Chapter 1
GENERAL INFORMATION

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A Landowner's Manual

Managing agricultural irrigation drainage water:

A guide for developing
Integrated On-Farm Drainage Management systems

Chapter 1. General Information

I. Introduction

Chronic problems of salt, selenium, boron and other naturally occurring elements in surface and groundwater supplies plague agricultural regions throughout the Westside of the San Joaquin Valley and the western U.S. Compounding the problem is the build-up of salty subsurface groundwater resulting from dense clay layers and inadequate natural drainage.

The Integrated On-Farm Drainage Management (IFDM) system was developed to manage these problems. A state-of-the-art, yet practical irrigation management system, the IFDM provides for drainage water reuse to improve water availability for crop production and to minimize salt and selenium risks to water quality and the environment.

IFDM manages irrigation water on salt-sensitive, high value crops and reuses drainage water to irrigate salt-tolerant crops, trees and halophyte plants. Salt and selenium are removed from the farming system and can be marketed. This system views the subsurface drainage water containing salts and selenium as resources, rather than considering them as wastes and environmental problems.

Simply stated, the grower sequentially reuses drainage water to produce crops with varying degrees of salt tolerance. A solar evaporator receives the final volume of drainage water; this water evaporates and salt crystallizes. Plants absorb selenium, which may be volatilized; or accumulate in the plant tissue. Of the remaining selenium some will remain in the soil and some will be contained in the final effluent to become a component of harvested salt. There is no discharge of salts and selenium into rivers or evaporation ponds. Drainage water, salts and selenium are managed on the farm.

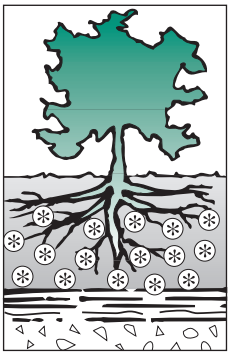
The use of an IFDM system for salt and water management on drainage-impacted farmland has two primary objectives:

1. To use drainage water as a resource to produce marketable crops; and
2. To manage the salt and selenium in drainage water directly on-farm.

An IFDM system can serve as a viable alternative for landowners who may not choose

to participate in a voluntary land retirement program for drainage-impacted lands. Once the irrigation systems have been optimized to maximize water use efficiency and to minimize the production of subsurface drainage water, an IFDM system can be designed to enable the landowner to process the resulting drainage water on-farm.

II. This manual



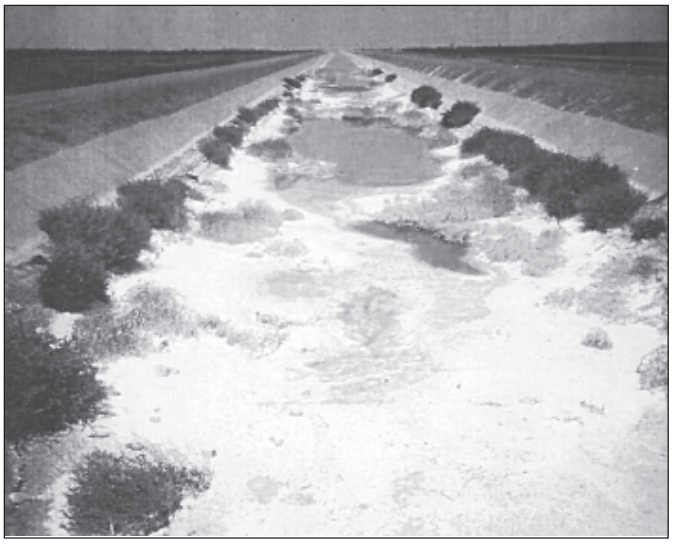
This manual is part of an educational and outreach program to educate landowners on the advant–ages, disadvantages, costs, environmental regulations and other issues involving an IFDM system. A companion manual is being produced to provide technical consultants and support personnel with the tools they need to assist growers with developing and implementing an effective IFDM program.

