Irrigation Sector Implementation

WATERWISE PROGRAM

1. **Program Overview**
   The purpose of the WaterWise Program is to improve energy-use efficiency through irrigation system energy reviews and design work for new and expanding irrigation systems and irrigation management techniques, and electrical efficiency improvements to upgrade existing Irrigation Systems.

2. **Program Procedures**
   In order to claim credit under Bonneville's Conservation and Renewable Resource Rate Discount Program Utilities must substantially comply with the objectives and terms of the appropriate items in WaterWise Procedures and Specifications.

   (a) Upon request by the Irrigator, the Utility may perform (or contract to have performed) a Simple or Full System Energy Review of the Irrigation System or Design Work.
   (b) The Utility shall provide a Privacy Act Notice to each Irrigator before information is collected for use under each of the options identified in the Program.
   (c) The Utility shall inform the Irrigator that kickbacks, rebates or other non-Program benefits from Installers are prohibited and may be subject to Federal Law.
   (d) The Utility may submit claims for a conservation rate discount after completing an inspection checklist and determining that each Irrigation System has been retrofitted in a Workmanlike manner.

3. **Eligibility Provisions**
   Notwithstanding eligibility criteria described in the appropriate Item of WaterWise Procedures and Specifications.

   (a) Performance under the WaterWise Program shall be limited to existing or new Irrigation Systems serving 15 or more acres in the Utility's Operating Area that are or will be Electrically Powered.
   (b) All Irrigation Systems as described in section 4(a) are eligible for evaluation under Stage I criteria. Eligibility for credits under Stage II criteria shall be based on the results of a completed Stage I Energy Review as described in Item 11 of WaterWise Procedures and Specifications.
   (c) The Irrigation Systems must meet eligibility criteria as described in Items 10 and 11 of WaterWise Procedures and Specifications.
   (d) Irrigation water management activities for which rate discount credits are being sought under this Program must meet eligibility criteria as described in Item 17 of WaterWise Procedures and Specifications.

4. **Program Records**
   Utilities shall maintain records in accordance with the provisions in Item 15 of these specification and as provided in the appropriate items in Bonneville's Conservation and Renewable Resource Rate Discount Program Implementation Policies and Procedures.

5. **Previous Work and Credit for Duplicate Payments**

When Bonneville or another State or Federal Agency has paid under any agreement for Administrative Costs or for the installation or completion of a Conservation Measure or Measures or Water Management Activity which meets the requirements of the WaterWise Program, rate credits shall not be made with respect to such Measure or Measures under the Conservation and Renewable Resource Rate Discount Program.

6. **Other Rate Credit Reimbursements**

(a) **Marketing Support Credits**
Rate credits for local media advertising and promotion shall be determined in accordance with the policies and procedures adopted by Bonneville for the Conservation and Renewable Resource Rate Discount Program.

(b) **Administrative Cost**
Administrative Cost credits shall be determined in accordance with the policies and procedures adopted by Bonneville for the Conservation and Renewable Resource Rate Discount Program.

WATERWISE PROGRAM
PROCEDURES AND SPECIFICATIONS

Table of Contents

Item 1 Program Overview
Item 2 Definitions
Item 3 Utility Duties
Item 4 Eligibility Provisions
Item 5 Quality Control
Item 6 Administrative Cost Credits
Item 7 Credits for Energy Savings
Item 8 Other Credits
Item 9 Certification of Analysts
Item 10 Stage I Eligibility
Item 11 Stage II Eligibility
Item 12 Measure Eligibility
Item 13 Stage I Evaluation
Item 14 Analysis Procedure Description
Item 15 Program Forms
Item 16 Large Irrigators
Item 17 Irrigation Water Management Introduction
Item 18 Irrigation Water Management Media Approach
Item 19 Irrigation Water Management On-Site Approach
Item 20 Irrigation Water Management Computer-Based Approach
Item 21 Irrigation Water Management Utility-Designed Approach
Item 22 Irrigation Water Management - Energy and Water Savings Assessment
Item 23 Completed Unit

ITEM 1
WATERWISE PROGRAM OVERVIEW

The purpose of the WaterWise Program is to improve the energy-use efficiency through Irrigation System Energy Reviews and Design Work for new and expanding Irrigation Systems and irrigation management techniques, and for electrical efficiency improvements to upgrade existing Irrigation Systems.

DEFINITIONS

(a) "Full System Energy Review" is a Pump Test supplemented by identification of irrigation methods, system leaks, nozzle sizes, system sketch, measurements to quantify Mainline velocity and friction loss, sprinkler operating pressures, crop types and rotation, scheduling techniques (if appropriate), and field elevations for an Irrigation System.

