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October 16, 1998
W.O.#5244

Federal Emergency Management Agency
Federal Insurance Administration
Office Risk Assessment
Technical Operations Division
500 C Street SW
Washington, D.C. 20472

Attention: Michael Buckley

SUBJECT: **CONDITIONAL LETTER OF MAP REVISION BASED ON PHYSICAL CHANGES FOR THE EAST C-1 DETENTION BASIN**

A complete analysis of the East C-1 Detention Basin and Levee including all design calculations is included herein, in support of this request for the Conditional Letter of Map Revision (CLOMR) for the East C-1 Detention Basin, in the City of Henderson, Nevada. This request for revision is based on physical changes to the watershed and floodplain due to the proposed construction of the East C-1 Detention Basin and Levee by the Southern Nevada Water Authority. The construction of this Regional Flood Control Project will reduce the peak runoff within the floodplain downstream of the East C-1 Detention Basin site. SDN5 was used for the C-1 Channel System and SDN3 was used for the East C-1 Detention Basin and Levee. Accompanying are the HEC-1 output both on floppy disk and hardcopy. This CLOMR is requested by the City of Henderson to eliminate the Zone "A" Northwest of the East C-1 Detention Basin.

Enclosed with this request are the following items:

1. Revision Requestor and Community Official Form (FORM 1)
2. Certification by Registered Professional Engineer And/Or Land Surveyor Form (FORM 2)
3. Hydrological Analysis Form (FORM 3)
4. Riverine Hydraulic Analysis Form (FORM 4)
5. Riverine/Costal Mapping Form (FORM 5)
6. Channelization Form (FORM 6)
7. Levee/Floodwall System Analyses Form (FORM 8)

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
TEL. (702) 873-7550 FAX: 362-2597

8. Dam Form (FORM 11)
9. Proposed Firm Map
10. Clark County Regional Flood Control District Maintenance of Structures Manual
11. East C-1 Detention Basin Calculation Notebook
12. Floppy disk containing SDN3 and SDN5 HEC-1 outputs
13. Construction Plans for the East C-1 Detention Basin and Levee

An annotated FIRM for the East C-1 Detention Basin CLOMR showing the proposed revisions has been included with this request, demonstrating that the Zone A floodplain should no longer exist Northwest of the East C-1 Detention Basin and Levee.

Because this is a public project and is funded by the Southern Nevada Water Authority, it is our understanding that the fee for reviewing this CLOMR application is waived.

If there are any questions or if additional information is necessary please contact this office at (702) 247-4020.

Respectfully Submitted,

VTN NEVADA

Lora Vennettilli, E.I.

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*
   - ☒ Physical change
     - ☐ Existing
     - ☒ Proposed
   - ☐ Improved methodology
   - ☐ Improved data
   - ☐ Floodway revision
   - ☐ Other _____

   Explain _____

2. Flooding Source: Unnamed Wash

3. Project Name/Identifier: East C-1 Detention Basin

4. FEMA zone designations affected: A

   (example: A, AH, AO, A1-A30, A99, AE, V, V1-30, VE, B, C, D, X)

5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
EX: 480301	Katy,City	Harris, Fort Bend	TX	480301	0005D	02/08/83
480287	Harris County	Harris	TX	48201C	0220G	09/28/90
32005	City of Henderson	Clark	NV	32003C	2620D	8/16/95

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding

- ☒ Riverine
- ☐ Coastal
- ☐ Alluvial Fan
- ☐ Shallow Flooding *(e.g. Zones AO and AH)*
- ☐ Lakes

Affected by wind/wave action
- ☐ Yes
- ☐ No

Structures

- ☒ Channelization
- ☒ Levee/Floodwall
- ☐ Bridge/Culvert
- ☒ Dam
- ☐ Coastal
- ☐ Fill
- ☐ Pump Station
- ☐ None
- ☐ Channel Relocation
- ☐ Excavation
- ☐ Other *(describe)*

Disciplines*

- ☒ Water Resources
  - ☒ Hydrology
  - ☐ Hydraulics
  - ☐ Sediment Transport
  - ☐ Interior Drainage
- ☐ Structural
- ☐ Geotechnical
- ☐ Land Surveying
- ☐ Other *(describe)*

☐ Other(describe) _____ _____ _____

* **Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? ☐ Yes ☒ No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM ☐ Yes ☒ No

   If yes, give reason: _____

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

Attach copy of either a public notice distributed by the community stating the community's intent to revise the floodway or a statement by the community that it has notified all affected property owners and affected adjacent jurisdictions.

9. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP? ☐ Yes ☒ No

If yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

3. PROPOSED ENCROACHMENTS

10. With floodways:

a. Does the revision request involve fill, new construction, substantial improvement, or other development in the floodway? ☐ Yes ☐ No

b. If yes, does the development cause the 100-year water surface elevation to increase at any location by more than 0.000 feet? ☐ Yes ☐ No

11. Without floodways:

a. Does the revision request involve fill, new construction, substantial improvement, or other development in the 100-year floodplain? ☒ Yes ☐ No

b. If yes, does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the 100-year water surface elevation to increase at any location by more than one foot (*or other surcharge limit if community or state has adopted more stringent criteria*)? ☐ Yes ☐ No

If the answer to either Items 10b or 11b is yes, please provide documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

4. REVISION REQUESTOR ACKNOWLEDGMENT

12. Having read NFIP Regulations, 44 CFR Ch. I, parts 59, 60, 61, and 72, I believe that the proposed revision ☐ is ☐ is not in compliance with the requirements of the aforementioned NFIP Regulations.

5. COMMUNITY OFFICIAL ACKNOWLEDGMENT

13. Was this revision request reviewed by the community for compliance with the community's adopted floodplain management ordinances? ☒ Yes ☐ No

14. Does this revision request have the endorsement of the community? ☒ Yes ☐ No

If no to either of the above questions, please explain: _____

Please note that community acknowledgment and /or notification is required for all requests as outlined in Paragraph 65.4(b) of the NFIP Regulations.

6. OPERATION AND MAINTENANCE

15. Does the physical change involve a flood control structure (e.g., levees, floodwalls, channelization, basins, dams)? ☒ Yes ☐ No

If yes, please provide the following information for each of the new flood control structures:

A. Inspection of the flood control project will be conducted periodically by City of Henderson (entity)

_____ with a maximum interval of 12 months between inspections.

B. Based on the results of scheduled periodic inspections, appropriate maintenance of the flood control facilities will be conducted by _____ (entity)

to ensure the integrity and degree of flood protection of the structure.

C. A formal plan of operation, including documentation of the flood warning system, specific actions and assignments of responsibility by individual name or title, and provisions for testing the plan at intervals not less than 1 year, ☐ has ☒ has not been prepared for the flood control structure.

D. The community is willing to assume responsibility for ☒ performing ☐ overseeing compliance with the maintenance and operation plans of the East C-1 Detention Basin (Name)

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal Government.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled "Appeals, Revisions, and Amendments to National Flood Insurance Program Maps, A Guide for Community Officials," dated December 1993, this request is for a:

XX a.	CLOMR	A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch. I, Parts 60, 65, and 72)*.
____ b.	LOMR	A letter from FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(See 44 CFR Ch. I Parts 60 and 65.)*
____ c.	PMR	A reprinted NFIP map incorporating changes to floodplains, floodways, or flood elevations. Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch. I, Parts 60 and 65.)*
____ d.	Other:	Describe _____

8. FORMS INCLUDED

17. Form 2 entitled, "Certification By Registered Professional Engineer and/or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	☒ Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	☒ Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	☒ Riverine /Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	☐ Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	☐ Bridge/Culvert Form (Form 7)
• The request involves a new revised levee/floodwall system	☒ Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	☐ Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	☐ Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	☒ Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

9. INITIAL REVIEW FEE

18. Has the minimum initial review fee for the appropriate request category been included? ☐ Yes ☐ No

Initial fee amount: $ _____

Check or money order only. Make check or money order payable to: **National Flood Insurance Program.** If paying by Visa or Mastercard please refer to the credit card information form which follows this form.

or

19. Is this request for a project that is for public benefit and is primarily intended for flood loss reduction to insurable structures in identified flood hazard areas which were in existence prior to the commencement of construction of the flood control project? ☒ Yes ☐ No

or

20. Is this request to correct map errors, to include the effects of natural changes within the areas of special flood hazard, or solely to provide more detailed data? ☐ Yes ☐ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Signature of Revision Requester

Ken D. Gilbreth, Principal

Printed Name and Title of Revision Requester

VTN Nevada

Company Name

(702) 247-4020 10-16-98

Telephone No. Date

Note: Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.

Signature of Community Official

Curt Chandler, Land Development Mgr

Printed Name and Title of Community Official

City of Henderson

Community Name

10-5-98

Date

Does this request impact any other communities? ☐ Yes ☒ No

If yes, attach letters from all affected jurisdictions acknowledging the revision request and approving the changes to the floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

9. INITIAL REVIEW FEE

18. Has the minimum initial review fee for the appropriate request category been included? ☐ Yes ☐ No

Initial fee amount: $ _____

Check or money order only. Make check or money order payable to: **National Flood Insurance Program.** If paying by Visa or Mastercard please refer to the credit card information form which follows this form.

or

19. Is this request for a project that is for public benefit and is primarily intended for flood loss reduction to insurable structures in identified flood hazard areas which were in existence prior to the commencement of construction of the flood control project? ☒ Yes ☐ No

or

20. Is this request to correct map errors, to include the effects of natural changes within the areas of special flood hazard, or solely to provide more detailed data? ☐ Yes ☐ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Signature of Revision Requester

Ken D. Gilbreth, Principal

Printed Name and Title of Revision Requester

VTN Nevada

Company Name

(702) 247-4020

Telephone No. Date

Note: Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.

Signature of Community Official

Kevin Eubanks, Assistant General Mg

Printed Name and Title of Community Official

Clark County Regional Flood Control

Community Name

10/1/98

Date

Does this request impact any other communities? ☐ Yes ☒ No

If yes, attach letters from all affected jurisdictions acknowledging the revision request and approving the changes to the floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

FEDERAL EMERGENCY MANAGEMENT AGENCY **CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average . 23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2
2. I am licensed with expertise in Hydrology and Hydraulics
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)** structural, geotechnical, land surveying.]
3. I have 10 years experience in the expertise listed above.
4. I have ☐ prepared ☒ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and /or designs, is/are being certified:
   To remove the ZOne A based on a physical change.
7. Based on the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)
   a. ☐ Viewed all phases of actual construction.
   b. ☐ Compared plans and specifications with as-built survey information.
   c. ☐ Examined plans and specifications and compared with completed projects.
   d. ☒ Other *(Specify)* currently under construction
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Ken D. Gilbreth
(please print or type)

Title: Project Manager
(please print or type)

Registration No. 9177 Expiration Date: 6-30-99

State Nevada

Type of License Civil

Signature

10-16-98
Date

Seal
(Optional)

*Specify Subdiscipline

Note: Insert not applicable (N/A) if statement does not apply.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.67 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash
(One form for each flooding source)

Project Name /Identifier: East C-1 Detention Basin

1. HYDROLOGIC ANALYSIS IN FIS

- [X] **Approximate study stream (Zone A)**
- [ ] **Detailed study stream (briefly explain methodology)** _____

2. REASON FOR NEW HYDROLOGIC ANALYSIS

- [ ] **No existing analysis**
- [ ] **Improved data** *(see data revision on page 3)*
- [X] **Changed physical conditions of watershed** *(explain)* Construction of Flood Control Facility in the watershed, the East C-1 Detention Basin.
- [ ] **Alternative methodology** *(justify why the revised model is better than model used in the effective FIS)*
- [X] **Evaluation of proposed conditions (CLOMRs only) (explain)** Currently under construction project should be complete by September, 1999
- [ ] **Other** _____

If a computer program/model was used in revising the hydrologic analysis, please provide a diskette with the input files for the 10-, 50-, 100 - and 500-year recurrence intervals.

