Northwest **Power** and **Conservation** Council

August 8, 2017

MEMORANDUM

TO: **Power Committee**

FROM: **Tina Jayaweera, Senior Energy Analyst**

SUBJECT: **Innovations in Irrigation Energy Efficiency**

BACKGROUND:

Presenter: Fred Ziari, President and CEO, IRZ Consulting

Summary: Mr. Ziari will discuss with the Council the advancement in irrigation technologies as it relates to both Water and Energy sustainability. Presentation will focus from both the global prospective and as it is practiced in Pacific Northwest.

Relevance: Efficiency measures in the agricultural sector for the Eighth Power Plan will likely be quite different from those reviewed in the prior plans, due to advances in irrigation practices.

Workplan: C.1. Prepare for the 8th Plan: Conservation

Background: Fred Ziari is an entrepreneur and innovator. His water resource and irrigation innovations in satellite soil-moisture monitoring and sensor technologies have resulted in savings of one hundred billion gallons of water and over 300 million kilowatt hours of electricity in just the last decade. He founded his first resource management company, IRZ Consulting, in 1984 and his fourth company in 2008. Through IRZ Consulting, he has assisted agricultural communities around the world to maximize our planet's precious resources.

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In 2012, Mr. Ziari's three of four companies were acquired by Lindsay Corporation (NYSE:LNN) to capitalize on IRZ's innovative irrigation engineering and water resource management expertise and the increased efficiencies of water and power by expansion of offices throughout the world.

As a social entrepreneur he founded the non-profit organization, Farmers Ending Hunger (FEH). Last year FEH provided over five million pounds of food products to the Oregon Food Banks and was recognized by the Agri-Business Council of Oregon.

In 2002 Fred Ziari was inducted into the ***OSU Agricultural Hall of Fame***. He received the prestigious ***Weatherford Award*** in 2010 from the Austin Entrepreneurship Program of OSU's College of Business. And, in 2011 he was honored by the Oregon Consular Corps and the City of Portland with their ***International Business Award***. He is present board member of OPB and Oregon Institute of Technologies.

More Info: IRZ Consulting website: http://www.irz.com

IRZ

Since 1984

Precision Irrigation Technology
A Global Model

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Maximizing the Planet's Resources Through Technology

2 Earth Dilemma !

- Our population is growing by >100 million/year
- By the 2050 we will have 9 billion people
- 12 bil. Acre in Agriculture, 3.4 bil. Acre Arable land
- To feed this many people you may need 2 earth

1 bil = 1804
2 bil = 1927
3 bil = 1960
4 bil = 1974
5 bil = 1987
6 bil = 1999
7 bil = 2011
:
9 bil = 2050

IRZ

Global Irrigation

- 17% of world agriculture is irrigated
- Irrigation is responsible for 40% of production
- In most countries 90% of water is used for irrigation. Competition for water is growing
- Flood irrigation is most widely used system
- Globally groundwater are declining rapidly
- Average global irrigation efficiency is 38%

