

DEMONSTRATION OR EMERGING IRRIGATION TECHNOLOGIES

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
WATER CONSERVATION OFFICE
AND STATE WATER RESOURCES CONTROL BOARD

COOPERATOR: HARRIS FARMS

CONTRACTOR: BOYLE ENGINEERING CORPORATION

CONSULTANTS: USDA/ARS WATER MANAGEMENT
RESEARCH LABORATORY

UC COOPERATIVE EXTENSION

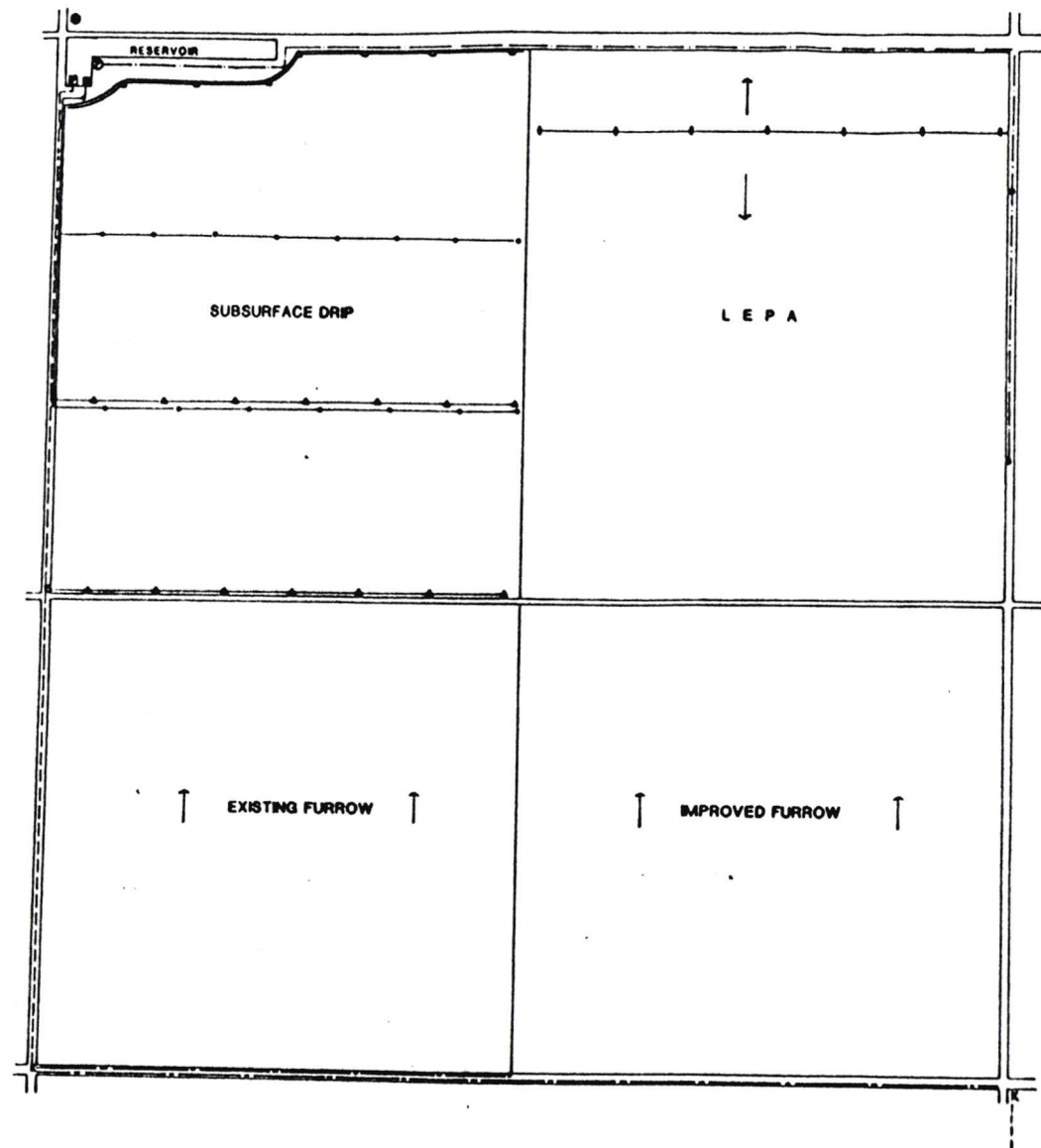
INTRODUCTION

BACKGROUND

- 160-ACRE PROJECT SITE
- LOCATED AT HARRIS FARMS, FIVE POINTS, CA
- DIVIDED INTO 40-ACRE PLOTS:
 - SUBSURFACE DRIP
 - LOW ENERGY PRECISION APPLICATION (LEPA)
 - IMPROVED FURROW
 - HISTORIC FURROW
- PLANTED TO COTTON IN 1989 AND 1990 (SJ2 AND GC510, RESPECTIVELY), MELONS IN 1991, AND COTTON (MAXXA) IN 1992

GOALS

- EVALUATE EFFECTIVENESS OF EMERGING TECHNOLOGIES
 - REDUCTION OF DEEP PERCOLATION
 - GROWER PROFITABILITY
- REDUCE APPLIED WATER
- MONITOR YIELD/SALINITY IMPACTS



LEGEND

- ← INDICATES DIRECTION OF IRRIGATION
- PUMP & FILTER STATION FOR SUBSURFACE DRIP
- WESTLANDS TURNOUT #22-28
- ⊞ EXISTING LIFT PUMP
- ⊙ DIESEL DRIVEN BOOSTER PUMP
- RISER VALVE
- ALUMINUM MAINLINE PIPE
- - - EXISTING BURIED PVC PIPE
- - - ALUMINUM GATED PIPE
- △— BURIED PVC FLUSHOUTS
- BURIED PVC MAINLINE & LATERALS