Only the 100-year recurrence interval need be included for SFHAs designated as Zone A.

3. APPROVAL OF ANALYSIS

- [X] **Approval of hydrologic analysis, including the resulting peak discharge value (s) has been provided by the appropriate local, state, or Federal Agency. (i.e.,** City of Henderson, Clark County Regional Flood Control District, Division of Water Resources, Dam Safety **)**
  Attach evidence of approval.
- [ ] **Approval of the hydrologic analysis is not required by any local, State, or Federal Agency.**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4. REVIEW OF RESULTS

Stream: Unnamed Wash

Comparison of 100-year Flood Discharges

Location	Drainage area (Sq mi.)	FIS (cfs):	Revised (cfs):
East C-1 Detention Basin	5.16	2688	93

Note: **When revised discharges are not significantly different than FIS discharges, FEMA may require a confidence limits analysis on attachment D at a later date to complete the review.**

As is often the case with revision requests, only a portion of a stream may actually be revised or affected by a revision. Therefore, transition to the unrevised portion is important to maintain the continuity of the study. NFIP regulations stipulate that such a transition must be assured. What is the transition from the proposed discharges to the effective discharges? Please explain how the transition was made *(attach separate sheet if necessary)*

With the construction of the East C-1 Detention Basin, the Zone A floodplain has been reduced and is confined to the existing washes downstream of the Detention Basin.

Attach a completed "review of results" page for each flooding source.

Is the new hydrologic analysis being developed solely to revise the flow values presented in the FIS *(i.e. no changed hydraulic conditions)*? ☐ **Yes** ☑ **No**

If yes, does the 100-year water surface elevation change by 1.0 foot or more? ☐ **Yes** ☐ **No**

Note: FEMA does not normally revise NFIP maps solely due to flow changes when changes in 100-year water surface elevation are less than 1.0 foot.

5. HISTORICAL FLOODING INFORMATION

Is historical data available for the flooding source? ☐ Yes ☒ No

If yes, provide the following:

Location along flooding source: _____

Maximum peak discharge: _____ cfs

Second highest peak discharge: _____ cfs

Source of information: _____

6. GAGE RECORD INFORMATION

Location of nearest gage to project site *(along flooding source or similar watershed; specify)*

N/A

Gaging Station: _____

Drainage area at gage: _____ mi^2

Number of years of data: _____

7. DATA REVISION

Please use the following table to list all the data and/or parameters affected by this request and identify them as new data (*New*) or as revising existing data (*Revised*). *(If necessary, attach a separate sheet.)*

Data Parameter	New	Revised	Data Source
Hydrology/Hydraulic Analysis	☒	☐	Clark County Regional Flood Control
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

- The data source can be a Federal, State, or local government agency, or a private source. Some State and local governments may have less strict data requirements than Federal agencies, in which case the hydrologic data may not be accepted by FEMA unless it is demonstrated that the data give a better estimate of the flood discharge.
- Attach documentation corroborating each data source *(i.e., certified statement, report, bibliographical reference to a published document)*. In the case of a published document or a government report, providing copies of the cover and pertinent pages may be helpful.

8. METHODOLOGY FOR NEW ANALYSIS

☐ Statistical Analysis of Gage Records *(use Attachment A)*

☐ Regional Regression Equations *(use Attachment B)*

☒ Precipitation/Runoff Model *(use Attachment C)*

☐ Other *(specify; attach backup computations and supporting data)* _____

_____

ATTACHMENT A: STATISTICAL ANALYSIS OF GAGE RECORDS

Gaging Station: _____

Gage Location (latitude and longitude): _____

	FIS:	Revised:
1. Number of years of data		
Systematic		
Historical		
2. Homogeneous data?	☐ Yes ☐ No	☐ Yes ☐ No
3. Data adjustments?	☐ Yes ☐ No	☐ Yes ☐ No
4. Number of high outliers		
Low outliers		
Zero events		
5. Generalized skew		
6. Station skew		
7. Adopted skew		
8. Probability distribution used (justify if log-Pearson III was not used)		
9. Transfer equations to ungaged sites		☐ Yes ☐ No

If yes, specify method

_____

_____

_____

10. Expected probability* ☐ Yes ☐ No

11. Comparison of results with other analyses ☐ Yes ☐ No

If yes, describe comparison

_____

_____

_____

*FEMA does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS.

If any data are not available, indicate with "N/A".

Attach analysis including plot of flood frequency curve.

1. **Bibliographical Reference:**

_____

_____

_____

(Attach a copy of title page, table of contents, and pertinent pages including equations.)

2. **Gaged or ungaged stream:** _____

3. **Hydrologic region(s):** _____
Attach backup map.

4. **Provide parameters, values, and source of data used to define parameters.**

_____

_____

_____

		FIS		Revised	
5.	**Urbanized conditions calculations?**	☐ **Yes**	☐ **No**	☐ **Yes**	☐ **No**
6	**Percent of watershed urbanization**	_____		_____	
7.	**Is the watershed controlled?**	☐ **Yes**	☐ **No**	☐ **Yes**	☐ **No**
8.	**Comparison with other analyses?**	☐ **Yes**	☐ **No**	☐ **Yes**	☐ **No**

If the answer to questions 5, 7, or 8 is yes, explain methodology in Comments.

If data are not available, indicate with "N/A".

9. **Comments**

_____

_____

_____

_____

Attach computation and supporting maps delineating the watershed boundary and drainage area divides.

ATTACHMENT C: PRECIPITATION/RUNOFF MODEL

		FIS:	Revised
1.	Method or model used:	Unknown	Hec-1
	Version:	"	410
	Date:	"	3/23/93
2.	Source of rainfall depth:	"	NOAA Atlas II
3.	Source of rainfall distribution:	"	NSACE
4.	Rainfall duration:	"	6 Hr
5.	Areal adjustment to precipitation (%):	"	Varies
6.	Maximum overland flow length	"	7000
7.	Hydrograph development method:	"	SCS
8.	Loss rate method:	"	SCS
	Source of soils information:	"	USDA Soil Survey
	Source of land use information	"	Current Zoning
9.	Channel routing method:	"	Kinematic
10.	Reservoir routing:	☐ Yes ☒ No	☒ Yes ☐ No
11.	Baseflow considerations:	☐ Yes ☒ No	☐ Yes ☒ No

If yes, explain how baseflow was determined:

12. Snowmelt considerations? ☐ Yes ☐ No ☐ Yes ☒ No

13. Model calibration? ☐ Yes ☐ No ☐ Yes ☒ No

If yes, explain how calibration was performed

14. Future land use conditions? ☒ Yes ☐ No

If yes, explain why

Because this Detention Basin is a Clark County regional Flood Control District master Plan Facility the facility was designed using ultimate land use conditions.

NOTE: FEMA policy is to base flooding on existing conditions.
If data are not available, indicate with "N/A".

Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.

ATTACHMENT D: CONFIDENCE LIMITS EVALUATION

Stream: _____

Selected location for Confidence Limits Evaluation (*describe location*): _____

_____

Discharges for selected location:

Exceedance Probability		FIS	Revised
10%	(10-year)	_____ cfs	_____ cfs
2%	(50-year)	_____ cfs	_____ cfs
1%	(100-year)	_____ cfs	_____ cfs
0.2%	(500-year)	_____ cfs	_____ cfs

1% (100-year) Flood Confidence Intervals

90% Confidence Interval:
- **5% limit** _____ cfs
- **95% limit** _____ cfs

50% Confidence Interval:
- **25% limit** _____ cfs
- **75% limit** _____ cfs

If the value of the 100-year frequency flood in the FIS is beyond the 50% confidence interval but within the 90% confidence interval, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

Note: An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

Attach Confidence Limits Analysis.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	FEMA USE ONLY	O.M.B. No. 3067-0148 Expires July 31, 1997

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash
(Use form for each flooding source)

Project Name/Identifier: East C-1 Detention Basin

1. REACH TO BE REVISED

Downstream limit: C1/Drake Channel

Upstream limit: East C-1 Detention Basin

2. EFFECTIVE FIS

☐ **Not studied**

☒ **Studied by approximate methods**

Downstream limit of study C1/Drake Channel

Upstream limit of study East C-1 Detention Basin

☐ **Studied by detailed methods**

Downstream limit of detailed study _____

Upstream limit of detailed study _____

☐ **Floodway delineated**

Downstream limit of Floodway _____

Upstream limit of Floodway _____

3. HYDRAULIC ANALYSIS

Why is the hydraulic analysis different from that used to develop the FIRM. ***(Check all that apply)***

☒ **Not studied in FIS**

☐ **Improved hydrologic data/analysis. Explain:** _____

☐ **Improved hydraulic analysis. Explain:** _____

☒ **Flood control structure. Explain:** Construction of the East C-1 Detention Basin and Appurtenant

☐ **Other. Explain:** _____

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

For areas which have detailed flooding:

Full input and output listings along with files on diskette (if available) for each of the models listed below (items 1, 2, 3, 4, and 5) and summary of the source of input parameters used in the models must be provided. The summary must include a complete description of any changes made from model to model (e.g. duplicate effective model to corrected effective model) At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.

For areas which do not have detailed flooding:

Only the 100-year flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

If hydraulic models are not developed, hydraulic analyses for existing or pre-project conditions and revised or post-project conditions must be submitted. All calculations must be submitted for these analyses. (See Item 6 below.)

	Natural	Floodway
1. Duplicate Effective Model Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models *(10-, 50-, 100-, and 500-year multi-profile runs and the floodway run)* must be obtained and then reproduced on the requestor's equipment to produce the duplicate effective model. This is required to assure that the effective model input data has been transferred correctly to the requestor's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.	☐	☐
2. Corrected Effective Model The corrected effective model is the model that corrects any errors that occur in the duplicate effective model, adds any additional cross sections to the duplicate effective model, or incorporates more detailed topographic information than that used in the currently effective model. The corrected effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.	☐	☐
3. Existing or Pre-Project Conditions Model The duplicate effective model or corrected effective model is modified to produce the existing or pre-project conditions model to reflect any modifications that have occurred within the floodplain since the date of the effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the corrected effective model or duplicate effective model.	☒	☐
4. Revised or Post-Project Conditions Model The existing or pre-project conditions model *(or duplicate effective model or corrected effective model, as appropriate)* is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for proposed project this model must reflect proposed conditions.	☐	☐
5. Other: Please attach a sheet describing all other models submitted.	☒	☐
6. Hydraulic Analyses (Only if Hydraulic Models are not developed) Attach all calculations for the existing or pre-project conditions and the revised or post-project conditions. Proceed to Form 5, "Riverine/Coastal Mapping Form".		

