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	CMNA2	.43	1	FLOW	702.	691.	671.	650.	643.	638.	633.	627.	619.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RMNA2	.43	1	FLOW	698.	687.	667.	646.	639.	634.	629.	623.	615.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	EFPOA1	.14	1	FLOW	264.	259.	251.	243.	240.	237.	236.	233.	230.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	COM1	.57	1	FLOW	916.	900.	872.	845.	835.	828.	821.	814.	803.
				TIME	3.58	3.58	3.67	3.58	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RCOM1	.57	1	FLOW	913.	898.	871.	844.	834.	827.	821.	813.	803.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	EFPOA2	.13	1	FLOW	239.	234.	227.	220.	217.	215.	213.	211.	208.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	COM2	.70	1	FLOW	1135.	1114.	1081.	1046.	1032.	1023.	1016.	1005.	990.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RCOM2	.70	1	FLOW	1113.	1093.	1061.	1027.	1014.	1007.	999.	988.	976.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	EFPOB1	.07	1	FLOW	116.	114.	110.	107.	105.	104.	103.	102.	101.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	REFPB1	.07	1	FLOW	114.	111.	108.	104.	103.	102.	101.	100.	99.

FOR COM3, COM4, COM5, COM6, CLMDBN, COM7, COM8, COM9, CLMDBS
SEE SDN3 MODEL #2

				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	W3	.31	1	FLOW	630.	620.	603.	586.	579.	574.	571.	565.	558.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ COMBINED AT	COM3	5.17	1	FLOW	2525.	2482.	2409.	2336.	2308.	2287.	2274.	2250.	2221.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RCOM3	5.17	1	FLOW	2496.	2452.	2382.	2308.	2281.	2258.	2246.	2222.	2195.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	WBCA	.06	1	FLOW	80.	79.	76.	74.	73.	72.	72.	71.	70.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
HYDROGRAPH AT	HLBW1-CA	.39	1	FLOW	673.	662.	644.	625.	618.	612.	609.	603.	595.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT	COM4	5.62	1	FLOW	3186.	3130.	3043.	2953.	2916.	2893.	2874.	2846.	2810.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RCOM4	5.62	1	FLOW	3184.	3128.	3041.	2950.	2914.	2890.	2871.	2843.	2808.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	HLBW1-CB	.12	1	FLOW	222.	218.	212.	206.	203.	201.	200.	198.	196.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	COM5	5.74	1	FLOW	3390.	3330.	3237.	3141.	3103.	3078.	3057.	3028.	2990.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RCOM5	5.74	1	FLOW	3385.	3327.	3233.	3138.	3098.	3073.	3053.	3023.	2986.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	WBAW	.06	1	FLOW	80.	78.	75.	73.	72.	71.	70.	69.	68.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	WRBW1	.33	1	FLOW	554.	545.	529.	513.	507.	503.	500.	495.	489.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT	COM6	6.12	1	FLOW	4019.	3950.	3837.	3724.	3677.	3647.	3624.	3587.	3543.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	RCOM6	6.12	1	FLOW	4004.	3933.	3824.	3709.	3660.	3629.	3607.	3570.	3530.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	LWBW1C	.06	1	FLOW	113.	111.	108.	104.	103.	102.	101.	100.	99.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	LMDBN	.02	1	FLOW	33.	33.	31.	30.	30.	29.	29.	29.	28.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	CLMDBN	6.20	1	FLOW	4114.	4040.	3928.	3809.	3759.	3727.	3705.	3667.	3625.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	BOXCANYO	3.41	1	FLOW	4811.	4716.	4557.	4398.	4334.	4290.	4258.	4207.	4144.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO	BOXDET	3.41	1	FLOW	42.	41.	41.	40.	40.	39.	39.	39.	39.
				TIME	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42
			** PEAK STAGES IN FEET **										
			1	STAGE	21.30	20.89	20.20	19.51	19.24	19.05	18.91	18.69	18.42
				TIME	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42	6.42
ROUTED TO	RBOXDET	3.41	1	FLOW	42.	41.	41.	40.	40.	39.	39.	39.	39.
				TIME	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
HYDROGRAPH AT	LWBW1A	.24	1	FLOW	436.	429.	416.	403.	398.	394.	392.	388.	383.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	UVB1-2A	.25	1	FLOW	467.	459.	445.	432.	426.	422.	420.	415.	410.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
DIVERSION TO	EDIV2A	.25	1	FLOW	363.	357.	346.	335.	331.	328.	326.	323.	318.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	NDIV2A	.25	1	FLOW	104.	102.	99.	96.	95.	94.	93.	92.	91.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RUVB1-2A	.25	1	FLOW	99.	97.	94.	91.	91.	90.	89.	88.	87.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT	COM7	3.90	1	FLOW	553.	542.	526.	510.	504.	500.	496.	490.	485.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RCOM7	3.90	1	FLOW	540.	529.	513.	498.	493.	488.	485.	480.	474.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67

REF. ULT. BASIN Q100

HYDROGRAPH AT	UVB1-2B	.02	1	FLOW	41.	40.	39.	38.	37.	37.	37.	37.	36.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
'DROGRAPH AT	LWBW1B	.08	1	FLOW	149.	146.	142.	138.	136.	135.	134.	132.	131.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	COM8	3.99	1	FLOW	724.	711.	690.	668.	660.	654.	649.	642.	634.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RCOM8	3.99	1	FLOW	712.	700.	679.	657.	649.	643.	638.	631.	623.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	RETDIV2A	.00	1	FLOW	363.	357.	346.	335.	331.	328.	326.	323.	318.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RDIV2A	.00	1	FLOW	356.	350.	339.	329.	324.	321.	320.	316.	312.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	UVB1-2C	.03	1	FLOW	64.	63.	61.	59.	58.	58.	57.	57.	56.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	COM10	.03	1	FLOW	420.	412.	400.	388.	383.	379.	377.	373.	368.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	COM9	4.02	1	FLOW	1132.	1112.	1079.	1044.	1031.	1022.	1015.	1004.	991.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	UVB1-1C	.02	1	FLOW	39.	38.	37.	36.	36.	35.	35.	35.	34.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
ROUTED TO	RUVB1-1C	.02	1	FLOW	36.	35.	34.	33.	33.	33.	32.	32.	31.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	UVB1-1B	.01	1	FLOW	26.	25.	25.	24.	23.	23.	23.	23.	23.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	COM11	.03	1	FLOW	62.	61.	59.	57.	56.	56.	55.	55.	54.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	UVB1-1A	.22	1	FLOW	421.	413.	401.	388.	383.	379.	377.	373.	368.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
JUTED TO	RUVB1-1A	.22	1	FLOW	417.	409.	396.	384.	379.	375.	373.	369.	363.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	UVB1-1D	.04	1	FLOW	72.	71.	68.	66.	65.	65.	64.	64.	63.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	COM12	.26	1	FLOW	482.	473.	459.	444.	438.	434.	431.	426.	420.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RCOM12	.26	1	FLOW	478.	470.	455.	440.	434.	431.	428.	423.	417.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	UVB1-1E	.03	1	FLOW	58.	56.	55.	53.	52.	52.	51.	51.	50.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
ROUTED TO	RUVB1-1E	.03	1	FLOW	55.	53.	52.	51.	49.	49.	49.	48.	48.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	COM13	.31	1	FLOW	590.	578.	560.	543.	535.	531.	528.	521.	514.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	WBCL	.03	1	FLOW	59.	58.	56.	55.	54.	53.	53.	53.	52.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	LMBW1	.08	1	FLOW	149.	146.	141.	135.	133.	132.	131.	129.	127.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
3 COMBINED AT	COM14	.43	1	FLOW	790.	775.	751.	727.	716.	710.	706.	697.	688.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	LMDBS	.06	1	FLOW	91.	89.	86.	82.	81.	80.	79.	78.	77.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
3 COMBINED AT	CLMDBS	4.51	1	FLOW	2010.	1973.	1912.	1851.	1826.	1810.	1798.	1777.	1753.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	CLMBWCDB	10.72	1	FLOW	5976.	5868.	5694.	5516.	5442.	5389.	5356.	5298.	5235.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	LMBWCDB	10.72	1	FLOW	122.	121.	120.	118.	118.	118.	117.	117.	117.
				TIME	41.50	41.58	41.50	41.50	41.50	41.58	41.42	41.42	41.33

** PEAK STAGES IN FEET **

1	STAGE	2739.95	2739.41	2738.53	2737.75	2737.49	2737.31	2737.19	2736.99	2736.74

				TIME	41.58	41.58	41.58	41.58	41.58	41.58	41.58	41.50	41.50
HYDROGRAPH AT	WBLM	.08	1	FLOW	127.	125.	121.	116.	115.	114.	113.	111.	110.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	COM15	10.80	1	FLOW	184.	181.	176.	171.	170.	168.	167.	166.	164.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RLMBWDB	10.80	1	FLOW	181.	178.	174.	169.	167.	166.	165.	164.	162.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.54	559.87	217.41	2.40	5.00	556.45	220.00	2.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4322E+02 EXCESS= .0000E+00 OUTFLOW= .4322E+02 BASIN STORAGE= .6644E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.55	549.26	218.56	2.36	5.00	545.72	220.00	2.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4238E+02 EXCESS= .0000E+00 OUTFLOW= .4238E+02 BASIN STORAGE= .5757E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.56	532.39	217.39	2.28	5.00	529.37	220.00	2.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4098E+02 EXCESS= .0000E+00 OUTFLOW= .4098E+02 BASIN STORAGE= .6592E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.58	516.14	217.82	2.20	5.00	512.01	220.00	2.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3958E+02 EXCESS= .0000E+00 OUTFLOW= .3959E+02 BASIN STORAGE= .5628E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.58	508.27	218.65	2.17	5.00	505.24	220.00	2.17

ONTINUITY SUMMARY (AC-FT) - INFLOW= .3903E+02 EXCESS= .0000E+00 OUTFLOW= .3903E+02 BASIN STORAGE= .5563E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.59	504.08	217.64	2.15	5.00	500.84	220.00	2.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3863E+02 EXCESS= .0000E+00 OUTFLOW= .3864E+02 BASIN STORAGE= .5899E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.59	501.61	218.06	2.13	5.00	496.44	220.00	2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3837E+02 EXCESS= .0000E+00 OUTFLOW= .3837E+02 BASIN STORAGE= .6686E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.60	494.36	218.74	2.11	5.00	491.87	220.00	2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3791E+02 EXCESS= .0000E+00 OUTFLOW= .3791E+02 BASIN STORAGE= .6880E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAMDK2	MANE	1.60	489.03	218.00	2.08	5.00	484.55	220.00	2.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3736E+02 EXCESS= .0000E+00 OUTFLOW= .3736E+02 BASIN STORAGE= .6767E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAM10	MANE	1.68	1501.81	297.45	2.14	5.00	1299.42	300.00	2.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4312E+03 EXCESS= .0000E+00 OUTFLOW= .4308E+03 BASIN STORAGE= .3910E+00 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAM10	MANE	1.74	1281.15	302.12	2.09	5.00	1123.50	305.00	2.09

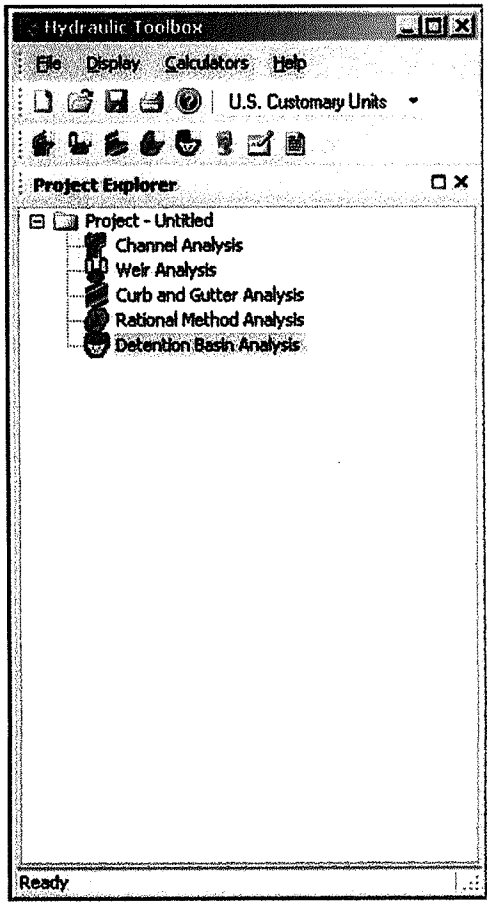
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4214E+03 EXCESS= .0000E+00 OUTFLOW= .4210E+03 BASIN STORAGE= .3910E+00 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAM10	MANE	2.01	644.08	313.57	2.01	5.00	636.29	315.00	2.01

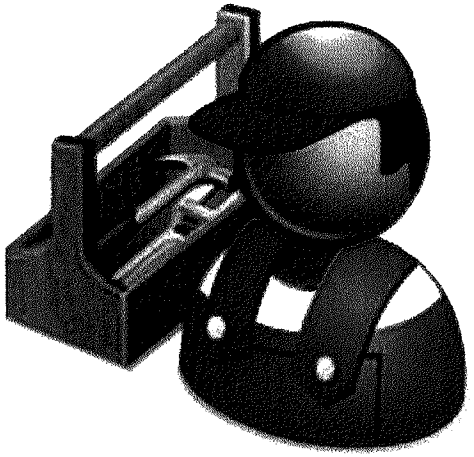
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4054E+03 EXCESS= .0000E+00 OUTFLOW= .4050E+03 BASIN STORAGE= .3909E+00 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RCAM10	MANE	2.66	159.26	340.61	1.94	5.00	159.25	340.00	1.95

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3919E+03 EXCESS= .0000E+00 OUTFLOW= .3915E+03 BASIN STORAGE= .3895E+00 PERCENT ERROR= .0



FHWA Hydraulic Toolbox Version 1.0 Desktop Reference Guide



Reference Guide Version 1.0.0

Introduction



The FHWA Hydraulic Toolbox Program is a stand alone suite of calculators that performs routine hydrologic and hydraulic computations. The Hydraulic Toolbox significantly extends the basic functionality of the historic version of the FHWA DOS Hydraulic Toolbox and Visual Urban Programs. The program allows a user to perform and save hydraulic calculations in one project file, analyze multiple scenarios, and create plots and reports of these analyses. The computations can be carried out in either CU or SI units.

Five calculators are available for project analysis:

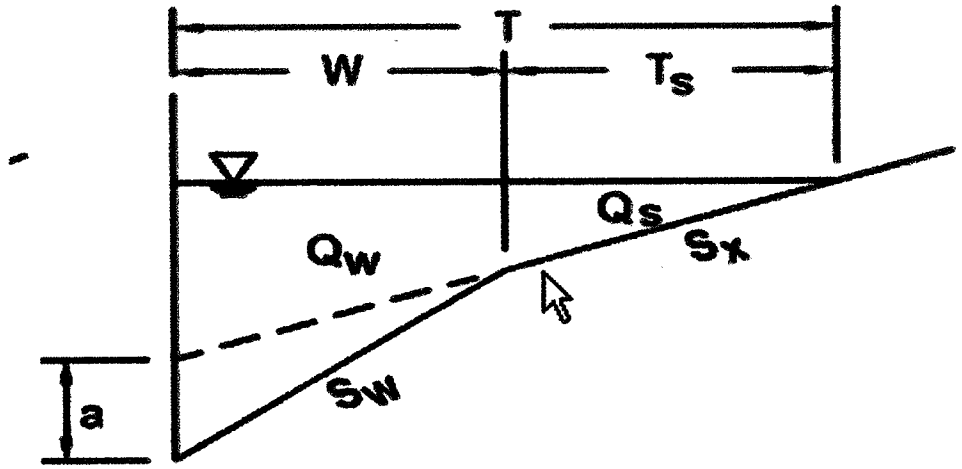
1. Channel Analysis
2. Weir Analysis
3. Rational Method Hydrologic Analysis
4. Detention Basin Analysis
5. Curb and Gutter Analysis

There are modules that save notes and reports with the analysis results. These results can be printed at the user's discretion.

Future versions of the program will have enhancements including improvements to the channel calculator (latest stable channel lining design technology from HEC-15), various riprap size calculators, enhanced reporting and plotting, and other new features.

