

Drainage Water Management and Nutrient Control Through Agricultural Field Drainage



DRAINAGE WATER MANAGEMENT

Keep Nutrients and Moisture in the Fields, Where They Belong.

How can nitrate loads in drainage water be reduced while maintaining sufficient drainage for increased crop yields? The answer is drainage water management.

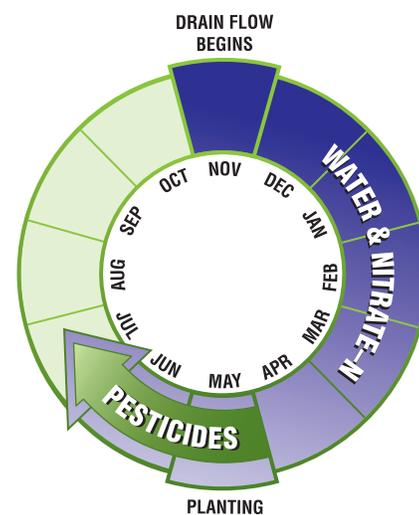
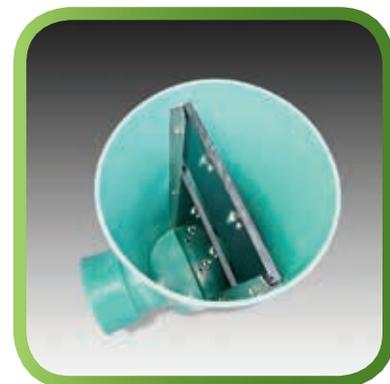
Drainage water management uses water control structures to manage the water table elevation and the coordination of releasing water from within surface and subsurface agricultural drainage systems. It is part of a conservation effort to reduce nutrients carried from subsurface agricultural drainage water into our streams, rivers and lakes.

What Does Drainage Water Management Do?

Drainage water management diminishes overall water flow from croplands, thus creating cleaner runoff by reducing nitrate loads from fertilizer, manure and organic sources in the soil. It also controls the amount of water and nutrients retained in the soil. Drainage water management can maximize crop yields while minimizing negative effects on water quality.

It was determined that the N applied in excess of the recommended amount was close to the N load measured in the drainage ditch at the outlet. Subsurface drainage systems are important modifiers of peaks and floodwater quality in rivers ditches and streams.

Farmers are not environmental activists, they are active environmentalists. They tend to be great stewards of the soil and now they can be stewards of our most important natural resource: water.



Most nitrate outflow is during the off-season months.

Zucker, L.A. and L.C. Brown (Eds.). 1998. Agricultural Drainage: Water Quality Impacts and Subsurface Drainage Studies in the Midwest. Management Systems Evaluation Areas (pg 18) Ohio State University Extension Bulletin 871. The Ohio State University



Drainage water management has many important benefits:

Cost

Depending on height, size of the tile, structure design, manufacturer and level of automation, most water control structures only range from \$500–\$2,000. According to the Agricultural Drainage Management Coalition, the benefits of using a drainage management system exceed costs by a ratio of three to one.

Decrease Nitrates in Drinking Water

A large portion of the United States receives its drinking water from sources fed by runoff from agricultural lands. Drainage water management retains nitrates within the system and decreases the need for denitrification.

Reduces Effects of Hypoxic Zone

By reducing nitrate runoff, drainage water management can improve the ecosystems in and around the Gulf of Mexico.

Increased Production/Yield

Drainage water management allows for a higher water table during the growing season and thus a soil profile that is more useful to the crop. Overall, the result is improved soil quality and more robust growth. Subirrigation/drainage systems can increase yields by 43% or more—compared to subsurface drainage alone—depending on the situation.

Decreased Yield Variability

Throughout the growing season, drainage water management increases soil moisture during dry periods and reduces yield variability. The extra water within the water table can not only increase yields, but can also help increase yields during droughts.

Crops are Less Susceptible to Droughts and Flooding

Drainage water management creates a larger underground reservoir of water and nitrates that can be more productively utilized by the crops throughout the season. Without the stress of seasonal droughts, crops can produce a larger yield. If flooding should occur, it can be easily drained, reducing the damage caused by root rot.

