

Micro Irrigation

Surface and Subsurface

What is Subsurface Drip Irrigation SDI?



- ▶ One of several types of micro-irrigation systems – Conservation Practice code 441.
- ▶ It is one of the most advanced irrigation methods used today.
- ▶ Operates at low pressure 10 - 15 psi, low volume and flow rates are measured in gph.
- ▶ It is a planned irrigation system where water is applied directly to the root zone.
- ▶ Potentially more efficient than flood or sprinkler irrigation, due to the reduction of evaporation.

Advantages

Adaptability to Crops and Fields



- ▶ Adaptable to fields with slopes and irregular shapes.
- ▶ Suitable for vegetables, grains and silage crops, as well as orchards and windbreaks.



Micro-sprinklers on young orchard



Distribution uniformity



30 acres irrigated in 4 hrs

Efficiency and Uniformity

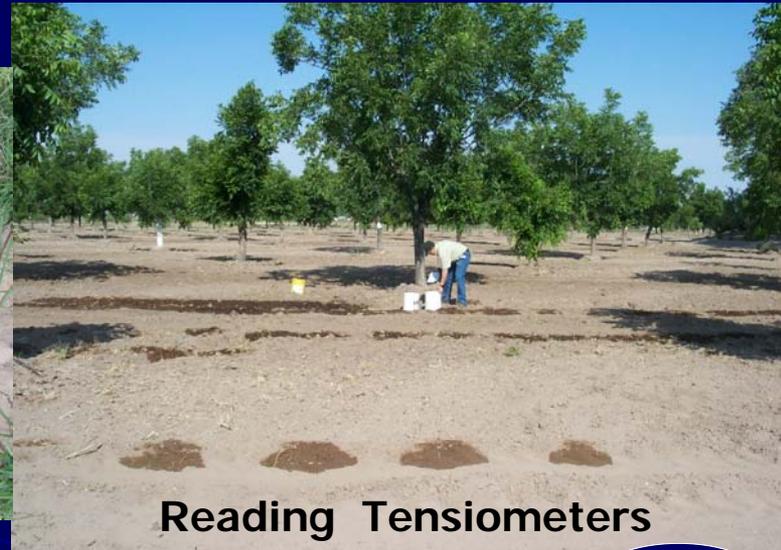
- ▶ Micro-irrigation has high application efficiency $> 90\%$ and a high distribution uniformity $> 85\%$.
- ▶ Reduces wet area to a fraction compared to conventional flood irrigation.
- ▶ Weed growth is reduced in arid climates, by keeping much of the soil surface dry.
- ▶ This is a 30 acres field that can be irrigated in 4 hours.
- ▶ For Irrigation Requirements see Section 5 Gross Irrigation Water Requirement Guide.

Nutrients Management

- ▶ With proper IWM percolation is controlled.
- ▶ Nutrients can be applied at anytime, at any dosage directly to the root zone, without wetting the plant foliage.
- ▶ Reading Electrical Resistance Blocks and tensiometers to monitor soil moisture.



Reading Electrical Resistance



Reading Tensiometers

Inputs reduced and Output increased



Planting area increased by 15%

- ▶ When compared to flood irrigation, labor cost is significantly decreased.
- ▶ If managed properly micro-irrigation decreases water, fertilizer, and pesticide use.
- ▶ Increases crop yields.
- ▶ This is an Onion crop where planting area has been increased 15% by reducing the furrow size.

- ▶ Soil erosion is reduced by eliminating tail water and overland flow irrigated induced erosion.



Pumpkin crop



Earth worms



Increased soil OM, Microbes

Conservation practices improved

- ▶ Many conservation practices are achieved and it may be through default.
- ▶ Increasing residue = Increases organic matter (OM) and micro organisms activity in the soil.

Disadvantages

- ▶ There is always apprehension in converting to something new or different.
- ▶ System requires a heavy initial investment.
- ▶ Currently cost ranges from \$1200-2200/acre.
- ▶ Equipment needs changes and adjustments.
- ▶ The process has a steep learning curve.
- ▶ Requires higher skilled labor than other irrigation systems.