Curb And Gutter Calculator

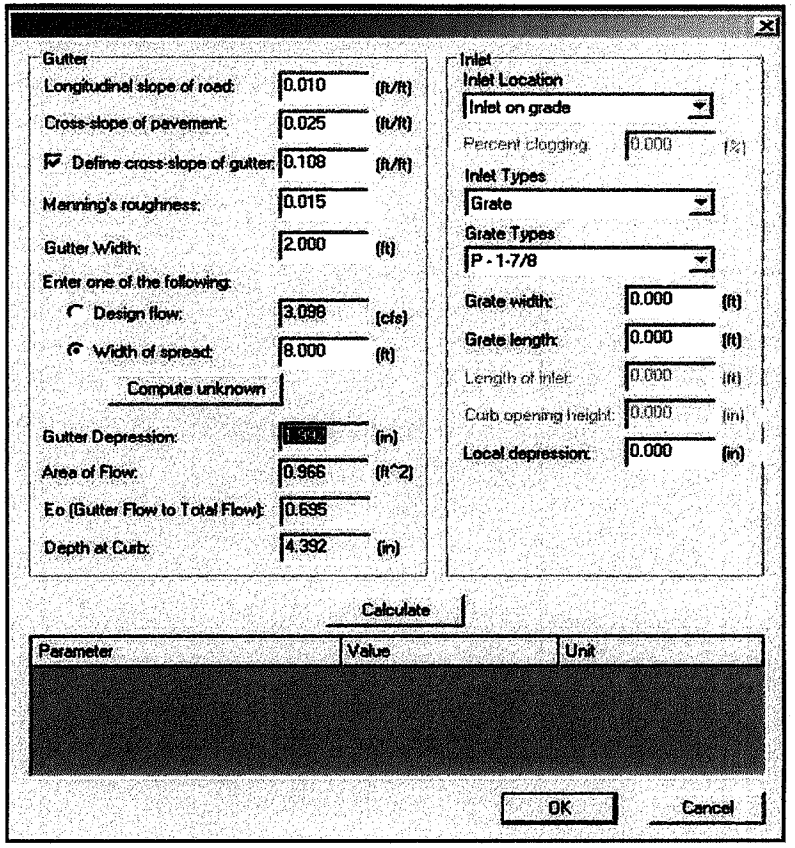
The **Curb and Gutter Calculator** can handle uniform or compound gutters. The curb and gutter analysis allows the user to calculate the design flow or the width of spread. If the gutter cross slope, S_w, is different than that of the pavement cross slope, S_x, the user defines the gutter cross section slope, S_w, by selecting the "Define cross-slope of gutter" box and entering the slope. Once the governing discharge or width of spread is entered and the compute unknown button is selected, the gutter depression value ("a" for compound gutter) along with the area of flow, percent of flow in the gutter, E_o, and depth of flow at the curb face will automatically be calculated and displayed.



Compound Gutter Cross Slope

Curb and Gutter Calculator

The **Curb and Gutter Calculator** also has a separate inlet capacity calculator on the right hand side of the screen. It allows the user to define the inlet location, type, size, and whether there is an added local depression at the inlet. In sag locations the user can also specify percent clogging which will reduce the inlet perimeter and open area accordingly. Once the variables are entered, the "Calculate" button is selected and the results are shown in a table in the bottom window.



Curb and Gutter Calculator

Curb and Gutter Calculator

The inlet capacity calculator contains five inlet types:

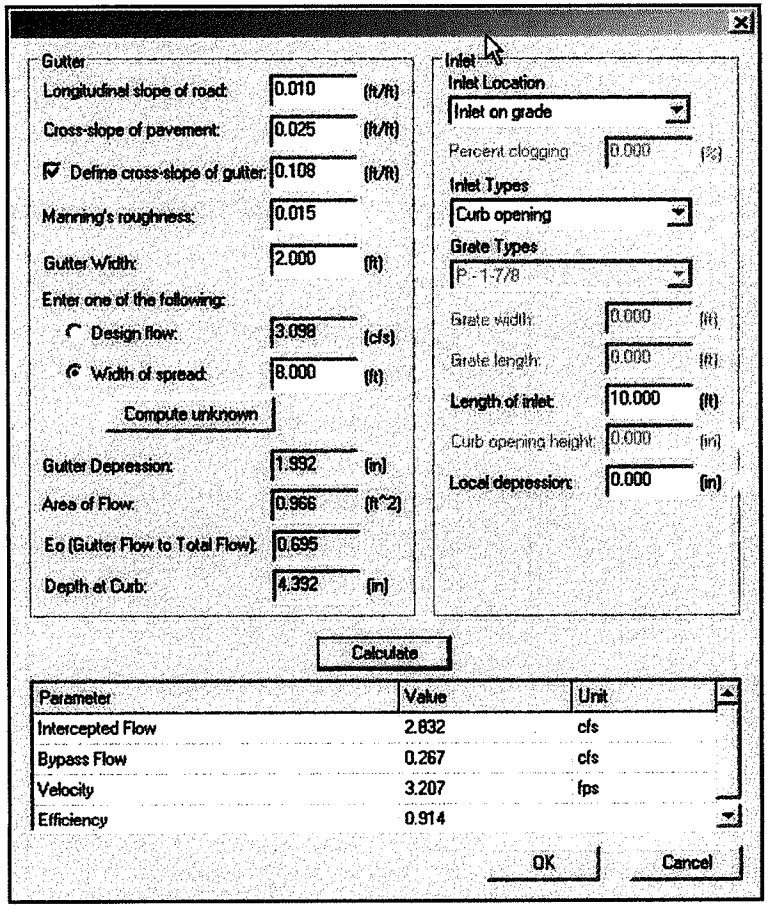
- Grate Only (P-1-7/8, P-1-7/8-4, P-1-1/8, Curved Vane, 45 Degree Tilt Bar 2-1/4", 45 Degree Tilt Bar 3-1/4", 30 Degree Tilt bar, Reticuline)
- Curb Opening
- Slotted Drain
- Sweeper Combination
- Equal Length Combination

Typical computed results for on-grade inlets include:

- Area of Flow
- Intercepted Flow
- Bypass Flow
- Velocity
- Splash-over Velocity
- Efficiency

Typical computed results for inlets in sags include:

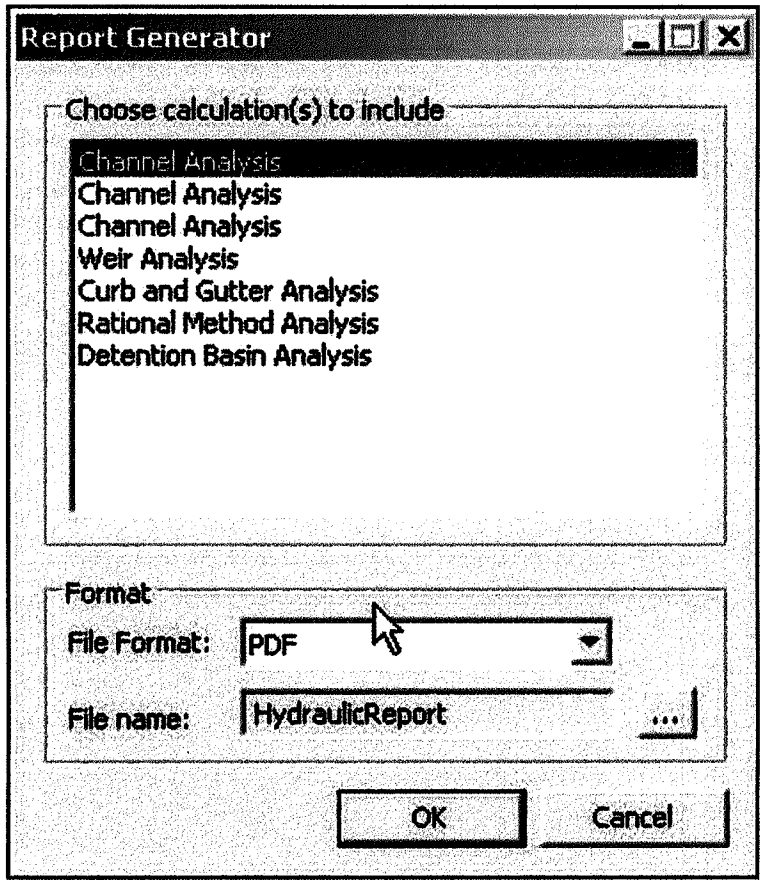
- Flow Type
- Effective Perimeter (accounting for clogging)
- Effective Area (accounting for clogging)
- Depth at Curb Face
- Width of Spread



Gutter and Inlet

Report Generation

The **Report Generator**, is used to create a report summarizing the hydraulic computations in your project. To create a report you click on "Calculators" and select "Create Report" from the drop down menu. Alternatively, you can select the "Create Report" icon located on the macro bar. You will be asked to save the report, give it a name and specify which analyses will be used to create the report. Select the analysis, the file type, and the location to save the report. You may save the report as a Rich Text File, RTF, or as a Adobe Acrobat PDF file. The Rich Text File format is easily imported in word processing software.



References



S.A. Brown, S.M. Stein, J.C. Warner 2001. "Urban Drainage Design Manual." Hydraulic Engineering Circular No. 22, FHWA-NHI-01-021, July.
http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hec/hec22.pdf



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http://www.nws.noaa.gov/oh/hdsc/currentpf.htm

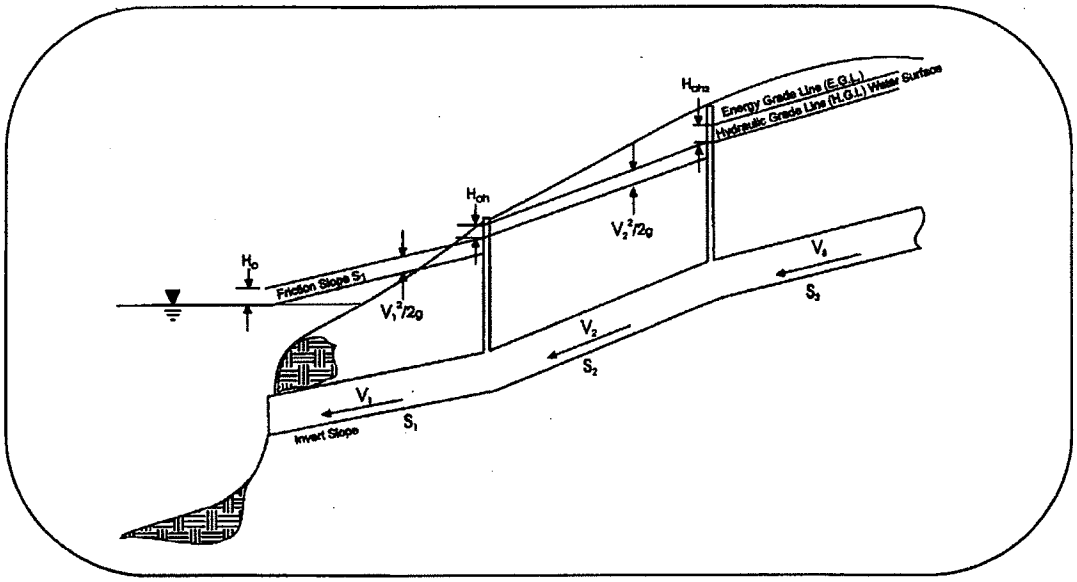
Publication No. FHWA-NHI-10-009
September 2009

U.S. Department
of Transportation

Federal Highway Administration

Hydraulic Engineering Circular No. 22, Third Edition

URBAN DRAINAGE DESIGN MANUAL



NATIONAL HIGHWAY INSTITUTE

Training Solutions for Transportation Excellence



Figure 4-16. Sweeper combination inlet.

Example 4-10

Given: *A combination curb-opening grate inlet with a 3 m (9.8 ft) curb opening, 0.6 m by 0.6 m (2 ft by 2 ft) curved vane grate placed adjacent to the downstream 0.6 m (2 ft) of the curb opening. This inlet is located in a gutter section having the following characteristics:*

W	=	*0.6 m (2 ft)*
Q	=	*0.05 m^3/s (1.77 ft^3/s)*
S_L	=	*0.01 m/m (ft/ft)*
S_x	=	*0.02 m/m (ft/ft)*
S_W	=	*0.062 m/m (ft/ft)*
n	=	*0.016*

Find: *Interception capacity, Q_i*

When slotted drains are used to capture overland flow, research has indicated that with water depths ranging from 9.7 mm (0.38 in) to 14.2 mm (0.56 in) the 25, 44, and 63 mm (1, 1.75 and 2.5 in) wide slots can accommodate 0.0007 $m^3/s/m$ (0.025 $ft^3/s/ft$) with no splash over for slopes from 0.005 to 0.09 m/m (ft/ft).

At a test system capacity of 0.0011 $m^3/s/m$ (0.40 $ft^3/s/ft$), a small amount of splash over occurred.

4.4.4.4. Combination Inlets

The interception capacity of a combination inlet consisting of a curb opening and grate placed side-by-side, as shown in Figure 4-15, is no greater than that of the grate alone. Capacity is computed by neglecting the curb opening. A combination inlet is sometimes used with a part of the curb opening placed upstream of the grate as illustrated in Figure 4-16. The curb opening in such an installation intercepts debris which might otherwise clog the grate and is called a "sweeper" inlet. A sweeper combination inlet has an interception capacity equal to the sum of the curb opening upstream of the grate plus the grate capacity, except that the frontal flow and thus the interception capacity of the grate is reduced by interception by the curb opening.

The following example illustrate computation of the interception capacity of a combination curb-opening grate inlet with a portion of the curb opening upstream of the grate.

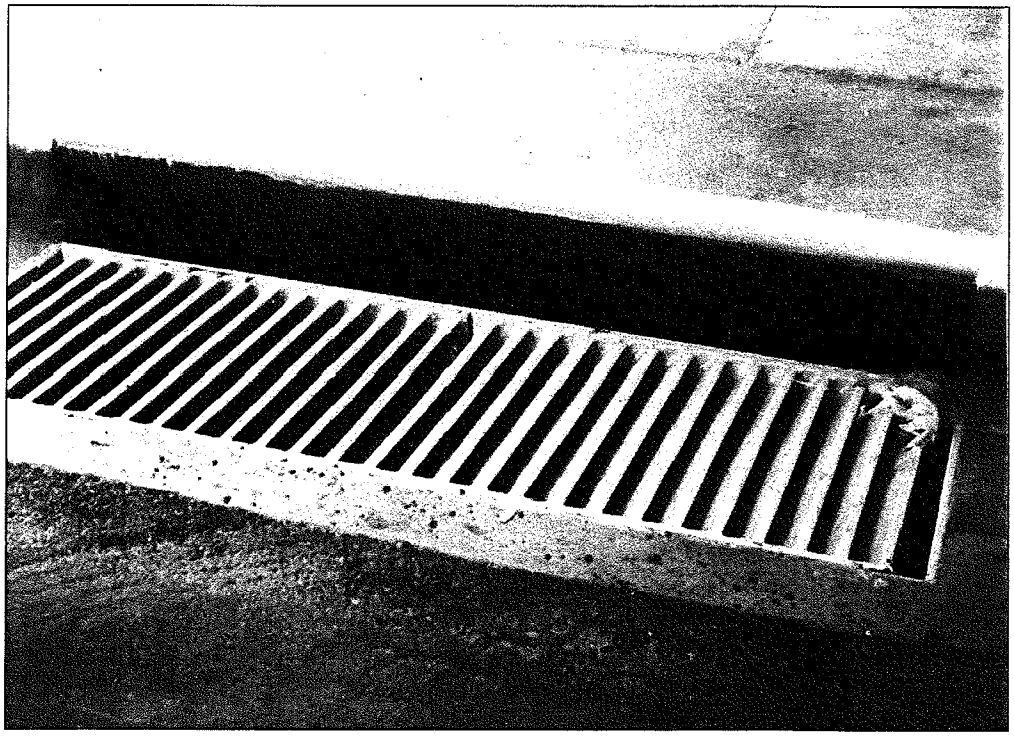
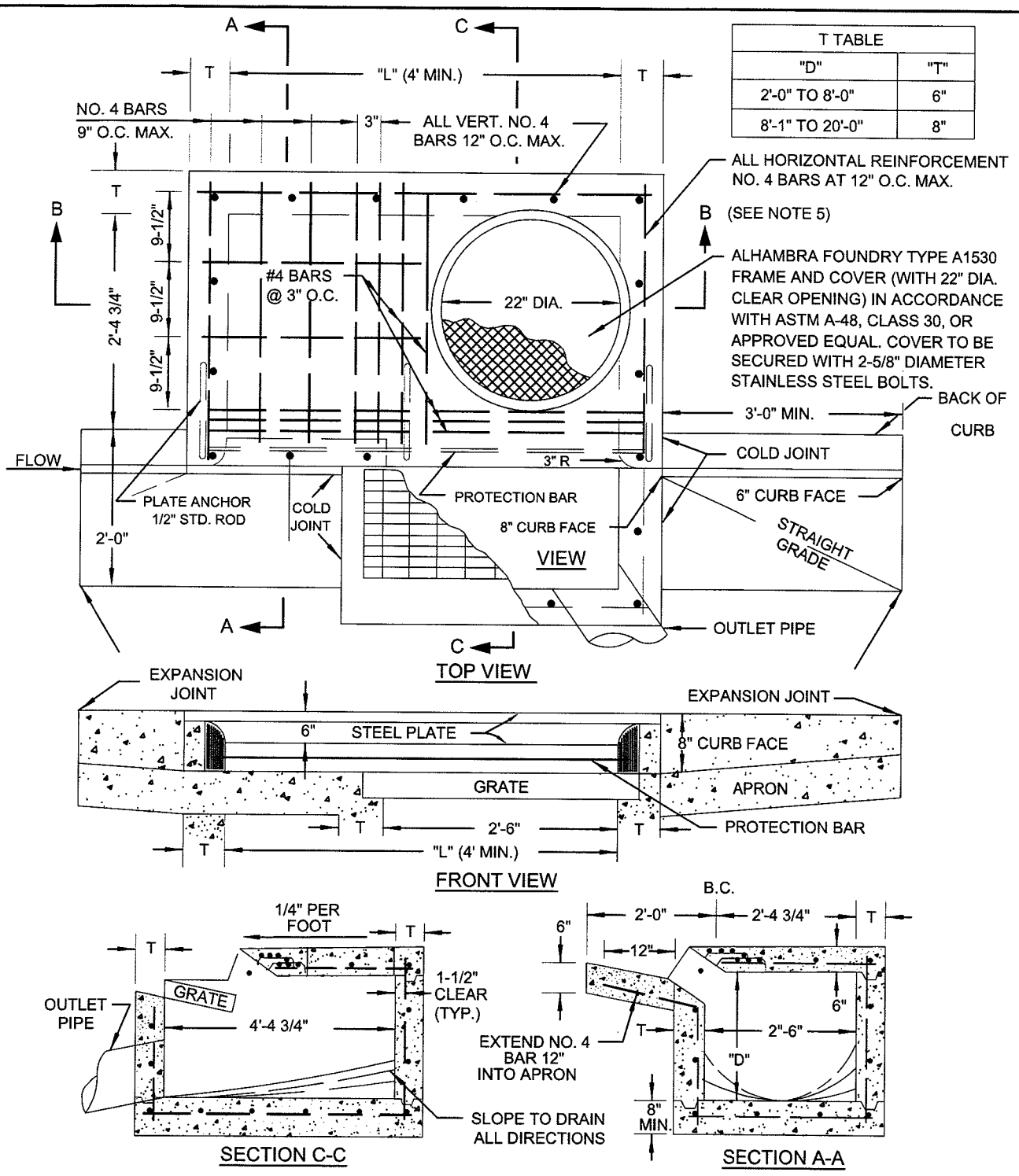