5. MODEL PARAMETERS (*from model used to revise 100-year water surface elevation*)

1. Discharges:	Upstream Limit	Downstream Limit
10-year		
50-year		
100-year	Upper limit of watershed boundary	East C-1 Detention Basin
500-year		

Attach diagram showing changes in 100-year discharge

2. **Explain how the starting water surface elevations were determined** the water surface elevations were determined using the revised HEC-1 flow rates.

3. **Give range of friction loss coefficients (*Manning's "N"*) Channel** ..... .015 .030

Overbanks ..... .015 .030

If friction loss coefficients are different anywhere along the revised reach from those used to develop the FIRM, give location, value used in the effective FIS, and revised values and an explanation as to how the revised values were determined.

Location	FIS	Revised

Explain:

4. **Describe how the cross section geometry data were determined (*e.g., field survey, topographic map, taken from previous study*) and list cross sections that were added.**

From Design drawing for the construction.

5. **Were natural channel banks selected as the location of the left and right channel banks in the model?**

☐ **Yes** ☒ **No** **If no, explain why not:** Because this is a man-made channel and all of the flow is contained in the channel.

6. **Explain how reach lengths for channel and overbanks were determined:**

From construction plans for the Channel see Design Calculation Notebook.

6. RESULTS *(from model used to revise 100-year water surface elevations)*

1. **Do the results indicate:**

a. Water surface elevations higher than end points of cross sections? ☐ Yes ☒ No

b. Supercritical depth? ☒ Yes ☐ No

c. Critical depth? ☐ Yes ☒ No

d. Other unique situations ☒ Yes ☐ No

If yes to any of the above, attach an explanation that discusses the situation and how it is presented on the profiles, tables, and maps.

2. **What is the maximum change in energy gradient between cross-sections?** _____

Specify location _____

3. **What is the distance between the cross-sections in 2 above?** _____

4. **What is the maximum distance between cross-sections?** _____

Specify location _____

5. **Floodway determination**

a. **What is the maximum surcharge allowed by the community or State?** _____ **foot**

b. **What is the maximum surcharge for the revised conditions?** _____ **foot**

Specify location _____

c. **What is the maximum velocity?** 19 **fps**

Specify location _____

d. **Are there any negeative surcharge values at any cross-section?** ☐ Yes ☒ No

If yes, the floodway may need to be widened. If it is not widened, please explain and indicate the maximum negative surcharge.

Explain: _____

6. RESULTS (Cont'd)

6. Is the discharge value used to determine the floodway anywhere different from that used to determine the natural 100-year flood elevations? ..... ☒ Yes ☐ No

If Yes, explain:

No channel at this location for 100-year flood elevations new construction.

7. Do 100-year water surface elevations increase at any location? ..... ☐ Yes ☐ No

If yes, please attach a list of the locations where the increases occur, state whether or not the increases are located on the requestor's property, and provide an explanation of the reason for the increases. *(For example: State if the increase is due to fill placed within the floodway fringe or placed within the currently adopted floodway limits)*

Attach a completed comparison table entitled: Water Surface Elevation Check (see page 6)

7. REVISED FIRM/FBFM AND FLOOD PROFILES

8. The revised water surface elevations tie into those computed by the effective FIS Model *(10-, 50-, 100-, and 500-year)*, downstream of the project at cross-section_____ within_____feet *(vertical)* and upstream of the project at cross section_____within_____feet *(vertical)*. N/A

9. The revised floodway elevations tie into those computed by the effective FIS model, dowstream of the project at cross section_____within_____feet *(vertical)* and upstream of the project at cross section_____ within_____feet *(vertical)*. N/A

10. Attach profiles, at the same vertical and horizontal scale as the profiles in the effective FIS report, showing stream bed and profiles of all floods studied (without encroachment). Also, label all cross sections, road crossings (including low chord and top-of-road data), culverts, tributaries, corporate limits, and study limits. If channel distance has changed, the stationing should be revised for all profile sheets.

11. Attach a Floodway Data Table showing data for each cross section listed in the published Floodway Data Table in the FIS report.

Proceed to Riverine /Coastal Mapping Form (Form 5)

FEDERAL EMERGENCY MANAGMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODIND SOURCE	PROJECT NAME /IDENTIFIER

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]

COMMENTS:

1-100-year (natural) Water Surface Elevation 2-Encroachment (floodway) Water Surface Elevation 3-Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

Sheet _____ of _____

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE/COASTAL MAPPING FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash

Project Name/Identifier: East C-1 Detention Basin

1. MAPPING CHANGES

1. A topographic work map of suitable scale, contour interval, and planimetric definition must be submitted showing *(indicate N/A when not applicable)*:

		Included					
A.	Revised approximate 100-year floodplain boundaries (Zone A)?	☒	Yes	☐	No	☐	N/A
B.	Revised detailed 100- and 500-year floodplain boundaries?	☐	Yes	☐	No	☒	N/A
C.	Revised 100-year floodway boundaries?	☐	Yes	☒	No	☐	N/A
D.	Location and alignment of all cross sections used in the revised hydraulic model with stationing control indicated?	☒	Yes	☐	No	☐	N/A
E.	Stream alignments, road and dam alignments?	☒	Yes	☐	No	☐	N/A
F.	Current community boundaries?	☐	Yes	☐	No	☒	N/A
G.	Effective 100- and 500-year floodplain and 100-year floodway boundaries from the FIRM/FBFM reduced or enlarged to the scale of the topographic work map?	☒	Yes	☐	No	☐	N/A
H.	Tie-ins between the effective and revised 100- and 500-year floodplains and 100-year floodway boundaries?	☐	Yes	☐	No	☒	N/A
I.	The requestor's property boundaries and community easements?	☐	Yes	☐	No	☒	N/A
J.	The signed certification of a registered professional engineer?	☒	Yes	☐	No	☐	N/A
K.	Location and description of reference marks?	☒	Yes	☐	No	☐	N/A
L.	Vertical datum (example: NGVD, NAVD etc.)?	☒	Yes	☐	No	☐	N/A
M.	Coastal zone designations tie into adjacent areas not being revised?	☐	Yes	☐	No	☒	N/A
N.	Location and alignment of all coastal transects used to revise the coastal analyses?	☐	Yes	☐	No	☒	N/A

If any of the items above are marked no or N/A, please explain: B&C detial boundaries are not included on the firm map. F. Community boundaries have not been changed. H. N/A M.&N. coastal zones N/A

2. What is the source and date of the updated topographic information *(example: orthophoto maps, July 1985; field survey, May 1979, beach profiles, June 1987, etc.)*? _____

3. What is the scale and contour interval of the following workmaps?
   a. Effective FIS _____ scale _____ Contour interval
   b. Revision Request _____ scale _____ Contour interval

NOTE: Revised topographic information must be of equal or greater detail.

4. Attach an annotated FIRM and FBFM at the scale of the effective FIRM and FBFM showing the revised 100- and 500-year floodplain and the 100-year floodway boundaries and how they tie into those shown on the effective FIRM and FBFM downstream and upstream of the revisions or adjacent to the area of revision for coastal studies Attach additional pages if needed

PLEASE REFER TO THE INSTRUCTION FOR THE APPROPRIATE MAILING ADDRESS

5. Flood Boundaries and 100-year water surface elevations:

a. Has the 100-year floodplain been shifted or increased or the 100-year water surface elevation increased at any location on property other than the requestor's or community's? ☐ Yes ☒ No

If yes, please give the location of shift or increase and an explanation for the increase.

b. Have the affected property owners been notified of this shift or increase and the effect it will have on their property? ..... ☐ Yes ☐ No

If yes, please attach letters from these property owners stating they have no objections to the revised flood boundaries if a LOMR is being requested.

c. What is the number of insurable structures that will be impacted by this shift or increase?_____

6. Have the floodway boundaries shifted or increased at any location compared to those shown on the effective FBFM or FIRM? ..... ☐ Yes ☒ No

If yes, explain:

7. If a V- zone has been designated, has it been delineated to extend landward to the heel of the primary frontal dune? ☐ Yes ☐ No

If no, explain:
N/A

8. Manual or digital map submission:

☒ Manual

☐ Digital

Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance of submission as possible.

2. EARTH FILL PLACEMENT

1. The fill is: ☐ Existing ☐ Proposed N/A Fill has not been utilized to remove the site from Zone A

2. Has fill been placed/will be placed in the regulatory floodway? ..... ☐ Yes ☒ No
If yes, please attach completed Riverine Hydraulic Analysis Form. (Form 4)

3. Has fill been/will be placed in floodway fringe *(area between the floodway and 100-year floodplain boundaries)*? ..... ☐ Yes ☒ No

If yes, then complete A, B, C, and D below.

a. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ..... ☐ Yes ☐ No

If yes, justify steeper slopes_____

_____

b. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? *(Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)*
..... ☐ Yes ☐ No

If no, describe erosion protection provided_____

_____

c. Has all fill placed in the revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☐ Yes ☐ No

d. Can structures conceivably be constructed on the fill at any time in the future? ☐ Yes ☐ No

If yes, provide certification of fill compaction (Item c. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer.

4. Has fill been placed/will be placed in a V-zone? ☐ Yes ☒ No

If yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall? ☐ Yes ☐ No

If yes, attach the coastal structures form.

FEDERAL EMERGENCY MANAGEMENT AGENCY **CHANNELIZATION FORM**	FEMA USE ONLY	O.M.B. No. 3067-0148 Expires July 31, 1997

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash

Project Name/Identifier: East C-1 Detention Basin

1. EXTENT OF CHANNELIZATION

Downstream limit: _____

Upstream limit: _____

2. CHANNEL DESCRIPTION

1. **Describe the inlet to the channel** _____

2. **Briefly describe the shape of the channel** ***(both cross sectional and planimetric configuration)*** **and its lining** ***(channel bottom and sides)*** Trapezoidal dirt lined channel with a 50 ft bottom width and H:4:1:V side slope and H:7:1:V side slope.

3. **Describe the outlet from the channel** _____

4. **The channelization includes:**

- ☒ **Levees** ***(Attach Levee/Floodwall system analysis Form)***
- ☐ **Drop structures**
- ☐ **Superelevated sections**
- ☒ **Transitions in cross sectional geometry**
- ☒ **Debris basin/detention basin**
- ☐ **Energy dissipater**
- ☐ **Other** _____

5. **Attach the following:**

a. **Certified engineering drawings showing channel alignment and locations of inlet, outlet, and items checked in item 4**

b. **Typical cross sections and profiles of channel banks and invert**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. HYDRAULIC CONSIDERATIONS

1. What is the 100-year flood discharge? ..... 229 & 599 cfs
2. Do the cross sections in the hydraulic model match the typical cross sections in the plans? ☒ Yes ☐ No
3. Are the channel banks higher than the 100- year flood elevations everywhere? ..... ☒ Yes ☐ No
4. Are the channel banks higher than the 100-year flood energy grade lines everywhere? .. ☐ Yes ☒ No
5. Is the land on both sides of the channel above the adjacent 100-year flood elevation at all points along the channel? ..... ☒ Yes ☐ No
6. What is the range of freeboard? ..... 4.2– 5.2 feet
7. What is the range of the 100-year flood velocities? ..... 9 – 13 ft/sec
8. What is the lining type (both bottom and sides)? Soil cement side and bottom to Station the channel with native material.