Disadvantages

- ▶ Must be carefully designed and installed to ensure proper emitter flow rate, row spacing, and tape depth.
- ▶ Requires proper operation and maintenance to ensure the life of the system.
- ▶ Filtration is critical, emitter clogging will affect distribution uniformity and it is expensive to replace (sand can not be dissolved).
- ▶ Soil salinity must be addressed, as limited leaching options exist.
- ▶ Excess CaCO_3 dissolved in irrigation water will clog emitter if pH is not managed. Too low pH will damage conveyance and emitters.

Disadvantages



Fertilizer tanks



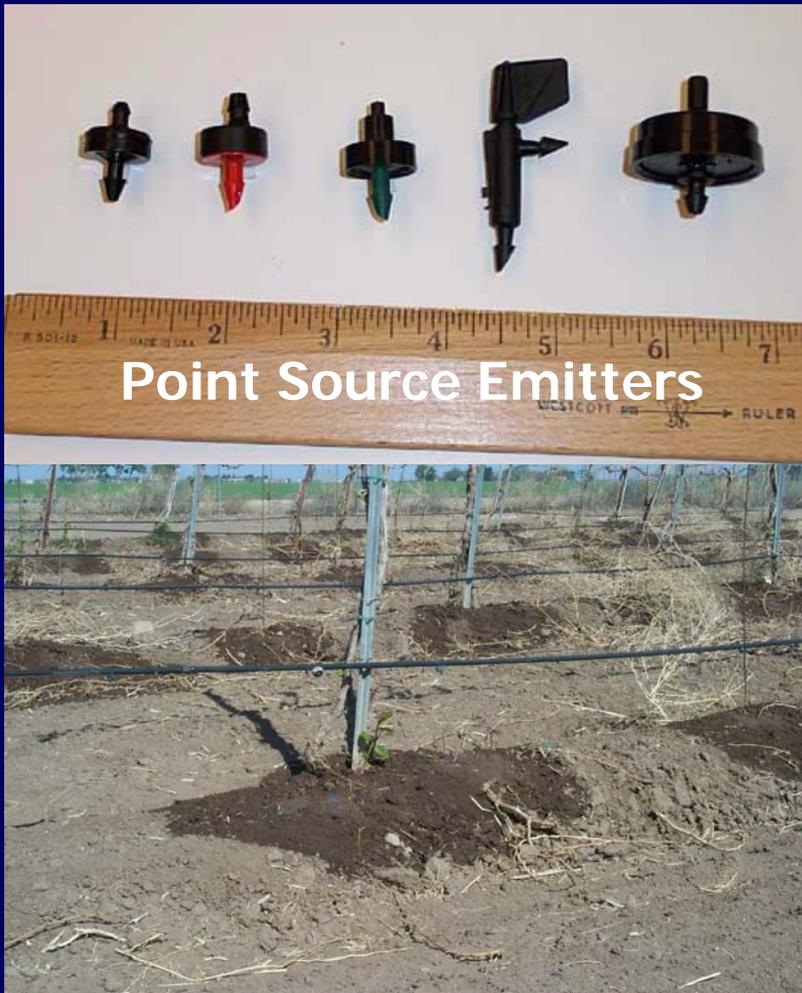
Tractor GPS and operator error

- ▶ Limited pesticides and fertilizers are available for injection.
- ▶ Algae, moss, bacteria slime growth must be controlled using chlorination injection.
- ▶ Components can be easily damaged by vandals and rodents.
- ▶ Implements, tractor GPS and operator error can cause this kind of problems. GPS may lose reception and tractor moves when injecting the tape.
- ▶ Small errors may be manually fixed.

