Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

SURFACE IRRIGATION SYSTEM

WIRSI301

Operate surface irrigation system

Competence

RQF Level: 3

Learning Hours 60

Credits: 6

Sector: Agriculture and food processing

Trade: Water and Irrigation

Module Type: SPECIFIC

Curriculum: AFPWIR3002- TVET Certificate III in water and irrigation

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Purpose statement	This module describes the skills, knowledge and attitude required to operate surface irrigation system. At the end of this module, learners will be able to carry out pre-start checks, operate and monitor the surface irrigation system, measure and control the water levels, flow rates and volume of water, monitor drainage and tail water, shut down surface irrigation in response to irrigation indicators. Qualified learners deemed competent to this competency may work alone or with others on routine tasks in marshland, hillside, small scale irrigation, garden, greenhouses, agricultural land, rain water harvesting, in-situ rain water harvesting and ground water harvesting related activities under minimum supervision.					
Delivery modality	**Training delivery**		**100%**	**Assessment**		**Total 100%**
	Theoretical content		30%	Formative assessment	30%	50%
	Practical work:		70%		70%	
	• Group project and presentation	20%				
	• Individual project /Work	50%				
				Summative Assessment		50%

Elements of Competency and Performance Criteria	
Elements of competency	**Performance criteria**
1. Carry out pre-start checks	1.1. Water, power, fuel and lubricants are regularly checked up to ensure that all are available and the control system is operational
	1.2. Pumps are systematically primed and gates are regularly controlled to ensure for their opening or closing in accordance with irrigation schedule
	1.3 pipes, equipment and outlets are conveniently positioned in accordance with the settled layout

2. Operate and monitor the surface irrigation system	2.1 Siphons are adequately primed and started and other delivery mechanisms are well started for proper conveyance of irrigation water
	2.2 Start-up sequences are systematically implemented in accordance with irrigation system start up
	2.3 Pressure at the head works and control of valves are regularly checked up to satisfy the required discharge
	2.4 Water is uniformly distributed to the targeted areas with minimal wastage and run-off
	2.5 Time lag between shut down and end of watering is carefully controlled to ensure for minimum run-off and deep percolation off
	2.6 All malfunctions, leaks, damage and blockages of irrigation and drainage channels are timely corrected and repaired.
3. Measure and control the water levels, flow rates and volume of water	3.1 Water heads, discharge and volume of water used are regularly measured to ensure required water in the irrigated fields
	3.2 All water outlets regularly checked up to ensure for their proper operation
	3.3 Blocked inlets and outlets are timely replaced or cleaned for adequate passage of water to irrigation fields
	3.4 Irrigation changes are properly implemented in accordance with the irrigation system design
4 Monitor drainage and tail water systems	4.1 Water distribution system is properly monitored to prevent excess water in the scheme
	4.2 Tail water systems are efficiently used to ensure for clearance and freedom of crops from aquatic weeds
	4.3 Pumps are timely back flushed in accordance with settled instructions.
5. Shut down surface irrigation in response to irrigation indicators	5.1 The surface irrigation system is systematically shut down based on the irrigation schedule.
	5.2 The performed irrigation activities are regularly recorded for further reporting purpose.
	5.3 The performed irrigation activities are timely reported to update the supervisor.

Course content	
Learning outcomes	At the end of the module the learner will be able to: 1. Carry out pre-start checks 2. Operate and monitor the surface irrigation system 3. Measure and control the water levels, flow rates and volume of water 4. Monitor drainage and tail water systems 5. Shut down surface irrigation in response to irrigation indicators
Learning outcome 1: Carry out pre-start checks	**Learning hours: 10**
Indicative content	
• Checking up water, power, fuel and lubricants to ensure their availability and the control system is operational ✓ **Selection criteria for surface irrigation method (basin, border and furrow)** ✓ **Types of water source:** ✓ **Irrigation water quality and quantity** ✓ Type of lubricants ✓ Types of fuel ✓ Power sources ✓ Energy efficiency indicators ✓ Description of wetland flooding phases: Advance phase, storage/ponding phase, depletion phase, recession phase • Priming of pump and control gates to ensure for their opening or closing ✓ **Types of gates and their technical specifications** ✓ Priming process of pump ✓ **Water hummer phenomenon in pumping systems** • Positioning pipes, equipments and outlets ✓ Land preparation tools and equipment ✓ Types of outlet ✓ Types of pipe ✓ Pipe laying process	

Resources required for the learning outcome	
Equipment	machine, Damp level, motor/ engine, pump
Materials	Flip charts, Markers, Technical manual, Book, Pegs, crops, land
Tools	Tape measure, hoe, chavel, wheel barrow
Facilitation techniques	• Demonstration and simulation • Individual and • group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 2: Operate and monitor the surface irrigation system	Learning hours: 20
Indicative content	
• Priming and starting siphons and other delivery mechanisms ✓ Methods of siphoning ↓ Siphoning with your mouth, siphoning by submersion, siphoning with two garden hoses ✓ Priming process • Implementation of start-up sequences ✓ Layout for different irrigation methods (basin, border and furrow) ✓ Components of surface irrigation: ✓ Surface irrigation components ↓ Water source, intake, conveyance system, storage reservoir, distribution network, application system, access network, in field structures ✓ Surface irrigation structures:	