Allows for seasonal moisture variability

With varying degrees of precipitation, agricultural drainage needs fluctuate throughout the year. Whether there is a wet spell or a drought, the water table elevation can be easily adjusted to create the optimal growing environment.

Retrofitting Availability

Depending on the slope and layout of the pipes, most drainage systems can be retrofitted with water control structures. Patterned drainage systems where the grade is 0.2 percent or less can benefit the most from this option.

THE IRRI-DRAIN® WATER TABLE MANAGEMENT SYSTEM

The Irri-Drain System lets you manage water with its proven capability both to irrigate and drain a field using the same pipe and installation. It also acts as a nutrient control system, allowing you to keep fertilizer in your fields longer for better absorption.

By managing your water level with Irri-Drain, you take control of the production variables—planting date, fertilizer uptake and plant development... herbicide and insecticide effectiveness, soil compaction, standability/lodging, harvest moisture, and, most importantly, YIELD.

Irrigation AND Drainage—at Your Control

By installing the Irri-Drain System, you gain better—and immediate—control of moisture in your fields. You simply irrigate when fields are dry and drain when they are wet. Irri-Drain lets you neutralize poor weather conditions to give you adequate planting time, increased crop yields and more crop options.

In the irrigation process, water can be pumped back from the source, through the feeder pipe, into the perforated pipe system—to where the roots absorb moisture as needed. This PUMP-BACK system raises the water table so that you can maintain the optimum soil moisture level for your crops, encouraging maximum root development.

Whenever drainage is required, such as during and right after extended rain, the pump is shut down, and the drainage outlet is opened.

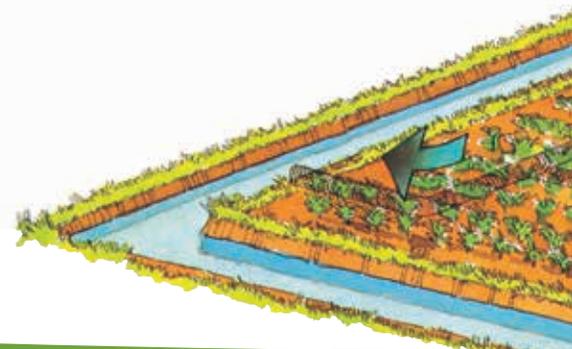
With an Irri-Drain System, you control the timing of both irrigation and drainage—to maximize yields and profits.

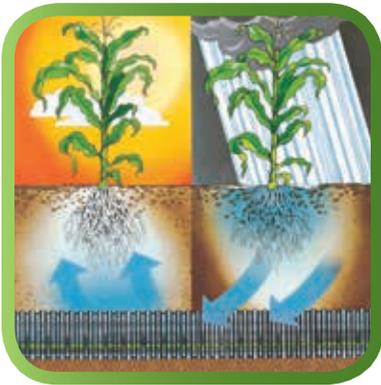
A Solution for Any Field

The Irri-Drain System also works effectively on sloping lands. Head-control stands with overflow baffles are used to distribute the flow in stair-step fashion down the slope. Pressures of no more than 5 psi are sufficient to operate the Irri-Drain system.



Irri-Drain head-control stand at the edge of a corn field





The Irri-Drain System is the ideal solution for drainage water management:

SAVES MONEY

By using one pipe system for two operations, the cost can be comparable to that of a pivot system.

SAVES ENERGY

Using gravity flow and low pumping pressure, an acre-inch of water can be built into the sub-soil with minimal energy usage.

ELIMINATES THE EVAPORATION

Evaporation associated with overhead sprinklers is eliminated.