- K HYDRANT

DEMONSTRATION OF EMERGING
IRRIGATION TECHNOLOGIES
GENERAL FIELD LAYOUT

SUBSURFACE DRIP DESIGN/ OPERATION PARAMETERS

NETAFIM INLINE EMITTERS 0.40 GPH

EMITTER SPACING AT 40" - ALONG ROW

TUBING SPACING AT 80" - ALTERNATE FURROWS

TUBING BURIED 18" $\pm$ 2" DEEP

PRIMARY FILTRATION BY PLUM CREEK SUCTION SCREEN

30-HP CENTRIFUGAL PUMP

SAND MEDIA FILTRATION (NO. 20 CRUSHED SILICA)

ONE IRRIGATION SET

SYSTEM FLOW RATE AT 620 GPM

APPLICATION RATE AT 0.036" PER HOUR

LEPA DESIGN/OPERATION PARAMETERS

1/4 MILE LINDSAY MANUFACTURING LATERAL
CONVERTED WITH DROP TUBES

CONVERTED TO HOSE DRAG SYSTEM

FILTRATION BY PLUM CREEK SUCTION SCREEN

FED BY SURFACE ALUMINUM MAINLINE

DIESEL ENGINE DRIVEN CENTRIFUGAL PUMP

SENNINGER "QUAD-SPRAY" HEADS WITH BUILT-IN 10-PSI
PRESSURE REGULATOR

40" DROP TUBE SPACING

TWO SETS/IRRIGATION

SET TIME AT 11 HOURS

DROP TUBE FLOW RATE AT 1.6 GPM

SYSTEM FLOW RATE AT 610 GPM

IMPROVED FURROW IRRIGATION DESIGN/OPERATION PARAMETERS

10-INCH GATED PIPE

ENERGY DISSIPATION SOCKS

1/8-MILE RUNS

TAILWATER RECOVERY SYSTEM

MODIFIED FURROW FLOW RATES/CUT-BACK FLOW

IRRIGATION SCHEDULING (NEUTRON PROBE, PRESSURE
BOMB, AND WATER BALANCE)

