RCRA Part A Permit Application for Waste Management Activities at the Nevada Test Site

Proposed Mixed Waste Storage Unit (MWSU)

June 2010

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof.

OMB# 2050-0024;	Expires 11/3	0/2011							
SEND COMPLETED FORM TO: The Appropriate State or Regional Office.						tection Ag			TOTAL PROTECTION
1. Reason for Submittal	To p for th	nis location)					information / to o		A ID number
MARK ALL BOX(ES) THAT APPLY	As a	component of	a First RCR	A Hazardous	Waste Part	A Permit App	rmation for this loo dication Application (Amer	·	)
	As a	component of	the Hazardo	ous Waste Re	eport (If mark	ed, see sub-l	bullet below)		
	>		e hazardous				waste, >1 kg of a nths of the report		
2. Site EPA ID Number	EPA ID Numi	ber							
3. Site Name	Name:								
4. Site Location	Street Addres	ss:							
Information	City, Town, o	r Village:		T			County:		
	State:			Country:			Zip Code:		
5. Site Land Type	Private	County	Distr	ict Fe	deral	Tribal	Municipal	State	Other
6. NAICS Code(s) for the Site	A.				C.				
(at least 5-digit codes)	В.				D				
7. Site Mailing	Street or P.O.	Box:							
Address	City, Town, o	r Village:							
	State:			Country:			Zip Code:		
8. Site Contact	First Name:			MI:	Last:				
Person	Title:								
	Street or P.O.	Box:							
	City, Town or	Village:							
	State:			Country:			Zip Code:		
	Email:								
	Phone:	······································	<b>*************************************</b>	óóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóóó	······································	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	‱wwww.		
9. Legal Owner	A. Name of S	ite's Legal O	wner:				Date Became Owner:	9	
and Operator of the Site	Owner Type:	Private	County	District	Federa	al Tribal	Municipal	State	Other
	Street or P.O.	Box:							

Country:

District

County

B. Name of Site's Operator:

Private

State:

Operator

Type:

Other

State

Zip Code:

Operator:

Tribal

Federal

**Date Became** 

Municipal

ΕP	A ID	Numl	oer						OMB#: 2050-0024; Expires 11/30/2011
10.					Activity (at your site) Il <u>current</u> activities (as of the date submitting	g the for	m); co	mple	ete any additional boxes as instructed.
A.	Haz	ardou	s Was	ste Activiti	es; Complete all parts 1-7.				
Υ	N				of Hazardous Waste ork only one of the following – a, b, or c.	Υ	N	2.	Transporter of Hazardous Waste If "Yes", mark all that apply.
			a.	LQG:	Generates, in any calendar month, 1,000 kg/n	no			a. T ransporter
					(2,200 lbs./mo.) or more of hazardous waste; Generates, in any calendar month, or	or			b. Transfer Facility (at your site)
					accumulates at any time, more than 1 kg/mo (lbs./mo) of acute hazardous waste; or Generates, in any calendar month, or accumulates at any time, more than 100 kg/m (220 lbs./mo) of acute hazardous spill cleanup	о Ү	N	3.	Treater, Storer, or Disposer of Hazardous Waste Note: A hazardous waste permit is required for these activities.
					material.	Y	Ν	4.	Recycler of Hazardous Waste
			b.	SQG:	100 to 1,000 kg/mo (220 – 2,200 lbs./mo) of n acute hazardous waste.	on-			
			C.	CESQG:	Less than 100 kg/mo (220 lbs./mo) of non-acu hazardous waste.	ite Y	N	5.	Exempt Boiler and/or Industrial Furnace If "Yes", mark all that apply.  a. Small Quantity On-site Burner
			lf	"Yes" abo	ve, indicate other generator activities.				Exemption
Υ	N		d.	time even	rm Generator (generate from a short-term or one at and not from on-going processes). If "Yes", n explanation in the Comments section.	e-			<ul> <li>b. Smelting, Melting, and Refining Furnace Exemption</li> </ul>
Υ	N		e.	•	ates Importer of Hazardous Waste	Υ	N	6.	Underground Injection Control
Υ	N		f.	Mixed Wa	aste (hazardous and radioactive) Generator	Υ	N		Receives Hazardous Waste from Off-site
R	Univ	/oreal	Wast	e Activitie	s; Complete all parts 1-2.	c	llear	ı Oil 4	Activities; Complete all parts 1-4.
٠.	0								Used Oil Transporter
	Y	N	1.		ıantity Handler of Universal Waste (you ate 5,000 kg or more) [refer to your State	Y	N		If "Yes", mark all that apply.
				regulatio	ns to determine what is regulated]. Indicate				a. T ransporter
				• •	universal waste managed at your site. If "Yo that apply.	es",			b. Transfer Facility (at your site)
				a. Batterie	es	Y	N	2.	Used Oil Processor and/or Re-refiner If "Yes", mark all that apply.
				b. Pesticio	d es				
				c. Mercui	ry containing equipment				a. Processor
				d. Lamps					b. Re-refiner
				e. Other	(specify)				
				f. Other	(specify)	Υ	N	3.	Off-Specification Used Oil Burner
				g. Other	(specify)	Y	N	4.	Used Oil Fuel Marketer If "Yes", mark all that apply.
	Υ	N	2.		on Facility for Universal Waste hazardous waste permit may be required for thi	s			<ul> <li>a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off- Specification Used Oil Burner</li> <li>b. Marketer Who First Claims the Used Oil Meets the Specifications</li> </ul>

EP	A ID Number												0	MB	<b>#</b> : 2050-00	24; Ex	oires 11/3	0/2011
<b>)</b> .	Eligible Acad							ifica	ation f	for o	oting in	to or wit	thdrawing	g fro	om managir	ng labor	atory haza	ardous
	<b>∻</b> You <u>mu</u> 262 Sul			your S	State to	deter	mine if	you	are el	ligible	to man	age labo	oratory ha	zard	ous wastes	pursuar	nt to 40 CF	R Part
	Opting into See the ite														zardous was lark all that		boratories	
	a. Colle	ege or	Univers	ity														
	b. Tead	ching	Hospital	that is	owne	d by o	r has a	form	nal wr	itten a	affiliatio	n agreen	nent with	a co	llege or univ	ersity		
	c. Non-	profit	Institute	that is	s owne	ed by c	or has a	forn	nal wr	ritten	affiliatio	n agreer	ment with	a cc	llege or uni	versity		
	2. Withdrawii	ng fror	m 40 CF	R Pari	t 262 S	Subpar	rt K for t	he n	nanaç	geme	nt of ha	zardous	wastes in	labo	oratories			
11.	Description of	of Haz	ardous	Waste	Э													
۸.	Waste Codes your site. List spaces are no	t them	in the o															
3.	Waste Codes hazardous wa spaces are no	astes l	nandled															

12. Notification of Hazardous Secondary Mater	rial (HSM) Activity	
Y N Are you notifying under 40 CFR 260 secondary material under 40 CFR 2	.42 that you will begin managing, are managing 61.2(a)(2)(ii), 40 CFR 261.4(a)(23), (24), or (25	
If "Yes", you <u>must</u> fill out the Addend Material.	dum to the Site Identification Form: Notification	for Managing Hazardous Secondary
13. Co mments		
Section 4 - The NTS is located at longitude 1 and 00 seconds North.	16 degrees, 11 minutes, and 00 seconds \	West; Latitude 37 degrees, 02 minutes,
* * * * * * * * * * * * * * * * * * *		
on my inquiry of the person or persons who me information submitted is, to the best of my known penalties for submitting false information, including	t this document and all attachments were prepare that qualified personnel properly gather and en that qualified personnel properly gather and en the anage the system, or those persons directly recovered and belief, true, accurate, and compleuding the possibility of fines and imprisonment all owner(s) and operator(s) must sign (see 40)	valuate the information submitted. Based esponsible for gathering the information, the te. I am aware that there are significant for knowing violations. For the RCRA
Signature of legal owner, operator, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
Stank A Mellings	Stephen A. Mellington, Manager	05/26/2010
7	NNSA/NSO-Owner	
ma Butake	Stephen M. Younger, President	05/26/2010
1	NSTec LLC-Operator	

## **Waste Codes**

EPA ID NO: NV3 890 090 001

**RCRA Subtitle C Identification Form** 

Section 11.A

## Attachment A – Waste Codes for Federally Regulated Hazardous Waste

D001	D002	D003	D004	D005	D006	D007	D008	D009	D010	D011	D012	D013	D014	D015	D016	D017	D018	D019	D020
D021	D022	D023	D024	D025	D026	D027	D028	D029	D030	D031	D032	D033	D034	D035	D036	D037	D038	D039	D040
D041	D042	D043	F001	F002	F003	F004	F005	F006	F007	F008	F009	F039	P001	P002	P003	P004	P005	P006	P007
P008	P009	P010	P011	P012	P013	P014	P015	P016	P017	P018	P020	P021	P022	P023	P024	P026	P027	P028	P029
P030	P031	P033	P034	P036	P037	P038	P039	P040	P041	P042	P043	P044	P045	P046	P047	P048	P049	P050	P051
P054	P056	P057	P058	P059	P060	P062	P063	P064	P065	P066	P067	P068	P069	P070	P071	P072	P073	P074	P075
P076	P077	P078	P081	P082	P084	P085	P087	P088	P089	P092	P093	P094	P095	P096	P097	P098	P099	P101	P102
P103	P104	P105	P106	P108	P109	P110	P111	P112	P113	P114	P115	P116	P118	P119	P120	P121	P122	P123	P127
P128	P185	P188	P189	P190	P191	P192	P194	P196	P197	P198	P199	P201	P202	P203	P204	P205	U001	U002	U003
U004	U005	U006	U007	U008	U009	U010	U011	U012	U014	U015	U016	U017	U018	U019	U020	U021	U022	U023	U024
U025	U026	U027	U028	U029	U030	U031	U032	U033	U034	U035	U036	U037	U038	U039	U041	U042	U043	U044	U045
U046	U047	U048	U049	U050	U051	U052	U053	U055	U056	U057	U058	U059	U060	U061	U062	U063	U064	U066	U067
U068	U069	U070	U071	U072	U073	U074	U075	U076	U077	U078	U079	U080	U081	U082	U083	U084	U085	U086	U087
U088	U089	U090	U091	U092	U093	U094	U095	U096	U097	U098	U099	U101	U102	U103	U105	U106	U107	U108	U109
U110	U111	U112	U113	U114	U115	U116	U117	U118	U119	U120	U121	U122	U123	U124	U125	U126	U127	U128	U129
U130	U131	U132	U133	U134	U135	U136	U137	U138	U140	U141	U142	U143	U144	U145	U146	U147	U148	U149	U150
U151	U152	U153	U154	U155	U156	U157	U158	U159	U160	U161	U162	U163	U164	U165	U166	U167	U168	U169	U170
U171	U172	U173	U174	U176	U177	U178	U179	U180	U181	U182	U183	U184	U185	U186	U187	U188	U189	U190	U191
U192	U193	U194	U196	U197	U200	U201	U202	U203	U204	U205	U206	U207	U208	U209	U210	U211	U213	U214	U215
U216	U217	U218	U219	U220	U221	U222	U223	U225	U226	U227	U228	U234	U235	U236	U237	U238	U239	U240	U243
U244	U246	U247	U248	U249	U271	U278	U279	U280	U328	U353	U359	U364	U367	U372	U373	U387	U389	U394	U395
U404	U409	U410	U411																

EPA ID NO: NV3 890 090 001

# RCRA Subtitle C Identification Form Section 11.B: Waste Codes for Regulated Hazardous Wastes

#### 1. California Waste Codes

Code	Description	Code	Description
141	Off-specification, aged, or surplus inorganics	351	Organic solids with halogens
151	Asbestos-containing waste	352	Other organic solids
161	Fluid-cracking catalyst waste	411	Alum and gypsum sludge
162	Other spent catalyst	421	Lime sludge
171	Metal sludge	431	Phosphate sludge
172	Metal dust and machining waste	441	Sulfur sludge
181	Other inorganic solids	451	Degreasing sludge
211	Halogenated solvents	431	Paint sludge
212	Oxygenated solvents	471	Paper sludge/pulp
213	Hydrocarbon solvents	481	Tetraethyl lead sludge
214	Unspecified solvent mixture	491	Unspecified sludge waste
221	Waste oil and mixed oil	511	Empty pesticide containers ≥ 30 gallons
222	Oil/water separation sludge	512	Other empty containers ≥ 30 gallons
223	Unspecified oil-containing waste	513	Empty containers ≤ 30 gallons
232	Pesticides and other waste associated with	521	Drilling mud
	pesticide production		
241	Tank bottom waste	531	Chemical toilet waste
251	Still bottoms with halogenated solvents	541	Photo chemicals/photo processing waste
252	Other still bottom wastes	551	Laboratory waste chemicals
261	Polychlorinated biphenyls and material	561	Detergent and soap
	containing PCBs		
271	Organic monomer waste (includes	571	Fly ash, bottom ash, and retort ash
	unreacted resins)		
272	Polymeric resin waste	581	Gas scrubber waste
281	Adhesives	591	Bag house waste
291	Latex wastes	611	Contaminated soil from site cleanups
311	Pharmaceutical waste	612	Household waste
321	Sewage sludge	613	Autoshredder waste
322	Biological waste other than sewage sludge	751	Solids or sludges with halogenated organic compounds ≥ 100 mg/Kg
331	Off-specification, aged, or surplus organics		

- 2. Wastes meeting "hazardous waste" definition in Nevada Administrative Code 444.843, which includes: Waste containing polychlorinated biphenyl; and waste brought into this State that is designated as hazardous waste in the state of its origin.
- 3. Wastes containing friable and nonfriable asbestos will also be accepted for disposal.

EPA ID Number N N	/   3   8   9   0   0	9 0 0 0 0 1		OMB#: 2050-0034; Expires 7/31/2012
		States Environme		tion Agency RMATION FORM
Facility Permit     Contact	First Name: Kenne	eth M	I: M Last	Name: Small
Contact	Contact Title: RCI	RA Program Manage		
	Phone: 702-295-1	1933	Ext.:	Email: small@nv.doe.gov
2. Facility Permit Contact Mailing	Street or P.O. Box:	P. O. Box 98518		
Address	City, Town, or Villa	ge: Las Vegas		
	State: NV			
	Country: USA			Zip Code: 89061
Operator Mailing     Address and	Street or P.O. Box:	P.O. Box 98518		
Telephone Number	City, Town, or Villa	ge: Las Vegas		
	State: NV			Phone: 702-295-5855
	Country: USA			Zip Code: 89193-8521
4. Facility Existence Date	Facility Existence I	Date (mm/dd/vvvv):	2/12/1952	
5. Other Environmental		,		
A. Facility Type (Enter code)		mit Number		C. Description
See Attachment C				

6. Nature of Business: The U.S. Department of Energy National Nuclear Security Administration Nevada Site Office maintains the capability at the Nevada Test Site to implement NNSA initiatives in stockpile stewardship, emergency management, waste management and remediation, research and development, and work for others, as well as supporting other DOE and NNSA programs.

#### 7. Process Codes and Design Capacities - Enter information in the Section on Form Page 3

- A. PRO CESS CODE Enter the code from the list of process codes below that best describes each process to be used at the facility. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in Item 8.
- B. PROCESS DESIGN CAPACITY For each code entered in Item 7.A; enter the capacity of the process.
  - 1. A MOUNT Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.
  - 2. <u>UNIT\_OF MEASURE</u> For each amount entered in Item 7.B(1), enter the code in Item 7.B(2) from the list of unit of measure codes below that describes the unit of measure used. Select only from the units of measure in this list.
- C. PROCESS TOTAL NUMBER OF UNITS Enter the total number of units for each corresponding process code.

Process Code	Process		te Unit of Measure for s Design Capacity	Process Code	Proces	ss		oriate Unit of Measure for cess Design Capacity
	Disp	osal		Tre	atment (Continu	ed)		(for T81 – T94)
D79 Underg	g round Injection Well Disposal Landfill	Liters Per Da Acre-feet; H	ers; Gallons Per Day; or ay ectares-meter; Acres; s; Hectares; Cubic	T81 Cemer	nt Kiln Kiln		Per Hour; S Kilograms F Day; Metric	r Day; Liters Per Day; Pounds Short Tons Per Hour; Per Hour; Metric Tons Per c Tons Per Hour; Short Tons TU Per Hour; Liters Per Hour;
D81	Land Treatment	Acres or He	ctares	T83	Aggregate Kiln		Kilograms F	Per Hour; or Million BTU Per
D82 Ocean			Day or Liters Per Day	T84	Phosphate Kiln		Hour	
D83 Surfac	'		ers; Cubic Meters; or	T85 Coke	Oven			
D99	Other Disposal	Any Unit of I	Measure Listed Below	T86	Blast Furnace			
		rage		T87	Smelting, Meltin	g, or Refining	g Furnace	
S01 Contain		Cubic Yards		T88	Titanium Dioxide	Chloride Ox	dation Reac	ctor
S02	Tank Storage	Cubic Yards		T89	Methane Reform	-		
S03	Waste Pile		or Cubic Meters	T90	Pulping Liquor F	•		
S04 Surface	•	Cubic Yards		T91	Combustion Dev Sulfuric Acid	rice Used in t	the Recovery	of Sulfur Values from Spent
S05	Drip Pad	Hectares; or	ers; Cubic Meters; Cubic Yards	T92	Halogen Acid Fu	irnaces		
S06 Contain	nment Building Storage	Cubic Yards	or Cubic Meters	T93	Other Industrial	Furnaces Lis	ted in 40 CFI	R 260.10
S99	Other Storage		Measure Listed Below	T94 Contai	inment Bu Treatment	ilding	Per Hour; G	s; Cubic Meters; Short Tons Gallons Per Hour; Liters Per
	Treat	tment						Per Hour; Pounds Per Hour; Per Day; Kilograms Per
T01 Tank T02 Surface	Treatment  Impoundment		Day; Liters Per Day Day; Liters Per Day				Hour; Metri Day; Liters	ic Tons Per Day; Gallons Per Per Day; Metric Tons Per Illion BTU Per Hour
T03	Incinerator	Short Tons F	Per Hour; Metric Tons			Miscellaneo	us (Subpart	X)
103	monerator	Per Hour; G Per Hour; B Per Hour; SI	allons Per Hour; Liters TUs Per Hour; Pounds nort Tons Per Day;	X01 Open	Burning/O Detonation			Measure Listed Below
		Day; Metric Million BTU		X02	Mechanical Prod	essing	Hour; Short Per Day; Po	Per Hour; Metric Tons Per t Tons Per Day; Metric Tons ounds Per Hour; Kilograms Gallons Per Hour; Liters Per
T04	Other Treatment	Pounds Per Hour; Kilogra Tons Per Da BTUs Per H	Day; Liters Per Day; Hour; Short Tons Per ams Per Hour; Metric ay; Short Tons Per Day; our; Gallons Per Day; our; or Million BTU Per	X03	Thermal Unit		Gallons Per Per Hour; S Kilograms F Day; Metric Per Day; B	r Day; Liters Per Day; Pounds Short Tons Per Hour; Per Hour; Metric Tons Per Tons Per Hour; Short Tons TU Per Hour; or Million BTU
T80	Boiler	,	ers; Gallons Per Hour; our; BTUs Per Hour; or Per Hour	X04	Geologic Repos	itory		ls; Cubic Meters; Acre-feet; eter; Gallons; or Liters
				X99	Other Subpart X		Any Unit of	Measure Listed Below
Unit of Mea		asure Code	Unit of Measure		leasure Code	Unit of Mea		Unit of Measure Code
	r Hour		Short Tons Per Hour Short Tons Per Day					Y
Gallons Pe	r Day	U	Metric Tons Per Hour.		W	Acres		В
			Metric Tons Per Day					A
	Hour Day		Pounds Per Hour Kilograms Per Hour		X			Q F
			Million BTU Per Hour .		X			I

EPA	ID Nu	mber	[	ĺ			OMB#: 205	0-0034	; Ex	pires	7/31	/201	2
7. P	roces	s Cod	es an	d Des	ign Capacities (Continued)								
EX	AMPL	E FOR	COMF	PLETIN	G Item 7 (shown in line number X-1 below): A fa	acility has a storage t	tank, which can hold s	33.788	gallo	ns.			
Li		Α	Proc. Code		B. PROCESS DESIGN CAPAC	ITY	C. Process Total	F	or Of	ficial	Use	Only	
Nun	nber	(Fro	m list a		(1) Amount (Specify)	(2) Unit of Measure	Number of Units		J. J.			· · · · · ·	
X 1		S	0	2	533.788	G	001						
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
1 2													
13													
Note					ore than 13 process codes, attach an addit y, taking into account any lines that will be								
Note Num	ber th	e line	sequ	entiall		e used for "other" p	process (i.e., D99, S						
Note Num 8. C	ber th Other I	e line Proce	seque sses	entiall (Follo	y, taking into account any lines that will be	e used for "other" p	orocess (i.e., D99, S s codes)						
Note Num  8. C Li Nun (Enter	other I	e line Proce A. Pr	sequ	entiali (Follo	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0	e used for "other" p	process (i.e., D99, S	:99, TO		nd X9	19) in	lten	
Note Num  8. C Li Nun (Enter	Other Inenter #s in ence	e line Proce A. Pr	seque	entiali (Follo	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY	4, and X99 process (2) Unit of	orocess (i.e., D99, S s codes)  C. Process Total	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	
Note Num  8. C Li Num  (Enter sequ with It	Other Inenter #s in ence	Proce A. Pr	seque sses cocess m list a	(Followard) Code (bove)	y, taking into account any lines that will be w instructions from Item 7 for D99, S99, T0  B. PROCESS DESIGN CAPACITY  (1) Amount (Specify)	4, and X99 process  (2) Unit of Measure	crocess (i.e., D99, S s codes)  C. Process Total Number of Units	:99, TO	94, an	nd X9	19) in	lten	

#### 9. Description of Hazardous Wastes - Enter Information in the Sections on Form Page 5

- A. EPA HAZARDOUS WASTE NUMBER Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR Part 261, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.
- B. ESTIMATED ANNUAL QUANTITY For each listed waste entered in Item 9.A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in Item 9.A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.
- C. UNIT OF MEASURE For each quantity entered in Item 9.B, enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS P		KILOGRAMS	K
TONS T		METRIC TONS	М

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure, taking into account the appropriate density or specific gravity of the waste.

#### D. PROCESSES

#### 1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all listed hazardous wastes.

For non-listed waste: For each characteristic or toxic contaminant entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

- 1. Enter the first two as described above.
- 2. Enter "000" in the extreme right box of Item 9.D(1).
- 3. Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 9.E.
- 2. PROCESS DESCRIPTION: If code is not listed for a process that will be used, describe the process in Item 9.D(2) or in Item 9.E(2).

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

- Select one of the EPA Hazardous Waste Numbers and enter it in Item 9.A. On the same line complete Items 9.B, 9.C, and 9.D by estimating the total annual quantity of the waste and describing all the processes to be used to store, treat, and/or dispose of the waste.
- 2. In Item 9.A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In Item 9.D.2 on that line enter "included with above" and make no other entries on that line.
- 3. Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING Item 9 (shown in line numbers X-1, X-2, X-3, and X-4 below) – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operations. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

Li	ne	A. E	PA F Waste	lazard	ous	B. Estimated Annual	C. Unit of Measure							D.	PROC	CESS	ES
Nun	nber		Enter			Qty of Waste	(Enter code)		(1) P	ROCI	ESS (	CODE	ODES (Enter Code)				(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))
X 1		K	054	4		900	Р	Т	0	3	D	8	0				
X 2		D	002	2		400	Р	Т	0	3	D	8	0				
Х 3		D	0.0	1		100	Р	Т	0	3	D	8	0				
X 4		D	0	0	2											Inc	lud ed With Above

			EPA H	łazard	Stes (Continued B. Estimated Annual	C. Unit of								PRO		
Line N	lumber	(		te No. code)	Qty of Waste	Measure (Enter code)		(1) PI	ROCI	ESS (	CODE	S (Er	nter C	ode)		(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))
	1															
	2															
	3															
	4															
	5															
	6															
	7															
	8															
	9															
1	0															
1	1															
1	2															
1	3															
1	4															
1	5															
1	6															
1	7															
1	8															
1	9															
2	0															
2	1															
2	2															
2	3															
2	4															
2	5															
2	6															
2	7															
2	8															
2	9															
3	0															
3	1															
3	2															
3	3															
3	4															
3	5															
3	6						1				1	<b> </b>			<b>-</b>	

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## EPA ID Number N V 3 8 9 0 0 9 0 0 0 1

	!	Α.	EPA I	Hazaro	dous	B. Estimated	C. Unit of					D. I	PROCES	SSES
	ine mber	Wa	aste N co	o. (En de)	iter	Annual Qty of Waste	Measure (Enter code)	(1) P	ROCE	ss cor	DES (E	nter C	ode)	(2) PROCESS DESCRIPTION (If of entered in 9.D.1)
3	7	D	0	2	2		(=:::::)							Included in above
3	8	D	0	2	3									Included in above
3	9	D	0	2	4									Included in above
4	0	D	0	2	5									Included in above
4	1	D	0	2	6									Included in above
4	2	D	0	2	7									Included in above
4	3	D	0	2	8									Included in above
4	4	D	0	2	9									Included in above
4	5	D	0	3	0									Included in above
4	6	D	0	3	1									Included in above
4	7	D	0	3	2									Included in above
4	8	D	0	3	3									Included in above
4	9	D	0	3	4									Included in above
5	0	D	0	3	5									Included in above
5	1	D	0	3	6									Included in above
5	2	D	0	3	7									Included in above
5	3	D	0	3	8									Included in above
5	4	D	0	3	9									Included in above
5	5	D	0	4	0									Included in above
5	6	D	0	4	1									Included in above
5	7	D	0	4	2									Included in above
5	8	D	0	4	3									Included in above
5	9	F	0	0	1									Included in above
6	0	F	0	0	2									Included in above
6	1	F	0	0	3									Included in above
6	2	F	0	0	4									Included in above
6	3	F	0	0	5									Included in above
6	4	F	0	0	6									Included in above
6	5	F	0	0	7									Included in above
6	6	F	0	0	8									Included in above
6	7	F	0	0	9									Included in above
6	8	Р	0	0	1									Included in above
6	9	Р	0	0	2									Included in above
7	0	Р	0	0	3									Included in above
7	1	Р	0	0	4									Included in above
7	2	Р	0	0	5									Included in above

-	ino	A.	EPA H	lazaro	dous	B. Estimated	C. Unit of					D. PROCES	
	ine nber	W	aste N co		iter	Annual Qty of Waste	Measure (Enter code)	(1) PR	OCES	S CODE	S (Ente	Code)	(2) PROCESS DESCRIPTION (If of entered in 9.D.1)
7	3	Р	0	2	1								Included in above
7	4	Р	0	2	2								Included in above
7	5	Р	0	2	3								Included in above
7	6	Р	0	2	4								Included in above
7	7	Р	0	2	6								Included in above
7	8	Р	0	2	7								Included in above
7	9	Р	0	2	8								Included in above
8	0	Р	0	2	9								Included in above
8	1	Р	0	3	0								Included in above
8	2	Р	0	3	1								Included in above
8	3	Р	0	3	2								Included in above
8	4	Р	0	3	3								Included in above
8	5	Р	0	3	4								Included in above
8	6	Р	0	3	5								Included in above
8	7	Р	0	3	6								Included in above
8	8	Р	0	3	7								Included in above
8	9	Р	0	3	8								Included in above
9	0	Р	0	3	9								Included in above
9	1	Р	0	4	0								Included in above
9	2	Р	0	4	1								Included in above
9	3	Р	0	4	2								Included in above
9	4	Р	0	4	3								Included in above
9	5	Р	0	4	4								Included in above
9	6	Р	0	4	5								Included in above
9	7	Р	0	4	6								Included in above
9	8	Р	0	4	7								Included in above
9	9	Р	0	4	8								Included in above
10	0	Р	0	4	9								Included in above
10	1	Р	0	5	0								Included in above
10	2	Р	0	5	1								Included in above
10	3	Р	0	5	4								Included in above
10	4	Р	0	5	6								Included in above
10	5	Р	0	5	7								Included in above
10	6	Р	0	5	8								Included in above
10	7	Р	0	5	9								Included in above
10	8	Р	0	6	0								Included in above

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		Α.	EPA H	lazaro	dous	B. Estimated	C. Unit of					D. PROCE	SSES
	ine nber	Wa	aste N co	•	iter	Annual Qty of Waste	Measure (Enter code)	(1) PR	OCE	ss co	DES (E	nter Code)	(2) PROCESS DESCRIPTION (If of entered in 9.D.1)
10	9	Р	0	6	2								Included in above
11	0	Р	0	6	3								Included in above
11	1	Р	0	6	4								Included in above
11	2	Р	0	6	5								Included in above
11	3	Р	0	6	6								Included in above
11	4	Р	0	6	7								Included in above
11	5	Р	0	6	8								Included in above
11	6	Р	0	6	9								Included in above
11	7	Р	0	7	0								Included in above
11	8	Р	0	7	1								Included in above
11	9	Р	0	7	2								Included in above
12	0	Р	0	7	3								Included in above
12	1	Р	0	7	4								Included in above
12	2	Р	0	7	5								Included in above
12	3	Р	0	7	6								Included in above
12	4	Р	0	7	7								Included in above
12	5	Р	0	8	1								Included in above
12	6	Р	0	8	2								Included in above
12	7	Р	0	8	4								Included in above
12	8	Р	0	8	5								Included in above
12	9	Р	0	8	7								Included in above
13	0	Р	0	8	8								Included in above
13	1	Р	0	8	9								Included in above
13	2	Р	0	9	2								Included in above
13	3	Р	0	9	3								Included in above
13	4	Р	0	9	4								Included in above
13	5	Р	0	9	5								Included in above
13	6	Р	0	9	6								Included in above
13	7	Р	0	9	7								Included in above
13	8	Р	0	9	8								Included in above
13	9	Р	0	9	9								Included in above
14	0	Р	1	0	1								Included in above
14	1	Р	1	0	2								Included in above
14	2	Р	1	0	3								Included in above
14	3	Р	1	0	4								Included in above
14	4	Р	1	0	5								Included in above

		A.	EPA I	Hazaro	dous	B. Estimated	C. Unit of					D.	PROCES	SSES
	ine nber	Wa	aste N co	o. (En de)	iter	Annual Qty of Waste	Measure (Enter code)	(1) PR	ROCE	ESS (	CODES	(Enter	Code)	(2) PROCESS DESCRIPTION (If contered in 9.D.1)
14	5	Р	1	0	6									Included in above
14	6	Р	1	0	8									Included in above
14	7	Р	1	0	9									Included in above
14	8	Р	1	1	0									Included in above
14	9	Р	1	1	1									Included in above
15	0	Р	1	1	2									Included in above
15	1	Р	1	1	3									Included in above
15	2	Р	1	1	4									Included in above
15	3	Р	1	1	5									Included in above
15	4	Р	1	1	6									Included in above
15	5	Р	1	1	8									Included in above
15	6	Р	1	1	9									Included in above
15	7	Р	1	2	0									Included in above
15	8	Р	1	2	1									Included in above
15	9	Р	1	2	2									Included in above
16	0	Р	1	2	3									Included in above
16	1	Р	1	2	7									Included in above
16	2	Р	1	2	8									Included in above
16	3	Р	1	8	5									Included in above
16	4	Р	1	8	8									Included in above
16	5	Р	1	8	9									Included in above
16	6	Р	1	9	0									Included in above
16	7	Р	1	9	1									Included in above
16	8	Р	1	9	2									Included in above
16	9	Р	1	9	4									Included in above
17	0	Р	1	9	6									Included in above
17	1	Р	1	9	7									Included in above
17	2	Р	1	9	8									Included in above
17	3	Р	1	9	9									Included in above
17	4	Р	2	0	0									Included in above
17	5	Р	2	0	1									Included in above
17	6	Р	2	0	2									Included in above
17	7	Р	2	0	3									Included in above
17	8	Р	2	0	4									Included in above
17	9	Р	2	0	5									Included in above
18	0	U	0	0	1									Included in above

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	ln a	Α.	EPA I	Hazaro	dous	B. Estimated	C. Unit of					D. PRO	CESSES
	ine nber	W	aste N co	o. (En de)	iter	Annual Qty of Waste	Measure (Enter code)	(1) PR	ROCE	SS COL	ES (E	nter Code)	(2) PROCESS DESCRIPTION (If of entered in 9.D.1)
18	1	U	0	Ó	2		,						Included in above
18	2	U	0	0	3								Included in above
18	3	U	0	0	4								Included in above
18	4	U	0	0	5								Included in above
18	5	U	0	0	6								Included in above
18	6	U	0	0	7								Included in above
18	7	U	0	0	8								Included in above
18	8	U	0	0	9								Included in above
18	9	U	0	1	0								Included in above
19	0	U	0	1	1								Included in above
19	1	U	0	1	2								Included in above
19	2	U	0	1	4								Included in above
19	3	U	0	1	5								Included in above
19	4	U	0	1	6								Included in above
19	5	U	0	1	7								Included in above
19	6	U	0	1	8								Included in above
19	7	U	0	1	9								Included in above
19	8	U	0	2	0								Included in above
19	9	U	0	2	1								Included in above
20	0	U	0	2	2								Included in above
20	1	U	0	2	3								Included in above
20	2	U	0	2	4								Included in above
20	3	U	0	2	5								Included in above
20	4	U	0	2	6								Included in above
20	5	U	0	2	7								Included in above
20	6	U	0	2	8								Included in above
20	7	U	0	2	9								Included in above
20	8	U	0	3	0								Included in above
20	9	U	0	3	1								Included in above
21	0	U	0	3	2								Included in above
21	1	U	0	3	3								Included in above
21	2	U	0	3	4								Included in above
21	3	U	0	3	5								Included in above
21	4	U	0	3	6								Included in above
21	5	U	0	3	7								Included in above
21	6	U	0	3	8								Included in above

-	ine	A.	EPA I	Hazaro	dous	B. Estimated	C. Unit of					D	. PROCE	SSES
	nber	Wa	aste N co	o. (En de)	ter	Annual Qty of Waste	Measure (Enter code)	(1) F	PROC	ESS (	CODES	(Enter	Code)	(2) PROCESS DESCRIPTION (If of entered in 9.D.1)
21	7	U	0	3	9		,							Included in above
21	8	U	0	4	0									Included in above
21	9	U	0	4	1									Included in above
22	0	U	0	4	2									Included in above
22	1	U	0	4	3									Included in above
22	2	U	0	4	4									Included in above
22	3	U	0	4	5									Included in above
22	4	U	0	4	6									Included in above
22	5	U	0	4	7									Included in above
22	6	U	0	4	8									Included in above
22	7	U	0	4	9									Included in above
22	8	U	0	5	0									Included in above
22	9	U	0	5	1									Included in above
23	0	U	0	5	2									Included in above
23	1	U	0	5	3									Included in above
23	2	U	0	5	5									Included in above
23	3	U	0	5	6									Included in above
23	4	U	0	5	7									Included in above
23	5	U	0	5	8									Included in above
23	6	U	0	5	9									Included in above
23	7	U	0	6	0									Included in above
23	8	U	0	6	1									Included in above
23	9	U	0	6	2									Included in above
24	0	U	0	6	3									Included in above
24	1	U	0	6	4									Included in above
24	2	U	0	6	6									Included in above
24	3	U	0	6	7									Included in above
24	4	U	0	6	8									Included in above
24	5	U	0	6	9									Included in above
24	6	U	0	7	0									Included in above
24	7	U	0	7	1									Included in above
24	8	U	0	7	2									Included in above
24	9	U	0	7	3									Included in above
25	0	U	0	7	4									Included in above
25	1	U	0	7	5									Included in above
25	2	U	0	7	6									Included in above

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		Α.	EPA H	lazaro	dous	B. Estimated	C. Unit of					D. PROCE	SSES
	ine nber	Wa	aste N co	o. (En de)	iter	Annual Qty of Waste	Measure (Enter code)	(1) PR	ROCE	SS C	ODES (	Enter Code)	(2) PROCESS DESCRIPTION (If of entered in 9.D.1)
25	3	U	0	7	7								Included in above
25	4	U	0	7	8								Included in above
25	5	U	0	7	9								Included in above
25	6	U	0	8	0								Included in above
25	7	U	0	8	1								Included in above
25	8	U	0	8	2								Included in above
25	9	U	0	8	3								Included in above
26	0	U	0	8	4								Included in above
26	1	U	0	8	5								Included in above
26	2	U	0	8	6								Included in above
26	3	U	0	8	7								Included in above
26	4	U	0	8	8								Included in above
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34	5	U	1	7	2								Included in above
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37	6	U	2	0	7									Included in above
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37	8	U	2	0	9									Included in above
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41	5	U	3	5	9										Included in above
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10.	Мар	
	Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, an other surface water bodies in this map area. See instructions for precise requirements.	nd
11.	Facility Drawing	
	All existing facilities must include a scale drawing of the facility (see instructions for more detail).	
12.	Photographs	
	All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas (see instructions for more detail).	
13.	Comments	

#### EPA NV3 890 090 001

Section 5 – Attachment C

## **List of Existing Permits**

Type	Number	Type, Area, Location
Е	NY-1054	Septic System, Area 3, Waste Management Office
Е	NY-1069	Septic System, Area 18, 820 <sup>th</sup> Red Horse Squadron
Е	NY-1076	Septic System, Area 6, (ART Hangar)
Е	NY-1077	Septic System, Area 27, Baker Compound
Е	NY-1106	Septic System, Area 5, Building 5-8
Е	NY-1079	Septic System, Area 12 (U12g Tunnel)
Е	NY-1080	Septic System, Area 23, Building 1103
Е	NY-1081	Septic System, Area 6, CP-170
Е	NY-1082	Septic System, Area 22, Building 22-1
Е	NY-1083	Septic System, Area 5, Radioactive Material Management Site (RWMS)
Е	NY-1084	Septic System, Area 6, Device Assembly Facility
Е	NY-1085	Septic System, Area 25, Central Support Area
Е	NY-1086	Septic System, Area 25, Reactor Control Point
Е	NY-1087	Septic System, Area 27, Able Compound
Е	NY-1089	Septic System, Area 12 Camp
Е	NY-1090	Septic System, Area 6, LANL Construction Campsite
Е	NY-1091	Septic System, Area 23, Gate 100
Е	NY-1103	Septic System, Area 22, Desert Rock Airport
Е	NY-1110-HAA-A	Individual Sewage Disposal System, A-12, Bldg. 12-910
Е	NY-1112	Commercial Sewage Disposal System, U1a, Area 1
Е	NY-1113	Commercial Sewage Disposal System, Area 1, Building 121
Е	NY-1124	Commercial Individual Sewage Disposal System, Area 6
Е	NY-1128	Area 6 Yucca Lake Project
Е	NY-17-06839	Septic Tank Pumping Contractor (5 units)
Е	GNEV93001	Water Pollution Control General Permit
Е	NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
Е	2287-5146	NTS Hazardous Materials Permit
Е	2287-5147	Non-Proliferation Test and Evaluation Complex Hazardous Materials Permit
R	NEVHW0021	NTS Hazardous Waste Management Permit (RCRA)
Е	AP9711-2557	NTS Class II Air Quality Operating Permit
Е	08-29	Open Burn Variance, Various Locations on the NTS
Е	09-08	Open Burn Variance, NTS Area 5 (NTS Fire & Rescue Training Center)
Е	NY-0360-12NTNC	Area 23 and Area 6
	ÄNY-4€J8-12NC	Area 25
EAWANY-4€J9-12NC		Area 12
Е	NY-0835-12NP	NTS (Water Hauler) #84846
Е	NY-0836-12NP	NTS (Water Hauler) #84847
Е	SW 13 000 01	Area 5 Asbestiform Low-Level Solid Waste Disposal Site
Е	SW 13 097 02	Area 6 Hydrocarbon Disposal Site
Е	SW 13 097 03	Area 9 U10c Solid Waste Disposal Site
Е	SW 13 097 04	Area 23 Solid Waste Disposal Site

## Section 10: Maps

## **Map A: Existing TSDFs**

## **Map B: Past, Present, and Future TSDFs**

## Map C: NTS Wells, Springs, and Surface Water Bodies

# Map D: Topographical Features and Infrastructure of NTS

## **Section 11: Facility Drawings MWSU**

## **Section 12: Aerial View**

RCRA Part B Permit Application

for Waste Management Activities at the Nevada Test Site

Proposed Mixed Waste Storage Unit (MWSU)

June 2010

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof.

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### **Acronyms**

BFF	Bureau of Federal Facilities	NNSA	National Nuclear Security Administration
BLM	U.S. Bureau of Land Management	NRS	Nevada Revised Statute
CAAB	Controlled Area Access Building	NSO	Nevada Site Office
CAU/	Corrective Action Unit/Corrective Action	NTS	Nevada Test Site
CAS CMS	Site cubic meters per second	NTSWAC	Nevada Test Site Waste Acceptance Criteria
COE	U.S. Army Corps of Engineers	NTTR	Nevada Test and Training Range
DHP	Drum Holding Pad	PCB	Polychlorinated Biphenyl
DOE	U.S. Department of Energy	PPE	Personal Protective Equipment
DOT	U.S. Department of Transportation	QA/QC	Quality Assurance/Quality Control
EODU	Explosive Ordnance Disposal Unit	RCRA	Resource Conservation and Recovery Act
EPA	U.S. Environmental Protection Agency	RCT	Radiological Control Technician
EPIP	Emergency Plan Implementing Procedure	RTR	Real-Time Radiography
FFACC	Federal Facilities Agreement and Consent Order	RWMC	Radioactive Waste Management Complex
FEMA	Federal Emergency Management Agency	RWMS	Radioactive Waste Management Site
FIRM	Flood Insurance Rate Map	SIS	Sprung Instant Structure
HEC	Hydrologic Engineering Center	TID	Tamper-Indicating Device
HWSU		TP	TRU Pad
LDR	Land Disposal Restriction	TPCB	TRU Project Cover Building
LLMW	·	TRU	Tansuranic
MCA	Mutual Consent Agreement	TSDF	Treatment, Storage, and Disposal Facility
MOU	Memorandum of Understanding	UHC	Underlying Hazardous Constituent
MSDS	-	UR	Use Restriction
MWDU		USGS	U.S. Geological Survey
MWSU		VERB	Visual Examination Repackaging Building
NAC	Nevada Administrative Code	WAP	Waste Analysis Plan
NDEP	Nevada Division of Environmental Protection		

Protection

### B.1 Mixed Waste Storage Unit [40 CFR 270.14(b)(1)]

The proposed Mixed Waste Storage Unit (MWSU) will be located within the Area 5 Radioactive Waste Management Complex (RWMC). Existing facilities at the RWMC will be used to store low-level mixed waste (LLMW). Storage is required to accommodate offsite-generated LLMW shipped to the Nevada Test Site (NTS) for disposal in the new Mixed Waste Disposal Unit (MWDU) currently in the design/build stage.

LLMW generated at the NTS (onsite) is currently stored on the Transuranic (TRU) Pad (TP) in Area 5 under a Mutual Consent Agreement (MCA) with the Nevada Division of Environmental Protection, Bureau of Federal Facilities (NDEP/BFF). When the proposed MWSU is permitted, the U.S. Department of Energy (DOE) will ask that NDEP revoke the MCA and onsite-generated LLMW will fall under the MWSU permit terms and conditions.

The unit will also store polychlorinated biphenyl (PCB) waste and friable and non-friable asbestos waste that meets the acceptance criteria in the Waste Analysis Plan (Exhibit 2) for disposal in the MWDU. In addition to Resource Conservation and Recovery Act (RCRA) requirements, the proposed MWSU will also be subject to Department of Energy (DOE) orders and other applicable state and federal regulations.

Table 1 provides the metric conversion factors used in this application. Table 2 provides a list of existing permits. Table 3 lists operational RCRA units at the NTS and their respective regulatory status.

### **B.1.a MWSU Background**

DOE submitted a Part B Permit application for LLMW storage in 1995. Land disposal restrictions (LDR) for hazardous waste in place at this time would have limited NTS characterization and remediation efforts since the LDRs offered limited waste treatment and disposal options. The permit application was set aside and the MCA provided DOE an avenue to store onsite-generated LLMW while treatment and disposal options were developed. The TP was selected to store the waste because it was RCRA compliant for the storage of hazardous waste.

The proposed MWSU will accept and store onsite- and offsite-generated LLMW. This application represents a new submittal by DOE for a permitted LLMW storage unit.

### **B.1.b RCRA Permit Application History**

In 1985 and 1987, respectively, the DOE submitted Parts A and B of the RCRA Permit Application to Region 9 of the U.S. Environmental Protection Agency (EPA) and the state of Nevada. The application provided detailed information regarding the disposal of LLMW at the Area 5 Pit 3 MWDU and the treatment of non-radioactive waste at the Area 11 Explosives Ordnance Disposal Unit (EODU). In September 1987, the NDEP concurred that the Pit 3 MWDU and the EODU met the regulatory requirements of interim status. In 1992, DOE resubmitted the Part B Application with the addition of the Hazardous Waste Storage Unit

(HWSU). From June 1992 through May 1995, DOE provided subsequent revisions to the application, including the addition of a proposed Area 5 LLMW Storage Unit in January 1995. In May 1995, NDEP issued a RCRA Part B Permit to DOE for the operation of two units; the Area 5 HWSU for the storage of non-radioactive hazardous waste and the Area 11 EODU for the treatment of non-radioactive waste explosives. This permit was renewed in November 2000 and 2005. In 2005, DOE requested accelerated closure of the Pit 3 MWDU and submitted a closure plan to NDEP. LLMW shipments for Pit 3 are scheduled to end in November 2010.

Additionally, in September 1998, DOE submitted a permit application for the operation of the Tactical Demilitarization and Demonstration Complex. This research and development permit was terminated in January 2000.

### **B.1.c Summary of RCRA Operational Units**

Figure 1 and Table 3 provide the locations of each RCRA operational unit on the NTS and its regulatory status. Specific information for Pit 3 MWDU, Area 11 EODU, and the Area 5 HWSU can be found in the RCRA Part B Permit Application, Volumes 1, 4, and 5 (DOE/NV--1053, May 2005), the NDEP Permit for a Hazardous Waste Management Facility (NEV-HW0021, December 2005), and the updated permit application information for Pit 3 MWDU - Volume 3 (NDEP approved October 2007).

#### Pit 18 MWDU

NDEP granted "conditional approval" to start design/build of this landfill in September 2009. The estimated permitted capacity of this unit is 25,485 cubic meters (m³) (33,333 cubic yards [yd³]).

#### Pit 3 MWDU

Pit 3 MWDU is an interim status landfill that disposes of onsite and offsite containerized LLMW from an approved DOE nexus. The permitted capacity of the unit is 20,000 m<sup>3</sup> (26,160 yd<sup>3</sup>). The unit is scheduled to close by November 30, 2010.

#### **EODU**

The Area 11 EODU is a permitted thermal treatment unit for conventional explosives. The unit encompasses approximately 8.1 hectares (ha) (20 acres [ac]) of land. A storage magazine is used to store detonation materials and serves as a satellite accumulation area for waste explosives. The unit has an annual estimated capacity of 1,875 kilograms (kg) (4,130 pounds [lbs]) of waste. The process design capacity of the EODU is 45 kg/hour (kg/hr) (100 lbs/hr).

#### **HWSU**

The Area 5 HWSU is a permitted storage unit for hazardous non-radioactive waste generated on the NTS. It is located immediately to the east of the RWMC. The process design capacity of the HWSU is approximately 61,600 liters (L) (16,280 gallons [gal]).

### **B.1.d NTS General Facility Description**

The NTS is a DOE/NNSA installation comprising approximately 3,561 square kilometers (km²) (1,375 square miles [mi²]) of federally owned land located in southeastern Nye County, Nevada. Located approximately 105 km (65 mi) northwest of Las Vegas, Nevada, the NTS is accessed from U.S. Highway 95, which roughly forms the southern boundary of the facility. The site is bordered to the west, north, and east by the Nevada Test and Training Range (NTTR), another government owned, restricted-access area. Public land to the south of the NTS is managed by the U.S. Bureau of Land Management (BLM). Land in the surrounding area is predominantly rural, undeveloped public desert lands used for grazing and agriculture. The NTS is well buffered from public access. The greater Las Vegas area is the closest major population center to the NTS. Smaller, rural communities near the NTS include Indian Springs, Amargosa Valley, and Pahrump.

The NTS varies in distance from 46 to 57 km (28 to 35 mi) in the east/west direction and from 65 to 90 km (40 to 55 mi) in the north/south direction. Elevation varies from approximately 915 to 2,345 meters (m) (3,000 to 7,700 feet [ft]) above sea level. The terrain of the NTS is characteristic of the Basin and Range Physiographic Province in Nevada, Arizona, and Utah, which is a province of intervening valleys and ranges, all nearly parallel. There are numerous north to northeast trending mountain ranges separated by gently sloping linear valleys and broad flat basins. The principal valleys within the NTS are Frenchman Flat, Yucca Flat, and Jackass Flats, with the principal highlands consisting of Pahute Mesa, Rainier Mesa, Timber Mountain, and Shoshone Mountain. Generally, large portions of the NTS are within one of two elevation ranges from approximately 915 to 1,220 m (3,000 to 4,000 ft) in the valleys to the south and east to 1,675 to 2,225 m (5,500 to 7,300 ft) in the high country toward the northern and western boundaries.

Mercury, the base camp at the NTS, is located in the southeast corner of the site, approximately 6.5 km (4.0 mi) north of U.S. Highway 95. Mercury has administrative and maintenance structures that currently support a working population of approximately 1,000 workers and a residential capacity of approximately 350. NTS areas outside of Mercury were used for many activities. In Area 5, the Frenchman Flat vicinity was designated for atmospheric testing, hazardous materials spill testing, underground nuclear testing, and radioactive waste management. Yucca Flat and Rainier Mesa both were used for underground nuclear tests and Yucca Flat was used for atmospheric nuclear tests. The Pahute Mesa vicinity was used for higher yield underground nuclear tests.

Historically the primary mission of the NTS was to conduct nuclear weapons tests. Since the moratorium on nuclear weapons testing began in October 1992, this mission has changed to maintaining readiness to conduct these tests, if so directed. Because of its favorable environment and infrastructure, the NTS supports national security related research, development, and testing programs, as well as waste management activities.

Numerous government and/or research organizations use the NTS for a variety of research activities and/or programs because of its specialized facilities, favorable climate, remote location, and controlled access. The research and testing activities comprising these programs are directly supported by NNSA/NSO.

NNSA/NSO's management and operations (M & O) contractor provides a number of services including designing and operating the functioning hazardous waste management units at the NTS. The contractor also provides onsite medical services and operates the NTS Fire and Rescue Department. Additionally, NNSA/NSO maintains separate contracts for security services (armed patrol, access control) and law enforcement support on the NTS.

**Table 1 Metric Conversion Factors** 

Unit Equals	
1 hectare	2.471 acres
1 in	2.540 cm
1 kg	2.205 lbs
1 L	0.264 gal
1 m	3.281 ft
1 m <sup>2</sup>	10.76 ft <sup>2</sup>
1 m <sup>3</sup>	35.32 ft <sup>3</sup>
1 m <sup>3</sup>	1.308 yd <sup>3</sup>
1 km	0.614 mi
1 km <sup>2</sup>	0.386 mi <sup>2</sup>
1 metric ton	1.102 short tons

The actual value (or real value) is converted to the corresponding metric or English unit by using the conversion factors listed above.

The converted value is then rounded in the following manner.

Numerical Range	Rounded to the Nearest
0–10	0.10
10–100	1
100–5,000	5
5,000–10,000	10
10,000–500,000	100
5000,000-1,000,000	1,000
> 1,000,00	10,000

### **Table 2 List of Existing Permits**

Number Ty	pe, Area, Location
NY-1054	Septic System, Area 3, Waste Management Office
NY-1069	Septic System, Area 18, 820 <sup>th</sup> Red Horse Squadron
NY-1076	Septic System, Area 6, ART Hangar
NY-1077	Septic System, Area 27, Baker Compound
NY-1079	Septic System, Area 12, U12g Tunnel
NY-1080	Septic System, Area 23, Building 1103
NY-1081	Septic System, Area 6, CP-170
NY-1082	Septic System, Area 22, Building 22-1
NY-1083	Septic System, Area 5, Radioactive Material Management Site (RWMS)
NY-1084	Septic System, Area 6, Device Assembly Facility
NY-1085	Septic System, Area 25, Central Support Area
NY-1086	Septic System, Area 25, Reactor Control Point
NY-1087	Septic System, Area 27, Able Compound
NY-1089	Septic System, Area 12 Camp
NY-1090	Septic System, Area 6, LANL Construction Campsite
NY-1091	Septic System, Area 23, Gate 100
NY-1103	Septic System, Area 22, Desert Rock Airport
NY-1106	Septic System, Area 5, Building 5-8
NY-1110-HAA-A	Individual Sewage Disposal System, A-12, Bldg. 12-910
NY-1112	Commercial Sewage Disposal System, U1a, Area 1
NY-1113	Commercial Sewage Disposal System, Area 1, Building 121
NY-1124	Commercial Individual Sewage Disposal System, Area 6
NY-1128	Area 6 Yucca Lake Project
NY-17-06839	Septic Tank Pumping Contractor (5 units)
GNEV93001	Water Pollution Control General Permit
NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
2287-5146	NTS Hazardous Materials Permit
2287-5147	Non-Proliferation Test and Evaluation Complex Hazardous Materials Permit
NEVHW0021	NTS Hazardous Waste Management Permit (RCRA)
AP9711-2557	NTS Class II Air Quality Operating Permit
09-30	Open Burn Variance, Various Locations on the NTS
09-31	Open Burn Variance, NTS Area 5 (NTS Fire & Rescue Training Center)
NY-0360-12NTNC	Area 23 and Area 6 Drinking Water
NY-4098-12NC	Area 25 Drinking Water
NY-4099-12NC	Area 12 Drinking Water
NY-0835-12NP	NTS (Water Hauler) #84846
NY-0836-12NP	NTS (Water Hauler) #84847
SW 13 000 01	Area 5 Asbestiform Low-Level Solid Waste Disposal Site
SW 13 097 02	Area 6 Hydrocarbon Disposal Site
SW 13 097 03	Area 9 U10c Solid Waste Disposal Site
SW 13 097 04	Area 23 Solid Waste Disposal Site

**Table 3 Operational Unit Locations and Regulatory Status** 

Unit Name	Location	Regulatory Status	Permit	Volume
Pit 18 MWDU	Area 5 RWMS	Permitted – Conditional	TBD	N/A
		Approval (12/17/09)		
Proposed MWSU	Area 5 RWMC	N/A	N/A	N/A
Pit 3 MWDU	Area 5 RWMS	Interim Status – 12/2005	NEV HW0021	3
EODU	Area 11	Permitted – 12/2005	NEV HW0021	4
HWSU	Area 5	Permitted – 12/2005	NEV HW0021	5

Figure 1, "NTS General Location Map"; Figure 2, "NTS Oversized Topographic Features and Infrastructure Map"; Figure 3, "NTS Land Use Map"; Figure 4, "Aerial View of the RWMC; and Figure 5 MWSU Overall Location Map, provide additional NTS information to support this Part B Application.

**Figure 1 NTS General Location Map** 

Figure 2 NTS Oversized Topographic Features and Infrastructure Map

Figure 3 NTS Land Use Map

Figure 4 Aerial View of the RWMC and Proposed MWSU Locations

Figure 5 MWSU Overall Location Map

### **B.1.e MWSU Description**

The proposed MWSU will occupy several existing facilities within the RWMC.

#### TRU Pad Cover Building (TPCB) and TRU Pad (TP)

This building measures 25.8 meters (m) [84.5 feet (ft)] wide by 70.6 m (231.75 ft) long. The building floor features two layers of asphaltic concrete that sandwich a petrochemical liner. The liner and asphalt form a six inch high curb at the edge of the building foundation. The entire building sits on a pad that is of similar construction that is also bermed. The TP offers an outdoor storage area.

Roll up doors on the east and west end of the building are large enough to accommodate the movement and placement of freight containers as well as waste boxes and drums.

Both the pad and footprint of the building are available for storage. The area available for storage is approximately 1,822 m<sup>2</sup> (19,605 ft<sup>2</sup>). A portion of this interior area is used to macro-encapsulate LLMW generated onsite and stage this waste for disposal at the RWMC.

TP available area is approximately 5,437 m<sup>2</sup> (58,500 ft<sup>2</sup>). A portion of this area is used to accumulate LLMW generated onsite.