(b) "Simple System Energy Review" means a Pump Test supplemented by identification of irrigation methods, system leaks, nozzle sizes, sprinkler operating pressures, crop types and rotation, scheduling techniques (if appropriate), and field elevations for an Irrigation System.

(c) "Site Inspection" means a personal visit by the Utility to the Irrigation System to determine if all claimed Measures are installed and operational.

(d) "Specialist" means the individual performing the on-site visit for Option II of Irrigation Management, who must meet the requirements for analysts performing level 1 and level 2 analyses as defined in Item 9, or be an agricultural engineer or be otherwise approved by the utility.

(e) "Stage I" is a written report delivered to the Irrigator, based on either a Simple System Energy Review, or Full System Energy Review which recommends Measures and estimates measure cost and potential energy savings; or for new systems is based on Design Work.

(f) "Stage II" is a summary report based on the Verification Pump Test to determines the energy savings.

(g) "Turf" is a sprinkler-irrigated area covered typically with mowed grass.

(h) "Verification Pump Test" means measuring total dynamic head (TDH), including pumping-water level, discharge pressure, and miscellaneous friction losses, flow rate, and input power (meter revolutions or volts, amps, and power factor) in order to determine Pumping Plant electrical energy savings after Measures are installed. This test is recommended for Level 3 systems, and is required for all Level 4 systems, including hours of operation at different flow rates.

(i) "WaterWise Program" means the Irrigation Program described in this document.

(j) "Weekday" means a day of the week except Saturday and Sunday.

(k) "Workmanlike" means performance with deviations from such specifications that neither materially affect the energy savings and life expectancy of the installed Measures nor adversely affects health and safety.

Utility Duties

In order to qualify for Conservation and Renewable Resource Rate Discount credits for energy saving from irrigated agriculture energy efficiency improvements utilities shall substantially comply with the objectives and terms of the WaterWise Program.

1. Upon request by the Irrigator, the Utility may perform a Simple or Full System Energy Review of the Irrigation System or Design Work. Such Reviews or Design Work shall be performed in accordance with procedures set forth in Item 14. Following completion of a Simple or Full System Energy Review, the Irrigation System shall remain eligible for Stage II under the Program until all eligible Measures are installed or the Conservation and Renewable Resource Rate Discount Program expires.
2. The Utility shall provide a Privacy Act Notice to each Irrigator before information is collected for use under each of the options identified in the Program. This notice shall explain that any information collected will be used in anonymous form by Bonneville and will not be released by Bonneville except as required by law.
3. The Utility shall inform the Irrigator that kickbacks, rebates or other non-Program benefits from Installers are prohibited and may be subject to Federal Law.
4. The Utility shall not submit claims for conservation rate credits until after completing an inspection checklist and determining that each Irrigation System has been retrofitted in a Workmanlike manner.

ITEM 4
ELIGIBILITY PROVISIONS

1. Performance under the Program shall be limited to existing or new Irrigation Systems serving 15 or more acres in the Utility's Operating Area that are or will be Electrically Powered.
2. All Irrigation Systems as described in section 4(a) are eligible for evaluation under Stage I criteria. Eligibility for Conservation Rate Credits under Stage II criteria, as described in Item 11, shall be based on the results of a completed Stage I.
3. The Irrigation Systems must meet eligibility criteria as described in Items 10 and 11.

ITEM 5
QUALITY CONTROL

1. Bonneville may review the Utility's WaterWise Program records to determine substantial compliance with the terms of the WaterWise Program. Such review may include, but is not limited to, inspection of the Utility's procedures, the use of standard engineering practices as they apply to the determination of Conservation estimates, program records or Utility accounts, site or record inspection for environmental compliance, and inspection of retrofitted irrigation systems. Results of the review will be conveyed, in writing, to the Utility, in a timely manner, following completion of the review.
2. If a review determines that the Utility's WaterWise Program is not in substantial compliance with the WaterWise Program, Bonneville shall consult with the Utility and may recommend corrective actions in accordance with section 17.

3. If a Utility's WaterWise Program, though in substantial compliance with the WaterWise Program, is found to contain operating deficiencies, Bonneville may recommend specific actions to correct such deficiencies, in accordance with section 17.

ITEM 6
ADMINISTRATIVE COST CREDITS

The total amount of the Utility's Administrative Cost that are eligible for credit under the Conservation and Renewable Resource Program shall be determined in accordance with Bonneville's policies and procedures. However, the following schedule is provided as a guide for establishing what typical Irrigation System Stage I and Stage II administrative costs might be.