Figure 4-15. Combination curb-opening, 45 degree tilt-bar grate inlet.



T TABLE	
"D"	"T"
2'-0" TO 8'-0"	6"
8'-1" TO 20'-0"	8"

NOTES:

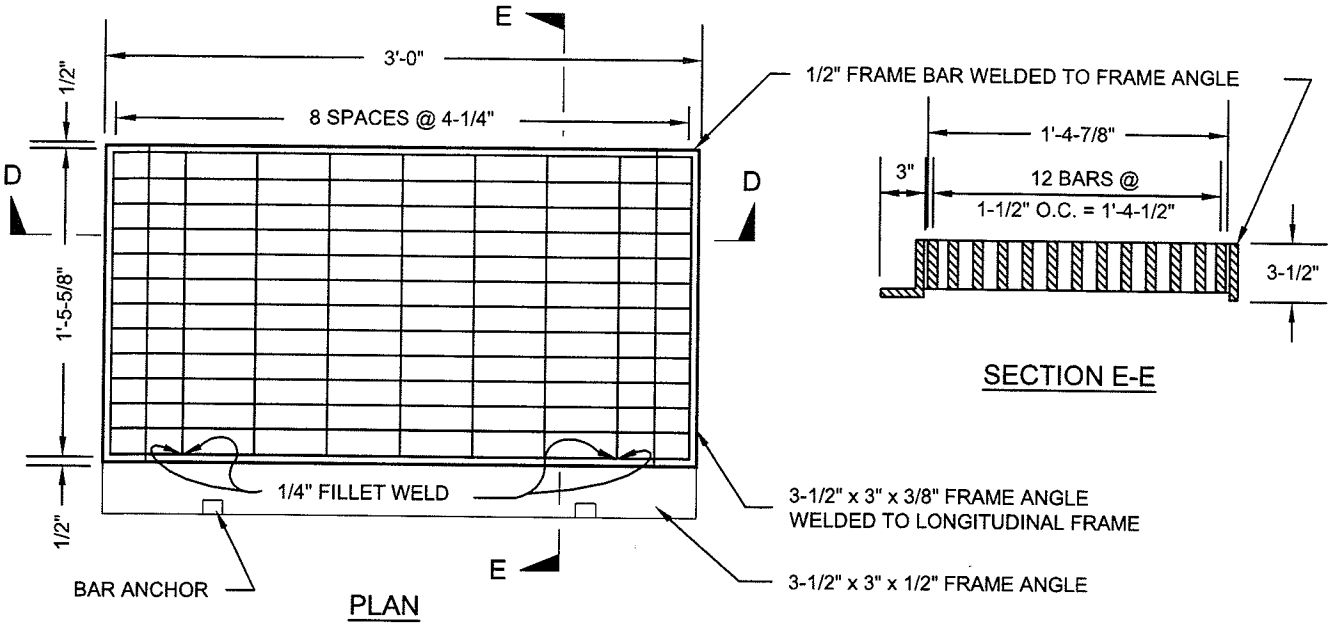
1. DEPTH "D" TO BE SHOWN ON PLANS.
2. OUTLET PIPE SIZE TO BE SHOWN ON PLANS.
3. WHEN LENGTH "L" EXCEEDS 4'-0" SUPPORT BOLTS REQUIRED, SEE STANDARD DRAWING NO. 418.
4. FOR GRATE DETAIL SEE STANDARD DRAWING NO. 417.
5. SECTION B-B IS OPTIONAL FOR INLETS WHERE L > 7'-0" AND D > 5'-0", SEE STANDARD DRAWING NO. 415.

SPECIFICATION REFERENCE	
501	CONCRETE
502	CONCRETE STRUCTURES
505	REINFORCING STEEL
713	STEEL

UNIFORM STANDARD DRAWINGS
CLARK COUNTY AREA

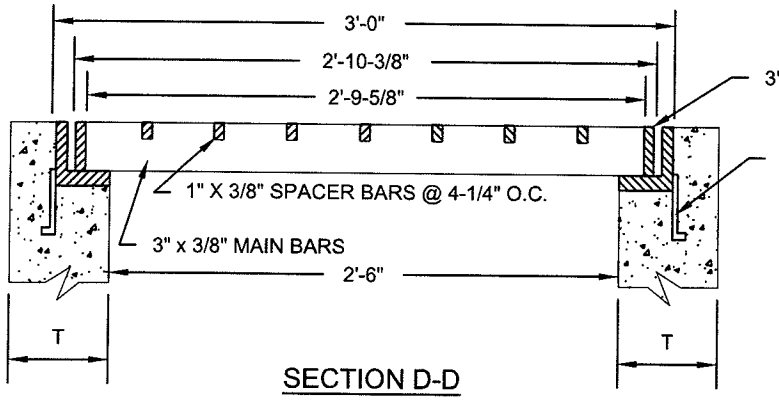
DROP INLET TYPE "C"

DATE 4-11-02	DWG. NO. 413	PAGE NO: 113



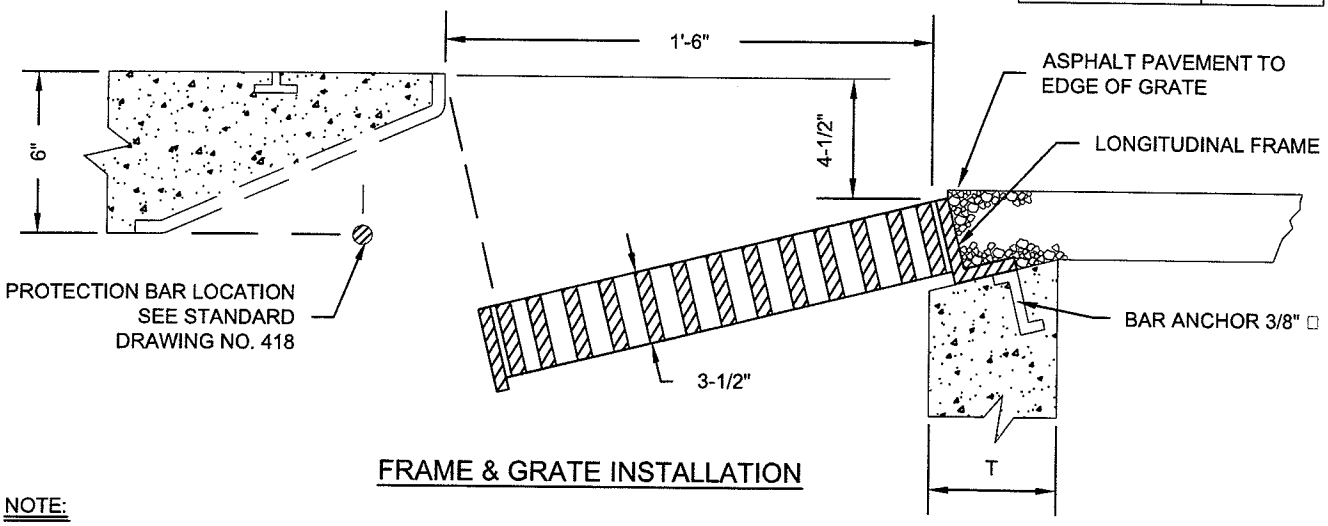
SECTION E-E

PLAN



SECTION D-D

APPROXIMATE WEIGHT	
FRAME	78 LBS.
GRATE	157 LBS.
TOTAL	235 LBS.



FRAME & GRATE INSTALLATION

NOTE:

ALL EXPOSED METAL PARTS SHALL BE GALVANIZED AND ALL GALVANIZING DAMAGED BY FABRICATION OR INSTALLATION SHALL RECEIVE TWO COATS OF ALUMINUM PAINT (GALVONOX OR EQUAL).

SPECIFICATION REFERENCE	
712	MISCELLANEOUS METAL
714	PAINT
715	GALVANIZING

UNIFORM STANDARD DRAWINGS
CLARK COUNTY AREA

DROP INLET
FRAME AND GRATE

DATE 10-14-99	DWG. NO. 417	PAGE 117

Appendix E: Agency Development Conditions

PLANNING & DEVELOPMENT

PLANNING & DEVELOPMENT DEPARTMENT

STATEMENT OF FINANCIAL INTEREST

Case Number: **SDR-38557** APN: 126-36-201-002 (a portion of)

Name of Property Owner: USA

Name of Applicant: Clark County School District

Name of Representative: KGA Architecture - Nathan Goodman

To the best of your knowledge, does the Mayor or any member of the City Council or Planning Commission have any financial interest in this or any other property with the property owner, applicant, the property owner or applicant's general or limited partners, or an officer of their corporation or limited liability company?

☐ **Yes** ☒ **No**

If yes, please indicate the member of the City Council or Planning Commission who is involved and list the name(s) of the person or persons with whom the City Official holds an interest. Also list the Assessor's Parcel Number if the property in which the interest is held is different from the case parcel.

City Official: _____

Partner(s): _____ _____

APN: _____

Signature of Property Owner: _____

Print Name: Jeff Weiler

Subscribed and sworn before me

This 16th day of June, 2010

_____

Notary Public in and for said County and State

PATRICIA A. O'GARA
Notary Public State of Nevada
No. 07-2982-1
My appt. exp. May 4, 2011

PLANNING & DEVELOPMENT DEPARTMENT

APPLICATION / PETITION FORM

Application/Petition For: Site Development Plan Review

Project Address (Location) SW corner of Ann Road and 215 Beltway

Project Name CCSD NW Transportation Facility **Proposed Use** Transport. Facility

Assessor's Parcel #(s) 126-36-201-002 (a portion of) **Ward #** 6

General Plan: existing PF proposed PF **Zoning:** existing C-V proposed C-V

Commercial Square Footage 41,000 **Floor Area Ratio** 1:39.5

Gross Acres 131.7 (40.8) **Lots/Units** n/a **Density** n/a

Additional Information

PROPERTY OWNER USA **Contact**

Address **Phone:** **Fax:**

City **State** **Zip**

E-mail Address

APPLICANT Clark County School District **Contact** Linda Perri

Address 4190 Mcleod Drive **Phone:** (702) 799-5214 **Fax:**

City Las Vegas **State** NV **Zip** 89121

E-mail Address lkperri@interact.ccsd.net

REPRESENTATIVE KGA Architecture **Contact** Nathan Goodman

Address 9075 West Diablo Drive, 3rd Floor **Phone:** (702) 367-6900 **Fax:** (702) 367-2043

City Las Vegas **State** NV **Zip** 89148

E-mail Address NGoodman@KGAarchitecture.com

Property Owner Signature* J. K. Weller

*An authorized agent may sign in lieu of the property owner for Final Maps, Tentative Maps, and Parcel Maps.

Print Name JEFF WELLER

Subscribed and sworn before me

This 14th day of JUNE, 2010.

Patricia A. O'Gara

Notary Public in and for said County and State

PATRICIA A. O'GARA
Notary Public State of Nevada
No. 07-2982-1
My appt. exp. May 4, 2011

FOR DEPARTMENT USE ONLY

Case #	SDR-38557
Meeting Date:	07/29/10
Total Fee:	$ 1030.00
Date Received:*	06/14/10
Received By:	JONATHAN B.

*The application will not be deemed complete until the submitted materials have been reviewed by the Planning and Development Department for consistency with applicable sections of the Zoning Ordinance.

Revised 10/27/08

SDR 38557
Clark County School District

SWC Ann Rd & CC 215

Proposed 509 bay bus yard.

Traffic produced by proposed development:

Existing Use	DESCRIPTION	#UNIT	RATE/# UNIT	TOTAL
Average Daily Traffic (ADT)	BUS YARD*	509	4.00	2,036
AM Peak Hour			1.00	509
PM Peak Hour			1.00	255

Proposed Increase	DESCRIPTION	#UNIT	RATE/# UNIT	TOTAL
Average Daily Traffic (ADT)	GENERAL OFFICE BUILDING [1000 SF]	12.485	11.01	137
AM Peak Hour			1.55	19
PM Peak Hour			1.49	19

Project Total	DESCRIPTION	#UNIT	RATE/# UNIT	TOTAL
Average Daily Traffic (ADT)	BUS YARD*	509	#N/A	2,173
AM Peak Hour			#N/A	528
PM Peak Hour			#N/A	273

Existing traffic on all nearby streets:

Ann Rd	
Average Daily Traffic (ADT)	2,200
PM Peak Hour (heaviest 60 minutes)	176

CC 215	
Average Daily Traffic (ADT)	26,188
PM Peak Hour (heaviest 60 minutes)	2,095

Traffic Capacity of adjacent streets:

	Adjacent Street ADT Capacity
Ann Rd	16,900
CC 215	34,500

This project is expected to add 2,173 trips per day on Ann Rd. and CC 215. This will increase traffic on Ann Rd. by about 99 percent, and on CC 215 by about 9 percent. Currently, Ann is at about 13 percent of capacity and CC215 is at about 76 percent of capacity.

Based on Peak Hour use, this development will about 528 additional cars into the area in the peak hour, or about nine every minute.

*Not from Trip Generation Manual

Note that this report assumes all traffic from this development uses all named streets.

City of Las Vegas

AGENDA MEMO

PLANNING COMMISSION MEETING DATE: JULY 29, 2010
DEPARTMENT: PLANNING AND DEVELOPMENT
ITEM DESCRIPTION: APPLICANT: CLARK COUNTY SCHOOL DISTRICT - OWNER: UNITED STATES OF AMERICA

** STAFF RECOMMENDATION(S) **

CASE NUMBER	RECOMMENDATION	REQUIRED FOR APPROVAL
VAR-38553	Staff recommends APPROVAL, subject to conditions:	
SDR-38557	Staff recommends APPROVAL, subject to conditions:	VAR-38553

** CONDITIONS **

VAR-38553 CONDITIONS

Planning and Development

1. Approval of and conformance to the Conditions of Approval for Site Development Plan Review (SDR-38557) shall be required, if approved.