Maximum storage volume for the building and pad is estimated to be 17,690  $\text{m}^3$  (624,810  $\text{ft}^3$ ). The volume estimate is derived from the volume of an individual freight container (36.2  $\text{m}^3$  (1.280  $\text{ft}^3$ )] stacked two high.

#### Sprung Instant Structure (SIS) Building

This building measures approximately 10.7 m (35 ft) wide by 18.3 m (60 ft) long. The floor area is made up of a concrete portion and a gravel portion. The entire floor space is available for storage of waste boxes and drums [195.8 m² (2,107 ft²)].

Maximum storage volume estimated for this building is 365 m<sup>3</sup> (12,891 ft<sup>3</sup>). The volume estimate is derived from the volume of an individual waste box (4.1 m<sup>3</sup> [144 ft<sup>3</sup>]) with no stacking.

### Visual Examination and Repackaging Building (VERB)

Usable interior storage in this building is limited to approximately 6.4 m (21 ft) wide by 10.1 m (33 ft) long area in the "permacon" portion of the building [64.6 m² (695 ft²)]. The building floor is concrete. Doorways are not forklift accessible. This storage area is for waste boxes and drums.

Maximum storage volume estimated for this building is 240  $\rm m^3$  (8,477  $\rm ft^3$ ). The estimated volume is based on waste boxes, stacked two high.

#### **Drum Holding Pad (DHP)**

This concrete pad is located adjacent to the VERB. The pad entrance slopes down into the pad creating a bermed pad. A cover and fencing are other features of the pad. The covered portion

of the pad measures 4.9 m (16 ft) wide by 7.3 m (24 ft) long [35.8 m<sup>2</sup> (385 ft<sup>2</sup>)] and can accommodate waste boxes and drums.

Maximum storage volume estimated for this building is 131 m<sup>3</sup> (4,627 ft<sup>3</sup>). The estimated volume is based on waste boxes, stacked two high.

Total capacity for the MWSU is approximately 18,429 m<sup>3</sup> (650,192 ft<sup>3</sup>).

Exhibit 1 contains facility drawings (floor plans) and photographs for each of the described facilities.

#### B.1.e.1 Storm Water Run-On and Runoff Control [40 CFR 270.21(b)(2)]

#### **Run-On Protection**

The MWSU is located in the RWMC and is protected from flooding from upstream watersheds by two flood control channels (west and east of the RWMC) and berms. The berms extend along the western, northern, and eastern sides of the RWMC. The channels were designed to divert the peak flow from a 25-year, 24-hour storm event, evaluated using the U.S. Army Corps of Engineers' Hydrologic Engineering Center (HEC) HEC-2 model. The 25-year flood peaks were derived using a HEC-1 model developed for the 100-year floodplain mapping that assumed that floodwater from the entire Barren Wash drainage basin would pass through the West Channel. Therefore, the channel design is highly conservative. The flood control channels divert storm water around the RWMC and onto Frenchman Flat.

A 25-year flood event was documented at the RWMC on February 23 and 24, 1998 (French and Curtis, 1999). The observed flow depth in the West Channel during this storm was only a few inches. The channel is designed for 242 cubic meters per second (cms) (316 yd³/s). The modeled peak for the event was 96 cms (126 yd³/s) and the estimated flow rate corresponding to observed water depth in the channel was less than 1.5 cms (2.0 yd³/s).

In addition, all waste stored at the MWSU will be containerized to prevent precipitation from contacting waste.

#### Runoff Protection

Runoff is not anticipated because waste will be containerized. The TP outdoor storage area is bermed (asphaltic concrete). Pallets will be used to ensure that containers do not contact precipitation that may collect on the pad.

The DHP has a sloped entry and a sunken floor with curbs and no drains. Pallets will be used to ensure that containers do not contact precipitation that may collect on the bermed floor.

#### **Erosion Protection**

Erosion from precipitation events is not applicable for MWSU facilities.

Exhibit 1 Facility Drawings and Photographs TPCB, TP, SIS Building, VERB, and DHP

Drawings not available for public view











### B.2 Chemical and Physical Analysis [40 CFR 270.14(b)(2)]

### B.2.a Volume and Composition of Hazardous Waste [40 CFR 264.13(a)]

LLMW stored in the MWSU contains both radioactive and hazardous material components as defined by the Atomic Energy Act, the RCRA, Nevada Revised Statutes (NRS) and Nevada Administrative Code (NAC). LLMW streams accepted at the MWSU may carry only the EPA hazardous waste codes listed in Table 4. State-only designated hazardous waste may be received at the NTS as hazardous waste. PCBs that meet the requirements for disposal in a hazardous waste landfill as specified in **40 CFR Part 761** and **NAC 444.9452** are also accepted.

LLMW will include waste that contains metals, solvents, organics, and listed constituents; or wastes from specific processes regulated in **40 CFR 261**.

LLMW containing friable or non-friable asbestos will be stored in the MWSU. Low Level Waste (LLW) containing friable or non-friable asbestos may be stored in the MWSU.

LLMW accepted for storage may also contain:

- Bulk PCB remediation waste [40 CFR 761.3] and
- PCB bulk product waste [40 CFR 761.3].

Table 4 provides general information on waste codes and design capacity of the proposed unit.

**Table 4 General Information on Waste Codes and Design Capacity** 

Process Code	D80 (Landfill Disposal)
Waste Codes	D001 through D043, F001 through F009, F039
	P001 through P018, P020 through P024; P026 through P032; P033, P034,
	P036 through P051, P054, P056 through P060, P062 through P078, P081,
	P082, P084, P085, P087 through P089, P092 through P099, P101 through
	P106, P108 through P116, P118 through P123, P127, P128, P185, P188
	through P192, P194, P196 through P205
	U001 through U012, U014 through U039, U041 through U053, U055 through
	U064, U066 through U099, U101 throughU103, U105 through U138, U140
	through U174, U176 through U194, U196, U197, U200 through U211, U213
	through U223, U225 through U228, U234 through U240, U243, U244, U246
	through U249, U271, U278, U279, U280, U328, U353, U359, U364, U367,
	U372, U373, U387, U389, U394, U395, U404, U409, U410, U411
Process Design Capacity	18,429 m <sup>3</sup> (650,192 ft <sup>3</sup> ) [Estimated]

#### **B.2.a.1 Offsite-Generated LLMW**

Offsite-generated LLMW destined for the MWSU will be containerized, fully characterized, LDR compliant, and contain no free liquids. These wastes will not contain D001, D002, or D003 waste codes.

#### **B.2.a.2 Onsite-Generated LLMW**

Onsite-generated LLMW received for storage may *not* be fully characterized or LDR compliant, may contain free liquids, and may be RCRA characteristic wastes. LLMW received from NTS generators will include waste-containing metals, solvents, organics, compressed gases, and listed constituents; or waste from specific processes regulated in **40 CFR Part 261**. Onsite wastes will be containerized and be compatible with the container and other waste components.

#### Wastes that are not LDR compliant

Wastes that are not LDR compliant will be staged at the MWSU while treatment technology options are considered and in some cases while treatment/disposal subcontracts are developed. The majority of onsite-generated LLMW (approximately 80%) requires treatment by macro-encapsulation to become LDR compliant. Other onsite-generated wastes (approximately 20%), are destined for offsite treatment and disposal at permitted facility.

Macro-encapsulation of this waste is done under a treatment plan at the RWMC and is regulated by the NDEP/BFF. This macro-encapsulated waste is disposed onsite in the MWDU.

#### Wastes that contain free liquid

Some of the non-LDR compliant onsite-generated LLMW accepted for storage at the MWSU will contain free liquids. All of these wastes are destined for offsite treatment and disposal at a permitted facility. These wastes will be containerized and stored on spill pallets while at the MWSU. Typically these wastes would be related to remediation projects and could be hydraulic fluids, septic tank wastes, corrosive liquids, and solvents.

#### Wastes that may exhibit RCRA characteristics

LLMW that exhibits a RCRA characteristic will also be accepted for storage. Some of these wastes are destined for offsite treatment and disposal at a permitted facility. Typically these wastes would be ignitable (solvents, organic liquids), corrosive liquids, or compressed gases. Lead solids are macro-encapsulated as described above.

### **B.2.b Compatibility of Waste with Containers [40 CFR 264.172]**

General requirements for containers include:

- Incompatible wastes or incompatible wastes and materials shall not be placed in the same container.
- LLMW containers of 450 liters (119 gallons) or less must be marked for the hazardous characteristics of the waste.
- A tamper-indicating device (TID) may be employed on packages that are inspected
  offsite as part of verification. The number of the TID must be recorded on the verification
  documentation. Some waste packaging does not allow for the application of TIDs
  (e.g., welded boxes)
- Waste containers meet applicable U.S. Department of Transportation (DOT), waste profile, and Treatment, Storage, and Disposal Facility (TSDF) packaging requirements.
- Inter-modal containers that are emptied and returned to the generator are prohibited.

### **B.3 Waste Analysis Plan [40 CFR 270.14(b)(3)]**

### **B.3.a Offsite-Generated LLMW**

Exhibit 2 is the latest revision of the Waste Analysis Plan (WAP) for the disposal of LLMW at the NTS. The plan provides examples of expected waste streams, waste description and sources, waste characteristics, characterization/acceptable knowledge requirements, sampling and analysis protocols, physical and chemical screening methods, prohibited waste, notification/certification requirements, and the waste generator approval process for offsite generators. This plan is adopted for offsite-generated LLMW storage, since all offsite-generated waste received for storage is destined for disposal at the NTS.

**Exhibit 2 LLMW Disposal Unit Waste Analysis Plan (WAP)** 



# MIXED WASTE DISPOSAL UNIT WASTE ANALYSIS PLAN REVISION 0

April 2009

# MIXED WASTE DISPOSAL UNIT WASTE ANALYSIS PLAN Revision 0

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### MIXED WASTE DISPOSAL UNIT (MWDU) WASTE ANALYSIS PLAN (WAP) [40 CFR 264.13 and 270.21(a)]

The Nevada Test Site (NTS) Waste Acceptance Criteria (NTSWAC) establishes the requirements generators shall meet to dispose of waste at the NTS. It includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, packaging and shipment of waste. The NTSWAC outlines the process requirements for generators to receive National Nuclear Security Administration Nevada Site Office (NNSA/NSO) Assistant Manager for Environmental Management (AMEM) approval to ship radioactive Low-Level Waste (LLW) and Low-Level Mixed Waste (LLMW) to the NTS. Applicable portions of this WAP are incorporated into the NTSWAC. This WAP applies to LLMW disposed in the MWDU. References are made throughout this plan to regulations promulgated by the EPA regarding waste analysis requirements for hazardous waste management facilities. These requirements are generally found in Title 40 Code of Federal Regulations (CFR) Part 264, Subpart B, and unless otherwise stated have been adopted by reference in the Nevada Administrative Code (NAC).

#### 1.0 Waste Description and Sources

Accepted wastes will be generated from U.S. Department of Energy (DOE) and NNSA activities including routine waste generation, remediation, and decontamination and decommissioning. Wastes may include contaminated soil and debris, pond sludge, personnel protective equipment (PPE), spill residue, decontamination effluent, lead debris and shielding, and other forms of contaminated media. The final treated waste forms may include incinerator ash; stabilized ash; debris; macroencapsulated debris and lead, and soil. NNSA/NSO may also accept wastes treated by equivalent technologies, provided the Nevada Division of Environmental Protection (NDEP) has approved the technologies. Acceptable hazardous waste codes are provided in Table 1.

Table 1: General Information – MWDU

PROCESS CODE:	D80 (Landfill Disposal)
WASTE CODES:	D004 through D043 F001 through F009, F039 P001 through P205 U001 through U249, U271, U278, U279, U280, U328, U353, U359, U364, U367, U373, U387, U389, U394, U395, U404, U411.
Other Wastes:	PCBs, Friable Asbestos, State Regulated.

#### 2.0 Waste Characteristics

The LLMW waste disposed in MWDU contains both radioactive and hazardous material components as defined by the Atomic Energy Act (AEA), the Resource, Conservation, and Recovery Act (RCRA), Nevada Revised Statues (NRS), and NAC. LLMW streams accepted at the MWDU for disposal may carry only the EPA hazardous waste numbers listed in Table 1 and must meet the NTSWAC. Waste must also meet the Land Disposal Restriction (LDR) treatment standard requirements in 40 CFR 268.40 and 268.45, including applicable standards for underlying hazardous constituents (UHCs). Waste meeting the alternative LDR treatment standard for contaminated soil (40 CFR 268.49) or equivalent treatment technologies (40 CFR

**268.42(b)**) approved by NDEP may also be accepted. State-only designated hazardous waste may be received at the NTS as hazardous waste. Polychlorinated Biphenyls that meet the requirements for the disposal in permitted hazardous waste landfill as specified in 40 CFR Part 761 and NAC 444.9452 are also accepted.

LLMW waste received from generators will include waste containing metals, solvents, organics, and listed constituents; or waste from specific processes regulated in 40 CFR 261.

#### 3.0 Waste Identification Parameters

The NTS onsite generators, DOE offsite generators, and the treatment, storage, and/or disposal facilities (TSDF) sending DOE waste for disposal in the MWDU will be referred to as the "generator." The operating organization is required to test certain LLMW, depending on the type of treatment standard, to ensure that the waste or treatment residual is in compliance with applicable LDR requirements. Such testing is performed according to the frequency specified in this WAP.

Characterization data must be developed under **40 CFR Part 261**. Data may be obtained from acceptable knowledge and/or sampling and analysis.

When demonstrating that a concentration-based LDR treatment standard has been met, a representative sample of the waste shall be submitted to a laboratory accepted under Section 12.4 for analysis. This sample shall be taken by the generator and is required to demonstrate compliance with the LDR treatment standards contained in **40 CFR 268.40**. When demonstrating that a treatment technology standard has been met, a LDR certification shall be submitted.

#### 4.0 Waste Form and Containers

#### 4.1 Prohibited Waste forms

- a. RCRA D, F, P, K, or U waste numbers other than those listed in Table 1.
- b. Wastes which contain only a hazardous component.
- c. Non LDR (40 CFR part 268) compliant waste.
- d. Pathogens, infectious wastes, or other etiologic agents.
- e. Compressed gases aerosol cans must be punctured and valve mechanisms removed from expended gas cylinders.
- f. Free liquids must be absorbed, stabilized, or otherwise removed from the waste. Containerized free liquids such as ampules and small articles that contain free liquids required for the article to function are acceptable. Provisions for additional sorbent should be made when significant temperature and atmospheric differences exist between the generating site and the disposal site.
- g. Non biodegradable sorbents Examples of nonbiodegradable sorbents are found in 40 CFR 264.314[e].
- h. PCBs not classified as bulk product was [40 CFR 761.62] or remediation waste [40 CFR 761.61].
- i. Chelating or complexing agents in amounts greater than 1% of the waste unless stabilized or solidified.

#### 4.2 LLMW Containers

Containers must meet the following requirements:

- a. Incompatible wastes, or incompatible wastes and materials shall not be placed in the same container if such placement:
  - (1) Generates extreme heat or pressure, fire or explosion, or violent reaction;
  - (2) Produces uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health;
  - (3) Produces uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions; or
  - (4) Damages the structural integrity of the device containing the waste.
- b. LLMW containers of 416 liters (110 gallons) or less must be marked for the hazardous characteristics of the waste. Containers must be marked with the following:
  - (1) The words "HAZARDOUS WASTE FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency";
  - (2) Generator's Name and Address; and
  - (3) Manifest Document Number.
- c. LLMW container marking must be:
  - (1) Durable:
  - (2) In English;
  - (3) Printed on or affixed to the surface of a package or on a label, tag, or sign;
  - (4) Displayed on a background of sharply contrasting color;
  - (5) Unobscured by other labels or attachments; and
  - (6) Located away from any marking that could substantially reduce its effectiveness.
- d. LLMW packages must be at least 90 percent full (40 CFR 264.315[a]).
- e. A TID may be employed on packages that are inspected off site as part of verification. The number of the TID must be recorded on the verification documentation. Some waste packaging does not allow for the application of TIDs (e.g., welded boxes).
- f. Intermodal containers that are emptied and returned to the generator are prohibited.

#### 5.0 LDR Notification and Certification

40 CFR 268.7(a) requires each generator evaluate waste to determine if it is restricted from land disposal. As applicable, wastes containing specific hazardous characteristics must be evaluated for UHCs reasonably expected to be in the waste. LLMW destined for disposal at the MWDU must meet LDR requirements prior to shipment to the NTS. LDR Notification and certification forms must be submitted per 40 CFR 268.7. The information on the notification (i.e., manifest number, EPA waste code(s), waste constituents to be monitored, category of waste, and waste analysis data) is compared with accompanying shipment documentation. If a certification statement is missing or unsigned and the discrepancy cannot be resolved, the waste shipment is not accepted and will be returned to a generator specified facility.

Generators are required to perform hazardous waste determinations including evaluating LDR treatment standard requirements on their waste streams. Generators are required to test the waste to ensure compliance with applicable concentration based treatment standards. On the waste profile, generators identify the applicable treatment standard, and whether the waste meets the

standards as generated, is excluded, or requires treatment before disposal.

When shipping waste to the MWDU, generators are required to submit all information, notifications, and certifications described in 40 CFR 268.7 to the operating organization. If the waste changes, the generator must send a new notice and certification to the operating organization.

#### 6.0 Waste Profile and Data Quality Assurance Process

Characterization data must be sufficient to verify compliance with the WAC, ensure safe management, identify UHCs, and verify waste meets LDR treatment standards prior to disposal. The waste profile shall provide a clear picture of the waste's radiological, physical, and chemical characteristics; its regulatory classification; and packaging. Generator-supplied data are the primary means by which NNSA/NSO demonstrates compliance with 40 CFR 264.13(a) and 264.13(b)(5) for obtaining detailed chemical, physical, and radiological analysis.

Generators shall determine the appropriate analysis (total vs. TCLP) to use when performing hazardous waste determinations and identifying UHCs.

Generators' waste characterization data must be based on samples collected using methods specified in EPA SW-846 or other equivalent methods.

#### 6.1 General Waste Profile Requirements

- a. Waste profiles will be submitted to NNSA/NSO for review and approval.
- b. Changes to approved waste streams may be submitted at any time. Depending on the significance of the change, the approval to ship may be temporarily suspended until the changes are reviewed and approved.
- c. Waste profiles shall have annual expiration dates if not recertified by the generator.
- d. Generators shall notify NNSA/NSO in writing when terminating an approved waste profile.

#### 6.2 Specific Waste Profile Requirements

The following information shall be included:

- a. EPA waste codes
- b. Applicable state waste codes
- c. Identification of sorbent(s) used and certification of the use of nonbiodegradable sorbents
- d. Chemical, physical, radiological, and general characteristics and properties
- e. Compliance with WAC items prohibitions
- f. Container type, size, weight, dose rate, and approximate number
- g. Demonstration of compliance with LDR standards including compliance with Universal Treatment Standards, if applicable
- h. Supplemental attachments consisting of container drawings, process flow information, analytical data, etc., if necessary.
- i. Visual inspection forms; analytical results or log books; and/or procedures or treatability tests results, as necessary.

#### 7.0 Pre-Acceptance Approval Process

The NTSWAC establishes the requirements generators shall meet to dispose of waste at the NTS. It includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, packaging and shipment of waste. The NTSWAC outlines the process requirements for generators to receive AMEM approval to ship radioactive LLW and LLMW to the NTS. Applicable portions of this WAP are incorporated into the NTSWAC. Approval flow diagrams are provided in Exhibit 1.

The NTSWAC establishes a facility evaluation system (audit and surveillance) to approve the generator's shipment of waste to the NTS. These evaluations, conducted by the operating organization, include rigorous attention to the characterization, certification, and QA programs at the generator site. The evaluations are conducted in accordance with written procedures and checklists.

During the evaluation of the generator's waste management program Corrective Action Requests (CARs) may be issued for quality affecting problems. These CARs must be answered by a corrective action plan identifying the root cause, corrective actions, and actions to preclude reoccurrence. The generator is not approved until all CARs are closed.

Once the AMEM approves the generator, waste profiles are accepted for review. The AMEM can suspend approvals at any time, based on programmatic or waste stream deficiencies.

#### 7.1 Generator Approval Process

Once a generator is approved for shipping waste to the NTS, a waste stream approval process is initiated. This process includes submitting a notification and/or waste profile, waste profile review, and determining the physical screening type and frequency. The generators program and waste profile are reevaluated at the specified frequency. If the waste analysis data are sufficient and the waste stream meets the WAC, the waste profile is approved. The approved waste is then scheduled for receipt at the RWMS.

The operating organization obtains detailed chemical and physical analysis of LLMW from generators requesting disposal in the MWDU. Before waste can be disposed, generators must perform a hazardous waste determination as required by their state regulations, 40 CFR 262.11, and 40 CFR 268.7. The characterization data are used to complete a waste profile for each waste stream.

A notification form (Exhibit 2) will be submitted for waste that has not yet been treated. By requiring generators to submit the notification, coordination of remote sampling and offsite visual verification is more readily accomplished. A waste profile form will be submitted for post-treatment final waste forms. For waste already treated, the generator will submit the waste profile. The notification and/or waste profile is submitted to NNSA/NSO for review and approval.

In general, LLMW received from onsite generators is managed the same as waste received from offsite generators. Differences include, but are not limited to: physical and chemical screening and shipping documentation (Uniform Hazardous Waste Manifests are used for waste from offsite generators, and onsite waste manifest forms are used for waste from onsite generators).

Generators shall provide, as necessary, sampling and analysis data that are of a known precision and accuracy to identify the physical and chemical properties of the waste.

#### 7.2 Notification Review

If treatment is required but has yet to occur, the operating organization will review the notification form, determine the physical screening frequency (section 7.4), and schedule offsite verification activities with the generator. See Exhibit 2 for an example of a notification review form.

#### 7.3 Waste Profile Review

The operating organization will review the initial generator-supplied waste analysis for waste profile approval in accordance with 40 CFR 264.13(b)(4).

The operating organization reviews the waste profile information including general waste stream information, chemical and physical characterization, treatment, and packaging information to verify that waste streams are defined adequately. This will demonstrate that the waste meets the WAC and complies with appropriate LDR treatment standards. If discrepancies are found, or inadequate characterization data have been provided, the operating organization requests additional information from the generators. Resolutions could include providing processing or treatment procedures, drawings, process flow information, or supplemental analytical data. Results from the review are documented in the operating record (see Exhibit 3 for an example of a Waste Stream Recommendation Form).

The operating organization will evaluate sampling and analysis documentation to ensure that: (1) samples are representative of the waste stream, (2) appropriate analytical procedures are used, and (3) sufficient quality controls are established to allow measurement and documentation of data quality. The initial physical screening frequency will be determined.

Generators who submitted a notification form will include any verification activity documentation with the waste profile. This information will be reviewed for final approval of the waste profile. After approval, generators can schedule waste shipments.

#### 7.4 Screening Frequency

The screening frequency is determined by the operating organization using the following process.

- a. Review of the generator waste profile information to determine the relative potential for mischaracterization or inappropriate segregation based on all relevant information, including any previous experience with the generator. Based on this review, the operating organization identifies any concerns associated with the following criteria:
  - (1) documented waste management program
  - (2) waste stream characterization information
  - (3) potential for inappropriate segregation
  - (4) waste type and packaging.
- b. Establishment of the physical screening frequency for the waste stream:
  - (1) The physical screening minimum is five percent of the waste stream

#### 7.5 Screening Options

The following are the screening options available:

- a. offsite (at generator or treatment facility) visual inspection
- b. offsite chemical screening
- c. offsite or onsite (NTS) review of photographs, videos, RTR images, and/or RTR recordings of treatment
- d. onsite RTR
- e. onsite visual inspection of container exterior (performed 100%)

#### 8.0 Physical and Chemical Screening

Verification activities are performed as required in 40 CFR 264.13[c]. The activities include container receipt inspection and could also include physical screening and/or chemical screening. Containers can be inspected visually, verified by RTR, or sampled for field or laboratory analysis to confirm that the waste matches the waste profile and container data information supplied by the generator. Any discrepancies between the verification results and the waste profile must be resolved before acceptance at the MWDU.

Screening methods have sufficient performance levels to yield valid decisions when considering method variability (precision and accuracy). When screening is performed at a location not within the RWMS, tamper-indicating devices (TIDs) may be applied to each container examined and, on receipt, verified as acceptable to ensure that no changes could have occurred to the packaging and waste content. Written procedures are maintained detailing the requirements for applying TIDs. Some waste packaging does not allow for the application of TIDs (e.g., welded boxes). The following elements are used to verify and provide sufficient data to ensure that waste received is correctly described in the shipping documentation.

#### 8.1 Physical Screening

This section describes the requirements pertaining to methods, frequency, and exceptions for verification by physical screening. Physical screening can be performed before the waste is shipped to the MWDU.

#### 8.1.1 Physical Screening Frequency

The minimum physical screening frequency is 5 percent. The operating organization adjusts the visual and RTR inspection levels for generators based on objective performance criteria.

#### 8.1.2 Physical Screening Exceptions

- a. Waste that cannot be physically screened at the Area 5 RWMS may be visually inspected at the generator location (e.g., classified LLMW, large components, remote-handled containers that cannot be opened, will not fit in RTR).
- b. A waste that was treated prior to issuance of the Permit is considered previously treated waste. The operating organization will evaluate the generator's approved Waste Certification Program, the waste profile including the LDR Certification Statement, treatment and packaging procedures, package inventories, acceptable knowledge information and any historical analytical data for acceptability.

#### 8.1.3 Physical Screening Methods

The following physical screening methods comply with the requirement to verify waste [40 CFR 264.13(c)]:

- a. Visual inspection
- b. RTR

#### 8.1.4 Physical Screening QC

Physical screening QC is used to ensure that quality data are obtained when performing RTR. Visual inspection does not use instrumentation or chemical tests. The operating organization RTR procedures and training requirements identify necessary QC elements.

#### 8.1.5 Physical Screening Parameters

The following methods are approved for use.

#### 8.1.5.1 Visual Inspection

<u>Rationale</u>: Because the NTS does not have a container-opening facility, a visual verification of the waste will be accomplished at the generator or treatment facility. This method meets the requirement to ensure consistency among the waste containers and the waste profile.

<u>Method</u>: The container is opened and the contents are inspected by direct visual observation or review of the images of the treatment process and package. Homogenous loose solids are probed. If the waste is being treated, direct visual observation of the treatment and container filling process is performed. Visual observations are compared with the applicable waste profile and container-specific information. Visual observations may include review of available RTR tapes, videotapes, photographs, digital images, etc. of the treatment and packaging process to ensure compliance.

<u>Failure Criteria</u>: A container fails inspection for any of the following: (1) undocumented or improperly packaged waste; (2) discovery of prohibited articles or materials; (3) discovery of material not consistent with the applicable waste profile (i.e., waste form); and (4) void space greater than 10 percent.

#### 8.1.5.2 Real-Time-Radiography

<u>Rationale</u>: This method meets the requirement to ensure the absence of prohibited items and consistency among waste containers, the waste profile, and the shipment documentation. Containers that are not amenable to visual inspection because of physical or radiological content can be examined safely and economically.

<u>Method</u>: The container is scanned with an RTR system. Images are observed on a video monitor and/or captured on videotape. Personnel trained in the interpretation of RTR imagery record their observations. These observations are compared to the contents listed on the waste profile and accompanying shipment documentation.

<u>Failure Criteria</u>: A container fails inspection criteria for any of the following reasons: (1) undocumented or improperly packaged waste, (2) discovery of prohibited articles as

identified in the NTSWAC and section 4.1 of this document, (3) image data inconsistent with the waste profile or shipment documentation; and (4) void space greater than 10 percent.

#### 8.2 Chemical Screening

Chemical screening will be performed before the waste is shipped to the Area 5 RWMS. The operating organization will determine which screening parameters are appropriate for the waste stream. Interpretation of the appropriate chemical screening method(s) are conducted and performed by trained personnel. Unless otherwise noted, chemical screening tests are qualitative, not quantitative. The objective of chemical screening is to obtain reasonable assurance that the waste received is consistent with the description of the waste on the waste profile and to ensure that the waste is safely managed.

#### 8.2.1 Chemical Screening Frequency

At a minimum, 10 percent of the waste containers amiable to chemical screening and verified by visual inspection will be chemically screened.

#### 8.2.2 Chemical Screening Exceptions

The following are cases in which chemical screening is not required:

- a. Waste subject to a technology based treatment standard.
- b. Chemical containing equipment removed from service (e.g., ballasts, batteries).
- c. Waste containing regulated asbestos.
- d. Waste containing beryllium
- e. Waste, environmental media, and/or debris from the cleanup of spills or release of single substance or commercial product or otherwise known material (e.g., material for which a material safety data sheet can be provided).
- f. Confirmed noninfectious waste (e.g., xylene, acetone, ethyl alcohol, isopropyl alcohol) generated from laboratory tissue preparation, slide staining, or fixing processes.
- g. Hazardous debris.
- h. Package is greater than 100 mrem/hr at 30 cm

#### 8.2.3 Chemical Screening Sampling

The chemical screening methods do not require any sample preservation methods because the screening tests are performed at the time and location of sampling or as soon as possible thereafter. When a delay is required, the samples are stored in a manner that maintains chain-of-custody controls and protects the sample composition. The equipment requirements in Table 2 may apply to sampling for chemical screening.

Individual containers are selected based on a review of the contents described in the associated documentation. If the containers and their contents are similar, containers are selected randomly for screening. If there are substantial differences among the containers or their contents, the containers are selected by stratified sampling with the strata being the types of containers and or contents presented.

#### 8.2.4 Chemical Screening QC

The following QC elements are used when performing chemical screening.

a. Containers and equipment of the appropriate size, given the analytical method and that

- are chemically compatible with the waste and testing reagents.
- b. Chemicals and test kits are labeled so that they are traceable.
- c. QC checks shall be performed on each test kit and associated replacements at the frequency specified in operating procedures.

#### 8.2.5 Chemical Screening Parameters

The following methods are approved for use in performing chemical screening.

#### 8.2.5.1 pH Screen

<u>Rationale</u>: To identify the pH and corrosive nature of waste and to confirm consistency with the shipment documentation.

<u>Method</u>: Full-range pH paper is used for the initial screening. If the initial screen indicates a pH below 4 or above 10, a pH meter could be used, or a narrow-range pH paper. Solids are mixed with an equal weight of water and the liquid portion of the solution is tested.

<u>Failure Criteria</u>: If the pH of a matrix exceeds regulatory limits (less than or equal to 2.0 or greater than or equal to 12.5) the container fails verification.

#### 8.2.5.2 Peroxide Screening

<u>Rationale</u>: To determine the presence of organic peroxides in solvent waste, to alert personnel to potential hazards, and to confirm consistency with the shipment documentation. The test is sensitive to low parts per million (ppm).

<u>Method</u>: Solids are tested by first wetting the test strip with water and contacting a small sample of the waste. A color change indicates a positive reaction. The color change can be compared with a chart on the packaging to determine an approximate organic peroxide concentration.

<u>Failure Criteria</u>: Peroxide concentrations greater than 20 ppm in liquid waste constituents that are known organic peroxide formers and are not documented as having been stabilized constitute failure.

#### 8.2.5.3 Paint Filter Test

Rationale: To verify the presence or absence of free liquid in solid or semisolid material.

<u>Method</u>: Using a standard paint filter, 100 cubic centimeters or 100 grams of waste are added and allowed to settle for five minutes. Any liquid passing through the filter signifies failure of the test. EPA SW 846 requires Method 9095 for the paint filter test.

<u>Failure Criteria</u>: Failure of the test in waste matrices constitutes failure of the container. Exceptions: small quantities of condensate trapped in inner plastic liner folds are acceptable.

#### 8.2.5.4 Oxidizer Screen

<u>Rationale</u>: To determine if a waste exhibits oxidizing properties and to confirm consistency with the shipment documentation.

<u>Method</u>: Acidified potassium iodide test paper is used to measure the oxidizing properties of waste in accordance with written procedures or manufacturer's suggested method.

<u>Failure Criteria</u>: A positive oxidizing indication in a waste that is not consistent with documented constituents fails verification.

#### 8.2.5.5 Water Reactivity Screen

<u>Rationale</u>: To determine if the waste has the potential to vigorously react with water or to form gases or other reaction products. This information is used to confirm consistency with the shipment documentation.

<u>Method</u>: Water reactivity screen is performed in accordance with written procedures or manufacturer's suggested method

<u>Failure Criteria</u>: A positive reactivity indication in a waste that is not consistent with documented properties fails verification.

#### 8.2.5.6 Cyanide Screen

<u>Rationale</u>: To indicate if waste releases hydrogen cyanide upon acidification near pH 2. This information is used to confirm consistency with the shipment documentation.

<u>Method</u>: A cyanide screen is performed in accordance with written procedures or manufacturer's suggested method.

<u>Failure Criteria</u>: A positive cyanide indication in a waste that is not consistent with documented constituents fails verification.

#### 8.2.5.7 Sulfide Screen

<u>Rationale</u>: To indicate if the waste could release hydrogen sulfide upon acidification near pH 2. This information is used to confirm consistency with the shipment documentation.

<u>Method</u>: A sulfide screen is performed in accordance with written procedures or manufacturer's suggested method.

<u>Failure Criteria</u>: A positive indication in a waste that is not consistent with documented constituents fails verification.

#### 9.0 Preshipment Authorization Process for Approved Wastes

For each shipment that is a candidate for disposal, the generator provides the following information:

- a. Container identification number
- b. Profile number
- c. Waste description
- d. Generator information (e.g., name, address, point of contact, telephone number)
- e. Container information (e.g., type, size, weight)
- f. EPA waste codes
- g. Waste composition
- h. Packaging materials and quantities
- i. Applicable treatment standard/technology.

Where potential conformance issues exist in the information provided (i.e., waste characteristics do not match the waste profile information, WAC, or additional constituents are expected to be present that do not appear on the documentation), the generator is contacted and the issue addressed. Container data are compared to the waste profile data to ensure that the waste to be shipped is as described on the profile. Screening provides a means to minimize the potential for acceptance of incorrectly identified waste.

#### 9.1 Paperwork Review.

Every shipment is reviewed to ensure that the waste meets the WAC. If the shipment information is verified to be acceptable, the operating organization determines if any of the waste containers are required to be RTR'd.

9.2 Visual inspection and Chemical Screening Documentation Review.

For those waste streams that underwent verification at the generator's or TSDFs site, the verification documentation will be reviewed for completeness.

#### 9.3 RTR Container Selection.

A list of waste packages with discrete identification numbers is required for random selection of containers to undergo RTR verification. The operating organization will follow procedures to select containers for RTR verification.

#### 10.0 Waste Acceptance and Verification Procedures Upon Arrival of Shipment

Waste containers undergo verification upon arrival at the NTS. The following section provides a description of verification methods available at the NTS. When a conformance issue exists, a determination is made regarding the acceptability of the container, and appropriate action is taken based on the severity of the issue.

#### 10.1 RWMS Paperwork Review

Rationale: Each shipment's paperwork is reviewed for completeness.

Method: The shipment is documented on a shipping/receiver log upon arrival at the Area 5 RWMS. Operations personnel perform a completeness review of the generator's required shipping paperwork which may include: a bill of lading, uniform hazardous waste manifest or equivalent state-of-generation manifest, LDR form, the original package storage and disposal request, and the original waste certification statement. Paperwork review and inspection requirements are documented on a shipment checklist.

<u>Failure Criteria</u>: A shipment fails inspection if there is (1) missing paperwork, (2) a discrepancy in the number of containers in the shipment, and/or (3) incorrect paperwork.

#### 10.2 Area 5 RWMS Visual Examination

<u>Rationale</u>: Each container in the shipment is inspected in its entirety for possible damage or content leakage, complete marking and labeling, and intact TIDs as required. This is to ensure that the shipment (1) is received in good condition, (2) has the container(s) corresponding to the shipping papers, (3) has not been opened after physical screening is performed, and (4) is complete.

<u>Method</u>: When the container is off-loaded, markings, and labels are inspected and compared with the associated manifests. Container inspections are individually recorded on a waste package checklist. These checklists, along with the shipment checklist, are recorded and filed with the shipping paperwork

<u>Failure Criteria</u>: A container fails inspection if (1) there is evidence of leaking or breaching of the container, (2) incorrect container numbers, (3) incorrect marking or labeling, (4) missing marking or labeling, (5) broken or missing TID, and/or (6) discrepancy in TID number.

#### 10.3 Area 5 RWMS RTR Examination

See Section 8.1.5.2 for the rationale, method, and failure criteria for the RTR.

#### 11.0 Manifest Tracking and Record Keeping

The generator will contact the operating organization, prior to shipment of waste to arrange for waste verification and shipment. The generator will be responsible for the identification and tracking of the waste shipment. Upon receipt of waste, each shipment will be screened according to the above sections. Once a shipment is accepted, the manifest will be:

- a. Signed and dated on each copy to certify that the LLMW covered by the manifest was received;
- b. Any significant discrepancies noted on each copy;
- c. One signed copy given to the transporter;
- d. Within 30 days of delivery, a copy will be sent to the generator; and
- e. Will be retained at the facility for at least three years from date of delivery.

The following data will be maintained in the operating record in accordance with the records inventory and disposition schedule:

- a. The RWMS will maintain the waste profile, supporting documentation, shipping documentation, and any associated QA/QC data.
- b. Errors and omissions (e.g., transcription errors, typographical errors, errors in calculations) shall be corrected as information becomes available. These corrections shall be in ink and initialed and dated by the person making the correction.
- c. Documentation from sampling events.

#### 12.0 Sampling and Analysis

LLMW must be sampled and analyzed by the test methods specified in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA Publication SW-846 [SW-846]) or approved equivalent methods. Analysis must be performed by an accepted laboratory as discussed in Section 12.4. The recommended sampling devices, EPA methods, parameters, and rationale for parameter selection for characterization and LDR requirements are identified in Tables 2 and 3.

Compliance with LDR [40 CFR 268.40] for wastes that have a treatment standard expressed as constituent concentrations in wastes can be shown using any appropriate method. If the waste treatment standard is expressed as constituent concentrations in waste extracts, then the Toxicity Characteristic Leaching Procedure (TCLP), must be performed.

For other parameters or methods not otherwise specified, the following are acceptable sources of testing methods (standard methods):

- a. The most recently promulgated version of EPA SW-846.
- b. Other current EPA methods, as applicable to the matrix under evaluation.
- c. Standard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA), American Water Works Association, Water Environment Federation.
- d. Annual Book of ASTM Standards, American Society for Testing and Materials.
- e. AOAC Official Methods of Analysis, AOAC (Association of Official Analytical Chemists), International.

Specific sampling procedures and techniques depend on both the nature of the waste and type of packaging. Waste samples are treated and preserved as necessary to protect the sample. Recommended treatment, preservation techniques, and holding times are stated in SW 846.

Table 2: Sampling Devices

Material	Equipment
Liquid	Coliwasa, Dipper, Weighted Bottle
Soil and Soil-like Material	Thief, Trier, Scoops, Shovels, Auger, Veihmeyer Soil Sampler

Table 3: EPA Methods, Parameters, and Rationale for Parameter Selection

EPA Method <sup>1</sup>	Parameter	Rationale for Parameter Selection
9040, 9041, or 9045	РН	To assign hazardous waste number and identify prohibited waste.
ASTM D 93-79, D 93-80, D 3278-78, or 1030	Ignitability	To assign hazardous waste number and identify prohibited waste.
9014, 9034	Reactivity	To assign hazardous waste number and identify prohibited waste.
9095	Free liquids	To assign hazardous waste number and identify prohibited waste.
1311 <sup>2</sup>	Toxicity characteristic leaching procedure (TCLP)	To assign hazardous waste numbers and verify compliance with LDR treatment standards.
2540C	Total Suspended Solids	To determine whether LDR wastewater or non-wastewater treatment standards apply.
6010, 6020, or 7000 series	TCLP metals analysis	To assign hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Volatiles analysis	To assign TC hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Semi volatiles analysis	To assign TC hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Halogenated organic compounds (HOCs) <sup>3</sup>	To verify applicability of LDR requirements of soil.
8082	Polychlorinated biphenyls (PCBs)	To identify prohibited items, meet Toxic Substances Control Act (TSCA) requirements.

Referenced methods are from Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846 unless otherwise noted. More current SW-846 methods may be substituted for any method listed in this column.

#### 12.1. Sampling Equipment and Preservation

Table 2 contains waste forms and sample equipment used to sample referenced waste. Sample preservation follows EPA SW 846 protocol.

<sup>&</sup>lt;sup>2</sup> An alternative to performing Method 1311 is to perform total contaminant concentration analysis and assume all contaminants to be leachable using the Toxicity Characteristic Leachate Procedure (TCLP) method. For purposes of this requirement, the total results based on a dry weight basis shall be divided by a conversion factor of 20 mg/kg in order to determine whether a TCLP limit has the possibility of being exceeded.

<sup>&</sup>lt;sup>3</sup> As specified in 40 CFR 268.2(a) and Appendix III to 40 CFR 268.

#### 12.2 Sampling Methods

The appropriate personnel are responsible for arranging sampling and laboratory support. Samples are processed at laboratories qualified to perform analysis of waste samples (refer to 12.4). The operating organization will determine the proper sampling protocol (simple random, stratified simple random, etc) for the grab sample(s) based on the waste type and form. Table 3 illustrates the EPA methods, parameters, and the rationale for parameter selection.

#### Sampling typically includes the following:

- a. Obtain a unique sample identification number and complete the sample tag before sampling.
- b. Obtain a precleaned sampling device and sample bottles.
- c. For sampling liquid waste, a Coliwasa sampler or pipette is used to sample for two-phase liquids. Homogeneous liquids in small containers are poured into a sample bottle.
- d. For sampling solid waste, a scoop, trier, or hand auger is used to obtain a sample of the waste. For large containers of waste, composite several augers or scoops to ensure samples are representative.
- e. Exterior surfaces of the sample bottles are wiped clean.
- f. Attach sample label to sample bottles.
- g. Complete the chain of custody forms.
- h. Place samples in an appropriate receptacle for transfer to the laboratory. If appropriate, include equipment for temperature sensitive samples to preserve the integrity of the sample as required by EPA methods.
- i. Seal and mark the receptacle.
- j. Transfer receptacle to the analytical laboratory as appropriate to meet sample holding times.
- k. Properly clean and decontaminate nondisposable sampling equipment or package for return to central sampling equipment decontamination area according to onsite requirements.

#### 12.3 Establishing QA and QC Procedures for Sampling

The operating organization maintains compliance with DOE Order 414.1C, Quality Assurance. Sampling personnel prepare a permanent log of sampling activities. A log of sampling activities is kept in accordance with EPA SW 846, Chapter 9. Log entries include, as appropriate: date of collection, time of collection, location, batch number, sample number, tank number, copy of the chain of custody form, sampling method, container description, waste matrix, description of generating process, number and volume of samples, field observations, field measurements (e.g., percent lower explosive limit), laboratory destination, and signature. These log entries are made while sampling is performed. The logs or copies of logs are maintained by appropriate personnel after completion of sampling activities. A chain of custody record accompanies samples at all times.

Compliance with applicable industrial hygiene and safety standards is mandatory during sampling activities. Transportation of samples is performed in accordance with applicable DOT requirements.

The following QA/QC elements are used to ensure that sampling activities result in acceptable laboratory data:

- a. Sampling methods as defined by EPA SW 846, Chapter 9
- b. Appropriate sample containers and equipment for specific waste streams
- c. Samples numbered and labeled
- d. Traceable labeling system
- e. Field QA/QC samples
- f. Equipment calibration
- g. Chain of custody.

#### 12.4 Laboratories and Treatment Facilities

The DOE Consolidated Accreditation Program (DOECAP) provides audits of commercial mixed waste TSDFs and analytical laboratories. TSDFs and laboratories used by generators shall have a current DOECAP or equivalent audit.

DOECAP incorporates a national standard (statement of work/contracts) and reporting requirements consistent with user needs and regulatory requirements (ISO 17025 basis). Treatment facilities and laboratories providing support to DOE are required to be audited by DOECAP. DOECAP is a complex-wide consolidated audit program that uses a multi-checklist audit process. The checklists address the following areas:

- a. Industrial and Chemical Safety
- b. Environmental Compliance/Permitting
- c. Quality Assurance Management Systems
- d. Radiological Control
- e. Transportation Management
- f. Sampling and Analytical Data Quality
- g. Waste Operations

Each facility is audited annually to evaluate the effective implementation of the QA/QC program. QA and technical experts evaluate the facility through onsite observations and/or reviews of the following documentation: copies of the QA/QC documents, records of surveillances/inspections, audits, nonconformances, and corrective actions.

#### 12.5 Evaluation of Analytical Results

The acquired data need to be scientifically sound, of known quality, and thoroughly documented. The operating organization is responsible to ensure that data assessment or evaluation is completed. Data are assessed to determine compliance with the following:

<u>Precision</u>. The overall precision is the agreement between the collected samples (duplicates) for the same parameters, at the same location, subjected to the same preparative and analytical techniques. Analytical precision is the agreement between individual portions taken from the same sample, for the same parameters, subjected to the same preparative and analytical techniques.

<u>Accuracy</u>. Accuracy of the measurement system is evaluated by use of various kinds of QA samples, including, but not limited to, certified standards, in-house standards, and performance evaluation samples.

<u>Representativeness</u>. Representativeness addresses the degree to which the data accurately and precisely represent a real characterization of the waste stream, parameter variation at a sampling point, sampling conditions, and the environmental condition at the time of sampling.

<u>Completeness</u>. Completeness is the amount of usable data obtained from a measurement system compared to the total amount of data requested.

<u>Comparability</u>. Comparability is the confidence with which one data set can be compared to another. This usually is accomplished by using the same methods for each data set.

If the data is found to be insufficient the operating organization may require: re-analysis, data validation and/or re-sampling.

#### 13.0 Acceptable Knowledge

Acceptable knowledge is a characterization technique that relies on the generator's knowledge of the physical and chemical properties of the materials and the waste generation processes. It includes knowledge of the fate of those materials during and subsequent to the process, and the associated administrative controls. When collecting documentation on a waste stream, the operating organization must determine if the information provided by the generator is acceptable knowledge. Acceptable knowledge requirements are met using any one or combination of the following types of information:

- a. Mass balance from a controlled process that has a specified input and output
- b. Material safety data sheet on chemical products
- c. Test data from a surrogate sample
- d. Analytical data on the waste or a waste from a similar process.

In addition, acceptable knowledge requirements can be met using a combination of analytical data or screening results and one or more of the following:

- a. Interview information
- b. Logbooks
- c. Procurement records
- d. Qualified analytical data
- e. Radiation work package
- f. Procedures and/or methods
- g. Process flow charts
- h. Inventory sheets
- i. Vendor information
- j. Mass balance from an uncontrolled process (e.g., spill cleanup)
- k. Mass balance from a process with variable inputs and outputs (e.g., washing/cleaning methods).

Acceptable knowledge may be used for determining:

- a. Hazardous waste constituents
- b. Wastes that are listed under 40 CFR 261.31, 261.32, and 261.33
- c. UHCs
- d. Necessary confirmatory sampling
- e. LDR compliance with technology based standards

If the information is sufficient to quantify the constituents of regulatory concern and to determine waste characteristics as required by the regulations and waste acceptance criteria (WAC), the information is considered acceptable knowledge. If the information is not sufficient, sampling may be required. Waste must conform to requirements found in this WAP, the EPA codes found in Table 1, and the NTSWAC.

#### 14.0 Issue Resolution

Conformance issues identified during verification could result in a waste container that does not meet the WAC. If a possible conformance issue is identified, the following actions are taken to resolve the issue:

- a. The operating organization compiles all information concerning the possible conformance issue(s).
- b. The generator is notified and requested to supply additional information that could assist in the resolution of the concern(s). If the generator supplies information that resolves the concern(s) identified, no further action is required.
- c. The operating organization and the generator discuss the conformance issue and identify the appropriate course of action to resolve the container/shipment in question;
- d. The operating organization has the following options (more than one may be used):
  - (1) suspend the waste stream, (2) suspend the generator's entire waste shipping program, (3) issue a CAR, (4) have the generator issue an internal non-conformance, (5) increase physical screening frequencies, (6) ensure issue is included during the next scheduled generator facility evaluation, (7) schedule a facility evaluation, (8) return waste container and/or shipment to a generator specified facility.
- e. On the issuance of a CAR, the operating organization requests the generator to provide a corrective action plan (CAP) that clearly states the reason for the failure and describes the actions to be completed to prevent reoccurrence.
- f. The operating organization reviews the CAP for adequacy.
- g. Issues and their corresponding resolutions will be recorded and tracked by the operating organization.
- h. On resolution of the initial conformance issue, the operating organization requests the generator to provide a corrective action plan (CAP) that clearly states the reason for the failure and describes the actions to be completed to prevent reoccurrence.
- i. The generator may request a reduction in verification of unaffected waste streams. This request must be accompanied by a justification that identifies why this waste stream(s) would not exhibit the same conformance issue.
- j. The operating organization reviews the CAP and waste stream justification for adequacy. If the waste stream justification is accepted, the operating organization adjusts the frequency.

#### 15.0 Reducing the Physical Screening Frequency

Physical screening percentages may be reduced based on the waste stream compliance with the waste profile, shipping documentation, and verification results. At no time will the frequency be reduced below 5 percent.

#### 16.0 Frequency of Analysis

#### 16.1 Facility Evaluations

Generators are evaluated according to the NTSWAC. CARs may be issued for quality affecting problems. These CARs must be answered by a CAP identifying the root causes, corrective actions, and actions to preclude reoccurrence. Dependent upon the severity of the problem(s), the NNSA/NSO may:

- a. Allow continued shipment of all approved waste streams.
- b. Suspend one or more waste streams from shipments,
- c. Suspend the entire waste shipment program.

#### 16.2 Waste Profiles

Generators will perform an initial characterization or identification analysis prior to submitting a waste profile. The following are examples of when an analysis may be repeated:

- a. Requested by the operating organization due to insufficient data,
- b. After one year (365 days) from waste profile approval (see Exhibit 4),
- c. The generating process has changed,
- d. On submission of a waste profile revision regarding characterization changes (if revision is submitted within one year of previous evaluation),
- e. If inspection or analysis indicates the waste received does not match the waste profile and/or shipment documentation.

If the generator has informed the operating organization of a change in the waste generation process or if the waste may not conform to the waste profile, the waste must be re-profiled and is re-reviewed.

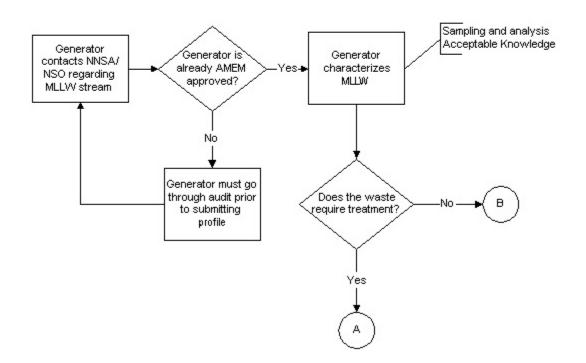
When a waste profile is re-evaluated, the operating organization could request the generator to do one or more of the following:

- a. Verify that the current waste profile is accurate
- b. Supply a new waste profile
- c. Submit a sample for analysis
- d. Cancel the waste profile.