Irrigation Market Demands

Water Use Efficiency

Biofuels BioEnergy

Global Population Growth

Food Requirements

Environmental Improvement

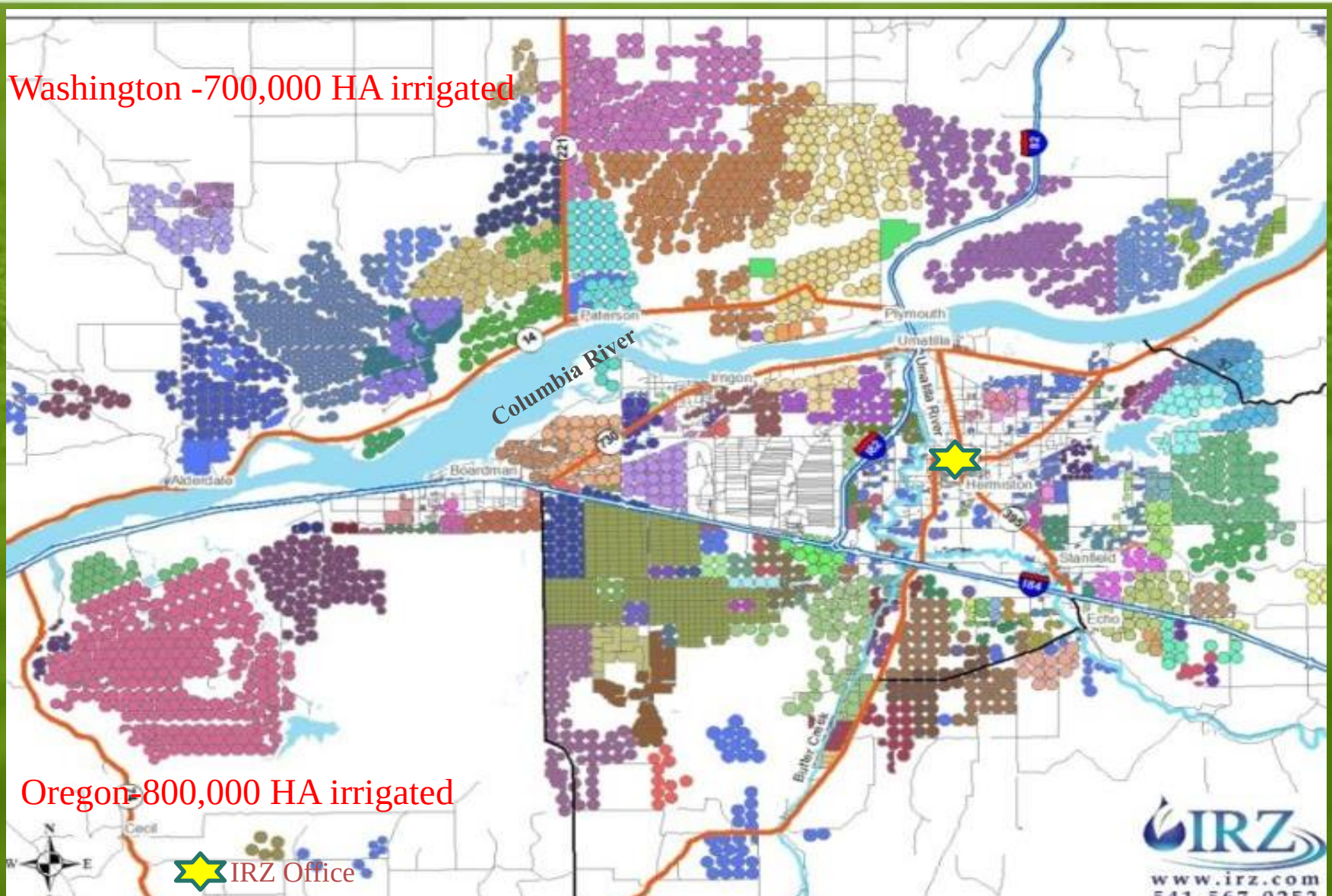
New Global Focus : water management and profitability

- Trends toward much larger irrigated farms
- More Integrated and market driven farms that owns part of the supply chain
- Well engineered irrigation systems
- Much reliance on technologies for highest yield
- Fully incorporate sustainability as a profit center
- More crop diversifications
- Promotes Value-add food processing as an engine of the economy

Global Model: Eastern Columbia River Basin High Yielding -Large scale Farming

- Over 80 different crops
- Highest Yield of crops in the US
- <1500 KWH/acre to produce 40 tons of potato/acre
- 80% of farm products is for export
- >95% Irrigation efficiency
- Most advanced use of Technologies in the world

Global Model:
High Yielding -Large scale Farming
Columbia River Basin



Precision Irrigation : New Technology Approach

- Technologies with significant improvement in water use efficiencies
- Meeting global demand for affordable food
- Results in high yielding crop, creates economic growth, decrease poverty

Precision Agriculture VS. Precision Irrigation

- **Precision Agriculture:**
  - GPS based technologies focused on Mechanized Tractors, Planting, Cultivation, Harvesting, etc.