   Explain how the channel lining prevents erosion and maintains channel stability *(attach documentation)*

   See Design Calculation Notebook

9. What is the design elevation in the channel based on?

   ☐ Subcritical flow
   ☐ Critical flow
   ☒ Supercritical flow
   ☐ Energy grade line

   Is the 100-year flood profile based on the above type of flow? ..... ☒ Yes ☐ No

   If no, explain: _____

10. Is there the potential for a hydraulic jump at the following locations:

    Inlet to channel? ..... ☐ Yes ☐ No
    Outlet of channel? ..... ☐ Yes ☒ No
    At Drop Structures? ..... ☐ Yes ☐ No
    At Transitions? ..... ☐ Yes ☒ No
    Other locations.? Explain: _____

    If the answer to any of the above is yes, please explain how the hydraulic jump is controlled and the effects of the hydraulic jump on the stability of the channel.

    Explain: _____

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. a. Is there any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water surface elevations and/or the capacity of the channel? ..... ☒ Yes ☐ No

   b. Based on the conditions of the watershed and stream bed, is there a potential for sediment transport (including scour and deposition) to affect the 100-year water surface elevations and /or the capacity of the channel? ..... ☒ Yes ☐ No

2. If the answer to either 1A or 1B is yes:

   a. What is the estimated sediment (bed) load?
   _____cfs (attach gradation curve)

   Explain method used to estimate load See Calculation Notebook.

   _____

   _____

   _____

   _____

   b. Is the 100-year flood velocity anywhere within the channel less than the 100-year flood velocity of the inlet? ☐ Yes ☒ No

   c. Will sediment accumulate anywhere within the channel? ☒ Yes ☐ No

   d. Will deposition or scour occur at or near the inlet? ☐ Yes ☒ No

   e. Will deposition or scour occur at or near the outlet? ☐ Yes ☒ No

Attach documentation showing affects on the hydrologic and hydraulic analyses

FEDERAL EMERGENCY MANAGEMENT AGENCY **LEVEE/FLOODWALL SYSTEM ANALYSES FORM**	FEMA USE ONLY	O.M.B. No. 3067-0148 Expires July 31, 1997

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.0. hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash

Project Name/Identifier: East C-1 Detention Basin

1. REACH TO BE REVISED

Downstream limit: C-1/Drake Channel

Upstream limit: East C-1 Detention Basin

This Levee/Floodwall analysis is based on:

- ☐ upgrading of an existing levee/floodwall system
- ☒ a newly constructed levee/floodwall system
- ☐ reanalysis of an existing levee/floodwall system

2. LEVEE/FLOODWALL SYSTEM ELEMENTS

1. Levee elements and locations:

☒ earthen embankment, dike, berm etc.	Station	11+00	to	46+00
☐ structural floodwall	Station		to	
☐ other (describe)	Station		to	

2. Structural Type:

- ☐ monolithic cast-in place reinforced concrete
- ☐ reinforced concrete masonry block
- ☐ sheet piling
- ☒ other (describe) Compact dirt with soil cement protection

3. Has this levee/floodwall system been certified by a Federal agency to provide protection against the 100-year flood event?

☐ Yes ☒ No

If yes, by which agency? _____

If yes, complete only the interior drainage section on pages 7 and 8 of this form and the operation and maintenance section of Revision Requestor and Community Official Form.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. LEVEE/FLOODWALL SYSTEM ELEMENTS (Cont'd)

3. Attach certified drawings containing the following information (indicate drawing sheet numbers):

a. Plan of the levee embankment and floodwall structures. Sheet Numbers_____

b. A profile of the levee/floodwall system showing the 100-year water surface elevations, levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers_____

c. A profile of the 100-year water surface elevation, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure device. Sheet Numbers_____

d. A layout detail for the embankment protection measures. Sheet Numbers_____

e. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers_____

3. FREEBOARD

1. The minimum freeboard provided above the 100-year water surface elevation is:

Riverine

3.0 feet or more at the downstream end and throughout	☐ Yes	☐ No
3.5 feet or more at the upstream end	☐ Yes	☐ No
4.0 feet immediately upstream and downstream of all structures and constrictions	☒ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave for the 100-year stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above 100-year stillwater surge elevation	☐ Yes	☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Part 65.10 (b) (1) (ii) of the National Flood Insurance Program regulations.

If no is answered to any of the above, please explain where and why:_____

_____

2. Is there an indication from historical records that ice-jamming can effect the 100-year water surface elevation?
☐ Yes ☒ No If yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Tabulate the elevations at critical locations (tabulate values at each levee crest grade change)

Station	Location	100-Year Water Surface Elevation	Levee Crest	Freeboard (ft.)
11+20	Upper end	2344.74	2349	4.26
14+50		2336.23	2340.5	4.27
18+56		2325.72	2330	4.28
24+50		2303.59	2308	4.41
29+61		2284.71	2289	4.29
36+00		2265.18	2269.5	4.32
43+50	Lower end	2241.71	2247	5.29

(Extend table on an added sheet as needed and reference)

5. SEDIMENT TRANSPORT CONSIDERATIONS

1. a. Is there any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water surface elevations?

☐ Yes ☒ No

b. Based on the conditions (such as geomorphology, vegetative cover and development of the watershed and stream bed, and bank conditions), is there a potential for debris and sediment transport (including scour and deposition) to affect the 100-year water surface elevations and/or the freeboard for the levee/floodwall?

☐ Yes ☒ No

2. If the answer to either 1a or 1b is yes:

A. What is the estimated sediment (bed material) load?

_____cfs (attach gradation curve)

Explain method used to estimate the sediment transport and the depth of scour and/or deposition

_____

_____

_____

_____

_____

B. Will sediment accumulate anywhere along the levee/floodwall (such as along any bends in the channel)?

☐ Yes ☐ No

If yes, what is the *minimum* freeboard at these locations?_____feet.

6. CLOSURES

1. Openings through the levee system:

☐ exist ☐ do not exist

If openings exist, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as neded and reference)

Geotechnical and geologic data:

In addition to the required detail analysis reports, data obtained during field and laboratory investigations and used in the design analysis must be submitted in a tabulated summary form for the following levee system features. (Reference U S. Army Corps of Engineers EM-1110-2-1906 Form 2086).

4. EMBANKMENT PROTECTION

1. Maximum levee slope landside: _____

2. Maximum levee slope floodside: _____

3. Range of 100-year riverine flood velocities along the levee: 8.97 fps (min.)
   to 12.74 fps (max.)

4. Embankment material is protected by (describe the kind): soil cement
   _____
   _____
   _____

5. Riprap Design Parameters: (Include references) ☐ Velocity; ☐ Tractive stress

Reach	Sideslope	Flow depth	Velocity	Curve or Straight	Stone Riprap D_{100}	Stone Riprap D_{50}	Stone Riprap Thickness	Depth of Toedown
Sta_____to_____								
Sta_____to_____								
Sta_____to_____								

(Extend table on an added sheet as needed and reference)

6. Has a bedding/filter analysis and design been included ☐ Yes ☒ No

7. Describe the analysis for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

7. EMBANKMENT AND FOUNDATION STABILITY

1. Identify locations and describe the basis for selection of critical locations for analyses: Typical section

☐ Overall height: Sta _____, height 10 ft.

☐ Limiting foundation soil strength:

Sta _____, depth 0 to 50+

strength Ø = 38 degrees, c = 100 psf

☐ slope: SS = 7 (h) to 1 (v)

(Repeat as needed on an added sheet for additional slopes and locations)

2. Specify the embankment stability analyses methodology used (e.g. circular arc, sliding block, infinite slope, etc.): circular arc

3. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction	3.3	1.3
II	Sudden drawdown	N/A	1.0
III	Critical flood stage	N/A	1.4
IV	Steady seepage at flood stage	N/A	1.4
VI	Earthquake (Case I)	1.4	1.0

(Reference: U.S. Army Corps of Engineers EM-1110-2-1913 Table 6-1)

4. Was a seepage analysis for the embankment performed? ☐ Yes ☒ No

Describe methodology used: _____

5. Was a seepage analysis for the foundation performed? ☐ Yes ☒ No

Were uplift pressures at the embankment landside toe checked? ☐ Yes ☐ No

Were seepage exit gradients checked for piping potential? ☐ Yes ☐ No

6. Duration of 100-year flood hydrograph against the embankment : _____ Hrs.

Note: Attach engineering analysis to support construction plans. See Geotechnical Design Report: Slope Stability Analysis for 4:1 Embankment Applied to 4:1 Levee Slope

B. FLOODWALL AND FOUNDATION STABILITY

1. Describe analysis submittal based on Code:

   ☐ UBC (1988) or ☐ Other (specify)_____

2. Stability analysis submitted provides for:
   ☐ Overturning; ☐ Sliding; If not, explain_____

   _____

3. Loading included in the analyses were:

   ☐ Lateral earth @ P_A = _____psf; P_p = _____psf

   ☐ Surcharge--Slope @_____, ☐ surface_____psf

   ☐ Wind @ P_w = _____psf

   ☐ Seepage (Uplift) _____ ☐ Earthquake @ P_{eq} = _____%g

   ☐ 100-year significant wave height_____ft.

   ☐ 100-year significant wave period_____sec.

4. Summary of Stability Analysis Results: Factors of Safety. Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta_____ To_____		Sta_____ To_____	
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood & Impact	1.5	1.5				
Dead, Soil & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; COE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

5. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load	Short Term Load
Computed design maximum	_____psf	_____psf
Maximum allowable	_____psf	_____psf

6. Foundation scour protection ☐ is, ☐ is not provided, (describe)

   _____

Note: Attach engineering analysis to support construction plans.

9. SETTLEMENT

1. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin?
   ☒ Yes ☐ No
2. Computed range of settlement: 0.05 ft. to 0.10 ft.
3. Settlement of the levee crest is determined to be primarily from:
   - ☒ Foundation consolidation
   - ☒ Embankment compression
   - ☐ Other (describe) Combined and both are short term
4. Differential settlement of floodwalls
   ☐ has ☐ has not been accommodated in the structural design and construction.

Note: Attach engineering analysis to support construction plans.

10. INTERIOR DRAINAGE

1. Specify size of each interior watershed
   - Draining to pressure conduit _____
   - Draining to ponding area _____
2. Relationships Established
   - Ponding elevation vs. storage ☐ Yes ☐ No
   - Ponding elevation vs. gravity flow ☐ Yes ☐ No
   - Differential head vs. gravity flow ☐ Yes ☐ No
3. The river flow duration curve is enclosed ☐ Yes ☐ No
4. Specify the discharge capacity of the head pressure conduit _____
5. Which Flooding Conditions Were Analyzed?
   - Gravity flow (Interior Watershed) ☐ Yes ☐ No
   - Common storm (River Watershed) ☐ Yes ☐ No
   - Historical ponding probability ☐ Yes ☐ No
   - Coastal wave overtopping ☐ Yes ☐ No

   If no, explain why: _____
6. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection.
   ☐ Yes ☐ No

   If no, explain why: _____
7. The rate of seepage through the levee system for the 100-year flood is _____ cfs

10. INTERIOR DRAINAGE (Cont'd)

8. The length of levee system used to drive the seepage rate in item 7: _____ ft.

9. Will a pumping plant(s) be used for interior drainage? ☐ Yes ☐ No

If yes, include the number of pumping plants: _____

For each pumping plant, list:	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operations be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: U.S. Army Corps of Engineers EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Note: Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

11. OTHER DESIGN CRITERIA

1. The following items have been addressed as stated:

Liquifaction ☐ is ☐ is not a problem.