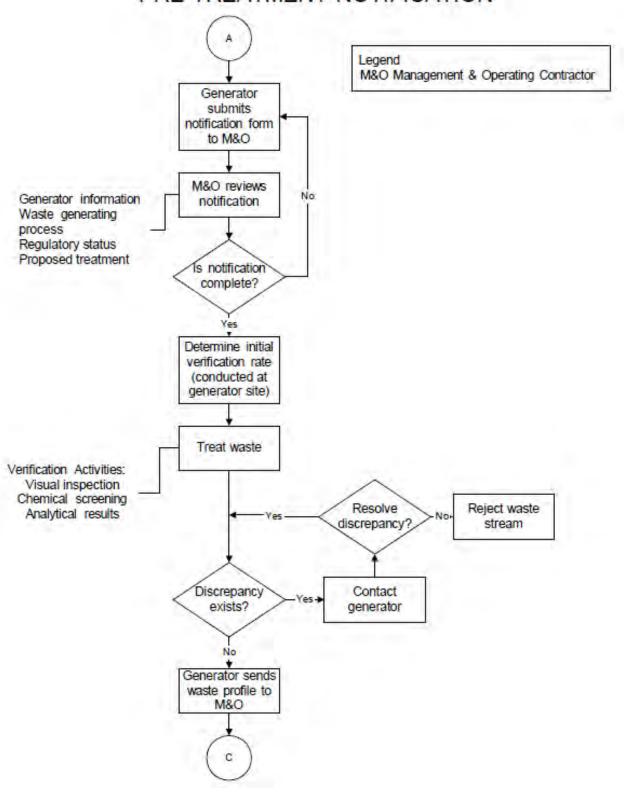
# Exhibit 1 Process Flow Diagrams

### WASTE GENERATOR APPROVAL

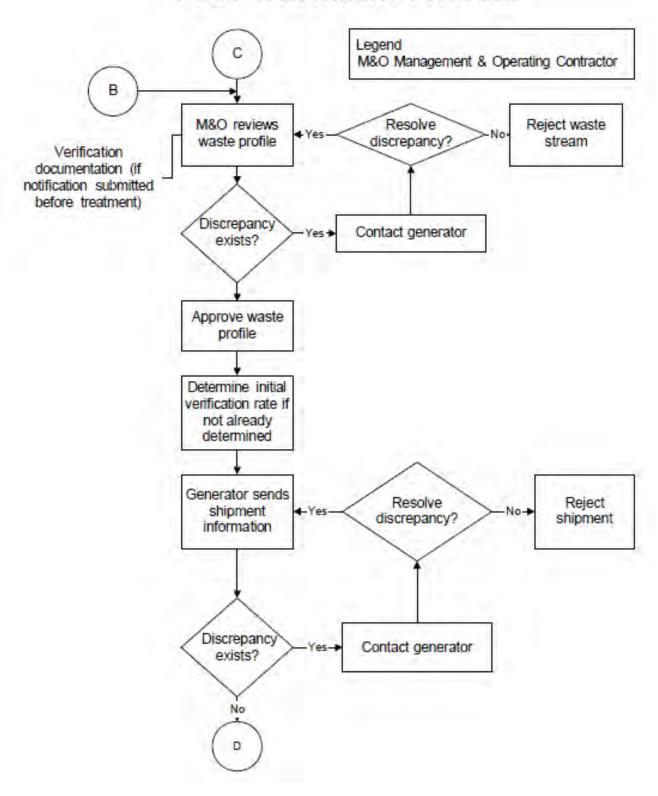
AMEM - Assistant Manager Environmental Management NNSA/NSO - National Nuclear Security Administration Nevada Site Office MLLVV - Mixed low-level radioactive waste

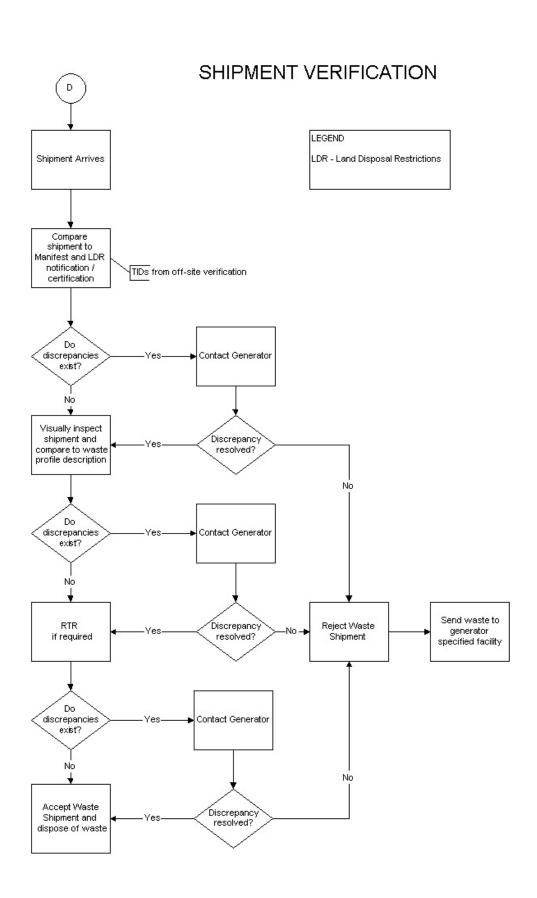


#### PRE-TREATMENT NOTIFICATION



### POST-TREATMENT PROFILE





### Exhibit 2

# NTS Pre-Treatment Notification Form for Mixed Waste Example

<ul><li>A. Generator Information</li><li>1. Company name:</li><li>2. Facility address:</li><li>3. Generator facility:</li></ul>	n					
<ol> <li>Primary technical cor</li> </ol>	ntact:	email:	Phone:	Fax:		
5. Waste certification offi		email:	Phone:	Fax:		
B. General Waste Stream  1. Waste stream name: 2. Waste stream identifica 3. Waste generating pro 4. Estimated volume aft	tion number	r: tion:		☐ Invento	ory attached	
5. Container Size		Weight (1	bs).	Dose rate	e (mR/hr @ 30 cm)	
applicable regular  State regulated h  Waste composition. I constituents that cont	azardous wa Describe the	aste codes: gross comp				zardous
CAS Number	Ch	nemical Con	nstituent	W	aste Component	
8. Reportable radionucl	ides. List the	e radionucli	des that could be	reportable i	n the waste stream:	
	etivity q/m³)					

#### C. Proposed Treatment Information

1.	Applicable LDR Trea	tment Standards:			
2.	Treatment standards:	Concentration	n Based	☐ Technolo	gy Based
3.	Proposed Treatment I	Facility:			
	Onsite	Generator proced	lures:		
	☐ Commercial	Facility name:			
		Address:			
		EPA Identification	on numbe	er:	
		Permit number:			
4.	DOECAP audit numb	per and date compl	leted of t	he treatment fa	acility:
5.	Treatment process(es	) or technology(ie	s):		
6.	Proposed final waste	form:			
	Solidified/Stabiliz	zed 🔲 De	ebris		■ Macroencapsulated
	☐ Incinerator Ash		oil		Other; describe:
7.	☐ Waste will contain	n sorbent.			
	What kind?	Sorbents used m	iust meet	40 CFR 264.3	$314(e)(1) \ or \ (2).$
8.	Schedule for treatment	t:			
9.	Training or PPE neces	sary for visual ins	pection of	of treatment/wa	aste:
Tec	hnical Contact Signatu	ıre:		Date:	
WC	O Signature:		Date:		

### Exhibit 3

**Waste Stream Recommendation Example** 

#### Waste Stream Recommendation Example

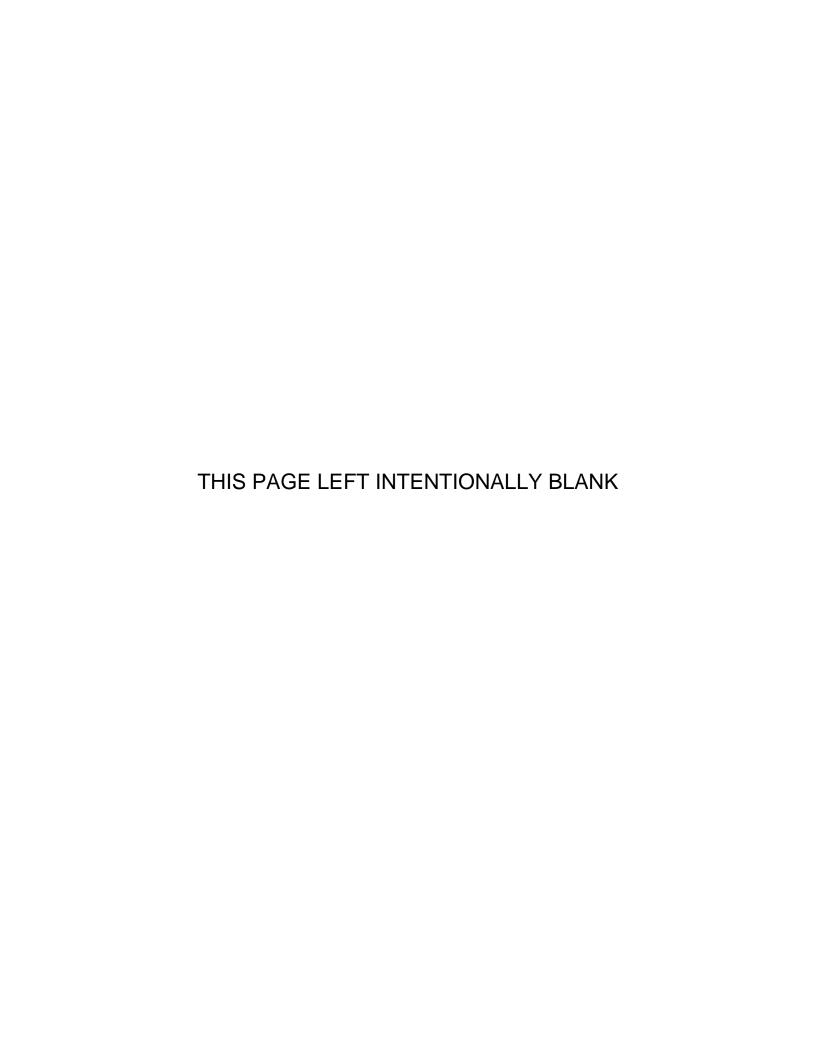
General Information:			
Generator Facility: Waste Stream Title: Waste Profile No./Rev.: Summary Review:			Limited
Recommendation:			<del>-</del>
	Hanford		Deignt
Approved – NTS and Approved – NTS ON		Approved – HANFORD ONLY	Reject Conditional Approval
Low-Level Waste Su	bject to Phys		
Mixed Low-Level W Estimated number of	_	o Physical Verification (minimum 5% requ containers:	ired).
□ RTR □	Visual	Verification Frequency:   Five Percent	Other: Percent
Mixed Low-Level Woods containers) Verification Frequence	_	o Chemical Screening (requires minimum 1  Percent	_
Special Instructions (	See Summar	y or Waste Profile)	
WARP Participants:			
RWAP Task Manager	Signature	Organization	Date
WARP Lead	Signature	Organization	Date
Disposal Operations Representative	Signature	Organization	Date
Performance Assessment Representative	Signature	Organization	Date
Criticality Safety Review, SME	Signature	Organization	Date
Hanford Representative	Signature	Organization	Date
Review Lead	Signature	Organization	Date

## Exhibit 4

# Mixed Waste Profile Annual Certification Example

### **Mixed Waste Profile Annual Certification Example**

Waste Profile l	Numb	er:	
Waste Profile l	Revisi	on No.:	Expiration Date:
Facility: WCO:			WCO:
recertify MWP expiration date approved. Please indicate not changed sig box below, pro and returning t	e unles your gnifica widing his for	n annuals it has been seen antly and the address the address to NN	file (MWP) is about to expire. The NTSWAC requires generators to I basis. No waste may be shipped under this profile after the been recertified or a new waste profile has been submitted and acce by checking the appropriate box below. If the waste stream has I the waste profile is still accurate, recertify by checking the third ditional information requested, signing the certification statement, NSA/NSO WMP. Upon approval, a letter will be sent which int of the waste stream for up to an additional year.
Box			
	The	re have l te strean	been significant changes to this waste stream. I understand that this n cannot be shipped to the NTS until a revised or new profile is will revise it or submit a new waste profile.
			certify the waste profile. I have reviewed the revision no
	and	certify t	hat it is current, complete, and accurate description of the waste
	the th	ird box	the methods employed to ensure that the waste meets the NTSWAC. above, answer the following questions to confirm that the waste ficantly. Significant changes will require a revision to the waste
☐ No		Yes	Has the waste generating process changed?
☐ No		Yes	Have the methods used to perform radiological characterization changed?
☐ No		Yes	Have the methods used to perform physical/chemical characterization changed?
☐ No		Yes	Have any of the RCRA or state waste codes changed?
☐ No		Yes	Has the LDR status (subcategories, treatment, etc.) changed?
☐ No		Yes	Have there been any other changes to the waste stream that could affect management of the waste at NTS?
☐ No		Yes	Do you have any new waste analysis data that confirms or improves your waste characterization?
If you checke	d any	"Yes"	boxes, please explain below and attach additional sheets as
necessary.			
		•	, to the best of my knowledge, the information provided on this umentation is accurate and complete.
WCO Signatur Print Name:			Date:



#### **B.3.b Onsite-Generated LLMW Waste Analysis Plan**

Onsite-generated LLMW received for storage may not be LDR compliant, may contain free liquids, and may contain RCRA characteristic wastes. Typically, LLMW generated at the NTS is from legacy facilities/sites or is newly generated from routine processes. Some of these wastes are treated onsite by macroencapsulation to meet LDR standards. This activity is regulated by NDEP/BFF. Other wastes accepted for mixed waste storage will be treated and disposed offsite. In some cases, treated waste may be returned to the NTS for disposal if the waste is classified or the radioactive content is too high to be disposed of at a permitted offsite facility.

#### B.3.b.1 Waste Identification Parameters [40 CFR 264.13(b)(1)]

NNSA/NSO will characterize onsite-generated waste to determine its physical, chemical, and radiological properties and content. Characterization data to determine the presence of hazardous waste is developed following **40 CFR 261**. Data may also be obtained from acceptable knowledge and/or sampling and analysis.

Waste analysis parameters are selected to determine waste compatibility, segregation, treatment/disposal, marking/labeling, and storage and handling requirements. Table 5 lists general hazardous waste analysis parameters for onsite-generated LLMW.

Table 5 EPA Methods, Parameters, and Rationale for Parameter Selection

EPA Method <sup>1</sup>	Parameter	Rationale for Parameter Selection
9040, 9041, or 9045	рН	To assign hazardous waste number and identify prohibited waste.
ASTM D 93-79, D 93-80, D 3278-78, or 1030	Ignitability	To assign hazardous waste number and identify prohibited waste.
9014, 9034	Reactivity	To assign hazardous waste number and identify prohibited waste.
9095	Free liquids	To assign hazardous waste number and identify prohibited waste.
1311 <sup>2</sup>	Toxicity characteristic leaching procedure (TCLP)	To assign hazardous waste numbers and verify compliance with LDR treatment standards.
2540C	Total Suspended Solids	To determine whether LDR wastewater or non-wastewater treatment standards apply.
6010, 6020, or 7000 series	TCLP metals analysis	To assign hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Volatiles analysis	To assign toxicity characteristic (TC) hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Semi volatiles analysis	To assign TC hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Halogenated organic compounds (HOCs) <sup>3</sup>	To verify applicability of LDR requirements of soil.

EPA Method <sup>1</sup>	Parameter	Rationale for Parameter Selection
8082	PCBs	To identify prohibited items, and verify compliance with LDR treatment standards.

<sup>&</sup>lt;sup>1</sup> Referenced methods are from Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, unless otherwise noted. More current SW-846 methods may be substituted for any method listed in this column.

#### B.3.b.2 Test Methods [40 CFR 264.13(b)(2)]

EPA test methods employed for each waste stream depend upon the type of waste and the quality of the acceptable knowledge. Methods identified in Table 5 are not intended to be all inclusive. Other SW-846 EPA test methods or equivalent methods may be used when appropriate.

#### **B.3.b.3 Sampling Methods [40 CFR 264.13(b)(3)]**

Sampling methods used are dependent on the type and form of waste. Typical sampling devices are identified in Table 6.

#### **Table 6 Sampling Devices**

Material Equipment	
Liquid	Coliwasa, Dipper, Weighted Bottle
Soil and Soil-like Material	Thief, Trier, Scoops, Shovels, Auger, Veihmeyer Soil Sampler

Sample techniques and methodologies will focus on obtaining a representative sample of the waste.

#### **Techniques**

- A grab sample is a sample collected in a particular time and place that represents the
  composition of the source at that time and location. Grab samples are useful when a
  source is known to be homogeneous over time and location. Representativeness of a
  grab sample decreases as the variation increases.
- Composite samples are non-discrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value over time and location.

#### Methodologies

 Random sampling is used when waste is completely homogeneous with regard to chemical properties and maintains homogeneity over time. In this case, a single sample collected at an arbitrary location and time theoretically generates an accurate and precise estimate of the waste's chemical properties.

<sup>&</sup>lt;sup>2</sup> An alternative to performing Method 1311 is to perform total contaminant concentration analysis and assume all contaminants to be leachable using the Toxicity Characteristic Leachate Procedure (TCLP) method. For purposes of this requirement, the total results based on a dry weight basis shall be divided by a conversion factor of 20 mg/kg in order to determine whether a TCLP limit has the possibility of being exceeded.

<sup>&</sup>lt;sup>3</sup> As specified in 40 CFR 268.2(a) and Appendix III to 40 CFR 268.

collected at an arbitrary location and time theoretically generates an accurate and precise estimate of the waste's chemical properties.

- Simple random sampling is appropriate where waste is randomly heterogeneous with regard to its chemical characteristics and that chemical heterogeneity remains constant batch to batch. For this type of sampling, all units in the population are considered and a suitable number of samples are selected from that population.
- Stratified random sampling is appropriate when a batch of waste is known to be non-randomly heterogeneous in terms of its chemical properties and/or nonrandom chemical heterogeneity is known to exist from batch to batch. In such cases, the population is stratified to isolate the known sources of nonrandom chemical heterogeneity. Stratification can occur over time or space and a simple random sample is collected from each stratum.

#### **B.3.b.4 Analytical Frequency [40 CFR 264.13(b)(4)]**

Re-sampling and analysis of specific waste streams are necessary when:

- There are changes to a process or the materials used in the process,
- TSDF requirements change or the TSDF requests additional data,
- There are requirements for periodic analysis of a waste stream,
- There are changes in analytical methods,
- There are changes in permit requirements,
- Traceability of the waste analysis and/or acceptable knowledge to the waste can no longer be confirmed.

# **B.3.b.5 Specific Waste Management Methods for Ignitable, Reactive, or Incompatible Wastes**

Waste handling, disposal, and storage areas within the RWMC are posted as No Smoking areas. Ignition sources related to welding or cutting (maintenance/construction activities) are not allowed without prior approval of the RWMC management. In these situations, safety considerations such as an assigned fire watch, isolating the operations from active waste storage, and pre-planning are used to eliminate potential fire hazards. Fuel-burning equipment used in waste handling is fitted with spark arrestors and maintained to ensure engine fluids and fuel does not leak.

Reactive wastes are characterized to ensure compatibility with other combined wastes and compatibility with the waste container. Segregation can also be used when necessary to confine a reactive waste to a specific facility or area of the MWSU.

All wastes stored in the MWSU are in closed containers that are DOT compliant. When applicable, spill pallets are used to hold waste containers. Inspections of waste storage areas are discussed in Section B.5.

#### B.4 Security [40 CFR 270.14(b)(4)]

The NTS is bordered on three sides by 6,629 km<sup>2</sup> (2,560 mi<sup>2</sup>) of federal land, providing restricted and secure access for the NTS. This restricted zone provides an additional buffer between the MWSU and other properties. Land administered by the BLM borders the fourth side of the NTS.

In addition to its remote location, NNSA/NSO maintains a contractor security force of highly trained security personnel who are present at the NTS 24 hours a day, 7 days a week, including holidays. These personnel monitor entry to and exit from the NTS and provide security measures throughout the NTS. The size and location of the NTS with respect to public highways has made the construction of a facility boundary fence impractical. General security measures taken at the NTS are maintained by a two-level system: (1) security stations at all authorized entrances to the NTS with property line warning signs and surveillance patrolling; and (2) specific security measures taken at individual locations such as fencing, warning signs, and building security.

#### **B.4.a NTS Access**

There are security stations at all authorized entrances to the NTS. Only authorized and badged personnel are allowed access to the NTS. Security personnel perform a visual and tactile inspection of each person's badge before entrance and exit from the NTS.

Signs stating **No Trespassing by Order of the United States Department of Energy** are located along the public highways that border the NTS. The signs are legible from a distance of 7.6 m (25 ft) and are spaced at regular intervals. In areas where the sign's view may be obstructed, signs may appear at more frequent intervals.

Security personnel also perform non-repetitive and random patrols of the NTS boundaries and roads. Security patrols also check buildings, facilities, and vehicles on the NTS on a 24-hour basis, including holidays.

#### **B.4.b MWSU Access**

All personnel entering the RWMC must log in at the main office (Building 5-07) before access is granted.

The SIS Building, VERB, and DHP are located outside of the fenced area of the RWMC. These facilities are only accessible through the RWMC Facility Manager.

The TPCB and TP are located inside the fenced area of the RWMC. **Danger-Unauthorized Personnel Keep Out** signs visible from 7.6 m (25 ft) are posted along the fence. Entry to, and exit from, the active area of the RWMC is via a controlled gate or through Building 5-31; the Controlled Area Access Building (CAAB).

#### B.5 General Inspection Schedule [40 CFR 270.14(b)(5)]

The inspection schedule will address the requirements for environmental monitoring equipment, fire protection systems, safety and emergency equipment, security devices, and operating or structural equipment that are critical to prevent, detect, or respond to human health or environmental hazards. Observations and descriptions of repairs or corrective actions will be noted on the inspection forms. Completed inspection forms will be filed at the RWMC as a record of inspection.

Weekly inspections will include items such as spill control materials, fencing, gates, signage, and container holding areas, exposed packages, run-on/runoff control, pits/trenches, and general housekeeping. Table 7 provides a detailed list of inspection items and frequencies for the RWMC. A sample of an inspection checklist is provided in Figures 6 and 7.

If an inspection reveals the deterioration or malfunction of equipment, containers, or structures, the problem will be documented on the appropriate inspection checklist. Corrective actions will be scheduled to ensure that problems do not lead to a human health or environmental hazard. When the corrective action is completed, it will be noted on the next scheduled inspection checklist. When a hazard is imminent or already exists, corrective action will be taken immediately.

**Table 7 RWMC Inspection Schedule** 

Inspection Criteria	Description	Frequency
Waste Containers	Ensure no damage, deterioration, leaks or spills	Weekly
General Areas	Housekeeping (no trash or debris) areas free of spills,	When waste handling
	leaks, releases	operations occur/weekly
Fencing/Gates	Ensure fencing/gates intact with no corrosion,	Weekly
	breaches, or deterioration	
Signs	Ensure signs posted in proper location, visible, and	Weekly
	adequate with entry requirements	
Run-on/Runoff Control	Ensure integrity of berms/dikes (erosion, sloughing),	Weekly/when standing
	adequacy of stacking	water is noticed during
		waste operations
Spill Control	Ensure adequate supplies with replacement after use	Weekly
Fire Extinguishers	Verify hoses are in good condition and pressure	Monthly
	gauges are in the appropriate range	
Communications Equipment	Ensure that communication equipment is functioning	As necessary
	properly	

Figure 6 Sample Inspection Checklist

AREA 5 WEEKLY PERMIT CHECKLIST	Pa	age 1	of 2
Mixed Waste Storage Unit		Yes	No
Are the signs posted on the perimeter fence and entry gate readable?			
Is the spill kit available and complete?			
Are portable fire extinguishers readily accessible and nearby?			
Are containers free of damage or deterioration?			
Are containers free of leaks or spills or indications thereof?			
Are container labels legible?			
Is there a communication system available to facility personnel to signal an emergency?			
Are spill pallets in containment areas free of standing water?			
Janes San Para Maria			
Waste Verification Holding Area			
Is the spill kit available and complete?			
Is there material in the Waste Verification Holding Area requiring inspection? If			
"No," remaining questions need not be answered.			
Are all waste containers in the Waste Verification Holding Area closed and in			
good condition with no leakage or signs of deterioration?			
Is there adequate space for personnel and equipment to respond to			
emergencies?			
Are all wastes in the Waste Verification Holding Area positioned in a manner to			
prevent rupture or leakage?	$\rightarrow$		
Are all waste containers in the Waste Verification Holding Area segregated			
within the area to maintain requirements for compatibility?			
Area all waste containers in the Waste Verification Holding Area positioned in			
a manner to prevent rupture or leakage?	_		
Are containers in the Waste Verification Holding Area marked with the words "HAZARDOUS WASTE" and other identifying information?			
Do the Waste Verification Log Book entries equal the waste items actually hel	14		
in the Waste Verification Holding Area?	lu		
Is there a communication system available to facility personnel to signal an			
emergency?			
Have all RCRA hazardous waste containers in the Waste Verification Holding			
Area been held for less than 60 days?			

**Figure 7 Sample Inspection Checklist (continued)** 

AREA 5 WEEKL	Y PERMIT CHECKLIST	Page 2 of 2		
Remarks: (IF "NO" is marked for any ite	em, document all noncompliances and all corre	ective actions		
taken.)				
INSPECTOR				
Name	Signature	Time/Date		
WFOM				
Name	Signature	Time/Date		
FM				
Name	Signature	Time/Date		

### B.6 Preparedness and Prevention [40 CFR 270.14(b)(7)]

RWMC emergency response activities are performed by the DOE contractor and/or subcontractor. Contractor emergency services located on the NTS include the NTS Fire Department, NTS Occupational Medicine, and the Nye County Sheriff's Office. Verbal and written notification requirements to the appropriate state and federal agencies will be performed by an NNSA/NSO representative.

DOE maintains Memorandums of Understanding (MOU) for emergency activities with Nye County, the BLM, Creech Air Force Base, and the U.S. DOE Office of Secure Transportation. Las Vegas area hospitals that are notified will include University Medical Center, Mountain View Hospital, Sunrise Hospital, and Mercy Flight for Life air ambulance service. NNSA/NSO also maintains an Agreement in Principal with the state of Nevada.

Because of the complexity of operations at the NTS, facilities are required to maintain individual emergency response procedures. Exhibit 3 provides a copy of the Emergency Plan Implementing Procedure (EPIP) for the Area 5 RWMC. As required in **40 CFR 264.56(j)**, any imminent or actual emergency requiring implementation of the EPIP will be recorded in the operating record and a written report will be submitted to NDEP by NNSA/NSO within 15 days of the incident. The written report will include the following information:

- Name, address, and telephone number of the owner or operator
- Name, address, and telephone number of the facility
- Date, time, and type of incident
- Name and quantity of materials involved
- Extent of injuries (if any)
- An assessment of actual or potential hazards to human health or the environment (as applicable)
- Estimated quantity and disposition of recovered material that resulted from the incident (see Section B.7 Contingency Plan [40 CFR 270.14(b)(7)]).

### **B.7 Contingency Plan [40 CFR 270.14(b)(7)]**

Exhibit 3 provides a copy of the Emergency Plan Implementing Procedure for the Area 5 RWMC.

**Exhibit 3 Emergency Plan Implementing Procedure for the Area 5 RWMC** 

Not available for public view

### B.8 MWSU Procedures to Prevent Hazards [40 CFR 270.14(b)(8)]

This section describes the procedures that will be used at the MWSU to prevent hazards to human health, safety, and the environment. A description of the procedures, structures, and equipment to be used at the MWSU are summarized below.

### **B.8.a Hazards in Off-Loading Operations**

Specific precautions to be taken during off-loading operations include preventative measures and monitoring activities to safely manage LLMW. Generators will provide advanced notification of shipments to the RWMC to ensure that shipments are authorized and scheduled with the facility.

Precautions to be taken during off-loading operations to prevent releases to the environment or exposure to MWSU personnel include:

- Examination of required documents for each waste shipment to verify that all information is accurate and complete.
- Surveys of waste transport vehicles using appropriate portable radiation detection instruments and/or standard swipe survey techniques. Vehicles and trailers are also surveyed before being released from the RWMC.
- Collection and analysis of swipe samples for radiological parameters from the exterior surface of selected containers.
- Use of container-handling equipment such as a drum dolly, mobile crane, or forklift with drum lift attachments or slings. Ramps may also be used during off-loading and to conduct visual inspections of containers.
- Limiting personnel access during container handling operations.

### **B.8.b Waste Handling Areas Surface Water Run-On and Runoff**

Storage of LLMW containers inside MWSU facilities are not subject to surface water run-on or runoff. Two storage facilities subject to run-on and/or runoff are the TP and the DHP.

The TP is a bermed pad. The DHP has a curbed concrete floor that will collect water during precipitation events.

Since the DHP does not have a drain, water is removed manually by RWMC personnel using brooms and squeegees. Accumulated precipitation on the TP is allowed to evaporate.

### **B.8.c Contamination of Water Supplies**

Contamination of water supplies by wastes stored at the MWSU is highly unlikely since:

- There is no surface water near the MWSU.
- The average annual potential evapotranspiration rate is approximately 11 times the average annual precipitation rate at the NTS, leading to a net water deficit in surrounding soils.
- The depth from the land surface to the ground water in the uppermost aquifer is approximately 255 m (835 ft).
- Offsite-generated wastes containing free liquids are prohibited.
- The nearest drinking water well (Well 5b) is located approximately 6.5 km (4.0 mi) away from the RWMC.
- The RWMC inspection program is designed to quickly discover safety or environmental hazards. The EPIP is intended to facilitate rapid response and cleanup of releases.

### **B.8.d Equipment Failure and Effects of Power Outages**

Equipment failures and power outages will not affect MWSU operations, cause a release of LLMW, or present safety hazards for the following reasons:

- Waste containers will be moved and placed into storage by equipment. Failed equipment can be replaced or activities can be delayed until the equipment is repaired.
- RWMC emergency communication equipment will be inspected monthly to ensure adequate inventory and proper operation. Hand-held radios are tested when used for proper function.
- Normal operations will be limited to daylight hours.

### **B.8.e Undue Exposure of Personnel to Typical LLMW**

Waste stored at the MWSU will be containerized limiting the possibility of undue exposure of personnel. RWMC personnel are trained in the proper procedures for handling LLMW, performing site operations, and responding to emergency situations. Frequent inspections of the facility and equipment assist in minimizing undue exposure, accidents, and injuries. RWMC personnel working with LLMW are trained and aware of potential hazards. Implementation of planning documents such as health and safety plans and radiological work permits further reduce potential employee exposures.

### **B.8.f Aisle Space**

Aisle space will be maintained inside MWSU facilities and outdoor storage areas to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.

### **B.8.g Releases to the Atmosphere**

Releases to the atmosphere are minimized through the use of DOT-compliant packaging. All LLMW is packaged, shipped, handled, and stored in DOT-compliant containers. Broken containers are not accepted for storage unless repackaged.

Onsite-generated wastes that contain free liquids will be stored on spill pallets.

Additionally, commercial motor carriers of inbound and outbound shipments are required to hold an EPA Identification Number for transporting hazardous waste.

## B.9 Prevention of Reaction of Ignitable, Reactive, and Incompatible Waste [40 CFR 270.14(b)(9)]

Ignitable, corrosive, reactive, and incompatible wastes will not be accepted for storage at the MWSU from offsite generators.

Specific waste management methods for ignitable, reactive, or incompatible onsite-generated wastes are discussed in Section B.3.b.5.

### B.10 Traffic [40 CFR 270.14(b)(10)]

Offsite generators transport LLMW to the RWMC on U.S. Highway 95 to the Mercury Highway entrance to the NTS. Major traffic flow into Area 5 is via the paved 5-01 Road. Direct access off the 5-01 Road to the RWMC is provided by a large paved parking lot and turnaround area.

Traffic volume on the 5-01 Road ranges from 40 to 60 vehicles per day and the posted speed limit is 73 km/hr (45 mi/hr). Conventional stop and yield signs at major intersections are used to maintain traffic flow and control throughout the NTS. Traffic regulations are enforced by the Nye County Sheriff.

The 5-01 Road consists of medium-sized gravel chips compacted into a solid mass (surfacing) that uses bituminous (asphaltic) oil as a binding agent. Several oil and chip applications have been applied over the years. Total thickness varies from 2.5 to 7.6 cm (1 to 3 in) along the length of the road.

An engineered-base load-bearing capacity cannot be definitely stated due to the 5-01 Road not conforming to pavement structural design standards. Laboratory testing of the 5-01 Road subgrade material (i.e., types of subgrade soils and basic engineering index properties) indicates that they provide relatively good support for pavements based on the American Association of State Highway and Transportation Officials classification system.

Subjective engineering evaluations of the 5-01 Road were performed in 1994 and 1999. These evaluations included visual observation of the entire road; pavement thickness measurements; evaluation of cracking, heaving, and other unconformities; and a review of the road's history and maintenance. Based on engineering judgment, these evaluations indicate that the existing capacity is adequate to support existing and future waste shipments in conjunction with regular inspection, continued maintenance, and reduced speed limits.

Access to the VERB, DHP, and the SIS Building do not require transport vehicles to enter the active area of the RWMC. These storage facilities are located outside the gate adjacent to the CAAB, Building 5-31. Access to the TPCB or the TP require that transport vehicles proceed through the gate adjacent to the CAAB.

Figure 8, Travel Routes Within the RWMC, depicts the waste transportation routes to various MWSU facilities.

Vehicles transporting LLMW to the RWMC include tractor/trailers and enclosed vans. Commercial motor carriers are required to have an EPA Identification Number for transport of hazardous waste.

Figure 8 Travel Routes Within the RWMC

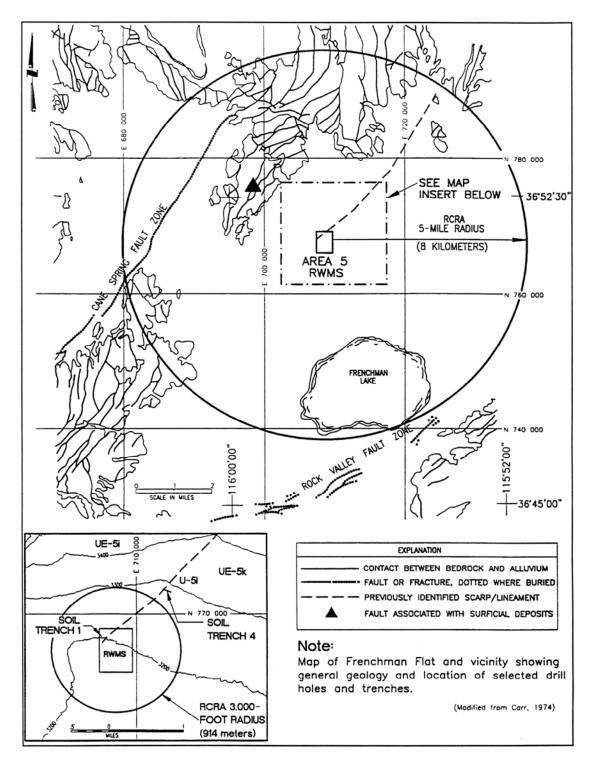
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### **B.11 Facility Location [40 CFR 270.14(b)(11)]**

### **B.11.a Seismic Standard**

The southwestern United States, including Nevada, is tectonically active compared with other parts of the country **(40 CFR 264, Appendix VI)**. Natural seismic risk is moderate in the NTS region.

The structural development and present structure of the region have been summarized by Carr et al. (1974), Barnes et al. (1982), and Hudson (1992). The mountains surrounding Frenchman Flat have had a complex structural history. There are numerous surface expressions of faults in the area (Figure 9).



**Figure 9 Map of Structural Pattern** 

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The RWMC lies between two northeast-trending Quaternary fault zones: the Cane Spring fault zone, 6.5 km (4 mi) northwest of the RWMC and the Rock Valley fault zone, 9.0 km (5.5 mi) south of the RWMC. A search of the University of Nevada-Reno Seismology Laboratory (<a href="www.seismo.unr.edu">www.seismo.unr.edu</a>) database (1852 to 2005) for earthquakes in the Richter magnitudes greater than 4.0 occurring in the approximate southern half of the NTS shows 67 events. Thirty-three of the 67 recorded earthquakes are coincident with the date of an underground test (DOE, 1994). Seven additional earthquakes occurred within a few days after an underground test, which, with one exception, had a yield greater than 1 megaton; the exception had a yield between 20 and 200 kilotons. Thirteen of the 67 earthquakes had Richter magnitudes between 5 and 6, inclusive; and two had Richter magnitudes greater than 6 (the largest earthquake had a magnitude of 6.2).

No surface-cutting or Holocene faults have been identified within 915 m (3,000 ft) of the RWMC (Raytheon Services Nevada, 1994). Activities used to identify and evaluate any potential surface-cutting faults included (1) detailed geomorphic mapping of waste disposal trench walls and pits at the RWMC, (2) video logging of one of the Greater Confinement Disposal boreholes, (3) lineament map preparation and associated field investigations, (4) trench excavations and mapping, (5) subsurface evaluation of previously drilled boreholes, and (6) large-scale (1:6,000) air-photo analysis and mapping of surficial deposits.

Soil trenches 1 and 4 were excavated to evaluate a previously mapped scarp (Rawlinson, 1991) and a possible fault in the surface alluvium identified by the U.S. Geological Survey (USGS) (Carr et al., 1967) at drill site U-5I (Figure 9).

Figure 10 100-Year Flood Delineation

Not available for public view

Mapping of approximately 200 m (650 ft) of exposed walls in these trenches to a depth of 3 m (10 ft) did not identify any surface-cutting faults associated with either the scarp or apparent fault in the surface alluvium. Additionally, a basalt flow or sill was intersected beneath about 290 m (950 ft) of alluvium in drill holes UE-5i and UE-5k, located approximately 2 km (1.2 mi) north and northeast of the RWMC, respectively (Figure 9, Map of Structural Pattern).

The numerical age of this basalt, presumably from a local center within or near Frenchman Flat, is 8.6 million years (B. Turrin [personal communication], August 1993). Occurrence of the basalt at a similar depth in these drill holes, which are 2 km (1.2 mi) apart and separated by this scarp, provides further evidence that this lineament is either not related to faulting or, if so, is not active or has had minimal displacement during the past 8.6 million years. The only lineament confirmed to be related to faulting and associated with surficial deposits is 3.6 km (2.2 mi) northwest of the RWMC in the longitudinal valley of the Massachusetts Mountains (Figure 9, Map of Structural Pattern). The faulting is believed to be late-Tertiary to early-Quaternary based on bed attitude and faulting of conglomeratic alluvium presumably of this age.

In summary, no known surface-cutting faults that have had displacement during Holocene time are present within 915 m (3,000 ft) of the RWMC **[40 CFR 264.18]**. Trench excavations and mapping, large-scale (1:6,000) air-photo analysis, and surficial-deposit mapping were performed to evaluate a lineament located within 61 m (200 ft) of the RWMC. These investigations show that this lineament is not a surface-cutting fault or Holocene tectonic feature.

### **B.11.b Flood Plain**

The MWSU is located outside the 100-year floodplain and is in compliance with **40 CFR 264.18(b)** and **270.14(b)(11)(iii)**. The southwest corner of the Area 5 RWMC falls within a 100-year floodplain as illustrated in Figure 10, 100-Year Flood Delineation. The RWMC is located in an area that is not subject to frequent flooding. The washes that drain toward the RWMC are normally dry and flow only during intense rainfall.

According to **40 CFR 270.14 (b)**, Flood Insurance Rate Maps (FIRMs) produced by the Federal Emergency Management Agency (FEMA) should be used to determine if a unit is within a 100-year flood hazard area (100-year flow depth greater than 0.30 m [1 ft]). When a FIRM has not been developed for an area, which is the case for Area 5, a flood hazard map must be developed using FEMA methodology. A flood study using FEMA methodology was completed and submitted to the NDEP in February 1993. *Flood Assessment at the Area 5 Radioactive Waste Management Site, DOE/Nevada Test Site, Nye County, Nevada,* (Exhibit 4) evaluated the 100-year flood hazard.

The overall watershed that could impact the RWMC is approximately 365 km² (140 mi²) (Figure 2, Topographic Features). This watershed was divided into 16 subbasins to best represent the hydrology of the study area. USGS topographic maps were used to divide the drainage area into subbasins ranging in size from 0.8 km² (0.3 mi²) to 210 km² (81.3 mi²). Barren Wash, Scarp Canyon, and Halfpint alluvial fans were delineated. These fans are

characterized by incised channels in the upper parts of the fans decreasing to sheet flow in lower parts of the fan.

The 100-year flood hazard for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans was analyzed using FAN, a computer program developed by FEMA (1990). This program was used to delineate the flood hazard zones on these alluvial fans according to FEMA methodology. The results of the alluvial fan analyses are shown in Figure 10, 100-Year Flood Delineation.

FEMA designates alluvial fan flooding, shallow concentrated flow, and sheet flow areas with 100-year flood depths between 0.30 m (1 ft) and 0.90 m (3 ft) as Zone AO. FEMA further designates an associated flow velocity for alluvial fan flood hazards. The flood hazard analysis of the alluvial fans determined that the southwest corner of the RWMC is within the 100-year flood hazard (Zone AO) of the Barren Wash alluvial fan. This part of the RWMC does not include RCRA units covered in the NTS RCRA Part B permit application.

The HEC-2 model developed by the U.S. Army Corps of Engineers (COE) to determine water surface elevations in channels was used to assess the flood hazard of shallow concentrated flow in a channel impacting the southwest corner of the RWMC. This analysis determined that flows exceed a depth of 0.30 m (1 ft) along the southwest corner of the RWMC, also placing this part of the RWMC in the 100-year flood hazard (Zone AO).

For the remaining subbasins that could impact the RWMC, flood hazard determinations were conducted assuming sheet-flow conditions. The analysis, using FEMA methodology for sheet-flow, concluded that these sheet-flow regions be designated as Zone X. FEMA defines Zone X as representing areas outside the 100-year flood hazard and/or areas of 100-year shallow flooding (sheet-flow) where average depths are less than 0.30 m (1 ft). A Zone X delineation does not mean that floods will <u>not</u> occur within this zone. For this reason, flood hazard zone protection must be addressed.

Flow from the watersheds above the Area 5 RWMC is diverted by flood control structures located on three upstream sides of the RWMC. These structures have been engineered to maintain a run-on control system capable of preventing flow into the active portion of the Area 5 RWMC during peak discharge from a 25-year, 24-hour storm.

**Exhibit 4 Flood Assessment at the Area 5 Radioactive Waste Management Site DOE/Nevada Test Site, Nye County, Nevada** 

# FLOOD ASSESSMENT AT THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE DOE/Nevada Test Site, Nye County, Nevada

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> Under Raytheon Services Nevada Contract DE-AC08-91NV10833

### FLOOD ASSESSMENT

### EXECUTIVE SUMMARY

A flood assessment at the Radioactive Waste Management Site (RWMS) and the Hazardous Waste Storage Unit (HWSU) in Area 5 of the Nevada Test Site (NTS) was performed to determine the 100-year flood hazard at these facilities. No previous flood studies of these facilities delineated the 100-year flood hazard. This current study was conducted to determine whether the RWMS and HWSU are located within a 100-year flood hazard as defined by the Federal Emergency Management Agency (FEMA), and to provide discharges for the design of flood protection.

The overall watershed which could impact the RWMS and HWSU is approximately 140-square miles. This watershed was divided into 16 subbasins to best represent the hydrology of the study area. United States Geologic Survey (USGS) topographic maps were used to divide the drainage area into subbasins ranging in size from 0.3-square miles to 81.3-square miles. Barren Wash, Scarp Canyon, and Halfpint alluvial fans were delineated. These fans are characterized by incised channels in the upper parts of the fans decreasing to sheetflow in lower parts of the fan.

The 2-year, 10-year, and 100-year discharges were determined using methods and guidelines provided in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Manual, 1990. The methodology in the CCRFCD Manual was developed specifically for Southern Nevada by Clark County and the U.S. Army Corps of Engineers, Los Angeles District, and is the most current and region-specific approach to develop discharges. Flood studies conducted in Clark County following the methods provided in the CCRFCD Manual have been accepted by FEMA. The proximity of Area 5 to Clark County and their similar physical and climatic characteristics support the use of this region-specific method as the means of generating discharges for the study area.

As directed in CCRFCD Manual, the HEC-1 rainfall-runoff model developed by the U.S. Army Corps of Engineers was used to generate discharges for the RWMS and HWSU areas. Hydrologic models were developed for the 2-year, 10-year, and 100-year discharges. Point precipitation values used in this model were taken from NOAA Atlas 2, Volume VII. Field observations were made to determine the vegetation type and cover density, Manning roughness coefficient, slope, channel geometry, and concentration point locations. From this information, curve numbers (a method to quantify precipitation losses) and lag times for each of the subbasins were determined, routing parameters were applied, and discharges were calculated. Discharges developed in this hydrologic analysis were used in the subsequent analysis to define the 100-year flood hazard.

The 100-year flood hazard for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans was analyzed using FAN, a computer program developed by FEMA. This program was used

to delineate the flood hazard zones on these alluvial fans in accordance with FEMA methodology. The FAN model requires information regarding apex location, fan boundaries, potential flow obstructions and diversions, fan surface slopes, Manning roughness coefficients, single-channel versus multiple-channel regions, and the 2-year, 10-year, and 100-year discharges from the hydrologic analysis. This information was gathered from studies of available topographic and surficial geologic maps and intensive field investigations. The results of the alluvial fan analyses are shown on the maps included in this document.

Part of the RWMS is located within the 100-year flood hazard on the Barren Wash Alluvial Fan. The southwest corner of the RWMS is within the Zone AO of the Barren Wash Alluvial Fan. (This part of the RWMS does not include RCRA units covered in the NTS RCRA Part B Permit Application.) FEMA designates alluvial fan flooding, shallow concentrated flow, and sheetflow areas with 100-year flood depths between 1 and 3 feet as Zone AO. FEMA further designates an associated flow velocity for alluvial fan flood hazards.

The HEC-2 model developed by the U.S. Army Corps of Engineers to determine water surface elevations in channels was used to assess the flood hazard of shallow concentrated flow in a channel impacting the southwest corner of the RWMS. This analysis determined that flows exceed a depth of 1 foot along the southwest corner of the RWMS, which places this part of the RWMS in the AO zone.

For the remaining subbasins that could impact the RWMS and HWSU, flood hazard determinations were conducted assuming sheetflow conditions. This analysis, using FEMA methodology for sheetflow, concluded that depths of flow during the 100-year flow event were less than 1 foot. Thus, the RWMS and the HWSU are not in a 100-year flood hazard as defined by FEMA.

Although the RWMS and HWSU facilities that are included in the RCRA Part B Permit Application are not within a 100-year flood hazard per FEMA definition (100-year flood depth at or greater than 1 foot), flow from a 100-year event could impact the facilities. Flood protection requirements are being evaluated.

Flood Assessment

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### 1.0 INTRODUCTION

### 1.1 Location

A flood assessment was conducted at the Radioactive Waste Management Site (RWMS) and the Hazardous Waste Storage Unit (HWSU) in Area 5 of the Nevada Test Site (NTS) in Nye County, Nevada (Figure 1). In this report, the RWMS includes the Transuranic (TRU) Radioactive pad, Mixed-Waste Disposal Unit, and Pit 3 within the RWMS. The study area encompasses portions of the Massachusetts Mountains, the Halfpint Range, and the drainages of Barren Wash and Scarp Canyon.

### 1.2 Purpose

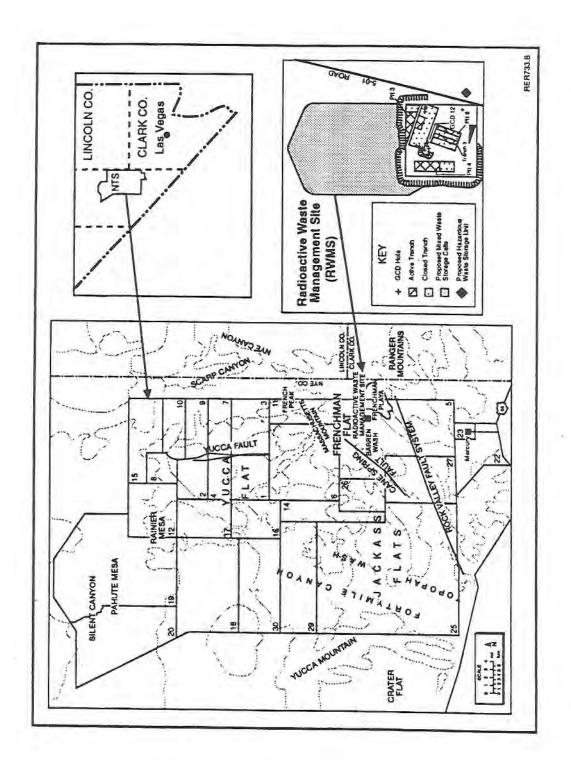
Flood assessment is one of the subtasks related to surficial geology studies at and near the RWMS. Surficial geology studies respond primarily to requirements and guidelines for site characterization found in federal regulations. The principal federal regulations and criteria pertaining to flooding with which the RWMS must comply are:

- Executive Order 11988 (Floodplain Management),
- 10 CFR 61.50 (Technical Requirements for Land Disposal Facilities),
- 40 CFR 264.18 (Location Standards for Hazardous Waste Management Facility),
- 40 CFR 270.14 (General Requirements for a Hazardous Waste Facility), and
- Department of Energy (DOE) / Nevada-341, Environmental Compliance Handbook, September 1990.

The RWMS must also comply with Nevada Administrative Code 444.8456 (Restrictions on Locations of Stationary Facilities for Management of Hazardous Waste; Exceptions). These regulations prohibit the placement of a hazardous waste facility in a 100-year floodplain. This subtask focuses on the potential 100-year flood hazard on the RWMS. Although the flood assessment subtask does not evaluate the erosion hazard over a geologic time scale (10,000 years), as required under 40 CFR 191.13 (Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste; Final Rule), other subtasks are being conducted to gather information regarding erosion on the RWMS. These subtasks include detailed trench and surface mapping, alluvial structure, and seismic fault definitions.

### 1.3 Objective

The objective of this flood assessment was to determine the 100-year flood hazard on and near the Area 5 RWMS using the most site-specific and applicable approaches for the hydrologic and hydraulic analyses. This flood assessment was conducted to provide hydrologic and hydraulic information for flood protection design and to follow the criteria for flood hazard determination required by the Federal Emergency Management Agency (FEMA), as specified in 40 CFR 270.14.



Flood Assessment

### 1.4 Previous Studies

Case et al., (1984), French and Lombardo (1984), and Cox (1986) discussed the potential for flooding at the Area 5 RWMS. Raytheon Services Nevada (1991) reported results of a limited study on surface water at and near the RWMS using methods discussed in these previous studies. These studies used regional flow equations that were developed in the late 1970's and early 1980's. At the time of these studies, the Clark County Regional Flood Control District Manual (CCRFCD Manual) had not yet been completed and the regional equations were the best method available. Methodology in the CCRFCD Manual is now the accepted method in Clark County. The proximity of Area 5 to Clark County and their similar physical and climatic characteristics support the use of this region–specific method as the means of generating discharges for the study area. Also since these studies, FEMA has adopted a methodology to evaluate flood hazards on alluvial fans. For these reasons, a more detailed flood assessment was required using the most updated information and methods.

### 2.0 WATERSHED DESCRIPTION

### 2.1 Introduction

The 140-square-mile watershed that could impact the RWMS and HWSU was divided into 16 subbasins (Figures 2 and 3). (For more detailed watershed maps, see Sheets 1 and 2.) Concentration points for the flow from the 16 delineated subbasins were chosen to best represent the hydrology of the study area. The apexes of Barren Wash, Scarp Canyon, and Halfpint alluvial fans represent three of these concentration points. The other concentration points were difficult to define because they represented the confluence of large areas of shallow concentrated flow and/or sheetflow that could impact the RWMS. Concentration point locations were based on aerial photographs, topographic data, and field observations.

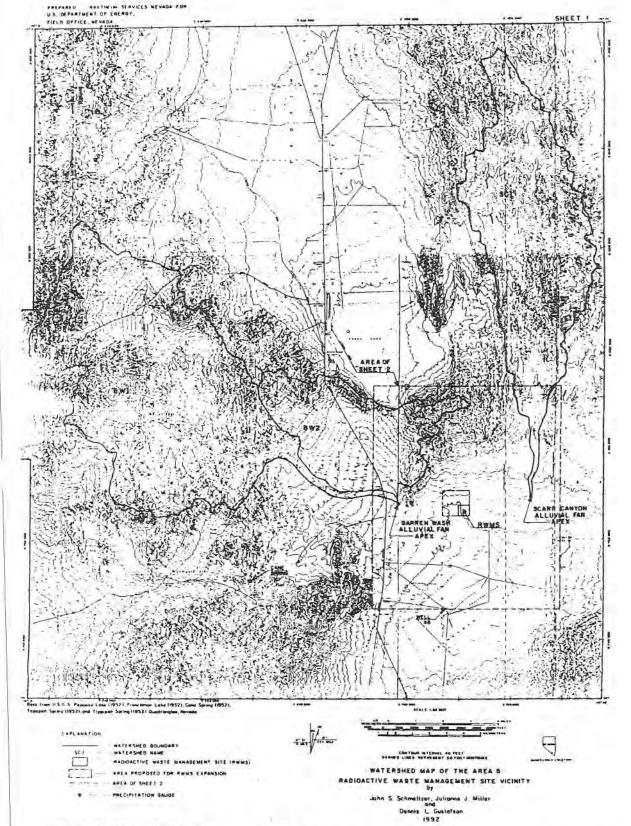
### 2.2 Apex Definitions

In this study, both a geologic definition and a FEMA definition for the apex of an alluvial fan are described. The geologic apex of an alluvial fan is the intersection of the mountain front and the piedmont plain (Figure 4). On many alluvial fans, a channel is entrenched into the upper, and possibly the middle part of the fan (Bull, 1964). Fans with entrenched channels have the active apex farther down the fan. FEMA defines the apex as the point below which the flowpath of the major stream that formed the fan becomes unpredictable and flooding of the fan can occur (FEMA, 1991). The FEMA definition was used in this study to determine the concentration points of flow at the active apex of the three alluvial fans within the study area: Barren Wash, Scarp Canyon, and Halfpint alluvial fans (see Figure 3 and Sheet 2) for locations of these apexes).

### 2.3 Barren Wash Alluvial Fan

The Barren Wash watershed covers 81.3-square miles and is located northwest of the RWMS (Figure 2 and Sheet 1). The wash drains to Frenchman Flat from an area that is bordered to the east by the Massachusetts Mountains, to the north by the CP Hogback, and to the west by the CP Hills. The watershed has been divided into two separate subbasins: Barren Wash 1 (BW1, 60.5-square miles) and Barren Wash 2 (BW2, 20.8-square miles).

Flood Assessment 3



The overall watershed is divided into 16 subbasins; 13 are shown here, with the remainder shown on Figure 3 (Sheet 2).

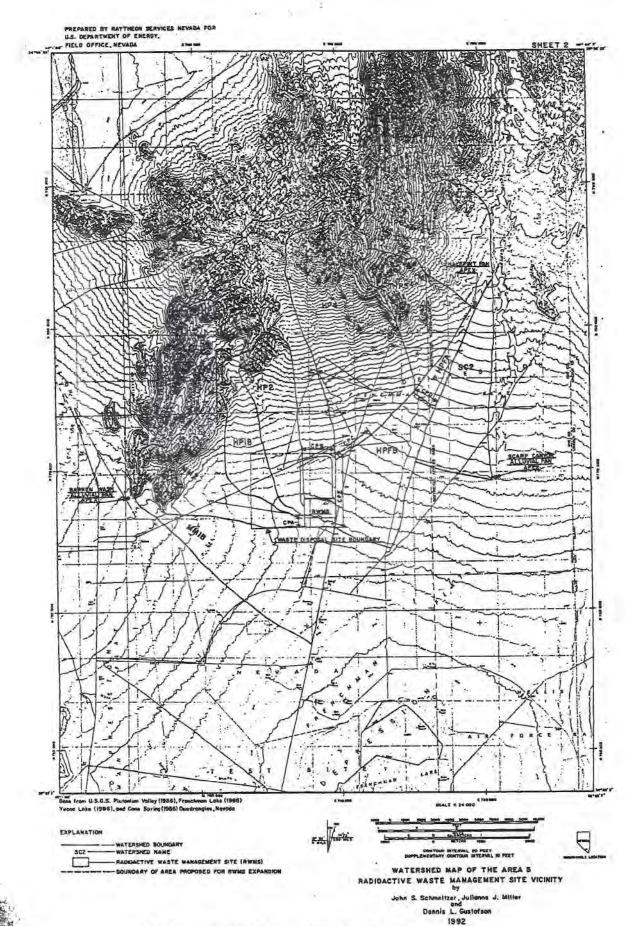


Figure 3. Watershed Map of the Area 5 Radioactive Waste Management Site Vicinity.

# Canyon Bed Canyon Bed Channel Canyon Channel Channel

Figure 4. Idealized Alluvial Fan Profile. The geologic apex is the intersection of the mountain front and the piedmont plain. The active "FEMA" apex is the point below which the flow of the main channel becomes unpredictable.

The Barren Wash Alluvial Fan is the dominant landform in the watershed. The proximal part of the fan (the area on the alluvial fan near the apex) is deeply entrenched by a stream channel. Significant parts of the fan surface are covered by desert pavement with desert varnish, and vegetation covers 15 to 25 percent of the surface. Erosion is the primary geomorphological process occurring on the proximal part of the fan, as shown by scalloping of the fanhead trench.

Continued trench incision has shifted deposition to a distal part of the fan (the outermost area, or lower zone of the fan). The Barren Wash channel captures the channel draining from the Massachusetts Mountains 1A (MM1A) subbasin at the southwestern corner of the Massachusetts Mountains (Figure 3 and Sheet 2). At this point a new, secondary fan is being formed which extends east toward the RWMS and south to Frenchman Flat. The RWMS is located on the lower-mid part of this secondary fan.

### 2.4 Scarp Canyon Alluvial Fan

The Scarp Canyon watershed, located northeast and east of the RWMS, covers about 40.9-square miles (Figure 2 and Sheet 1). This watershed drains onto Scarp Canyon Alluvial Fan from an area that extends north to Carbonate Ridge (French and Lombardo, 1984), west to the Massachusetts Mountains, and east to Raysonde Butte. The watershed is divided into two subbasins: Scarp Canyon 1 (SC1, 39.4-square miles), the drainage area above the active apex; and Scarp Canyon 2 (SC2, 1.5-square miles), the area between the channel that drains SC1 and the eastern boundary of Halfpint Alluvial Fan (Figure 3 and Sheet 2).

A large fanhead trench, ranging to a depth of 40 feet, cuts through a thin layer of alluvium and bedrock above the active apex. Below the active apex, the channel cuts through unconsolidated and calcrete-cemented alluvium. Parts of the fan surface are covered by desert pavement with desert varnish. Vegetation density is 15 to 25 percent over the fan surface.

The channel within the trench of Scarp Canyon is braided. Relatively flat interchannel bars and side terraces are approximately 1 to 5 feet above the streambeds, and covered by fine-grained sediment. High-water indicators are present on the bars and terraces several feet above the streambed. These indicators include large clasts and boulders, small logs and sticks, and uprooted Joshua trees found snagged in the vegetation. The vegetation also shows signs of being washed over by water. Concurrence of the high-water indicators with the fine-grained deposits suggests that these deposits are fluvial rather than eolian.

### 2.5 Halfpint Alluvial Fan

Halfpint Alluvial Fan, located northeast of the RWMS, develops from a channel that collects flow from the drainage area (HP6, 2.2-square miles) along the eastern front of the Halfpint Range (Figure 3 and Sheet 2). The alluvial fan is divided into two separate subbasins: Halfpint Fan A (HPFA, 0.26-square miles) and Halfpint Fan B (HPFB, 1.61-square miles).

The channel located above the apex of the Halfpint Alluvial Fan is incised 2 to 3 feet in depth. The apex of the fan was located where the flowpath of the channel becomes unpredictable. Below the apex, a very braided channel system has developed. Relatively little desert pavement or desert varnish is found on this fan surface; vegetation cover density is approximately 20 percent. The RWMS is located in the lower-mid part of this fan.

### 2.6 Massachusetts Mountains/Halfpint Range Subbasins

The 13.6-square-mile watershed that drains from the Massachusetts Mountains/Halfpint Range toward the RWMS was divided into nine subbasins (Figure 3 and Sheet 2). These subbasins include MM1A, MM1B, MM2, HP1A, HP1B, HP2, HP3, HP4, and HP5. The upper parts of these subbasins are located in bedrock consisting of several different tuffs. From a geomorphic viewpoint, the drainages in the lower regions extending into Frenchman Flat form coalescing alluvial fans along the mountain front. From a hydraulic engineering viewpoint, the flow system on these landforms are distributary-flow systems. Hjalmerson (1992) states that the "... major physiographic characteristics used to identify and categorize distributary-flow areas ... include (1) vegetation density and soil color, (2) drainage texture, and (3) the random nature of channel links."

The proximal parts of these coalescing alluvial fans (geomorphic viewpoint) are characterized by channels incised 5 to 10 feet across the surface. Vegetation density on the fan surface is 20 to 35 percent. Undisturbed deposits covered by desert pavement with desert varnish are present.