- **Precision Irrigation**
  - Focus on GPS water technology and as important
  - Rapid development of sensor technologies
  - Save water and energy resources,
  - Transfer saved water to increase irrigated land
  - Save in Water/Energy/ Fertilizers, Labor

Precise Irrigation Design System

Top Photos: 15,000 hectare project

Bottom Photos: 3000 hectare project

"Optimizing Water Resources Through Technology"

IRZ

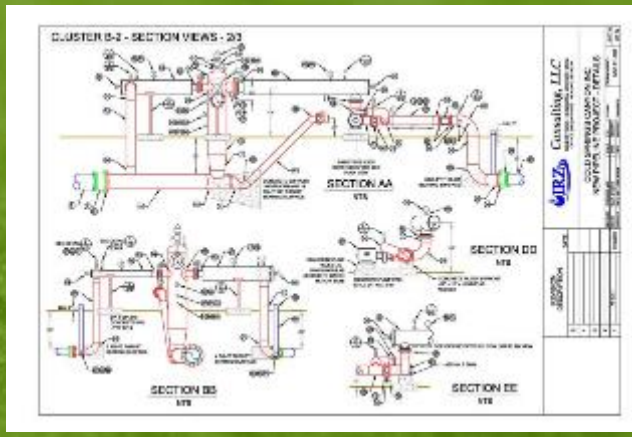
IRZ Design: Very Large Pump Station

14 x1 MW pumping station (18000 Horsepower) with flow rate of 30000 m3/hour (132000 gpm)

Electrical Panels, Variable Frequency Drive

ICDC Design: Irrigation Cluster Distribution Center

"Chemigation, operation and cost efficiency"



-A central Chemigation tanks for 4 to 5 pivots
- Central Location for all Filtration
- Central location for injectors (shared)
- Central location for all power transformers

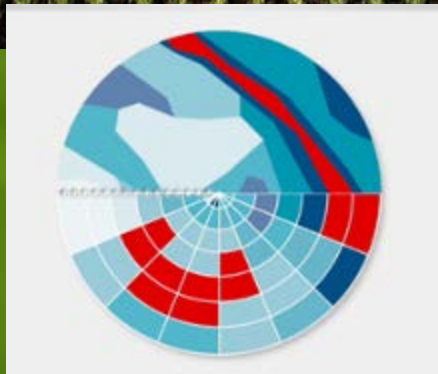
VRI- Variable Rate Irrigation

- VRI allows different amounts of water to be applied to each part of the field
- Achieved by individual control of the sprinklers by pulsing, while also controlling the travel speed of the system
- This modifies the application depth along the length of the Center [ivot