2. This approval shall be void two years from the date of final approval, unless a building permit has been issued for new construction. An Extension of Time may be filed for consideration by the City of Las Vegas.

3. Prior to occupancy, all necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Building and Safety Department.

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

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

SDR-38557 CONDITIONS

Planning and Development

1. Approval of and conformance to the Conditions of Approval for Variance (VAR-38553) shall be required, if approved.

2. This approval shall be void two years from the date of final approval, unless a building permit has been issued for the principal building on the site. An Extension of Time may be filed for consideration by the City of Las Vegas.

3. All development shall be in conformance with the site plans and landscape plan date stamped 07/09/10, and building elevations date stamped 06/14/10, except as amended by conditions herein.

4. An Exception from Title 19.10.010 is hereby approved, to allow 114 parking lot trees where 128 trees are required.

5. Prior to occupancy, all necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Building and Safety Department.

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

7. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, and shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications.

8. Reflective glazing at the pedestrian level is prohibited. Glazing above the pedestrian level shall be limited to a maximum reflectance rating of 22% (as defined by the National Institute of Standards and Technology).

9. All utility boxes exceeding 27 cubic feet in size shall meet the standards of LVMC Title 19.12.040.

10. Parking lot lighting standards shall be no more than 30 feet in height and shall utilize downward-directed lights with full cut-off luminaries. Lighting on the exterior of buildings shall be shielded and shall be downward-directed. Non-residential property lighting shall be directed away from residential property or screened, and shall not create

fugitive lighting on adjacent properties.

SS

11. A Master Sign Plan shall be submitted for approval by the City of Las Vegas prior to the issuance of a Certificate of Occupancy for any building on the site and prior to the issuance of any sign permits.

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

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

Public Works

14. Coordinate with the City of Las Vegas Right-of-Way Section of the Department of Public Works to determine all materials and information needed to submit an application to the Bureau of Land Management (BLM) for an appropriate Right-of-Way Grant Easement for Washburn Road, Alpine Ridge, Hammer Lane, and Cliff Shadows Parkway, including those portions required for the appropriate geometric connection of this site to Ann Road, prior to the issuance of any permits..

15. Construct half street improvements including appropriate overpaving, where legally able, on Washburn Road, Alpine Ridge, Hammer Lane, and Cliff Shadows Parkway adjacent to this site concurrent with development of this site. Provide a minimum of two lanes of paved, legal access to this site prior to occupancy of this development. Extend all required underground utilities, such as electrical, telephone, etc., located within public rights-of-way, past the boundaries of this site prior to construction of hard surfacing (asphalt or concrete).

16. Coordinate with the property owner of Assessor Parcel Number #126-36-301-001 and the BLM to determine the final disposition of the existing truck haul route adjacent to this site with respect to the roadway designs proposed for this Site. Provide written documentation that this property owner and/or the BLM agrees with the final geometric design of the roadways shown on the Approved Site Plan prior to the issuance of permits for this Site. Once it is determined what portions of the truck haul route must be modified to accommodate the roadways being designed for this Site, coordinate the final geometric traffic control and roadway design with the Traffic Engineering Section of the Department of Public Works.

17. Coordinate with the Collection System Planning Section of the Department of Public Works to determine an appropriate location for public sewer connection to this site, prior to the issuance of any permits. Provide public sewer easements for all public sewers not located within existing public street right-of-way prior to the issuance of any permits. Improvement Drawings submitted to the City for review shall not be approved for construction until all required public sewer easements necessary to connect this site to the existing public sewer system have been granted to the City.

18. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits, submittal of any construction drawings or the submittal of a Map subdividing this site, whichever may occur first. Provide and improve all drainageways recommended in the approved drainage plan/study. The developer of this site shall be responsible to construct such neighborhood or local drainage facility improvements as are recommended by the City of Las Vegas Neighborhood Drainage Studies and approved Drainage Plan/Study concurrent with development of this site.

19. A Traffic Impact Analysis must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits, submittal of any construction drawings. Comply with the recommendations of the approved Traffic Impact Analysis prior to occupancy of the site. The Traffic Impact Analysis shall also include a section addressing Standard Drawings #234.1 #234.2 and #234.3 to determine additional right-of-way requirements for bus turnouts adjacent to this site, if any; dedicate all areas recommended by the approved Traffic Impact Analysis. All additional rights of way required by Standard Drawing #201.1 for exclusive right turn lanes and dual left turn lanes shall be dedicated prior to or concurrent with the commencement of on site development activities unless specifically noted as not required in the approved Traffic Impact Analysis. If additional rights of way are not required and Traffic Control devices are or may be proposed at this site outside of the public right of way, all necessary easements for the location and/or access of such devices shall be granted prior to the issuance of permits for this site. Phased compliance will be allowed if recommended by the approved Traffic Impact Analysis. No recommendation of the approved Traffic Impact Analysis, nor compliance therewith, shall be deemed to modify or eliminate any condition of approval imposed by the Planning Commission or the City Council on the development of this site.

** STAFF REPORT **

PROJECT DESCRIPTION

The subject site, which is currently undeveloped, is located on 37.20 acres of federally owned property at the northwest corner of Alpine Ridge Way and Washburn Road. A 41,000 square-foot bus maintenance facility with 12,574 square feet of administrative office space, a 5,740 square-foot fuel canopy and a 3,344 square-foot bus wash is proposed to provide a localized hub for storage and maintenance of public school vehicles in this area of the city. The maintenance building is proposed to contain 17 bus maintenance bays, a lounge and restroom facilities for bus drivers. The site as proposed is compatible with adjacent development, and the severe grade of the area justifies the use of higher perimeter walls. Staff therefore recommends approval. If denied, the project as proposed cannot be constructed and a new site design and review would be necessary.

ISSUES

- Approval of a Variance to allow perimeter retaining and screening walls that exceed the heights established by Title 19.12 is required prior to approval of a Site Development Plan Review for the Transit Yard facility.
- Per Title 19.14.130 a Master Sign Plan is required for signage on the site. The Master Sign Plan shall be approved prior to issuance of sign permits and a Certificate of Occupancy for any building on the site.
- The proposed bus maintenance bays face eastward toward Clark County 215. However, they will be screened by parked buses and a series of retaining and screening walls along the east perimeter.
- Along the south and west perimeters of the development, chain link fencing materials are proposed. Staff does not support use of these materials and instead recommends wrought iron fencing.

BACKGROUND INFORMATION

Related Relevant City Actions by P&D, Fire, Bldg., etc	
05/16/07	The City Council adopted an ordinance authorizing the Annexation (ANX-10156) of approximately 246 acres generally located west of Clark County 215, north of Washburn Road, south of Centennial Parkway and east of Puli Road. The Planning Commission and staff recommended approval. The annexation became effective on 05/24/07.

01/24/08	The Planning Commission accepted the city's request to withdraw without prejudice a request for a Site Development Plan Review (SDR-25627) for a proposed public facility campus, including a public park, on 131.7 acres at the southwest corner of Ann Road and Clark County 215 (Bruce Woodbury Beltway). Staff had recommended approval.
08/20/08	The City Council approved a request to amend the Centennial Hills Sector Plan of the General Plan from PCD (Planned Community Development) to PF (Public Facilities) on 131.7 acres at the southwest corner of Ann Road and Clark County 215 (GPA-25625). The Planning Commission and staff recommended approval.
08/20/08	The City Council approved a Rezoning (ZON-25626) from U (Undeveloped) [PCD (Planned Community Development) General Plan Designation] to C-V (Civic) on 131.7 acres at the southwest corner of Ann Road and Clark County 215. The Planning Commission and staff recommended approval.

Most Recent Change of Ownership
There has not been a change in ownership on this site.

Related Building Permits/Business Licenses
No permits or business licenses have been issued on the subject site.

Pre-Application Meeting
A pre-application meeting was not held for the proposed project. A previous meeting was held 09/16/09 in which a similar plan was presented.

Neighborhood Meeting
A neighborhood meeting is not required, nor was one held.

Field Check	
06/24/10	A field check was conducted on the subject property. The following items were noted: • The site is undeveloped and free of trash and debris. • Alpine Ridge Way and Washburn Road are unimproved adjacent to the proposed site.

Details of Application Request	
Site Area	
Gross Acres	40.80 (a portion of a 131.70-acre lot)
Net Acres	37.20

Surrounding Property	*Existing Land Use Per Title 19.04*	*Planned or Special Land Use Designation*	*Existing Zoning District*
Subject Property	Undeveloped	PF (Public Facilities)	C-V (Civic)
North	Undeveloped	PCD (Planned Community Development)	U (Undeveloped)
	Undeveloped	PF (Public Facilities)	C-V (Civic)
South	Mining, Sand and Gravel Excavation	PCD (Planned Community Development)	R-U (Rural Open Land – Clark County Designation)
East	Undeveloped	PF (Public Facilities)	C-V (Civic)
West	Undeveloped	PF (Public Facilities)	C-V (Civic)

Master Plan Areas	*Yes*	*No*	*Compliance*
Master Plan Area		X	N/A
Special Purpose and Overlay Districts	***Yes***	***No***	***Compliance***
Special Purpose and Overlay Districts			
C-V (Civic) District	X		Y
Trails		X	N/A
Rural Preservation Overlay District		X	N/A
Las Vegas Redevelopment Plan Area		X	N/A
Development Impact Notification Assessment		X	N/A
Project of Regional Significance		X	N/A

DEVELOPMENT STANDARDS

Pursuant to Title 19.06, minimum development standards for C-V zoned properties shall be established by the Planning Commission or City Council in connection with the approval of a Site Development Plan. The following standards are proposed through the submitted site development plan:

Standard	***Provided***
Min. Lot Size	131.70 acres
Min. Lot Width	1,320 Feet
Min. Setbacks • Front (Hammer Lane) • Side • Corner (Alpine Ridge Way) • Rear	 180 Feet 373 Feet 721 Feet 487 Feet
Min. Distance Between Buildings	185 Feet
Max. Lot Coverage	0.87%
Max. Building Height	32 Feet
Max. Building Height – Fuel Canopy	19 Feet
Trash Enclosure	Walled, gated, roofed
Mech. Equipment	Screened

Pursuant to Title 19.12, the following landscape standards apply to the subject proposal:

Landscaping and Open Space Standards				
Standards	***Required***		***Provided***	***Compliance***
	Ratio	***Trees***		
Buffer Trees: • North • South • East • West	 1 Tree / 30 Linear Feet 1 Tree / 30 Linear Feet 1 Tree / 30 Linear Feet 1 Tree / 30 Linear Feet	 34 Trees 37 Trees 67 Trees 32 Trees	 92 Trees 55 Trees 95 Trees 54 Trees	 Y Y Y Y
TOTAL PERIMETER TREES		**241 Trees**	**296 Trees**	**Y**
Parking Area Trees	1 Tree / 6 Uncovered Spaces, plus 1 tree at the end of each row of spaces	128 Trees	114 Trees	N

SS

LANDSCAPE BUFFER WIDTHS			
Min. Zone Width • North • South • East • West	 15 Feet 15 Feet 15 Feet 15 Feet	 29 Feet 29 Feet 29 Feet 29 Feet	 Y Y Y Y
Wall Height	Max. six-foot retaining Max. combined 12 feet retaining and screening	Max. 11-foot retaining; combined 14 feet	N

Pursuant to Title 19.10, the following parking standards apply:

Parking Requirement							
	Gross Floor Area or Number of Units	***Required Parking***			***Provided Parking***		***Compliance***
Use		***Parking Ratio***	Regular	Handi-capped	Regular	Handi-capped	
Rail/Transit Yard or Shop	500 employees	1 space per em-ployee on largest shift	500				
Office	12,485 SF	1 space per 300 SF GFA	42				
TOTAL SPACES REQUIRED			**542**		562		Y
TOTAL (With Handicapped)			531	11	548	14	Y
Bus Parking			N/A	N/A	509	0	N/A

Exceptions		
Requirement	***Request***	***Staff Recommendation***
Title 19.10.010 – 128 parking lot trees	114 trees	Approval

ANALYSIS

A Transit Yard is defined by Title 19.20 as a facility or area for the maintenance, repair or storage of bus, rail or other transit vehicles. The proposed facility will provide a hub for storage and maintenance of the applicant's fleet of school buses. Title 19.06.020 permits education-related uses within the C-V (Civic) Zoning District. Development standards for projects within a C-V zone are determined on a case-by-case basis with the approval of a site development plan. Title 19 does not specify additional use requirements for a Transit Yard.

The design and layout of the proposed Transit Yard is compatible with adjacent development, which includes an existing Mining, Sand and Gravel Excavation site to the south, federally-owned open land to the west and east, and undeveloped private land to the north. The natural grade across the site decreases an average of 5.6 percent from west to east and about 2.1 percent from south to north. This has created the need to retain backfill along the north and east perimeter to maintain a consistent grade and provide adequate drainage. As a result, retaining walls of up to 11 feet in height as measured from the low side of the wall and combined screening and retaining wall heights of a maximum of 14 feet are proposed. These dimensions do not meet Title 19.12 wall standards; however, an attempt has been made to soften the impact of the grade difference by terracing the walls and providing an 11-foot landscaped buffer between the walls. These walls also have an added advantage of screening the property from views from Clark County 215 eastward. Because of the excessive grade and the location of the site away from sensitive properties, the variance request is justified and can be supported. Along a portion of the south and the west perimeter, an eight-foot tall chain link fence is proposed. Although chain link may be approved as part of an overall site development plan, staff does not support the use of this material for fencing and instead recommends wrought iron. Although these portions of the property do not face sensitive uses and are partially screened by landscaping, they still are located along 80-foot rights-of-way and will be visible by passersby. Staff recommends approval of the overall site based on the compatibility of the use and development with the surrounding area and its mitigation of potentially major effects to existing and future development in the area.

Currently, only Alpine Ridge Way and Washburn Road exist in unimproved condition adjacent to this site. Additional streets are proposed along the north and west boundaries of the project that will tie into Ann Road. The Department of Public Works will require Bureau of Land Management right-of-way grant easements and appropriate half-street improvements for new streets as conditions of approval of this review. The city of Las Vegas will pursue an amendment to the Master Plan of Streets and Highways to recognize and classify adjacent streets at a future date as part of a larger request.

The proposal includes 562 parking spaces for bus drivers, maintenance and administrative staff, sufficient to satisfy Title 19.04 requirements for parking. Initially, 509 parking spaces for buses are proposed, with space for an additional 94 spaces available if needed in the future. With regard to landscaping, the project conforms to all perimeter buffer requirements. Although the minimum number of parking lot trees are not proposed to be located within the confines of the maintenance building parking lot, additional trees not required along the west perimeter of the property will provide adequate shade and buffering benefits to this area.

Because the site exceeds 15 acres in size, a Master Sign Plan detailing on-premise signage locations and specifications will be required under separate application. The sign plan shall be approved prior to issuance of sign permits and a Certificate of Occupancy for any building on the site.

FINDINGS (VAR-38553)

In accordance with the provisions of Title 19.18.070(B), Planning Commission and City Council, in considering the merits of a Variance request, shall not grant a Variance in order to:

1. Permit a use in a zoning district in which the use is not allowed;
2. Vary any minimum spacing requirement between uses;
3. Relieve a hardship which is solely personal, self-created or financial in nature."

Additionally, Title 19.18.070(L) states:

> "Where by reason of exceptional narrowness, shallowness, or shape of a specific piece of property at the time of enactment of the regulation, or by reason of exceptional topographic conditions or other extraordinary and exceptional situation or condition of the piece of property, the strict application of any zoning regulation would result in peculiar and exceptional practical difficulties to, or exceptional and undue hardships upon, the owner of the property, a variance from that strict application may be granted so as to relieve the difficulties or hardship, if the relief may be granted without substantial detriment to the public good, without substantial impairment of affected natural resources and without substantially impairing the intent and purpose of any ordinance or resolution."

A true hardship has been demonstrated in this case as a result of the severe natural grade in this location. The visual impact of the higher walls will be mitigated by use of perimeter landscaping directly in front of the walls. A Variance to allow walls that exceed Title 19 requirements can therefore be supported by staff.