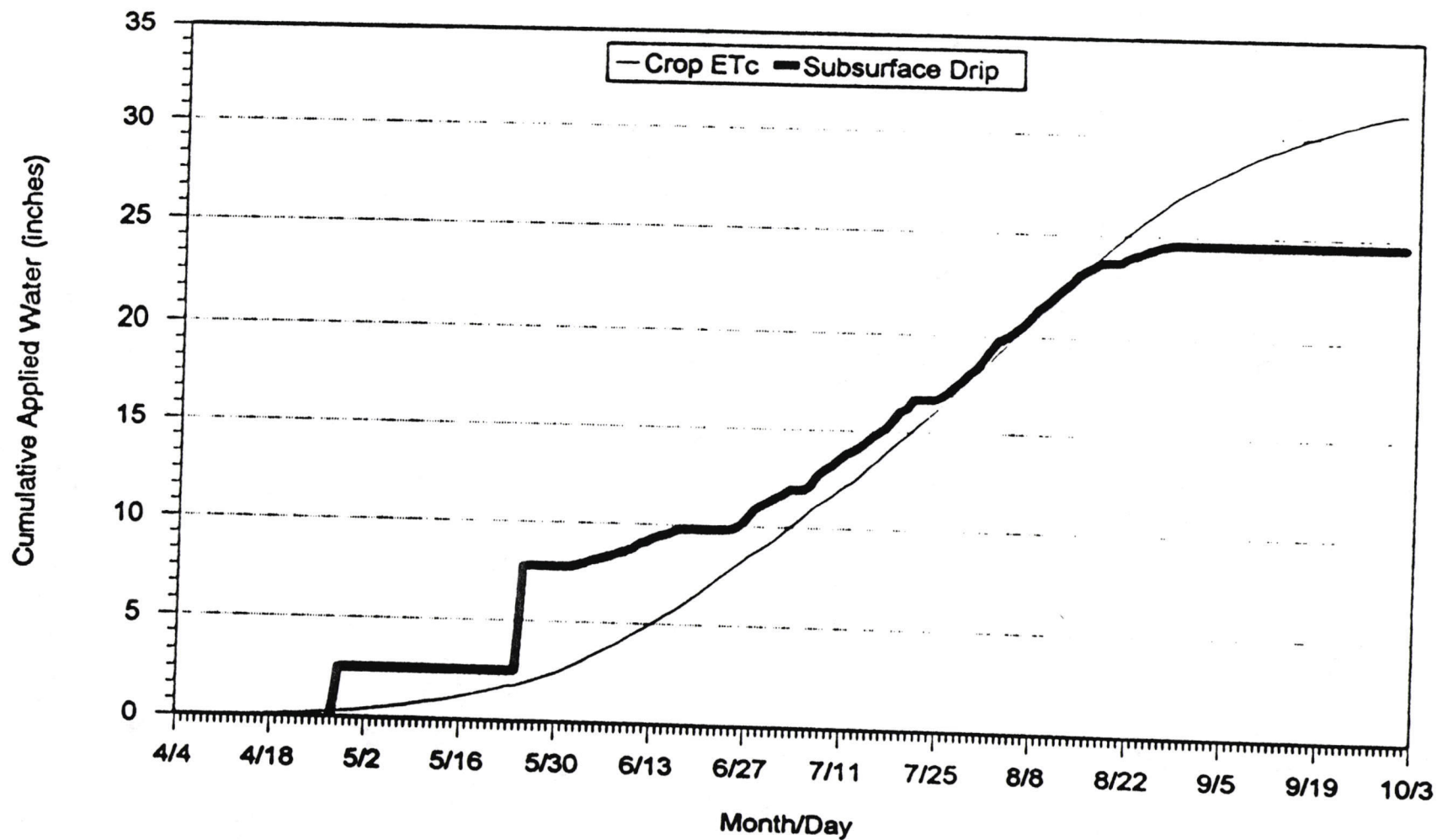
HISTORIC FURROW IRRIGATION DESIGN/OPERATION PARAMETERS

EARTH HEAD DITCH WITH SIPHON TUBES

1/4-MILE RUNS

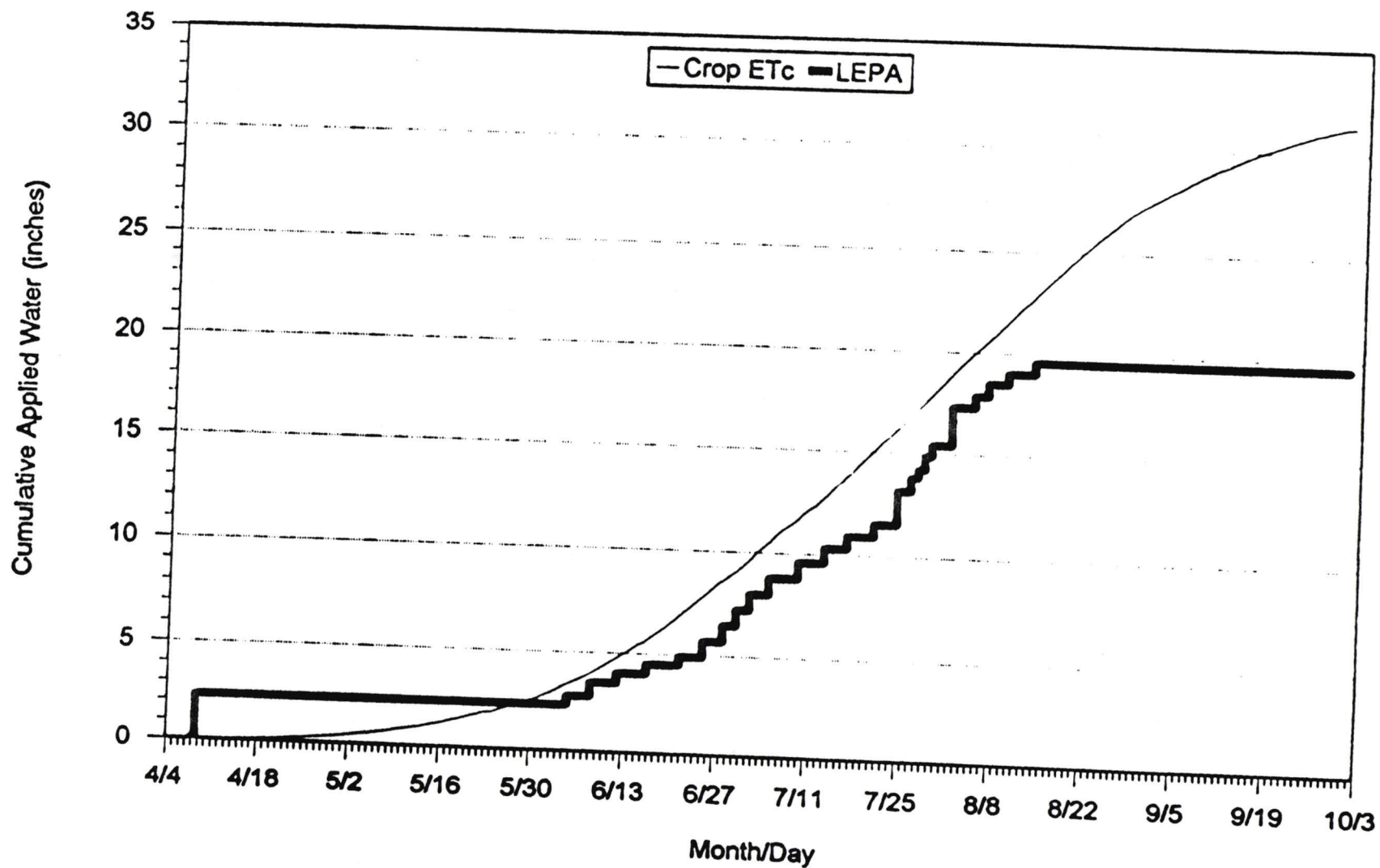
MANAGED BY HARRIS FARMS

Cumulative Applied Water 1992 Crop Year Subsurface Drip



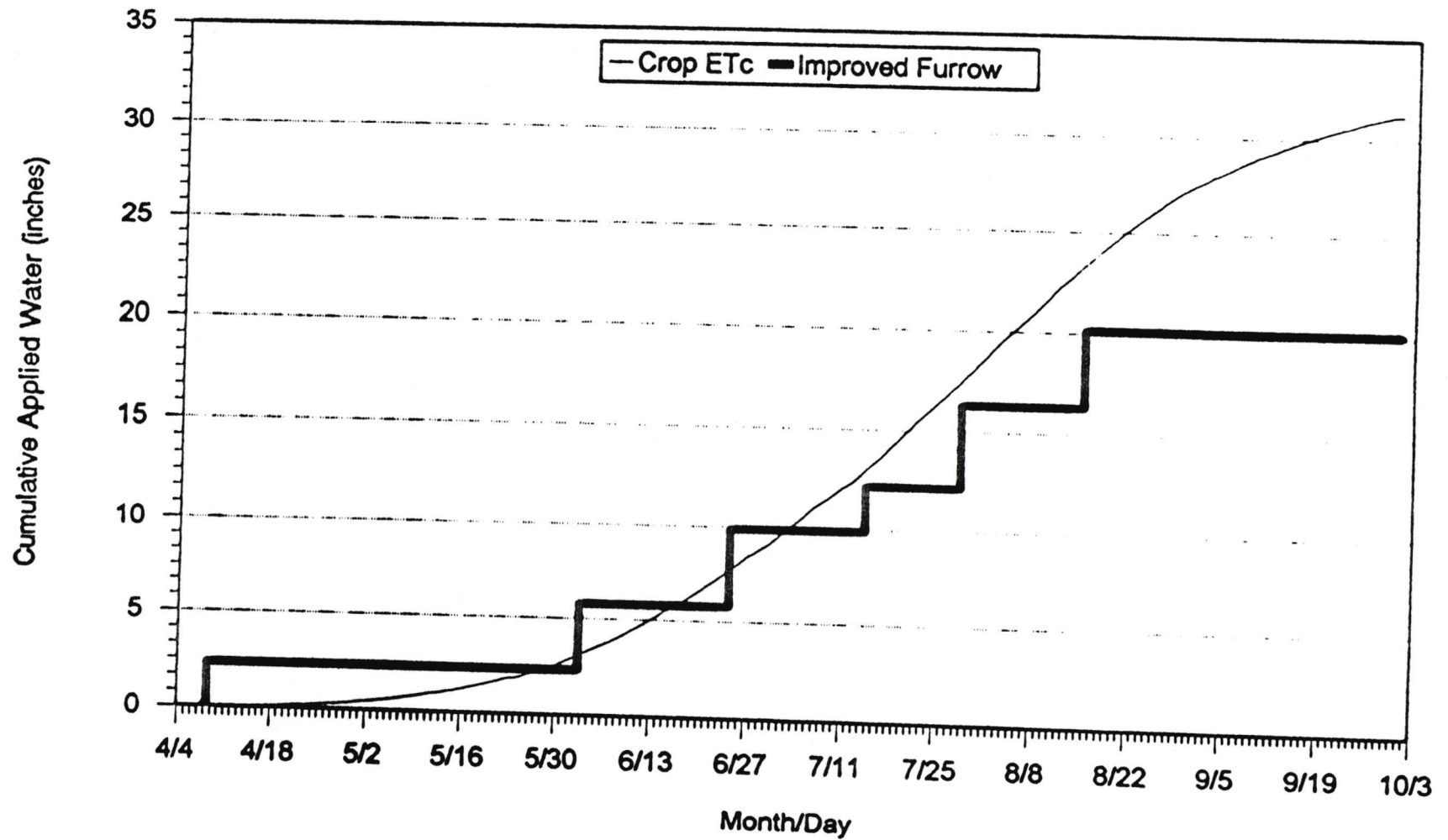