VRI Components

1. VRI Main Controller
2. Wireless Nodes
3. Latching Solenoid Valves
4. Wiring Loom
5. GPS

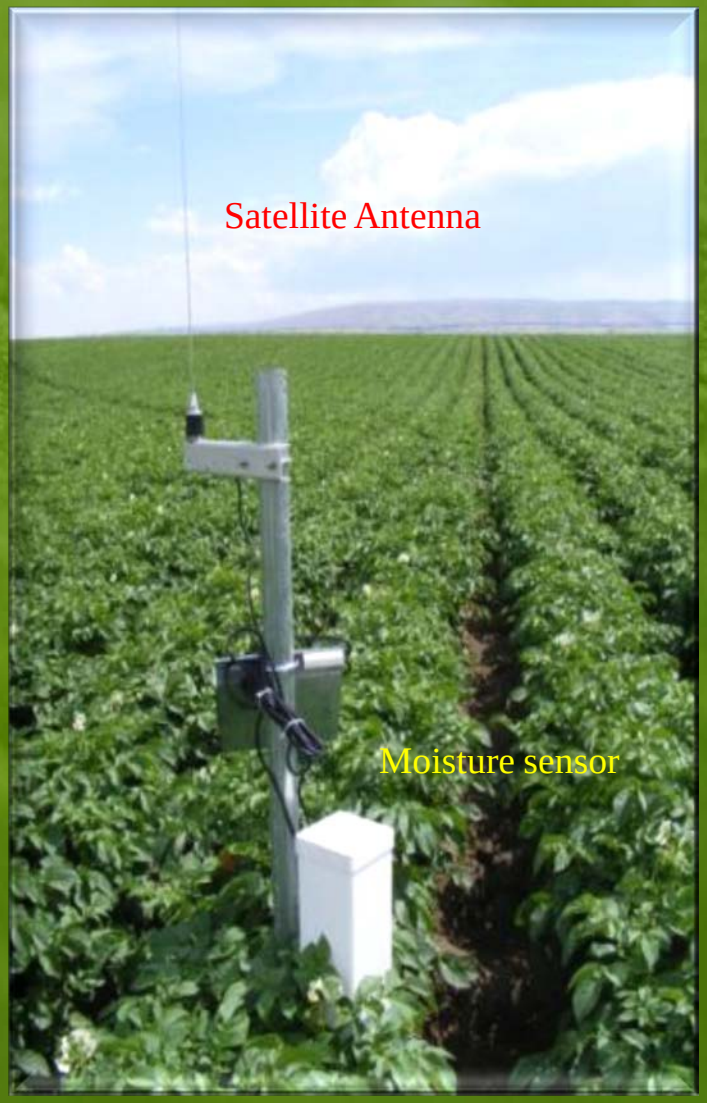
VRI: irrigate only the areas with crops



IRZ Integrated Water Management Services

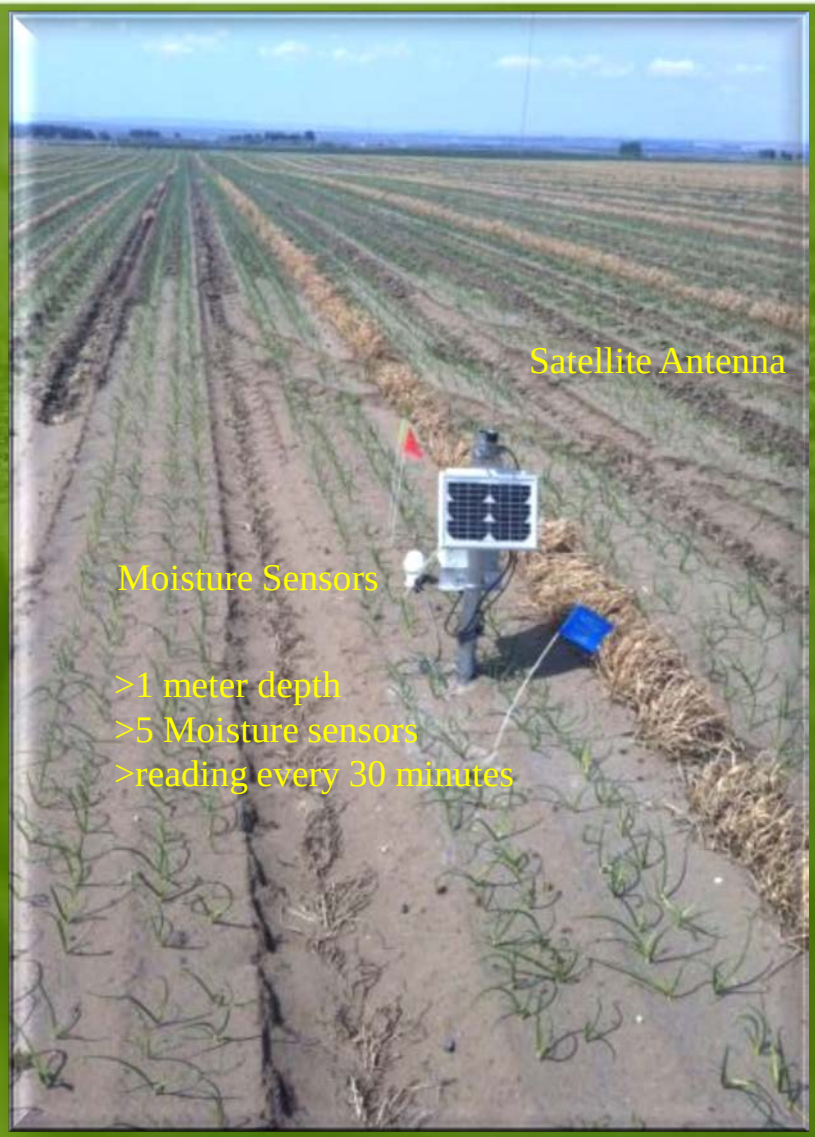
- Using real-time Soil Moisture sensors (transmit every 30 minutes), real-time Weather Stations, Crop Modeling (ET) Soil, and Wireless Technologies to maximize efficiency and Profitability ($)
- 3000 sensors over 250,000 Acre.