INCREASES FIELD COVERAGE

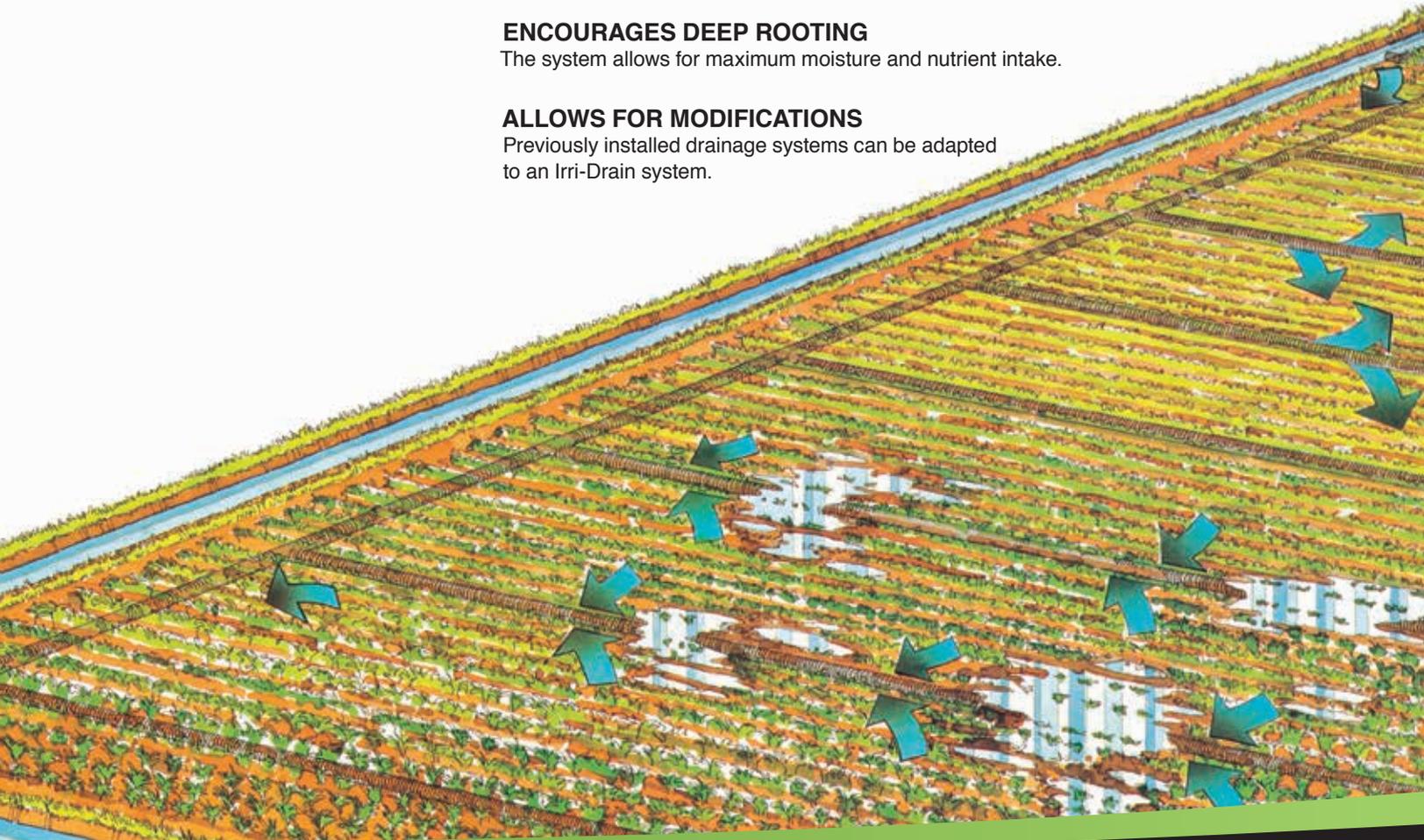
Irri-Drain can cover a field of any size and shape and includes the corners not reached by overhead pivot systems.

ENCOURAGES DEEP ROOTING

The system allows for maximum moisture and nutrient intake.

ALLOWS FOR MODIFICATIONS

Previously installed drainage systems can be adapted to an Irri-Drain system.



IRRI-DRAIN SYSTEM DESIGN

Steps Required for System Design

1. Perform soil permeable test
2. Use soil auger to determine soil profile

Steps Required to Determine Irri-Drain Needs in Field

1. Analyze field topography
 - a. Zones for each water control structure will be in 1 foot elevations
2. Use soil profile results to locate the impermeable layer that will support the water table
3. Determine the location of the water source and spacing of laterals
4. Use Conversion Factors below to determine how much water to pump into system.