FINDINGS (SDR-38557)

In order to approve a Site Development Plan application, per Title 19.18.050 the Planning Commission and/or City Council must affirm the following:

1. **The proposed development is compatible with adjacent development and development in the area;**

   The design and layout of the proposed Transit Yard is compatible with adjacent development, which includes an existing Mining, Sand and Gravel Excavation site to the south, federally-owned open land to the west and east, and undeveloped private land to the north.

2. **The proposed development is consistent with the General Plan, this Title, the Design Standards Manual, the Landscape, Wall and Buffer Standards, and other duly-adopted city plans, policies and standards;**

   With approval of a variance to allow perimeter wall heights to exceed Title 19 allowances, the proposed development is consistent with Title 19. Staff does not support the use of chain link fencing on a portion of the perimeter, but instead recommends wrought iron materials. The General Plan and zoning designations of the property were previously amended to allow for public uses such as the one proposed for this site.

3. **Site access and circulation do not negatively impact adjacent roadways or neighborhood traffic;**

   Access to the site will be provided by gated driveways along Cliff Shadows Parkway, a proposed 80-foot right-of way. Restricted ingress and egress for school buses will be provided from Washburn Road, an existing 80-foot right-of-way, Hammer Lane, a proposed 60-foot right-of-way and Cliff Shadows Parkway. Ann Road will collect commuting bus traffic to and from the site. The project's location in a largely undeveloped area near a primary arterial and Clark County 215 will reduce the potential for negative impacts to traffic in the vicinity.

4. **Building and landscape materials are appropriate for the area and for the City;**

   Landscape materials consist of desert-tolerant evergreen and shade trees that will provide shading, screening and cooling effects to mitigate the extensive amount of paved surfaces proposed. Building materials are typical for commercial and industrial uses and meet Title 19.08 standard requirements.

5. **Building elevations, design characteristics and other architectural and aesthetic features are not unsightly, undesirable, or obnoxious in appearance; create an orderly and aesthetically pleasing environment; and are harmonious and compatible with development in the area;**

   Building elevations contain adequate articulation and variation in color and material to provide an aesthetically pleasing environment. Maintenance bays will be screened from views from adjacent streets by landscaping, decorative perimeter walls, and parked buses.

6. **Appropriate measures are taken to secure and protect the public health, safety and general welfare.**

   Development of the proposed Transit Yard will be subject to permit review and inspection for conformance to approved plans as appropriate, thereby protecting the public health, safety and welfare.

NEIGHBORHOOD ASSOCIATIONS NOTIFIED	3
NOTICES MAILED	6,956
APPROVALS	15
PROTESTS	37

Jon Hayslip GRADE DIFFERENTIAL EMAIL

From: Vernon Harkins
Sent: Monday, November 15, 2010 9:53 AM
To: Jon Hayslip
Subject: RE: CCSD NW Trans Zoning

Met with McDermott, Anderson, Welch and the adjacent owner to the south. the first three about three times and the adjacent owner once.

During one of the initial meetings (at BLM) LRN presented a schematic grading plan to all attendees. At said meeting LRN staff presented their reasoning for the cut within the right of way. The reasons for the cut were due to the existing slope and vertical elevation difference (100 vertical feet from the SW to the NE) and to reduce the amount of retaining walls. Shortly after the meeting schematic grading plans were sent to CLV for review. Two more meetings were held at CLV. At the last meeting a representative from the gravel pit owner was in attendance. The purpose of said meeting was to obtain any comments or objections to the proposed grading of the CCSD site. The owner representative had no objections to the proposed grading. In addition, CLV staff did not have any objections to the proposed grading. An updated copy of the grading plans were submitted to CLV for review and comment. As of the writing of this letter no response or comments have been received from CLV.

Vernon R. Harkins, P.E.
Senior Project Manager
L. R. NELSON CONSULTING ENGINEERS, INC.
6765 WEST RUSSELL ROAD, SUITE 200
LAS VEGAS, NEVADA 89118
Phone: 702.798.7978
Direct Line: 702.940.4305
Cell: 702.406.6690
Fax: 702.451.2296
vern.harkins@lrneng.com

From: Jon Hayslip
Sent: Monday, November 15, 2010 9:33 AM
To: Vernon Harkins
Subject: CCSD NW Trans Zoning

Can you give the Cliff Notes version regarding the grade lowering at the intersection of Washburn/Cliff Shadows for the CLV Standard Form 2 & TDS. I know you were working w/Bart Anderson and need to provide some background for the site.

Jon Hayslip, P.E., CFM
Flood Control Manager
L. R. NELSON CONSULTING ENGINEERS, INC.
6765 WEST RUSSELL ROAD, SUITE 200
LAS VEGAS, NEVADA 89118
Phone: 702-798-7978
Fax: 702-451-2296
jon.hayslip@lrneng.com

Albert Sung

From: Robert Welch
Sent: Monday, January 10, 2011 2:49 PM
To: Albert Sung
Subject: FW: Grading of CCSD Bus Yard
Attachments: 4649_001.pdf

Albert,

On January 6, 2011, there was a meeting regarding the CCSD Bus Yard. This meeting was with CLV Real Estate. We were requesting their input on the proposed grading associated with the project. Rebecca Rury and Robin Yoakum both believed that the CCSD would need a Free Use Permit (FUP) and update their Environmental Assessment (EA). Rebecca then comments below that BLM would most likely require a Right-of-Way Grant for the proposed scarping to the West of Cliff Shadows Parkway.

Please set up a meeting with LR Nelson to discuss.

Thanks,

Rob.

-----Original Message-----
From: rrury@blm.gov [mailto:rrury@blm.gov]
Sent: Thursday, January 06, 2011 4:18 PM
To: Bart Anderson; Robert Welch; Victor Bolanos; Mary A. Wulff
Cc: Robin Yoakum; Rebecca Rury
Subject: Grading of CCSD Bus Yard

As I was driving back to BLM it occurred to me that it is likely BLM will also require a Right-of-Way Grant for the scarping (maybe Short-Term Grant). This is in addition to the EA & FUP. Of course, paying the mitigation fees will be a part of the EA's stipulations.

I do my best thinking in the car apparently...

Rebecca
x6262
515-5087 (BLM)

- THEY HAVE A BLM APP FOR FULL ROW AROUND SITE AND ACCESS ROAD TO ANN.

- THEY HAVE SUBMITTED PLANS TO CCPW.

- GEOTECH WILL NEED TO BE SUBMITTED AS PART OF CIVIL

- THEY WILL LOOK @ 14' OVERPASS.

- THEY WILL DESIGN TRESTLE RAIL.

Washburn : 7'-overpave ok. Land Development,

(Typical : 14' overpave)

Greg, Rob, Rebecca Rury — Set up. Meet to discuss intersection of Shawnee / Washburn.

Bart, Robin Topeka

Victor

PLANNING & DEVELOPMENT
CITY OF LAS VEGAS
Comprehensive Planning

City of Las Vegas

Meeting Attendance Sheet

Page 1 of 1
Date 12/16/10
Time 10:30 (am) pm

Project Name NW Transportation Facility

	Name	Company/Department	Address	
1.	ROB WELCH	CLV FLOOD		Phone 229-2177 Fax
2.	Albert Sung	CLV Flood		Phone 229-2001 Fax
3.	DENNIS Moyer	CLV Land Dev		Phone 229-2002 Fax
4.	Kevin Berg	CLV Land Dev		Phone 229 4837 Fax
5.	Victor Bolanos	CLV TRAFFIC		Phone 229-6901 Fax
6.	BART ANDERSON	CLV DEVCO		Phone 229-2198 Fax
7.	Greg McDermott	CLV PW-Roadway Planning		Phone 229-2143 Fax
8.	JON HAYSLIP	LRN		Phone 798-7978 Fax
9.	VERNON HARRIGINS	LRN		Phone 798-7978 Fax
10.	Doug Rankin	CLV Planning		Phone 229-5408 Fax
11.				Phone Fax
12.				Phone Fax
13.				Phone Fax
14.				Phone Fax
15.				Phone Fax
16.				Phone Fax
17.				Phone Fax

mtg & phone forms;comp plan3;ftr;ce/9-1-98

Public Works | City of Las Vegas

DEVELOPMENT SERVICES CENTER
731 S. Fourth Street
Las Vegas, NV 89101
702-229-6301

MEETING ATTENDANCE SHEET

Date:	1/6
Time:	2:00
Page:	of

	NAME	COMPANY/DEPARTMENT	ADDRESS		
1	ROB WELCH	CLV (Lands)		Phone	2177
				E-Mail	
				Fax	
2	BART ANDERSON	CLV DEVCO		Phone	x2198
				E-Mail	
				Fax	
3	VICTOR BOLANOS	CLV TRAFFIC		Phone	x6901
				E-Mail	
				Fax	
4	Robin Yakum	CLV Real Estate		Phone	x 1022
				E-Mail	
				Fax	
5	Rebecca C-Rupp	CLV Real Estate		Phone	x 6262
				E-Mail	
				Fax	
6	MARY WOLFF	CLV R/W		Phone	X2139
				E-Mail	
				Fax	
7				Phone	
				E-Mail	
				Fax	
8				Phone	
				E-Mail	
				Fax	



L.R. NELSON CONSULTING ENGINEERS

6765 W. RUSSELL RD., SUITE 200
LAS VEGAS, NV 89118
PHONE: (702)798-7978 FAX: (702)451-2296

TRANSMITTAL

DATE: Thursday, November 18, 2010	
TO: Mr. Albert Sung, P.E., Flood Control Project Engineer	
FIRM / AGENCY NAME: **City of Las Vegas** **Department of Public Works** **Development Services Center** **Engineering Planning** **731 S. Fourth Street** **Las Vegas, NV 89101**	
	PROJECT NUMBER: 032-085-092
REFERENCE: Clark County School District Northwest Transportation Facility	
Submitting the following: **1 – City of Las Vegas Inter-Office Memorandum waiving the Review Fee dated August 5, 1998** **1 – Copy of the Technical Drainage Study for the above referenced project**	
SENT BY: Jon Hayslip, P.E.	**Received by:**
	Date:

11/18/10

NOTES

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

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

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

USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

0 50 100 200 400 600 800

MAP LEGEND

AVERAGE QA VALUE 55

PARCEL BOUNDARY
SUBD BOUNDARY
ROAD EASEMENT
PM/LD BOUNDARY
NON-PARCEL LOT LINE
MATCH LINE / LEADER LINE
001 ROAD ID NUMBER

001 1.00 PARCEL NUMBER ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 25-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.
M. W. Schofield, Assessor

BOOK T19S R59E | SEC. 36 | MAP S 2 NW 4 | 126-36-2

	R58E	R59E	R60E
T18S	98	99	100
T19S	127	126	125
T20S	136	137	138

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

8	4	8	4
5	1	5	1
6	2	6	2
7	3	7	3
8	4	8	4
5	1	5	1

Scale:1"=200' Rev:06/07/07

CLARK COUNTY ASSESSOR NEVADA

PT 126-36-201-002

201

002
131.70

PROJECT SITE

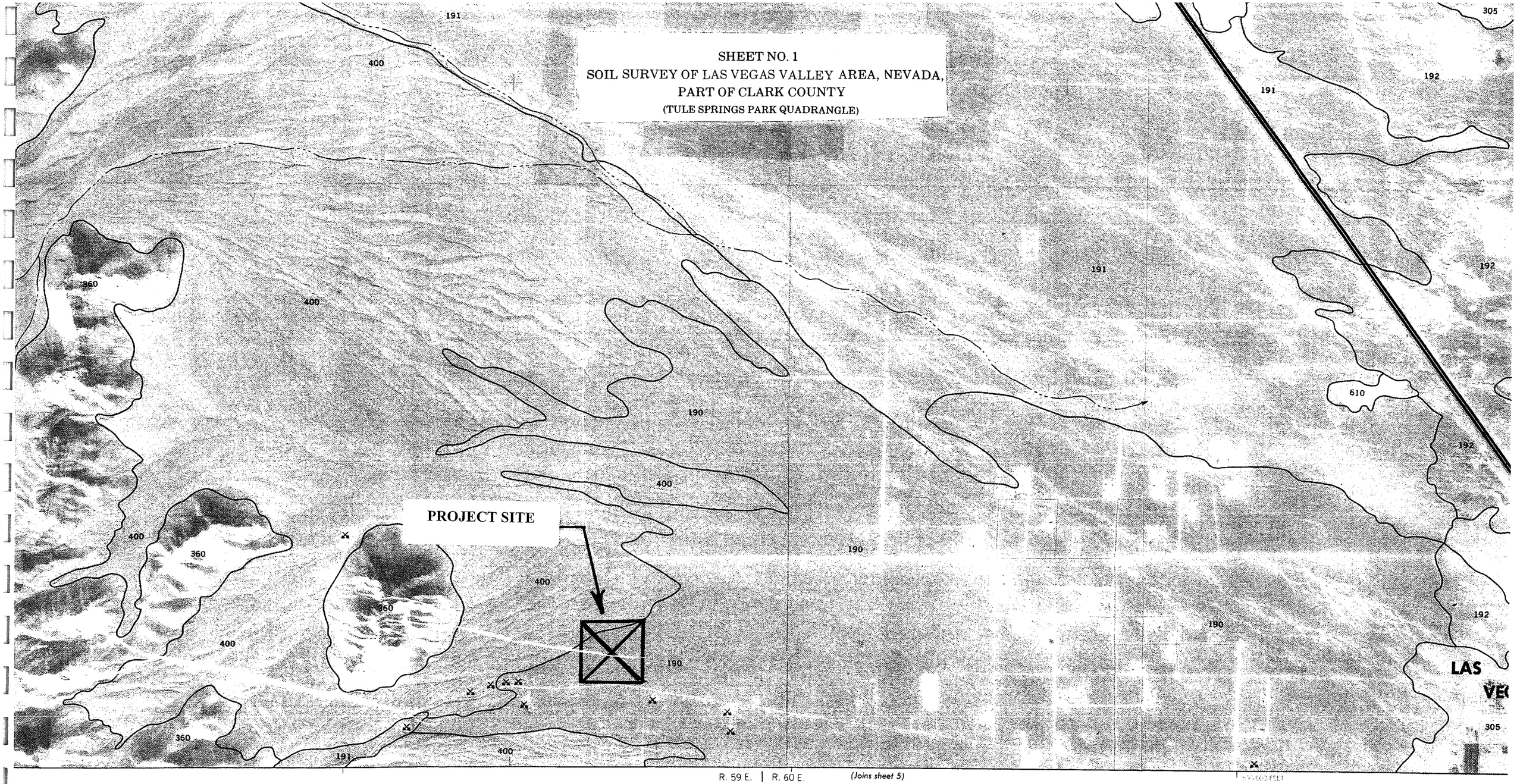
FIGURE 2

TAX DIST 200

SHEET NO. 1

SOIL SURVEY OF LAS VEGAS VALLEY AREA, NEVADA, PART OF CLARK COUNTY

(TULE SPRINGS PARK QUADRANGLE)



y map was compiled by the U.S. Department of Agriculture
on Service, and cooperating agencies. Base maps are
phs prepared by the U.S. Department of the Interior, Geological
1973 and 1977 aerial photography. Coordinate grid ticks and
ners, if shown, are approximately positioned