Channel incisions, averaging 1 to 3 feet, decrease near the middle part of the fan. Debris flow deposits from the HP1A and HP1B subbasins in part compose the coalescing alluvial fans (geomorphic viewpoint). Channel depths decrease down gradient until sheetflow occurs.

Sheetflow, typical of areas of low relief and poorly established drainage systems, occurs on the distal parts of the coalescing alluvial fans (geomorphic viewpoint). The RWMS is located in the lower-mid parts of these coalescing alluvial fans where channel depths average less than 1 foot. Vegetation covers 20 to 30 percent of the fan surface. There are relatively few undisturbed areas of relic deposits covered by desert pavement with desert varnish.

### 3.0 HYDROLOGY

### 3.1 Methodology

Standard statistical methods to determine flood discharges for a specific return period are not applicable to a majority of the watersheds in the arid Southwest because most of the watersheds in this region are ungaged and do not have stream discharge information. Furthermore, arid watersheds that do have discharge data usually have a short period of record with many years of no flow. A study conducted by Hjalmarson and Thomas (1992) found that 20 years is the average recording period for stream gages located in Nevada, western Utah, western Arizona, and southeastern California.

In the arid Southwest, rainfall-runoff models are often used to estimate flood discharges. In this flood assessment, rainfall-runoff models were developed using the HEC-1 computer program developed by the U.S. Army Corps of Engineers (COE) (1990). The CCRFCD Manual lists the HEC-1 computer program as an acceptable tool to estimate discharges and to generate hydrographs for watersheds within Clark County. Methods in the CCRFCD Manual were used to produce the input parameters required for the HEC-1 computer program. Other jurisdictions in the arid Southwest, such as Maricopa County (central Arizona), Pima County (southern Arizona), and San Bernardino County (southern California), use similar approaches to estimate flood discharges.

The hydrologic approach described in the CCRFCD Manual was developed for Clark County from studies conducted by WRC Engineering and the COE. The methods described in the CCRFCD Manual were considered the best approach for estimating discharges for the flood assessment of the RWMS and vicinity for these reasons:

- The physical setting and flood-producing storms for the RWMS and vicinity are similar to those of Clark County;
- b. The eastern boundary of the study area is adjacent to the Clark County line;
- Local and federal agencies (e.g., FEMA) accept the methods in the CCRFCD Manual; and,
- Clark County is the nearest local jurisdiction with a hydrologic method based on region-specific information.

The Soil Conservation Service (SCS) unit hydrograph option in the HEC-1 computer program was used in the hydrologic models. The SCS unit hydrograph is widely used in rainfall-runoff models and is recommended as an option in the CCRFCD Manual. The input parameters required to run the HEC-1 computer model using the SCS unit hydrograph option are:

- precipitation parameters (depth of precipitation, storm duration and time distribution, and depth-area ratios);
- drainage area (total drainage area and subbasins);
- precipitation losses (curve numbers);
- lag time for each basin; and,
- channel routing parameters.

The procedure used to obtain these parameters generally followed the methods described in the CCRFCD Manual. The following sections provide an overview of how these parameters were determined and substantiate any deviations from the methods provided in the CCRFCD Manual. A detailed description of how these parameters are determined is in the CCRFCD Manual.

### 3.1.1 Precipitation

Rainfall events that cause flooding on the NTS and in southern Nevada are usually convectional storms. According to Christenson and Spahr (1980), the probable flood-generating storm in the NTS area would be from summer convectional storms. These flood-producing storms are normally characterized as short-duration (6 hours or less), high-intensity storms over a localized area. Methods regarding precipitation parameters in the CCRFCD Manual assume that summer convectional storms are the likely precipitation event to produce flooding in Clark County. In an analysis of precipitation records for southern Nevada, WRC Engineering and the COE determined that a 6-hour rainfall should be the design storm. A 6-hour mass curve (intensity of rainfall per 15-minute intervals over the 6-hour design storm) was developed and a relationship between precipitation depth and storm size (depth-area ratios) was determined. These parameters are discussed below in more detail.

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### a. Point Precipitation Values

As specified in the CCRFCD Manual, the design depths of precipitation for the 6-hour storm were taken from NOAA Atlas 2, Volume VII (1973) and are listed in Table 1.

Table 1. Six-Hour Storm Point Precipitation Values and Correction Factors (CCRFCD Manual, 1990). Correction factors used to adjust precipitation values for design depths of precipitation for the six-hour storm.

	NOAA Values (inches)	Correction Factor	Corrected Point Rainfall (inches)
2-Year, 6-Hour	0.70	1.00	0.70
10-Year, 6-Hour	1.10	1.24	1.36
100-Year, 6-Hour	1.60	1.43	2.43

The 100-year, 6-hour point precipitation value of 1.6-inches (NOAA Atlas 2, Volume VII, 1973) compares well with the 1.8-inch value generated from a figure developed by French (1983) for the Cane Springs precipitation gauge (Figure 5). A preliminary value of 2.6-inches for the 100-year, 24-hour storm taken from a statistical analysis of the rainfall data at Well 5b (Figure 5) by Reynolds Electrical & Engineering Co., Inc., (personal communication, Barker, 1992) compares well with the value listed in NOAA Atlas 2, Volume VII (1973). Locations of these gauges are shown on Figure 3 and Sheet 1.

The CCRFCD Manual requires that the point precipitation values listed in NOAA Atlas 2, Volume VII (1973) be used to determine point precipitation; however, the CCRFCD Manual specifies that rainfall events above the 2-year storm be adjusted. Table 1 shows the correction factors listed in the CCRFCD Manual. These correction factors were identified from studies conducted by WRC Engineering and COE for Clark County (CCRFCD Manual, 1990) based on available rainfall data, primarily from the Las Vegas Valley; these factors may not be applicable for the RWMS study area.

French (1983) hypothesized that the southern part of Nevada can be divided into three precipitation zones: an excess zone, a transition zone, and a deficient zone (Figure 6). French (1983) indicates that the Las Vegas Valley is located in the excess zone, and the NTS is located in the transition zone. He further hypothesizes that the excess zone is a result of storms tracking up the Colorado River Valley, and the influence of the river on precipitation values lessens with distance away from the Colorado River Valley. The precipitation analysis by French (1983) and Barker (1992) support this hypothesis and suggest that the noncorrected precipitation values for the RWMS study area are more applicable than using the precipitation correction factors specified in the CCRFCD Manual. Hydrologic models in this flood assessment used the nonadjusted values in NOAA Atlas 2, Volume VII (1973); however, a discharge model was developed using the adjustment factors specified in the CCRFCD Manual to compare with the hydrologic models developed without the adjustment factors. The results of this comparison are discussed in Section 3.4, Hydrology Discussion.

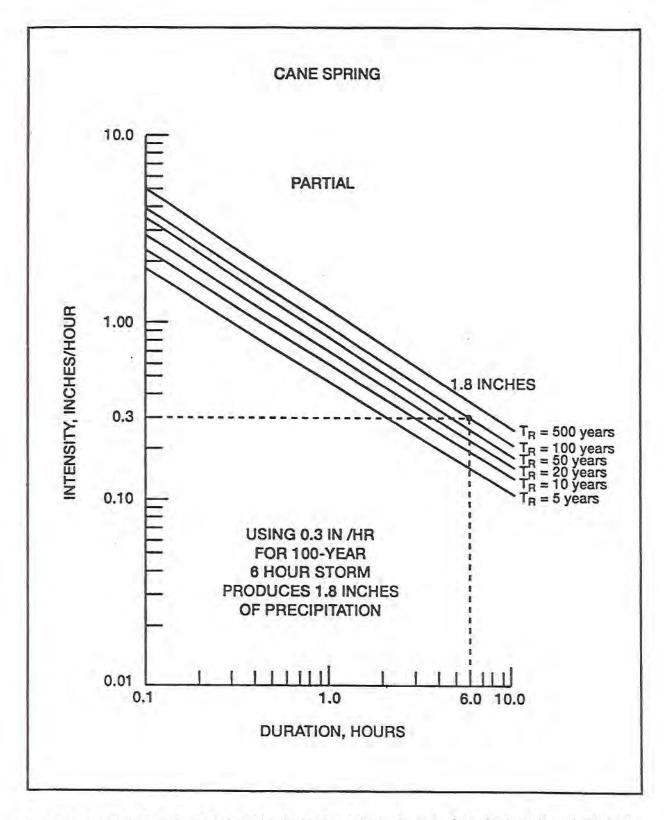


Figure 5. Intensity Duration Relationships for Various Return Periods, Cane Springs, Nevada Test Site, Nevada (modified from French, 1983). The 100-year, 6-hour point precipitation value of 1.6 inches compares well with the value from French, 1983.

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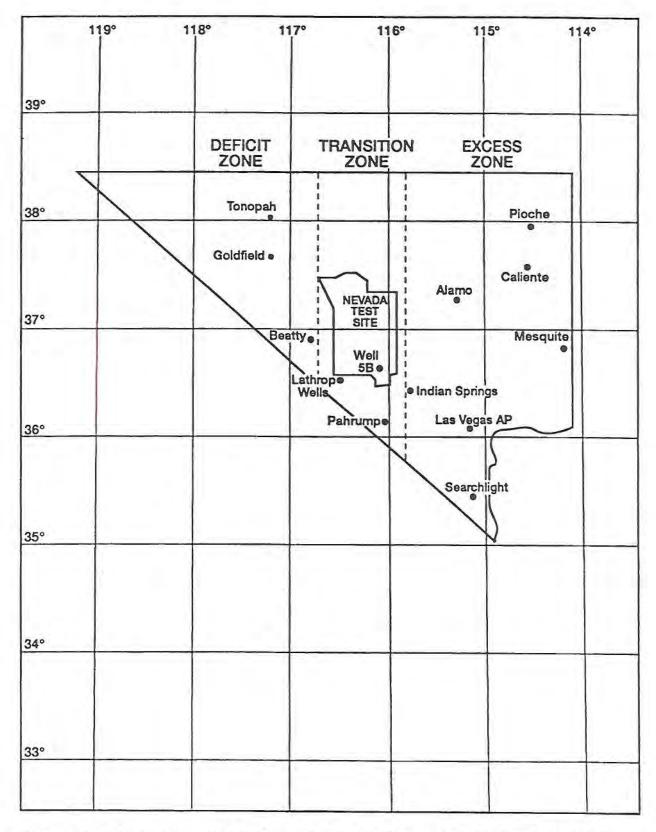


Figure 6. Hypothesized Zones of Precipitation in Southern Nevada (modified from French, 1983).

The NTS is located in the transition zone of precipitation.

### b. Storm Duration and Time Distribution

Clark County has adopted two 6-hour storm distribution tables to be used to generate discharges (CCRFCD Manual, 1990). The two storm distributions defined in this manual are for areas less than or larger than 10 square miles. These storm distributions were used for the subbasins in the hydrologic models for the RWMS. A mass curve of the two storm distributions is shown in Figure 7.

### c. Depth-Area Ratios

During a flood-producing storm, usually a convectional storm in this region, point precipitation values probably would not apply to an entire drainage basin. Depth-area ratios have been developed for arid regions which reduce the point precipitation value for a watershed as a function of area. Clark County uses the depth-area ratios that were developed by the COE for Clark County and vicinity (Table 2). These depth-area ratios are a modification of ratios developed by Zehr (1984) on arid watersheds in Arizona and New Mexico. Ratios in the CCRFCD Manual were used in the hydrologic model for the RWMS.

### 3.1.2 Drainage Areas

The area of each drainage basin defined in the hydrologic model was delineated using 7.5-and 15-minute United States Geological Survey (USGS) topographic quadrangle maps of the area (Figures 2 and 3; Sheets 1 and 2), along with 1:6,000 orthophotos with a 10-foot contour interval that were developed for the area. Basin delineations were verified by field observations and study of color and infrared aerial photos. The area of each subbasin was determined using a planimeter. The drainage area, and the other watershed parameters for each subbasin used in the HEC-1 model, are listed in Table 3. The USGS topographic maps used to define the drainage area are:

15-minute Topographic Quadrangles (USGS):

- Papoose Lake (1952)
- Frenchman Lake (1952)
- Cane Spring (1952)
- Topopah Spring (1952)
- Tippipah Spring (1952)

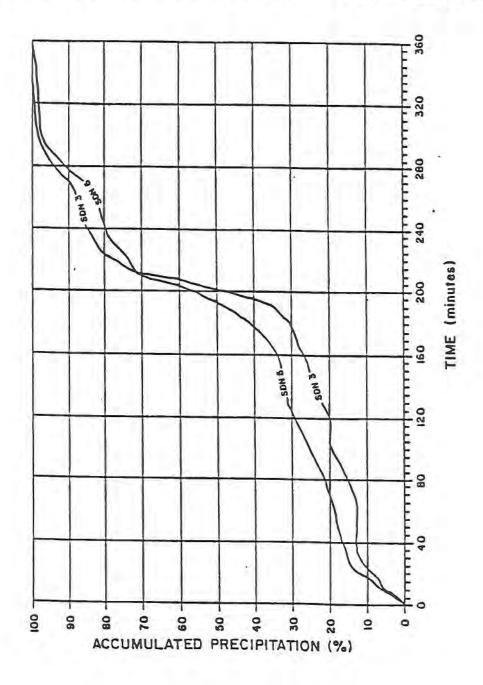
# 7.5-minute Topographic Quadrangles (USGS):

- Plutonium Valley (1986)
- Frenchman Lake (1986)
- Yucca Lake (1986)
- Cane Spring (1986)

### 3.1.3 Precipitation Losses

Precipitation losses were determined using the SCS curve number methodology and the applicable table (Table 4) found in the CCRFCD Manual. The following information is required to determine a curve number for a specific subbasin:

# SIX-HOUR DESIGN STORM DISTRIBUTIONS



## Notes:

- 1. For drainage areas less than 10 square miles in size, use SDN 3.
- 2. For drainage areas equal to or greater than 10 square miles in size, use SDN 5.

Figure 7. Storm Distributions (CCRFCD Manual, 1990 [reference USACE, Los Angeles District, 1988]). Storm distribution curves are selected based on drainage basin size.

Table 2. Six-Hour Precipitation Depth-Area Reduction Factors (CCRFCD Manual, 1990).

Depth-area ratios reduce the point precipitation value for a watershed as a function of area.

Drainage Area (mi²)	Reduction Factor	100-Year (In.)	10-Year (in.)	2-Year (In.)
0.01	1.00	2.43	1.36	0.70
1	0.97	2.36	1.32	0.68
10	0.86	2.09	1.17	0.60
20	0.79	1.92	1.07	0.55
30	0.74	1.80	1.01	0.52
50	0.68	1.65	0.92	0.48
100	0.60	1.46	0.82	0.42

Table 3. Watershed Parameters. Watershed parameters were delineated using topographic maps, aerial photos, and field investigations.

		C	urve Numbe	n	
Watershed Name	Basin Area (mi²)	AMC I	AMC II	AMC III	Lag Time (hrs)
MM1A	0.9	63	80	90	0.31
BW1	60.5	67	83	93	2.10
BW2	20.8	63	80	90	0.90
MM1B	2.1	59	77	87	0.48
MM2	1.4	62	79	89	0.47
HP1A	0.8	70	85	95	0.48
HP1B	1.0	60	78	88	0.51
HP2	1.2	60	78	88	0.51
<b>НР3</b>	1.7	66	82	92	0.59
HP4	3.3	62	79	89	0.52
HP5	1.2	62	79	89	0.30
HP6	2.2	63	80	90	0.55
HPFA	0.3	59	77	87	0.33
HPFB	1.6	59	77	87	0.44
SC1	39.4	66	82	92	2.10
SC2	1.5	59	77	87	0.48

Table 4. Runoff Curve Numbers (Semiarid Rangelands¹) [CCRFCD Drainage Manual, 1990 {reference SCS TR-55, USDA, June 1988}]. Hydrologic soil group, vegetation type, and percent of ground cover determine curve numbers.

Cover Description	190	Curve Numbers for Hydrologic Sell Group					
Cover Type	Hydrologic Condition <sup>2</sup>	A³	B	С	D		
Herbaceous-mixture of grass, weeds,	Poor		80	87	93		
and low-growing brush, with brush the	Fair		71	81	89		
minor element	Good		62	74	85		
Oak-aspen-mountain brush mixture of	Poor	244	66	74	79		
oak brush, aspen, mountain mahogany,	Fair		48	57	63		
bitter brush, maple, and other brush	Good		30	41	48		
Pinyon-juniper-pinyon, juniper, or both;	Poor		75	85	89		
grass understory	Fair	-	58	73	80		
	Good		41	61	71		
Sagebrush with grass understory	Poor	4.0	67	80	85		
The Control of the North Contr	Fair		51	63	70		
	Good		35	47	55		
Desert shrubmajor plants include	Poor	63	77	85	88		
saltbush, greasewood, creosote bush,	Fair	55	72	81	86		
blackbrush, bursage, palo verde, mesquite, and cactus	Good	49	68	79	84		

Average runoff condition, and I, = 0.2S.

Fair: 30 to 70% ground cover. Good: > 70% ground cover.

- hydrologic soil group;
- vegetation type; and
- percent vegetation cover.

The following procedures were used to obtain this information:

The percent of bedrock and alluvium was determined for each subbasin using aerial
photos and geologic and topographic maps. Bedrock areas of the subbasins were assigned as
hydrologic soil group D. This soil group has high runoff potential and applies to areas with
shallow soils or exposed bedrock. The alluvium is mostly sand and was assigned as hydrologic

<sup>&</sup>lt;sup>2</sup> Poor: < 30% ground cover (litter, grass, and brush overstory).

<sup>&</sup>lt;sup>3</sup> Curve numbers for Group A have been developed only for desert shrub.

soil group B based on the preliminary surficial map by Rawlinson (1991), Romney (1973), and extensive field investigation conducted by the authors.

- 2. The cover type for the subbasins was determined to be desert shrub based on descriptions given in Table 4, field investigation, and study of aerial color and infrared photos.
- 3. The hydrologic condition was determined to be poor based on 30 ground surveys conducted on the alluvium (*Table 4*). Ground cover ranged between 5 and 30 percent. Results of these surveys were assumed to be representative of all subbasins. This assumption was verified by study of aerial photos and field investigations. Because of the very steep slopes and minimal or nonexistent soil, bedrock areas have less vegetation than alluvial areas; therefore, the hydrologic condition of the bedrock areas was also classified as poor.

According to the CCRFCD Manual, curve numbers for precipitation losses should be determined assuming an antecedent moisture condition of II (AMC-II). Antecedent moisture condition is dependent on the antecedent rainfall. The antecedent rainfall is the amount of rainfall between 5 and 30 days preceding a flood-producing storm. AMC-I assumes the soil is dry, and AMC-III assumes the soil is near or at saturation; AMC-II is halfway between AMC-I and AMC-III. The CCRFCD Manual designates AMC-II because data required to determine the antecedent moisture condition for an entire area are not quantifiable.

Assuming AMC-II, curve numbers for the alluvium and bedrock were 77 and 88, respectively. The curve number for each subbasin was determined by taking the weighted average between the percentage of alluvium and bedrock present in each subbasin. Curve numbers for each subbasin for AMC-I, AMC-II, and AMC-III are listed in Table 3. Hydrologic models in this study developed to estimate the 2-year and 10-year discharges assumed the antecedent moisture conditions were AMC-II. The 100-year hydrologic models developed for this study assumed conditions ranging between AMC-II and AMC-III. The results from all the models and the justification for varying the curve numbers per antecedent moisture conditions are addressed in Section 3.4, Hydrology Discussion.

## 3.1.4 Lag Time

In the SCS unit hydrograph method, only 1 input parameter, the lag time, is required. The CCRFCD Manual uses the lag time equation from the U.S. Bureau of Reclamation (Cudworth, 1989) for subbasins greater than 1-square mile:

TLag = 
$$20K_n(\frac{LL_c}{S^{1/2}})^{1/3}$$

where:

TLag = the lag time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

K, = the Manning roughness factor (dimensionless) for the basin channels.

the length of the longest watercourse (miles) within the subbasin.

- L<sub>e</sub> = the length along the longest watercourse (miles) measured upstream to a point opposite the centroid of the basin.
- S = the average slope of the longest watercourse (feet per mile).

As indicated in the CCRFCD Manual, K<sub>n</sub> is subjective. Therefore, criteria listed in Table 604 in the CCRFCD Manual (Table 5) are recommended and were used for this study. Characteristics of the subbasins fell halfway between the "n" value description for 0.03 and 0.05. Parameters used to determine the lag time are listed in Table 6. The L and S values for each subbasin were determined using a map wheel on the watershed maps (Sheets 1 and 2). The L<sub>c</sub> value was determined using a planimeter to find the centroid of each subbasin. A point on the longest watercourse of each subbasin which was closest to the respective centroid was selected.

## 3.1.5 Channel Routing

The Muskingum routing method was used for routing reaches. This routing method requires three parameters: x, K, and the integer step. The weighting factor (x) expresses the amount of attenuation of the flood wave within the reach (Dunne and Leopold, 1978), and was determined using criteria cited by Cudworth (1989). The Muskingum coefficient (K) accounts for the translation of the peak flow for the entire channel reach. This storage constant K is directly related to the length and the average velocity of the reach. The average channel velocity is determined using the Manning Equation. The Manning roughness coefficient was chosen based on field observations. Channel geometry was determined through field measurements. (The integer step and routing reach were determined so that the total travel time through the reach would be equal to K.) Only three reaches were routed in the models. Table 7 lists the routing parameters for these reaches.

Transmission losses for the routing reaches are ignored in the models. Variability of infiltration rates along a channel reach can be extensive; thus, these losses over an entire reach are difficult to quantify. Ignoring these losses adds another conservative assumption into the model.

## 3.2 Hydrologic Models

Seven hydrologic models were developed using the HEC-1 computer program to determine discharges for this flood assessment (Table 8). All the models have the same hydrologic parameters, with the exception of point precipitation values and curve numbers. The differences between the models are explained in each model description (Table 8). Output from the seven hydrologic models are located in Appendix A.

## 3.2.1 Model Layout

The overall watershed that could impact the RWMS was divided into 16 subbasins to provide discharges at key concentration points. Figure 8 is a schematic showing how the subbasins were connected in the HEC-1 models. The model layout was the same for all models.

Table 5. Lag Equation Roughness Factors (CCRFCD Manual, 1990 [reference USACE, Los Angeles District, 1982]). Characteristics of the subbasins fell halfway between the 0.030 and 0.50 "n" values.

Watershed Characteristics	Roughness Factor, Kn
Urbanized Areas: Water courses in the drainage area consist of street, storm sewer, and improved channels.	0.015
Natural Areas: Water courses in the drainage area are well defined, unimproved channels or washes. Watershed has minimal vegetation.	0.030
Natural Areas:  Water courses in the drainage area are not well defined, and consist of many small rills and braided wash areas. Runoff from area combines slowly into channels. Includes mountainous channels with large boulders and flow restrictions.	0.050

Table 6. Lag Time Parameters. Parameters used to calculate lag times.

Watershed Name	L (mi)	Lc (mi)	S (ft/mi)	<u>Kn</u>	Lag Time (hrs)
MM1A	0.87	0.64	97.7	0.04	0.31
BW1	18.60	11.50	143.0	0.04	2.07
BW2	6.50	3.10	251.5	0.04	0.87
MM1B	2.46	0.72	71.9	0.04	0.48
MM2	2.16	1.33	215.3	0.04	0.47
HP1A	1.33	0.83	503.8	0.04	0.30
HP1B	2.54	1.33	173.2	0.04	0.51
HP2	2.58	1.55	242.2	0.04	0.51
HP3	3.79	2.27	459.1	0.04	0.59
HP4	3.18	1.70	415.1	0.04	0.52
HP5	1.48	0.64	378.4	0.04	0.30
HP6	3.37	1.74	332.3	0.04	0.55
HPFA	1.44	0.53	121.5	0.04	0.33
HPFB	2.08	0.80	103.4	0.04	0.44
SC1	18.10	10.60	106.1	0.04	2.10
SC2	2.69	0.85	119.0	0.04	0.48

NOTE:

TLag = 
$$20K_n(\frac{LL_c}{S^{1/2}})$$

#### where.

TLag = the lag time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

K<sub>n</sub> = the Manning roughness factor (dimensionless) for the basin channels.

L = the length of the longest watercourse (miles) within the subbasin.

L<sub>c</sub> = the length along the longest watercourse (miles) measured upstream to a point opposite the centroid of the basin.

S = the average slope of the longest watercourse (feet per mile).

Table 7. Routing Parameters. The Muskingum routing method was used for routing reaches.

Reach name	Integer Step	Storage Constant (K)	Weighting Factor (X)
HP1A to CPA	9	0.43	0.2
HP6 to CPD	5	0.27	0.2
CPD to CPE	8	0.39	0.2

### NOTE:

Integer Step The integer step is the number of subreaches for the Muskingum routing.

Storage Constant (K): The Muskingum "K" coefficient is the travel time (hours) through the reach.

Weighting Factor (X): The weighting factor expresses the amount of attentuation of the flood wave within the reach.

Table 8. Hydrologic Models. Hydrologic models were developed for the 2-year, 10-year, and 100-year flood events.

	100-Year Hydrologic Model
RWMS.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers were developed assuming AMC-II.
RWMSCN.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers for all basins were increased by 5 to account for an AMC greater than II.
RWMSW.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers for all basins were increased by 10 to account for AMC-III.
RWMSC.OUT	Clark County correction factors were used in conjunction with the point precipitation values taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II.
	10-Year Hydrologic Model
RWMS10.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II.
RWMS10C.OUT	Clark County correction factors were used in conjunction with the point precipitation values taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II.
	2-Year Hydrologic Model
RWMS2.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II. No correction factor to the 2-year point precipitation values from the NOAA Atlas 2, Volume VII, is required by the CCRFCD Manual.

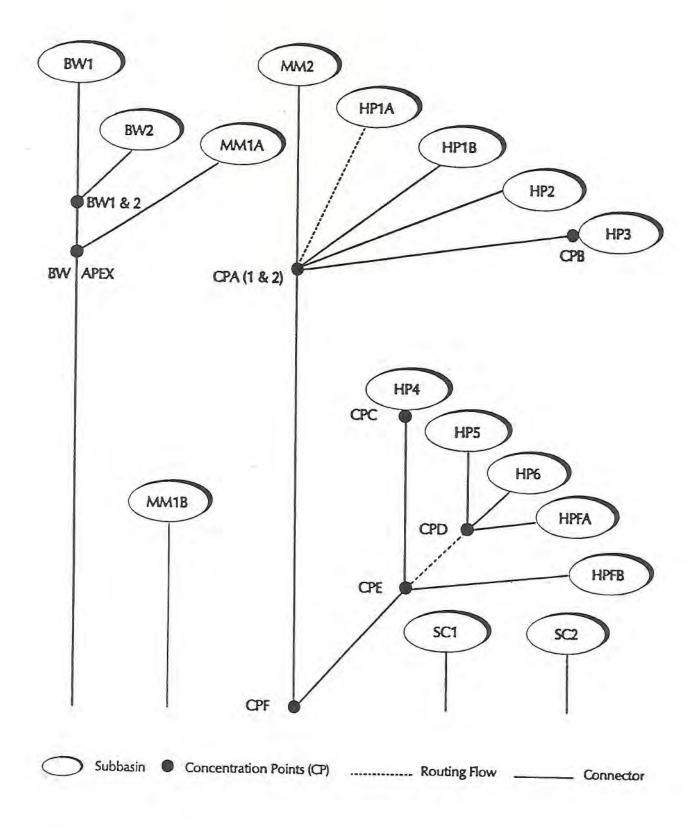


Figure 8. Schematic Diagram of Stream Network. This diagram shows how the 16 subbasins were combined in the HEC-1 models.

Conservative assumptions which simplified the model layout were made regarding routing and combining subbasins. For example, subbasins BW1, BW2, and MM1A within the HEC-1 models were considered to combine at the same point (Figure 8), but MM1A actually combines with the Barren Wash subbasins (BW1 and BW2) approximately 2,000 feet downstream. The HEC-1 models demonstrated little attenuation and translation of peak flows through this short reach; therefore, combining these basins without routing simplified the model and provided an additional conservative assumption to the model. Also, subbasins were combined along the perimeter of the RWMS without routing. First, flows from Concentration Point A (CPA1) were combined with flows from CPB; then flows from CPC and CPE were combined; and finally flows from CPA (1 and 2), CPC, and CPE were combined at CPF (Figure 8). CPF is located downstream from the RWMS. Again, the attenuation and translation of the peak flows as modeled using HEC-1 were minimal and, by combining the subbasins as shown on Figure 8, the models were simplified and conservative.

Another conservative assumption pertaining to subbasin HPFB was made in the model layout for a part of this subbasin that drains directly towards CPE. Difficulty in determining the percentage of discharge that could reach the RWMS from this subbasin led to the assumption that the entire subbasin would drain towards the RWMS.

Figure 8 shows flow from BW Apex, MM1B, SC1, and SC2 not connected to the major concentration points. Flow from BW Apex was not connected because flow from this drainage does not currently impact the RWMS; however, channel avulsions can potentially occur during a flood, thus directing flow towards the RWMS. This potential is addressed in Section 4.2, Results and Discussion of Flood Hazard Determination. Subbasin MM1B encompasses the Barren Wash Alluvial Fan, and flow that falls directly onto the fan would not drain towards the RWMS.

Subbasin SC1 is the Scarp Canyon watershed. The concentration point for this watershed is the apex of the Scarp Canyon alluvial fan. Flow from this watershed does not impact the RWMS, as shown in the Section 4.2, Results and Discussion of Flood Hazard Determination. Subbasin SC2 is a portion of the nonactive fan surface composed of sediments deposited by the Scarp Canyon channel. Because the channel has become entrenched and has extended the active apex approximately 2.5 miles down the existing fan surface, runoff from this surface would be sheetflow and, as indicated by the topography (Figure 3 and Sheet 2), drains away from the RWMS.

#### 3.2.2 Concentration Points

The concentration point locations were determined to provide discharges at the most appropriate location for the hydraulic analysis (Figures 3 and 4 and Sheets 1 and 2). Concentration points were selected for sheetflow locations and at the active apexes of the alluvial fans. In the case of sheetflow, with the exception of CPC and CPD, the concentration points were spread across the area of potential flood impact with the RWMS. CPC was selected where all water from subbasin HP4 would be funneled southwest between subbasins HP4 and HPFB towards the RWMS. CPD was selected where water from subbasins HP5, HP6, and HPFA would be concentrated together before being routed to CPE.

### 3.3 Hydrology Results

Discharges of key concentration points from the seven models used in this analysis are listed in Table 9.

Table 9. Discharges From HEC-1 Models at Key Concentration Points

			100-Year Dis	100-Year Discharges (cfs)		10-Year Disc	10-Year Discharges (cfs)	2-Year Discharges (cfs)
Concentration	DA (mi <sup>2</sup> )	RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT	RWMS10,OUT	RWMS10C.OUT	HWMS2.OUT
BWAPX*	82.20	1,848	3,513	6,018	5,498	510	1,083	22
CPA1	4,40	459	786	1,229	1,297	130	278	15
CPA2	6.10	629	1,126	1,757	1,827	187	399	23
СРВ	1.70	263	450	624	661	87	170	14
CPC	3.30	360	626	984	1,060	88	210	80
CPD	3.70	333	570	884	945	8	199	10
CPE	8.60	603	1,180	1,819	1,898	168	335	6
CPF	14.70	878	1,462	2,396	2,462	301	576	25
SC1APX**	39.40	1,251	2,178	3,498	3,438	356	769	15

\*Barren Wash Apex \*\*Scarp Canyon Apex

NOTE: Discharge outputs are from the HEC-1 model and do not incorporate significant figures.

Discharges from the models RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT (2-year, 10-year, and 100-year discharges, respectively) were used in the analysis to determine the flood hazard zones for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans. Discharges from RWMSW.OUT were used to evaluate the 100-year sheetflow and shallow concentrated flow that could impact the RWMS. Justification for choosing these models is discussed in the following section.

## 3.4 Hydrology Discussion

Although only three models were used in the flood assessment, a total of seven models were developed and evaluated in this study. A two-step approach was used to select the appropriate models for the 2-year, 10-year, and 100-year discharges. The following paragraphs provide a description of this approach.

The first step focused on the hydrologic model (HEC-1) for the 2-year flood. In arid regions, such as the RWMS location, it is common that no flow will occur in washes for several years; therefore, the 2-year model-generated discharges for the subbasins should be close to zero. The 2-year discharges from RWMS2.OUT (Table 9) were low, less than 25 cubic feet per second. These discharges from RWMS2.OUT appear reasonable so no other model was developed for the 2-year flood.

To verify the model-generated discharges for the 10-year and 100-year floods, another step was required. This step compared the skew coefficient developed from model-generated discharges and the regional skew coefficient (Water Resource Council [WRC] 17B, 1981). If the hydrologic models are producing reasonable discharges, then the skew coefficient from these models should be close to the regional skew coefficient.

A major assumption in using skew coefficients is that the relationship between discharge and return period must follow a Log-Pearson Type III (LPIII) probability distribution, as specified in WRC (1981). The FEMA FAN computer program (1990) contains a subroutine that calculates skew coefficients using a least-square fit and a LPIII probability distribution. This program calculated skew coefficients for specific concentration points using model-generated discharges. This program requires discharges for a minimum of three return periods to calculate the skew coefficient. (In this analysis the 2-year, 10-year, and 100-year model-generated discharges were entered into the FAN program.)

WRC (1981) contains a map which shows the regional skew coefficients for the country (Figure 9). According to the information on this map, the skew coefficient for washes on the NTS should be near zero. A zero skew coefficient means that if discharge versus probability were plotted on log-probability paper, then the flood frequency curve would plot as a log-normal distribution (a straight line). Preliminary results from a study by the USGS using stream gage data gathered after 1981 also support a zero skew for this region (Hjalmarson [personal communication], 1992).

The first three models that were evaluated using the skew comparison approach were RWMS2.OUT, RWMS10.OUT, and RWMS.OUT (Model Set 1). These models were developed using the noncorrected precipitation values from NOAA Atlas 2, Volume VII (1973) and followed the methods in CCRFCD Manual for the remaining input parameters. Discharges at the apexes of the Barren Wash, Halfpint, and Scarp Canyon alluvial fans were evaluated. Discharges at these apexes were entered into the FAN program to determine the skew coefficients. The skew coefficients, as shown in Table 10, were negative and were not close to zero. The discharges

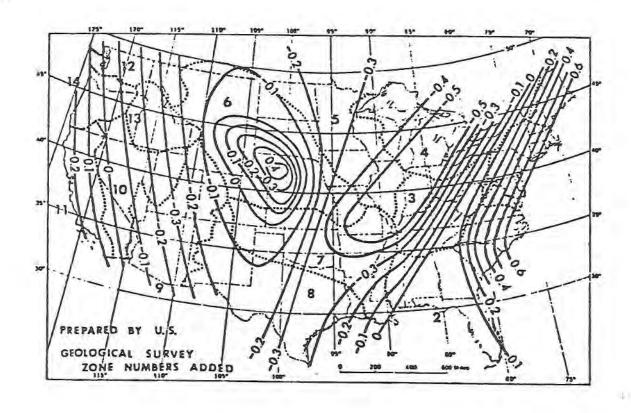


Figure 9. Generalized U.S. Skew Coefficients (WRC [1981]). The Nevada Test Site is located in an area with a zero skew coefficient value.

Table 10. Skew Coefficients From Different Model Sets. Model Set 3 generated skew coefficients closest to zero for the three apexes.

Apex Locations	Model Set 1	Model Set 2	Model Set 3	Model Set 4
Barren Wash	-1.2	-0,6	-0.1	-1.2
Scarp Canyon	-1.2	-0.7	-0.3	-1.3
Halfpint	-1,1	-0.4	0.1	-1.0
Return Period	Model Set 1	Model Set 2	Model Set 3	Model Set 4
2-Year Model	RWMS2.OUT	RWMS2.OUT	RWMS2,OUT	RWMS2.OUT
10-Year Model	RWMS10.OUT	RWMS10.OUT	RWMS10.OUT	RWMS10C.OUT
100-Year Model	RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT

in this set must be adjusted to move the skew coefficients closer to zero. The 2-year model (RWMS.OUT2) was determined to generate reasonable results; therefore, adjustment must occur either to the 10-year, 100-year or both models.

The 10-year and 100-year hydrologic models could be modified by adjusting the curve numbers, depth of precipitation, or lag times. Of these three parameters, curve numbers have the widest variability because they are dependent on antecedent moisture conditions, as indicated in *Table 3*. Curve numbers for the subbasin in this study (*Table 3*) can range in the 50's and 60's under dry soil conditions (AMC-I) to the high 80's and low 90's (AMC-III) for saturated conditions. The CCRFCD Manual assumes AMC-II because antecedent moisture conditions for a drainage basin are impossible to quantify and a standard approach is required in Clark County to assure consistent analysis and design in drainage facilities and structures. The assumption of AMC-II may be reasonable for the 2-year flood event, as reflected in RWMS2.OUT, but may not be for the 10-year and 100-year flood events. For 10-year floods or greater, the antecedent moisture condition as well as rainfall may contribute to flooding.

Precipitation depth and lag times are not as variable. Variation from the precipitation depths in NOAA Atlas 2, Volume VII is not supportable because analysis of precipitation data in the study area (French, 1983; and Barker [personal communication], 1992) do not vary substantially from the values in NOAA Atlas 2, Volume VII, and any variation to precipitation data would be difficult to support. Variability in lag time is limited because three of the four parameters (L, L, and S) are measured from a topographic map, and significant variations in the K, are not defensible using the methods described in the CCRFCD Manual (Table 5). Therefore, the curve numbers in the models were considered the most reasonable parameter to modify.

Modification of curve numbers in the 100-year model were evaluated first. Two additional 100-year models were created from the original 100-year model (RWMS.OUT): RWMSCN.OUT and RWMSW.OUT. In RWMSCN. OUT, curve numbers were 5 greater than the original model, and in RWMSW.OUT, curve numbers were 10 greater than the original model. Increasing the curve numbers by 5 assumes an antecedent moisture condition between AMC-II and AMC-III; increasing the curve numbers by 10 assumes AMC-III.

Using these models, two additional model sets were developed with these two models: Model Set 2 (RWMS2.OUT, RWMS10.OUT, and RWMSCN.OUT) and Model Set 3 (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT). The 2-year, 10-year, and 100-year discharges for each model set were entered into the FAN program. The skew coefficients of the apexes of the three fans were closer to zero (*Table 10*). Model Set 3 generated skew coefficients closest to zero for the three apexes. These models from Model Set 3 were used to define the 100-year flood hazards in this flood assessment.

The 10-year model was not modified because an increase in the curve numbers would require a corresponding increase in the curve numbers for the 100-year model to maintain a zero skew. Assuming AMC-III (saturated conditions), the discharges generated from RWMSW.OUT are at their upper limit; therefore, an increase in curve numbers for the 10-year model would result in a negative skew.

Additional HEC-1 models were developed using the precipitation correction factors in the CCRFCD Manual required to the 10-year and 100-year precipitation depths (*Table 1*). Two additional models were necessary: RWMS10C.OUT and RWMSC.OUT. The skew coefficient using discharges from the models RWMS2.OUT, RWMS10C.OUT, and RWMSC.OUT (Model Set 4) were calculated and are listed in *Table 10*.

Adjusting the curve numbers for the 100-year event and not using precipitation correction factors varies from the methods given in the CCRFCD Manual, but the 100-year discharges generated using this approach (RWMSW.OUT) are comparable to 100-year discharges from the model (RWMSC.OUT). Plus, the skew coefficients calculated using RWMSW.OUT for the 100-year discharges (Model Set 3) are closer to zero than the model following CCRFCD Manual criteria (Model Set 4). For these reasons, Model Set 3 was used in this flood assessment instead of Model Set 4.

As a result of this two-step approach to determine the appropriate hydrologic models, seven models were developed but only three models (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT) were used in determining the flood hazard of the RWMS and HWSU facilities.

# 4.0 HYDRAULICS AND FLOOD HAZARD DETERMINATION

The RWMS and HWSU are located in an arid region where traditional approaches to define flood hazards (e.g., the hydraulic model HEC-2, which assumes a stable and fixed channel geometry) may not be appropriate for all types of flooding. Potential flooding of the RWMS and HWSU can occur as alluvial fan flooding, shallow concentrated flow, and sheetflow. FEMA has developed methodology to determine the 100-year flood hazards from these types of flooding. FEMA methodology was used to delineate the flood hazards impacting the RWMS and HWSU per 40 CFR 270.14. This section provides:

- a brief description of the FEMA methodology used to evaluate alluvial fan flooding, shallow concentrated flow, and sheetflow;
- the results and discussion of the flood hazard evaluation; and
- flood hazard maps.

# 4.1 Hydraulics and Flood Hazard Determination Methodology

## 4.1.1 FEMA Alluvial Fan Methodology

Flooding from the Barren Wash, Scarp Canyon, and Halfpint alluvial fans could impact these facilities. Hydraulic processes on alluvial fans are different than in riverine channels. Alluvial fan flooding, as described by FEMA (1991), "... is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flowpaths." Channel geometry and direction on alluvial fans can change in direct response to a flood discharge. Field investigations and study of topographic maps and aerial photos of the Barren Wash, Scarp Canyon, and Halfpint alluvial fans support this description because flowpaths are unpredictable, soil development is weak, and evidence of recent erosion and deposition is present.

FEMA (1991) states that if flowpaths below the active apex cannot be predicted (which is the case for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans), the FEMA Alluvial Fan Methodology must be applied to evaluate the 100-year flood hazard. This methodology, which is a modification of the method proposed by Dawdy (1979), relates probability of discharges at the apex to probability of channel depths and flow velocities that occur on the alluvial fan.

According to Dawdy (1979), flood flow from the apex of a typical alluvial fan does not spread evenly over the fan surface, but is instead confined to a surface or channel that carries the flood waters from the apex to the toe of the fan (Figure 10). The active apex is selected at the point where the flowpath becomes unpredictable, and flow is no more likely to follow an existing channel than create a new path. In the upper region of an alluvial fan, flow is confined to a single channel where the depth and width of the channel is a function of the flow itself. In general, flow occurs at critical depth and velocity as a result of steep slopes associated with this upper region. As slopes decrease towards the mid and distal parts of the fans, channel bifurcation can occur resulting in a multiple-channel region. Dawdy (1979) did not incorporate a multiple-channel region into his methodology. FEMA (1985, 1991) modified the Dawdy methodology to address multiple-channel regions of alluvial fans.

Key assumptions of the FEMA Alluvial Fan Methodology follow (French, 1989):

- The location of the flood event channel on the fan surface is random.
   Furthermore, the probability of the channel passing through any given point on
   a contour is uniform.
- Flow occurs in flow-formed channels. Well-defined channels result from the subsequent erosion from this process.
  - Incised channels do not exist previous to the first flow event.
  - Existing channel capacity is not adequate to convey the flow, and overbank flooding occurs.
- The width and depth of the channel is a function of discharge.
- 4. Transmission losses are not considered.
- 5. On-fan precipitation is not considered.

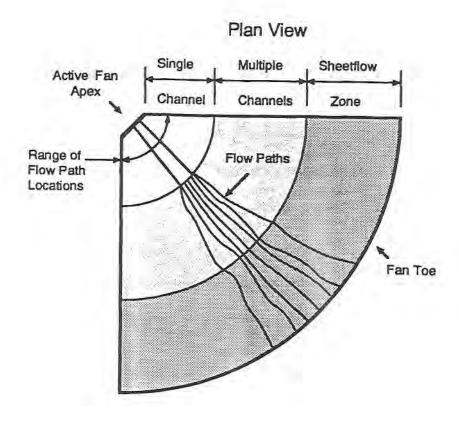


Figure 10. Alluvial Fan Plan View (modified from French, 1989). Plan view of an idealized alluvial fan showing the single channel, multiple channel, and sheetflow regions.

- The alluvial fan is active; e.g., net deposition is occurring in both time and space and avulsions (the migration of channel from one location to another during a single event) are occurring.
- Flood discharge frequency distribution must be available at the apex of the alluvial fan.

Field observations, a study of topographic and geologic maps, aerial photographs, and examination of historic records were made during the flood assessment of these alluvial fans. Sources of flooding were defined, an apex selected, active fan boundaries delineated, entrenched reaches of channels located and measured, and locations of barriers to flow determined.

The methodology used for defining flood hazards on alluvial fans incorporates FEMA's computer model, FAN (1990). Delineation of the 100-year flood hazard using the FEMA FAN Model requires the following parameters and assumptions:

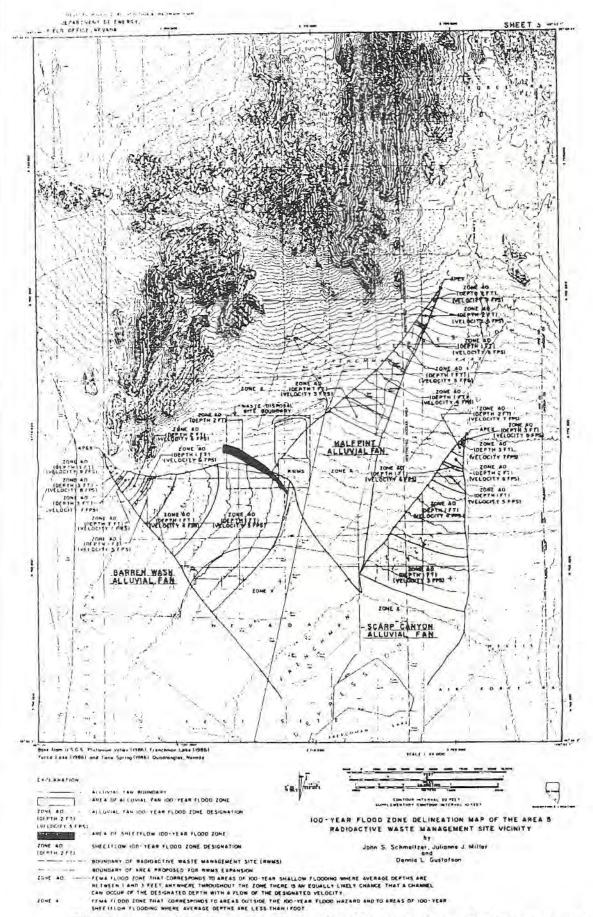
- Discharge information
- Apex location
- Fan boundaries and dimensions
- Potential flow obstructions and/or diversions
- Multiple channel region parameters:
  - Manning roughness coefficient
  - Slope

The FAN model requires that at least three discharges of different return periods be used to define the flood hazard zones. The 2-year, 10-year, and 100-year flood discharges for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans were taken from the HEC-1 models labeled RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT, respectively (Table 9). Discharges calculated by the HEC-1 models for CPBWAPEX or CPBW1&BW2 (Figure 8), whichever were greater, were used as the discharges at the apex of the Barren Wash Alluvial Fan in the FAN model. Discharges used in the FAN model for Scarp Canyon were taken from the HEC-1 models at the active apex of Scarp Canyon (Subbasin SC2). Discharges for Halfpint Alluvial Fan were taken from CPE as calculated within the HEC-1 model, and were assumed to have originated from the fan apex. All approaches for selecting discharges at the apexes are considered to be conservative.

Apex locations and fan boundaries were determined from aerial photographs; available topographic, geologic, and surficial maps; and field investigations. Apexes were located using the FEMA definition for an active apex. Location of the apexes for Barren Wash, Scarp Canyon, and Halfpint alluvial fans are shown in Figure 11 and Sheet 3.

Potential flow obstructions and diversions such as roads, buildings and other structures which can prevent flooding in some areas and increase flooding in others must be designated. In this flood assessment, all barriers such as Mercury Highway, 5–01 road, all secondary roads, the nonengineered berms surrounding the RWMS perimeter, and all disturbed areas diverting flow away from the RWMS were ignored. Quantification of the diversion would be difficult. Assuming that all flow can reach the RWMS produces a more conservative flood analysis.

A Manning roughness coefficient of 0.030 was used for the multiple-channel regions of all three fans. The Manning roughness coefficient for the multiple-channel regions of the fan were



rigure 11. 100-Year Flood Zone Delineation Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 3)

determined from field observations, and confirmed using the descriptions and values found in tables developed by Chow (1959). Slope of the fans for the multiple-channel region parameters were determined from the 1:6,000 orthophotos with a 10-foot contour interval.

# 4.1.2 Shallow Concentrated Flow

For subbasins MM2 and HP1B, a defined natural drainage exists that traverses the southwest corner of the RWMS. Field investigation of the geomorphology and a study of aerial photos suggest that shallow concentrated flow occurs through this reach and that standard hydraulic analysis may be appropriate. The 100-year flood hazard elevation of this drainage was estimated using the HEC-2 computer program (COE, 1990), a standard hydraulic method. HEC-2 is a hydraulic model developed by the COE and is used by FEMA to delineate flood hazards of channelized flow. The input requirements of the HEC-2 model include channel cross section information; distances between cross sections; and Manning roughness coefficient. Cross section information and distances were taken from a 1:4,800 topographic map with a 5-foot contour interval (Appendix C contains HEC-2 output, work map and cross sections) in conjunction with field observations and measurements. As in the alluvial fan analysis, Manning roughness coefficients were estimated from field observations, and confirmed using the descriptions and values found in tables developed by Chow (1959).

#### 4.1.3 Sheetflow

According to FEMA (1991), sheetflow

... is the broad, relatively unconfined downslope movement of water across sloping terrain that results from ... a channel that crosses a drainage divide, ... and overflow from a perched channel onto ... plains of lower elevations ... [Sheetflow] is typical in areas of low topographic relief and poorly established drainage systems ... Shallow flooding is often characterized by poorly defined channels and highly unpredictable flow direction because of low relief or shifting channels and debris loads. Where such conditions exist, the entire area susceptible to this unpredictable flow should be delineated as an area of equal risk. Small-scale topographic relief that is not evident on existing topographic mapping and that might lead to "islands" of one flood hazard zone within larger areas of another should be ignored.

This definition of sheetflow describes the distributary-flow system (hydraulic engineering viewpoint) areas that drain from the Halfpint Range towards the RWMS. With current elevation information (10-foot contour interval) on available orthophotos, a detailed assessment of the flood hazard was not possible because of the inability to distinguish channels and nonchannel regions; therefore, per FEMA (1991) the 100-year flood hazard of this area was analyzed assuming that the entire area is prone to flooding and is delineated as an area of equal risk. Geomorphologic evidence gathered from analysis of color and infrared aerial photos and field observations supports this assumption because these areas have weak soil development and relatively few areas of relic deposits covered by desert pavement with desert varnish.

## 4.2 Results and Discussion of Flood Hazard Determination

Using the methods described in the previous section, the 100-year flood hazard areas were defined on the topographic maps (*Figure 11* and *Sheet 3*). Zone AO and Zone X were used to denote the flood hazards in the vicinity of the RWMS.

FEMA designates alluvial fan, shallow concentrated flow, and sheetflow areas with a 100-year flood depth of greater than 1 foot as a Zone AO. FEMA (1990) defines Zone AO as the area of 100-year shallow flooding where average depths are between 1 and 3 feet. For alluvial fans, anywhere throughout the zone there is a probability of 0.01 that a channel can occur at the designated depth with flow at the designated velocity. Zone X, shown on Figure 11 and Sheet 3 and Figure 12 and Sheet 4, represents areas outside the 100-year flood hazard and/or areas of the 100-year shallow flooding (sheetflow or shallow concentrated flow) where average depths are less than 1 foot. A Zone X delineation does not mean that floods will not occur within this zone. For this reason, flood hazard protection must be addressed.

## 4.2.1 Alluvial Fan Flooding

The 100-year flood hazard zones for the Barren Wash, Scarp Canyon, and the Halfpint fans are shown on Figure 11 and Sheet 3. The 100-year flood hazard for the RWMS and its immediate vicinity is also shown on an 1:6,000 orthophoto (Figure 12 and Sheet 4).

Using the FEMA Fan Methodology, the southwest corner of the RWMS is within the 100-year flood hazard zone, designated as Zone AO; depth 1 foot; velocity 3 feet per second, of the Barren Wash Alluvial Fan. The part of the RWMS that is located within Zone AO of this alluvial fan is not included in the RCRA Part B Permit Application for the Area 5 RWMS because it is not used for storage or disposal of hazardous, mixed, or radioactive waste. This designation means that the southwest corner of the RWMS has a probability of 0.01 (a 100-year event) to be impacted by channelized flow averaging 1 foot of depth and having a velocity of 3 feet per second. The HWSU is not within the 100-year flood hazard of the Barren Wash Alluvial Fan.

Neither the RWMS nor the HWSU are located within the 100-year flood hazard of the Halfpint Alluvial Fan (100-year flow depths 1 foot or greater), but are located in the Zone X area of the Halfpint Alluvial Fan (100-year flow depths less than 1 foot). This study determined that 100-year flow from the Scarp Canyon Alluvial Fan does not impact the RWMS or HWSU. Appendix B contains the output of the FAN model results.

The review of field data; topographic, geologic, and surficial maps; and aerial photographs does not invalidate the assumptions of the FEMA Alluvial Fan Methodology. However, other methods for determining flood hazards in arid regions are currently being developed. At the time of the writing of this report, none of these other methods have been adopted by FEMA; therefore, the FEMA methods were the only methods used. For example, French (1992) argues that the FEMA assumption of an uniform probability of a channel being formed on any given contour may not be valid. As a result of analyzing channel orientation of over 90 alluvial fans in the United States, French found that fanhead channels tend to form along or near the centerline of alluvial fans (an imaginary line which bisects the alluvial fan from the apex to the toe of the alluvial fan). In his study, French modified the FEMA Alluvial Fan Methodology to incorporate this tendency. Using French's approach, the flood hazard potential from the Barren Wash Alluvial Fan is less than the potential determined from the FEMA methodology because the RWMS is located adjacent to the north boundary of the fan.

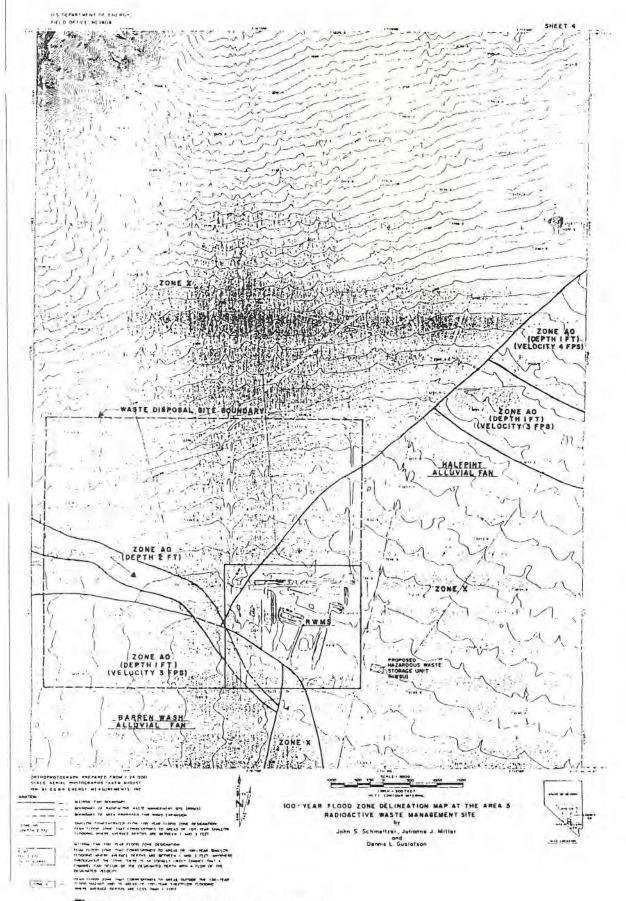


Figure 12. Orthophoto With Fans (Sheet 4)

## 4.2.2 Shallow Concentrated Flooding

Results of the HEC-2 analysis for the watercourses draining subbasins MM2 and HP1A&B estimated the 100-year flow depths at 2 feet. The southwest corner of the site is also located within the 100-year flood hazard of this drainage, and is designated as Zone AO; depth 2 feet (Figure 11 and Sheet 3). Again, this portion of the RWMS is not used for disposal of waste and is not included in the RCRA Part B Permit Application for the Area 5 RWMS. Appendix C contains the output of the HEC-2 model, the workmap, and cross sections used to analyze this drainage.

#### 4.2.3 Sheetflow

FEMA (1991) usually describes areas that experience sheetflow as Zone X (an area of flooding with depths less than 1 foot). Calculations to determine the average 100-year depths for sheetflow areas support this assertion. Calculated depths within the proposed RWMS boundary and the HWSU were all less than 1 foot. These facilities are not in a 100-year flood hazard from flow draining from the Massachusetts Mountains/Halfpint Range. Appendix D contains the calculations used to estimate the depth of flow in sheetflow regions.

