

# Irrigation Systems Evaluation

## Introduction

- The material provided in this section is intended to serve as a framework for irrigation system evaluation training.
- Trainers should modify the training material referenced as necessary to achieve the planned skill level for the trainees.
- Trainers are encouraged to include locally developed training materials to complement and/or supplement the referenced material.
- As new training materials are developed by trainers, they are encouraged to furnish copies to the National Employees Development Center for inclusion in future versions of the Toolbox.

## Suggested Objectives

- Perform an irrigation system evaluation in a safe manner using accepted procedures.
- Determine irrigation system operating performance by gathering necessary data, and calculating and analyzing applicable efficiency values and/or operating costs.
- Determine irrigation system performance by calculating distribution uniformity, or pattern efficiency, if applicable.
- Make recommendations for improvement, if needed, based on the results of evaluations.

## Suggested Outline

- I. Introduction
- II. Body
  - A. Irrigation Evaluation
    1. Necessary equipment
    2. Safety measures.
    3. Procedure
  - B. Operating Performance
    1. Collection of field data
    2. Calculate/analyze applicable efficiency values
  - C. Irrigation System Performance
    1. Data evaluation and display
    2. Distribution uniformity
    3. Pattern efficiency
  - D. Recommendations For Improvement
    1. If needed
    2. Based on results of evaluation
- III. Summary

# Irrigation Systems Evaluation

## Systems Included

1. Fixed (Solid Set) Sprinkler Irrigation System Evaluation.
2. Periodic Move Sprinkler Irrigation System Evaluation.
3. Center Pivot Sprinkler Irrigation System Evaluation.
4. Traveling Gun Sprinkler Irrigation Evaluation.
5. Lateral Move (Linear Move) Sprinkler System Irrigation Evaluation.
6. Level Border Irrigation System Evaluation.
7. Graded Border Irrigation System Evaluation.
8. Level Furrow Irrigation System Evaluation.
9. Graded Furrow Irrigation Evaluation.
10. Surface Irrigation System Evaluation.
11. Contour Ditch Irrigation System Evaluation.
12. Trickle Irrigation System Evaluation.
13. Pumping Plant Evaluation.
14. Low Energy Precision Application (LEPA)/Low Pressure In Canopy Application (LPIC) Irrigation System Evaluation.
15. Level Basin/Levee Irrigation System Evaluation.

# Irrigation Systems Evaluation

## 1. Fixed (Solid Set) Sprinkler Irrigation Evaluation

### Reference Material

- Irrigation Guide, Chapter 9, 15.
- Methods of Evaluating Irrigation Systems, USDA, Agriculture Handbook 82.
- NEH 15, Chapter 11.

### Toolbox Material

- Lesson Plan “Evaluation of Fixed (Solid Set) Sprinkler System”, NRCS, FL.
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State Univ.

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Systems Evaluation

## 2. Periodic Move Sprinkler Irrigation System Evaluation

### Reference Material

- Irrigation Guide. Chapter 9,15.
- NEH 15, Chapter 11.

### Toolbox Material

- Lesson Plan IWM Sprinkler Irrigation Evaluation Lesson Plan 9&10 Oregon, 1972.
- Publication Farm Irrigation System Evaluation: A Guide for Management”, Utah State University
- Video “Irrigation Energy Conservation”, Oklahoma State University (Located in IIWM Plan)
- Video Irrigation Training Series, Module 930(DRAFT), Periodic Move Sprinkler Irrigation Evaluation, USDA, NRCS (video & story board).
- Video “Irrigation Water Management”, Oklahoma State University (Located in IIWM Plan)

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation System Evaluation

## 3. Center Pivot Sprinkler Irrigation Evaluation

### Reference Material

- Irrigation Guide, Chapter 9, 15.
- Irrigation System and Pumping Plant Efficiency Evaluations: 1978-1981, Texas Department of Water Resources, LP-191, 9/83.
- NEH 15, Chapter 11.
- Center Pivot Electrical Safety, Slide Presentation prepared by Dickey and Underwood (slides & story board), NRCS, Texas, 817-774-1217.
- Center Pivot Irrigation Safety, presentation from Texas Section ASAE meeting 10/91, NRCS, Texas, 817-774-1217.