Types of Emitters

- ▶ Point Source
- ▶ Line Source
- ▶ Spray or Mini-Sprinkler
- ▶ Bubblers

Point Source Emitters



- ▶ Are installed by attaching to the outside of the lateral or distribution line.
- ▶ Installer selects the location, installing emitters equally or at variable spacing.
- ▶ Water applied to soil forms a small, round wetting diameter.
- ▶ They are suited for widely space plants like orchards, vineyards and landscape.
- ▶ Most of these types of emitters are designed to be installed above ground.

Line Source Emitters



- ▶ Are factory installed emitters either molded or glued internally to the drip line, and equally spaced along the line.
- ▶ They are available in two variations: **Thin wall** drip line and **Thick wall** drip hose.
- ▶ Water applied to soil forms a continuous wetting pattern.
- ▶ These emitters are suitable for row crops, orchards, vineyards, and gardens.

Micro Spray or Mini-Sprinkler

Mini sprinkler heads



- ▶ Are emitters that operate by throwing water through the air.
- ▶ Some have spinners and others contain no moving parts.
- ▶ This system covers a wide area, with a wetting diameter of 2–7 feet. Some may cover 20-30 ft.
- ▶ The flow rate varies from 3 to 30 gph, depending on orifice size and line pressure.
- ▶ Mini-sprinklers are less prone to clogging than point source emitters.

Basin Bubblers



- ▶ Single or multiple port.
- ▶ Apply water in a small basin or depression in the soil.
- ▶ They are more applicable in orchards greenhouses and landscaping.

SDI Components & Installation



- ▶ **Filter station**
- ▶ **Chemigation and fertilization injection**
- ▶ **Drip tape injection**
- ▶ **Mainline, Submain and Manifold**
- ▶ **Valves and Controls**

Filter Station Construction

Sand Media Filter Station



Disc Filters



Screen filter and pressure sustaining Valve



Multi Filtration System



Chemigation and Fertigation



Chemical Tanks



Mixing Tank



Injection System

Jar Test

Tape Injection



- ▶ Tractor with six rolls unit for tape injecting.



- ▶ GPS guided tractor for bedding and tape installation is recommended to minimize row movement.

Mainline, Submain and Manifold

Trencher



Mainline trench slices through tape



Manifold, tubing, tape connections



Field Control valves

Automated Control Valve



W/ Pressure Regulator



Control Box



Main and Sub-Main Flush Valve



Buried Control Valve

Lateral
Flush Valves



Manual Control

Design Requirements SDI

- ▶ This practice will be designed in accordance with all federal, state, and local laws and regulations.
- ▶ SDI falls under Micro-irrigation - Conservation Practice Code 441.
- ▶ Must be carefully designed and installed to ensure proper emitter flow rate, row spacing, and tape depth.
- ▶ Shall consist of pipe size, layout, efficiency calculations to $> 90\%$ and distribution uniformity $> 85\%$.
- ▶ Show all components in design layout, to make checkout much more easy.