The seven-year IFDM pilot system at Red Rock Ranch has demonstrated that the use of IFDM on a larger scale is possible and practical. Several farms and water districts, likewise, have developed IFDM systems in their areas.

The merits of IFDM have been recognized by the U.S. Environmental Protection Agency and the State Water Resources Control Board through the award of a Clean Water Act Section 319(h) Grant to educate farmers and to train professionals about IFDM implementation. This manual is funded by the grant, and it targets the needs of the landowners, water/drainage district managers, engineers and technical professionals.

III. History

The Westside of the San Joaquin Valley is plagued with a build-up of salts, selenium, boron and other naturally occurring elements. Fine-textured soil and dense, shallow clay layers allow the build-up of these salts and trace elements by preventing unused irrigation water from percolating into the deep aquifer. Growers in the region are faced with severe problems of high water tables and soil salinization.



Drainage canals have been used to capture subsurface saline drainage water. The IFDM system manages the saline drainage effluent on-farm.

Prior to 1986, drainage water collected from fields in western Fresno County was discharged into the San Luis Drain with the ultimate objective of disposal into saline Bay-Delta waters. However, the Drain was closed in 1986 due to public concern over the environmental degradation of the Bay-Delta, and waterfowl poisonings, which resulted from selenium contamination at Kesterson Reservoir. Without a viable way to drain the land, growers' options to purge their land of salts become severely limited. As the salts and boron encroach into the crop root zone, yields are reduced, crop choices are limited, and over time, crop production can become unprofitable. Likewise, water quality in the Sacramento-San Joaquin Bay-Delta estuary ecosystem is being impacted by the addition of salts, selenium and other elements from storm run-off and subsurface drainage that ultimately reaches the San Joaquin River. A total maximum daily load (TMDL) for selenium is being implemented for the upper San Joaquin River and TMDLs for salt and boron currently are under development for the river. It is clear that alternative methods for managing salinity are needed to ensure the long-term agricultural productivity of the region.

Since 1985, several water and resource management agencies have responded to the need, developing the IFDM system. IFDM evolved from the agroforestry concept and was developed by the Westside Resource Conservation District,

Notes:

California Department of Water Resources, California Department of Food and Agriculture and the USDA-Natural Resources Conservation Service. Valuable research information has been contributed by the University of California, Davis and Riverside, California State University, Fresno and the USDA Salinity Lab in Riverside and Water Management Research Lab in Parlier, and staff from the Denver office of the U.S. Bureau of Reclamation. The Center for Irrigation Technology at California State University, Fresno is overseeing the preparation of these manuals and follow-up workshops on IFDM implementation. The Central Valley Regional Water Quality Control Board and U.S. Fish and Wildlife Service also have participated.

The pilot IFDM system was developed at Red Rock Ranch, owned by John Diener, in western Fresno County. Professional staff from several government agencies, universities, and consultants provide the required technical assistance.

The IFDM system has created conditions for economically viable and sustainable farming on the land that previously had severe salinity problems and consequently, reduced yields and productivity. Using the experiences from the Red Rock Ranch IFDM project, many growers are interested in developing IFDM systems on their farms.

To date, IFDM projects are being considered for drainage-impacted areas on the Westside and in Kern County. Likewise, farmers and water districts in the Grasslands Drainage Basin have expressed interest in IFDM to help reduce drainage flows, selenium load levels and drainage effluent in their discharge outlets. The IFDM system offers benefits to water managers, farmers and political leaders by providing a practical example of integrated farming and engineering methods to protect the quality of rivers, groundwater resources, soils and the environment.

Moreover, the concepts within IFDM are consistent with local and regional water and drainage management plans. The Federal-State Interagency San Joaquin Valley Drainage Program's final report, *A Management Plan For Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley*, September 1990, recommends several measures for managing subsurface agricultural drainage, which are employed by IFDM systems. The major components include source control (water conservation practices), sequential reuse of drainage water and the treatment and/or disposal of drainage water.