Hydrocompaction ☐ is ☐ is not a problem

Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem.

2. For each of these problems, state the basic facts and corrective action taken.

_____

_____

_____

_____

3. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?

☐ Yes ☐ No

Attach supporting documentation

Are the planned/installed works in full compliance with NFIP regulations, Section 44 CFR Ch. 1. 65.10?

☐ Yes ☐ No

1. Does the operation plan incorporate all the provisions for closure devices as required in Section 65.10 (c) (1), of the NFIP regulations?

☐ Yes ☒ No

2. Does the operation plan incorporate all the provisions for interior drainage as required in Section 65.10 (c) (2), of the NFIP regulations?

☐ Yes ☒ No

If the answer is no to either of the above, please explain below.

_____

_____

_____

_____

FEDERAL EMERGENCY MANAGEMENT AGENCY **DAM FORM**	FEMA USE ONLY	O.M.B. No. 3067-0148 Expires July 31, 1997

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 0.5 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unanmed Wash

Project Name/Identifier: East C-1 Detention Basin

1. IDENTIFIER

Name of Dam: East C-1 Detention Basin

Location of dam along flood source (in terms of stream distance or cross section identifier):

Check one of the following:

- ☐ Existing dam
- ☒ New dam
- ☐ Modifications of existing dam (describe modifications)_____

Was the dam designed by: _____Federal agency _____State agency

_____Local government agency X Private organization?

2. BACKGROUND

Does the dam have dedicated flood control storage? ☒ Yes ☐ No

Does the project involve revised hydrology? ☒ Yes ☐ No

If yes, complete Hydrologic Analysis Form (Form 3) and include calculations of the 100-year inflow flood hydrograph routed through the dam with the beginning pool at the normal pool elevation (spillway crest elevation for ungated spillway). Include any inflow hydrograph bulking by watershed sediment yield and provide necessary debris and sediment yield analysis.

Does the revised hydrology affect the 100-year water-surface elevation behind the dam or downstream of the dam? ☒ Yes ☐ No

If yes, complete the Riverine Hydraulic Analysis Form (Form 4) and complete the table shown on the following page.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS.

3. RESULTS

	Stillwater Elevation Behind the Dam	
	FIS	Revised
10-year		
50-year		
100-year		2485
500-year		
Normal Pool Elevation		-0-

Was long term sediment accumulation taken into consideration in determining the normal pool elevation? ☒ Yes ☐ No

Was the dam designed to withstand the hydrostatic and hydrodynamic forces associated with floods greater than the 100-year flood? ☒ Yes ☐ No

If no, and the dam has a reasonable probability of failure during the 100-year flood, please attach dam break analysis.

Provide the following data on the dam:

Dimensional Height: 64 ft

Crest Elevation of top of dam: 2510 ft

100-year flood storage capacity: 347

Freeboard (measured from 100-year water surface elevation): 25 ft

Spillway(s):

Type: ☐ gated ☐ ungated

Dimensional Width: 300' Ogee Crested Weir

Dimensional Height: R1'

Crest Elevation of top of spillway: 2500

Outlet(s):

Type: ☐ gated ☐ ungated

Width:

Height

Diameter:

Invert Elevation:

Explain flow regulation plan:

Are the project features, including the emergency spillway, designed to accommodate the 100-year flood discharge without overtopping the dam? ☒ Yes ☐ No

Was the dam designed in accordance with all currently applicable local, State, and Federal regulations? ☒ Yes ☐ No

If no, please provide explanation.

FEMA may request a list of regulations that have been complied with and supporting documentation demonstrating compliance with these regulations.

Attach copy of formal operation and maintenance plan

Answer N/A to any questions which are not applicable

INTERLOCAL CONTRACT

1998/1999 ANNUAL MAINTENANCE PROGRAM

THIS CONTRACT, made and entered into this 11th day of June, 1998, by and between the CITY OF HENDERSON, a political subdivision of the State of Nevada, hereinafter referred to as "City", and the CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT, hereinafter referred to as "District".

W I T N E S S E T H:

WHEREAS, pursuant to Chapter 543 of the Nevada Revised Statutes, the District may approve and fund projects to maintain flood control improvements; and

WHEREAS, the City desires to maintain flood control improvements within the City in accordance with the maintenance program set forth herein, and hereinafter referred to as "Project"; and

WHEREAS, the facility upon which maintenance will be done is a facility described in the District's Master Plan.

NOW, THEREFORE, in consideration of the covenants, conditions, agreements, and promises of the parties hereto, the District authorizes the project as it is mutually understood and agreed as follows:

SECTION I - SCOPE OF PROJECT

This Interlocal Contract applies to the maintenance of flood control facilities, which are identified in the District's Master Plan facilities including updates and amendments subsequently approved. The basic maintenance to the facilities will be in accordance with performance standards of the Operations and Maintenance Manual. The Project is more specifically described in Exhibit "A", which is attached hereto, and by this reference incorporated herein.

SECTION II - PROJECT COSTS

The District agrees to provide reimbursement for Project costs within the limits specified below:

1. The Project costs shall not exceed $298,629.00.

The amounts allocated to each individual facility within the Project must be specified in Exhibit "A".

Any changes to said allocated amounts must be approved by the Chief Engineer of the Clark County Regional Flood Control District in accordance with Section 4.24 of the District Operations and Maintenance Manual.

A written request must be made to the District and a Supplemental Interlocal Contract approved to increase the amount noted above prior to payment of any additional funds.

2. "Authorization to Proceed" is herein granted for maintenance of facilities in Exhibit "A" in an amount not to exceed $74,657, effective July 1, 1998.

3. A separate request for an " Authorization to Proceed" will be required for additional facility maintenance funds.

4. A written request must be made to the District and a Supplemental Interlocal Contract approved to increase the amount noted above prior to payment of any additional funds.

5. The City and District will comply with Section 4.12 of the Operations and Maintenance Manual. In accordance with said manual the City shall submit invoices together with a detailed summary report of the maintenance service performed. The City shall submit an Invoice Voucher prepared in duplicate in the manner prescribed by the District. The vouchers shall include such information as is necessary for the District to determine the nature of all expenditures. Each voucher will clearly indicate that it is for services rendered in performance under this contract. Each voucher will also be accompanied by a written certification from the City stating that it is for performance of maintenance activities under this contract and is composed of completed elements set forth in the annual work program. All invoices must be submitted for payment to:

Gale W. Fraser, II, P.E., General Manager/Chief Engineer
Clark County Regional Flood Control District
301 East Clark, Suite 301
Las Vegas, NV 89101

Payment shall be considered timely if made by the District within 30 days. Pursuant to Section IV, Paragraph 6, the District may, in its sole discretion, withhold payments to the City for services rendered if the City fails to satisfactorily comply with any term or condition of this contract and/or the District's

Operations and Maintenance Manual.

SECTION III - PROJECT TIME

The City agrees to perform the Project to the satisfaction of the District prior to June 30, 1999. The District may grant extensions or terminate this contract and require all sums advanced to the City to be repaid if the City fails to perform by said date.

SECTION IV - GENERAL

1. The City will complete the Project as set forth in Exhibit "A". The City staff personnel responsible for coordination work under this contract are as listed below:

Mark T. Calhoun, Director of Public Works
W. Curtis Chandler, Land Development Manager
Carl Noyes, Support Services Manager

It is understood that staff named above will be responsible for work coordination throughout the period of this contract unless the District is informed in writing of changes in these personnel assignments.

2. In addition to the specific terms set forth in this Contract, the parties hereto shall be subject to and governed by the District's Operations and Maintenance Manual, and any applicable portions of the Policies and Procedures adopted by the District.

3. It is the intent of the District that scheduling of maintenance and repair of drainage and flood control facilities in general and Master Plan Facilities specifically be coordinated among entities. Therefore, in those cases where Master Plan approved and District-funded projects have regional flood control significance impacting more than one entity, the City will allow all impacted entities an opportunity to review the maintenance schedule in order to coordinate maintenance efforts.

4. The Chief Engineer of the District shall be responsible for monitoring the performance of the City, approval for payment of billings and expenses submitted by the City and the acceptance of any reports provided by the City. The City shall be responsible for monitoring performance of City staff or private contractors, and the City shall maintain detailed records of all payments made to contractors and make such

records available to the District upon request.

5. The City shall provide right of access to its facilities to the District or Chief Engineer at all reasonable times, in order to monitor and evaluate performance, compliance, and/or quality assurance under this contract.

6. In the event the City fails to perform the maintenance according to the standards specified in this contract and in the District's Operations and Maintenance Manual, the District may perform or cause to be performed the maintenance necessary to assure proper operation of the facility. Cost incurred by the District shall be reimbursed by the City or be deducted from the amount authorized by this contract. The District may not exercise this right without giving the City specific written notice of the maintenance required and allowing the City 60 days within which to perform said maintenance. The notice required by this provision must be sent to:

Mark T. Calhoun, Director of Public Works
240 Water Street
Henderson, NV 89015

7. The records of the City and/or private contractors pertaining to the subject matter of this contract shall at all reasonable times be subject to inspection and audit by the District, County Auditor, or an Agent of the District.

8. If any provision of this contract shall be deemed in conflict with any statute or rule of law, such provision shall be deemed modified to be in conformance with said statute or rule of law.

9. All parties to this contract shall comply with applicable local, state, and federal laws.

10. Any costs found to be improperly allocated in the project will be refunded by the City to the District.

11. It is specifically understood and agreed to by and between the parties hereto that it is not intended by any of the provisions of any part of this contract to create in the public or any member thereof a third party beneficiary hereunder, or to authorize anyone not a party to this contract to maintain a suit for

personal injuries or property damage pursuant to the terms or provisions of this contract.

12. The City hereby indemnifies and shall defend and hold harmless the District, its representatives and their employees (or their authorized representatives) from and against any and all suits, actions, legal or administrative proceedings, claims, demands, damages, liabilities, interest, attorney's fees, costs and expenses whatsoever of any kind or nature whether arising before or after completion of the work hereunder and in any manner directly or indirectly caused, occasioned or contributed to in whole or in part, by reason of any act, omission, fault or negligence whether active or passive of the City, of anyone acting under its direction or control, or on its behalf in connection with or incident to the performance of this Contract. The City's aforesaid indemnity and hold harmless obligations, or portions or applications thereof, shall apply to the fullest extent permitted by law, but in no event shall they apply to liability caused by the sole negligence or willful misconduct of the party indemnified or held harmless.

IN WITNESS WHEREOF, the parties have caused this contract to be executed the day and year first above written.

****

CITY OF HENDERSON

Date of Council Action:

7/7/98

BY: _____
JAMES B. GIBSON, Mayor

ATTEST:

_____
SUSAN ROBISON, CMC, City Clerk

****

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT

Date of District Action:

JUN 11 1998

BY: _____
Lance Malone, Chairman

ATTEST:

_____
DEANNA LEFKO, Board Secretary

APPROVED AS TO FORM:

_____
CHRISTOPHER FIGGINS, Deputy District Attorney

F:\HOME\SHRDPW\WP\E_LAND\CCRFCD\ICANNLMT.96

VTN nevada

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SERVICES SINCE 1960

November 13, 1998
W.O.#~~5041~~ 5244

Federal Emergency Management Agency
P.O. Box 3173
Merrifield, VA 22116-3173

ATTN: FEE-COLLECTION SYSTEM ADMINISTRATOR

Enclosed is a check (#54817) in the amount of $5000.00 per your request in a letter dated October 29, 1998, reference Case No. 99-09-066R. This fee is required to begin processing of the East C-1 Detention Basin LOMR request. Thank-you for your assistance.