Cumulative Applied Water 1992 Crop Year

LEPA

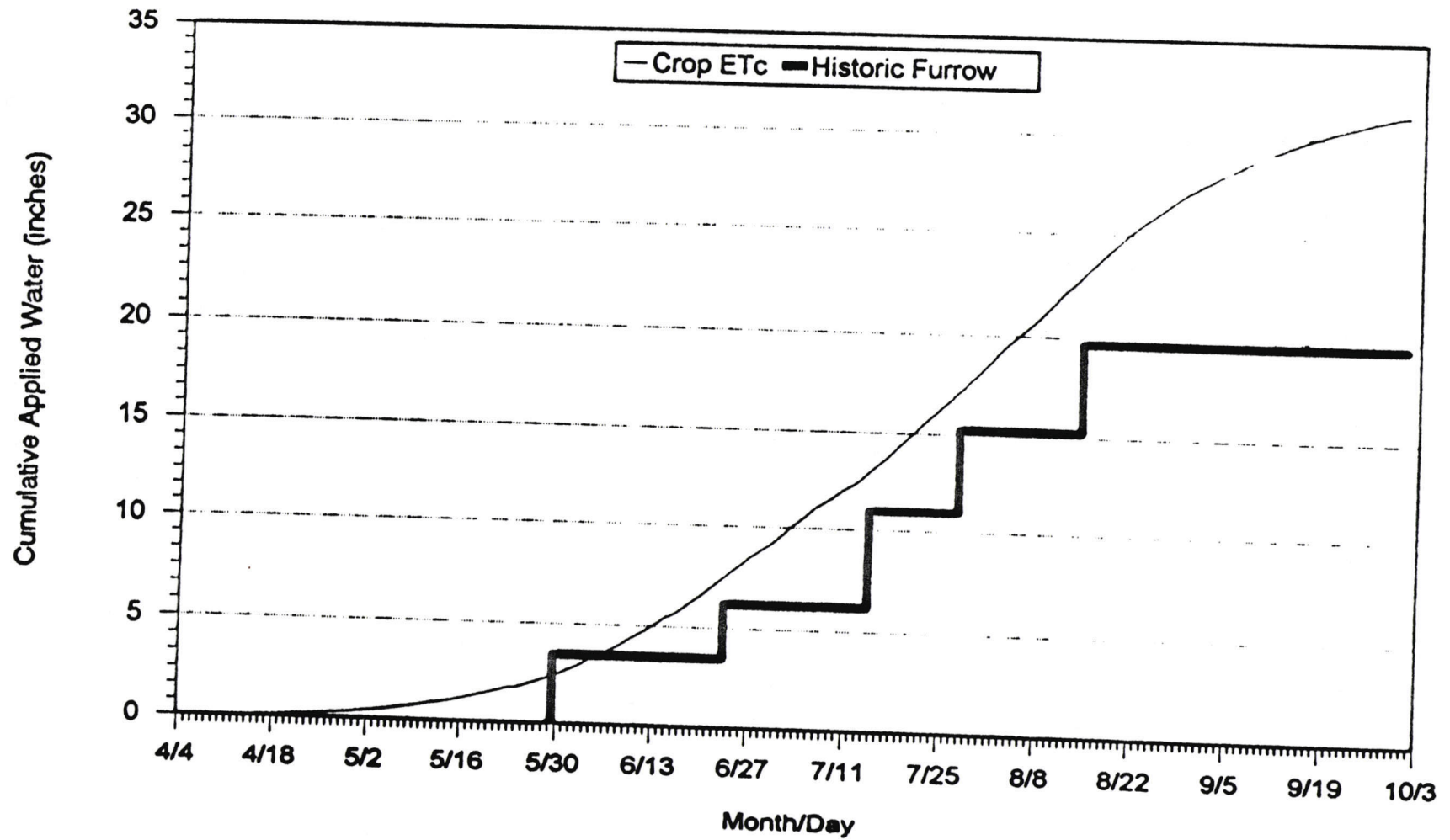


Cumulative Applied Water 1992 Crop Year

Improved Furrow



Cumulative Applied Water 1992 Crop Year Historic Furrow



ESTIMATED WATER BALANCE
1989, 1990, 1991, AND 1992 CROP YEARS
(acre-feet/acre)

(PRELIMINARY DATA SUBJECT TO REVISION)
2/15/93

Irrigation System	Year	Total Applied Water	Estimated Evapotranspiration (ET) ET _c ¹	Estimated Contribution to Drainage ² ET _c
Subsurface Drip	1989	1.92	1.99	-0.07
	1990	2.00	1.85	0.15
	1991 ³	0.73	1.28	-0.55
	1992	2.04	2.50	-0.46
LEPA	1989	1.68	1.99	-0.31
	1990	2.21	1.85	0.36
	1991 ³	0.94	1.28	-0.34
	1992	1.63	2.50	-0.87
Improved Furrow	1989	2.46	1.99	0.47
	1990	1.64	1.85	-0.21
	1991 ³	0.89	1.28	-0.39
	1992	1.67	2.50	-0.83
Historic Furrow	1989	2.54	1.99	0.55
	1990	2.40	1.85	0.55
	1991 ³	1.45	1.28	0.17
	1992	1.64	2.50	-0.86

¹ET_c using CIMIS weather station at UC Westside Field Station and USDA/ARS crop coefficient for the period from planting through September 15.