1 3/4 1/2 1/4 0 1 2 MILES

1 0 5 0 1 2 KILOMETERS

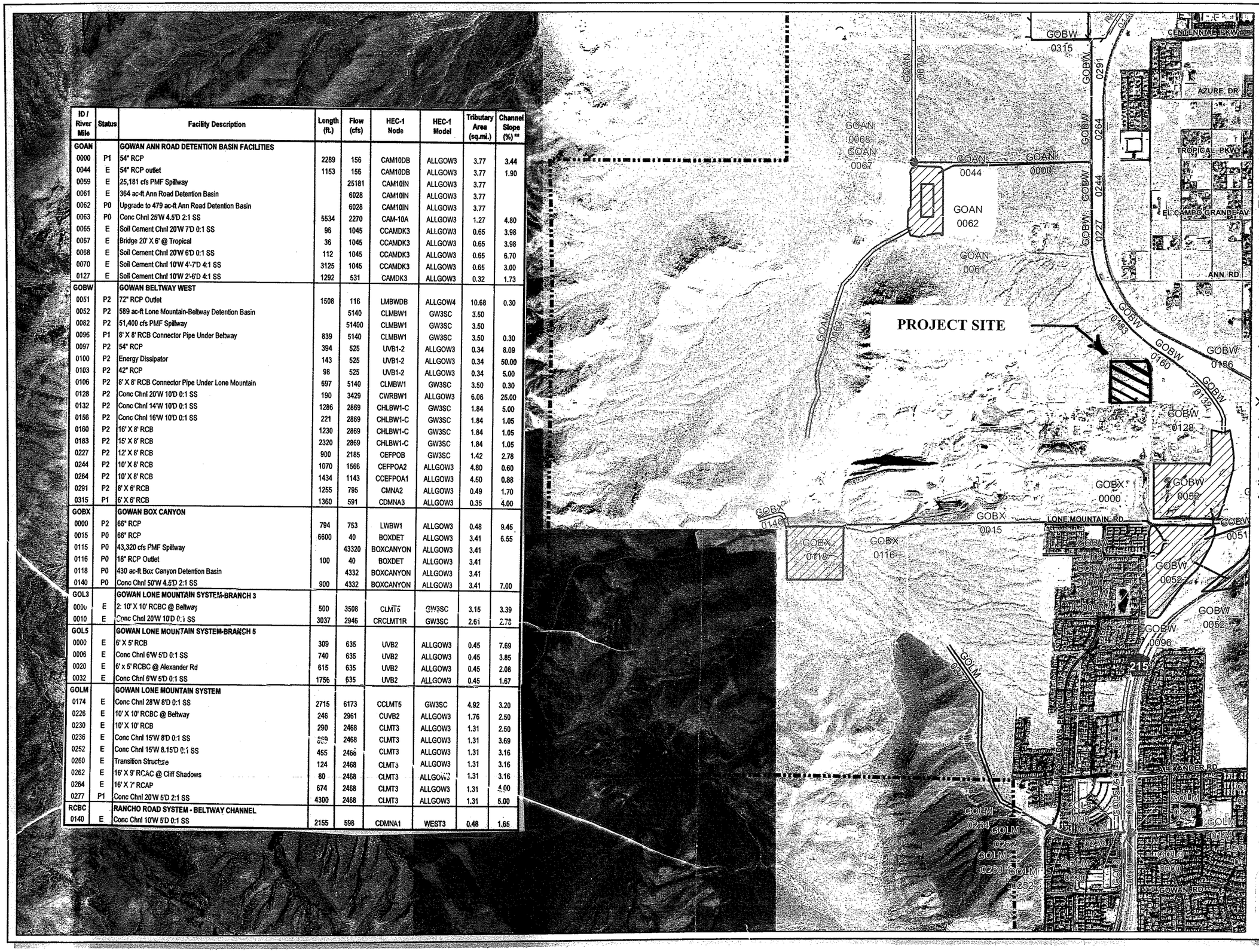
SCALE 1:24 000

LAS VEGAS VALLEY AREA, NEVADA NO. 1

FIGURE 4

E

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOAN		**GOWAN ANN ROAD DETENTION BASIN FACILITIES**						
0000	P1	54" RCP	2289	156	CAM10DB	ALLGOW3	3.77	3.44
0044	E	54" RCP outlet	1153	156	CAM10DB	ALLGOW3	3.77	1.90
0059	E	25,181 cfs PMF Spillway		25181	CAM10IN	ALLGOW3	3.77	
0061	E	364 ac-ft Ann Road Detention Basin		6028	CAM10IN	ALLGOW3	3.77	
0062	P0	Upgrade to 479 ac-ft Ann Road Detention Basin		6028	CAM10IN	ALLGOW3	3.77	
0063	P0	Conc Chnl 25'W 4.5'D 2:1 SS	5534	2270	CAM-10A	ALLGOW3	1.27	4.80
0065	E	Soil Cement Chnl 20'W 7'D 0:1 SS	96	1045	CCAMDK3	ALLGOW3	0.65	3.98
0067	E	Bridge 20' X 6' @ Tropical	36	1045	CCAMDK3	ALLGOW3	0.65	3.98
0068	E	Soil Cement Chnl 20'W 6'D 0:1 SS	112	1045	CCAMDK3	ALLGOW3	0.65	6.70
0070	E	Soil Cement Chnl 10'W 4'-7'D 4:1 SS	3125	1045	CCAMDK3	ALLGOW3	0.65	3.00
0127	E	Soil Cement Chnl 10'W 2'-6'D 4:1 SS	1292	531	CAMDK3	ALLGOW3	0.32	1.73
GOBW		**GOWAN BELTWAY WEST**						
0051	P2	72" RCP Outlet	1508	116	LMBWDB	ALLGOW4	10.68	0.30
0052	P2	589 ac-ft Lone Mountain-Beltway Detention Basin		5140	CLMBW1	GW3SC	3.50	
0062	P2	51,400 cfs PMF Spillway		51400	CLMBW1	GW3SC	3.50	
0096	P1	8' X 8' RCB Connector Pipe Under Beltway	839	5140	CLMBW1	GW3SC	3.50	0.30
0097	P2	54" RCP	394	525	UVB1-2	ALLGOW3	0.34	8.09
0100	P2	Energy Dissipator	143	525	UVB1-2	ALLGOW3	0.34	50.00
0103	P2	42" RCP	98	525	UVB1-2	ALLGOW3	0.34	5.00
0106	P2	8' X 8' RCB Connector Pipe Under Lone Mountain	697	5140	CLMBW1	GW3SC	3.50	0.30
0128	P2	Conc Chnl 20'W 10'D 0:1 SS	190	3429	CWRBW1	ALLGOW3	6.06	25.00
0132	P2	Conc Chnl 14'W 10'D 0:1 SS	1286	2869	CHLBW1-C	GW3SC	1.84	5.00
0156	P2	Conc Chnl 16'W 10'D 0:1 SS	221	2869	CHLBW1-C	GW3SC	1.84	1.05
0160	P2	16' X 8' RCB	1230	2869	CHLBW1-C	GW3SC	1.84	1.05
0183	P2	15' X 8' RCB	2320	2869	CHLBW1-C	GW3SC	1.84	1.05
0227	P2	12' X 8' RCB	900	2185	CEFPOB	GW3SC	1.42	2.78
0244	P2	10' X 8' RCB	1070	1566	CEFPOA2	ALLGOW3	4.80	0.60
0264	P2	10' X 8' RCB	1434	1143	CCEFPOA1	ALLGOW3	4.50	0.88
0291	P2	8' X 6' RCB	1255	795	CMNA2	ALLGOW3	0.49	1.70
0315	P1	6' X 6' RCB	1360	591	CDMNA3	ALLGOW3	0.35	4.00
GOBX		**GOWAN BOX CANYON**						
0000	P2	66" RCP	794	753	LWBW1	ALLGOW3	0.48	9.45
0015	P0	66" RCP	6600	40	BOXDET	ALLGOW3	3.41	6.55
0115	P0	43,320 cfs PMF Spillway		43320	BOXCANYON	ALLGOW3	3.41	
0116	P0	18" RCP Outlet	100	40	BOXDET	ALLGOW3	3.41	
0118	P0	430 ac-ft Box Canyon Detention Basin		4332	BOXCANYON	ALLGOW3	3.41	
0140	P0	Conc Chnl 50'W 4.5'D 2:1 SS	900	4332	BOXCANYON	ALLGOW3	3.41	7.00
GOL3		**GOWAN LONE MOUNTAIN SYSTEM-BRANCH 3**						
0000	E	2: 10' X 10' RCBC @ Beltway	500	3508	CLMT5	GW3SC	3.15	3.39
0010	E	Conc Chnl 20'W 10'D 0:1 SS	3037	2946	CRCLMT1R	GW3SC	2.61	2.76
GOL5		**GOWAN LONE MOUNTAIN SYSTEM-BRANCH 5**						
0000	E	6' X 5' RCB	309	635	UVB2	ALLGOW3	0.45	7.69
0006	E	Conc Chnl 6'W 5'D 0:1 SS	740	635	UVB2	ALLGOW3	0.45	3.85
0020	E	6' x 5' RCBC @ Alexander Rd	615	635	UVB2	ALLGOW3	0.45	2.08
0032	E	Conc Chnl 6'W 5'D 0:1 SS	1756	635	UVB2	ALLGOW3	0.45	1.67
GOLM		**GOWAN LONE MOUNTAIN SYSTEM**						
0174	E	Conc Chnl 28'W 8'D 0:1 SS	2715	6173	CCLMT5	GW3SC	4.92	3.20
0226	E	10' X 10' RCBC @ Beltway	246	2961	CUVB2	ALLGOW3	1.76	2.50
0230	E	10' X 10' RCB	290	2468	CLMT3	ALLGOW3	1.31	2.50
0236	E	Conc Chnl 15'W 8'D 0:1 SS	869	2468	CLMT3	ALLGOW3	1.31	3.69
0252	E	Conc Chnl 15'W 8.15'D 0:1 SS	455	2468	CLMT3	ALLGOW3	1.31	3.16
0260	E	Transition Structure	124	2468	CLMT3	ALLGOW3	1.31	3.16
0262	E	16' X 9' RCAC @ Cliff Shadows	80	2468	CLMT3	ALLGOW3	1.31	3.16
0264	E	16' X 7' RCAP	674	2468	CLMT3	ALLGOW3	1.31	4.00
0277	P1	Conc Chnl 20'W 5'D 2:1 SS	4300	2468	CLMT3	ALLGOW3	1.31	5.00
RCBC		**RANCHO ROAD SYSTEM - BELTWAY CHANNEL**						
0140	E	Conc Chnl 10'W 5'D 0:1 SS	2155	598	CDMNA1	WEST3	0.48	1.65



REGIONAL FLOOD CONTROL DISTRICT

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-18
FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert or Bridge Crossing
- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain
Crossing	Crossing

N

0 500 1,000 2,000 3,000
Feet

Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)

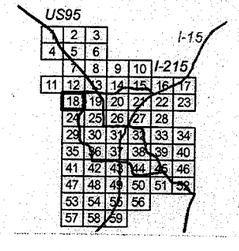


FIGURE 5

FD

REGIONAL FLOOD CONTROL DISTRICT

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE H- 18
HYDROLOGIC SUMMARY

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- Subbasin Boundary
- Drought Ordinance Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/ Parallel Facilities
- Category B Remove & Replace/ Parallel Facilities

Type Hydrologic Soil Groups

- A Low Runoff Potential
- B Moderately Low Runoff Potential
- C Moderately High Runoff Potential
- D High Runoff Potential/Rock Outcrops

Typical Land Use

- 1 Undeveloped Land, Open Desert
- 2 Parks, Golf Courses
- 3 Rural
- 4 / 14* Low Density Residential
- 5 / 15* Medium Density Residential
- 6 / 16* High Density Residential
- 7 / 17* Public Facility, Residential
- 8 / 18* Very High Density Residential
- 9 / 19* Commerical, Retail, Casino, High Rise Condominiums
- 10 / 20* Light Industrial
- 11 / 21* Heavy Industrial
- 12 / 22* Schools
- 13 Lakes

* Drought Ordinance Applied

N

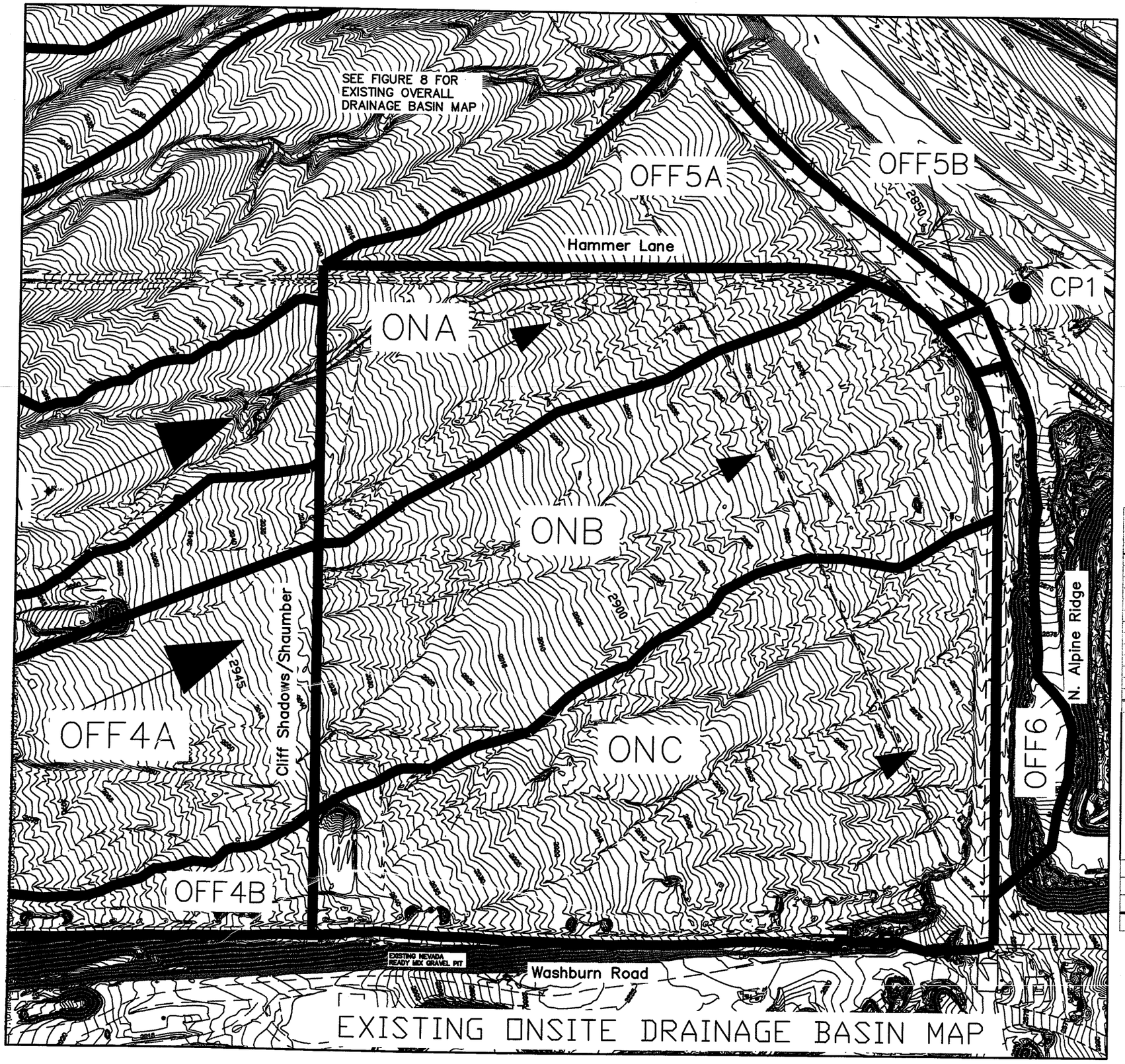
0 500 1,000 2,000 3,000
Feet

Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)

US95 I-15 I-215

FIGURE 6



NORTH

GRAPHIC SCALE

200 0 100 200 400

(IN FEET)
1 inch = 200 ft.