Several measures were taken to assure that this flood assessment would be as conservative as reasonable. Discharges were calculated using a "state-of-the-art" approach for this region (i.e., CCRFCD Manual). All flow barriers such as roads, structures and existing nonengineered dikes were ignored to assume that all flow could reach the RWMS. The entire area was assumed to be prone to flooding and was delineated as an area of equal risk because of the inability to distinguish channels from the available topographic maps.

A Zone X designation is somewhat misleading. Although FEMA requires flood protection only for areas listed as Zone AO, a flood hazard must still be recognized within a Zone X. The sheetflow region to the north of the RWMS contains channels which range in depth up to 3 feet. FEMA (1991) states that discharge in sheetflow regions must be spread equally over the entire surface area. To the north of the RWMS, this results in average flow depths of less than 1 foot, and thus the designation of Zone X. Field observations of channels within this region indicate that flows greater than 1 foot could occur in these channels during a 100-year flood. Any type of flood protection design criteria must address the potential of channelized flow for this area.

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# **HEC-1 MODEL OUTPUT**

FILENAME: RWMSCN.OUT

(100-YEAR MODEL)

FLOOD HYDROGRAPH PACKAGE (HEC-1) SEPTEMBER 1990 VERSION 4.0

RUN DATE 01/29/1993 TIME 21:56:35

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

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAM77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE; NEW FINITE DIFFERENCE ALGORITHM

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15	PC	13.0	13.0	13.0	13.3	14.0	14.2	14.8	15.8	17.2	18.1
16	PC	19.0	19.7	19.9	20.0	20.1	20.4	21.4	22.9	24.1	24.9
17	PC	25.1	25.6	27.0	27.8	28.1	28.3	29.5	32.2	35.2	40.9
18	PC	49.9	59.0	71.0	74.4	78.1	81.2	81.9	83.5	85.1	85.6
19	PC	86.0	86.8	87.6	88.8	91.0	92.6	93.7	95.0	97.0	97.6
20	PC	98.2	98.5	98.7	98.9	99.0	99.3	99.3	99.4	99.5	
21	PC	99.8	99.9	100.0	,	77.0	77.3	77.3	77.4	77.5	99.8
22	JD	1.55	1	100.0							
23	JD	1.38	9.99								
23				DICTRIBUT			0.00 22 24	1-0-110	NO STREET		
24	10	HANGED RA	INFALL	DIZIKIBUI	TON ABOV	E 10 50.	MILES P	R CLARK	COUNTY	MANUAL	
25	JD		10.01	4.2	1.000	20.0	54.7	55.75	A 3.5.5.		
25	PC	0	2.0	5.9		11.0	14.4	15.0	16.0	16.8	17.1
26	PC	18.0	18.2	18.7	19.0	19.7	20.2	21.0	22.0	23.0	24.1
27	PC	25.0	25.9	26.5	28.0	29.0	30.0	30.5	30.9	31.0	31.7
28	PC	32.1	32.7	33.3	34.6	36.1	38.1	40.8	43.0	47.7	51.4
29	PC	56.1	63.0	71.0	72.0	73.1	75.2	77.9	79.0	79.5	80.4
30	PC	81.0	82.0	82.6	84.0	85.9	88.9	91.0	93.8	96.6	97.0
31	PC	97.4	97.9	98.1	98.3	98.5	98.9	99.0	99.2	99.3	99.6
32	PC	99.7	99.9	100.0		1505	1.00			35.2	77.0
33	JD	1.26	20	0.000							
34	JD	1.18	30								
35	JD	1.09	50								
36	JD	.96	100								
30	30	. 70	100								
37	VV.	MMTA									
	KK		00000	ries de San	10 Tree 1		And State of the Control				
38	KM	Basin I	unott c	alculatio	n for Ma	ess. Moun	tains 1A				
39	BA	.9	795								
40	LS		80								
41	UD	.31									
42	KK	BW1									
43	KM		runoff	calculat	ion for	Farrer II	lach 1				
44	BA	60.5		COLCUIBL	1011 101	parien w	dall I				
45	LS	00.3	83								
46		2 1	03								
40	UD	2.1									

```
47
48
49
50
51
               KK
                       BW2
               KM
                       Basin runoff calculation for Barren Wash 2
               BA
                      20.8
               LS
               UD
                        .9
52
53
54
               KK
                     BW182
                     Combined BW1 and BW2
               HC
55
               KK
56
57
                    Combine 8W1, BW2, and MM1A (assume dischaarge of Barren Wash "active apex")
               KM
58
               KK
59
               KM
                      Basin runoff calulation for Mass. Mountains 18
                    Flow was not combined with BW APX because flow from this watershed
                   will not directly impact RWMS wereas a channel migration at the apex could impact the RWMS
               .
60
               BA
                       2.1
61
                       .48
62
               UD
63
               KK
                      MM2
64
               KM
                      Basin runoff calculation for Mass. Mountains 2
               BA
                       1.4
66
                                 79
               LS
                       .47
67
               UD
               KK
68
                      HP1A
69
70
                      Basin runoff calculation for Half Pint Range 1A
               BA
                        .8
71
72
               LS
                                 85
                       .48
73
74
75
               KK
                    RICPA
                     Route Flow from HP1A to CPA
               KM
76
77
78
79
               KK
                      Basin runoff calculation for Half Pint Range 1B
               KM
               BA
                       1.0
               LS
                                 78
80
                       .51
81
               KK
                       HP2
82
               KH
                      Basin runoff calculation for Half Pint Range Z
83
               BA
                      1.2
84
               LS
                                 78
85
               UD
                       .51
86
               KK
                      Combine MMZ, routed HP1A, HP1B, HP2
87
               KM
88
               HC
89
               KK
90
91
                       (CPB) Basin runoff calculation for Half Pint Range 3 1.7
               KM
               BA
92
               LS
                                 82
93
               UD
                       .59
94
               KK
                      CPA2
95
                      Combine HP3 with flow from CPA1
96
               HC
97
98
99
100
                       (CPC) Basin runoff calculation for Half Pint Range 4
               KM
               BA
                       3.3
               LS
101
                       .52
               UD
102
               KK
                       HP5
103
               KM
                       Basin runoff calculation for Half Pint Range 5
104
               BA
                       1.2
105
               LS
                                 79
106
               UD
                        .3
107
               KK
                       HP6
                       Basin runoff calculation for Half Pint Range 6
108
               KM
109
               BA
                       2.2
110
               LS
                                 80
               UD
                       .55
112
113
114
               KK
                     RTCPD
               KM
RM
                      Route HP6 to CPD
                         5
                                .27
                                          .2
```

```
KK
KM
BA
LS
UD
115
116
                             Basin runoff calculation for Half Pint Range FA
                             .3
118
                             .33
120
121
122
                   KK
KM
HC
                             CPD
                            Combine HP5, routed HP6, and HPFA
123
124
125
                   KK
                            Route flow from CPD to CPE
8 .39 .2
                   KM
126
127
128
129
                   KK
                            Basin runoff calculation for Half Pint Range FB
1.6
                   KM
BA
LS
UD
130
                            .44
131
132
133
                   KK
                   KM
                           Combine HP4 (CPC) with routed flow from CPD, and HPFB
134
135
136
                   KK
                           Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
                   KM
HC
                  KK SC1
KM Basin runoff calculation for Scarp Canyon 1

* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA 39.4

82
137
138
139
140
142
143
144
145
146
147
                   KK
                            SCZ
                   KM
BA
LS
                            Basin runoff calculation for Scarp Canyon 2
                            1.5
                            .48
                   UD
                   22
```

LINE	(V) ROUTI		RAM OF STREAM		P FLOU		
NO.	(.) CONNE		(<) RETUR				
37	MM1A		, , , , , , , , , , , ,	OF DIVERT	ED OR PUMPED	FLOW	
42	- 8	BW1					
			0				
47			BW2				
Ξ.		- 0					
52		BW182					
55	BW APX						
58		MM18					
	- 2						
63			SMM2				
			1.3				
68		10.1	- 10	HP1A			
		39	-	V			
73			- 7	RTCPA			
		•	-				
76	- 2			•	HP1B		
	- 6	*		- 5	Nr 15		
81							
				-		HP2	
86		:	CPA1				
	1.5	- 1	9. 7. 1. 1. 1.	*********		*******	
89	11.			ND7			
				HP3			
94		•	CPA2				
		:					
97				826			
		1		HP4			
102		•	- 92				
102					HP5		
107		14			1.2		
107		- 5	•	198.1		HP6	
	7.			19	•	V	
112	•	1.4				RTCPD	
		3	•				
115	•	. 45	1 25		3.5		HPI
	- 2			2	39.		ne i
120					CPD	•	
		1.	1.0		ν		
123				•	V		
	1.6-1		100	:	RTCPE		
126	*						
						HPFB	
131	-	0.0					
	3	-	9.4	CPE	**********		
134			0.20				
134	3.	-	CPF				
422			100				
137		196		SC1			
	-		-				
142							

FLOOD HYDROGRAPH PACKAGE (HEC-1) SEPTEMBER 1990 VERSION 4.0

RUN DATE 01/29/1993 TIME 21:56:35 \*

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

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FLOOD ASSESSMENT FOR RUMS JOB #:51056 FILE: RWMS.DAT
100-YEAR 6-HOUR STORM 1.6 INCHES
POINT RAINFALL VALUES FORM NOAA ATLAS 2 VOL VII
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RUMS

11 10 OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL

OSCAL D. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN 3 MINUTES IN COMPUTATION INTERVAL 1DATE 1 0 STARTING DATE 1TIME 0000 STARTING TIME NO 300 NUMBER OF HYDROGRAPH ORDINATES NDDATE 1 0 ENDING DATE

NDDATE 1 0 ENDING DATE
NOTIME 1457 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .05 HOURS TOTAL TIME BASE 14.95 HOURS

ENGLISH UNITS

DRAINAGE AREA SQUARE MILES PRECIPITATION DEPTH INCHES LENGTH, ELEVATION FEET

FLOW CUBIC FEET PER SECOND STORAGE VOLUME ACRE-FEET

SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

13 JD INDEX STORM NO. 1

STRM 1.60 PRECIPITATION DEPTH TRDA .01 TRANSPOSITION DRAINAGE AREA

14 PI	DOECIDITAT	ION PATTERN								
	1.20 .36 .18 .54 .18 .30 1.62 2.04 .30 .96	1.54 .24 .26 .54 .32 .48 1.68 2.10 .28 .86 .16	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78	1.02 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36
22 JD	INDEX STORM STRM TRDA	NO. 2 1.55 1.00		TATION DEF	тн		.02	.00	.06	.06
Û PI	PRECIPITAT 1.20 .36 .18 .54 .18 .30 1.62 2.04 .30 .96 .18	10N PATTERN 1.54 .24 .26 .54 .32 .48 1.68 2.10 .28 .86 .16	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66 .12	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74 .12	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	1.02 .00 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56 .92	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36 .18	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36 .06	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36

23 JD	INDEX STORM NO. 3 STRM 1.38 TRDA 9.99	PRECIPITATION DEP TRANSPOSITION ORA	TH INAGE AREA			
0 PI	PRECIPITATION PATTERN 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	. 24	.00 .12 .42 .90 .48 3.42 5. 1.86 .48	.02 1.10 .00 .00 .36 .44 .12 .10 .72 .64 .18 .16 .40 5.42 .42 .60 .48 .56 .20 .92 .06 .10	1.26 1.06 .00 .00 .60 .76 .06 .06 .48 .24 .12 .52 5.46 6.62 .96 .96 .72 1.12 .36 .36 .18 .06	.96 .84 .06 .12 .72 7.20 .96 1.32 .36
24 JD	INDEX STORM NO. 4 STRM 1.38 TRDA 10.01	PRECIPITATION DEP	TH INAGE AREA			
25 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 1.62 .48 .28 .42 .34 .54 .54 .30 .26 .36 .64 2.82 2.42 .66 1.06 .36 1.54 .12 .12	.18 .30 .54 .24 .78 2.22 2. 1.26 1. .60 1.68 1.	.90 1.00	2.04 .92 .12 .24 .60 .60 .90 .70 .42 .30 1.20 1.48 4.14 4.58 4.66 .42 .84 1.04 .24 .24 .24 .12	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
33 JD	INDEX STORM NO. 5 STRM 1.26 TRDA 20.00	PRECIPITATION DEPTRANSPOSITION DRA	TH INAGE AREA			172
ÖPI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	.48 .28 .42 .34 .54 .54 .30 .26 .36 .64	.30 .54 .24 .78 2.22 2. 1.26 1. .60 1.68 1.	.54 .40 .48 .52 .36 .54 .06 .18 .90 1.00 .82 3.26 .62 1.30 .36 .52 .68 1.20	2.04 .92 .12 .24 .60 .60 .90 .70 .42 .30 1.20 1.48 4.14 4.58 4.14 4.58 4.66 .42 .84 1.04 .24 .24 .24 .12	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24 .06
34 JD	INDEX STORM NO. 6 STRM 1.18 TRDA 30.00	PRECIPITATION DEP	TH INAGE AREA			
O PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	.36 .64	.18 .30 .54 .24	.36 .54	2.04 .92 .12 .24 .60 .60 .90 .70 .42 .30 1.20 1.48 4.14 4.58 4.66 .42 .84 1.04 .24 .24 .24 .12	.60 .24 1.62 4.80 .30 1.14 .24
35 JD	INDEX STORM NO. 7 STRM 1.09 TRDA 50.00	PRECIPITATION DEP TRANSPOSITION DRA	TH			
O PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 1.62 .48 .28 .42 .34 .54 .54 .30 .26 .36 .64 2.82 2.42 .66 1.06 .36 .52 1.26 1.54	1.26 1.38 .30 .54 .24 .78 2.22 2 1.26 1.68 1.12 .18	.80 1.88 .54 .40 .48 .52 .36 .54 .06 .18 .90 1.00 .82 3.26 .62 1.30 .36 .52 .68 1.20 .12 .16 .06 .08	2.04 .92 .12 .24 .60 .60 .90 .70 .42 .30 1.20 1.48 4.14 4.58 .66 .42 .84 1.04 .24 .24 .24 .12	1.62 4.80 .30 1.14

36 JD	INDEX STORM STRM TRDA	NO. 8 .96 100.00	PRECIP TRANSPO	ITATION DEF	PTH VINAGE AREA					
O PI	PRECIPITAT 1.20 .60 .18 .66 .60 .36 1.32 .54 1.80 .30	1.58 1.58 1.56 2.6 2.62 .50 .36 1.82 .62 .48 1.62 .24	2.34 .48 .42 .54 .30 .36 2.82 .66 .126 .12	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54 .12	1.26 .18 .30 .54 .78 2.22 1.26 .60 1.68 .12 .18	1.80 .54 .48 .36 .06 .90 2.82 1.62 .36 1.68	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20 .16	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24 .06

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

TIME OF MAX STAGE

	005041100	CTATION	PEAK	TIME OF	AVERAGE F	LOW FOR MAXII	HUM PERIOD	BASIN	MUMIXAM
•	OPERATION	STATION	FLOW	PEAK	6-HOUR	24 - HOUR	72 - HOUR	AREA	STAGE
	HYDROGRAPH AT	MM1A	174.	3.80	30.	12.	12.	.90	
+	HYDROGRAPH AT	BW1	1786.	6.35	961.	405.	405.	60.50	
	HYDROGRAPH AT	BW2	1016.	5.40	389.	156.	156.	20.80	
	2 COMBINED AT	BW1&2	1848.	5.95	1003.				
	2 COMBINED AT					421.	421.	81.30	
*	HYDROGRAPH AT	BW APX	1841.	5.95	1004.	421.	421.	82.20	
		MM1B	200.	4.05	47.	19.	19.	2.10	
+	HYDROGRAPH AT	MMZ	184.	4,00	41.	16.	16.	1.40	
	HYDROGRAPH AT	HP1A	200.	3.95	42.	17.	17.	.80	
	ROUTED TO	RTCPA	190.	4.40	42.	17-	17.	.80	
	HYDROGRAPH AT	HP1B	116.	4.05	27.	112	11.	1.00	
	HYDROGRAPH AT	HPZ	136.	4.05	32.	13.	13.	1.20	
	4 COMBINED AT	CPA1	459.	4.15	120.	48.	48.	4.40	
	HYDROGRAPH AT	нР3	263.	4.10	64.	26.	26.	1.70	
+	2 COMBINED AT	CPA2	659,	4.15	170.	68.	68.	6.10	
	HYDROGRAPH AT	HP4	360.	4.05	86.	35.	35,	3.30	
*	HYDROGRAPH AT	NP5	206.	3.80	36.	14.	14.	1.20	
•	HYDROGRAPH AT	HP6	277.	4.10	67.	27.	27.	2.20	
	ROUTED TO	RTCPD	268.	4.35	67.	27.	27.	2.20	
*	HYDROGRAPH AT	HPFA	41.	3.85	8.	3.	3.	.30	
	3 COMBINED AT	CPD	333.	4.25	99.	40.	40.	3.70	100
	ROUTED TO	RTCPE	326.	4.65	99.	40.	40.	3.70	
	HYDROGRAPH AT	HPFB	167.	4.00	37,	15.	15.	1.60	
*	3 COMBINED AT	CPE	603.	4.20	191.	77.	77.	8.60	
	2 COMBINED AT	CPF	878.	5.15	301.	121.	121.	14.70	
	HYDROGRAPH AT	SC1	1251.	6.35	673.	283.	283.	39.40	
	HYDROGRAPH AT	202							
2		scs	151.	4.05	35.	14.	14.	1.50	

# **HEC-1 MODEL OUTPUT**

FILENAME: RWMS.OUT
(100-YEAR MODEL)

FLOOD HYDROGRAPH PACKAGE (HEC-1) SEPTEMBER 1990 VERSION 4.0

RUN DATE 01/29/1993 TIME 21:59:18 .

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

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

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

1	10	FL000 /	ASSESSME	NT FOR RW	MS JOB #	¥:51056	FI	LE: RUA	SCN.DAT		
23456789	10	100-AE	AR 6-HOU	R STORM 1	.6 INCHE	S					
3	10	POINT I	RAINFALL	VALUES F	ROM NOA	ATLAS 2	VOL VII				
4	10	DEPTH-	AREA RED	UCTION FA	CTORS FR	OM TARLE	502 IN				
2	ID	CLARK	COUNTY H	YDROLOGIC	CRITERI	A AND DE	RAINAGE DE	SIGH MO	DOEL (CCR	FCD . 199	201
6	10	CORVE	YUMBERS	DETERMINE	DUSING	TABLE AL	12 IN CCDE	m 100	00	C - V.A.	
7	10	LAG III	MES DETE	RMINED US	ING MET	HOO IN SE	CTION ANA	3 1M (	CRECO 1	990	
8	ID	UKAINA	GE AREAS	FROM 7.5	MINUTE	AND 15 A	AIMUTE OUR	ne	Service Services		
	10	THIS MO	DOEL ADD	RESSES DR	AINAGES	THAT COL	H.D. IMPACT	THE PL	MS		
10	*D1	ADJUSTE AGRAM	ED CURVE	NUMBERS	BY 5 TO	ACCOUNT	FOR MOIST	ER SOIL	S DURING	THE 100	-YR EV
11	17	3	0	0	300						
12	10	5									
13	110	- 5									
14	JD	1.6	.01								
	e R	AINFALL D	ISTRIBU	TION FROM	CI APK C	WINTY ME	NUAL LESS	THAN .	0 00 41		
15	PC	0	2	5.7	7.0	8.7	10.8	12.4	13.0		
16	PC	13.0	13.0	13.0	13.3	14.0	14.2	14.8		13.0	13.0
17	PC	19.0	19.7	19.9	20.0	20.1			15.8	17.2	18.1
18	PC	25.1	25.6	27.0	27.8	28.1	20.4	21.4	22.9	24.1	24.9
19	PC	49.9	59.0	71.0	74.4	70 1	28.3	29.5	32.2	35.2	40.9
20	PC	86.0	86.8			78.1	81.2	81.9	83.5	85.1	85.6
21	PC	98.2		87.6	88,8	91.0	92.6	93.7	95.0	97.0	97.6
22			98.5	98.7	98.9	99.0	99.3	99.3	99.4	99.5	99.8
23	PC	99.8	99.9	100.0							244,25
24	1D	1.55	1								
24	סנ	1.38	9.99								
	. C	HANGED RA	INFALL I	DISTRIBUT	ION ABOY	E 10 SQ.	MILES PE	R CLARK	COUNTY	MANUAL	
25	10	1.20	10.01						444010	7.103.00	
26	PC	0	2.0	5.9	8.0	11.0	14.4	15.0	16.0	16.8	17.1
27	PC	18.0	18.2	18.7	19.0	19.7	20.2	21.0	22.0	23.0	24.1
28	PC	25.0	25.9	26.5	28.0	29.0	30.0	30.5	30.9	31.0	31.7
29	PC	32.1	32.7	33.3	34.6	36.1	38.1	40.8	43.0	47.7	
30	PC	56.1	63.0	71.0	72.0	73.1	75.2	77.9	79.0	79.5	51.4
31	PC	81.0	82.0	82.6	84.0	85.9	88.9	91.0	93.8	96.6	80.4
32	PC	97.4	97.9	98.1	98.3	98.5	98.9	99.0	99.2		97.0
33	PC	99.7	99.9	100.0	.0.5	70.5	70.7	99.0	77.2	99.3	99.6
34	JD	1.26	20	100.0							
35	JD	1.18	30								
36	JD	1.09	50								
37	JD	.96	100								
	0.0	. 70	100								
38	KK	MMTA									
39	KM		Acres 3	Design Date			J. W				
40	BA	.9	Unott C	alculation	u tor wa	iss. Mour	itains 1A				
41		. 4									
42	LS	44	85								
	UD	.31									
43	KK	BW1									
44	KM	Basin	runoff	calculat	ion for	Barren L	ack 1				
45	BA	60.5	- 5-20-E-1		191	COLL CIT I	4311				
46	LS	24.5	88								
47	UD	2.1	00								
2.0											

```
48
49
50
51
               KK
                      BW2
               KM
                      Basin rumoff calculation for Barren Wash 2
               BA
                     20.8
               LS
52
                        .9
               UD
53
54
55
                    BW182
               KK
                    Combined 8W1 and BW2
              KM
56
57
58
              KM
                    Combine BW1, BW2, and MM1A (assume dischaarge of Barren Wash "active apex")
59
              KK
              KM
60
                     Basin runoff calulation for Mass. Mountains 18
                   Flow was not combined with BW APX because flow from this watershed
                   will not directly impact RWMS wereas a channel migration at the apex could impact the RWMS
              BA
61
                      2.1
                                 82
62
               15
              UD
                      .48
64
               KK
                      MM2
                     Basin runoff calculation for Mass. Mountains 2
              BA
LS
67
                                 84
                       .47
68
              UD
69
70
              KK
                     HP1A
                     Basin runoff calculation for Half Pint Range 1A
71
72
73
               BA
                       .8
               LS
                                 90
              UD
                       .48
74
               KK
                    RTCPA
                    Route Flow from HP1A to CPA
9 .43 -2
75
76
               RM
77
78
79
               KK
                      Basin runoff calculation for Half Pint Range 1B
               KM
              BA
                      1.0
80
                                 83
                       .51
81
               UD
82
                      HP2
                      Basin runoff calculation for Half Pint Range 2
83
               KM
84
               BA
85
               LS
                                 83
                       .51
86
              UD
87
               KK
                      CPA1
88
                      Combine MM2, routed HP1A, HP1B, HP2
               KM
89
               HC
90
               KK
91
92
                       (CPB) Basin runoff calculation for Half Pint Range 3 1.7
               BA
93
                                 87
               LS
94
                       .59
               UD
95
96
97
               KK
                      CPA2
                      Combine HP3 with flow from CPA1
               HC
98
               KK
               KM
                       (CPC) Basin runoff calculation for Half Pint Range 4
100
               BA
                       3.3
101
               LS
                                 84
                       .52
102
               UD
103
               KK
                       HP5
104
               KM
                       Basin runoff calculation for Half Pint Range 5
105
               BA
                       1.2
106
               LS
107
                        .3
               UD
108
               KK
                       HP6
109
                       Basin runoff calculation for Half Pint Range 6
110
               BA
                       2.2
111
                                 85
                       .55
112
               UD
113
               KK
                     RTCPD
114
               KM
                      Route HP6 to CPD
               RM
                         5
                                .27
```

```
116
117
118
119
                 KK
KM
BA
                         HPFA
                          Basin runoff calculation for Half Pint Range FA
                 LS
                           .33
121
122
123
                  KK
                          CPD
                          Combine HP5, routed HP6, and HPFA
                  KM
124
125
126
                 KK
                        RTCPE
                          Route flow from CPD to CPE
8 .39 .2
                  KM
                 RM
127
128
129
130
131
                 KK
                          Basin runoff calculation for Half Pint Range FB 1.6
                  KM
                 BA
                  LS
                                      82
                          .44
                 UD
132
133
134
                 KM
HC
                         Combine HP4 (CPC) with routed flow from CPD, and HPFB
135
136
137
                 KK
KM
                          CPF
                         Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
138
                 KK
                          SC1
                 KM Basin runoff calculation for Scarp Canyon 1
** Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139
140
                 BA
                         39.4
141
                 LS
                 UD
143
144
145
146
147
148
                 KK
                          SC2
                 KM
                          Basin runoff calculation for Scarp Canyon 2 1.5
                 BA
                          .48
                 UD
```

LINE	(V) ROUTI	NG	(>) DIVER	SION OR PUMP	FLOU		
NO.	(.) CONNE		(<) RETUR			FLOW	
38	MM1A			ii Gillianiania	A TO NAME OF THE PARTY OF THE P	1649	
30							
1.44		4.14					
43	•	BW1					
	- Y.	- 2					
48		•	8MS				
	11.5		7.70				
53	5	BW182.					
			11011111111				
	BU ADV						
56	BW APX						
59		MM1B					
64		- 2	MM2				
		4					
40	7			200			
69		•		HP1A			
	15			v			
74		-4		RTCPA			
	•						
77		1.0			HP1B		
			74				
82						1.72	
DZ.					-	HP2	
		2	100				
87	3.1		CPA1				
		•					
90	-	1.00	L	HP3			
1.2	- 2		1				
-			N. P.				
95			CPA2				
98				HP4			
103	12			•	HP5		
			- 2				
108					4.		
100		10	*	•	•	HP6	
750				1	4.0	v	
113				-		RTCPD	
						•	
116			- 3				HP
	1.0		3			- 4	ne
121			1,4			4	
121				•	CPD		******
					V		
124					RTCPE		
127	120		1.0		1.5	HPFB	
	Q.		15				
132		•		505		4	
122				CPE	*********		
322			- 4				
135			CPF				
	1.0		(*1				
138	- 3		4	SC1			
143	1.0	4			222		
1-3			4.0		SCZ		

\*

RUN DATE 01/29/1993 TIME 21:59:18 .

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

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FLOOD ASSESSMENT FOR RHMS JOB #:51056 FILE: RWMSCN.DAT
100-YEAR 6-HOUR STORM 1.6 INCHES
POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MODEL (CCRFCD, 1990)
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RUMS
ADJUSTED CURVE NUMBERS BY 5 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR EV

	ADJUSTED CURVE	NUMBERS	BY 5 TO A	CCOUNT FOR	MOISTER S	OILS DURIN	IG THE 100-	YR EV	
12 10	OUTPUT CONTROL VARIABLES IPRNT 5 IPLOT 0		NTROL TROL						
11	171ME 0000 NO 300 NDDATE 1 0 NDTIME 1457	STARTING	DATE TIME F HYDROGR ATE IME	ATION INTE					
	COMPUTATION INTERVAL TOTAL TIME BASE	.05 HO							
	STORAGE VOLUME ACRE SURFACE AREA ACRE	C FEET PE							
14 JD	INDEX STORM NO. 1 STRM 1.60	PRECIPIT.	ATION DEP	TH					
	TRDA .01	TRANSPOS	ITION DRA	INAGE AREA					
15 PI	PRECIPITATION PATTERN 1-20 1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
	.36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16	.00 .42 .54 .60 .84 1.80 2.22 .24 .66 .12	.00 .22 .46 .80 .60 2.88 1.98 .40 .74 .12	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	.00 .36 .12 .72 .18 5.40 .42 .48 1.20	.00 .44 .10 .64 .16 5.42 .60 .56 .92	.00 .60 .06 .48 .12 5.46 .96 .72 .36 .18	.00 .76 .06 .24 .52 6.62 .96 1.12 .36 .06	.00 .84 .06 .12 .72 7.20 .96 1.32 .36 .00
23 JD	INDEX STORM NO. 2 STRM 1.55 TRDA 1.00	PRECIPIT. TRANSPOS	ATION DEP	TH INAGE AREA					
O PI	.36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10	.84 1.80 2.22 .24 .66	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74 .12	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	1.02 .00 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56 .92 .10	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36 .18	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36 .06	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36 .00

24 JD	INDEX STORM NO. 3 STRM 1.38 TRDA 9.99	PRECIP	ITATION DEP	TH INAGE AREA						
0 PI	PRECIPITATION PATTERN 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	1.02 .00 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56 .92	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36	
25 JD	INDEX STORM NO. 4 STRM 1.38 TRDA 10.01	PRECIPI	TATION DEP	TH INAGE AREA				025		
26 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68	1.80 .54 .48 .36 .06 .90 2.82 1.62 .36 1.68	1.88 -40 .52 .54 .18 1.00 3.26 1.30 .52 1.20 .16	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .24 1.62 4.80 1.14 .24 .06	
34 10	INDEX STORM NO. 5 STRM 1.26 TRDA 20.00	PRECIPI	TATION DEP	78		100		.00	.00	
0 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12 .18	1.80 .54 .48 .36 .06 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 4.21 1.04 .24	.36 .30 .60 .24 1.62 4.80 1.14 .24	
35 JD	INDEX STORM NO. 6 STRM 1.18 TRDA 30.00	PRECIPI TRANSPO	TATION DEP	TH INAGE AREA				9.5		
0 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12	1.80 .54 .48 .36 .06 .90 2.82 1.62 .36 1.68	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 4.58 4.52 1.04 .24 .12	.36 .30 .60 .24 1.62 4.80 1.14 .24 .06	
36 JD	INDEX STORM NO. 7 STRM 1.09 TRDA 50.00	PRECIPI TRANSPO	TATION DEP	TH INAGE AREA						
0 61	1.32 1.82	2.34 .48 .42 .54 .30 .36 2.82 .66 .126 .12	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54 .12	1.26 .18 .30 .54 .78 2.22 1.26 .60 1.68 .12 .18	1.80 .54 .48 .36 .06 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20 .16	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24 .06	

37 JD	INDEX STORM STRM TRDA	NO. 8 .96 100.00	PRECIPI TRANSPO	TATION DEF	TH INAGE AREA						
, 0 PI	PRECIPITAT 1.20 .60 .18 .66 .60 .36 1.32 .60 .54 1.80 .30	ION PATTERN 1.58 .56 .26 .50 .36 1.82 .48 1.62 .24 .10	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26 .12	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54 .12	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20 .16	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24 .06	

RUNGFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

MAXIMUM STAGE TIME OF MAX STAGE

				3 5 7 5 1	moons, Ant	n in adonne	.,,,,,		
	OPERATION	STATION	PEAK	TIME OF PEAK	AVERAGE F	LOW FOR MAXIN	HUM PERIOD	BASIN	
*	OFERRITOR	3141104	FLOW	PEAR	6-HOUR	24-HOUR	72-HOUR	AREA	
	HYDROGRAPH AT	ни1а	284.	3.75	47.	19.	19.	.90	
*	HYDROGRAPH AT	BW1	3190.	6.15	1762.	745.	745.	60.50	
	HYDROGRAPH AT	BWZ	1645.	4.40	678.	273.	273.	20.80	
*	2 COMBINED AT	8w1&2	3513.	5.75	1943.	817.	817.	81.30	
•	2 COMBINED AT	BW APX	3506.	5.75	1948.	819.	819.	82.20	
*	HYDROGRAPH AT	MM1B	361.	4.00	78.	31.	31.	2.10	
*	HYDROGRAPH AT	MM2	311.	3.95	65.	26.	26.	1.40	
•	HYDROGRAPH AT	HP1A	300.	3.95	62.	25.	25.	.80	
•	ROUTED TO	RTCPA	284.	4.35	62,	25.	25.	.80	
	HYDROGRAPH AT	HP18	200,	4.00	44.	18.	18.	1.00	
+	HYDROGRAPH AT	HP2	235,	4.00	52.	21.	21.	1.20	
+	4 COMBINED AT	CPA1	786.	4.10	194.	78.	78.	4.40	
	HYDROGRAPH AT	нР3	420.	4.10	99.	40.	40.	1.70	
•	2 COMBINED AT	CPA2	1126.	4.10	274.	110.	110.	6.10	
•	HYDROGRAPH AT	HP4	626.	4.00	139.	56.	56.	3.30	
•	HYDROGRAPH AT	HP5	345.	3.75	56.	23.	23.	1.20	
	HYDROGRAPH AT	HP6	465.	4.05	106,	42.	42.	2.20	
*	ROUTED TO	RTCPD	449.	4.30	106.	42.	42.	2.20	
•	HYDROGRAPH AT	HPFA	71.	3.80	12.	5.	5.	.30	
÷	3 COMBINED AT	CPD	570.	4.20	161.	64.	64.	3.70	
+	ROUTED TO	RTCPE	558.	4.55	161.	64.	64.	3.70	
+	HYDROGRAPH AT	HPFB	299.	3.95	61.	25.	25.	1.60	
*	3 COMBINED AT	CPE	1108.	4.15	319.	128.	128.	8.60	
*	2 COMBINED AT	CPF	1462,	4.10	513.	206.	206.	14.70	
	HYDROGRAPH AT	SC1	2178.	6.15	1201.	508.	508.	39.40	
•	HYDROGRAPH AT	scz	269.	4.00	58.	23.	23.	1.50	

<sup>\*\*\*</sup> NORMAL END OF HEC-1 \*\*\*

FILENAME: RWMSW.OUT

(100-YEAR MODEL)

FLOOD HYDROGRAPH PACKAGE (HEC-1) \*
SEPTEMBER 1990
VERSION 4.0 \*
RUN DATE 01/29/1993 TIME 22:01:21 \*\*

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

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

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

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

```
FLOOD ASSESSMENT FOR RWMS JOB #:51056
                                                                                   FILE: RWMSW.DAT
 23
                 ID
                        100-YEAR 6-HOUR STORM 1.6 INCHES
                       POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                 ID
 4
                 ID
                       CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MAUAL (CCRFCD, 1990)
                 ID
                       CURVE NUMBER DETERMINED USING TABLE 602 IN CORFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CORFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RUMS
 6
                 ID
                 10
 8
                 10
                 10
                        ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR E
10
                 ID
                 *DIAGRAM
11
                                       0
                 17
                                                 0
                                                         300
12
                 10
13
                 IN
                 JD 1.6 .01

* RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
PC 0 2 5.7 7.0 8.7 10.8 12.4 13.0 11
14
15
                                                                                       12.4
                                                                                                            13.0
                                                                                                                      13.0
                 PC
                                   13.0
19.7
25.6
16
                                              13.0
                                                                   14.0
                                                                             14.2
                                                                                                  15.8
                                                                                                            17.2
                                                                                                                       18.1
17
                 PC
                         19.0
                                              19.9
                                                        20.0
                                                                   20.1
                                                                             20.4
                                                                                       21.4
                                                                                                            24.1
                                                                                                                      24.9
18
                 PC
                                             27.0
71.0
87.6
                                                                             28.3
                                                                                                  32.2
                                                        27.8
                                                                   28.1
                                                                                                            35.2
85.1
                                                                                                                      40.9
19
                 PC
                         49.9
                                   59.0
                                                                                        81.9
                                                                   78.1
                                                                                                                      85.6
20
21
                 PC
                                   86.8
                         86.0
                                                        88.8
                                                                  91.0
                                                                             92.6
                                                                                        93.7
                                                                                                  95.0
                                                                                                            97.0
                                                                                                                      97.6
                 PC
                         98.2
                                              98.7
                                   98.5
                                                        98.9
                                                                  99.0
                                                                             99.3
                                                                                                            99.5
                                                                                                                      99.8
22
                 PC
                         99.8
                                   99.9
                                            100.0
23
                 JD
                         1.55
                 JD 1.36
* CHANGED R
24
                                   9.99
                                 INFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
25
                 JD
                         1.38
                                  10.01
26
27
28
                 PC
                            0
                                    2.0
                                               5.9
                                                         8.0
                                                                   11.0
                                                                             14.4
                                                                                        15.0
                                                                                                  16.0
                                                                                                            16.8
                                                                                                                      17.1
                         18.0
                 PC
                                   18.2
                                              18.7
                                                        19.0
                                                                   19.7
                                                                             20.2
                                                                                       21.0
                                                                                                                      24.1
                                                                                                  22.0
                                                                                                            23.0
                 PC
                                                                             30.0
                         25.0
                                   25.9
                                              26.5
                                                        28.0
                                                                  29.0
                                                                                                  30.9
                                                                                                            31.0
29
                 PC
                         32.1
                                   32.7
                                              33.3
                                                        34.6
                                                                   36.1
                                                                                        40.8
                                                                                                  43.0
                                                                                                            47.7
                                                                                                                      51.4
30
                 PC
                         56.1
                                   63.0
                                              71.0
                                                        72.0
                                                                   73.1
                                                                                       77.9
                                                                             75.2
                                                                                                  79.0
                                                                                                            79.5
31
                 PC
                         81.0
                                   82.0
97.9
                                              82.6
                                                                   85.9
                                                                             88.9
                                                                                        91.0
                                                                                                  93.8
                                                                                                            96.6
                                                                                                                      97.0
                         97.4
                 PC
                                              98.1
                                                        98.3
                                                                   98.5
                                                                                        99.0
                                                                                                            99.3
                                                                                                                      99.6
33
                 PC
                                   99.9
                                            100.0
34
                 JD
                         1.26
                                      20
35
                 JD
                         1.18
                                      30
                         1.09
36
                 JD
37
                 JD
                          .96
                                     100
38
                 KK
                         MMTA
39
                       Basin runoff calculation for Mass. Mountains 1A
                 KM
                 BA
                           .9
41
                 LS
                                      90
42
                 UD
                          .31
43
                 KK
44
                KM
                          Basin runoff calculation for Barren Wash 1
45
                 BA
                         60.5
46
                 LS
                                      93
                UD
                          2.1
```

```
48
49
50
                 KK
                         BWZ
                 KM
BA
LS
                         Basin runoff calculation for Barren Wash 2
                        20.8
 51
52
                                    90
                           .9
                 UD
 53
54
55
                 KK
                       8¥1&2
                       Combined BW1 and BW2
                 KM
 56
                 KK
                      BW APX
                 KM
HC
 57
                       Combine BW1, BW2, and MM1A (assume dischaarge of Barren Wash "active apex")
 58
 59
                 KK
                        MM1B
                     Basin runoff calulation for Mass. Mountains 1B
flow was not combined with BW APX because flow from this watershed
will not directly impact RLMS wereas a channel migration at the apex
 60
                KM
                      could impact the RWMS
 61
62
63
                 BA
                         2.1
                LS
                                    87
                         .48
 64
65
66
67
                         MH2
                KK
KM
BA
LS
UD
                        Basin runoff calculation for Mass. Mountains 2
                         1.4
 68
                         .47
 69
                 KK
                        HP1A
 70
                        Basin runoff calculation for Half Pint Range 1A
                 KM
 71
                 BA
                          .8
 72
73
                 LS
                 UD
                         .48
 74
                 KK
                       RTCPA
 75
76
                KM
RM
                       Route Flow from HP1A to CPA
 77
78
79
                 KK
                        HP18
                KM
BA
                        Basin runoff calculation for Half Pint Range 1B
                        1.0
 80
                 LS
                                    88
 81
                         .51
                 UD
 82
                 KK
                         HP2
 83
                        Basin runoff calculation for Half Pint Range 2
 84
85
                 BA
                        1.2
                 LS
                                    88
                         .51
 86
                 UD
 87
                 KK
 88
                 KM
                        Combine MM2, routed HP1A, HP1B, HP2
 90
                 KK
 91
92
93
                 KM
                         (CPB) Basin runoff calculation for Half Pint Range 3
                BA
                         1.7
 94
                UD
                         .59
 95
                 KK
                        CPA2
                KM
 96
                        Combine HP3 with flow from CPA1
 97
 98
                 KK
                KM
BA
                         (CPC) Basin runoff calculation for Half Pint Range 4 3.3
 99
100
101
                 LS
                                    89
102
                 UD
                         .52
103
                 KK
                KM
BA
104
                         Basin runoff calculation for Half Pint Range 5
105
106
                 LS
                          .3
107
                UD
                KK
108
                         HP6
109
                         Basin runoff calculation for Half Pint Range 6
110
                BA
                         2.2
                 LS
                                    90
112
                         .55
                UD
                KK
                       RTCPD
                        Route HP6 to CPD
                 KM
                RM
                                  .27
                                             .2
```

```
116
117
118
                          HPFA
                  KK
KM
BA
LS
UD
                           Basin runoff calculation for Half Pint Range FA
119
                            .33
121
122
123
                  KK
                            CPD
                           Combine HP5, routed HP6, and HPFA
                  KM
124
125
126
                  KK
                         RTCPE
                  KM
RM
                           Route flow from CPD to CPE
8 .39 .2
127
                  KK
128
129
130
131
                           Basin runoff calculation for Half Pint Range FB
                  KM
                  BA
LS
UD
                           1.6
                           .44
132
133
134
                  KK
                          Combine HP4 (CPC) with routed flow from CPD, and HPF8
                           CPE
                  KM
135
136
137
                  KM
KM
                          Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
138
139
                  KM Basin runoff calculation for Scarp Canyon 1

Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
140
141
142
                  BA
                          39.4
                                       92
                           2.1
                  UD
143
144
145
                  KK
KM
BA
LS
                           SCZ
                           Basin runoff calculation for Scarp Canyon 2
146
147
148
                                       87
                  UD
                           .48
                  22
```

#### SCHEMATIC DIAGRAM OF STREAM NETWORK

			NETWORK	RAM OF STREAM	MATIC DIAG	SCHE	INPUT
		FLOW	SION OR PUMP	(>) DIVER	NG	(V) ROUTI	LINE
	FLOU			(<) RETUR		(.) CONNE	NO.
	LLOW	ON PONFED				MM1A	38
					BW1	1 2	43
					17.7		
				BW2			48
					BW182		53
				202023000		1.5	
						BW APX	56
					MM1B		59
						1.0	
				MM2		•	64
					4		
			HP1A		G.		69
			٧	4	-		
			RTCPA		8		74
			•	•	-		
		HP1B		45	4		77
		1.5	3.3	•	7		
	HP2		4.3				82
			-7	- LS		1.0	
				CPA1			87
				3.0			0.0
			HP3	119			90
				CPA2		-	95
				1	26	-	
			HP4	03:0	- 9		98
				31		3.	***
		HP5	1.0		•		103
				1			108
	HP6		*	•	1		100
	V		2		- Art		113
	RTCPD	1.	3.74	*			113
	1.	1	15	-	-		116
HP	1.61		•	3			
		7		- 3	146	19.	121
• • • • • •	• • • • • • • • • • • • • • • • • • • •	CPD	2	- 22		7	
	*	v	- 4		1.4		124
		RTCPE	-		4	146	.04
						-	127
	HPFB					4.5	
						1.0	132
		••••••	CPE		18	3	1
			4	CPF	1.0		135
			11834		101		
			SC1	- 4	1067	3	138
			361				

RUN DATE 01/29/1993 TIME 22:01:21 \* \* U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 (916) 756-1104

\*\*\*\*\*\*\*\*

FLOOD ASSESSMENT FOR RWMS JOB #:51056 FILE: RWMSW.DAT
100-YEAR 6-HOUR STORM 1.6 INCHES
POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MAUAL (CCRFCD, 1990)
CURVE NUMBER DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YE ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR E

OUTPUT CONTROL VARIABLES 12 10

IPRHT 5 PRINT CONTROL IPLOT O PLOT CONTROL

QSCAL 0. HYDROGRAPH PLOT SCALE

HYDROGRAPH TIME DATA 17

NHIN 3 MINUTES IN COMPUTATION INTERVAL

IDATE ITIME

O STARTING DATE

0000 STARTING TIME

300 NUMBER OF HYDROGRAPH ORDINATES

0 ENDING DATE

1457 ENDING TIME NDDATE NOTIME 19 CENTURY MARK

COMPUTATION INTERVAL .05 HOURS TOTAL TIME BASE

ENGLISH UNITS

DRAINAGE AREA PRECIPITATION DEPTH SQUARE HILES INCHES

LENGTH, ELEVATION FEET CUBIC FEET PER SECOND ACRE-FEET FLOW

STORAGE VOLUME SURFACE AREA ACRES

TEMPERATURE DEGREES FAHRENHEIT

INDEX STORM NO. 1 14 JD 1.60 PRECIPITATION DEPTH

.06

.06

.06

	STRM TRDA	1.60	TRANSPO	TATION DEP	TH INAGE AREA	-				
15 PI	PRECIPITATIO	N PATTERN								
	1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
	.18	.26	-42	.22	.12	.36	-44	.60	.76	.00
	.54	.54	.54 .60	.46	.42	.12	-10	.06	.06	.06 .12 .72 7.20
	.30	.48	.84	.60	.90	.72	.16	-48	.24	.12
	1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7 20
	2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	7.20
	.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
	.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
	.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
	.06	.06	.06	.14	.18	.00	.02	.06	.06	.06
23 JD	INDEX STORM NO	0. 2								
	STRM	1,55	PRECIPI	TATION DEP	TH					
	TRDA	1.00	TRANSPO	SITION DRA	INAGE AREA					
0 PI	PRECIPITATIO	N PATTERN								
	1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	0.6
	.36	.24	.00	.00	.00	.00	.00	.00	.00	.96
	.18	.26	.42	.22	.12	.36	. 44	.60	.76	.00 .84 .06 .12 .72 7.20
	-54	.54	.54	.46	-42	.12	.10	.06	.06	.06
	.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
	1.62	1.68	1.80	2.88	3.42	. 18	. 16	.12	.52	.72
	2.04	2.10	2.22	1.98	1.86	5.40	5.42	5.46	6.62	7.20
	.30	.28	.24	.40	.48	.48	.56	.96	1.12	.96 1.32
	.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
	.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
	.06	.06	06	14	18	.00	0.2	0.4	.00	.00

14

.02

.06

.06

.06

0 71	PRECIPITATION PATTERN 1.20 1,58 60 ,56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .242 1.06 .52	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12	1.80 .54 .48 .36 .06 .90 2.82 1.62 .36 1.68	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
0 P1	STRM 1.09 TRDA 50.00	PRECIPI TRANSPO	TATION DEF	TH INAGE AREA				,	
6 JD	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10  INDEX STORM NO. 7	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26 .12	1.62 .28 .34 .54 .64 2.42 1.06 .52 1.54 .12	1.26 .18 .30 .54 .78 2.22 1.26 .60 1.68 .12 .18	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20 .16	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24
5 JD	INDEX STORM NO. 6 STRM 1.18 TRDA 30.00	PRECIPI TRANSPO	TATION DES	TH INAGE AREA					
0 91	.18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26 .12	.34 .54 .26 .64	.18	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24	.36 .30 .60 .64 1.62 4.80 .30 1.14 .24
4 JD	INDEX STORM NO. 5 STRM 1.26 TRDA 20.00		TATION DEF SITION DRA	TH INAGE AREA					
6 PI	.18 .26 .66 .62 .60 .50	.42 .54 .30 .36 2.82 .66	.54 .26	1.26 .18 .30 .54 .78 2.22 1.26 .60 1.68 .12 .18	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20 .16	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24
5 JD	INDEX STORM NO. 4 STRM 1.38 TRDA 10.01	PRECIPI TRANSPO	TATION DEF	TH INAGE AREA					
0 PI	.18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66 .12	.22 .46 .80 .60 2.88 1.98	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	1.02 .00 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56 .92 .10	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36 .18	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36
	STRM 1.38 TRDA 9.99	TRANSPO	TATION DEF	INAGE AREA					

37 JD	INDEX STORM STRM TRDA	NO. 8 .96 100.00	PRECIPI	TATION DES	PTH LINAGE AREA					
0 PI	PRECIPITAT	ION PATTERN								
	1.20	1.58 .56 .26	2.34	1.62	1.26	1.80	1.88	2.04	.92	.3
	.60 .18 .66 .60 .36	.26	42	.34	.30	.48	.52	.12	.60	.3
	.66	.62	.54 .30 .36 2.82	.34	.54	.48	.54 .18 1.00 3.26	.90	.70	. 6
	.60	.36	.30	.26	.24	.06 .90 2.82	.18	.42	.30	1.6
	1.32	1.82	2 82	2.42	2.22	2.90	1.00	1.20	1.48	1.6
	.60 .54 1.80 .30	-62	.66	1.06	1.26	1.62	1.30	4.14	4.58	4.8
	.54	.48	.66	.52	.60	.36	.52	.84	1.04	1.1
7	1.80	1.62	1.26	1.54	1.68	1.68	1.20	.66 .84 .24	.24	.2
	.12	.24	.12	.12	.12	.12	.16	.24	.12	.0
	. 12	.10	.06	-14	.18	.06	.08	-12	.08	.0

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

				2000	215016 One	A THE DECIME					
	OPERATION	STATION	PEAK	TIME OF PEAK	AVERAGE F	LOW FOR MAXI	MUM PERIOD	BASIN	MAXIMUM	TIME OF	
+	-12.000(1931	63733.1971	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	CEAR	6-HOUR	24-HOUR	72-HOUR	AREA	STAGE	MAX STAGE	
*	HYDROGRAPH AT	MM1A	426.	3.75	70.	28.	28.	.90			
	HYDROGRAPH AT	BW1	5241.	6.00	2989.	1289.	1289.	60.50			
	HYDROGRAPH AT	BW2	2759.	4.35	1102.	445.	445.	20.80			
	2 COMBINED AT	BW1&2	6018.	5.65	3425.	1462.	1462.	81.30			
+	2 COMBINED AT	BW APX	6014.	5.65	3441.	1469.	1469.	82.20			
+	HYDROGRAPH AT	MM18	580.	3.95	120.	48.	48.	2.10			
	HYDROGRAPH AT	MMZ	477.	3.95	98.	39.	39.	1.40			
	HYDROGRAPH AT	HP1A	423.	3.90	91.	37.	37.	.80			
	ROUTED TO	RTCPA	401.	4.35	91.	37.	37.	.80			
+	HYDROGRAPH AT	KP18	309.	4.00	66.	27.	27.	1.00			
	HYDROGRAPH AT	HP2	365.	4.00	78.	32.	32.	1.20			
	4 COMBINED AT	CPA1	1229.	4.05	298.	120.	120.	4.40			
	HYDROGRAPH AT	нР3	624.	4.05	148.	59.	59.	1.70			
	2 COMBINED AT	CPAZ	1757.	4.05	423.	170.	170.	6.10			
4	HYDROGRAPH AT	HP4	984.	4.00	214.	86.	86.	3.30			
•	HYDROGRAPH AT	HP5	526.	3.75	85.	34.	34.	1.20			
4.	HYDROGRAPH AT	HP6	711,	4.00	160.	64.	64.	2.20			
	ROUTED TO	RTCPD	689.	4.30	160.	64.	64.	2.20			
	HYDROGRAPH AT	HPFA	110.	3.80	19.	8.	8.	.30			
+	3 COMBINED AT	CPD	884.	4.15	246.	99.	99.	3.70			
	ROUTED TO	RTCPE	868.	4.50	246.	99.	99.	3.70			
+	HYDROGRAPH AT	HPFB	476.	3.90	94.	38.	38.	1.60			
+	3 COMBINED AT	CPE	1819.	4.10	502.	202.	202.	8.60			
•	2 COMBINED AT	CPF	2396.	4.05	820.	330.	330.	14.70			
	HYDROGRAPH AT	SC1	3498.	6.00	1988.	855.	855.	39.40			
4	HYDROGRAPH AT	sc2	427.	3.95	89.	36.	36.	1.50		-	

<sup>\*\*\*</sup> NORMAL END OF HEC-1 \*\*\*

FILENAME: RWMSC.OUT
(100-YEAR MODEL)

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

RUN DATE 01/29/1993 TIME 22:03:06 \*

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

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X	×	XXXXXXX	XX	XXX		×
X	X	X	X	X		XX
X	X	X	X			X
X	XXXXXX	XXXX	X		XXXXX	X
X	X	X	X		011114110	X
X	X	X	X	X		X
X	X	XXXXXXX	XX	XXX		XXX