### Toolbox Materials

- Lesson Plan "Evaluation of Center Pivot System", NRCS, FL.
- Video "Center Pivot Sprinkler Irrigation Evaluation", Irrigation Training Series, Module 931, NRCS, with Video, Parts A, B, and C.
- Publication "Irrigation Water Management- Interdisciplinary Team Special Program", SNTC Engineering Technical Note, 707, USDA, SCS, 12/82.
- Publication "Farm Irrigation System Evaluation: A Guide for Management", Utah State University.
- Video - "Irrigation Energy Conservation and Irrigation Water Management", Oklahoma State University (Located in IWM Plan)

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation System Evaluation

## 4. Traveling Gun Sprinkler Irrigation Evaluation

### Reference Material

- Irrigation Guide, Chapter 9, 15.
- NEH 15, Chapter 11.

### Toolbox Material

- Lesson Plan “Evaluation of Traveling Gun”, NRCS, FL.
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.
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### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Systems Evaluation

## 5. Lateral Move (Linear Move) Sprinkler Irrigation System

### Reference Material

- Irrigation Guide, Chapter 9, 15.
- NEH 15, Chapter 11.

### Toolbox Material

- Publication "Farm Irrigation System Evaluation: A Guide for Management", Utah State University, 1978.
- Video "Irrigation Energy Conservation and Irrigation Water Management", Oklahoma State University (Located in IWM Plan)

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation System Evaluation

## 6. Level Border Irrigation Evaluation

### Reference Material

- Irrigation Guide, Chapter 9, 15.
- NEH 15, Chapter 11.

### Toolbox Material

- Video                “Level Border Irrigation Evaluation”, Module 910, Irrigation Training Series, NRCS.
- Publication        “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.



# Irrigation System Evaluation

## 7. Graded Border Irrigation System Evaluation

### Reference Material

- Irrigation Guide, Chapter 9, 15.
- NEH 15, Chapter 4.

### Toolbox Material

- Video “Graded Border Irrigation Evaluation”, Irrigation Training Series, Module 911, with Video, Parts A and B, NRCS.
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation System Evaluation

## 8. Level Furrow Irrigation Evaluation

### Reference Material

- Irrigation Guide Chapter 9, 15.
- NEH 15, Chapter 5.
- Engineering, Technical Note 17, Evaluating Surge Flow Irrigation, NRCS, Colorado.

### Toolbox Material

- Lesson Plan “Gathering & Evaluating Data for Furrow Irrigation”, NRCS, OR.
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.
- Publication “Irrigation Water Management-Interdisciplinary Team Special Program”, SNTC Engineering Technical Note, 707, USDA, SCS, 12/82.
- Video “Irrigation Energy Conservation and Irrigation Water Management”, Oklahoma State University (Located in IWM Plan)

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Systems Evaluation

## 9. Graded Furrow Irrigation Evaluation

### Reference Material

- Irrigation Guide, Chapter 9,15.
- Irrigation System and Pumping Plant Efficiency Evaluations: 1978-1981, Texas Department of Water Resources, LP-191, 9/83. NEH 15, Chapter 5.
- Engineering, Technical Note 17, Evaluating Surge Flow Irrigation, NRCS, Colorado.

### Toolbox Material

- Lesson Plan “Gathering & Evaluating Data for Furrow Irrigation”, NRCS, OR.
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.
- Publication “Irrigation Water Management- Interdisciplinary Team Special Program”, SNTC Engineering Technical Note, 707, USDA, SCS, 12/82.
- Video “Irrigation Energy Conservation and Irrigation Water Management”, Oklahoma State University (Located in IWM Plan)

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Systems Evaluation

## 10. Subsurface Irrigation System Evaluation

### Reference Material

- Irrigation Guide 9, 15.
- NEH, Part 624, Water Table Control.
- Agricultural Drainage and Subirrigation Systems, Maumee Valley RC&D Defiance, Ohio, 1/94.
- Managing Agricultural Drainage Waters in Today's Environment, 1995, Overholt Drainage School, Ohio State University, 3/95.
- Subirrigation and Controlled Drainage, H.W. Belcher, et.al., Library Of Congress 94-30888.

### Toolbox Material

Lesson Plan "Evaluation of Subsurface Irrigation System", NRCS, FL.

### Facilitation Options

- Self-paced, Facilitator guided, or Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Systems Evaluation

## 11. Contour Ditch Irrigation System Evaluation

### Reference Material

- Irrigation Guide chapter 9,15.
- NEH 15 .

### Toolbox Material

None

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Systems Evaluation

## 12. Trickle Irrigation Evaluation

### Reference Material

- NEH 15- Chap. 7, pages 101-107.
- Irrigation Guide Chapter 9 Microsystems.