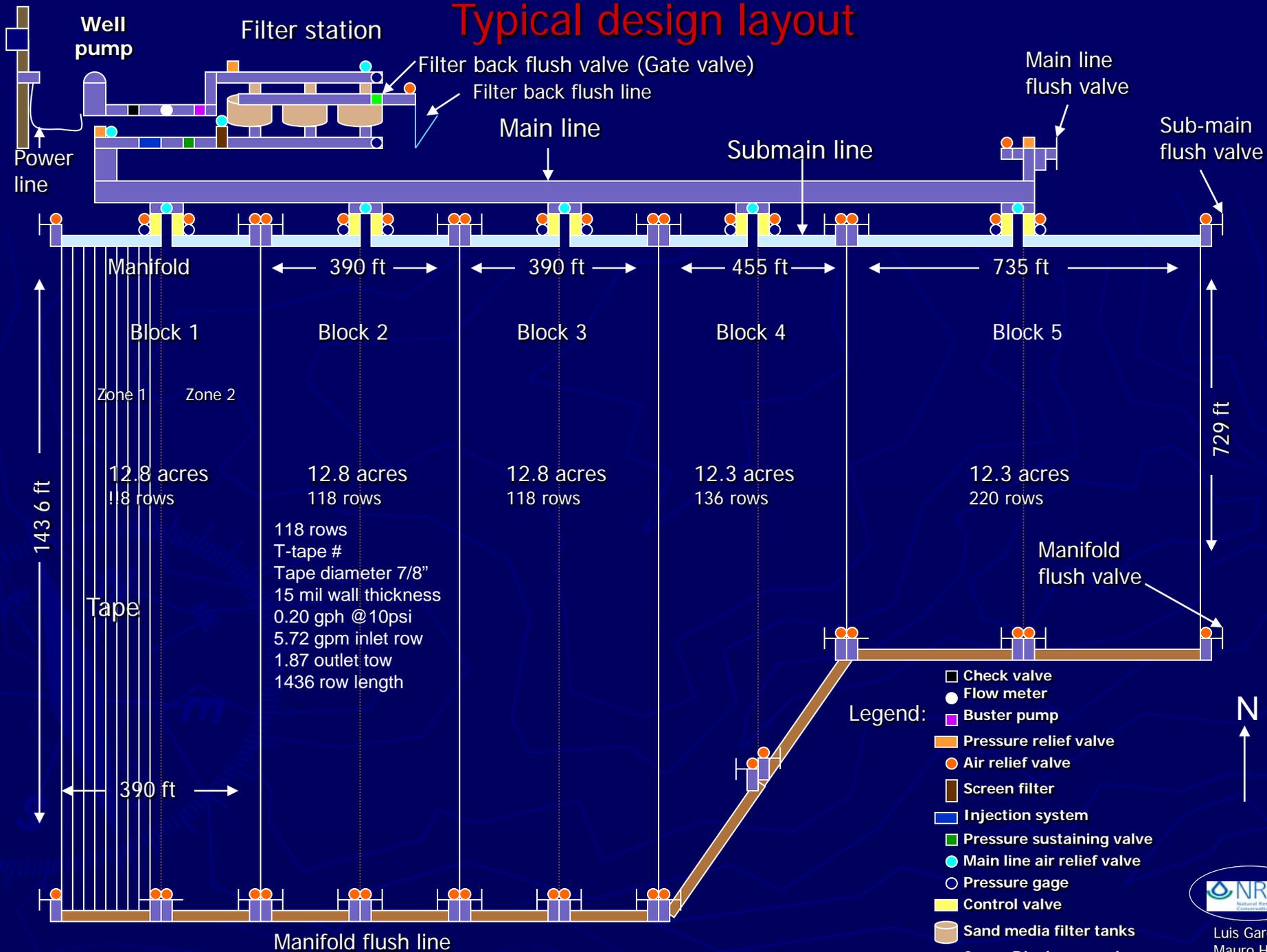
Design Requierements SDI

- ▶ All materials shall be of high quality
- ▶ Ensure that fields are measured to exact size or it will cause irrigation efficiency errors.
- ▶ When testing the well for production, the well should be tested with back pressure.
- ▶ Resource inventories, local conditions and needs must be assessed prior to design (Soil types, crop needs and rooting depths of crops, germination, and climate).
- ▶ Drip system will be designed to deliver the maximum water requirements to all fields within 18 hours.

Design Requirements SDI

- ▶ Designed for good plant growth without excessive water loss, erosion, reduction in water quality, or salt accumulation.
- ▶ Designs will be developed to meet resource needs and the clients goals and objectives.
- ▶ Materials and workmanship on the entire system needs to be guaranteed for at least one year.
- ▶ Currently most SDI systems are being planned and designed by private contractors with final review and approval from NRCS.
- ▶ Don't forget NM One Call system and document for utilities.

Typical design layout



Luis Garcia
 Mauro Herrera

Maintenance

Water quality

- ▶ Water quality is a factor in maintaining micro-irrigation systems.
- ▶ Take a water sample and test it for silt, sand, algae, bacteria, dissolved solids such as iron, sulfur, salts and calcium, and pH of the water.