Sincerely,
VTN Nevada

Lora Vennettilli

Lora Vennettilli, E.I.

cc: Mr. Kevin L. Eubanks, P.E.
Assistant General Manager
Clark County Regional Flood
Control District

Mr. Curt Chandler, P.E.
Land Development Manager
Department of Public Works
City of Henderson

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
TEL. (702) 873-7550 FAX: 362-2597

W.O.# 5244
FILE

Federal Emergency Management Agency

Washington, D.C. 20472

November 24, 1998

Ms. Lora Vennettilli, E.I.
VTN Nevada
2727 South Rainbow Boulevard
Las Vegas, Nevada 89146-5148

IN REPLY REFER TO:
Case No.: 99-09-066R
Community: City of Henderson, Nevada
Community No.: 320005

316-ACK.FRQ

Dear Ms. Vennettilli:

This responds to your letter dated November 13, 1998, concerning an October 16, 1998, request that the Federal Emergency Management Agency (FEMA) issue a conditional revision to the Flood Insurance Rate Map (FIRM) for Clark County, Nevada and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	East C-1 Detention Basin
Flooding Source:	Unnamed Wash
FIRM Panel(s) Affected:	32003C2620 D

We have completed an inventory of the items that you submitted. We have received the data and the review and processing fee ($5,000) required to begin a detailed technical review of your request. If additional data are required, we will inform you within 30 days of the date of this letter.

Please direct all questions concerning your request to our Technical Evaluation Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attention: Ms. Pernille Buch-Pedersen
(703) 317-6224

When you write us about your request, you must include the case number referenced above in your letter.

If you have any questions concerning FEMA policy, or the National Flood Insurance Program in general, please contact Mr. Max Yuan of our staff in Washington, DC, either by telephone at (202) 646-3843 or by facsimile at (202) 646-4596.

Sincerely,

Matthew B. Miller

Matthew B. Miller, P.E., Chief
Hazards Study Branch
Mitigation Directorate

cc: Mr. Curt Chandler, P.E.
Land Development Manager
Department of Public Works
City of Henderson

VTN nevada

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SERVICES SINCE 1960

December 15, 1998
W.O.#5244

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, VA 22304

Attention: Mr. James Stitzel

SUBJECT: Conditional Letter of Map Revision, Case No. 99-09-066R

This letter is in response to our telephone conversation 12/11/98. The following items are submitted per your request:

1. East C-1 Detention Basin Flood Control Improvements (11" x 17"), dated April 1998.

2. Sediment Study for East C-1 Detention Basin, dated September 29, 1997.

3. Final Design Calculation Notebook for the East C-1 Detention Basin, dated April 1998.

Figure 1.1 in Appendix A is a subbasin map. The Hec-2 run for the levee is found in Section 8, and the Hec-6 run for the basin is found in Section 9. The sediment study addresses bed loads.

The enclosed information should satisfy the issues of concern. If you require further information or if you have any additional questions please contact our office at (702) 247-4020.

Sincerely,

VTN Nevada

Lora Vennettilli

Lora Vennettilli, E.I.

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
TEL. (702) 873-7550 FAX: 362-2597

vtn nevada

LETTER OF TRANSMITTAL

TO: Michael Baker Jr., Inc.
3601 Eisenhower Avenue Suite 600
Alexandria, VA 22304

DATE: 3/30/99

PROJECT: East C-1 Detention Basin
Conditional Letter of Map Revision
Case No. 99-09-066R

ATTN: James Stitzel

W.O. NO.: 5244

BY MAIL:	BY MESSENGER:	PICK-UP:	EXPRESS MAIL:	XX
FAX:			FEDERAL EXPRESS:	

No. Copies:	Description
1	Zip diskette containing Hec-6 model runs for the Sediment Study
1	Copy of correspondence letter from Chen Engineering Technology
1	README.TXT printout

COMMENTS:

Here is the supplemental data you requested for the above mentioned project. Please call if you need anything else. Thank-you.

MATERIAL SENT FOR THE FOLLOWING REASONS:

CHECKING:	FILING: XX	APPROVAL:	YOUR FILES:
OTHER:	CC:		

SENDER: Lora
Lora V. Gookin, E.I.

ABOVE MATERIAL RECEIVED BY:

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89102-5148
TEL.: (702)873-7550 FAX: 362-2597

W.O.# 5244
LVG

CET CHEN ENGINEERING TECHNOLOGY

March 10, 1999

Ms. Lora Vennettilli
VTN Nevada
2727 South Rainbow Boulevard
Las Vegas, NV 89102

Re: East C-1 Detention Basin (Project No. NV-VTN-01)

Dear Lora:

Enclosed please find a Zip diskette containing all the HEC-6 model runs made for the above referenced project. A text file README.TXT briefly explains the contents of these files. A printout of README.TXT is attached. Tables 2-5 of the report are reproduced here along with three new columns added to the end of the tables. These added columns show where the values of stream sediment yields (bed-material loads) were found from the HEC-6 output files, including the specific HEC-6 output file name, the line number and the section ID.

Each HEC-6 input data file contains the inflow sediment loading relationships specified at the upstream boundaries (e.g., see the enclosed portion of C4C-PMP.DAT) of the model. For channels with relatively coarse bed materials and long reaches, the effects of these inflow sediment loading relationships on sediment loading to downstream basins are relatively minor, because sediment transport tends to reach an equilibrium within a short distance due to channel erosion and deposition (e.g., see the enclosed portion of C4C-PMP.OUT).

I believe that the enclosed materials should provide you with sufficient information to substantiate how we determined the stream sediment yields. However, if you have any questions or need more information, please call me.

Sincerely yours,

Yung Hai Chen, Ph.D., P.E.
Principal Engineer

cc: Mr. Ken Gilbreth

619 South College Avenue, Suite 10, Fort Collins, Colorado 80524 970/484-7860 (Phone) 970/221-9118 (FAX)

README.TXT

DESCRIPTION OF HEC-6 DATA FILES AND OUTPUT FILES:

(1) HEC-6 MODEL INPUT DATA AND OUTPUT FILES FOR BASIN C4C, NATURAL CONDITIONS

C4C-PMP.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, PMP STORM, NATURAL COND.
C4C-PMP.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, PMP STORM, NATURAL COND.
C4C-10K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 10K-YR STORM, NATURAL COND.
C4C-10K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 10K-YR STORM, NATURAL COND.
C4C-8K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 8K-YR STORM, NATURAL COND.
C4C-8K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 8K-YR STORM, NATURAL COND.
C4C-1K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 1000-YR STORM, NATURAL COND.
C4C-1K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 1000-YR STORM, NATURAL COND.
C4C-500.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 500-YR STORM, NATURAL COND.
C4C-500.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 500-YR STORM, NATURAL COND.
C4C-100.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 100-YR STORM, NATURAL COND.
C4C-100.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 100-YR STORM, NATURAL COND.
C4C-50.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 50-YR STORM, NATURAL COND.
C4C-50.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 50-YR STORM, NATURAL COND.
C4C-25.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 25-YR STORM, NATURAL COND.
C4C-25.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 25-YR STORM, NATURAL COND.
C4C-10.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 10-YR STORM, NATURAL COND.
C4C-10.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 10-YR STORM, NATURAL COND.
C4C-5.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C4C, 5-YR STORM, NATURAL COND.
C4C-5.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 5-YR STORM, NATURAL COND.

(2) HEC-6 MODEL INPUT DATA AND OUTPUT FILES FOR NATURAL CONDITIONS IN BASIN C5D1

C5D1-PMP.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D1, PMP STORM, NATURAL COND.
C5D1-PMP.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, PMP STORM, NATURAL COND.
C5D1-10K.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 10K-YR STORM, NATURAL COND.
C5D1-10K.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 10K-YR STORM, NATURAL COND.
C5D1-8K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 8K-YR STORM, NATURAL COND.
C5D1-8K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 8K-YR STORM, NATURAL COND.
C5D1-1K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 1000-YR STORM, NATURAL COND.
C5D1-1K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 1000-YR STORM, NATURAL COND
C5D1-500.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 500-YR STORM, NATURAL COND.
C5D1-500.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 500-YR STORM, NATURAL COND.
C5D1-100.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 100-YR STORM, NATURAL COND.
C5D1-100.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 100-YR STORM, NATURAL COND.
C5D1-50.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 50-YR STORM, NATURAL COND.
C5D1-50.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 50-YR STORM, NATURAL COND.
C5D1-25.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 25-YR STORM, NATURAL COND.
C5D1-25.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 25-YR STORM, NATURAL COND.
C5D1-10.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 10-YR STORM, NATURAL COND.
C5D1-10.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 10-YR STORM, NATURAL COND.
C5D1-5.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D1, 5-YR STORM, NATURAL COND.
C5D1-5.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D1, 5-YR STORM, NATURAL COND.

(3) HEC-6 MODEL INPUT DATA AND OUTPUT FILES FOR NATURAL CONDITIONS IN BASIN C5D2

C5D2-PMP.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D2, PMP-YR STORM, NATURAL COND.
C5D2-PMP.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, PMP-YR STORM, NATURAL COND.
C5D2-10K.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 10K-YR STORM, NATURAL COND.
C5D2-10K.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 10K-YR STORM, NATURAL COND.
C5D2-8K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 8K-YR STORM, NATURAL COND.
C5D2-8K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 8K-YR STORM, NATURAL COND.
C5D2-1K.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 1000-YR STORM, NATURAL COND.
C5D2-1K.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 1000-YR STORM, NATURAL COND
C5D2-500.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 500-YR STORM, NATURAL COND.
C5D2-500.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 500-YR STORM, NATURAL COND.

C5D2-100.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 100-YR STORM, NATURAL COND.
C5D2-100.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 100-YR STORM, NATURAL COND.
C5D2-50.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 50-YR STORM, NATURAL COND.
C5D2-50.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 50-YR STORM, NATURAL COND.
C5D2-25.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 25-YR STORM, NATURAL COND.
C5D2-25.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 25-YR STORM, NATURAL COND.
C5D2-10.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 10-YR STORM, NATURAL COND.
C5D2-10.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 10-YR STORM, NATURAL COND.
C5D2-5.DAT: HEC-6 MODEL INPUT DATA FOR BASIN C5D2, 5-YR STORM, NATURAL COND.
C5D2-5.OUT: HEC-6 MODEL OUTPUT FILE FOR BASIN C5D2, 5-YR STORM, NATURAL COND.

(4) HEC-6 MODEL INPUT DATA AND OUTPUT FILES FOR BASIN C4C, ALTERNATIVE A

C4C1-PMP.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C4C, PMP STORM, ALT. A.
C4C1-PMP.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, PMP STORM, ALT. A.
C4C1-100.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C4C, 100-YR STORM, ALT. A.
C4C1-100.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 100-YR STORM, ALT. A.