²Total applied water less estimated evapotranspiration. A negative value indicates consumptive use from the shallow groundwater table.

³Melons were grown in 1991.

**SUMMARY OF CROP YIELD AND ESTIMATED VALUE
1989, 1990, AND 1992 CROP YEARS**

Irrigation System	Year	Yield (lb/ac)		WUE	Value (\$/ac) ¹		Total
		Seed	Lint		Seed	Lint	
Subsurface Drip	1989	2,864	1,527	0.29	243.44	1,145.25	1,388.69
	1990	2,783	1,291	0.24	236.56	968.25	1,204.81
	1992	2,523	1,626	0.29	214.46	1,219.50	1,433.96
LEPA	1989	1,841	1,016	0.22	156.49	762.00	918.49
	1990	1,816	728	0.12	154.53	546.00	700.53
	1992	2,149	1,385	0.31	182.67	1,038.75	1,221.42
Improved Furrow	1989	2,158	1,064	0.16	183.43	798.00	981.43
	1990	2,494	1,224	0.27	211.99	918.00	1,129.99
	1992	2,261	1,458	0.32	192.19	1,093.50	1,285.69
Historic Furrow	1989	1,975	1,081	0.16	167.88	810.75	978.63
	1990	2,537	1,275	0.20	215.65	956.25	1,171.90
	1992	2,229	1,437	0.32	189.47	1,077.75	1,267.22

¹Value estimates based on assuming seed @ \$170.00/ton and lint @ \$0.75/lb.

SUMMARY OF IRRIGATION SYSTEM ANNUAL COST ESTIMATES (\$/ACRE)¹
1989, 1990, AND 1992 CROP YEARS

Irrigation System	Year	System	Maintenance	Operation	Energy	Preirrigation (sprinkler)	Total
Subsurface Drip	1989	177.35	39.75	12.10	18.46	27.52	275.18
	1990	177.35	39.75	12.10	20.53	26.37	276.10
	1992	184.70	42.01	9.78	17.96	33.68	288.13
LEPA	1989	73.23	29.45	13.57	20.16	27.52	163.93
	1990	73.23	29.45	14.97	26.52	0.00	144.17
	1992	73.23	29.45	14.97	17.28	0.00	134.93
Improved Furrow	1989	20.42	15.49	22.03	0.00	0.00	57.94
	1990	60.22	23.56	24.39	8.40	24.73	141.30
	1992	60.22	23.56	27.68	8.40	24.46	144.32
Historic Furrow	1989	20.42	15.49	22.03	0.00	0.00	57.94
	1990	20.42	15.49	22.03	0.00	0.00	57.94
	1992	20.42	15.49	22.03	0.00	0.00	57.94

¹ See Table 6-7 for detailed irrigation system cost estimates for 1992 crop year.

**SUMMARY OF NET CROP INCOME
1989, 1990, AND 1992 CROP YEARS¹**

Irrigation System	Net Income (\$/acre)			Total
	1989	1990	1992 ¹	
Subsurface Drip	268.58	46.04	66.53	381.15
LEPA	(81.63) ²	(361.30)	281.04	(161.89)
Improved Furrow	127.65	165.59	316.44	609.68
Historic Furrow	130.03	235.98	397.20	763.21

¹Preliminary data subject to revision.

²() denotes net loss.

SUMMARY OF CONTRIBUTION TO DRAINAGE

Irrigation System	Contribution (acre-inch/acre)		
	1989	1990	1992
Subsurface Drip	-0.8 ¹	1.8	-5.5
LEPA	-3.7	4.3	-10.4
Improved Furrow	5.6	-2.5	-10.0
Historic Furrow	6.6	6.6	-10.3

¹Negative data indicate crop ET_c contribution from water table.