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

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

1	10	FLOOD /	ASSESSME	NT FOR RM	MS JOB A	:51056	F	LE: RW	SC.DAT		
2 3 4 5 6 7 8 9	ID	100-YE	AR 6-HOUR	STORM 2	.43 INCH	FS					
3	ID	POINT	RAINFALL	VALUES F	ROM NOAA	ATLAS 2	VOL VII				
4	10	ADJUST	ED RAINFA	ALL PER C	DRRECTIO	N FACTOR	IN TARLE	501 OF			
5	ID	CLARK (	COUNTY H	POROLOGIC	CRITERI	A AND DE	ATNACE DE	SICH MA	MILAI /CC	DECT 10	0001
6	10	DEPTH-	AREA DEDI	JCTION FA	CTOPE ED	OM TARLE	502 141	SIUN MA	TOOME (CL	AFCD, 19	A03
7	10	CHIPME !	WINDERS !	ETERMINE	CIUNS IN	TARLE CO	302 IN 0	CKFW,	1990		
	10	LAC TI	HOMOEKS I	PETERMINE	DOLME	TABLE OU	Z IN CCKI	CD, 195	70	Sub.	
0	0.00	CAG III	MES DETE	MINED US	ING MEIN	DO IN SE	CITON 608	5.3 IN C	CRFCD, 1	990	
	10	UKATNA	GE AKEAS	FROM 7.5	MINUTE	AND 15 M	INUTE QUA	IDS			
10	10	AGRAM	ODEL ADDI	RESSES DR.	AINAGES	THAT COU	LD IMPACT	THE RE	MS		
11	IT	3	0		700						
12	7.0	5	U	0	300						
	01										
13	IN	5	0.0								
14	JD	2.43	.01								
	* R/	AINFALL (	DISTRIBU	TION FROM	CLARK C	AM YTHUO	NUAL LESS	THAM T	0 SO MI	IFS	
15	PC	0	2	5.7	7.0	8.7	10.8	12.4	13.0	13.0	13.0
16	PC	13.0	13.0	13.0	13.3	14.0	14.2	14.8	15.8		
17	PC	19.0	19.7	19.9	20.0	20.1	20.4			17.2	18.1
18	PC	25.1	25.6	27.0	27.8	28.1		21.4	22.9	24.1	24.9
19	PC	49.9					28.3	29.5	32.2	35.2	40.9
			59.0	71.0	74.4	78.1	81.2	81.9	83.5	85.1	85.6
20	PC	86.0	86.8	87.6	88.8	91.0	92.6	93.7	95.0	97.0	97.6
21	PC	98.2	98.5	98.7	98.9	99.0	99.3	99.3	99.4	99.5	99.8
22	PC	99.8	99.9	100.0					235.9	4412	22.5
23	JD	2.36	1								
24	JD	2.09	9.99								
	• C	HANGED R	AINFALL I	DISTRIBUT	ION AROL	F 10 SO	MILES DE	D CLADE	COUNTY	MANUAL	
25	JD	2.09	10.01		TON HOUSE		WILLS LE	A CLARK	COUNTY	PANUAL	
26	PC	0	2.0	5.9	8.0	11.0	14.4				22.1
27	PC	18.0	18.2					15.0	16.0	16.8	17.1
28	PC	25.0	10.2	18.7	19.0	19.7	20.2	21.0	22.0	23.0	24.1
20			25.9	26.5	28.0	29.0	30.0	30.5	30.9	31.0	31.7
29	PC	32.1	32.7	33.3	34.6	36.1	38.1	40.8	43.0	47.7	51.4
30	PC	56.1	63.0	71.0	72.0	73.1	75.2	77.9	79.0	79.5	80.4
31	PC	81.0	82.0	82.6	84.0	85.9	88.9	91.0	93.8	96.6	97.0
32	PC	97.4	97.9	98.1	98.3	98.5	98.9	99.0	99.2	99.3	99.6
33	PC	99.7	99.9	100.0	,	,0.5	,0.,	77.0	77.2	77.3	99.0
34	JD	1.92	20	100.0							
35	JD	1.80	30								
36	JD										
37		1.65	50								
31	JD	1.46	100								
38	KK	MM1A									
39	KM		runnéé -	alculatio	n fa- 11.	ne Wei					
40	BA	.9	unot i	or cutatio	II TOT ME	iss, mour	itains lA				
41		. 4	00								
	LS	-	80								
42	UD	.31									
43	KK	BW1									
44	KM		n runnff	calculat	ing for	Parren I	lach 4				
45	BA	60.5		catcutat	TON TOP	odi i en v	idsh i				
46	LS	00.3	83								
	La										
47	UD	2.1	-								

```
48
49
50
51
52
                        BWZ
                KK
                        Basin runoff calculation for Barren Wash 2
                KM
                       20.8
                BA
                LS
                         .9
                UD
 53
                      BW182
                KK
 54
                KM
                      Combined BW1 and BW2
                HC
 56
 57
58
                      Combine BW1, BW2, and MM1A (assume dischaarge of Barren Wash "active apex")
                KM
                HC
 59
                KK
                       MMIB
 60
                KM
                       Basin runoff calulation for Mass. Mountains 1B
                    Flow was not combined with BW APX because flow from this watershed will not directly impact RWMS wereas a channel migration at the apex could impact the RWMS
                9
                BA
                        2.1
 62
63
                LS
                UD
                        .48
 64
65
66
67
                KK
                        MM2
                       Basin runoff calculation for Mass. Mountains 2
                KM
                BA
                        1.4
                                   79
                LS
 68
                        .47
                UD
 69
70
71
72
73
                KK
                       HP1A
                KM
                       Basin runoff calculation for Half Pint Range 1A
                BA
                        .8
                LS
                                   85
                UD
                        .48
 74
75
76
                      RTCPA
                KK
                     Route Flow from HP1A to CPA
                KM
RM
 77
78
79
80
                KK
                       Basin runoff calculation for Half Pint Range 18
                KH
                BA
                                   78
 81
                UD
                        .51
 82
                        HP2
                KK
 83
                       Basin runoff calculation for Half Pint Range 2
                KM
 84
85
                BA
LS
UD
                                   78
 86
                       .51
 87
                KK
 88
                       Combine HMZ, routed HP1A, HP1B, HP2
 89
                HC
 90
                KK
 91
92
                        (CPB) Basin runoff calculation for Half Pint Range 3
                KM
                BA
                        1.7
 93
                                   82
                UD
                        .59
 95
                KK
                       CPA2
 96
97
                       Combine HP3 with flow from CPA1
                HC
 98
                KK
 99
                KM
                        (CPC) Basin runoff calculation for Half Pint Range 4
100
                        3.3
                BA
101
                LS
                                  79
102
                        .52
103
                KK
                        HP5
104
                KM
                        Basin runoff calculation for Half Pint Range 5
105
                BA
                        1.2
106
                LS
107
                UD
                         .3
                KK
108
                        HP6
109
                        Basin runoff calculation for Half Pint Range 6
110
                        2.2
                BA
                LS
                                   80
112
                UD
                        .55
113
                      RTCPD
                       Route HP6 to CPD 5 .27
114
                KH
```

```
116
117
118
                  KK
KM
BA
                           Basin runoff calculation for Half Pint Range FA
                  LS
119
120
                           .33
121
                  KK
                           CPD
                          Combine HP5, routed HP6, and HPFA
                  KM
122
124
                  KK
125
                  KM
RM
                          Route flow from CPD to CPE
8 .39 .2
127
                  KK
                 KM
BA
LS
UD
                          Basin runoff calculation for Half Pint Range FB
128
129
130
131
                           .64
132
133
134
                 KK
KM
HC
                          CPE
                         Combine HP4 (CPC) with routed flow from CPD, and HPFB
135
136
137
                 KK
KM
                         Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
138
139
                  KK
                          SC1
                  KM Basin runoff calculation for Scarp Canyon 1

Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
140
                 BA
141
                 LS
                                      82
                          2.1
                 UD
143
144
145
146
147
                 KK
KM
BA
LS
                          SC2
                          Basin runoff calculation for Scarp Canyon 2
                 UD
                           .48
```

#### SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT	(V) ROUTIN		(>) DIVER		FLOW		
NO.			(<) RETUR			51.001	
		- TOIL	, , , , , , , , , , , , , , , , , , ,	M OF DIVERSE	D OK POMPEU	r L OW	
38	ми1а						
43		BW1					
48		.•	BW2				
53		BW182.					
56	BW APX						
50		ww10					
59		MM18					
41							
64			MM2				
40	•			200			
69	•			HP1A			
7/			5	V			
74	20	10.	-:	RTCPA			
77			-				
77	10		100		HP1B		
			14				
82		•	13			HPZ	
			2.0				
87		15	CPA1			*******	
20	a l	- 12					
90				HP3			
95			CPA2				
22		7					
98		- 3		HP4			
200							
103			4	30	HP5		
No.							
108		1.50		2.	1.0	HP6	
		- 35				V	
113						RTCPD	
			-0.5		3.5	19	
116	-	1.5		- 1			HPFA
121				- 3	CPD		
				- 6	V		555885588
124		7.			RTCPE		
	•						
127	1					HPFB	
		•					
132				CPE			
						******	
135		1	CPF				
	•	-	4,500				
138			*	SC1			
7	-	- 4-		301			
143	•			*	SC2		
2.3					SLZ		

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

RUN DATE 01/29/1993 TIME 22:03:06 \* \*\*\*\*\*\*\*\*\*\* U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

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FLOOD ASSESSMENT FOR RWMS JOB #:51056 FILE: RWMSC.DAT
100-YEAR 6-HOUR STORM 2.43 INCHES
POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
ADJUSTED RAINFALL PER CORRECTION FACTOR IN TABLE 501 OF
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN CCRFCD, 1990
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE DUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

	THIS MODEL ADD	RESSES DRAINAGES	THAT COULD	IMPACT THE	RWMS			
12 10		PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT	SCALE					
17	HYDROGRAPH TIME DATA  NMIN 3 IDATE 1 0 ITIME 0000 NG 300 NDDATE 1 0 NDTIME 1457 ICENT 19	MINUTES IN COMPUSTARTING DATE STARTING TIME NUMBER OF HYDROC ENDING DATE ENDING TIME CENTURY MARK						
	COMPUTATION INTERVAL TOTAL TIME BASE	.05 HOURS						
	PRECIPITATION DEPTH INCH LEMGTH, ELEVATION FEET FLOW CUBI STORAGE VOLUME ACRE SURFACE AREA ACRE	C FEET PER SECOND						
14 JD	INDEX STORM NO. 1 STRM 2.43 TROA .01	PRECIPITATION DE						
15 PI	PRECIPITATION PATTERN 1.20 1.54	2.22 1.26 .00 .00 .42 .22 .54 .46 .60 .80 .84 .60	.78 .00 .12 .42 .90 .48	1.02 .00 .36 .12 .72 .18 5.40	1.10 .00 .44 .10 .64 .16 5.42 .60 .56 .92 .10	.00 .60 .06 .48 .12 5.46	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36 .06	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36 .00
23 JD	INDEX STORM NO. 2 STRM 2.36 TRDA 1.00	PRECIPITATION DI TRANSPOSITION DI		V.				
O PI	PRECIPITATION PATTERN 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	2.22 1.26 .00 .00 .42 .22 .54 .46 .60 .80 .84 .60 1.80 2.88 2.22 1.98 .24 .40 .66 .74 .12 .12	1.86	.36 .12 .72 .18 5.40	1.10 .00 .44 .10 .64 .16 5.42 .60 .56	.00 .60 .06 .48 .12 5.46 .96 .72 .36	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36

24 JD	INDEX STORM NO. 3 STRM 2.09 TRDA 9.99	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
O PI	.18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68	2.22     1.26     .78     1.02     1.10     1.26     1       .00     .00     .00     .00     .00     .00       .42     .22     .12     .36     .44     .60     .60       .54     .46     .42     .12     .10     .06     .60       .80     .90     .72     .64     .48     .8       .84     .60     .48     .18     .16     .12       1.80     2.88     3.42     5.40     5.42     5.46     6       2.22     1.98     1.86     .42     .60     .96       .24     .40     .48     .48     .56     .72     1       .66     .74     .78     1.20     .92     .36       .12     .12     .12     .06     .10     .18	06 .96 00 .00 76 .84 06 .06 24 .12 52 .72 62 7.20 96 .96 12 1.32 36 .36 06 .00
25 JD	INDEX STORM NO. 4 STRM 2.09 TRDA 10.01		
26 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	.48 .28 .18 .54 .40 .12 .42 .34 .30 .48 .52 .60 .54 .90 .30 .26 .24 .06 .18 .42 .36 .36 .54 .90 .36 .26 .24 .06 .18 .42 .36 .36 .54 .90 .100 .120 .1 .20 .282 .242 .222 .282 .3.26 .4.14 .4 .66 .52 .60 .36 .52 .84 .1 .26 .52 .56 .52 .84 .1 .26 .52 .1.26 .1.54 .1.68 .1.68 .1.20 .24 .12 .12 .12 .12 .16 .24	92 .36 24 .30 60 .60 70 .60 30 .24 48 1.62 58 4.80 42 .30 04 1.14 24 .24 12 .06 08 .06
34 JD	INDEX STORM NO. 5 STRM 1.92 TRDA 20.00	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
Q PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34	92 .36 24 .30 60 .60 70 .60 30 .24 48 1.62 58 4.80 42 .30 04 1.14 24 .24 12 .06 08 .06
35 JD	INDEX STORM NO. 6 STRM 1.80 TRDA 30.00	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
O PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	.48 .28 .18 .54 .40 .12 .42 .34 .30 .48 .52 .60 .54 .54 .54 .54 .54 .90 .30 .26 .24 .06 .18 .42 .36 .54 .90 .36 .54 .90 .36 .54 .90 .36 .54 .54 .54 .54 .54 .54 .54 .54 .54 .54	92 .36 24 .30 60 .60 70 .60 30 .24 48 1.62 58 4.80 42 .30 04 1.14 24 .24 12 .06
36 JD	INDEX STORM NO. 7 STRM 1.65 TRDA 50.00	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
O PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	.48 .28 .18 .54 .40 .12 .42 .34 .30 .48 .52 .60 .54 .54 .54 .36 .54 .90 .30 .26 .24 .06 .18 .42 .36 .36 .64 .78 .90 1.00 1.20 1. 2.82 2.42 2.22 2.82 3.26 4.14 4. 66 1.06 1.26 1.26 1.30 .66 .36 .52 .84 1. 1.26 1.54 1.68 1.68 1.20 .24 .12 .12 .12 .12 .16 .24	.92 .36 .24 .30 .60 .60 .70 .60 .30 .24 .48 1.62 .58 4.80 .42 .30 .04 1.14 .24 .24 .12 .06 .08 .06

37 JD	INDEX STORM STRM TRDA	1.46	PRECIP:	TATION DEP	TH INAGE AREA					
Q PI	PRECIPITAT 1.20 .60 .18 .66 .60 .36 1.32 .60 .54 1.80 .30 .12	ION PATTERN 1.58 -56 -26 -62 -50 -36 1.82 -62 -48 1.62 -24 -10	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .78 2.22 1.26 .60 1.68 .12	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	1.88 -40 -52 -54 -18 1.00 3.26 1.30 -152 1.20 -16 -08	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .12 .08	.3 .36 .66 .22 1.66 4.88 .31 .22

# RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE MILES

MAXIMUM STAGE

TIME OF MAX STAGE

				AT-1-14- TIL	IN SADVIE !			
OPERATION	STATION	PEAK	TIME OF	AVERAGE F	LOW FOR MAXIE	HUM PER100	BASIN	
OPERATION	STATION	FLOW	PEAK	6-HOUR	24 - HOUR	72-HOUR	AKEA	
HYDROGRAPH AT	MM1A	467.	3.75	77.	31.	31.	.90	
HYDROGRAPH AT	BW1	4883.	6.15	2699.	1141.	1141.	60.50	
HYDROGRAPH AT	BW2	2778.	4.40	1133.	456.	456.	20.80	
2 COMBINED AT	BW182	5498.	5.75	3049.	1282.	1282.	81.30	
2 COMBINED AT	BW APX	5488.	5.75	3060.	1287.	1287.	82.20	
HYDROGRAPH AT	MM1B	644.	4.00	136.	55.	55.	2.10	
HYDROGRAPH AT	MM2	526.	3.95	108.	44.	44.	1.40	
HYDROGRAPH AT	HP1A	444.	3.95	92.	37.	37.	.80	
ROUTED TO	RTCPA	420.	4.40	92.	37.	37.	.80	
HYDROGRAPH AT	HP18	346.	4.00	75.	30.	30.	1.00	
HYDROGRAPH AT	HP2	407.	4.00	89.	36.	36.	1.20	
4 COMBINED AT	CPA1	1297.	4.05	317.	127.	127.	4.40	
HYDROGRAPH AT	нрз	661.	4.05	156.	63.	63.	1.70	
2 COMBINED AT	CPA2	1827.	4.10	442.	177.	177.	6.10	
HYDROGRAPH AT	нр4	1060.	4.00	233.	94.	94.	3.30	
HYDROGRAPH AT	HP5	582.	3.75	94.	38.	38.	1.20	
HYDROGRAPH AT	KP6	766.	4.05	174.	70.	70.	2.20	
ROUTED TO	RTCPD	741.	4.30	174.	70.	70.	2.20	
HYDROGRAPH AT	HPFA	125.	3.80	21.	9.	9.	.30	
3 COMBINED AT	CPD	945.	4.15	266.	107.	107.	3.70	
ROUTED TO	RTCPE	927.	4.55	266.	107.	107.	3.70	
HYDROGRAPH AT	HPF8	533.	3.95	107.	43.	43.	1.60	
3 COMBINED AT	CPE	1898.	4.10	537.	215.	215.	8.60	
2 COMBINED AT	CPF	2462.	4.05	854.	343.	343.	14.70	
HYDROGRAPH AT	sc1	3438.	6.15	1900.	804.	804.	39.40	
HYDROGRAPH AT	sc2	478.	4.00	101.	41.	41.	1.50	
	HYDROGRAPH AT HYDROGRAPH AT COMBINED AT HYDROGRAPH AT COMBINED AT HYDROGRAPH AT ROUTED TO HYDROGRAPH AT COMBINED AT ROUTED TO HYDROGRAPH AT COMBINED AT ROUTED TO HYDROGRAPH AT COMBINED AT	HYDROGRAPH AT HYDROGRAPH AT HYDROGRAPH AT BW1  COMBINED AT BW182  COMBINED AT BW APX HYDROGRAPH AT CPD HYDROGRAPH AT HP5 HYDROGRAPH AT CPD HYDROGRAPH AT HP6 ROUTED TO RTCPD HYDROGRAPH AT CPD HYDROGRAPH AT CPD HYDROGRAPH AT CPD HYDROGRAPH AT CPD HYDROGRAPH AT CPE	NYDROGRAPH AT HM1A 467.  HYDROGRAPH AT BW1 4883.  HYDROGRAPH AT BW2 2778.  2 COMBINED AT BW182 5498.  2 COMBINED AT BW182 5498.  HYDROGRAPH AT HM1B 644.  HYDROGRAPH AT HM1B 644.  HYDROGRAPH AT HM1B 444.  ROUTED TO RTCPA 420.  HYDROGRAPH AT HP1B 346.  HYDROGRAPH AT HP2 407.  4 COMBINED AT CPAT 1297.  HYDROGRAPH AT HP3 661.  2 COMBINED AT CPAT 1827.  HYDROGRAPH AT HP4 1060.  HYDROGRAPH AT HP5 582.  HYDROGRAPH AT HP6 766.  ROUTED TO RTCPD 741.  HYDROGRAPH AT HP6 766.  ROUTED TO RTCPD 741.  HYDROGRAPH AT HP6 766.  ROUTED TO RTCPD 945.  ROUTED TO RTCPE 927.  HYDROGRAPH AT HP8 533.  3 COMBINED AT CPE 1898.  2 COMBINED AT CPE 1898.  2 COMBINED AT CPE 1898.  HYDROGRAPH AT CPF 2462.  HYDROGRAPH AT CPF 2462.  HYDROGRAPH AT CPF 2462.  HYDROGRAPH AT CPF 3438.	OPERATION         STATION         FLOW         PEAK           HYDROGRAPH AT         MMIA         467.         3.75           HYDROGRAPH AT         BWI         4883.         6.15           HYDROGRAPH AT         BWI         2778.         4.40           2 COMBINED AT         BWI         5498.         5.75           2 COMBINED AT         BWI         5488.         5.75           HYDROGRAPH AT         HMIB         644.         4.00           HYDROGRAPH AT         HPIA         444.         3.95           HYDROGRAPH AT         HPIB         346.         4.00           HYDROGRAPH AT         HPIB         346.         4.00           HYDROGRAPH AT         HPI         346.         4.00           HYDROGRAPH AT         HPI         3661.         4.05           2 COMBINED AT         CPA2         1827.         4.10           HYDROGRAPH AT         HPI         1060.         4.00           HYDROGRAPH AT         HPI         582.         3.75           HYDROGRAPH AT         HPI         1060.         4.00           HYDROGRAPH AT         HPI         125.         3.80           HYDROGRAPH AT         HPI         12	HYDROGRAPH AT HM1A 467. 3.75 77. HYDROGRAPH AT BW1 4883. 6.15 2699. HYDROGRAPH AT BW2 2778. 4.40 1133. 2 COMBINED AT BW182 5498. 5.75 3049. 2 COMBINED AT BW APX 5488. 5.75 3060. HYDROGRAPH AT HM1B 644. 4.00 136. HYDROGRAPH AT HM2 526. 3.95 108. HYDROGRAPH AT HP1A 444. 3.95 92. ROUTED TO RICPA 420. 4.40 92. HYDROGRAPH AT HP1B 346. 4.00 75. HYDROGRAPH AT HP2 407. 4.00 89. 4 COMBINED AT CPA1 1297. 4.05 317. HYDROGRAPH AT HP3 661. 4.05 156. 2 COMBINED AT CPA2 1827. 4.10 442. HYDROGRAPH AT HP4 1060. 4.00 233. HYDROGRAPH AT HP5 582. 3.75 94. HYDROGRAPH AT HP6 766. 4.05 174. ROUTED TO RICPD 741. 4.30 174. HYDROGRAPH AT HP6 766. 4.05 174. ROUTED TO RICPD 741. 4.30 174. HYDROGRAPH AT HPFB 533. 3.95 107. 3 COMBINED AT CPD 945. 4.15 266. HYDROGRAPH AT HPFB 533. 3.95 107. 2 COMBINED AT CPE 1898. 4.10 537. 2 COMBINED AT CPE 1898. 4.10 537. 2 COMBINED AT CPE 1898. 4.10 537. 4 COMBINED AT CPE 1898. 4.10 537.	OPERATION         STATION         FLOW         PEAK         6-HOUR         24-HOUR           HYDROGRAPH AT         HM1A         467.         3.75         77.         31.           HYDROGRAPH AT         BW1         4883.         6.15         2699.         1141.           HYDROGRAPH AT         BW2         2778.         4.40         1133.         456.           2 COMBINED AT         BW APX         5488.         5.75         3049.         1282.           2 COMBINED AT         HM1B         644.         4.00         136.         55.           HYDROGRAPH AT         HM1B         644.         4.00         136.         55.           HYDROGRAPH AT         HP1A         444.         3.95         92.         37.           ROUTED TO         RTCPA         420.         4.40         92.         37.           HYDROGRAPH AT         HP1B         346.         4.00         75.         30.           HYDROGRAPH AT         HP2         407.         4.05         317.         127.           HYDROGRAPH AT         HP3         661.         4.05         156.         63.           2 COMBINED AT         CPA2         1827.         4.10         442.	OPERATION         STATION         FLOW         PEAK         6-HOUR         24-HOUR         72-HOUR           HYDROGRAPH AT HYDROGRAPH AT HYDROGRAPH AT HYDROGRAPH AT SULES         MMIA         467.         3.75         77.         31.         31.           HYDROGRAPH AT SULES         BUI 4883.         6.15         2699.         1141.         1141.         1141.           HYDROGRAPH AT SULES         5498.         5.75         3049.         1282.         1282.           2 COMBINED AT SULES         5498.         5.75         3060.         1287.         1287.           HYDROGRAPH AT HM1B         644.         4.00         136.         55.         55.           HYDROGRAPH AT HM2         526.         3.95         108.         44.         44.           HYDROGRAPH AT HM2         420.         4.40         92.         37.         37.           HYDROGRAPH AT HM2         407.         4.00         89.         36.         36.           4 COHBINED AT CPAI         1297.         4.05         317.         127.         127.           HYDROGRAPH AT HM2         1060.         4.00         233.         94.         94.           HYDROGRAPH AT HM2         1060.         4.00         233.	OPERATION         STATION         FLOU         PEAK         6-HOUR         24-HOUR         72-HOUR           HYDROGRAPH AT         MM1A         467.         3.75         77.         31.         31.         .90           HYDROGRAPH AT         BUT         4883.         6.15         2699.         1141.         1141.         60.50           HYDROGRAPH AT         BUZ         2778.         4.40         1133.         456.         456.         20.80           2 COMBINED AT         BU APK         5488.         5.75         3049.         1282.         1287.         82.20           HYDROGRAPH AT         HM1B         644.         4.00         136.         55.         55.         2.10           HYDROGRAPH AT         HM2         526.         3.95         108.         44.         44.         1.40           HYDROGRAPH AT         HP1A         444.         3.95         92.         37.         37.         .80           HYDROGRAPH AT         HP1B         346.         4.00         75.         30.         30.         1.00           HYDROGRAPH AT         HP2         407.         4.00         89.         36.         36.         1.20           4

<sup>\*\*\*</sup> NORMAL END OF HEC-1 \*\*\*

FILENAME: RWMS10.OUT
(10-YEAR MODEL)

\*

\* RUN DATE 01/29/1993 TIME 22:05:10 \*

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

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X X XXXXXXX XXXXX X XX XXXX X XXXXXXX XXXXX X X X XXXXXXX X XXXXX

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

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

1	10	FLOOD	ASSESSME	NT FOR RW	AS JOR	#-51056	E	LE: RWH	TAG OLE		
2	10	10-YFA	R A-HOUR	STORM 1.	1 10000			LL. KWIT	10.UAT		
2 3 4 5 6 7 8	10	POINT	DATHEALL	VALUE FR	OM NOA	*******					
7		DEDTH	TOTAL SEC	VALUE FRI	UN NUAP	AILASS 2	AOF ATT				
4	ID	DEPIH-	AKEA KED	UCTION FA	CTORS F	ROM TABLE	502 IN				
5	ID.	CLARK	COUNTY H	YDROLOGIC	CRITER	IA AND DR	AINAGE DE	SIGN MAI	WAL (CC	RECD. 19	1000
6	10	CURVE	NUMBERS !	DETERMINE	USING	TARLE 60	2 IN CCRI	rn 100	1		, . ,
7	10	LAG TI	MES DETE	MINED USI	NO METH	OD IN CEL	TION COK	7 111 550	1500 10	000	
R	ID	DEATHA	CE ADEAC	FROM 7.5	MILLIT	OD TH SEC	I TON GOO.	. J IN CLI	erco, 19	70	
9		THIS	DE MAENS	TRUM 1.3	MINUIE	AND IS M	INUIE DO	ADS			
7	10	INTO W	COEL ADD	RESSES DR	AINAGES	THAT COU	LD IMPAC	THE RUN	45		
1.2		GRAM			500.00						
10	11	3	0	0	300						
11	10	5									
12	IN	5									
13	JD	1.1	.01								
13	30				Tall Giller	EE-WELVINS					
	" KA	INFALL	DISIKIBU	TION FROM	CLARK	COUNTY MA	NUAL LESS	THAN 1	SQ. HI	LES	
14	PL	. 0	13.0	3.1	7.0	8.7	10.8	12.4	13.0	13.0	13.0
15	PC	13.0	13.0	13.0	13.3	14.0	14.2	14.8	15.8	17.2	18.1
16	PC	19.0	19.7	19.9	20.0	20.1	20.4	21.4	22.9		
17	PC	25.1	25.6	27.0	27.8					24.1	24.9
18		49.9				28.1	28.3	29.5	32.2	35.2	40.9
	PC		59.0	71.0	74.4	78.1	81.2	81.9	83.5	85.1	85.6
19	PC	86.0	86.8	87.6	88.8	91.0	92.6	93.7	95.0	97.0	97.6
20	PC	98.2	98.5	98.7	98.9	99.0	99.3	99.3	99.4	99.5	99.8
21	PC	99.8	99.9	100.0		,,,,		,,,,	77.4	77.3	99.0
22	JD	1.07	1	100.0							
23											
23	JD	.95	9.99								
in the same	- CI	ANGED R	AINFALL	DISTRIBUT	ION ABO	OVE 10 SQ.	MILES PI	ER CLARK	COUNTY	MANUAL	
24	JD	.95	10.01						was a little		
25	PC	0	2.0	5.9	8.0	11.0	14.4	15.0	16.0	16.8	17.1
26	PC	18.0	18.2	18.7	19.0	19.7	20.2				
27	PC	25.0	25.9	26.5				21.0	22.0	23.0	24.1
28		23.0			28.0	29.0	30.0	30.5	30.9	31.0	31.7
	PC	32.1	32.7	33.3	34.6		38.1	40.8	43.0	47.7	51.4
29	PC	56.1	63.0	71.0	72.0	73.1	75.2	77.9	79.0	79.5	80.4
30	PC	81.0	82.0	82.6	84.0	85.9	88.9	91.0	93.8	96.6	97.0
31	PC	97.4	97.9	98.1	98.3		98.9	99.0			
32	PC	99.7	99.9	100.0	,0.2	70.2	70.7	99.0	99.2	99.3	99.6
33	JD	.87	20	100.0							
34	JD	-81	30								
35	JD	.75	50								
36	JD	.66	100								
**	1000	20040									
37	KK	MMTA									
38	KM	Basin	runoff c	alculatio	n for h	lace Mour	taine 14				
39	BA	.9	SENENS S	5,33,30,3		TODAL MODE	Tallis In				
40	LS		80								
41	UD	.31	OU.								
	17.5	177									
42	KK	BW1									
43	KM	Basi	n runoff	calculat	ion for	Barren L	ash 1				
44	BA	60.5				Dai Lett W	idali i				
		.00.2	24.5								
45	1.5		07								
45	LS	2.1	83								

```
47
48
49
50
51
                KK
                        8W2
                KM
                        Basin runoff calculation for Barren Wash 2
                BA
                       20.8
                LS
                                   80
                UD
                         .9
 52
53
54
                KK
                      BW182
                KM
                      Combined BW1 and BW2
                HC
 55
                KK
 56
57
                      Combine BW1,8W2, and MM1A (assume dischaarge of Barren Wash "active apex")
                HC
 58
                KK
                       MM18
                    Basin runoff calulation for Mass. Mountains 18
Flow was not combined with BW APX because flow from this watershed
 59
                KM
                    will not directly impact RWMS wereas a channel migration at the apex
                     could impact the RUMS
 60
                BA
                        2.1
 61
                LS
                                  77
                UD
                        .48
 63
                KK
                        MM2
 64
                KM
                       Basin runoff calculation for Mass. Mountains 2
                BA
                        1.4
                LS
 67
                UD
                        .47
 68
                KK
                       HP1A
 69
70
                KH
                             runoff calculation for Half Pint Range 1A
                       Basin
                BA
                        .8
 71
72
               LS
                                  85
                        .48
 73
74
75
                KK
                      RTCPA
                      Route Flow from HP1A to CPA
9 .43 .2
                KM
                RM
 76
77
78
79
                KK
                       HP18
               KM
BA
                       Basin runoff calculation for Half Pint Range 18
                        1.0
                LS
                                  78
 80
                UD
                        .51
                KK
                        HP2
 82
                KM
                       Basin runoff calculation for Half Pint Range 2
 83
                BA
                       1.2
 84
                LS
                                  78
 85
                W
                        .51
 86
                KK
 87
88
                       Combine MM2, routed HP1A, HP1B, HP2
                KH
                HC
 89
90
                KK
                        (CPB) Basin runoff calculation for Half Pint Range 3
                KM
 91
92
93
                BA
                        1.7
                LS
                        .59
                UD
 94
95
                KK
                       CPAZ
                KM
                       Combine HP3 with flow from CPA1
 96
                HC
 97
                KK
                        HP4
                        (CPC) Basin runoff calculation for Half Pint Range 4 3.3
 98
                KM
 99
                BA
100
                LS
                                  79
101
                UD
                        .52
102
                KK
                        Basin runoff calculation for Half Pint Range 5
103
                KM
104
                BA
105
                LS
106
                UD
                         .3
107
                KK
                        HP6
108
                        Basin runoff calculation for Half Pint Range 6
                KM
109
                BA
                        2.2
110
                LS
                                  80
111
                UD
                        .55
112
                KK
                      RTCPD
113
                KM
                       Route HP6 to CPD
                RM
                                 .27
                                            .2
```

```
115
116
117
                   KK
KM
BA
                            Basin runoff calculation for Half Pint Range FA
118
                   LS
                                       77
                            .33
                   UD
120
121
122
                   KK
                            Combine HPS, routed HP6, and HPFA
                   KM
HC
                   KK
KM
RM
123
                         RTCPE
124
                           Route flow from CPD to CPE
8 .39 .2
                   KK
KM
BA
126
127
128
                           Basin runoff calculation for Half Pint Range FB
                            1.6
129
130
                   LS
                            .44
                   UD
131
132
133
                   KK
                            CPE
                  KM
                           Combine HP4 (CPC) with routed flow from CPD, and HPFB
134
135
136
                   KK
KM
HC
                           Combine all flow at Concentration just below RWMS (flow from CPA & CPE)
137
138
                   KK
                  KM Basin runoff calculation for Scarp Canyon 1

* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139
140
141
                  BA
LS
UD
                          39.4
                           2.1
142
143
144
145
146
147
                  KK
KM
BA
LS
UD
ZZ
                           SCZ
                           Basin runoff calculation for Scarp Canyon 2
                                       77
                            .48
```

### SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT	SCHER	MAIL DIAG	RAM OF STREAM	NETWORK			
LINE	(V) ROUTIN	IG	(>) DIVER	SION OR PUM	P FLOW		
NO.	(.) CONNEC	TOR	(<) RETUR	N OF DIVERT	ED OR PUMPED	FLOW	
37	HM1A						
42	•	BW1					
47			8W2				
			•				
52		BW182.					
55	BW APX						
58		HM1B					
	1.0						
63	•		MM2				
			· ·				
68							
00		1.5		HP1A			
7979				V			
73	**		10. **	RTCPA			
2	1		1.0				
76			-		HP1B		
					•		
81						HP2	
		•	•				
86			CPA1				
	1.4						
89	2	1		HP3			
94			CPA2	200.500			
			2000				
97	10.4		•	HP4			
102	0.4		•		was		
102					HP5		
107							
107					•	HP6	
.595	- 0					v	
112						RTCPD	
	-0.				1.5		
115	ů.			- 1			НР
					0.0		
120			1		CPD		
	•	•	9	9	V		
123					RTCPE		
			7-1				
126			103	•		HPFB	
	-	- 2					
131	100	*	•	CPE	a contract	- F	
9-4				CPE		origination.	
134							
154		2	CPF	********			
137		1.0		0241			
137	- C.	1.		SC1			
142	5	1	2	990			
					SC2		

RUN DATE 01/29/1993 TIME 22:05:10 \*

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FLOOD ASSESSMENT FOR RWMS JOB #:51056 FILE: RWMS10.DAT
10-YEAR 6-HOUR STORM 1.1 INCHES
POINT RAINFALL VALUE FROM HOAA ATLASS 2 VOL VII
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

OUTPUT CONTROL VARIABLES 11 10 5 PRINT CONTROL 0 PLOT CONTROL IPRNT IPLOT QSCAL O. HYDROGRAPH PLOT SCALE IT HYDROGRAPH TIME DATA MIN 3 MINUTES IN COMPUTATION INTERVAL O STARTING DATE IDATE ITIME 0000 NO 300 NUMBER OF HYDROGRAPH ORDINATES NDDATE 0 ENDING DATE NDT I ME 1457 ENDING TIME ICENT 19 CENTURY MARK

TOTAL TIME BASE 14,95 HOURS

ENGLISH UNITS

DRAINAGE AREA
PRECIPITATION DEPTH
LENGTH, ELEVATION
FLOW
STORAGE VOLUME
SURFACE AREA
TEMPERATURE

INDEX STORM NO. 1

SIRM

SQUARE MILES
INCHES
FEET
CUBIC FEET PER SECOND
ACRE-FEET
ACRES
DEGREES FAHRENHEIT

13 JD STRM 1.10 PRECIPITATION DEPTH .01 TRANSPOSITION DRAINAGE AREA 14 PI PRECIPITATION PATTERN 1.20 1.54 2.22 1.26 .78 1.02 1.10 1.26 1.06 .36 .24 .00 .00 .00 .00 .00 .00 .76 .00 .18 .26 .42 .22 .12 .36 .60 .84 .54 .54 .42 .06 .24 .52 6.62 .54 .46 .10 .06 -06 .18 .60 .80 .90 .64 .48 .12 .48 .30 5.42 .60 .48 .12 .72 7.20 .96 1.32 .36 1.62 1.68 1.80 2.88 1.86 5.40 5.46 2.04 2.10 2.22 1.98 .96 .42 .60 .96 .40 .30 .28 .24 .48 .48 .56 1.12 .96 .86 .66 .74 1.20 .92 .36 .18 .12 .06 .10 .18 06 .00

	.06	.06	.06	.14	.18	.00	.02	.06	.06	.06
22 JD	INDEX STORM STRM TRDA	NG. 2 1.07 1.00		TATION DEP		i.				
0 P1		ION PATTERN								
	1.20 .36 .18 .54 .18 .30 1.62 2.04 .30 .96	1.54 .24 .26 .54 .32 .48 1.68 2.10 .28 .86 .16	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78	1,02 ,00 ,36 ,12 ,72 ,18 5,40 ,42 ,48 1,20	1.10 .00 .44 .10 .64 .16 5.42 .60 .92	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36	.96 .00 .84 .06 .12 .72 7.20 1.32 .36
	.00	.00	.00	.14	.18	.00	.02	.06	.06	.06

INDEX STORM NO. 3 STRM .95 IRDA 9.99	PRECIPITAT TRANSPOSIT	TION DEPT	N NAGE AREA					
PRECIPITATION PATTERN 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66 .12	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	1.02 .00 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56	1.26 .00 .60 .06 .48 .12 5.46 .96 .72 .36 .18	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36	.96 .00 .84 .06 .12 .72 .72 .72 .96 1.32 .36 .00
STRM .95	PRECIPITAT	ION DEPT	н					-
PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24
STRM .87	PRECIPITAT	TON DEPT	н	,,,,,		-2.5	.00	.00
1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48	2.34 .48 .42 .54 .30 .36 2.82 .66 .36	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .106	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	1.48	1.62
INDEX STORM NO. 6 STRM .81 IRDA 30.00	PRECIPITAT TRANSPOSIT	TON DEPT	н				77	
PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	.48 .42 .54 .30 .36 2.82 .66 .36	.28 .34 .54 .26 .64 2.42 1.06 .52	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	.54 .18 1.00 3.26 1.30 .52 1.20	.60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
INDEX STORM NO. 7 STRM .75 TRDA 50.00	PRECIPITAT TRANSPOSIT	ION DEPT	H NAGE AREA			1.5		.00
PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62	2.34 .48 .42 .54 .30 .36 2.82 .66 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06	1.26 .18 .30 .54 .24	1.80 .54 .48 .36 .90 2.82 1.62 .36 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24 .12	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
	STRM 959 IRDA 9.99  PRECIPITATION PATTERN 1.20 1.54 .36 .24 .18 .26 .54 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06  INDEX STORM NO. 4 STRM 10.01  PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .60 .50 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .50 .36 .36 1.32 1.82 .60 .56 .18 .26 .66 .62 .50 .50 .31 .32 1.82 .60 .50 .33 1.82 .60 .56 .36 .36 1.32 1.82 .60 .56 .38 1.82 .60 .56 .39 1.82 .60 .50 .30 .32 1.82 .60 .50 .31 .32 1.82 .60 .50 .33 1.82 .60 .50 .34 1.82 .60 .56 .35 1.82 .60 .56 .36 1.32 1.82 .60 .56 .36 1.32 1.82 .60 .50 .36 1.32 1.82 .60 .50 .36 1.32 1.82 .60 .50 .36 1.32 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .36 1.82 .60 .50 .37 1.82 .60 .50 .38 1.82 .60 .50 .39 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .50 .30 1.82 .60 .62 .54 1.80 1.62 .30	STRM	STRM	STRM	STRM	SIRM	STAM	STRM

36 JD	INDEX STORM ( STRM TRDA	NO. 8 100.00		TATION DEP	TH INAGE AREA	0				
O PI	PRECIPITAT: 1.20 .60 .18 .66 .60 .36 1.32 .60 .54 1.80 .30	10N PATTERN 1.58 .56 .26 .62 .50 .36 1.82 .62 .48 1.62 .24	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26	1.62 .28 .34 .54 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68	1.80 .54 .48 .36 .90 2.82 1.62 1.68 .12	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 -42 1.04 .24	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24

RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE MILES

> HAXIMUM STAGE

TIME OF MAX STAGE

				5.40E 10	meaner) man	IN SOUNCE	MILLS		
	OPERATION	STATION	PEAK	TIME OF PEAK	AVERAGE F	LOW FOR MAXII	MUM PERIOD	BASIN	
			, , ,	FEAR	6-HOUR	24-HOUR	72-HOUR	AREA	
*	HYDROGRAPH AT	MHTA	50.	3.90	10.	4.	4.	.90	
+	HYDROGRAPH AT	BW1	511.	6.55	265.	111.	111.	60.50	
+	HYDROGRAPH AT	BW2	328.	5.50	104.	42.	42.	20.80	
٠	2 COMBINED AT	BW182	510.	6.35	268.	112.	112.	81.30	
	2 COMBINED AT	BW APX	452.	6.40	237.	99.	99.	82.20	
	HYDROGRAPH AT	MM1B	43.	5.10	13.	5.	5.	2.10	
*	HYDROGRAPH AT	MM2	48.	4.10	13.	5.	5.	1.40	
•	HYDROGRAPH AT	HP1A	81.	4.00	18.	7.	7.	.80	
*	ROUTED TO	RTCPA	77.	4.45	18.	7.	7.	.80	
*	HYDROGRAPH AT	HP18	28.	4.20	8,	3.	3.	1.00	
	HYDROGRAPH AT	HP2	33.	4.20	10.	4.	4.	1.20	
r <b>i</b> i	4 COMBINED AT	CPA1	130.	4.35	39.	16.	16.	4.40	
	HYDROGRAPH AT	HP3	87.	4.20	24.	10.	10.	1.70	
*	2 COMBINED AT	CPA2	187.	4.30	56.	22.	22.	6.10	
٠	HYDROGRAPH AT	HP4	88.	4.20	26.	10.	10.	3.30	
	HYDROGRAPH AT	HP5	54.	3.90	11.	5.	5.	1.20	
	HYDROGRAPH AT	HP6	77.	4.20	22.	9.	9.	2.20	
+	ROUTED TO	RTCPD	75.	4.45	22.	9.	9.	2.20	
•	HYDROGRAPH AT	HPFA	9.	3.95	2.	1.	1,	.30	
+	3 COMBINED AT	CPD	90.	4.70	31.	12.	12.	3.70	
*	ROUTED TO	RTCPE	90.	5.05	31.	12.	12.	3.70	
٠	HYDROGRAPH AT	HPFB	35.	5.05	10.	4.	4.	1.60	
+	3 COMBINED AT	CPE	168.	5.10	53.	21.	21.	8,60	
*	2 COMBINED AT	CPF	301.	5.20	84.	34.	34.	14.70	
•	HYDROGRAPH AT	SC1	356.	6.55	184.	78.	78.	39.40	
٠	HYDROGRAPH AT	SC2	32.	5.10	10.	4.	4.	1.50	

<sup>\*\*\*</sup> NORMAL END OF HEC-1 \*\*\*

FILENAME: RWMS10C.OUT
(10-YEAR MODEL)

RUN DATE 01/29/1993 TIME 22:06:45 \*

U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 (916) 736-1104

X	X	XXXXXXX	XX	XXX		x
X	X	X	X	X		XX
X	X	X	X			X
XXX	XXXX	XXXX	X		XXXXX	Y
X	X	X	X			×
X	X	X	X	X		Y
X	X	XXXXXXX	XXX	XXX		XXX

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAM77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1	1D 1D	FL000	ASSESSMEN	STORM 1.	MS JOB A	:51056	FI	LE: RWM	STOC.DAT		
2 3 4 5 6 7 8	10	POINT	PAINEALL	VALUE C	DOM HOLES		VOL VII				
ž	10	AD HIST	FD PAINE	III DEB C	ODDECTIO	AILAS 2	IN CLARK		Anne	ave libe	Cn.
5	10	DEPTH-	APEA PENI	CTION FA	CTOPE E	M FACTOR	IN CLARK	COUNTY	MANUAL	TABLE SO	11
6	10	CLARK	COUNTY HY	DEUL DELE	COLICE!	A AVE	SUZ IN			of the same	Ca.J
7	10	CURVE	NIMBERS !	ETERMINE	DUCTOR	A AND UR	AINAGE DE 2 IN CCRF	SIGN MA	NUAL (CC	RFCD, 19	90)
á	10	LAG TI	MES DETEN	ILIER HEL	D DSING	TABLE OU	2 IN ECRI	CD, 199	0	12	
9	10	DRAINA	CE ADEAS	EDOW 7 F	NG METHO	D IN SEC	ITON 606. INUTE QUA	3 IN CC	RFCD, 19	90	
10	10	THIS M	ODEL ADD	FEEL DE	MINUTE	M CI UNA	INUIE QUA	DS			
	*D1	AGRAM		COSES DK	AINAGES	THAT COU	LD IMPACT	THE RW	MS		
11	17	3	0	0	300						
12	10	5									
13	IN	5									
14	JD	1.36	.01								
	# R	AINFALL I	DISTRIBUT	TON FROM	CLARK C	CKINTY MAI	NUAL LESS	THAN 1	0 00 41	100	
15	PC	0	2	5.7	7.0	8.7	10.8	12.4	13.0	13.0	17 0
16	PC	13.0	13.0	13.0	13.3	14.0	14.2	14.8			13.0
17	PC	19.0	19.7	19.9	20.0	20.1	20.4		15.8	17.2	18.1
18	PC	25.1	25.6	27.0	27.8	28.1		21.4	22.9	24.1	24.9
19	PC	49.9	59.0	71.0	74.4	78.1	28.3	29.5	32.2	35.2	40.9
20	PC	86.0	86.8	87.6	88.8		81.2	81.9	83.5	85.1	85.6
21	PC	98.2	98.5	98.7	98.9	91.0	92.6	93.7	95.0	97.0	97.6
22	PC	99.8	99.9		90.9	99.0	99.3	99.3	99.4	99.5	99.8
23	JD	1.32	17.7	100.0							
24		1.17	9.99								
24	* CI	HANGED R	AINFALL D	TURISTRI	TON AROU	F 10 sn	MILES PE	D CLADY	COLUMN	OLOGOUS.	
25	JD	1.17	10.01		TOR ABOV	L 10 34.	MICES PE	R CLARK	COUNTY	MANUAL	
26	PC	0	2.0	5.9	8.0	11.0	14.4	15.0	47.5		4- 4
27	PC	18.0	18.2	18.7	19.0	19.7	20.2		16.0	16.8	17.1
28	PC	25.0	25.9	26.5	28.0	29.0		21.0	22.0	23.0	24.1
29	PC	32.1	32.7	33.3	34.6	36.1	30.0	30.5	30.9	31.0	31.7
30	PC	56.1	63.0	71.0	72.0	73.1	38.1	40.8	43.0	47.7	51.4
31	PC	81.0	82.0	82.6	84.0	85.9	75.2	77.9	79.0	79.5	80.4
32	PC	97.4	97.9	98.1			88.9	91.0	93.8	96.6	97.0
33	PC	99.7	99.9	100.0	98.3	98.5	98.9	99.0	99.2	99.3	99.6
34	JD	1.07	20	100.0							
35	JD	1.01	30								
36											
37	JD	.92	50								
37	JD	.82	100								
38	KK	MMTA									
39	KH	Basin	runoff ca	alculatio	n for Ma	SS. Moun	taine 14				
40	BA	.9			., ., .,	Joseph Modern	LOTTIS IA				
41	LS	2.5	80								
42	UD	.31									
43	KK	BW1									
44	KH		n runofé	caledian	inn (	0	250 0				
45	BA	60.5	Turio!	calculat	tou tor	Rarren M	asn 1				
46	LS	00.5	07								
47	UD	2.1	83								
	4.974	( )									

```
48
                KK
                        BW2
 49
50
51
52
                KM
                        Basin runoff calculation for Barren Wash 2
                BA
                       20.8
                LS
                UD
                         .9
 53
54
55
                KK
                      BU187
                KM
                      Combined BW1 and BW2
                HC
 56
57
58
                KK
                      Combine BW1, BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
                KM
                HC
 59
                KK
                     Basin runoff calulation for Mass. Mountains 1B
Flow was not combined with BW APX because flow from this watershed
 60
                KM
                    will not directly impact RWMS wereas a channel migration at the apex
could impact the RWMS
                .
                BA
                        2.1
 62
                LS
                UD
                        .48
 64
65
66
67
                KK
                        MMZ
                       Basin runoff calculation for Mass. Mountains 2
                BA
                        1.4
                LS
                                   79
                        .47
 68
                UD
 69
70
71
72
73
                KK
                       HP1A
                       Basin runoff calculation for Half Pint Range 1A
                KM
                BA
                        .8
                                   85
                UD
                        .48
 74
                KK
                      RTCPA
 75
76
                      Route Flow from HP1A to CPA
9 .43 .2
                KM
                RM
 77
78
79
                KK
                       Basin runoff calculation for Half Pint Range 1B
                KM
                BA
                        1.0
 80
                LS
                                   78
 81
                UD
                        .51
 82
                KK
 83
84
85
86
                KM
                       Basin runoff calculation for Half Pint Range 2
                BA
                       1.2
                LS
                                   78
                        .51
                UD
 87
                KK
                       CPA1
 88
                       Combine MM2, routed HP1A, HP1B, HP2
                KM
 89
                HC
 90
                KK
 91
                KM
                        (CPB) Basin runoff calculation for Half Pint Range 3
                BA
                        1.7
 93
                LS
                                   82
 94
                UD
                        .59
 95
                KK
 96
97
                       Combine HP3 with flow from CPA1
                HC
 98
                KK
99
                        (CPC) Basin runoff calculation for Half Pint Range 4
                KM
                        3.3
                BA
101
                LS
102
                        .52
                UD
103
                KK
                        HP5
104
                        Basin runoff calculation for Half Pint Range 5
                KM
105
                BA
106
                LS
                                   79
107
                UD
                         .3
108
                KK
109
                KM
                        Basin rumoff calculation for Half Pint Range 6
110
                BA
                        2.2
111
                        .55
112
                UD
113
                KK
                      RTCPD
                       Route HP6 to CPD 5 .27
114
                KM
                RM
                                            .2
```

```
116
117
118
119
120
                  KK
KM
BA
LS
UD
                          HPFA
                           Basin runoff calculation for Half Pint Range FA
                            .3
                            .33
121
122
123
                  KK
                           CPD
                  KM
                           Combine HP5, routed HP6, and HPFA
124
125
126
                  KK
                         RTCPE
                  KM
RM
                           Route flow from CPD to CPE
8 .39 .2
127
128
129
130
131
                  KK
                           Basin runoff calculation for Half Pint Range FB
1.6
                  KM
                  BA
LS
UD
                           .46
132
133
134
                  KK
                           CPE
                          Combine HP4 (CPC) with routed flow from CPD, and HPFB
                  KM
HC
135
136
137
                  KK
KK
                          Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
138
139
                  KK
                  KM Basin runoff calculation for Scarp Canyon 1

Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA 39.4
140
141
                  LS
                                       82
                  UD
                          2.1
143
                  KK
                           SC2
144
                  KM
BA
LS
                           Basin runoff calculation for Scarp Canyon 2
                           1.5
146
147
148
                           .48
                  UD
                  ZZ
```

FLOOD HYDROGRAPH PACKAGE (HEC-1) SEPTEMBER 1990 VERSION 4.0

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

RUN DATE 01/29/1993 TIME 22:06:45 .

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

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FLOOD ASSESSMENT FOR RWMS JOB #:51056 FILE: RWMS10C.DAT FLOOD ASSESSMENT FOR RWMS JOB #:51056

FILE: RWMS10C.DAT

10-YEAR 6-HOUR STORM 1.1 INCHES

POINT RAINFALL VALUES FROM HOAA ATLAS 2 VOL VII

ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501

DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN

CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)

CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990

LAG TIMES DETEMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990

DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS

THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

			Standard of		Str. fiel 1998	Train 12			
12 10	IPLOT	D PLOT CO	ONTROL	CALE					
11	NQ 3 NDDATE 1 NDTIME 14	3 MINUTES 0 STARTIN	OF HYDROGR DATE TIME						
	COMPUTATION INTERVA	L .05 1	HOURS						
	ENGLISH UNITS  DRAINAGE AREA  PRECIPITATION DEPTH 1  LENGTH, ELEVATION F FLOW C  STORAGE VOLUME A SURFACE AREA	QUARE MILES	S PER SECOND						
14 JD		36 PRECIPO							
15 PI	PRECIPITATION PATTE 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	2.22 .00 .42 .54 .60 .84 1.80 2.22 .24 .66	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74 .12	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	1.02 .00 .36 .12 .72 .18 5.40 .42 .48 1.20	1.10 .00 .44 .10 .64 .16 5.42 .60 .56	1.26 .00 .60 .06 .48 .12 5.46 .72 .36 .72	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36
23 JD	STRM 1.	32 PRECIPI	TATION DEP	TH					,,-
0 PI	PRECIPITATION PATTE 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	2.22 .00 .42 .54 .60 .84 1.80 2.22	1.26 .00 .22 .46 .80 .60 2.88 1.98 .40 .74	.78 .00 .12 .42 .90 .48 3.42 1.86 .48 .78 .12	.12 .72 .18 5.40	.44 .10 .64 .16 5.42 .60 .56	.60 .06 .48 .12 5.46 .96	.76 .06	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36 .00

24 JO	INDEX STORM NO. 3 STRM 1.17 TRDA 9.99	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
O PI	.18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28	2.22     1.26     .78     1.02     1.10     1.26     1.06       .00     .00     .00     .00     .00     .00     .00     .00       .42     .22     .12     .36     .44     .60     .76       .54     .46     .42     .12     .10     .06     .06       .60     .80     .90     .72     .64     .48     .24       .84     .60     .48     .18     .16     .12     .52       1.80     2.88     3.42     5.40     5.42     5.46     6.62       2.22     1.98     1.86     .42     .60     .96     .96       .24     .40     .48     .48     .56     .72     1.12       .66     .74     .78     1.20     .92     .36     .36       .12     .12     .12     .12     .06     .10     .18     .06       .06     .14     .18     .00     .02     .06     .06	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36
25 JD	INDEX STORM NO. 4 STRM 1.17 TRDA 10.01	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
26 PI	1.32 1.82 .60 .62 .54 .48 1.80 1.62	2.34 1.62 1.26 1.80 1.88 2.04 .92 .48 .28 .18 .54 .40 .12 .24 .42 .34 .30 .48 .52 .60 .60 .54 .54 .54 .54 .90 .70 .30 .26 .24 .06 .18 .42 .30 .36 .64 .78 .90 1.00 1.20 1.48 .28 .26 2.42 2.22 2.82 3.26 4.14 4.58 .66 1.06 1.26 1.62 1.30 .66 .42 .36 .36 .52 .60 .36 .52 .84 1.04 .12 .12 .12 .12 .16 .24 .12 .06 .14 .18 .06 .08 .12 .08	.36 .30 .60 .24 1.62 4.80 1.14 .24
34 JD	INDEX STORM NO. 5 STRM 1.07 TRDA 20.00	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	7.5
O PI	. 18 . 26 . 66 . 62 . 60 . 50 . 36 . 36 1.32 1.82 . 60 . 62 . 54 . 48	2.34	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
35 JD	INDEX STORM NO. 6 STRM 1.01 TRDA 30.00	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
0 P1	.18 .26 .66 .62 .60 .50 .36 .36	2.34	.60 .24 1.62
36 JD	INDEX STORM NO. 7 STRM .92 TRDA 50.00	PRECIPITATION DEPTH TRANSPOSITION DRAINAGE AREA	
0 P1	PRECIPITATION PATTERN 1,20 1,58 .60 ,56 .18 ,26 .66 ,62 .60 ,50 .36 ,36 1,32 1,82 .60 ,62 .54 ,48 1,80 1,62 .30 ,24 .12 ,10	2.34       1.62       1.26       1.80       1.88       2.04       .92         .48       .28       .18       .54       .40       .12       .24         .42       .34       .30       .48       .52       .60       .60       .60         .54       .54       .54       .90       .70	.60 .60 .24 1.62 4.80

37 JD	INDEX STORM STRM TRDA	но. 8 .82 100.00		TATION DEP	TH INAGE AREA					
O PI	PRECIPITAT 1.20 .60 .18 .66 .60 .36 1.32 .60 .54 1.80 .30	10N PATTERN 1.58 .56 .26 .62 .50 .36 1.82 .62 .48 1.62 .24	2.34 .48 .42 .54 .30 .36 2.82 .66 .36 1.26 .12	1.62 .28 .34 .26 .64 2.42 1.06 .52 1.54	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12	1.80 .54 .48 .36 .90 .90 2.82 1.62 .36 1.68 1.68	1.88 .40 .52 .54 .18 1.00 3.26 1.30 .52 1.20	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 4.58 1.04 .24	.36 .30 .60 .24 1.62 4.80 1.14 .24

SCHEMATIC	DIAGRAM	OF	STREAM	NETWORK

LINE	(V) ROUTING		(>) DIVERS	ION OR PUMP	FLOW		
NO.	(.) CONNECTO	OR	(<) RETURN	OF DIVERTED	OR PUMPED F	LOW	
38	MM1A						
43		BW1					
	•		BW2				
48							
2.0							
53	* 1	BW182.					
56	BW APX						
59		MM1B					
64			MM2				
- 671							
69	3.0	0.0	*	HP1A			
07				V			
				RTCPA			
74				AICPA			
7.7		(*)	•		HP1B		
			5				
82				19		HP2	
	90.	10					
87		Ú.	CPA1				
		- 3					
90		- 3		HP3			
		- 3					
95			CPA2	50mm 18.0			
43			U.AL				
4.2	46		9	wa.			
98	- 3	- 15	1	HP4			
					5.5		
103	2		•0	€.	HP5		
	100						
108	-				1.00	HP6	
	20	2	2	•		V	
113		1				RTCPD	
	1,750.0				· •		
116	1.2		- 7		32		HP
100.0	102				D*I		1,33
121	1361			•	CPD	and the second	
121	13.01			1.0	V		
444		13	•		V		
124	1,00	•	1		RTCPE		
1.30				1,25			
127	113			1.3	-	HPFB	
						- 2	
132				CPE			
	•			1.9			
135	12		CPF				
	10.3						
138		4		SC1			
.50							
143	19			19	603		
145					SC2		

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

				TIME IN	HOURS, AREA	IN SQUARE P	IILE2				
*	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FL	OH FOR HAXIN	72-HOUR	BASIN	MAXIMUM STAGE	TIME OF MAX STAGE	
•	HYDROGRAPH AT	MH1A	108.	3.85	20.	8.	8.	.90			
4	HYDROGRAPH AT	BW1	1083.	6.40	574.	242.	242.	60.50			
+	HYDROGRAPH AT	BW2	653.	5.45	232.	93.	93.	20.80			
	2 COMBINED AT	BW182	1083.	6.10	581.	244.	244.	81.30			
*-	2 COMBINED AT	BW APX	1078.	6.10	581.	244.	244.	82.20			
*	HYDROGRAPH AT	MM18	110.	4.10	28.	11.	11.	2.10			
	HYDROGRAPH AT	MM2	110.	4.05	26.	10.	10.	1.40			
	HYDROGRAPH AT	HP1A	139.	4.00	30.	12.	12.	.80			
•	ROUTED TO	RTCPA	132.	4.40	30.	12.	12.	.80			
	HYDROGRAPH AT	HP1B	68.	4.10	17.	7.	7.	1.00			
*	HYDROGRAPH AT	HP2	79.	4.10	20.	8.	8.	1.20			
•	4 COMBINED AT	CPA1	278.	4.25	76,	31.	31.	4.40			
*	HYDROGRAPH AT	нр3	170.	4.15	43.	17.	17.	1.70			
•	2 COMBINED AT	CPAZ	399.	4.20	108.	43.	43.	6.10			
•	HYDROGRAPH AT	HP4	210.	4.10	54.	21.	21.	3.30			
•	HYDROGRAPH AT	HP5	123.	3.85	23.	9.	9.	1.20			
•	ROUTED TO	HP6	168.	4.10	43.	17.	17.	2.20			
*	HYDROGRAPH AT	RTCPD	164.	4.40	43.	17.	17.	2.20			
•	3 COMBINED AT	HPFA	23.	3.90	5.	2.	2.	.30			
+	ROUTED TO	CPD	199.	4.30	62.	25.	25.	3.70			
•	HYDROGRAPH AT	RICPE	196.		62.	25.	25.	3.70			
	3 COMBINED AT	HPFB	93.		23.	9.	9.	1.60			
•	2 COMBINED AT	CPE	335.		116.	46.	46.	8.60			
•	HYDROGRAPH AT	CPF	576.		182.	73.	73.	14.70			
•	HYDROGRAPH AT	501	769.		408.	172.	172.	39.40			
		SC2	84.	4.10	21.	9.	9.	1.50			

## HEC-1 MODEL OUTPUT

FILENAME: RWMS2.OUT
(2-YEAR MODEL)

FLOOD HYDROGRAPH PACKAGE (HEC-1)
SEPTEMBER 1990
VERSION 4.0
RUN DATE 01/29/1993 TIME 22:08:57

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAM 73), HEC1GS, HEC1DB, AND HEC1EW.