(5) HEC-6 MODEL INPUT DATA AND OUTPUT FILES FOR BASIN C4C, ALT. B, C, D

C4C2-PMP.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C4C, PMP STORM, ALT. B.
C4C2-PMP.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, PMP STORM, ALT. B.
C4C3-PMP.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C4C, PMP STORM, ALT. C.
C4C3-PMP.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, PMP STORM, ALT. C.
C4C3-100.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C4C, 100-YR STORM, ALT. C.
C4C3-100.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, 100-YR STORM, ALT. C.
C4C4-PMP.DAT:HEC-6 MODEL INPUT DATA FOR BASIN C4C, PMP STORM, ALT. D.
C4C4-PMP.OUT:HEC-6 MODEL OUTPUT FILE FOR BASIN C4C, PMP STORM, ALT. D.

Table 2. Sediment Yields for Subbasin C4CA

Return Period (years)	Peak Discharge (cfs)	Flood Volume (acre-feet)	Upland Sediment Yield, Y_s (tons)	Stream Sediment Yield, Y_{bm} (tons)	Total Sediment Yield (tons)	HEC-6 Output Filename	Line Number	Section ID
PMP	17,030	2,453	283,400	70,700	354,100	C4C-PMP.OUT	16609	1.000
10,000	7,450	1,193	119,100	36,500	155,600	C4C-10K.OUT	19488	1.000
8,000	6,404	1,109	105,100	28,900	134,000	C4C-8K.OUT	18437	1.000
1,000	4,378	687	64,900	21,300	86,200	C4C-1K.OUT	19745	1.000
500	2,809	438	39,400	14,400	53,800	C4C-500.OUT	17890	1.000
100	2,048	318	27,600	10,200	37,800	C4C-100.OUT	17023	1.000
50	1,596	248	20,900	9,670	30,570	C4C-50.OUT	16236	1.000
25	1,150	180	14,500	7,590	22,090	C4C-25.OUT	14667	1.000
10	646	104	7,730	4,560	12,290	C4C-10.OUT	13108	1.000
5	316	54	3,590	3,030	6,620	C4C-5.OUT	12067	1.000

Table 3. Sediment Yields for Subbasin C4CB

Return Period (years)	Peak Discharge (cfs)	Flood Volume (acre-feet)	Upland Sediment Yield, Y_s (tons)	Stream Sediment Yield, Y_{bm} (tons)	Total Sediment Yield (tons)	HEC-6 Output Filename	Line Number	Section ID
PMP	2,677	310	26,140	10,300	36,440	C4C-PMP.OUT	16488	0.070
10,000	1,145	151	10,860	6,410	17,270	C4C-10K.OUT	19367	0.070
8,000	985	129	9,140	5,500	14,640	C4C-8K.OUT	18318	0.070
1,000	674	87	5,930	3,940	9,870	C4C-1K.OUT	19624	0.070
500	433	55	3,580	2,710	6,290	C4C-500.OUT	17769	0.070
100	316	40	2,510	2,040	4,550	C4C-100.OUT	16900	0.070
50	247	31	1,900	1,710	3,610	C4C-50.OUT	16115	0.070
25	178	23	1,340	1,260	2,600	C4C-25.OUT	14546	0.070
10	100	13	700	800	1,500	C4C-10.OUT	12987	0.070
5	49	7	330	450	780	C4C-5.OUT	11946	0.070

Table 4. Sediment Yields for Subbasin C4CC

Return Period (years)	Peak Discharge (cfs)	Flood Volume (acre-feet)	Upland Sediment Yield, Y_s (tons)	Stream Sediment Yield, Y_{bm} (tons)	Total Sediment Yield (tons)	HEC-6 Output Filename	Line Number	Section ID
PMP	2,474	234	21,720	9,030	30,750	C4C-PMP.OUT	16553	0.080
10,000	1,035	114	8,910	4,500	13,410	C4C-10K.OUT	19432	0.080
8,000	891	97	7,490	4,210	11,700	C4C-8K.OUT	18381	0.080
1,000	611	66	4,890	2,730	7,620	C4C-1K.OUT	19689	0.080
500	393	42	2,960	1,930	4,890	C4C-500.OUT	17834	0.080
100	286	30	2,050	1,410	3,460	C4C-100.OUT	16967	0.080
50	223	24	1,580	1,160	2,740	C4C-50.OUT	16180	0.080
25	162	17	1,090	840	1,930	C4C-25.OUT	14611	0.080
10	91	10	580	550	1,130	C4C-10.OUT	13052	0.080
5	44	5	260	290	550	C4C-5.OUT	12011	0.080

Table 5. Sediment Yields for Subbasin C5D1

Return Period (years)	Peak Discharge (cfs)	Flood Volume (acre-feet)	Upland Sediment Yield, Y_s (tons)	Stream Sediment Yield, Y_{bm} (tons)	Total Sediment Yield (tons)	HEC-6 Output Filename	Line Number	Section ID
PMP	795	47	13,670	5,630	19,300	C5D1-PMP.OUT	3184	0.160
10,000	298	23	5,290	3,110	8,400	C5D1-10K.OUT	2605	0.160
8,000	257	19	4,380	2,720	7,100	C5D1-8K.OUT	2565	0.160
1,000	180	13	2,900	1,900	4,800	C5D1-1K.OUT	2025	0.160
500	119	9	1,870	1,270	3,140	C5D1-500.OUT	1546	0.160
100	89	6	1,270	980	2,250	C5D1-100.OUT	1447	0.160
50	70	5	1,000	790	1,790	C5D1-50.OUT	1400	0.160
25	52	4	750	650	1,400	C5D1-25.OUT	1363	0.160
10	31	2	380	500	880	C5D1-10.OUT	1295	0.160
5	16	1	180	250	430	C5D1-5.OUT	1017	0.160

Table 6. Sediment Yields for Subbasin C5D2

Return Period (years)	Peak Discharge (cfs)	Flood Volume (acre-feet)	Upland Sediment Yield, Y_s (tons)	Stream Sediment Yield, Y_{bm} (tons)	Total Sediment Yield (tons)	HEC-6 Output Filename	Line Number	Section ID
PMP	1,109	80	8,690	7,370	16,060	C5D2-PMP.OUT	3913	0.210
10,000	433	39	3,430	4,110	7,540	C5D2-10K.OUT	3457	0.210
8,000	375	33	2,890	3,570	6,460	C5D2-8K.OUT	3349	0.210
1,000	261	23	1,920	2,560	4,480	C5D2-1K.OUT	3121	0.210
500	171	15	1,200	1,670	2,870	C5D2-500.OUT	2260	0.210
100	127	11	850	1,240	2,090	C5D2-100.OUT	1918	0.210
50	100	8	620	1,040	1,660	C5D2-50.OUT	1867	0.210
25	73	6	440	770	1,210	C5D2-25.OUT	1747	0.210
10	43	4	260	490	750	C5D2-10.OUT	1576	0.210
5	22	2	120	280	400	C5D2-5.OUT	1462	0.210

C4C-PMP.DAT

(1)

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T1       EAST C-1 DETENSION BASIN
T2       SUB-BASIN C4C
T3       SEDIMENTATION BASIN AND EROSION STUDY
NC   0.05     0.05     0.03      0.1      0.3
X1    0.1        7      90.     260.       0.       0.       0.
GR 2360.        0.   2330.      90.   2320.     120.   2320.     170.   2330.     260.
GR 2330.      340.   2360.     440.
HD    0.1       10.
X1   0.35        7      90.     260.    1330.    1330.    1330.
GR 2400.        0.   2370.      90.   2360.     120.   2360.     170.   2370.     260.
GR 2370.      340.   2400.     440.
HD   0.35       10.
X1   0.60        7      90.     260.    1330.    1330.    1330.
GR 2440.        0.   2410.      90.   2400.     120.   2400.     170.   2410.     260.
GR 2410.      340.   2440.     440.
HD   0.60       10.
X1   0.80        7      90.     260.    1100.    1100.    1100.
GR 2480.        0.   2450.      90.   2440.     120.   2440.     170.   2450.     260.
GR 2450.      340.   2480.     440.
HD   0.80       10.
QT      2
X1   0.90        6      90.     270.     580.     580.     580.
GR 2520.        0.   2480.      90.   2462.     170.   2462.     270.   2480.     450.
GR 2520.      570.
HD   0.90       10.
QT      3
X1    1.0        6     250.     420.     350.     350.     350.
GR 2520.        0.   2480.     250.   2474.     370.   2474.     420.   2480.     470.
GR 2520.      630.
HD    1.0       10.
X1    1.1        6     200.     300.     410.     410.     410.
GR 2520.        0.   2490.     200.   2485.     250.   2485.     300.   2490.     360.
GR 2503.      600.
HD    1.1       10.
X1   1.67        6     200.     300.    3000.    3000.    3000.
GR 2630.        0.   2602.     200.   2597.     250.   2597.     300.   2602.     360.
GR 2615.      600.
HD   1.67       10.
X1   2.24        6     200.     300.    3000.    3000.    3000.
GR 2740.        0.   2714.     200.   2709.     250.   2709.     300.   2714.     360.
GR 2727.      600.
HD   2.24       10.
X1   2.81        6     200.     300.    3000.    3000.    3000.
GR 2850.        0.   2826.     200.   2821.     250.   2821.     300.   2826.     360.
GR 2839.      600.
HD   2.81       10.
X1   3.38        6     200.     300.    3000.    3000.    3000.
GR 2962.        0.   2938.     200.   2933.     250.   2933.     300.   2938.     360.
GR 2951.      600.
HD   3.38       10.
EJ
$TRIB
CP      2
T1       SUB-BASIN C4CC
T2
T3
NC   0.05     0.05     0.03      0.1      0.3
X1   0.00        5      50.     170.       0.       0.       0.
GR 2468.        0.   2444.      50.   2441.     100.   2444.     170.   2468.     350.
HD   0.00       10.
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X1  0.08       5     50.    170.    430.    430.    430.
GR 2480.       0.  2455.     50.   2452.    100.   2455.    170.   2480.    350.
HD  0.08      10.
X1  0.37       5    240.    320.   1550.   1550.   1550.
GR 2520.       0.  2500.    240.   2497.    280.   2500.    320.   2520.    350.
HD  0.37      10.
X1  0.66       5    240.    320.   1550.   1550.   1550.
GR 2582.       0.  2562.    240.   2559.    280.   2562.    320.   2582.    350.
HD  0.66      10.
X1  0.95       5    240.    320.   1550.   1550.   1550.
GR 2644.       0.  2624.    240.   2621.    280.   2624.    320.   2644.    350.
HD  0.95      10.
X1  1.24       5    240.    320.   1550.   1550.   1550.
GR 2706.       0.  2686.    240.   2683.    280.   2686.    320.   2706.    350.
HD  1.24      10.
EJ
$TRIB
CP      3
T1        SUB-BASIN C4CB
T2
T3
NC  0.05    0.05    0.03     0.1      0.3
X1  0.00       5    110.    220.       0.      0.      0.
GR 2470.       0.  2466.    110.   2462.    160.   2466.    220.   2506.    350.
HD  0.00      10.
X1  0.07       5    110.    220.    350.    350.    350.
GR 2484.       0.  2480.    110.   2476.    160.   2480.    220.   2520.    350.
HD  0.07      10.
X1  0.16       5    180.    300.    480.    480.    480.
GR 2503.       0.  2496.    180.   2493.    240.   2496.    300.   2520.    480.
HD  0.16      10.
X1  0.44       5    180.    300.   1500.   1500.   1500.
GR 2563.       0.  2556.    180.   2553.    240.   2556.    300.   2580.    480.
HD  0.44      10.
X1  0.72       5    180.    300.   1500.   1500.   1500.
GR 2623.       0.  2616.    180.   2613.    240.   2616.    300.   2640.    480.
HD  0.72      10.
X1  1.00       5    180.    300.   1500.   1500.   1500.
GR 2683.       0.  2676.    180.   2673.    240.   2676.    300.   2700.    480.
HD  1.00      10.
X1  1.28       5    180.    300.   1500.   1500.   1500.
GR 2743.       0.  2736.    180.   2733.    240.   2736.    300.   2760.    480.
HD  1.28      10.
X1  1.56       5    180.    300.   1500.   1500.   1500.
GR 2803.       0.  2796.    180.   2793.    240.   2796.    300.   2820.    480.
HD  1.56      10.
EJ        END OF CROSS-SECTIONAL DATA
T4        BED GRADATIONS FROM FIELD SAMPLES   SUB-BASIN C4C
T5        SEDIMENT TRANSPORT BY TOFFALETI AND MEYER-PETER AND MULLER COMBINATION
T6
T7
T8
I1              5
I4  SAND       12       1      10
LQ              1.      50.   1000.    5000.   10000.   21000.
LT  TOTAL      10.     100.   1000.   10000.   50000.  100000.
LF   VFS     0.07    0.07    0.07     0.07    0.07    0.07
LF    FS     0.05    0.05    0.05     0.05    0.05    0.05
LF    MS     0.06    0.06    0.06     0.06    0.06    0.06
LF    CS     0.10    0.10    0.10     0.10    0.10    0.10
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Inflow sediment rating relationship at the upstream boundary C4CA