LEGEND

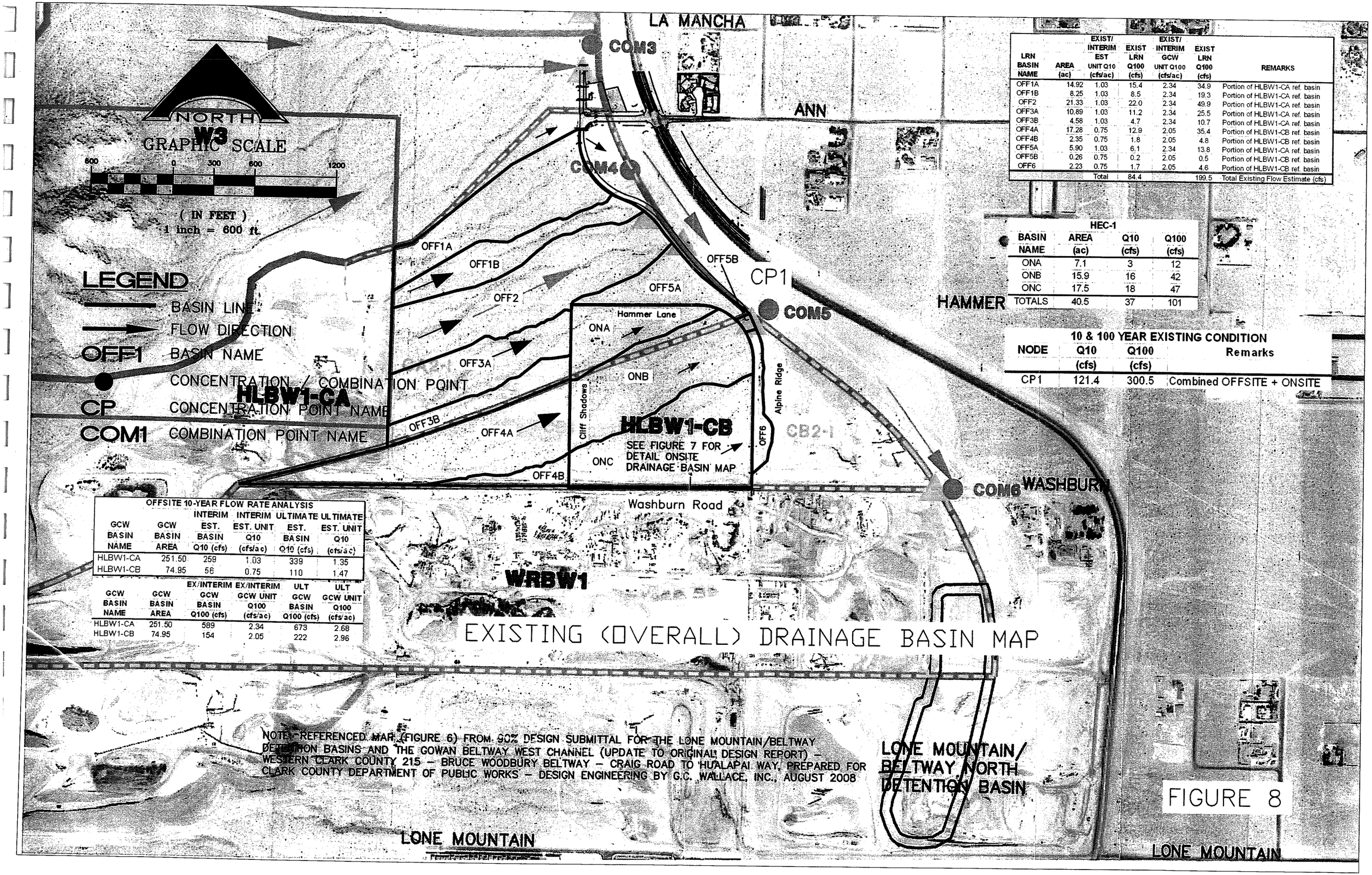
- BASIN LINE
- FLOW DIRECTION
- OFF1 — BASIN NAME
- ● — CONCENTRATION / COMBINATION POINT
- CP — CONCENTRATION POINT NAME
- COM1 — COMBINATION POINT NAME

LRN BASIN NAME	LRN AREA (ac)	INTERIM ESTIMATE UNIT Q10 (cfs/ac)	INTERIM LRN Q10 (cfs)	INTERIM GCW UNIT Q100 (cfs/ac)	INTERIM LRN Q100 (cfs)	REMARKS
OFF1A	11.31	1.03	11.7	2.34	26.5	Portion of HLBW1-CA ref. basin
OFF1A1	3.61	1.03	3.7	2.34	8.5	Portion of HLBW1-CA ref. basin
OFF1B	5.89	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFFB1	2.37	1.03	2.4	2.34	5.5	Portion of HLBW1-CA ref. basin
OFF2	13.36	1.03	13.8	2.34	31.3	Portion of HLBW1-CA ref. basin
OFF21	7.97	1.03	8.2	2.34	18.6	Portion of HLBW1-CA ref. basin
OFF3A	10.89	1.03	11.2	2.34	25.5	Portion of HLBW1-CA ref. basin
OFF3B	4.58	1.03	4.7	2.34	10.7	Portion of HLBW1-CA ref. basin
OFF4A	17.26	0.75	12.9	2.05	35.4	Portion of HLBW1-CB ref. basin
OFF4B	2.35	0.75	1.8	2.05	4.8	Portion of HLBW1-CB ref. basin
OFF5A	5.90	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	0.75	0.2	2.05	0.5	Portion of HLBW1-CB ref. basin
OFF6	2.23	0.75	1.7	2.05	4.6	Portion of HLBW1-CB ref. basin
		Totals	84.4		199.5	Total Q10 & Q100 Estimate (cfs)

HEC-1			
BASIN NAME	AREA (ac)	Q10 (cfs)	Q100 (cfs)
ONA	7.1	3	12
ONB	15.9	16	42
ONC	17.5	18	47
TOTALS	40.5	37	101

100-YEAR EXISTING CONDITION			
NODE	Q10 (cfs)	Q100 (cfs)	Remarks
CP1	121.4	300.5	Combined OFFSITE + ONSITE

FIGURE 7



LRN BASIN NAME	AREA (ac)	EXIST/ INTERIM EST UNIT Q10 (cfs/ac)	EXIST LRN Q100 (cfs)	EXIST/ INTERIM GCW UNIT Q100 (cfs/ac)	EXIST LRN Q100 (cfs)	REMARKS
OFF1A	14.92	1.03	15.4	2.34	34.9	Portion of HLBW1-CA ref. basin
OFF1B	8.25	1.03	8.5	2.34	19.3	Portion of HLBW1-CA ref. basin
OFF2	21.33	1.03	22.0	2.34	49.9	Portion of HLBW1-CA ref. basin
OFF3A	10.89	1.03	11.2	2.34	25.5	Portion of HLBW1-CA ref. basin
OFF3B	4.58	1.03	4.7	2.34	10.7	Portion of HLBW1-CA ref. basin
OFF4A	17.28	0.75	12.9	2.05	35.4	Portion of HLBW1-CB ref. basin
OFF4B	2.35	0.75	1.8	2.05	4.8	Portion of HLBW1-CB ref. basin
OFF5A	5.90	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	0.75	0.2	2.05	0.5	Portion of HLBW1-CB ref. basin
OFF6	2.23	0.75	1.7	2.05	4.6	Portion of HLBW1-CB ref. basin
		Total	84.4		199.5	Total Existing Flow Estimate (cfs)

HEC-1

BASIN NAME	AREA (ac)	Q10 (cfs)	Q100 (cfs)
ONA	7.1	3	12
ONB	15.9	16	42
ONC	17.5	18	47
TOTALS	40.5	37	101

10 & 100 YEAR EXISTING CONDITION

NODE	Q10 (cfs)	Q100 (cfs)	Remarks
CP1	121.4	300.5	Combined OFFSITE + ONSITE

OFFSITE 10-YEAR FLOW RATE ANALYSIS

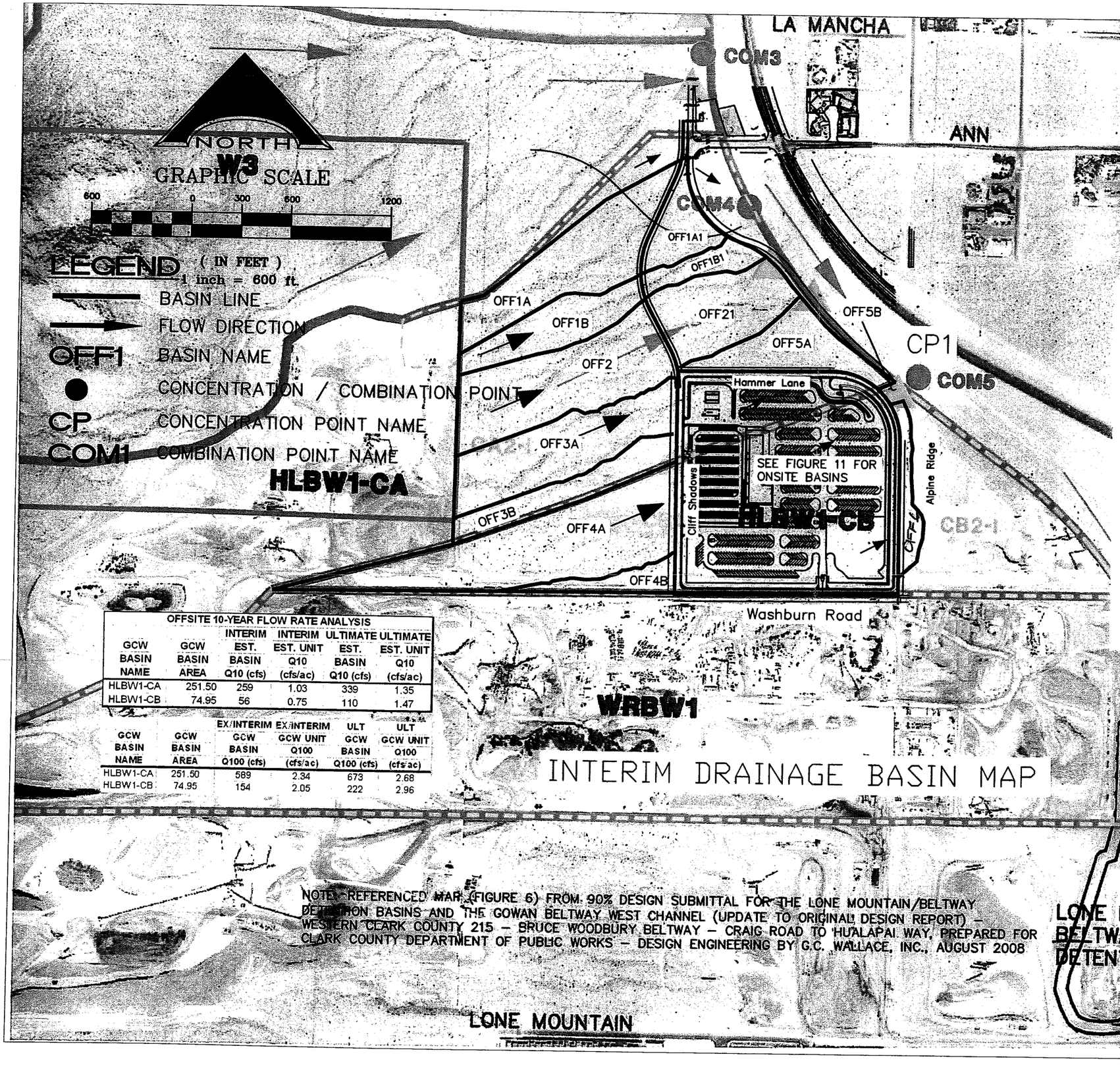
GCW BASIN NAME	GCW BASIN AREA	INTERIM EST. BASIN Q10 (cfs)	INTERIM EST. UNIT Q10 (cfs/ac)	ULTIMATE EST. BASIN Q10 (cfs)	ULTIMATE EST. UNIT Q10 (cfs/ac)
HLBW1-CA	251.50	259	1.03	339	1.35
HLBW1-CB	74.95	56	0.75	110	1.47

GCW BASIN NAME	GCW BASIN AREA	EX/INTERIM GCW BASIN Q100 (cfs)	EX/INTERIM GCW UNIT Q100 (cfs/ac)	ULT GCW BASIN Q100 (cfs)	ULT GCW UNIT Q100 (cfs/ac)
HLBW1-CA	251.50	589	2.34	673	2.68
HLBW1-CB	74.95	154	2.05	222	2.96

EXISTING (OVERALL) DRAINAGE BASIN MAP

NOTE: REFERENCED MAP (FIGURE 6) FROM 90% DESIGN SUBMITTAL FOR THE LONE MOUNTAIN/BELTWAY DETENTION BASINS AND THE GOWAN BELTWAY WEST CHANNEL (UPDATE TO ORIGINAL DESIGN REPORT) – WESTERN CLARK COUNTY 215 – BRUCE WOODBURY BELTWAY – CRAIG ROAD TO HUALAPAI WAY, PREPARED FOR CLARK COUNTY DEPARTMENT OF PUBLIC WORKS – DESIGN ENGINEERING BY G.C. WALLACE, INC., AUGUST 2008

FIGURE 8



LRN BASIN NAME	LRN AREA (ac)	INTERIM ESTIMATE UNIT Q10 (cfs/ac)	INTERIM LRN Q10 (cfs)	INTERIM GCW UNIT Q100 (cfs/ac)	INTERIM LRN Q100 (cfs)	REMARKS
OFF1A	11.31	1.03	11.7	2.34	26.5	Portion of HLBW1-CA ref. basin
OFF1A1	3.61	1.03	3.7	2.34	8.5	Portion of HLBW1-CA ref. basin
OFF1B	5.89	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFFB1	2.37	1.03	2.4	2.34	5.5	Portion of HLBW1-CA ref. basin
OFF2	13.36	1.03	13.8	2.34	31.3	Portion of HLBW1-CA ref. basin
OFF21	7.97	1.03	8.2	2.34	18.6	Portion of HLBW1-CA ref. basin
OFF3A	10.89	1.03	11.2	2.34	25.5	Portion of HLBW1-CA ref. basin
OFF3B	4.58	1.03	4.7	2.34	10.7	Portion of HLBW1-CA ref. basin
OFF4A	17.28	0.75	12.9	2.05	35.4	Portion of HLBW1-CB ref. basin
OFF4B	2.35	0.75	1.8	2.05	4.8	Portion of HLBW1-CB ref. basin
OFF5A	5.90	1.03	6.1	2.34	13.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	0.75	0.2	2.05	0.5	Portion of HLBW1-CB ref. basin
OFF6	2.23	0.75	1.7	2.05	4.6	Portion of HLBW1-CB ref. basin
		Totals	84.4		199.5	Total Q10 & Q100 Estimate (cfs)

HEC-1 ID/ Conc. Point	Area (ac)	CN Value	10-YR (cfs)	100-YR (cfs)	REMARKS
ON3	3.27	87.8	4	11	Onsite Parking Area
R3	0.91	98.0	2	3	Washburn
ON4	2.43	94.2	4	10	Onsite Parking Area
COMB1	n/a	n/a	10	23	Combine Q @ Washburn & South Entrance
R4+	0.68	88.4	(1) 11	(2) 25	Washburn (U/S combined & routed -> R4)
R5+	1.65	86.6	(<1) 11	(3) 28	Alpine Ridge (U/S com & ->R5 to Low Point)
ON2	1.89	94.8	4	8	Onsite Parking Area
RTE1	n/a	n/a	3	7	Route ON2 through ON5
ON5	7.06	97.6	13	27	Onsite Parking Area
FUT1	3.34	92.0	4	10	Future area rough graded
RTE2	n/a	n/a	4	10	Route FUT1 through ON5
COMB2	n/a	n/a	20	43	Combine Flow @ ON7/ON5 Boundary
RTE3	n/a	n/a	19	42	Route Flow to Exit in Hammer
ON1	4.14	95.5	7	15	Onsite Parking Area
ON6	1.34	96.7	3	5	Onsite Parking Area
COMB3	n/a	n/a	10	21	Combine Flow at Inlet Area
RTE4	n/a	n/a	9	20	Route through ON7
ON7	9.98	97.4	21	41	Onsite Parking Area
COMB4	n/a	n/a	49	102	Combine All Flow Leaving Hammer
R0	1.56	91.1	3	5	Cliff Shadows
R1+	0.37	94.1	(<1) 3	(1) 6	Cliff Shadows (U/S R0 routed -> R1)
R2+	1.90	91.6	(3) 6	(7) 13	Cliff Shadows (U/S R1 routed -> R2)
COMB5	n/a	n/a	55	115	Com Q on N½ of Alpine Ridge Low Point
COMBALL	n/a	n/a	66	143	Total of All Onsite Computed Q

OFFSITE 10-YEAR FLOW RATE ANALYSIS

GCW BASIN NAME	GCW BASIN AREA	INTERIM EST. BASIN Q10 (cfs)	INTERIM EST. UNIT Q10 (cfs/ac)	ULTIMATE EST. BASIN Q10 (cfs)	ULTIMATE EST. UNIT Q10 (cfs/ac)
HLBW1-CA	251.50	259	1.03	339	1.35
HLBW1-CB	74.95	56	0.75	110	1.47

GCW BASIN NAME	GCW BASIN AREA	EX/INTERIM GCW BASIN Q100 (cfs)	EX/INTERIM GCW UNIT Q100 (cfs/ac)	ULT GCW BASIN Q100 (cfs)	ULT GCW UNIT Q100 (cfs/ac)
HLBW1-CA	251.50	589	2.34	673	2.68
HLBW1-CB	74.95	154	2.05	222	2.96