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

1	1D 1D			T FOR RW			F	ILE: RUM	SZ.DAT		
2	10	POINT P	ALMEALL	STUKE U.	1 INCHES	2 401 41	1 440 40	III THE WE			
23456	10	DEDTH A	AINFALL	FROM NOA	A AILAS	Z VUL VI	I (NO AD	DOZIMENT	NECESSA	RY)	
4		CLASK C	KEA KEUL	ICTION FA	CIUKS FK	UM TABLE	502 IN			5200 54	400
3	ID	CLARK L	OUNIT H	DROLOGIC	CRITERI	A AND DR	ATNAGE D	ESIGN MA	NUAL (CC	FRCD, 19	90)
6	10	CURVE N	UMBERS I	ETERMINE	D USING	TABLE 60	2 IN CCF	RCD, 199	0		
7	ID.	LAG TIM	ES DETER	RMINED US	ING METH	OD IN SE	CTION 60	6.3 IN C	CFRCD, 1	990	
8	10			FROM 7.5					100		
9	10	THIS MO	OEL ADDI	RESSES DR	AINAGES	THAT COU	LD IMPAC	T THE RW	MS		
	*DIA	GRAM									
10	17	3	0	0	300						
11	10	5	75	7							
12	1N	5									
13	JD	0.7	.01								
13		INEALL D		LION COOM	C1 10V C	~ 11174 44					
14	PC	O	ISIKIBU	TION FROM	LLAKE C	DUNIT MA	NUAL LES	S THAN T	U SQ. MI	LES	12.15
			. 2	3.1	7.0	8.7	10.8	12.4	13.0	13.0	13.0
15	PC	13.0	13.0	13.0	13.3	14.0	14.2	14.8	15.8	17.2	18.1
16	PC	19.0	19.7	19.9	20.0	20.1	20.4	21.4	22.9	24.1	24.9
17	PC	25.1	25.6	27.0	27.8	28.1	28.3	29.5	32.2	35.2	40.9
18	PC	49.9	59.0	71.0	74.4	78.1	81.2	81.9	83.5	85.1	85.6
19	PC	86.0	86.8	87.6	88.8	91.0	92.6	93.7	95.0	97.0	97.6
20	PC	98.2	98.5	98.7	98.9	99.0	99.3	99.3	99.4	99.5	99.8
21	PC	99.8	99.9	100.0		4 4 4 9 9	4455	1.7.			77.0
22	JD	.68	1	1444							
23	30	.60	9.99								
				DISTRIBUT	104 4000	E 10 CO	MILES D	CD C! 100	COLUMN	COLUMN TAX	
24	JD	.60	10.01	212141001	TOM WROA	E 10 54.	HILES P	ER LLAKE	COUNTY	MANUAL	
	PC	.00	2.0				46.4	40.4	22.2	20.0	224
25				5.9	8.0	11.0	14.4	15.0	16.0	16.8	17.1
26	PC	18.0	18.2	18.7	19.0	19.7	20.2	21.0	22.0	23.0	24.1
27	PC	25.0	25.9	26.5	28.0	29.0	30.0	30.5	30.9	31.0	31.7
28	PC	32.1	32.7	33.3	34.6	36.1	38.1	40.8	43.0	47.7	51.4
29	PC	56.1	63.0	71.0	72.0	73.1	75.2	77.9	79.0	79.5	80.4
30	PC	81.0	82.0	82.6	84.0	85.9	88.9	91.0	93.8	96.6	97.0
31	PC	97.4	97.9	98.1	98.3	98.5	98.9	99.0	99.2	99.3	99.6
32	PC	99.7	99.9	100.0	1010		4.50		****	77.3	77.0
33	JD	.55	20	10010							
34	JD	.52	30								
35	JD	.48	50								
36	10		100								
30	30	.42	100								
37	KK	MM1A									
				Van Leade		Will Great	466.50				
38	KM	Basin r	unott c	alculatio	n for Ma	iss. Mour	itains lA				
39	BA	.9	22								
40	LS	122	80								
41	מט	.31									
42	KK	BW1									
43	KM	Basin	runoff	calculat	ion for	Barren V	Jash 1				
44	BA	60.5	1 2 7 50	22,30,10	2300 3430	earling.	-0246				
45	LS	2010	83								
46	UD	2.1	0.5								
	00	4.1									

```
KK
KM
BA
47
48
49
50
51
                         BW2
                         Basin runoff calculation for Barren Wash 2
                       20.8
                                   80
                LS
                UD
 52
                KK
                      BW182
                      Combined BW1 and BW2
53
                KM
55
                KK
                      Combine BW1, BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
56
                HC
58
59
                KM
                       Basin runoff calulation for Mass. Mountains 18
                     Flow was not combined with BW APX because flow from this watershed will not directly impact RWMS wereas a channel migration at the apex could impact the RWMS
 60
                                   77
61
                LS
                         .48
 63
                KK
                         MM2
64
65
66
67
                KM
                       Basin runoff calculation for Mass. Mountains 2
                BA
                         1.4
                         .47
                UD
                KK
68
69
70
71
72
                       HP1A
                KM
                       Basin runoff calculation for Half Pint Range 1A
                BA
                         .8
                LS
                         .48
                UD
 73
74
75
                KK
                      RTCPA
                KM
                      Route Flow from HP1A to CPA
76
77
78
79
80
                KK
                       HP1B
                KM
                       Basin runoff calculation for Half Pint Range 18
                         1.0
                LS
                                   78
                         .51
 81
                        HP2
82
83
                       Basin runoff calculation for Half Pint Range 2
                BA
                        1.2
84
85
                LS
                         .51
                UD
 86
                KK
                       CPA1
                KM
 87
                       Combine MM2, routed HP1A, HP1B, HP2
 88
 89
90
                KK
                        (CPB) Basin runoff calculation for Half Pint Range 3
                KM
 91
92
93
                BA
                         .59
                NO
 94
95
96
                KK
                       CPA2
                KM
                        Combine HP3 with flow from CPA1
 97
                KK
 98
                KM
                         (CPE) Basin runoff calculation for Half Pint Range 4
                BA
                         3.3
100
                         .52
                UD
102
                KK
                         Basin runoff calculation for Half Pint Range 5
103
104
                BA
                         1.2
                LS
106
                UD
                         .3
107
                KK
                        HP6
108
                KM
                         Basin runoff calculation for Half Pint Range 6
109
                         2.2
110
                LS
                                   80
                         .55
111
                UD
112
                KK
                      RTCPD
                       Route HP6 to CPD
                RM
```

```
115
116
117
118
119
                   KK
KM
BA
LS
UD
                            KPFA
                             Basin runoff calculation for Half Pint Range FA
                              .33
120
121
122
                   KK
KM
HC
                             Combine HP5, routed HP6, and HPFA
123
124
125
                    KK
                           RTCPE
                             Route flow from CPD to CPE
8 .39 .2
                   KH
126
127
128
                             Basin runoff calculation for Half Pint Range FB 1.6
                   KK
KM
BA
LS
UD
129
                              .44
131
132
133
                    KK
KM
                            CPE
Combine HP4 (CPC) with routed flow from CPD, and HPFB
3
                            CPF
Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
2
134
135
136
                    KK
KM
137
138
                    KK
                   KM Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139
140
141
                    BA
LS
UD
                            39.4
                                          82
                             2.1
142
143
144
145
146
147
                    KK
                             Basin runoff calculation for Scarp Canyon 2
                    KM
BA
LS
UD
ZZ
                              .48
```

INPLIT		IC DIAGRAM OF	>) DIVERSION	OR PUMP FLOW			
LINE	(V) ROUTING		-) PETLIPH OF	DIVERTED OR P	UMPED FLOW		
NO.	(.) CONNECTO	OR (<	-) KE JOHN OF	2 4 1 2 KHOLES CO. T.			
37	MM1A						
25	2						
42.		BW1					
			BW2				
47		3	, ,				
			0.000				
52	•	BW182					
55	BW APX						
1		MM1B					
58		4					
			MM2				
63			1.5				
68		7		HP1A			
00		*	1	v			
73				RTCPA			
12					HP1B		
76							
				0.00		HP2	
81	15			1.3	4		
			0041				
86		*	CPA1				
				HP3			
89				•			
		- 3	CPA2				
94		•					
				HP4			
97							
0.5			5		HP5		
107	2				- 6	HP6	
						V	
10	,			- 4	A.	RTCPD	
11			4		\$	KILIFO	
1,		+	- 32		14	9	HPF
111	15		•				
	\$ 3			14	CPD		
13	20 .		19.		A		
	5- 3		•	•	RTCPE		
1	23			:	KIC. 2		
					1	HPFB	
1	26						
				CPE		30.00	
1.0	131	£			CONTRACTOR OF THE PARTY OF THE		
		: :	CPF.				
	134		CPF.				
		4 4		SC1			
	137						
		3			SCZ		
	142	SO COMPUTED A					

FLOOD HYDROGRAPH PACKAGE (HEC-1)
SEPTEMBER 1990
VERSION 4.0

RUN DATE 01/29/1993 TIME 22:08:57

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

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FLOOD ASSESSMENT FOR RWMS JOB #:51056 FILE: RWMS2.DAT
2-YEAR 6-HOUR STORM 0.7 INCHES
POINT RAINFALL FROM HOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

OUTPUT CONTROL VARIABLES 11 10 IPRNT PRINT CONTROL IPLOT O PLOT CONTROL QSCAL 0. HYDROGRAPH PLOT SCALE HYDROGRAPH TIME DATA 11 HMIN 3 MINUTES IN COMPUTATION INTERVAL IDATE 0 STARTING DATE 0000 STARTING TIME NUMBER OF HYDROGRAPH ORDINATES ENDING DATE ITIME 300 NO NODATE 0 1 NOTIME 1457 ENDING TIME ICENT 19 CENTURY MARK COMPUTATION INTERVAL .05 HOURS TOTAL TIME BASE 14.95 HOURS ENGLISH UNITS DRAINAGE AREA SQUARE MILES PRECIPITATION DEPTH INCHES LENGTH, ELEVATION FFET

CUBIC FEET PER SECOND FLOW STORAGE VOLUME ACRE-FEET SURFACE AREA ACRES DEGREES FAHRENHEIT TEMPERATURE 13 JO INDEX STORM NO. 1 STRM .70 PRECIPITATION DEPTH TROA .01 TRANSPOSITION DRAINAGE AREA 14 PI PRECIPITATION PATTERN 1.54 1.20 2.22 1.26 1.02 1.10 1.26 1.06 .96 .36 .00 .00 .00 .00 .00 .00 .76 .00 .42 .54 .60 .18 .26 .22 .12 .60 .54 .54 .42 .46 .12 .10 .06 .06 .06 .80 .72 .64 .48 .24 .12 .30 .48 .84 .60 5.42 .52 18 . 12 1.62 3.42 1.68 1.80 2.88 5.40 5.46 6.62 7.20 2.04 2.10 1.98 1.86 .42 .60 .96 1.12 .96 1.32 .36 .40 .30 .28 .24 .48 48 .56 .72 .86 .66 .78 1.20 .92 .36 .36 .18 -16 .12 -12 . 12 .06 .10 .18 .06 .00 .06 .06 -06 . 18 .00 .02 .06 .06 22 10 INDEX STORM NO. 2 STRM AA. PRECIPITATION DEPTH 1.00 TRANSPOSITION DRAINAGE AREA O PI PRECIPITATION PATTERN 1.20 1.54 2.22 1.26 .78 1.02 1.10 1.26 1.06 .96 .24 .00 .00 .00 .00 .00 .00 .00 .00 . 18 .42 .12 .26 .22 .36 .44 .60 .76 .84 .54 .46 .12 .10 .06 .06 .06 .18 .60 .80 .72 .24 .64 48 .12 .30 .48 .84 .60 48 . 16 .18 .12 1.62 1.80 2.88 3.42 1.68 5.40 6.62 7.20 2.04 2.10 1.98 1.86 .42 .60 .96 .30 .24 .40 .48 .28 48 .56 .72 1.12 1.32 -96 .86 1.20 .66 .36 .36 .18 .12 .12 .12 .06 .10 .18 00 .06 .06 .06 .02 .06 .06

23 10	INDEX STORM NO. 3 STRM TRDA 9.99	PRECIPITATION DE TRANSPOSITION DR	PTH AINAGE AREA				
O PI	PRECIPITATION PATTERM 1.20 1.54 .36 .24 .18 .26 .54 .54 .18 .32 .30 .48 1.62 1.68 2.04 2.10 .30 .28 .96 .86 .18 .16 .06 .06	2.22 1.26 .00 .00 .42 .22 .54 .46 .60 .80 .84 .60 1.80 2.88 2.22 1.98 .24 .40 .66 .74 .12 .12	.00 .12 .42 .90 .48 3.42 1.86	1.02 1.10 .00 .00 .36 .44 .12 .10 .72 .64 .18 .16 .40 5.42 .42 .60 .48 .56 1.20 .92 .06 .10	.00 .60 .06 .48 .12 5.46	1.06 .00 .76 .06 .24 .52 6.62 .96 1.12 .36 .06	.96 .00 .84 .06 .12 .72 7.20 .96 1.32 .36
24 10	INDEX STORM NO. 4 STRM .60 TRDA 10.01	PRECIPITATION DE	PTH RAINAGE AREA				
25 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 1.62 .48 .28 .42 .34 .54 .54 .30 .26 .36 .64 2.82 2.42 .66 1.06 .36 .52 1.26 1.54 .12 .12 .06 .14	.18 .30 .54 .24 .78 2.22	1.80 1.88 .54 .40 .48 .52 .36 .54 .06 .18 .90 1.00 2.82 3.26 1.62 1.30 .36 .52 1.68 1.20 .12 .16 .06 .08	12 .60 .90 .42 1.20 4.14 .66 .84	.92 .24 .60 .70 .30 1.48 4.58 4.58 4.24 .12	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
33 JO	INDEX STORM NO. 5 STRM .55 TRDA 20.00	PRECIPITATION DI TRANSPOSITION DI					
0 PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24	2.34 1.62 .48 .28 .42 .34 .54 .54 .30 .26 .36 .64 2.82 2.42 .66 1.06 .36 .52 1.26 1.54 .12 .12	1.26 .18 .30 .54 .24 .78 2.22 1.26 .60 1.68 .12	1.80	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24	.36 .30 .60 .24 1.62 4.80 .30 1.14 .24
34 JD	INDEX STORM NO. 6 STRM .52 IRDA 30.00	PRECIPITATION D TRANSPOSITION D	EPTH RAINAGE AREA				
O PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 1.62 .48 .28 .42 .34 .54 .54 .30 .26 .36 .64 2.82 2.42 .66 1.06 .36 .52 1.26 1.54 .12 .12	. 54	1.80	.12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24	.36 .30 .60 .62 1.62 4.80 .30 1.14 .24
35 JD	INDEX STORM NO. 7 STRM .48 TROA 50.00	PRECIPITATION D	EPTH RAINAGE AREA				
O PI	PRECIPITATION PATTERN 1.20 1.58 .60 .56 .18 .26 .66 .62 .60 .50 .36 .36 1.32 1.82 .60 .62 .54 .48 1.80 1.62 .30 .24 .12 .10	2.34 1.62 .48 .28 .42 .34 .54 .54 .54 .30 .26 .36 .64 2.82 2.42 .66 1.06 .36 .52 1.26 1.54 .12 .12	.54 .24 .78	1.80	2.04 .12 .60 .90 .42 1.20 4.14 .66 .84 .24	.92 .24 .60 .70 .30 1.48 4.58 .42 1.04 .24	.36 .30 .60 .60 .24 1.62 4.80 .30 1.14 .24

36 JD	INDEX STORM I STRM TRDA	100.00		TATION DE	PTH AINAGE AREA					
0 PI	PRECIPITAT	ION PATTERN								
.,,	1.20 .60 .18 .66 .60	1.58 .56 .26 .62 .50	2.34 .48 .42 .54 .30 .36 2.82	1.62 .28 .34 .54	1.26 .18 .30 .54 .24 .78 2.22	1.80 .54 .48 .36 .06	1.88 .40 .52 .54 .18	2.04 .12 .60 .90	.92 .24 .60 .70	.36 .30 .60 .60
	1.32 .60 .54 1.80 .30	1.82 .62 .48 1.62 .24	2.82 .66 .36 1.26 .12	2.42 1.06 .52 1.54 .12	2.22 1.26 .60 1.68 .12 .18	.90 2.82 1.62 .36 1.68 .12	1.00 3.26 1.30 .52 1.20 .16	1.20 4.14 .66 .84 .24 .24	1.48 4.58 .42 1.04 .24 .12	1.62 4.80 .30 1.14 .24 .06

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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

				TIME IN	HOURS, AREA	IN SQUARE M	ILES			
			PEAK	TIME OF	AVERAGE FL	OW FOR MAXIM	UM PERIOD	BASIN	MAXIMUM STAGE	TIME OF MAX STAGE
	OPERATION.	STATION	FLOW	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA	STAGE	PAR STAGE
*	HYDROGRAPH AT	MMTA	6.	5.00	1.	0.	0.	.90		
	HYDROGRAPH AT	BW1	22.	7.10	11,	4.	4.	60.50		
	HYDROGRAPH AT	BW2	7.	6.00	2.	1.	1.	20.80		
	2 COMBINED AT	BW182	22.	7.10	11.	4.	4.	81.30		
è	2 COMBINED AT	BW APX	9.	7.10	4.	2.	2.	82.20		
	HYDROGRAPH AT	MM1B	2,	5.30	0.	0.	0.	2.10		
٠	HYDROGRAPH AT	MM2	5.	5.15	1.	0.	0.	1.40		
*-	HYDROGRAPH AT	HP1A	16.	4.15	4.	2,	2.	.80		
	ROUTED TO	RTCPA	15.	4.55	4.	2.	2.	.80		
	HYDROGRAPH AT	HP1B	3.	5.25	0.	0.	0.	1.00		
	HYDROGRAPH AT	HP2	3.	5.25	1.	0.	0.	1.20		
٠	4 COMBINED AT	CPA1	15.	5.40	4.	2.	2,	4.40		
	HYDROGRAPH AT	нРЗ	14.	5.20	4.	2.	2.	1.70		
•	2 COMBINED AT	CPA2	23.	5.30	6.	3.	3.	6.10		
•	HYDROGRAPH AT	HP4	8.	5.25	2.	1.	1.	3.30		
*	HYDROGRAPH AT	HP5	6	. 5.00	1.	0.	0.	1.20		
	HYDROGRAPH AT	HP6	10	. 5.25	2.	1.	1.	2.20		
	ROUTED TO	RTCPD	10	. 5.50	Ż.	1.	1.	2.20		
*	HYDROGRAPH AT	HPFA	1	. 5.10	0.	0.	0.	.30		
٠	3 COMBINED AT	CPD	10	5.40	2.	1.	1.	3.70		
•	ROUTED TO	RTCPE	9	5.75	2.	1.	1.	3.70		
•	HYDROGRAPH AT	HPFB	2	2. 5.25	0.	0.	0.	1.60		
•	3 COMBINED AT	CPE	9	9. 5.55	2.	1.	1,	8.60		
	2 COMBINED AT	CPF	2	5. 5.50	6.	3.	3.	14.70		
	HYDROGRAPH AT	SC1	1	5. 7.10	7.	3.	3.	39.40		
	HYDROGRAPH A	sc2		2. 5.30	Ů.	. 0.	. 0.	1.50		

# FEMA FAN MODEL OUTPUT

BARREN WASH ALLUVIAL FAN
(Model Sets 1, 2, 3 & 4)

## Barren Wash Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

## FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	1848	1845

MEAN = 1.042752 STANDARD DEVIATION = 1.533850 SKEW = -1.2

### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511 50-YEAR DISCHARGE = 1440 100-YEAR DISCHARGE = 1845 500-YEAR DISCHARGE = 2633

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6502+0.5415 LOG(Q)

MEAN OF Z = 2.214841STANDARD DEVIATION = 0.830596 SKEW = -1.200000 TRANSFORMATION CONSTANT = 4.989660

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	BEING EX	TY OF DISCHARGE CCEEDED AT THE PEX BY: 0.5415	WIDTH (FT)
12.55			Q	44.6869 Q	(11)
0.5	0.3	49 756	0.39939 0.06472	0.77515 0.22080	5458 1555
VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	AP	CEEDED AT THE EX BY: 0.5415	WIDTH (FT)
			Q	44.6869 Q	

SLOPE = 0.0120000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY:  0.5415  Q 44.6869 Q
0.5	0.4	429	0.12044 0.35977 962
- _JCITY _FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: WIDTH 0.5415 (FT) Q 44.6869 Q
3.5	0.5	1046	0.03859 0.14838 3970

## Barren Wash Alluvial Fan: Model Set 2

## AVULSION FACTOR = 1.5000

## FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	508
100	3513	3523

MEAN = 1.220155 STANDARD DEVIATION = 1.237478 SKEW = -0.6

### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 508 50-YEAR DISCHARGE = 2234 100-YEAR DISCHARGE = 3523 500-YEAR DISCHARGE = 8018

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3608+0.7454 LOG(Q)

MEAN OF Z = 2.270321STANDARD DEVIATION = 0.922428

SKEW = -0.600000

TRANSFORMATION CONSTANT = 5.221557

ENERGY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
(FT)	(FT)	(CFS)		0.7454	(FT)
			Q	22.9512 Q	
0.5	0.3	49	0.38603	0.75342	5552
1.5	1.0	756	0.07282	0.27335	2014
2.5	1.7	2712	0.01575	0.08826	650

* LOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
I/SEC)	(FT)	(CFS)		0.7454	(FT)
De l'Or A			Q	22.9512 Q	17.
3.5	0.4	68	0.33839	0.70932	5227
4.5	0.6	238	0.17753	0.49364	3637
5.5	0.9	649	0.08326	0.30011	2211
6.5	1.3	1496	0.03427	0.16404	1209
7.5	1.7	3059	0.01310	0.07724	566

SLOPE = 0.0120000 N-VALUE = 0.0300000

ENERGY	DEPTH	DISCHARGE	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE
(FT)	(FT)	(CFS)	APEX BY: WIDT 0.7454 (FT Q 22.9512 Q
0.5	0.4	429	0.11715 0.37930 1062
JCITY	DEPTH	DISCHARGE	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: WIDTH
FT/SEC)	(FT)	(CFS)	Q 22.9512 Q (FT
3.5 4.5	0.5	1046 2981	0.05069 0.21668 606 0.01367 0.07961 2218

### Barren Wash Alluvial Fan: Model Set 3

### AVULSION FACTOR = 1.5000

## FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	6018	6011

MEAN = 1.323916 STANDARD DEVIATION = 1.089877 SKEW = -0.1

## SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511 50-YEAR DISCHARGE = 3187 100-YEAR DISCHARGE = 6011 500-YEAR DISCHARGE = 21319

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.1038+0.9523 LOG(Q)

MEAN OF Z = 2.364550STANDARD DEVIATION = 1.037845 SKEW = -0.100000 TRANSFORMATION CONSTANT = 5.498632

DATE ST. 18	2400.00	Waliotal Iron	BEING EXC		
ENERGY	DEPTH	DISCHARGE	APE	X BY:	WIDTH
(FT)	(FT)	(CFS)		0.9523	(FT)
			Q	12.7010 Q	
0.5	0.3	49	0.37636	0.74376	5771
1.5	1.0	756	0.07741	0.31531	2447
2.5	1.7	2712	0.02368	0.15673	1203
			W		
CLOCITY	DEPTH	DISCHARGE	BEING EXC	Y OF DISCHARGE EEDED AT THE X BY:	WIDTH
LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	BEING EXC	EEDED AT THE X BY: 0.9523	WIDTH (FT)
(FT/SEC)	(FT)	(CFS)	BEING EXC APE	EEDED AT THE X BY: 0.9523 12.7010 Q	(FT)
(FT/SEC)	(FT)	(CFS)	BEING EXC APE Q 0.32668	EEDED AT THE X BY: 0.9523 12.7010 Q 0.70074	(FT) 5438
3.5 4.5	(FT) 0.4 0.6	(CFS) 68 238	BEING EXC APE: Q 0.32668 0.17183	EEDED AT THE X BY: 0.9523 12.7010 Q 0.70074 0.50209	(FT) 5438 3896
3.5 4.5 5.5	(FT) 0.4 0.6 0.9	(CFS)  68 238 649	DEING EXC APE: Q 0.32668 0.17183 0.08625	EEDED AT THE X BY: 0.9523 12.7010 Q 0.70074 0.50209 0.33928	(FT) 5438 3896 2633
3.5 4.5	(FT) 0.4 0.6	(CFS) 68 238	BEING EXC APE: Q 0.32668 0.17183	EEDED AT THE X BY: 0.9523 12.7010 Q 0.70074 0.50209	(FT) 5438 3896

SLOPE = 0.0120000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY: 0.9523 12.7010 Q	WIDTH (FT)
0.5	0.4	429	0.11639	0.40412	11916
OCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)		TY OF DISCHARGE CEEDED AT THE EX BY: 0.9523 12.7010 Q	WIDTH (FT)
3.5 4.5	0.5	1046 2981	0.05870 0.02152	0.26939 0.14740	7936 4278

## Barren Wash Alluvial Fan: Model Set 4

### AVULSION FACTOR = 1.5000

## FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	1083	1100
100	5498	5436

MEAN = 0.967763 STANDARD DEVIATION = 1.909410 SKEW = -1.2

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 1100 50-YEAR DISCHARGE = 3994 100-YEAR DISCHARGE = 5436 500-YEAR DISCHARGE = 8466

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.1296+0.4869 LOG(Q)

MEAN OF Z = 2.600766STANDARD DEVIATION = 0.929608 SKEW = -1.200000 TRANSFORMATION CONSTANT = 6.163823

ENERGY	DEPTH	DISCHARGE	BEING EXC	TY OF DISCHARGE DEEDED AT THE EX BY:	WIDTH
(FT)	(FT)	(CFS)	Q 1	0.4869 134.7735 Q	(FT)
0.5	0.3	49	0.41930	0.84140	7319
1.5	1.0	756	0.13521	0.45395	3949
2.5	1.7	2712	0.03806	0.17863	1554

LOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
(FT/SEC)	(FT)	(CFS)		0.4869	(FT)
			Q	134.7735 Q	455
3.5	0.4	68	0.38395	0.81578	7096
4.5	0.6	238	0.24947	0.66394	5775
5.5	0.9	649	0.14958	0.48573	4225
6.5	1.3	1496	0.07778	0.30563	2659
7.5	1.7	3059	0.03212	0.15540	1352

SLOPE = 0.0120000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	APE	Y OF DISCHARGE EEDED AT THE X BY: 0.4869 34.7735 Q	WIDTH (FT)
0.5	0.4	429	0.18835	0.56624	18717
- COLTRA	DDDMI	DIGGUARGE		EEDED AT THE	
LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)		X BY: 0.4869 34.7735 Q	WIDTH (FT)
3.5 4.5	0.5	1046 2981	0.10475 0.03340	0.38461 0.16040	12713 5302

## FEMA FAN MODEL OUTPUT

SCARP CANYON ALLUVIAL FAN
(Model Sets 1, 2, 3 & 4)

## Scarp Canyon Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

### FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	351
100	1251	1265

### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 351 50-YEAR DISCHARGE = 987 100-YEAR DISCHARGE = 1265 500-YEAR DISCHARGE = 1805

## STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.5751+0.5415 LOG(Q)

MEAN OF Z = 2.050915 STANDARD DEVIATION = 0.830638 SKEW = -1.200000 TRANSFORMATION CONSTANT = 4.290921

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY: 0.5415	WIDTH (FT)
			Q	37.5951 Q	32.57
0.5	0.3	49 756	0.34883 0.03535	0.72387 0.13698	4383 829
				TY OF DISCHARGE CEEDED AT THE	
VELOCITY	DEPTH	DISCHARGE		EX BY:	WIDTH
r/sec)	(FT)	(CFS)		0.5415	(FT)
			Q	37.5951 Q	42,416
3.5	0.4	68	0.30420	0.67202	4069
4.5	0.6	238	0.14528	0.41207	2495
5.5	0.9	649	0.04559	0.17003	1030

SLOPE = 0.0148000 N-VALUE = 0.0300000

-				
ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: 0.5415 Q 37.5951 Q	WIDTH (FT)
0.5	0.4	443	0.07886 0.25909	5962
LLOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: 0.5415 Q 37.5951 Q	WIDTH (FT)
3.5	0.4	805	0.03152 0.12353	2842

## Scarp Canyon Alluvial Fan: Model Set 2

## AVULSION FACTOR = 1.5000

## FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	351
100	2178	2198

MEAN = 1.030262 STANDARD DEVIATION = 1.279943 SKEW = -0.7

### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 351 50-YEAR DISCHARGE = 1443 100-YEAR DISCHARGE = 2198 500-YEAR DISCHARGE = 4604

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3680+0.7081 LOG(Q)

MEAN OF Z = 2.097573STANDARD DEVIATION = 0.906384 SKEW = -0.700000 TRANSFORMATION CONSTANT = 4.459600

623

ENERGY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
(FT)	(FT)	(CFS)	Q	0.7081 23.3345 Q	(FT)
0.5	0.3	49	0.33492	0,70714	4450
1,5	1.0	756	0.04683	0.19857	1250
VELOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
VELOCITY	DEPTH (FT)	DISCHARGE (CFS)	BEING EX	CEEDED AT THE	WIDTH (FT)
			BEING EX AP Q	CEEDED AT THE EX BY: 0.7081 23.3345 Q	(FT)
3.5 4.5	(FT)	(CFS)	BEING EX AP Q 0.28883	CEEDED AT THE EX BY: 0.7081 23.3345 Q 0.65373	(FT)
T/SEC)	(FT)	(CFS)	BEING EX AP Q	CEEDED AT THE EX BY: 0.7081 23.3345 Q	(FT)

SLOPE = 0.0148000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY:  0.7081  Q 23.3345 Q
0.5	0.4	443	0.08348 0.29635 7087
CITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: WIDTH 0.7081 (FT) Q 23.3345 Q
3.5	0.4	805	0.04358 0.18942 4530

## Scarp Canyon Alluvial Fan: Model Set 3

## AVULSION FACTOR = 1.5000

### FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
(		(/
2	15	15
10	356	357
100	3498	3491

MEAN = 1.117872 STANDARD DEVIATION = 1.152607 SKEW = -0.3

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 357 50-YEAR DISCHARGE = 1976 100-YEAR DISCHARGE = 3491 500-YEAR DISCHARGE = 10458

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2079+0.8628 LOG(Q)

MEAN OF Z = 2.172367 STANDARD DEVIATION = 0.994433 SKEW = -0.300000 TRANSFORMATION CONSTANT = 4.652288

#### SINGLE-CHANNEL REGION

WIDTH	TY OF DISCHARGE CEEDED AT THE EX BY:	BEING EX	DISCHARGE	DEPTH	ENERGY
(FT)	0.8628 16.1400 Q	Q	(CFS)	(FT)	(FT)
4602	0.70098	0.32531	49	0.3	0.5
1631	0.24845	0.05446	756	1.0	1.5
625	0.09633	0.01444	2712	1.7	2.5

LOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
(. I/SEC)	(FT)	(CFS)	Q	0.8628 16.1400 Q	(FT)
3.5	0.4	68	0.27964	0.64926	4263
4.5	0.6	238	0.13909	0.43758	2873
5.5	0.9	649	0.06377	0.27117	1780
6.5	1.3	1496	0.02760	0.16044	1051
7.5	1.7	3059	0.01232	0.08785	565

SLOPE = 0.0148000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	BEING EX	CTY OF DISCHARGE CCEEDED AT THE PEX BY: 0.8628 16.1400 Q	WIDTH (FT)
0.5	0.4	443	0.08692	0.33143	8269
ELOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CCEEDED AT THE PEX BY:	WIDTH
(FT/SEC)	(FT)	(CFS)	Q	0.8628 16.1400 Q	(FT)
3.5 4.5	0.4	805 2293	0.05067 0.01738	0.23920 0.11285	5968 2774

#### Scarp Canyon Alluvial Fan: Model Set 4

#### AVULSION FACTOR = 1.5000

# FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	769	779
100	3438	3406

MEAN = 0.751408 STANDARD DEVIATION = 2.011177 SKEW = -1.3

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 779 50-YEAR DISCHARGE = 2597 100-YEAR DISCHARGE = 3406 500-YEAR DISCHARGE = 4925

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.0997+0.4540 LOG(Q)

MEAN OF Z = 2.440823 STANDARD DEVIATION = 0.913058 SKEW = -1.300000 TRANSFORMATION CONSTANT = 5.305945

# SINGLE-CHANNEL REGION

ENERGY	DEPTH	DISCHARGE	BEING E	ITY OF DISCHARGE XCEEDED AT THE PEX BY:	WIDTH
(FT)	(FT)	(CFS)		0.4540	(FT)
			Q	125.8027 Q	700
0.5	0.3	49	0.38263	0.81739	6120
1.5	1.0	756	0.10286	0.37538	2811
2.5	1.7	2712	0.01841	0.09197	689

				Y OF DISCHARGE EEDED AT THE	
LOCITY	DEPTH	DISCHARGE		X BY:	WIDTH
rT/SEC)	(FT)	(CFS)		0.4540	(FT)
			Q 1	25.8027 Q	15.54
3.5_	0.4	68	0.34751	0.78692	5892
4.5	0.6	238	0.21491	0.61188	4582
5.5	0.9	649	0.11751	0.41056	3074
6.5	1.3	1496	0.05029	0.21689	1624
7.5	1.7	3059	0.01396	0.07173	537

SLOPE = 0.0148000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: 0.4540 Q 125.8027 Q	WIDTH (FT)
0.5	0.4	443	0.15397 0.49326	14035
;LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: 0.4540 Q 125.8027 Q	WIDTH (FT)
3.5	0.4	805 2293	0.09752 0.36091 0.02578 0.12522	10269 3563

# FEMA FAN MODEL OUTPUT

HALFPINT ALLUVIAL FAN (Model Sets 1, 2, 3 & 4)

#### Halfpint Alluvial Fan: Model Set 1

#### AVULSION FACTOR = 1.5000

# FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	170
100	603	598

MEAN = 0.759609 STANDARD DEVIATION = 1.328618 SKEW = -1.1

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 170 50-YEAR DISCHARGE = 464 100-YEAR DISCHARGE = 598 500-YEAR DISCHARGE = 876

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2765+0.5980 LOG(Q)

MEAN OF Z = 1.730742STANDARD DEVIATION = 0.794495 SKEW = -1.100000 TRANSFORMATION CONSTANT = 3.392134

# SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)		TTY OF DISCHARGE CCEEDED AT THE PEX BY: 0.5980 18.9020 Q	WIDTH (FT)
0.5	0.3	49	0.26742	0.59475	2847
VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)		TY OF DISCHARGE CCEEDED AT THE PEX BY: 0.5980 18.9020 Q	WIDTH (FT)

SLOPE = 0.0196000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: 0.5980 Q 18.9020 Q	IDTH (FT)
0.5	0.3	449	0.02168 0.08480	1543
ELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)		IDTH

# Halfpint Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

# FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	169
100	1180	1176

MEAN = 0.928731 STANDARD DEVIATION = 1.055311 SKEW = -0.4

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 169 50-YEAR DISCHARGE = 731 100-YEAR DISCHARGE = 1176 500-YEAR DISCHARGE = 2890

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.0090+0.8374 LOG(Q)

MEAN OF Z = 1.786716 STANDARD DEVIATION = 0.883714 SKEW = -0.400000 TRANSFORMATION CONSTANT = 3.569505

#### SINGLE-CHANNEL REGION

NERGY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
(FT)	(FT)	(CFS)		0.8374	(FT)
			Q	10.2094 Q	
0.5	0.3	49	0.24808	0.57142	2878
1.5	1.0	756	0.01928	0.09924	500

VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: WIDTH 0.8374 (FT) Q 10.2094 Q
3.5	0.4	68	0.20017 0.50667 2552
4.5	0.6	238	0.07596 0.26560 1338
5.5	0.9	649	0.02353 0.11884 599

SLOPE = 0.0196000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILI BEING EX AP	WIDTH (FT)	
0.5	0,3	449	0.03741	0.16695	3196
-			BEING EX	TY OF DISCHARGE CEEDED AT THE	
'LLOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	AP Q	EX BY: 0.8374 10.2094 Q	WIDTH (FT)
3.5	0.4	566	0.02835	0.13656	2614

# Halfpint Alluvial Fan: Model Set 3

#### AVULSION FACTOR = 1.5000

# FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPU'	T DISCHARGE (CFS)	E	BEST FIT DISCHARGE (CFS)
2 10 100		10 168 1819		10 168 1821
	STANDARD	MEAN DEVIATION		1.016033 0.935309

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 168 50-YEAR DISCHARGE = 970 100-YEAR DISCHARGE = 1821 500-YEAR DISCHARGE = 6634

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=0.7953+1.0450 LOG(Q)

SKEW = 0.1

MEAN OF Z = 1.857036 STANDARD DEVIATION = 0.977359 SKEW = 0.100000 TRANSFORMATION CONSTANT = 3.728261

3.5

4.5

5.5

6.5

0.4

0.6

0.9

1.3

2653

1546

883

462

#### SINGLE-CHANNEL REGION

68

238

649

1496

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	AP	CEEDED AT THE EX BY: 1.0450	WIDTH (FT)
0.5	0.3	49	Q 0.23709	6.2420 Q 0.56316	2963
1.5	1.0	756	0.02605	0.15414	802
YELOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
T/SEC)	(FT)	(CFS)	Q	1.0450 6.2420 Q	(FT)

0.19242

0.07866

0.03085

0.01313

0.50416

0.29407

0.16909

0.09258

SLOPE = 0.0196000 N-VALUE = 0.0300000

ENERGY	DEPTH	DISCHARGE	PROBABILI BEING EX AP	WIDTH	
(FT)	(FT)	(CFS)	Q	1.0450 6.2420 Q	(FT)
0.5	0.3	449	0.04315	0.20703	4126

CITY	DEPTH	DISCHARGE	PROBABILITED BEING EXC	WIDTH	
(FT/SEC)	(FT)	(CFS)	Q	1.0450 6.2420 Q	(FT)
3.5	0.4	566 1614	0.03509 0.01192	0.18232 0.08813	3625 1651

# Halfpint Alluvial Fan: Model Set 4

#### AVULSION FACTOR = 1,5000

# FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	335	343
100	1898	1867

MEAN = 0.734788 STANDARD DEVIATION = 1.596884 SKEW = -1.0

#### SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 343 50-YEAR DISCHARGE = 1310 100-YEAR DISCHARGE = 1867 500-YEAR DISCHARGE = 3269

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6637+0.5765 LOG(Q)

MEAN OF Z = 2.087308 STANDARD DEVIATION = 0.920624 SKEW = -1.000000 TRANSFORMATION CONSTANT = 4.101043

#### SINGLE-CHANNEL REGION

	D. 20 mile	DI GOVI DOD	BEING EX	TY OF DISCHARGE CEEDED AT THE	
ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	API	EX BY: 0.5765	WIDTH (FT)
1	1/	(5.5)	Q	46.0992 Q	(11)
0.5	0.3	49	0.31010	0.71462	4136
1.5	1.0	756	0.04476	0.19714	1141
VELOCITY r/sec)	DEPTH (FT)	DISCHARGE (CFS)	BEING EXC	TY OF DISCHARGE CEEDED AT THE EX BY: 0.5765	
			BEING EXC	CEEDED AT THE	WIDTH (FT)
r/SEC)	(FT)		BEING EXC	CEEDED AT THE EX BY: 0.5765	(FT)
7/SEC) 3.5 4.5	(FT) 0.4 0.6	(CFS) 68 238	BEING EXC API Q	CEEDED AT THE EX BY: 0.5765 46.0992 Q	
3.5	(FT)	(CFS)	BEING EXC API Q 0.27085	CEEDED AT THE EX BY: 0.5765 46.0992 Q 0.66516	(FT)

SLOPE = 0.0196000 N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY: 0.5765 46.0992 Q	WIDTH (FT)
0.5	0.3	449	0.08068	0.30203	6642
VLLOCITY	DEPTH	DISCHARGE	BEING EX	TY OF DISCHARGE CEEDED AT THE EX BY:	WIDTH
VLLOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	BEING EX		WIDTH (FT)

HEC-2 WATER SURFACE PROFILES Version 4.6.2; May 1991 29JAN93 TIME 15:20:50 RUN DATE

U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET, SUITE D
DAVIS, CALIFORNIA 95616-4687
(916) 756-1104

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

T1 HEC-2 RUN TO DETERMINE 100-YEAR FLOOD HAZARD LIMITS AND DEPTHS
T2 SOUTHWEST CORNER OF RWMS ASSUMING NO BERM
T3 FLOW CONDITION OF "NATURAL CONDITIONS" FILE: SWCRWMS.DAT

SUBCRITICAL FLOW CROSS SECTIONS DEVELOPED FROM 1"=400', 5' C.I. TOPOGRAPHIC MAP OF THE RWMS. THE 100-YEAR DISCHARGE AT CROSS SECTION 1 FROM HEC-1 MODEL RWMSW.OUT (CPF) 1S 2396 CFS. THE REMAINING CROSS SECTIONS (2-7) USED THE 100-YEAR DISCHARGE OF 1230 CFS FROM HEC-1 MODEL RWMSW.OUT (CPA1).

Jì	ICHECK	INQ	VINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ	
	0	2	0	0	-1	0	0	0	3166	0	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE	
	1	0	-1	0	0	-1	0	0	0	0	
NC OT	0.040	0.040	.035		.1	.3	0	0	0		
GR GR	1.0 3175 3175	6 0 670	3165		670 300	3167	340	3165	360	3170	390
GR GR GR GR GR	1 2.0 3180 3176 3176 3176	1229 19 0 461 555 611	445 3177.5 3176 3175 3176		661 420 470 556 660	1240 3177.5 3175.5 3175 3178	1240 445 471 590 661	1240 3177 3175.5 3176.5 3180	446 490 591 930	3176.5 3176 3176.5	460 491 610
X1 GR GR	3.0 3185 3181	9 0 776	765 3181 3181		821 740 820	560 3181 3182	560 765 821	560 3180 3185	766 1100		775
X1 GR	4.0 3190	3 0	3185		1060 660	800 3190	800 1060	800			
X1 GR	5.0 3215	3 0	3210		1440 770	1840 3215	1840 1440	1840			
X1 GR	6.0 3220	3 0	3215		1130 440	820 3220	820 1130	820			
X1 GR	7 3230	3 0			1150 590	780 3230	780 1150	780			

	SECNO O TIME SLOPE	DEPTH OLOB VLOB XLOBL	XLCH VCH CMSEL	CRIWS OROB VROB XLOBR	WSELK ALOB XNL ITRIAL	EG ACH XNCH IDC	HV AROB XHR I CONT	HL VOL WTN CORAR	OLOSS TWA ELMIN TOPWID	L-BANK R-BANK SSTA ENDST	
.0	*PROF 1	,									
	CCHV= .1 *SECNO 1.000	OO CEHV=	.300								
	3720 CRITICA 1.000 2396.0 .00 .015002		3168.18 2396.0 7.66 0.	3168.18 .0 .00	3166.00 .000	3169.09 312.8 .035 22	.91 .00 .000	.00 .00 .000	.00 .0 3165.00 174.47	3175.00 3175.00 204.61 379.08	
	*SECNO 2.000										
	3301 HV CHAN		THAN HVINS								
	2.000	2.68	3177.68	.00	.00	3177.84	.16	8.67	.08	3177.50	
	1229.0 .11 .002669	3.6 .52 1240.	1225.4 3.19 1240.	.0 .00 1240.	7.0 .040 6	383.9 .035 0	.000 000.	10.0 .000 .00	6.3 3175.00 270.29	3178.00 390.55 660.84	
	*SECNO 3.000 3685 20 TRIA 3693 PROBABL 3720 CRITICA 3.000	LS ATTEMP E MINIMUM	SPECIFIC E		.00	3182.70	.40	2.92	.07	3181.00	
	1229.0	691.4	532.6	5.1	187.7	82.1 .035	4.1	14.3	10.3	3182.00 500.26	
	.014448	560.	560.	560.	20	12	0	.00	348.26	848.52	
	*SECNO 4.000										
	3302 WARNING	: CONVEY	ANCE CHANG	OUTSIDE	OF ACCEPTA	BLE RANGE,	KRATIO =	2.19			
	4.000 1229.0 .23 .003005	2.17 .0 .00 800.	3187.17 1229.0 2.46 800.	.00 .00 .00	.00 .000 5	3187.26 499.9 .035	.09 .00 .000	4.54 21.4 .000 .00	.03 17.7 3185.00 460.39	3190.00 3190.00 373.34 833.73	
	*SECNO 5.000 3685 20 TRIA 3693 PROBABL 3720 CRITICA 5.000 1229.0 .34 .021001	LS ATTEMP	SPECIFIC		.00 .0 .000 20	3211.69 260.3 .035	.35 .0 .000	11.64 37.4 .000	.08 35.6 3210.00 387.21	3215.00 3215.00 562.95 950.16	
	*SECNO 6.000										
	3302 WARNING		ANCE CHANG	E OUTSIDE	OF ACCEPTA	BLE RANGE.	KRATIO =	2.55			
	6.000 1229.0 .43 .003231	2.09 .0 .00 820.	3217.09 1229.0 2.49 820.		.00	3217.18 494.3 .035		5.47 44.6 .000 .00	.03 43.7 3215.00 472.69	3220.00 3220.00 255.94 728.63	
	*SECNO 7.000 3685 20 TRIA 3693 PROBABI 3720 CRITICA	ALS ATTEMP LE MINIMUM AL DEPTH A	SPECIFIC	ENERGY							
	7.000 1229.0 .47 .020478	1.47 .0 .00 780.	3226.47 1229.0 4.95 780.	3226.47 .0 .00 780.	.00 0.000 000	3226.85 248.4 .035	.38 .00 .000	5.16 51.2 .000	.09 51.0 3225.00 338.04	3230.00 3230.00 416.57 754.61	
					2.0	13	U	.00	330.04	734.01	

NOTE- ASTERISK (\*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

CONDITION OF "NATURAL C SUMMARY PRINTOUT TABLE 150

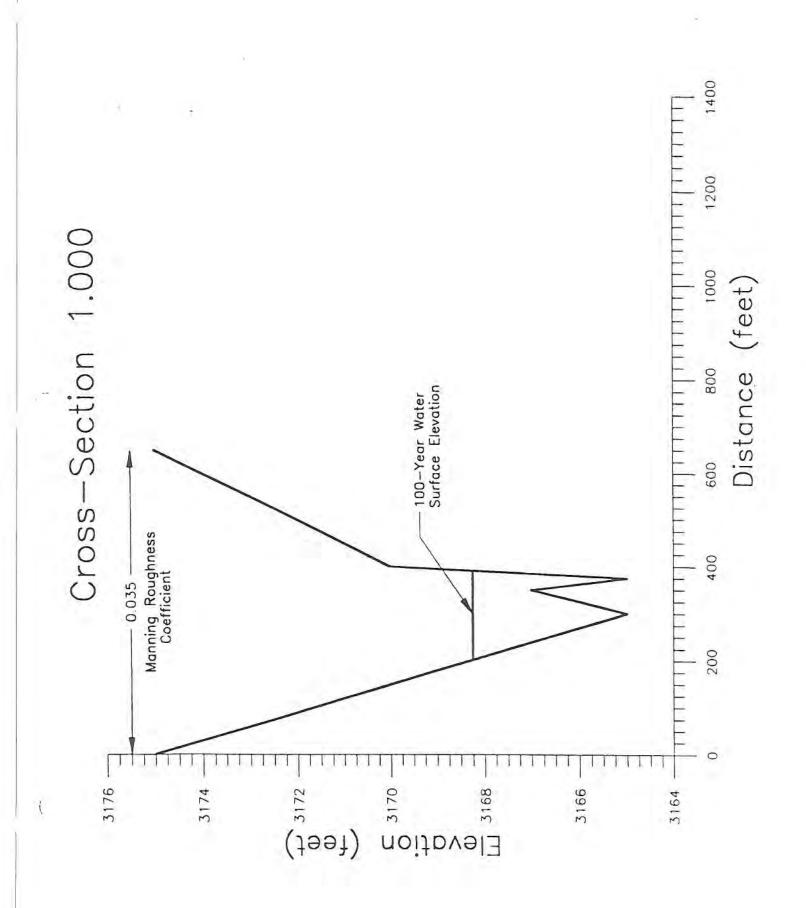
	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CMSET	CRIWS	EG	10*KS	VCH	AREA	.01K
•	1.000	.00	.00	.00	3165.00	2396.00	3168.18	3168.18	3169.09	150.02	7.66	312.77	195.62
	2.000	1240.00	.00	.00	3175.00	1229.00	3177.68	.00	3177.84	26.69	3.19	390.85	237.88
	3.000	560.00	.00	.00	3180.00	1229.00	3182.30	3182.30	3182.70	144.48	6.49	273.88	102.25
	4.000	800.00	.00	.00	3185.00	1229.00	3187.17	.00	3187.26	30.05	2.46	499.89	224.21
	5.000	1840.00	.00	.00	3210.00	1229.00	3211.34	3211.34	3211.69	210.01	4.72	260.30	84.81
•	6.000	820.00	.00	.00	3215.00	1229.00	3217.09	.00	3217.18	32.31	2.49	494.33	216.23
•	7.000	780.00	.00	.00	3225.00	1229.00	3226.47	3226.47	3226.85	204.78	4.95	248.41	85.88
	1,000	2396.00	3168.18	.00	.00	2.18	174.47	.00					~7.62
	2.000	1229.00	3177.68	.00	9.50	.00	270.29	1240.00					
	3.000	1229.00	3182.30	.00	4.62	.00	348.26	560.00					
*	4.000	1229.00	3187.17	.00	4.87	.00	460.39	800.00					
	5.000	1229.00	3211.34	.00	24.17	.00	387.21	1840.00					
	6.000	1229.00	3217.09	.00	5.74	.00	472.69	820.00					
	7.000	1229.00	3226.47	.00	9.38	.00	338.04	780.00					

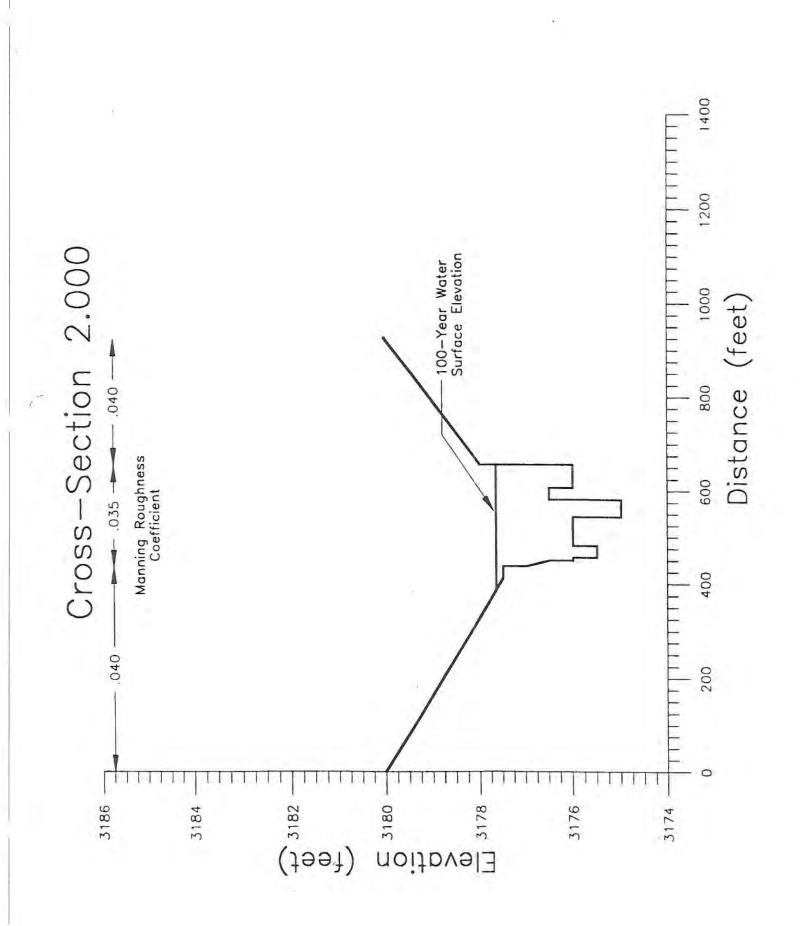
#### SUMMARY OF ERRORS AND SPECIAL NOTES

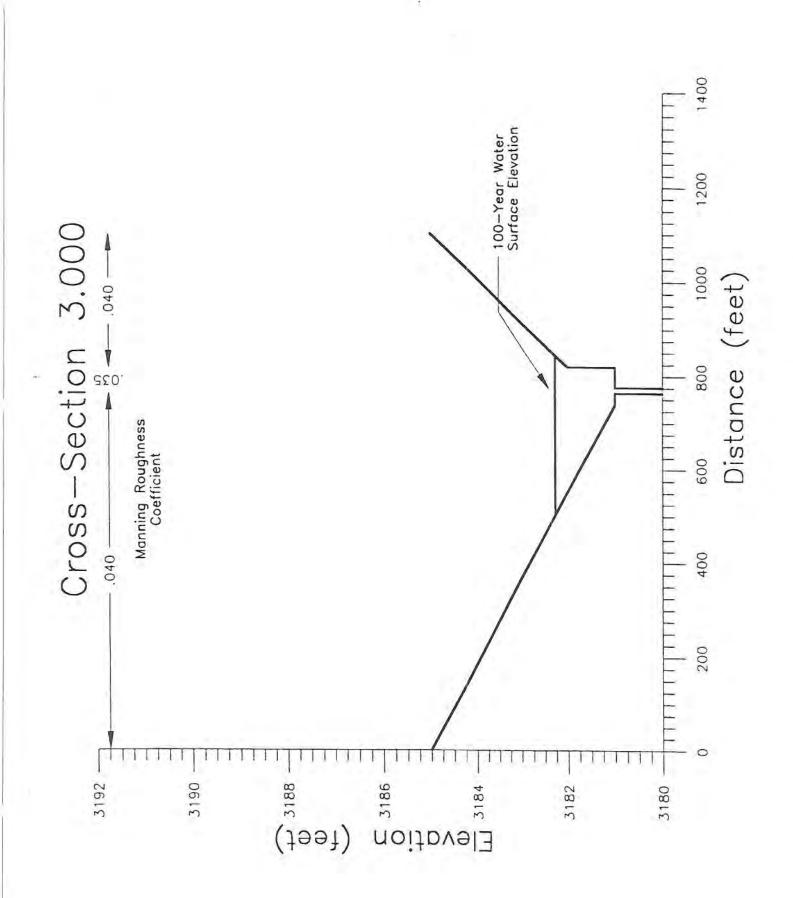
CAUTION	SECNO=	1.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
10N	SECNO=	3.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	3.000	PROFILE =	1	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	3.000	PROFILE=	1	20 TRIALS ATTEMPTED TO BALANCE WSEL
WARNING	SECNO=	4.000	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION	SECNO=	5.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	5.000	PROFILE=	1	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	5.000	PROFILE=	1	20 TRIALS ATTEMPTED TO BALANCE WSEL
WARNING	SECNO=	6.000	PROFILE=	1	CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION	SECNO=	7.000	PROFILE=	1	CRITICAL DEPTH ASSUMED
CAUTION	SECNO=	7.000	PROFILE=	1	PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION	SECNO=	7.000	PROFILE=	1	20 TRIALS ATTEMPTED TO BALANCE WELL