- Water Savings: 10%-15%
- Energy Savings:10%-20%
- Saves Fertilizers/ Increase yield
- Saved 10 Billion Gallons Water/Year
- Saved 35 Million Kwh Energy/Year



Global Real-Time, Soil Moisture Monitoring and Crop

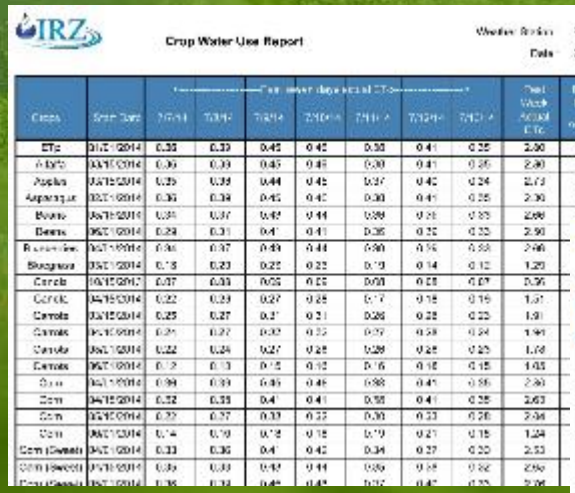
maximize yield , save water & energy



Real-Time Weather Station and Crop Evapotranspiration

Satellite based weather station provide site specific weather, crop water usage (EvapoTranspiration) based on your crops planting schedule (over 100 crop models)