Recommended Conversion Factors

Assume: Need 5" if water for irrigation over 45 days

100 acre Irri-Drain Project

Evap-Transpiration (ET) Rate Peak = .3" per day
(evaporation + transpiration rate)

1 acre foot = amount of water required to cover one acre—one foot deep
= 325,850 gallons

1 acre inch = 27,154 gallons (325,850 ÷ 12)

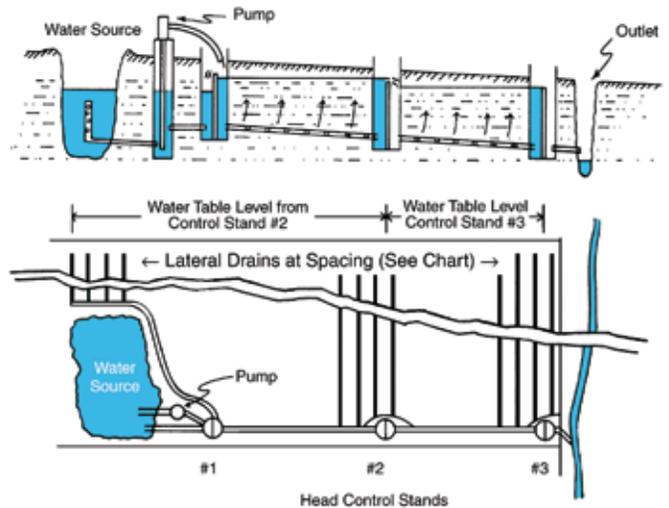
1 acre inch = 18.7 GPM (27,154 ÷ 60 ÷ 24)

.3 acre inch/day = 5.6 GPM (18.7 x .3)

Water needed for 100 acres @ .3 ET rate = 565 GPM supply

Water needed for 40 acres of irrigation @ .3 ET rate = 226 GPM

ADS HP Pump Stations for Water Management



WATER CONTROL STRUCTURE



The Nyloplast® Water Control Structure is an innovative stormwater management basin that provides an effective and economical way to manage water levels and improve the water quality of our valuable receiving streams, rivers and lakes.

The Water Control Structure allows overflow for heavy rainfall events, but also restricts water movement during normal conditions to maximize residence time for valuable nutrients so they can stay in the crop zone.

Studies have found reductions in annual nitrate load in drain flow ranging from 15 to 75 percent, depending on location, climate, soil type and crop practices. Nitrate loads are reduced by about the same percentage as drain flow is lowered.

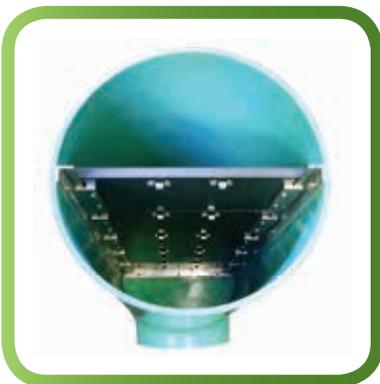
When using a Water Control Structure, nitrate reductions come from three factors: reduced volume of drainage exported from the system, denitrification within the soil and deep seepage. A decrease in drainage water is a factor in reducing nitrate flow to ditches and streams.



Using a Water Control Structure in a main, submain or lateral drain allows you to vary the depth of the drainage outlet. In the early spring and in the fall, the Water Control Structure can be lowered to allow drainage to flow freely prior to field operations. After spring operations, the structure can be raised to store water for the crop to use in midsummer. After the harvest season, the Water Control Structure can be raised to reduce the delivery of nitrate to ditches and streams in the off-season.

One Water Control Structure can typically control at least 10-20 acres and flatter fields require fewer overall structures. In addition, most drainage systems can be retrofitted with Water Control Structures. Please check with your ADS representative to see if the slope and current system's layout will allow their use.

Water Control Structures are fabricated with a Nyloplast drainage structure, which is corrosion-resistant over time. Numerous stub options for different pipe types are available along with watertight push-on pipe connections. Water levels can be controlled in 6" increments with the easily adjustable, corrosion-resistant flashboards.



ADS—A Worldwide Leader Supporting the Agriculture Industry



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