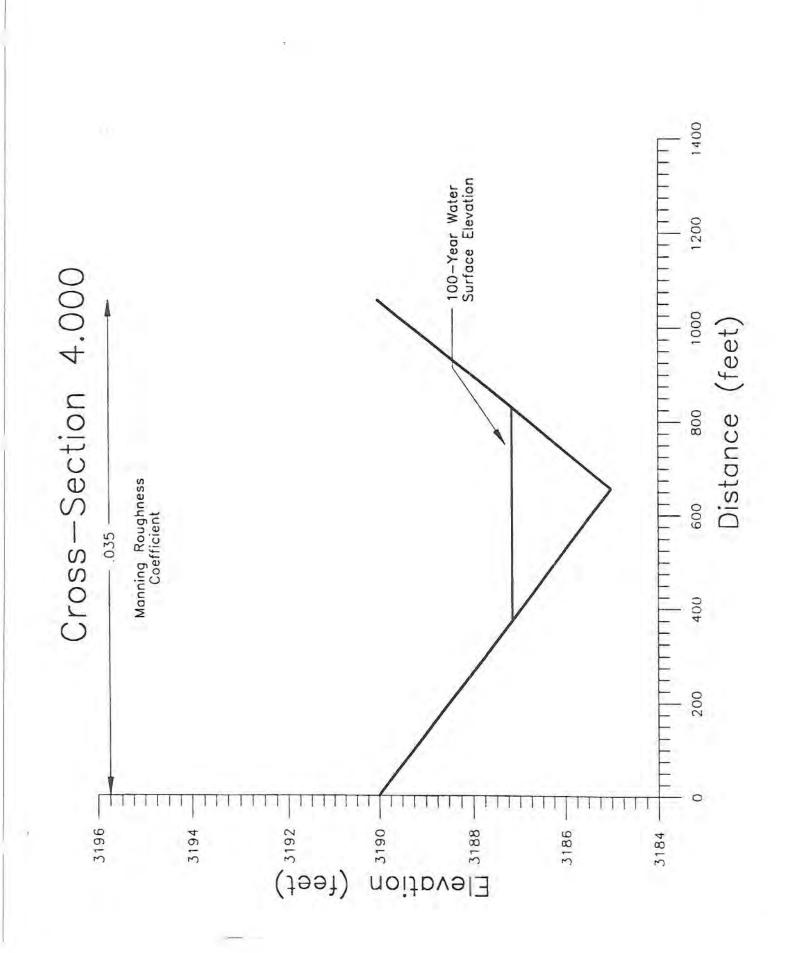
# **HEC-2 MODEL OUTPUT**

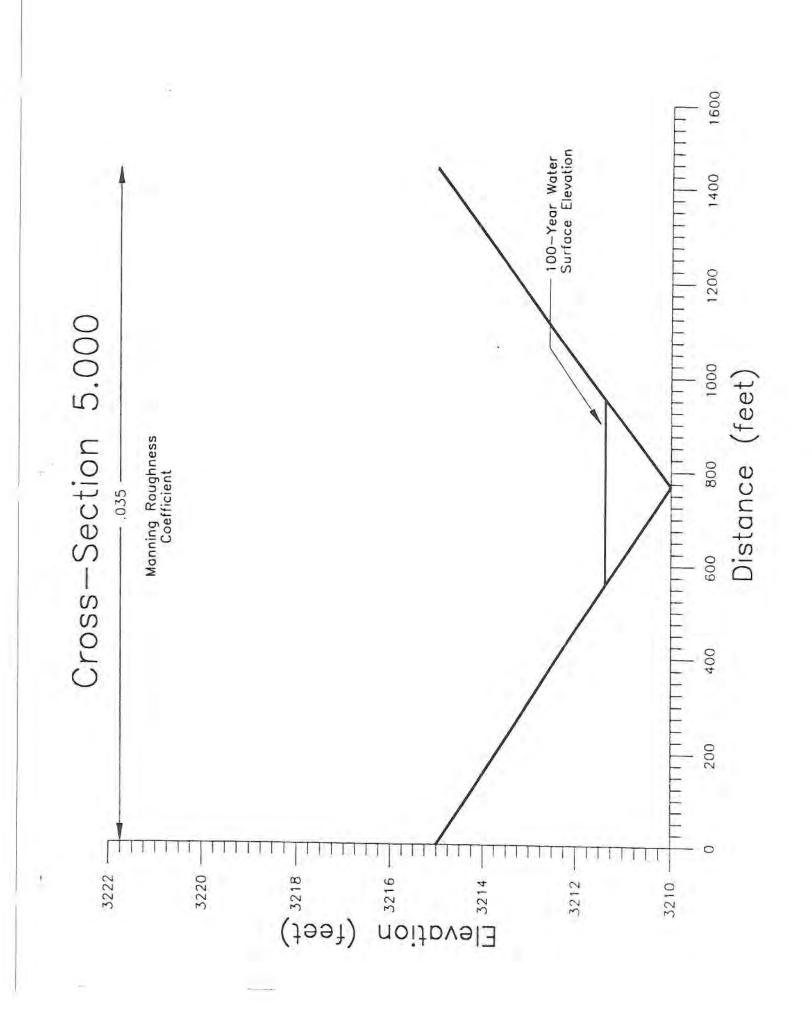
**CROSS SECTIONS** 

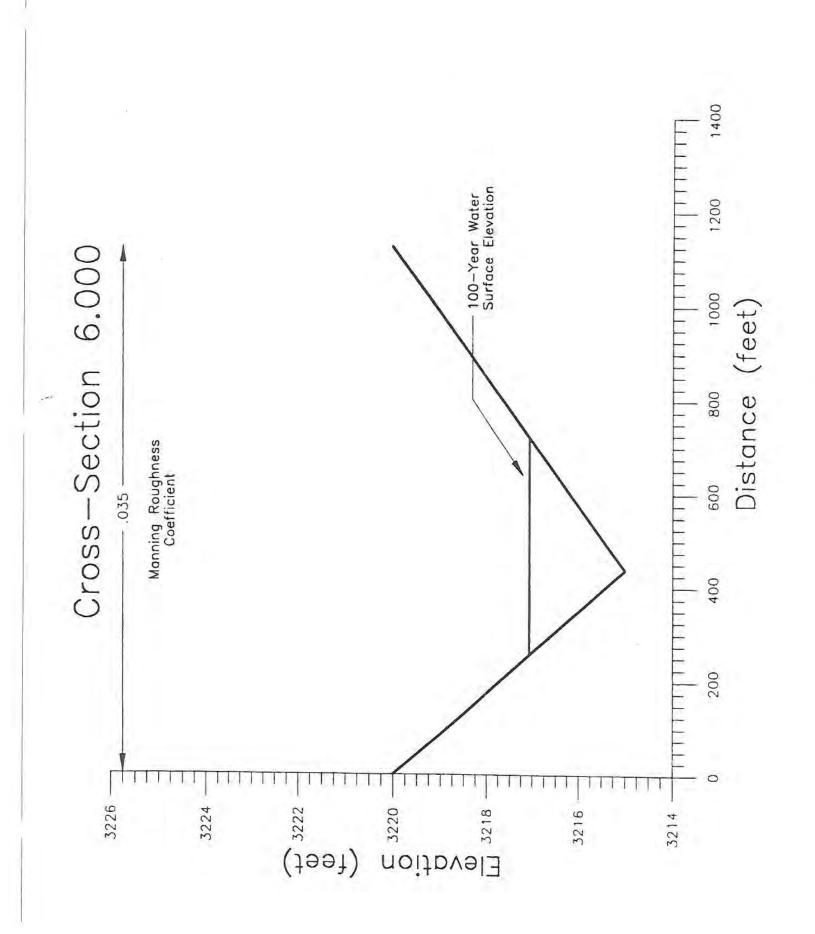


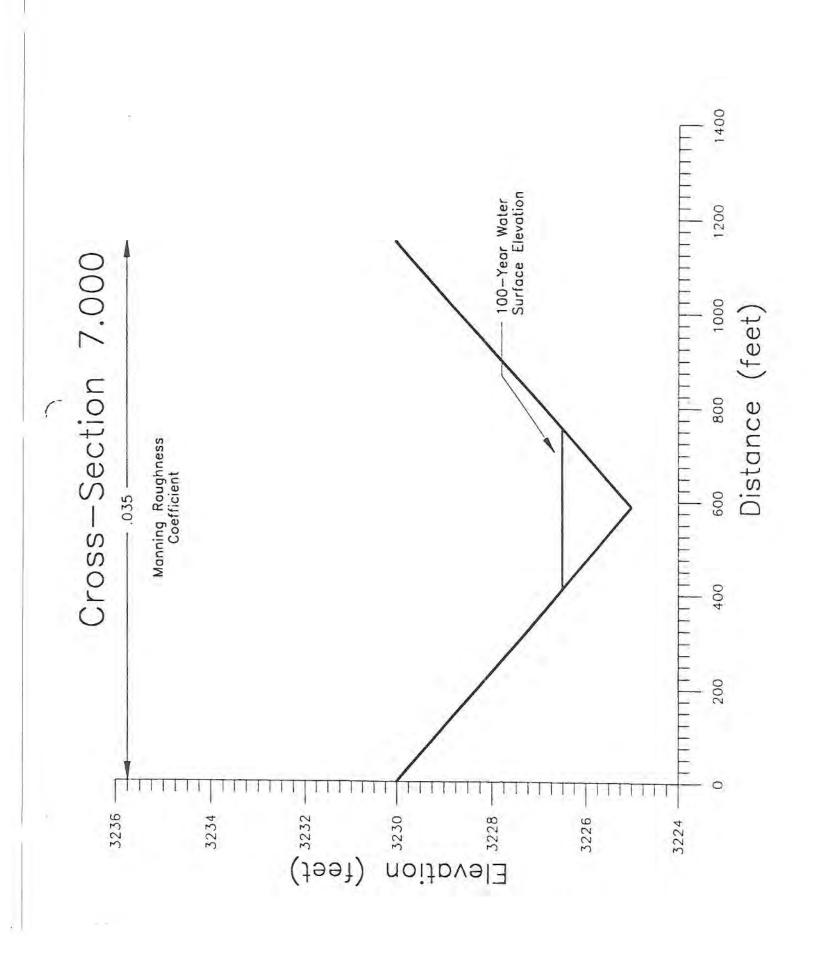












# SHEETFLOW CALCULATIONS FOR THE NORTH SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION	REACH LENGTH	MANNING COEFFICIENT	SLOPE	WIDTH	DISCHARGE
(ft)	(ft)	23-1130311	(ft/ft)	(ft)	(ft³/sec)
90	3500	0.035	0.026	2500	624

Q=DISCHARGE (ft³/sec)
V=VELOCITY (ft/sec)
A=AREA (ft²) (For a rectangular channel, area = depth \* width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)
d=DEPTH (ft)

#### EQUATIONS:

Q=VA

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

#### CALCULATIONS:

$$Q = \frac{1.49}{m} d^{1/3} S^{1/2} dW$$

$$Q = \frac{1.49}{n} d^{5/3} S^{1/2} W$$

$$d = \frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

#### DEPTH CALCULATION:

FLOW DEPTH = 0.11 ft

# SHEETFLOW CALCULATIONS FOR THE EAST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION	REACH LENGTH	MANNING COEFFICIENT	SLOPE	WIDTH	DISCHARGE
(ft)	(ft)		(ft/ft)	(ft)	(ft³/sec)
75	4250	0.035	0.018	2460	1100

Q=DISCHARGE (ft3/sec)

V=VELOCITY (ft/sec)

A=AREA (ft2) (For a rectangular channel, area = depth \* width)

R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)

S=SLOPE (ft/ft)

n=MANNING COEFFICIENT

W=WIDTH (ft)

d=DEPTH (ft)

#### EQUATIONS:

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

# CALCULATIONS:

$$Q = \frac{1.49}{n} d^{2/3} S^{1/2} dW$$

$$Q = \frac{1.49}{n} d^{5/3} S^{1/2} W$$

$$d = \frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

#### DEPTH CALCULATION:

FLOW DEPTH = 0.22 ft

# SHEETFLOW CALCULATIONS FOR THE WEST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION	REACH LENGTH	MANNING COEFFICIENT	SLOPE	WIDTH	DISCHARGE	
(ft)	(ft)	3 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(ft/ft)	(ft)	(ft³/sec)	
100	3500	0.035	0.029	2780	450	

Q=DISCHARGE (ft<sup>3</sup>/sec)
V=VELOCITY (ft/sec)
A=AREA (ft<sup>2</sup>) (For a rectangular channel, area = depth \* width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)

EQUATIONS:

d=DEPTH (ft)

Q = VA

$$V = \frac{1.49}{n} R^{2/3} S^{1/3}$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

CALCULATIONS:

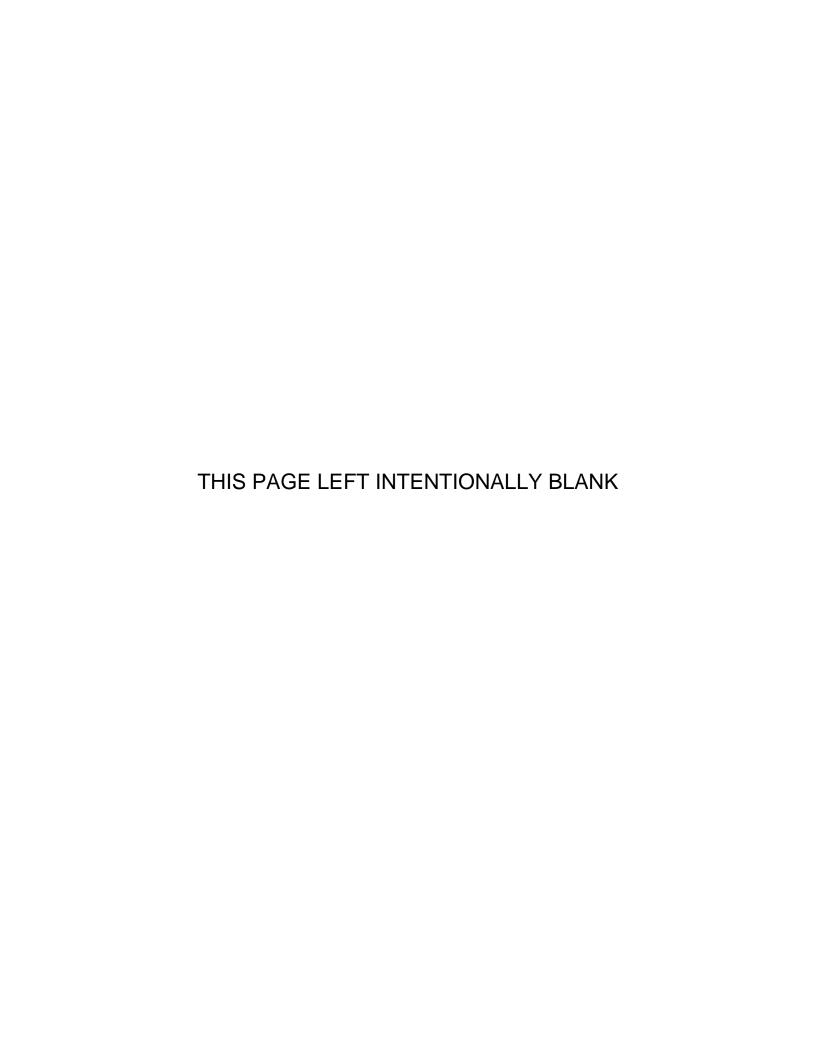
$$Q = \frac{1.49}{n} d^{2/3} S^{1/2} dW$$

$$Q = \frac{1.49}{n} d^{5/3} S^{1/2} W$$

$$d = \frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.10 ft



# RCRA PART B PERMIT APPLICATION FOR WASTE MANAGEMENT ACTIVITIES AT THE NEVADA TEST SITE PROPOSED MIXED WASTE STORAGE UNIT (MWSU) JUNE 2010

# B.12 Training [40 CFR 270.14(b)(12)]

This section identifies the training requirements applicable to personnel assigned to perform duties at the MWSU.

#### **B.12.a Radioactive Waste Management Program Training**

The training requirements are established using the contractor's Training Program Manual. The manual uses a systematic approach that ensures personnel assigned to waste handling operations are trained and qualified to safely and effectively perform their assigned work. Qualified training personnel work with the Operations Manager and subject matter experts, who are knowledgeable of hazardous and radioactive waste management and emergency procedures, to develop job descriptions for each functional title. Based on job descriptions, qualification programs are developed for each position that identify critical task assignments, entry-level qualifications, and additional training needs. Qualification cards are prepared for all RWMC personnel that document completion of the assigned training program for their functional title. Annual reviews of training programs and qualification status for RWMC personnel are performed to ensure personnel training qualifications are current. Personnel qualification cards are maintained by the contractor's Training Department. Personnel training records are accessible at the RWMC via the contractor's training database. The Operations Manager also maintains a List of Qualified Individuals at the RWMC to ensure personnel training and qualification are current.

# **B.12.b RWMC Personnel [40 CFR 264.16(d)]**

The information provided in Table 8, MWSU Training Matrix, includes functional title and required training for personnel assigned to perform work at the MWSU. Current functional titles and job descriptions are maintained in the Radioactive Waste Operations Training Records.

# RCRA PART B PERMIT APPLICATION FOR WASTE MANAGEMENT ACTIVITIES AT THE NEVADA TEST SITE PROPOSED MIXED WASTE STORAGE UNIT (MWSU) JUNE 2010

**Table 8 MWSU Training Matrix** 

Functional Title	8 MWSU Training Matrix Outline of Required Training
Operations Manager	Hazard Communication
operations manager	Hazardous Waste Site General Worker
	Basic RCRA and Hazardous Waste Manifest
	Hazardous Waste Site General Worker Refresher
	Radiological Worker II
	RCRA Refresher
	General Employee Training
Facility Manager	Hazard Communication
Tacility Manager	Hazardous Waste Site General Worker
	Basic RCRA and Hazardous Waste Manifest
	Hazardous Waste Site General Worker Refresher
	Radiological Worker II
	RCRA Refresher
11770	General Employee Training
LLW Operations Supervisor	Hazard Communication
	Hazardous Waste Site General Worker/Supervisor (8 hr)
	Basic RCRA and Hazardous Waste Manifest
	Hazardous Waste Site General Worker Refresher
	Radiological Worker II
	RCRA Refresher
	General Employee Training
Waste Specialist	Hazard Communication
	Hazardous Waste Site General Worker
	Basic RCRA and Hazardous Waste Manifest
	Hazardous Waste Site General Worker Refresher
	Radiological Worker II
	RCRA Refresher
	General Employee Training
Radiological Control Technician	Hazard Communication
	Hazardous Waste Site General Worker
	Basic RCRA and Hazardous Waste Manifest
	Hazardous Waste Site General Worker Refresher
	Radiological Control Technician Training
	RCRA Refresher
	General Employee Training

# RCRA PART B PERMIT APPLICATION FOR WASTE MANAGEMENT ACTIVITIES AT THE NEVADA TEST SITE PROPOSED MIXED WASTE STORAGE UNIT (MWSU) JUNE 2010

Functional Title	Outline of Required Training
Craft Ha	zard Communication
	Hazardous Waste Site General Worker
	Hazardous Waste Site General Worker Refresher
	RCRA for Crafts
	Radiological Worker II
	RCRA Refresher
	General Employee Training
RTR Operator	Hazard Communication
	Hazardous Waste Site General Worker
	Hazardous Waste Site General Worker Refresher
	RCRA Refresher
	Radiological Worker II
	General Employee Training

#### **B.12.c Visitors**

Untrained visitors are not permitted within the boundaries of the RWMC without an escort. Training requirements for visitors needing unescorted access are reviewed on a case-by-case basis by the RWMC Facility Manager or designee. The amount of training required for an unescorted visitor depends upon the task the visitor is performing, the type of operations occurring at the RWMC, and whether exposure to wastes of hazardous constituents could occur.

Visitors may include inspectors, auditors, vendors, consultants, subcontractors, and TSDF contractors. Other visitors can include personnel not assigned to perform normal day-to-day operations at the RWMC. Visitors receive a facility indoctrination briefing which, at a minimum, includes:

- Elements of the Contingency Plan and emergency procedures (alarms, evacuation routes, emergency equipment);
- · Hazard communication information; and
- Hazard awareness and personal protective equipment (PPE) requirements.

Personnel not assigned to the RWMC who are performing work within the RWMC boundaries must receive approval from the RWMC Facility Manager or designee. These personnel receive a detailed facility briefing specific to the task to be performed including additional hazard communication when required. Visitors must sign in and out each day they are visiting.

### **B.12.d Implementation and Documentation of the Training Program**

All new employees must meet the training requirements within six months of employment and before working at the MWSU. The contractor's Training Department and the Operations Manager will:

- Maintain, update, and revise the training program as necessary.
- Review regulations and operations/safety procedures to determine the adequate amount of training for each employee.
- Ensure that personnel conducting or administering the training have the proper credentials and certifications.
- Verify that the training program is documented and maintained in the MWSU personnel training records.
- Verify that former employee records are maintained for a minimum of three years from the date the employee is reassigned or terminated.
- Verify that employees are notified when specific training is required or due and that the training is received and successfully completed.
- Verify that employees have successfully completed the required training before working in an unsupervised capacity.

### **B.12.e Course Descriptions**

- Hazard Communication [29 CFR 1910.1200] This course provides the employee with an awareness of the Hazard Communication standard and its basic requirements.
   Course elements include hazards in the workplace, employee right-to-know, methods and observations, and safe work practices. [Frequency - one time]
- Hazardous Waste Site General Worker/Annual Refresher [29 CFR 1910.120, 40 CFR 264.16] Workers at a hazardous/mixed waste TSDF are required to have a minimum of 40 hours of training with an 8-hour annual refresher. The training includes regulations, PPE, toxicology, basic chemistry, decontamination techniques, monitoring instruments, risk assessment/hazard evaluation, sampling methods and techniques, and emergency management. [Frequency annual refresher]
- Hazardous Waste Site Supervisor [29 CFR 1910.120] This course provides a review of
  the supervisor's responsibilities concerning the Health and Safety Program; associated
  employee training programs; the PPE Program; the Spill Containment Program; health
  hazard monitoring procedure and techniques; and the legal aspects of supervising when
  conducting hazardous waste operations. [Frequency one time]
- Basic RCRA and Hazardous Waste Manifest/Annual Refresher [40 CFR 260-268] This
  course discusses the RCRA regulations, how these apply to mixed waste handling and
  disposal, types of waste, how to identify hazardous waste, emergency response, and the
  LDR for hazardous waste. Hazardous waste manifest requirements are also covered.
  [Frequency annual refresher]

- Radiological Worker II [10 CFR 835.901] This course provides employees with knowledge necessary to work safely in areas controlled for radiological purposes. The course covers identification of controlled areas, proper work practices, contamination control, practical factors demonstration, and handling radioactive material. Refresher training (every two years) is required.
- RCRA Refresher [40 CFR 264.16] This course provides employees with RCRA information for waste management activities (identification of hazardous and mixed waste, LDRs, uniform hazardous waste manifest, and emergency response actions).
- General Employee Training (GET) [29 CFR 1910.120, 40 CFR 264.16] This course
  provides employees with information on radioactive waste operations facilities as related
  to waste characterization, handling of classified waste, transuranic waste activities,
  mixed waste disposal, general work hazards, and response to emergency/off-normal
  events. [Frequency one time]
- Radiological Control Technician (RCT) Qualification Program [10 CFR 835.103] This
  qualification program requires Radiological Control Technicians to complete both
  national and site-specific written and oral examinations of radiological control
  procedures, work practices, and instrumentation. Job performance is also tested using
  field situations. Continuing education to maintain qualification is provided through
  in-house training on specific and general radiation control topics at regular intervals.
  [Frequency continuing]

### B.13 Closure and Post-Closure Care Plan [40 CFR 270.14(b)(13)]

This information represents the Closure and Post-Closure Care Plan for the MWSU. A description of the waste managed at this unit can be found in Section B.2 and the facility operating record. Closure activities are subject to the requirements of **40 CFR 264.112**.

This document presents an interim closure and post-closure care plan for the MWSU. New information, technologies, or changes in performance monitoring may warrant an amendment to the closure and post-closure care plan.

A copy of this closure plan will be maintained in the MWSU Operating Record.

### **B.13.a Description of Closure [40 CFR 264.112(b)(4)]**

The MWSU is proposed as a clean closure; therefore does not include a written post-closure care plan.

### B.13.b Closure Performance Standard [40 CFR 264.111]

As defined in 40 CFR 264.111 and NAC 444.8632, the standard for closure for the MWSU will:

- Use engineering and administrative controls during closure to minimize or eliminate, to the extent necessary, the release of hazardous substances from the unit.
- Minimize the need for maintenance.
- Protect human health and the environment during closure and after closure activities.

LLMW and residues remaining in MWSU facilities will be removed and disposed according to regulatory requirements at the time of closure. Hazardous wastes and residues will be removed from the site. Container systems and closure equipment will be decontaminated before removal from the unit.

Spills or releases of LLMW noted in the operating record that have not been remediated will be remediated before closure. Clean up of releases of mixed waste to the ground will involve the removal of soil. The excavated area will be surveyed for isotopes identified in the generator characterization data. If the radionuclide levels are less than or equal to the NTS Radiological Control Manual (DOE/NV/25946--081) Table 2-2 (Surface Contamination Values in dpm/100 cm²) or Table 4-2 (Allowable Total Residual Surface Contamination Values in dpm/100 cm²) the release will be considered remediated for any hazardous constituents that may be present in the waste. Table 2-2 limits are applicable for an area clean up and Table 4-2 limits are applicable to material/equipment clean up.

### **B.13.c Coordination with Other Regulatory Standards**

Disposal of LLW (including the LLW component of LLMW) at the RWMC is subject to requirements and performance objectives of DOE Order 435.1, *Radioactive Waste Management*, and the associated manual (DOE M 435.1-1) and guidance (DOE G 435.1-1).

DOE Order 435.1 requires that a Disposal Authorization Statement be obtained for new or existing disposal facilities. A Disposal Authorization Statement for the RWMC was issued by DOE Headquarters in December 2000 and specifies that the disposal program shall be conducted according to the site Performance Assessment (PA).

### B.13.d Financial Requirements [40 CFR 264.140(c)]

State and federal governments are exempt from the 40 CFR 264 Subpart H requirements.

### B.13.e Facility Location and Description at Closure [40 CFR 264.112(b)(1)]

The MWSU is located in the southeast corner of the existing RWMC, in a remote area of the southern NTS. Figures and text describing the unit and locating it in the RWMC are in Section B.1 and Exhibit 1 of this permit application. Facilities that comprise the MWSU will be clean closed and be reused as necessary.

#### **B.13.e.1 Maximum Waste Inventory**

The maximum amount of LLMW stored at the proposed MWSU at any one time is estimated to not exceed 18,429 m<sup>3</sup> (650,192 ft<sup>3</sup>) [Section B.1.e]. The life time of the unit is not known at this time.

#### **B.13.e.2 Removal or Decontamination**

Equipment or facilities contaminated with LLMW constituents from storage operations will be decontaminated by appropriate methods. The contaminated media will be disposed. If the contaminated media requires treatment it will be treated to meet applicable land disposal requirements and disposed at a permitted facility.

### B.13.f Closure Schedule [40 CFR 264]

Table 9 depicts a closure activity schedule for the unit.

**Table 9 MWSU Closure Activity Schedule** 

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Closure Activity	Duration
Notify NDEP of closure	Within 45 days before commencement of closure activities and within
	30 days of receipt of the last shipment of LLMW.
Closure of the unit	Initiated 45 days after notification of closure and competed within
	180 days of receiving the final volume of hazardous waste.
Certification of closure	Within 60 days after completion of closure activities.

### B.13.g Amendment to Closure Plan [40 CFR 264.112(c)]

An amended closure plan will be submitted to NDEP for approval as a permit modification at least 60 days before the proposed change in facility design or operation or no later than 60 days after an unexpected event has occurred that affects the closure plan. However, if an unexpected event occurs during the partial or final closure period, NNSA/NSO will request a permit modification no later than 30 days after the unexpected event. The approved closure plan will become a condition of the permit. If contamination is detected, this closure plan will be amended to provide specific decontamination and removal procedures applicable to the type and extent of contamination.

### **B.13.h Post-Closure Care [40 CFR 264.117]**

The MWSU will be clean closed, therefore post-closure care is not required.

### **B.14 Post-Closure Notices [40 CFR 270.14(b)(14)]**

Closed hazardous waste disposal units on the NTS are noted in NDEP Permit NEV HW0021 (November 2005), Part VII. A description of the closure/post closure requirements are noted in Volume 1 of the Permit Application for NEV HW0021.

Closure of legacy hazardous waste management sites on the NTS is carried out through the Federal Facilities Agreement and Consent Order (FFACO). The FFACO is an agreement between the state of Nevada, U.S. Department of Defense (DoD), DOE Legacy Management, and NNSA/NSO. The process requires that use restrictions (UR) shall always be instituted on sites where contamination above regulatory limits is being closed-in-place. Two types of UR are established in the FFACO, administrative and standard. Administrative URs differ from the standard in that they do not require onsite postings or other physical barriers. Administrative URs apply to remote locations and occasional use areas where future land use scenarios are used to calculate final action levels.

Each UR site is identified and documented on a UR form with an enclosed map. The completed form and map are the official records documenting the sites where contamination remains in place after closure. The DOE and the DoD will maintain UR records as long as the land is under their jurisdiction. The information on the form and the maps are filed in the DOE Facility Information Management System, the FFACO database, the DOE CAU/CAS [corrective action unit/corrective action site] files, and in the U.S. Air Force Geographical Information System.

### **B.15 Closure Cost Estimate [40 CFR 270.14(b)(15)]**

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

### B.16 Post-Closure Cost Estimate [40 CFR 270.14(b)(16)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

### B.17 Liability Requirements [40 CFR 270.14(b)(17)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

### **B.19 Topographic Map**

Figure 5, MWSU Overall Location Map, with 1.5 m (5 ft) contour intervals, and a scale of 2.5 cm (1 in) equal to 61 m (200 ft) illustrates the MWSU facilities and the RWMC boundaries and extends a distance of 305 m (1,000 ft) outside the MWSU boundaries. This figure shows access roads, gates, existing facilities, well drainage, and flood control structures. The center of the RWMC is located at N 768650.25 and E 706476.40 (based on Nevada State Plane Grid – Central Zone, North American Datum, 1983).

#### **B.19.b Land Use**

Several Public Land Orders withdrew land from the public domain to establish the NTS. Public Land Order 805, issued in 1952, withdrew the land where the MWSU is located. Since then, NTS land has been used for national defense and energy related testing and research and waste management activities. In 2009, NNSA/NSO sought to expand the Area 5 RWMC to build a new mixed waste disposal cell. The BLM reviewed the land use in Area 5 and determined that land originally withdrawn was unsuitable for return to the public domain. On October 30, 2009, the General Services Administration transferred custody and accountability of portions of Area 5 to DOE to expand the RWMC.

The NTS is not open to public entry for any purpose (e.g., agriculture, mining, homestead, or recreation). Because of the nature of land use at the NTS over the last 58 years, there are no plans to return this area to public use. Certain areas in and adjacent to Area 5 were used for atmospheric and underground nuclear weapons testing. Current land uses in Area 5 include LLW disposal, LLMW disposal; controlled hazardous material spill testing; and hazardous waste storage. An NTS land use map is provided in Figure 3, NTS Land Use Map.

#### **B.19.c Wind Rose**

Wind speed and direction are provided in Figure 11, Wind Rose for the RWMS. Winds in this area are generally from the southwest, with wind velocities varying from 0-20 m/second. However, there is a diurnal reversal effect such that winds are predominantly southerly during the day and northerly at night. In a similar manner, there is a seasonal reversal such that winds are predominantly southerly during the summer and northerly during the winter.

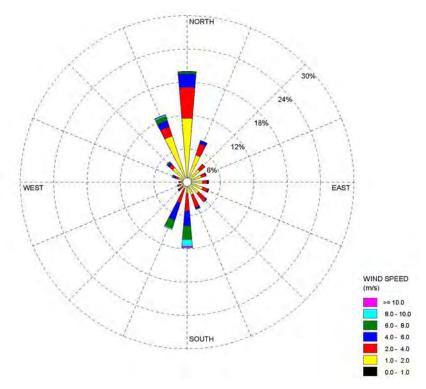


Figure 11 Wind Rose for the RWMS

#### **B.19.d Well Locations**

Figure 5, MWSU Overall Location Map, is a topographic map with 6.1 m (20 ft) contour showing MWSU facilities and the surrounding area, including nearby well locations.

#### **B.19.e Utility Characteristics**

Utilities at the RWMS are shown in Figures 12 through 14.

#### (1) Potable Water, Wastewater, and Fire Protection

The potable and fire protection water system for the RWMC is served by Public Water System Permit NY-0360-12NTNC. Domestic wastewater from RWMC office buildings and the VERB is discharged to a permitted septic system (NY-1038) located south of the RWMC.

RWMC fire alarm pull boxes are located in Buildings 5-6, 5-7, and 5-31. Personnel working in the MWSU have access to hand-held radio, telephone, and cell phone communications.

Emergency response is discussed in Section B.7.

#### (2) Power System

Offsite electrical power is supplied to the NTS and transmitted through a loop. The voltage is transformed down to a distribution voltage and then to a working voltage. The Frenchman Flat Substation provides power to the RWMC through an overhead line. A diesel generator provides emergency power to the VERB when necessary.

### (3) Storm Water Drainage

The storm drainage system designed to protect the RWMC from run-on and runoff is depicted in Figure 6.

Figure 12 Utilities

### Not available for public view

Figure 13 Utilities

### Not available for public view

Figure 14 Utilities

### Not available for public view

### B.20 Additional Information [40 CFR 270.14(b)(20)]

### **B.20.a Operations**

#### **B.20.a.1 Operating Record [40 CFR 264.73]**

NNSA/NSO will maintain a written operating record. Because the MWSU is located in a remote area, portions of the operating record are maintained at the RWMC, Mercury, or North Las Vegas Facility for convenience.

The operating record will include:

- A description and quantity of each hazardous waste received/stored and the date the waste was placed in storage and the date removed from storage.
- Location and quantity of each hazardous waste within the MWSU, cross referenced to specific manifest document numbers.
- Records and results of waste analyses and waste determinations.
- Summary reports and details of all incidents that require implementing the contingency plan.
- Records and results of inspections for the last three years.
- Monitoring, testing, or analytical data and corrective actions resulting from a release from the proposed MWSU.
- Record of written notice from NNSA/NSO to generators indicating that NNSA/NSO has all the necessary permits for and will accept the waste the generator is shipping.

#### **B.20.a.2 Generator Process**

The following steps outline the procedure for offsite generators shipping LLMW to the NTS.

- Waste generators and the waste profile must be approved according to the current revision of the Nevada Test Site Waste Acceptance Criteria (NTSWAC) and the Waste Analysis Plan (Exhibit 2) before waste shipment. An initial waste verification rate per waste stream is developed and approved by NNSA/NSO.
- An EPA Uniform Hazardous Waste Manifest (40 CFR 264.71), appropriate LDR certification or notification (40 CFR 268.7), and a "Package Shipment and Disposal Request" form are required for each waste shipment. Waste transport must be according to state, federal, and DOE requirements. Applicable state requirements include those of the state in which the shipment originates, states the waste is transported through, and the state of Nevada. The package number and the waste stream number are entered on the "Package Shipment and Disposal Request" form.
- The NTS receives and verifies waste containers Monday through Thursday, unless otherwise coordinated in advance.
- The transporter must provide the necessary paperwork for initial review at Gate 100, the entrance to the NTS. If the transporter does not have an NTS badge, a temporary badge

will be issued at the gate after checking the driver's identification. A map to the RWMC is also available at the gate.

 The transporter delivers the waste shipment to the RWMC for processing and off-loading.

The following steps outline the procedure for onsite generators transferring LLMW for storage at the MWSU.

- Generators will complete the necessary waste stream characterization outlined in Section B.3.b.1.
- The transporter delivers the waste shipment to the RWMC for processing and off-loading.

#### B.20.a.3 Waste Receipt, Survey, and Shipping Records

When the shipment arrives at the RWMC, the driver parks and signs in at Building 5-7, completes the route survey, and submits applicable shipping documents. RWMC personnel perform a completeness review of the generator's shipping documents which may include:

- Uniform Hazardous Waste Manifest or Onsite Waste Transportation Manifest and
- LDR documents.
- <u>Flat bed trailers</u> vehicle and load are surveyed for radiological contamination and transport integrity before entering the controlled area.
- <u>Closed transport vehicles (vans)</u> vehicles are surveyed for radiological contamination and van integrity.
- Upon approval from RWMC personnel, the transporter is escorted into the controlled area by proceeding through the gate adjacent to the Controlled Area Access Building (Building 5-31) for shipments going to the TPCB or TP. Shipments destined for storage in other MWSU facilities are directed as shown in Figure 8.
- RWMC personnel perform pre-entry radiation surveys of the exterior of the waste transport vehicle and a radiation survey as the closed transport vehicle door is opened. Radiation surveys are conducted on all packages off-loaded at the designated MWSU facilities.
- At Building 5-6, only required containers are unloaded for real-time radiography (RTR) verification. The RTR system has the capability to perform RTR on three 55-gallon drums or one typical waste box at a time. Only the specified quantity of waste requiring RTR will be removed from the transport vehicle. After RTR has been completed, accepted containers are then transported to the appropriate MWSU facility. Containers may not be loaded back onto the transport vehicle but may be transported by other means such as a forklift.
- Containers, markings, and labels are inspected and compared with the associated manifests. Paper work review and inspection requirements are documented on a shipment checklist. The waste manifests, LDR Notices, and Certifications are inspected by qualified personnel. Specific details on containers are recorded on a container checklist that is filed with the associated shipping paperwork. When unloading is completed and all containers

have been accepted, RWMC personnel will commence placing the waste containers in the storage configuration.

 Radiological surveys of the truck bed and tires are performed before releasing the waste transport vehicles from the RWMC.

#### **B.20.a.4 Discrepancies**

- If a discrepancy is detected at any time during the paperwork or inspection process, the
  discrepancy will be categorized dependent upon the level of severity of the condition.
   Waste containers will remain on the transport vehicle until the noncompliant condition
  has been resolved.
- Offsite shipments destined for disposal in the MWDU may be screened by RTR. If one of
  the containers in the original sample set fails RTR, a second sample set of equal
  quantity will be selected from the shipment. A second failure in either the first or the
  second sample set constitutes failure of the shipment. If the second sample set passes
  inspection, the single failed container is considered an anomaly and the remainder of the
  shipment passes verification. Failed containers and shipments are dispositioned via the
  Radioactive Waste Acceptance Program.
- If a discrepancy requires several days to resolve, the containers will be placed in the verification hold area on the TP. Wastes in this area shall meet the requirements in 40 CFR 264.170 to 178, inclusive.
- If the discrepancy cannot be resolved, all waste packages associated with the noncompliant shipment will be returned to a generator-specified facility and required discrepancy notifications are made.
- Manifesting of partial or full loads that are rejected by NNSA/NSO will be carried out as required in 40 CFR 264.72.

#### **B.20.a.5 Condition of Containers [40 CFR 264.171]**

Shipments received for storage will arrive in DOT-compliant containers. If a container is not in good condition when it arrives, the waste container will be repackaged into a larger container before storage. This includes containers that exhibit severe rust, structural defects, and/or if a container begins to leak.

#### B.20.a.6 Compatibility of Waste Containers [40 CFR 264.172 and 264.177]

Containers shall be made of or lined with materials that will not react with and are compatible with the hazardous waste to be stored.

Incompatible wastes or wastes in combination with incompatible materials will not be placed in the same container.

#### B.20.a.7 Management of Containers [40 CFR 264.173]

Containers from offsite generators in the MWSU will remain closed during storage. If repackaging is necessary, the damaged container will not be opened or contents removed. The entire container and contents will be repackaged in a larger container. In the case of a

leaking waste box or freight container, the container will be wrapped/diapered rather than put in a larger container.

Containers will be managed and handled by trained personnel using the proper equipment to eliminate the potential for rupture or leakage.

#### **B.20.a.8 Inspections [40 CFR 264.174]**

MWSU inspection procedures and schedules are described in Section B.5.

#### **B.20.a.9 Containment [40 CFR 264.175]**

Wastes accepted for storage at the MWSU from offsite generators do not contain free liquids. Wastes accepted for storage at the MWSU from onsite generators may contain free liquids. Wastes that contain any free liquid will be stored on spill pallets. MWSU facilities that can be impacted by precipitation include the TP and DHP.

The TP is a bermed pad. Whenever waste boxes or drums are stored on this pad, metal pallets will be used to prevent contact with accumulated precipitation.

The DHP is a sloped pad with berms. Whenever waste boxes or drums are stored on this pad, pallets will be used to prevent contact with accumulated precipitation. The pad is not drained; therefore, any accumulation of precipitation will be removed using brooms and squeegees.

#### **B.20.a.10 Special Requirements for Ignitable Wastes [40 CFR 264.177]**

Not applicable. The MWSU is located at least 15 m (50 ft) from the nearest NTS boundary.

#### B.20.a.11 Closure [40 CFR 264.178]

The MWSU will be clean closed. All hazardous waste and hazardous waste residues will be removed. Any equipment, materials, or soils contaminated by spills or releases of hazardous waste will be decontaminated or removed and disposed of according to regulations in effect at the time of closure (Section B.13.b).

#### **B.20.a.12 Air Emission Standards [40 CFR 264.179]**

Subpart CC standards for air emission are not applicable to mixed waste management [40 CFR 264.1080(a)(6)].

#### B.20.b Other Federal Laws [40 CFR 270.3]

Other federal laws that apply to operations and discharges from the RWMC include:

- National Historic Preservation Act Within the boundaries of the RWMC, waste disposal
  activities will not create adverse effects to properties listed or eligible for listing on the
  National Register of Historic Places.
- Endangered Species Act Waste disposal activities at the RWMC are not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.

- Clean Air Act Fugitive dust emissions from activities at the RWMC are regulated by Air Quality Permit AP9711-2557 (NTS Class II Air Quality Operating Permit) issued by the state of Nevada.
- Clean Air Act (National Emissions Standards for Hazardous Air Pollutants) Air
  monitoring for radionuclide emissions is conducted from two monitoring stations at the
  RWMC. Results confirm that emissions are below reporting limits for radionuclide
  emissions.

### **B.20.c Exposure Information Report [40 CFR 270.10(j)]**

According to **40 CFR 270.10(j)**, an exposure information report for this operational unit is not required.

### B.22 Summary of Pre-Application Meeting [40 CFR 124.31 and 40 CFR 270.14(b)]

This section provides a summary of the pre-application public meeting and the published notice of the meeting. The meeting was held at the Bob Rudd Community Center in Pahrump, Nevada, on Monday, April 26, 2010, from 17:30 to 18:30 hours.

The meeting was held to inform the public of proposed hazardous waste management activities, provide information on the design and purpose of the unit, diagram travel corridors used by transporters, and allow the public to comment on the proposed permit.

Exhibit 5 contains the following information:

- Meeting notice
- Posters representing public information disseminated at the meeting
- · Record of public comments

**Exhibit 5 Summary of Pre-Application Meeting** 





### **Pat Arnold**

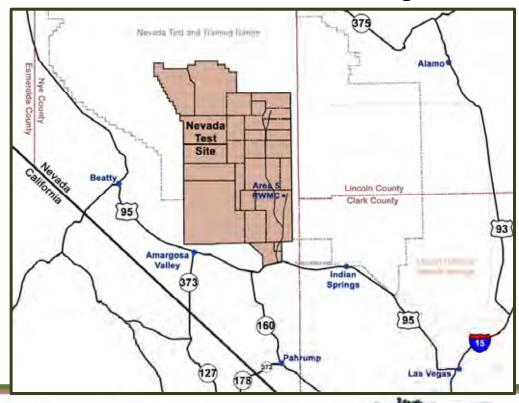
Project Manager
National Security Technologies, LLC (NSTec)
Bob Ruud Community Center in Pahrump, NV
April 26, 2010



### New Permit Being Pursued

 The U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office is submitting an

application to the State of Nevada Division of Environmental Protection (NDEP) for a Resource Conservation Recovery Act (RCRA) Permit to store mixed low-level waste (MLLW) at the Nevada Test Site prior to permanent disposal



### What is MLLW?

 MLLW is waste that contains both low-level radioactive waste and a hazardous component (toxic, corrosive, reactive, ignitable, or specifically identified by the U.S. Environmental Protection Agency as "hazardous")



### Why is a Storage Unit Needed?

- Currently, MLLW is permanently disposed in Pit 3 at the Nevada Test Site Area 5 Radioactive Waste Management Complex (RWMC)
- In accordance with a RCRA permit, Pit 3 must close by November 30, 2010
- Planning and design of a new RCRA-permitted MLLW disposal cell is underway (anticipate opening March 2011)
- On-site MLLW will be stored in accordance with the new RCRA storage permit
- Storage of off-site MLLW is needed to continue supporting clean up activities at DOE sites

### Where will the Waste Come From?

 MLLW is generated by environmental clean up activities at DOE sites, including the Nevada Test Site



# Where will the Mixed Waste Storage Unit be Located?

- Waste is proposed to be stored in multiple locations at the Nevada Test Site Area 5 RWMC
  - TRU Pad Cover Building and storage pad (1)
  - Visual Examination and Repackaging Building (2)
  - Real-Time Radiography
     Building and pad (3)
  - Sprung Instant StructureBuilding (4)
  - Drum Holding Pad (5)





TRU Pad Cover
Building and
storage pad

Real-Time Radiography Building and pad





Sprung Instant
Structure Building

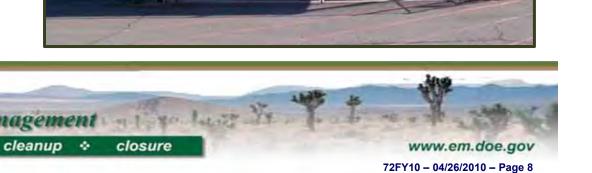




Visual Examination and Repackaging Building

**Drum Holding Pad** 

performance .



### Permitting Process Timeline

- Public meeting held to inform community of intent to submit permit application – April 26, 2010
- DOE accepting comments on its intent to submit application – May 7, 2010
- DOE submits permit application to State of Nevada (NDEP) – May 2010
- NDEP reviews permit application and returns comments to DOE – 180 days from receipt
- DOE responds to and resolves NDEP comments
  - within 30 days of receiving comments

# Permitting Process Timeline (continued)

- NDEP conducts a 45-day public comment period on the draft permit – Fall 2010
- NDEP resolves public comments in conjunction with DOE – Fall 2010
- NDEP notifies DOE regarding permit decision December 2010

# Anticipated Permit Terms and Conditions

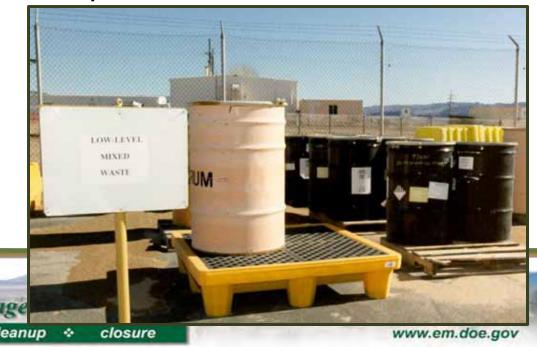
- RCRA permit valid for 5 years
- NDEP determines the storage volume limit

performance

Waste stored in boxes and/or drums in accordance with U.S.
 Department of Transportation requirements and Nevada Test

Site Waste Acceptance Criteria

- NDEP conducts annual inspections
- NDEP has authority to revoke permit



### Opportunity for Public Comment

- The public is encouraged to provide comments regarding DOE's plan to submit an application to NDEP by May 7, 2010
  - Public comments will be included in the application submittal
  - Comments can be given to the court reporter this evening or mailed to:

Ken Small, RCRA Program Manager P.O. Box 98518 Las Vegas, NV 89193-8518

# Opportunity for Public Comment (continued)

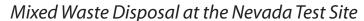
 NDEP will conduct a 45-day public comment period which will be announced in local newspapers (anticipated timeframe - Fall 2010)

### For More Information...

Office of Public Affairs
702-295-3521
envmgt@nv.doe.gov
www.nv.energy.gov
www.facebook.com/NNSANevadaSiteOffice

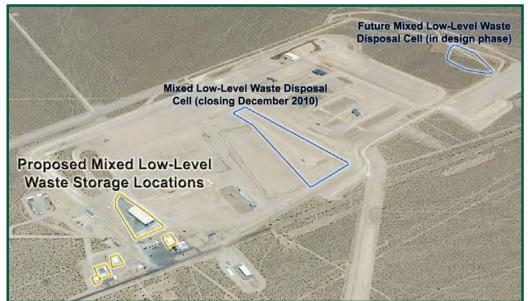
# Mixed Low-Level Radioactive Waste Management at the Nevada Test Site

- Mixed waste contains both a hazardous and a low-level radioactive waste component
- Hazardous waste is toxic, corrosive, reactive, ignitable, or specifically identified by the U.S. Environmental Protection Agency as "hazardous"
- Mixed waste management (treatment, storage, and disposal) at the Nevada Test Site is conducted in accordance with regulatory requirements at the Area 5 Radioactive Waste Management Complex





Nevada Test Site Area 5 Radioactive Waste Management Complex



- All waste shipped to the Nevada Test Site must comply with strict U.S. Department of Transportation regulations
- Mixed waste acceptance, packaging, and disposal is conducted in accordance with stringent Nevada Test Site Waste Acceptance Criteria
- Currently, only mixed waste generated at the Nevada
   Test Site can be stored in accordance with the Mutual
   Consent Agreement

The U.S. Department of Energy, National Nuclear Security
Administration Nevada Site Office plans to submit a permit
application to the State of Nevada for approval to store mixed waste
prior to disposal.

One of the Five (5) Proposed Mixed Waste Storage Locations at the Area 5 Radioactive Waste Management Complex

















closure



### Nevada Test Site

### Resource Conservation and Recovery Act (RCRA)

### Permit Submittal Process



The U.S. Department of Energy, National Nuclear Security
Administration Nevada Site Office (NSO) plans to submit a RCRA
Part B permit application to the State of Nevada Division of
Environmental Protection (NDEP) for the storage of mixed lowlevel radioactive waste prior to disposal. Public comments are
encouraged and will be included in the permit application if
received by May 7, 2010. Comments received after this date
should be forwarded to NDEP for consideration.



### **Application Review**

- NDEP has 180 days to review and comment
- NDEP reviews the application for:
  - Completeness
  - Regulatory compliance
  - Environmental impact
- NSO must satisfactorily resolve all NDEP comments



### **Permit Issuance**

- NDEP prepares the draft permit
- Permit published for 45-day public review and comment
- NDEP addresses public comments
- NDEP issues final permit or denies the application
- If permit issued, NSO may commence with the storage of mixed low-level radioactive waste prior to disposal



### **Permit Compliance**

- NDEP required to conduct periodic inspections
- NSO required to correct inspection deficiencies/violations
- NDEP may modify, revoke, or terminate permit with just cause
- Permit renewal required every five years

### What is RCRA?

RCRA is a federal law regulating the management of hazardous waste (which is a component of mixed waste) from generation to disposal. RCRA applies to all private, public, and governmental entities.



One of the Five (5) Proposed Mixed Low-Level Radioactive Waste Storage Locations at the Nevada Test Site Area 5 Radioactive Waste Management Complex

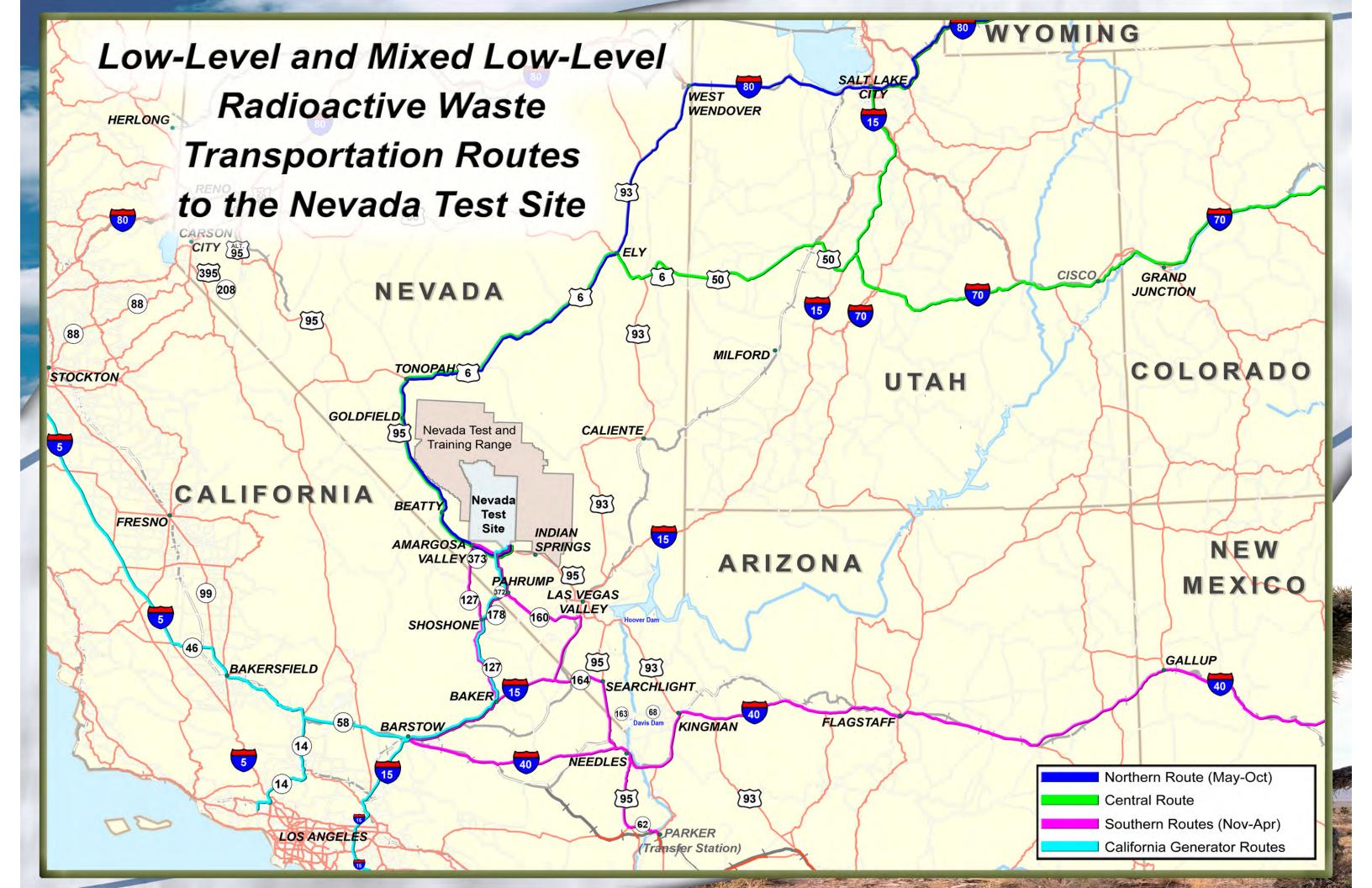


Containerized Mixed Low-Level Radioactive Waste Disposed at the Nevada Test Site









### C.1 MWSU Groundwater Protection [40 CFR 270.14(c)]

The proposed MWSU operations constitute storage, not treatment or land disposal; therefore, a groundwater monitoring plan is not required.