10 & 100 YEAR INTERIM CONDITION

NODE	Q10 (cfs)	Q100 (cfs)	Remarks
CP1	152.4	344.5	Combined OFFSITE + ONSITE

INTERIM DRAINAGE BASIN MAP

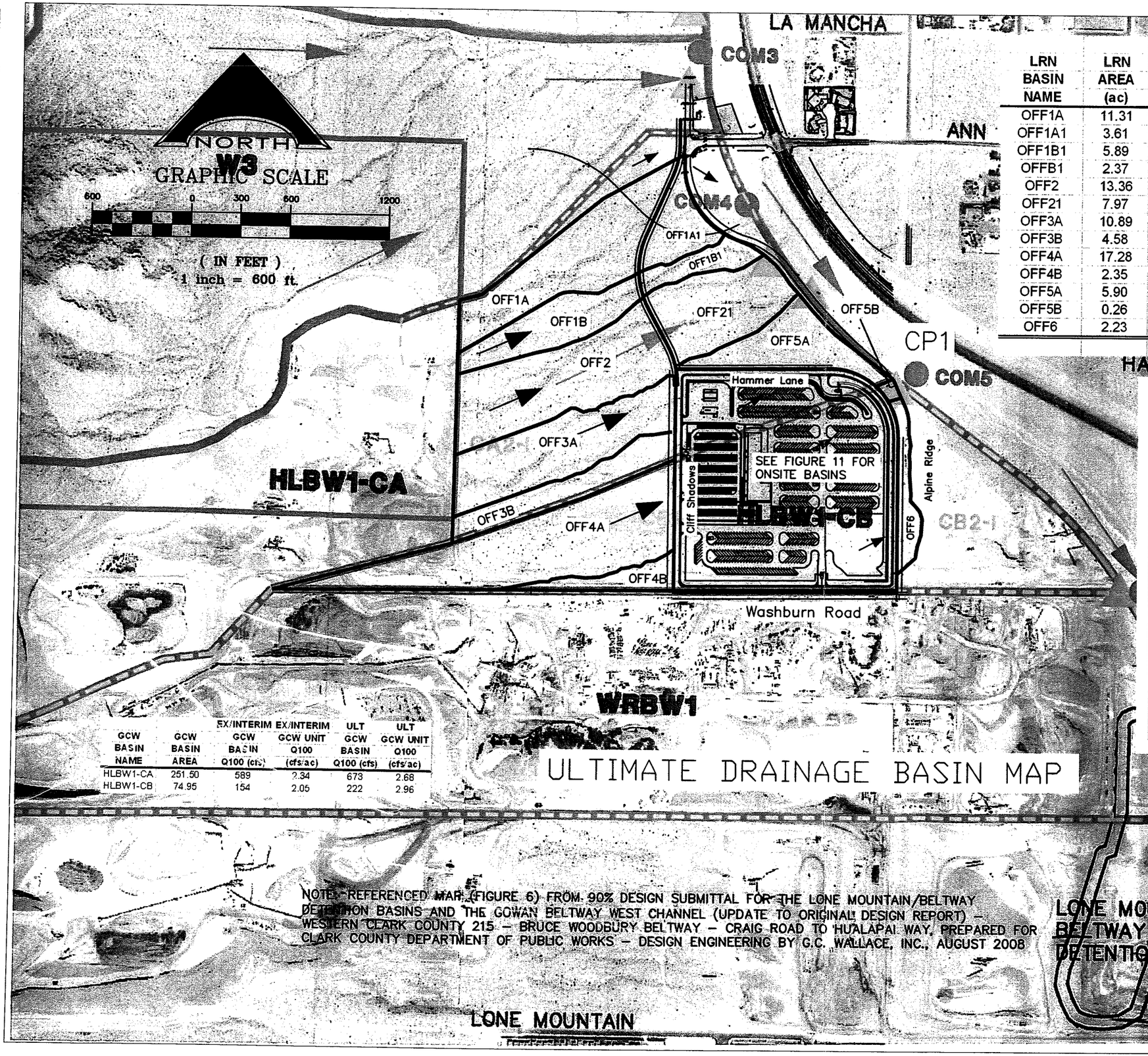
NOTE: REFERENCED MAP (FIGURE 6) FROM 90% DESIGN SUBMITTAL FOR THE LONE MOUNTAIN/BELTWAY DETENTION BASINS AND THE GOWAN BELTWAY WEST CHANNEL (UPDATE TO ORIGINAL DESIGN REPORT) – WESTERN CLARK COUNTY 215 – BRUCE WOODBURY BELTWAY – CRAIG ROAD TO HUALAPAI WAY, PREPARED FOR CLARK COUNTY DEPARTMENT OF PUBLIC WORKS – DESIGN ENGINEERING BY G.C. WALLACE, INC., AUGUST 2008

LONE MOUNTAIN/ BELTWAY NORTH DETENTION BASIN

FIGURE 9

LONE MOUNTAIN

LONE MOUNTAIN



LRN BASIN NAME	LRN AREA (ac)	ULTIMATE ESTIMATE UNIT Q10 (cfs/ac)	ULTIMATE LRN Q10 (cfs)	ULTIMATE GCW UNIT Q100 (cfs/ac)	ULTIMATE LRN Q100 (cfs)	REMARKS
OFF1A	11.31	1.35	15.3	2.68	30.3	Portion of HLBW1-CA ref. basin
OFF1A1	3.61	1.35	4.9	2.68	9.7	Portion of HLBW1-CA ref. basin
OFF1B1	5.89	1.35	7.9	2.68	15.8	Portion of HLBW1-CA ref. basin
OFFB1	2.37	1.35	3.2	2.68	6.3	Portion of HLBW1-CA ref. basin
OFF2	13.36	1.35	18.0	2.68	35.8	Portion of HLBW1-CA ref. basin
OFF21	7.97	1.35	10.8	2.68	21.3	Portion of HLBW1-CA ref. basin
OFF3A	10.89	1.35	14.7	2.68	29.2	Portion of HLBW1-CA ref. basin
OFF3B	4.58	1.35	6.2	2.68	12.3	Portion of HLBW1-CA ref. basin
OFF4A	17.28	1.47	25.4	2.96	51.1	Portion of HLBW1-CB ref. basin
OFF4B	2.35	1.47	3.5	2.96	7.0	Portion of HLBW1-CB ref. basin
OFF5A	5.90	1.35	8.0	2.68	15.8	Portion of HLBW1-CA ref. basin
OFF5B	0.26	1.47	0.4	2.96	0.8	Portion of HLBW1-CB ref. basin
OFF6	2.23	1.47	3.3	2.96	6.6	Portion of HLBW1-CB ref. basin
		Totals	121.4		242.0	Total Q10 & Q100 Estimate (cfs)

HAMMER

HEC-1 ID/ Conc. Point	Area (ac)	CN Value	10-YR (cfs)	100-YR (cfs)	REMARKS
ON3	3.27	87.8	4	11	Onsite Parking Area
R3	0.91	98.0	2	3	Washburn
ON4	2.43	94.2	4	10	Onsite Parking Area
COMB1	n/a	n/a	10	23	Combine Q @ Washburn & South Entrance
R4+	0.68	88.4	(1) 11	(2) 25	Washburn (U/S combined & routed -> R4)
R5+	1.65	86.6	(<1) 11	(3) 28	Alpine Ridge (U/S com & ->R5 to Low Point)
ON2	1.89	94.8	4	8	Onsite Parking Area
RTE1	n/a	n/a	3	7	Route ON2 through ON5
ON5	7.06	97.6	13	27	Onsite Parking Area
FUT1	3.34	94.7	6	12	Future area assumed to be paved
RTE2	n/a	n/a	5	12	Route FUT1 through ON5
COMB2	n/a	n/a	22	45	Combine Flow @ ON7/ON5 Boundary
RTE3	n/a	n/a	21	44	Route Flow to Exit in Hammer
ON1	4.14	95.5	7	15	Onsite Parking Area
ON6	1.34	96.7	3	5	Onsite Parking Area
COMB3	n/a	n/a	10	21	Combine Flow at Inlet Area
RTE4	n/a	n/a	9	20	Route through ON7
ON7	9.98	97.4	21	41	Onsite Parking Area
COMB4	n/a	n/a	51	104	Combine All Flow Leaving Hammer
R0	1.56	91.1	3	5	Cliff Shadows
R1+	0.37	94.1	(<1) 3	(1) 6	Cliff Shadows (U/S R0 routed -> R1)
R2+	1.90	91.6	(3) 6	(7) 13	Cliff Shadows (U/S R1 routed -> R2)
COMB5	n/a	n/a	57	117	Com Q on N½ of Alpine Ridge Low Point
COMBALL	n/a	n/a	68	145	Totals of Computed Q

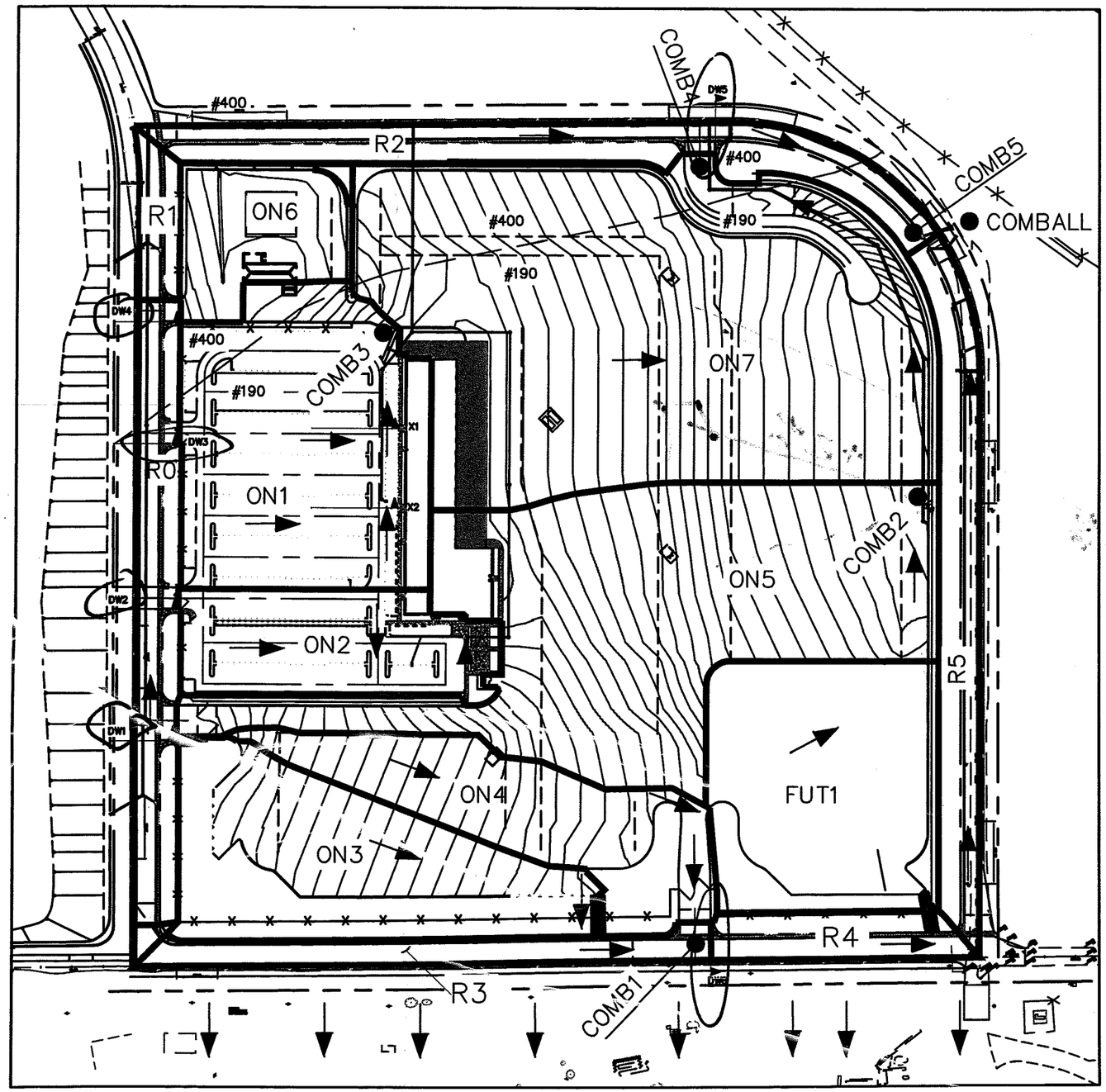
GCW BASIN NAME	GCW BASIN AREA	EX/INTERIM GCW BASIN Q100 (cfs)	EX/INTERIM GCW UNIT Q100 (cfs/ac)	ULT GCW BASIN Q100 (cfs)	ULT GCW UNIT Q100 (cfs/ac)
HLBW1-CA	251.50	589	2.34	673	2.68
HLBW1-CB	74.95	154	2.05	222	2.96

ULTIMATE DRAINAGE BASIN MAP

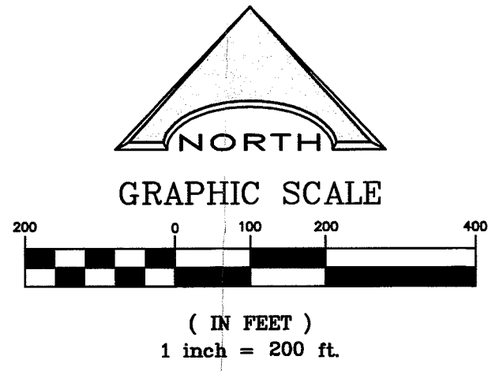
10 & 100 YEAR ULTIMATE CONDITION			
NODE	Q10 (cfs)	Q100 (cfs)	Remarks
CP1	189.5	387.0	Combined OFFSITE + ONSITE

NOTE: REFERENCED MAP (FIGURE 6) FROM 90% DESIGN SUBMITTAL FOR THE LONE MOUNTAIN/BELTWAY DETENTION BASINS AND THE GOWAN BELTWAY WEST CHANNEL (UPDATE TO ORIGINAL DESIGN REPORT) – WESTERN CLARK COUNTY 215 – BRUCE WOODBURY BELTWAY – CRAIG ROAD TO HUALAPAI WAY, PREPARED FOR CLARK COUNTY DEPARTMENT OF PUBLIC WORKS – DESIGN ENGINEERING BY G.C. WALLACE, INC., AUGUST 2008

FIGURE 10



PROPOSED ONSITE DRAINAGE BASIN MAP



LEGEND

- BASIN LINE
- FLOW DIRECTION
- OFF1 — BASIN NAME
- ● — CONCENTRATION / COMBINATION POINT
- CP — CONCENTRATION POINT NAME
- COM1 — COMBINATION POINT NAME
- HSG SCS BOUNDARY
- #190 — HSG SCS NUMBER

HEC-1 ID/ Conc. Point	Area (ac)	CN Value	10-YR (cfs)	100-YR (cfs)	REMARKS
ON3	3.27	87.8	4	11	Onsite Parking Area
R3	0.91	98.0	2	3	Washburn
ON4	2.43	94.2	4	10	Onsite Parking Area
COMB1	n/a	n/a	10	23	Combine Q @ Washburn & South Entrance
R4+	0.68	88.4	(1) 11	(2) 25	Washburn (U/S combined & routed -> R4)
R5+	1.65	86.6	(<1) 11	(3) 28	Alpine Ridge (U/S com & ->R5 to Low Point)
ON2	1.89	94.8	4	8	Onsite Parking Area
RTE1	n/a	n/a	3	7	Route ON2 through ON5
ON5	7.06	97.6	13	27	Onsite Parking Area
FUT1	3.34	94.7	6	12	Future area assumed to be paved
RTE2	n/a	n/a	5	12	Route FUT1 through ON5
COMB2	n/a	n/a	22	45	Combine Flow @ ON7/ON5 Boundary
RTE3	n/a	n/a	21	44	Route Flow to Exit in Hammer
ON1	4.14	95.5	7	15	Onsite Parking Area
ON6	1.34	96.7	3	5	Onsite Parking Area
COMB3	n/a	n/a	10	21	Combine Flow at Inlet Area
RTE4	n/a	n/a	9	20	Route through ON7
ON7	9.98	97.4	21	41	Onsite Parking Area
COMB4	n/a	n/a	51	104	Combine All Flow Leaving Hammer
R0	1.56	91.1	3	5	Cliff Shadows
R1+	0.37	94.1	(<1) 3	(1) 6	Cliff Shadows (U/S R0 routed -> R1)
R2+	1.90	91.6	(3) 6	(7) 13	Cliff Shadows (U/S R1 routed -> R2)
COMB5	n/a	n/a	57	117	Com Q on N½ of Alpine Ridge Low Point
COMBALL	n/a	n/a	68	145	Totals of Computed Q

10-/100-Year flow rates are computed for the basin and combined w/upstream basin via RD.08 = "YES" in the HEC-1 model in Appendix B

FIGURE 11

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