Maintenance

Chemical treatment

Acid injection

- ▶ Contact your supplier to decide what type of acid to apply.
- ▶ Continually treat system with acid to ensure that calcium carbonate do not precipitate out of solution.
- ▶ Consult with manufacture to determine pH limits of drip tape, emitters and conveyance line.



Acid flow meter

Fertilizer flow meter

Chlorine flow meter

Maintenance

Chlorination

- ▶ If water has high organic load, chlorinate system continuously 1-2 ppm or bi-weekly with 5-20 ppm.
- ▶ End of season chlorinate at 40 ppm for at least four hours, and completely flush and drain all pipes with clean water.
- ▶ Also, blow out lateral lines with air not to exceed 15 to 20 psi of pressure.



Chlorine flow meter

Maintenance

Check components and damages

- ▶ Monitor your pressure gages.
- ▶ Protect your components from rodents.
- ▶ Check for mechanical damage.
- ▶ Check for rodents and get rid of them.
- ▶ Repair leaks. There are several ways for repairing.

Pressure gage



Check for rodents



Repair leaks



Screen to protect against coyotes and squirrels



Maintenance

- ▶ Replace damaged parts, clean Sand media and Disk filters as required by manufactures.
- ▶ Irrigation system evaluation by a trained professional is highly recommended.



Crops in subsurface drip irrigation



Onion crop

Chile





Alfalfa





Vineyards





Pecan orchard





Corn silage

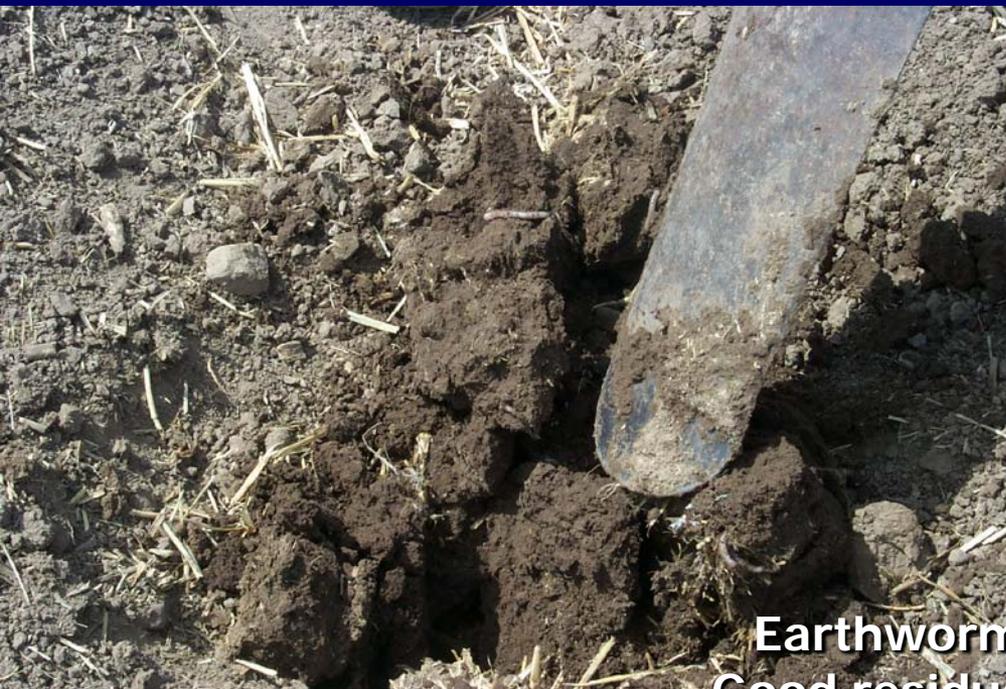




Chile



Luis García/Mauro Herrera



Earthworms- Chile Crop
Good residue management



Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