### Toolbox Material

- Lesson Plan “ Evaluation of Trickle Irrigation System”, NRCS, FL.
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

# Irrigation Evaluation

## 13. Pumping Plant Evaluation

### Reference Material

- NEB Pumping Plant Performance , (Manual).
- Irrigation System and Pumping Plant Efficiency Evaluations: 1978-1981. Texas Department of Water Resources, LP-191, 9/83
- Irrigation Guide Chapter 9.

### Toolbox Material

- Lesson Plan      Pumping Plant Evaluation”, Irrigation Training Series, Module 950 (DRAFT), NRCS.
- Publication      “Irrigation Water Management- Interdisciplinary Team Special Program”, SNTC Engineering Technical Note, 707, USDA, SCS, 12/82.
- Video              “Irrigation Energy Conservation and Irrigation Water Management”, Oklahoma State University (Located in IWM Plan)

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

## **Irrigation Systems Evaluation**

### **14. Low Energy Precision Application (LEPA)/Low Pressure In Canopy Application (LPIC) System Evaluation**

#### **Reference Material**

None

#### **Toolbox Material**

None

#### **Facilitation Options**

- Self-paced,
- Facilitator guided, or
- Formal training course.

#### **Evaluation**

Each state should develop an evaluation procedure which addresses the level of competence before and after training.



# Irrigation Systems Evaluation

## 15. Level Basin/Levee Evaluation

### Reference Material

### Toolbox Material

- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University.

### Facilitation Options

- Self-paced,
- Facilitator guided, or
- Formal training course.

### Evaluation

Each state should develop an evaluation procedure which addresses the level of competence before and after training.

### Appendix

#### Software

- Michigan Software - IWM Evaluation.

# Irrigation Systems Evaluation

## Contents of Toolbox

- Publication and Audio Tape: Trickle Irrigation System Evaluation - Field Guide
- Publication “Module 910 - Level Border Irrigation Evaluation”, NRCS
- Publication “Module 911 - Graded Border Irrigation Evaluation”, NRCS
- Lesson Plans: “Efficiencies”, NRCS
- Lesson Plan “Evaluation of Subirrigation Systems”, NRCS, FL
- Lesson Plan “Evaluating Data Obtained From a Border Irrigation”, NRCS
- Lesson Plan “Gathering Data for Evaluating a Border Irrigation”, NRCS
- Lesson Plan “Pumping Plant Evaluation”, Irrigation Training Series”, Module 950 (DRAFT), NRCS
- Lesson Plan “Evaluation of Center Pivot System”, NRCS, FL
- Lesson Plan “Evaluating Data Obtained From a Sprinkler Irrigation”, NRCS
- Lesson Plan “Data Gathering and Acquisition Methods”, NRCS
- Lesson Plan “Gathering Data for Evaluating Furrow or Corrugation Irrigation”, NRCS, OR
- Lesson Plan “Evaluating Data Obtained From a Furrow or Corrugation Irrigation”, NRCS
- Lesson Plan “Gathering Data for Evaluating a Sprinkler Irrigation”, NRCS
- Lesson Plan “Evaluation of a Trickle Irrigation System”, NRCS, FL
- Lesson Plan “Evaluation of a Traveling Gun Sprinkler Irrigation System”, Lesson Plan Outline, NRCS, FL
- Lesson Plan “Evaluation of a Fixed (Solid Set) Sprinkler System”, NRCS, FL
- Lesson Plan “Troubleshooting”, NRCS
- Lesson Plan “Safety Considerations in Evaluating Natural Gas and Electric Pumping Plants”, NRCS
- Publication “Farm Irrigation System Evaluation: A Guide for Management”, Utah State University
- Publication “Irrigation Water Management- Interdisciplinary Team Special Program”, SNTC Engineering Technical Note, 707, USDA, SCS, 12/82.
- Video “Level Border Irrigation Evaluation”, Irrigation Training Series, Module 910, NRCS
- Video “Center Pivot Sprinkler Irrigation Evaluation” (2), Irrigation Training Series, Module 931, NRCS, with Video, Parts A, B and C
- Video “Periodic Move Sprinkler Irrigation Evaluation”, Irrigation Training Series, Module 930 (DRAFT), NRCS
- Video “Graded Border Irrigation Evaluation”, Irrigation Training Series, Module 911, NRCS, Parts A and B
- Video “Level Border Irrigation Evaluation”, Irrigation Training Series, Module 910, NRCS
- Video “Irrigation Management”, Oklahoma State University
- Video “Irrigation Energy Conservation”, Oklahoma State University