- Diversion structures, conveyance structures, distribution structures, flow control structures, access networks (farm roads, main road)

✓ Start-up sequences for surface irrigation
✓ Dimension and shape of irrigation structures

- Checking up pressure at the head works and control of valves

✓ Pressure measuring devices:
✓ Pressure regulator
✓ Types of valves

- Distribution of water to the targeted areas with minimal wastage and run-off

✓ **Water distribution efficiency**

- Water distribution uniformity, soil moisture content, irrigation schedule, soil/plant/water relationships, water requirements of plants

- Control time lag between shut down and end of watering to ensure for minimum run-off and deep percolation

✓ Irrigation duration
✓ Irrigation frequency and interval

- Irrigation water efficiency, Factors affecting the irrigation interval, Irrigation interval

- Correction and repair all malfunctions, leaks, damage and blockages of irrigation and drainage channels

✓ Causes of malfunctions, leaks, damage and blockages
✓ Disilting /dregging
✓ Weeding
✓ Malfunction checklist surface irrigation
✓ Cause of leaks in surface irrigation

Resources required for the indicative content	
Equipment	Projectors, Pressure gauge, Pressure regulator, Pump
Materials	Books, Valves, Internet, Irrigation scheme, Flip charts, Markers, DVD players ,Pegs, Siphon pipes
Tools	Tool box
Facilitation techniques	• Demonstration and simulation • Individual and

	• group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 3: Measure and control the water levels, flow rates and volume of water	**Learning hours: 10**
Indicative content	
• Measuring the water heads, discharge and volume of water used to ensure required water in the irrigated fields ✓ Irrigation discharge ✓ Irrigation needs ✓ Discharge measuring devices ✓ Critical measures for moisture availability ✓ Readily available water, water holding capacity, wilting point, field capacity, infiltration rates • Checking up all water outlets to ensure for their proper operation ✓ Types of water outlet ✓ Water outlet parts ✓ Status of water outlet ✓ Types of end treatment ✓ Shape of outlet ✓ Dimension of outlet • Replacing or cleaning of blocked inlets and outlets ✓ Disilting /dregging ✓ Weeding ✓ Causes of blockage of water inlets and outlets ✓ Types of intakes (Lateral , Bottom, Overhead) ✓ Elements of intake structures	

- Implementation of irrigation changes
  - Border irrigation layout, basin irrigation layout, furrow irrigation layout, crop water needs, season variables

Resources required for the indicative content	
Equipment	flow meter,
Materials	Books, Flip charts, Marker, Internet, DVD players , Layout, Internet connection, Ranging pole, Pegs
Tools	Toolbox
Facilitation techniques	• Demonstration and simulation • Individual and • group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 4: Monitor drainage and tail water systems	**Learning hours: 10**
Indicative content	

- Monitoring water distribution system

✓ Source of excess water in the scheme

  - Rainfall, snow melting, excess irrigation, rising of ground water table (GWT), seepage from canals and reservoirs, leaching of soil, artesian wells

✓ Needs for drainage

  - Control of water ponding, control of water logging, control of water salinisation, control of water table

✓ **Signs of excess water to the plants**

- Reuse tail water systems to ensure for clearance and freedom of crops from aquatic weeds

✓ Components of tail water system

- Operation of back flushing of pumps

✓ Back flushing process

✓ Back flushing time

Resources required for the indicative content	
Equipment	Computer, Flash disk
Materials	Flip chart, Book, Markers, Report template, Irrigation scheme, Hand book, Pencil, Pen, DVD, crops
Tools	irrigation tool box
Facilitation techniques	• Demonstration and simulation • Individual and • group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 5: Shut down surface irrigation in response to irrigation indicators	Learning hours: 10
Indicative content	

- Shutting down of surface irrigation system

✓ Soil moisture content

✓ Irrigation schedule

✓ Crop water need

- Recording of the performed irrigation activities for further reporting purpose

- Irrigation duration
- Irrigation frequency
- Irrigation water efficiency

- Reporting of the performed irrigation activities to update the supervisor

  ✓ **Report format**

Resources required for the indicative content	
Equipment	Computer, Flash disk
Materials	Flip chart, Markers, Books, Irrigation scheme, Measuring tape, Hand book, Pencil, Pen, DVD, CROPS
Tools	Tools box
Facilitation techniques	• Demonstration and simulation • Individual and • group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Project based assessment

Integrated/Summative assessment

Integrated situation

RUGERAMIGOZI marshland is located in the Southern Province, Muhanga District in Nyamabuye and Shyogwe Sectors; and in Ruhango District in Byimana Sector, at 55 Km from Kigali City.

The rehabilitated marshland counts in total 120 Ha. Recently, Rural Sector Support Project (RSSP) has supported leveling activities and fertilizing of new plots (on 10 Ha) nearest the KIGALI-HUYE asphalted road.

Water users Association is in charge of water taxes collection, irrigation water management and maintenance of irrigation infrastructures.