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LF    VCS     0.09     0.09     0.09     0.09     0.09     0.09
LF    VFG     0.12     0.12     0.12     0.12     0.12     0.12
LF     FG     0.19     0.19     0.19     0.19     0.19     0.19
LF     MG     0.15     0.15     0.15     0.15     0.15     0.15
LF     CG     0.11     0.11     0.11     0.11     0.11     0.11
LF    VCG     0.04     0.04     0.04     0.04     0.04     0.04
PF             0.1      1.0      64.      32.      94.0     16.     83.0      8.     68.0
PFC    4.     49.0       2.     37.0       1.     28.0      0.5     18.0     0.25    12.0
PFC .125       7.0   0.0625      0.0
$TRIB
T4       BED GRADATIONS FROM FIELD SAMPLES   SUB-BASIN C4CC
T5       SEDIMENT TRANSPORT BY TOFFALETI AND MEYER-PETER AND MULLER COMBINATION
T6
T7
T8
LQL              1.       50.      100.      500.     1000.    2500.   } for C4CC
LTLTOTAL        10.      100.      500.     1000.     5000.   10000.
LFL   VFS     0.07     0.07     0.07     0.07     0.07     0.07
LFL    FS     0.05     0.05     0.05     0.05     0.05     0.05
LFL    MS     0.06     0.06     0.06     0.06     0.06     0.06
LFL    CS     0.10     0.10     0.10     0.10     0.10     0.10
LFL   VCS     0.09     0.09     0.09     0.09     0.09     0.09
LFL   VFG     0.12     0.12     0.12     0.12     0.12     0.12
LFL    FG     0.19     0.19     0.19     0.19     0.19     0.19
LFL    MG     0.15     0.15     0.15     0.15     0.15     0.15
LFL    CG     0.11     0.11     0.11     0.11     0.11     0.11
LFL   VCG     0.04     0.04     0.04     0.04     0.04     0.04
PF             0.00      1.0      64.      32.      94.0     16.     83.0      8.     68.0
PFC    4.     49.0       2.     37.0       1.     28.0      0.5     18.0     0.25    12.0
PFC .125       7.0   0.0625      0.0
$TRIB
T4       BED GRADATIONS FROM FIELD SAMPLES   SUB-BASIN C4CB
T5       SEDIMENT TRANSPORT BY TOFFALETI AND MEYER-PETER AND MULLER COMBINATION
T6
T7
T8
LQL              1.       50.      100.      500.     1000.    2500.   } for C4CA
LTLTOTAL        10.      100.      500.     1000.     5000.   10000.
LFL   VFS     0.07     0.07     0.07     0.07     0.07     0.07
LFL    FS     0.05     0.05     0.05     0.05     0.05     0.05
LFL    MS     0.06     0.06     0.06     0.06     0.06     0.06
LFL    CS     0.10     0.10     0.10     0.10     0.10     0.10
LFL   VCS     0.09     0.09     0.09     0.09     0.09     0.09
LFL   VFG     0.12     0.12     0.12     0.12     0.12     0.12
LFL    FG     0.19     0.19     0.19     0.19     0.19     0.19
LFL    MG     0.15     0.15     0.15     0.15     0.15     0.15
LFL    CG     0.11     0.11     0.11     0.11     0.11     0.11
LFL   VCG     0.04     0.04     0.04     0.04     0.04     0.04
PF             0.00      1.0      64.      32.      94.0     16.     83.0      8.     68.0
PFC    4.     49.0       2.     37.0       1.     28.0      0.5     18.0     0.25    12.0
PFC .125       7.0   0.0625      0.0
$HYD
$RATING
RC              40      500.     1000.       0.  2321.59  2322.00  2322.36  2322.67  2322.95
RC         2323.21  2323.45  2323.67  2323.89  2324.09  2324.28  2324.47  2324.65  2324.82
RC         2324.98  2325.14  2325.29  2325.44  2325.59  2325.73  2325.87  2326.00  2326.13
RC         2326.26  2326.39  2326.51  2326.63  2326.75  2326.86  2326.97  2327.09  2327.19
RC         2327.30  2327.41  2327.51  2327.61  2327.71  2327.81  2327.91  2328.01
*    A
Q   1000.     234.     154.
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C4C-PMP.OUT

STREAM SEGMENT # 1: EAST C-1 DETENSION BASIN (C4CA)

SUMMARY TABLE: MASS AND VOLUME OF SEDIMENT

SECTION	SEDIMENT THROUGH SECTION (tons)				SEDIMENT DEPOSITED IN		
	TOTAL	SAND	SILT	CLAY	TOTAL	CUMULATIVE	SAN
INFLOW	4601.	4601.	0.	0.	3664.		
3.380	71614.	71614.	0.	0.	-53376.	-53376.	-5337
2.810	76514.	76514.	0.	0.	-3903.	-57279.	-390
2.240	75939.	75939.	0.	0.	458.	-56820.	45
1.670	75937.	75937.	0.	0.	2.	-56819.	
1.100	63131.	63131.	0.	0.	10200.	-46619.	1020
1.000	70700.	70700.	0.	0.	-6029.	-52648.	-602
TRIB	6932.	6932.	0.	0.	5522.		
0.900	88673.	88673.	0.	0.	-8793.	-61442.	-879
TRIB	3969.	3969.	0.	0.	3162.		
0.800	105255.	105255.	0.	0.	-10046.	-71487.	-1004
0.600	97643.	97643.	0.	0.	6063.	-65424.	606
0.350	89055.	89055.	0.	0.	6840.	-58585.	684
0.100	38548.	38548.	0.	0.	40229.	-18356.	4022

Based on inflow sediment rating relationship specified at the upstream boundary of C4CA.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM158	2111.20	Standard U.S. Government Land Office Monument located along Equestrian Drive approximately 2,500 feet east of Magic Way.
RM160	2251.97	"T" bar with cap located approximately 1,200 feet east of the intersection of Foothills Drive and Equestrian Drive. Established by U.S. Soil Conservation Service.

HATCHED AREAS INDICATE PORTIONS OF ZONE "A" TO BE ELIMINATED.

114°56'15" 36°03'45"

JOINS PANEL 2610

114°55'30" 36°03'45"

R63E R63 1/2E R64E

JOINS PANEL 2615

JOINS PANEL 2625

JOINS PANEL 2630

RIDGE R63 1/2E R64E

36°00'00"

CITY OF HENDERSON 320005

CLARK COUNTY UNINCORPORATED AREAS 320003

CITY OF BOULDER CITY 320004

LAKE MEAD NATIONAL RECREATIONAL AREA

CORPORATE LIMITS

CITY OF HENDERSON CLARK COUNTY

CLARK COUNTY CITY OF BOULDER CITY

NOTE: THIS AREA SUBJECT TO ALLUVIAL FAN FLOODING.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 22 SOUTH, RANGE 63 EAST, TOWNSHIP 22 SOUTH, RANGE 63 1/2 EAST ND TOWNSHIP 22 SOUTH, RANGE 64 EAST.

NOTE: THIS AREA SUBJECT TO ALLUVIAL FAN FLOODING.

ZONE X

ZONE A

ZONE AO (DEPTH 1) (VELOCITY 4 FPS)

ZONE AO (DEPTH 2) (VELOCITY 7 FPS)

ZONE AO (DEPTH 4) (VELOCITY 9 FPS)

ZONE AO (DEPTH 1) (VELOCITY 5 FPS)

ZONE AO (DEPTH 5) (VELOCITY 10 FPS)

LEVEE

SPILLWAY

LIMIT OF DETAILED STUDY

PROPOSED EAST L-1 DETENTION BASIN

DAM

RM158

RM160

EQUESTRIAN DRIVE

LONGMEADOW STREET

GOLDEN SHADOW COURT

BURGUNDY DRIVE

SPRING LAKE DRIVE

COLT DR

DE ANZA AVE

HERMOSA AVENUE

RIO GRANDE STREET

GRANADA STREET

COPACABANA STREET

ALBINO			DRIVE
ARABIAN			DRIVE
BRIDLE			DRIVE
COLT			DRIVE
DERBY			DRIVE
LATIGO			DRIVE
MUSTANG			DRIVE
PALOMINO			DRIVE
QUARTER	HORSE		DRIVE
RAWHIDE			DRIVE
ROCKING	HORSE		DRIVE
SONDOWN			DRIVE
STIRRUP			DRIVE
TUMBLEWEED			DRIVE

APPALOOSA ROAD — FOOTHILLS DRIVE

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- ZONE A — No base flood elevations determined.
- ZONE AE — Base flood elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — Will be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- ZONE X — Areas determined to be outside 500-year floodplain.
- ZONE D — Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 — Identified 1990 — Otherwise Protected Area

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones
- 513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum
- D — D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum
- RM7 — Elevation Reference Mark
- M2 — River Mile
- 97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Coastal base flood elevations apply only landward of 0.0 NGVD and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

For community map revision history prior to countywide mapping, refer to Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:
AUGUST 16,1995

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE listed on this map to determine when actuarial rates apply to structures in zones where elevations or flood hazards have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2620 OF 4090

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY	COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER CITY	CITY OF BOULDER CITY	320004	2620	
CLARK COUNTY	UNINCORPORATED AREAS	320003	2620	
HENDERSON	CITY OF HENDERSON	320005	2620	

MAP NUMBER
32003C2620 D

EFFECTIVE DATE:
AUGUST 16,1995