IRZ Daily Crop Water Use



IRZ Crop Water Use Report

IRZ Center Pivot Report

IRZ Center Pivot Report

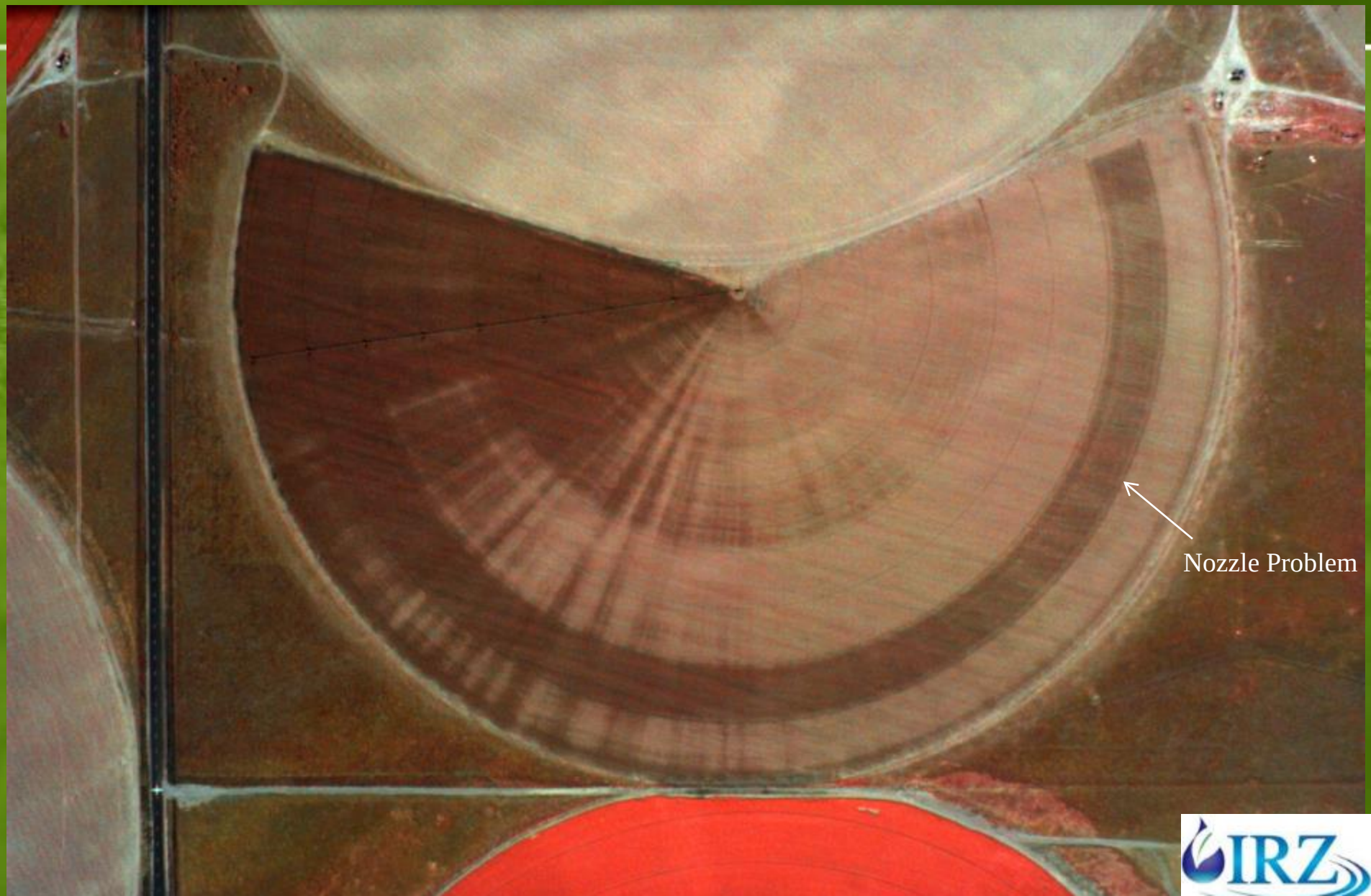
Energy, Water Usage and Cost Tracking

Tracking of Energy and Water Usage is essential in determining the actual energy cost per increment of water applied to a field, thus allowing the ability to determine cost benefits for irrigation water applied to a field.

Tracking of:

- Energy use for irrigation systems
- Irrigation water pumped
- Irrigation applied to each field
- Cost per acre-inch of water applied
- Hours of operation
- Seasonal irrigation benchmarks

IRZ Aerial Infrared Service / Drone



FieldNET Wireless Technologies

- Platform that monitors and controls pivot & drip irrigation systems
- Web-based software with supporting mobile Apps
- Monitor and Control pumps, water, energy & sensors

WIRELESS Broadband for SmartFarm

- IRZ designs and engineers a multi-purpose Broadband Wireless with 100's to 1000's times the capacity of "radio" or cellular phone
- Wireless Network is Private, secure and standards-based.
- Compatible with center pivots, pumps, weather stations, **video** for security, asset tracking and any Internet connected device.

Technology Recommendations

- Irrigation Technologies are evolving rapidly
  - **Variable Rate Irrigation, Real Time Efficiency**
- Focus on Water Management to increase water/Energy Efficiency from 50% to >90%
- Irrigation in the Lower Columbia Basin is ideal for :
  - **Pump Storage with focus on micro storage**
  - **Load Balancing**
  - **Demand Response**
  - **Small Hydro / Pipe energy recapture / etc.**