Due to lack of a skilled technician, the gates are not operated at convenient time and

consequently the rice yield is not as high as expected.

The main objective of this project is "**to operate surface irrigation system" within 5 hours.**

The tasks should meet the following specifications:

- Carry out pre-start checks
- Operate and monitor the surface irrigation system
- Measure and control the water levels, flow rates and volume of water
- Monitor drainage and tail water systems
- Shut down surface irrigation in response to irrigation indicators

Resources

Tools	tool box
Equipment	Moto pump,
Materials/ Consumables	Source of water, Books, Irrigation scheme, Technical manual, Papers, Pencil

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: Carry out pre-start checks **(15%)**	1.1. Water, power, fuel and lubricants are regularly checked up to ensure that all are available and the control system is operational	Ind.1 Checkup guidelines			1
		Ind.2 Source of power			1
		Ind.3 Water quality			1
	1.2. Pumps are systematically primed and gates are regularly controlled to ensure for their opening or closing in	Ind.1 Priming steps			1
		Ind.2 Controlled gates			1
		Ind.3Positioned equipment			3

	accordance with irrigation schedule				
	1.3. pipes, equipments and outlets are conveniently positioned in accordance with the settled layout	Ind.1 Land preparation			2
		Ind.2Positioned pipe/infrastructures facilities			1.5
		Ind.3Positioned equipment			1.5
Learning outcome 2: Operate and monitor the surface irrigation system **(25%)**	2.1. Siphons are adequately primed and started and other delivery mechanisms are well started for proper conveyance of irrigation water	Ind.1 Primed pump			1
		Ind.2 Installed siphon			1
		Ind.3Install water application system			2
	2.2. Startup sequences are systematically implemented in accordance with irrigation system start up	Ind.1 Layout of irrigation system			1
		Ind.2irrigation components			1
		Ind.3irrigation structures and shaped			1
	2.3. Pressure at the head works and control of valves are regularly checked up to satisfy the required discharge	Ind.1 Pressure measuring devices			1
		Ind.2 Measured pressure			1
		Ind.3 Controlled valves			1
	2.4. Water is uniformly distributed to the targeted areas with	Ind.1 Soil moisture measured			2
		Ind.2 Crop water need			2

	minimal wastage and run-off	Ind.3 Volume of irrigation water distributed			2
	2.5 Time lag between shut down and end of watering is carefully controlled to ensure for minimum run-off and deep percolation off	Ind.1 Irrigation time			1
		Ind.2 Irrigation frequency			1
		Ind.3 Irrigation interval			1
	2.6 All malfunctions, leaks, damage and blockages of irrigation and drainage channels are timely corrected and repaired.	Ind.1 Corrected malfunctions for irrigation and drainage channels			2
		Ind.2 Corrected damages for irrigation and drainage channels			2
		Ind.3 Corrected leaks for irrigation and drainage channels			2
Learning outcome 3: Measure and control the water levels, flow rates and volume of water **(20%)**	3.1. Water heads, discharge and volume of water used are regularly measured to ensure required water in the irrigated fields	Ind.1 Measured water head			2
		Ind.2 Measured discharge			2
		Ind.3 Measured volume of water			2
	3.2. All water outlets regularly checked up to ensure for their proper operation	Ind.1 Status of water outlet			1
		Ind.2 Shape of water outlet			1
		Ind.3 Dimension of water outlet			1
	3.3 Blocked inlets and outlets are timely	Ind.1 Cleaned inlet			2
		Ind.2 Cleaned outlet			2

	replaced or cleaned for adequate passage of water to irrigation fields	Ind.3 Replaced out let/outlet if any			2
	3.4 Irrigation changes are properly implemented in accordance with the irrigation system design	Ind.1 Irrigation layout			2
		Ind.2 Crop water needs			2
		Ind.3 Season variables			1
Learning outcome 4: Monitor drainage and tail water systems **(20%)**	4.1. **Water distribution system is properly monitored to prevent excess water in the scheme**	Ind.1 Soil moisture measured			2
		Ind.2 Source of excess water			2
		Ind.3 Drained soil			2
		Ind.4Drainage system component status			2
	4.2. **Tail water systems are efficiently used to ensure for clearance and freedom of crops from aquatic weeds**	Ind.1 Reused tail water			2
		Ind.2 Clearance of crop			2
		Ind.3 check for aquatic weeds			2
	4.3 Pumps are timely back flushed in accordance with settled instructions.	Ind.1 Back flushed pump			2
		Ind.2 Back flushing time			2
		Ind.3 Back flushing process			2
Learning outcome 5: Shut down surface irrigation in response to	5.1. The surface irrigation system is systematically shut down based on the irrigation schedule.	Ind.1 Soil moisture content			4
		Ind.2 Irrigation schedule			4
		Ind.3 Shut down surface irrigation system			4

irrigation indicators **(20%)**	5.2. The performed irrigation activities are regularly recorded for further reporting purpose	Ind.1 Record book and pen			2
		Ind.2Irrigation activities recorded			2
	5.3 The performed irrigation activities are timely reported to update the supervisor	ind 1: Filled report format			4
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

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