Stage I - Typical Administrative Cost

Min Irreg. Acres	Level	Analysis	Analysis	Indirect Costs
15	1	Pump Test	$100	$ 0
35	2	Simple	$300	$ 50
70	3	Review	$600	$ 100
480	4	Review	NTE $0.0005 x kWh use + $0.75/irrigated acre	$ 100
70	Design Work	NTE $2000	$100	

- The minimum Stage I Analysis administrative cost is typically $2,000, but should never exceed the actual cost. For large irrigation systems the maximum Administrative cost can be determined by multiplying $0.0005 times the irrigation system's average annual kWh consumption plus $0.75 per irrigated acre.

Stage II - Typical Administrative Cost

Level	Verification Type	Verification Costs	Indirect Costs
1	Site Inspection	$ 0	$ 50
2	Verif Test & Site Insp	$ 200	$ 150
3	Verif Test & Site Insp	$ 400	$ 300
4	Verif Test & Site Insp	$.02/kWh saved NTE $8000	$ 300

Indirect costs are those costs incurred by the Utility in time spent arranging for Pump Tests, performing Irrigator interviews, attending meetings with irrigation dealers, completing forms, assembling invoices, and reporting.

ITEM 7
CREDITS FOR ENERGY SAVINGS

Conservation rate discount credits for energy savings are based on the value of these savings to the region's power system. In order to determine this value certain information is required. The most important is an accurate estimate of the potential energy savings. When improved water management activities are undertaken it is also critical that a reasonable estimate of the water savings be obtained, since these savings increase the regional power system benefits.

For installed Measures, the rate discount credit is based on Measured first-year energy savings (kWh) times the regional power system value. This value varies by measure life and the timing of the savings both during the day and during the year. To determine first year energy savings, the Utility shall perform a Verification Pump Test and Site Inspection for Level 2 through Level 4 Irrigation Systems. The Utility shall choose one of the following two formulae on which to base the estimate of first year energy savings. The Utility shall use good judgment as to the appropriateness of each formula:

1. Conservation Savings Based on Actual Demand Reduction

$$\text{First Year kWh Savings} = \frac{kWi - kWf}{kWi} \times \text{Average kWh Use}$$

2. Conservation Savings Based on Actual Demand per Flow Reduction

$$\text{First Year kWh Savings} = \frac{(kWi/GPMi - kWf/GPMf)}{KWi/GPMi} \times \text{Average kWh Use}$$

In the above equations, the “i” means the initial readings for Stage I and the “f” means the final readings as obtained in Stage II.

Once the annual energy and water savings of the measure or activity have been determined, Utilities should use the software program developed by the Regional Technical Forum to converts a measure's first year energy savings into its regional power system value. This software and instructions for installing and using it are available at: www.nwppc.org/rtf/XXXXXXXX).

ITEM 8
OTHER PAYMENTS

1. **Marketing Support**

   The Utility may support local media advertising and promotion efforts during each Fiscal Year that the Conservation and Renewable Resource Rate Discount Program is in effect. Such efforts may include media or direct mail advertising, local agricultural shows and fairs, specialty items, site signs, and other promotional materials and events. The amount of marketing support eligible for rate discount credit shall be limited by the policies adopted by Bonneville.

ITEM 9
CERTIFICATION OF ANALYSTS

Analysts performing Level 1 and Level 2 Analyses must be certified based upon successful completion of the ***Irrigation Association's*** Step 2 examination.

Analysts performing Level 3 and Level 4 Analyses or Design Work must be certified based upon successful completion of the ***Irrigation Association's*** Step 3 "System Design" examination or be registered as a licensed professional engineer in the state where the work is to be performed.

The Irrigation Association Certification requires: (1) A minimum of 3 years' irrigation experience; (2) Passing of separate examinations; and (3) The endorsing of a comprehensive "Code of Ethics." The ***Irrigation Association*** then certifies that the individual has successfully completed these requirements. Any annual fees or dues shall be the responsibility of the Analyst. (Insert full reference for the "Irrigation Association")

ITEM 10
STAGE I ELIGIBILITY

Any Irrigation System is eligible for a Stage I Energy Review if it meets the following criterion:

1. Must be a sprinkler, spray or drip Irrigation System or Open Discharge that irrigates a crop for agricultural purposes. Systems irrigating turf will be eligible if the Pumping Plant is used solely for Irrigation purposes.
2. Must allow for electrically safe, head, horsepower, and flow measurements.
3. Must use Electric Power from a Utility.
4. Must have been operated for three full seasons within the past 5 years. For Levels 2, 3, and 4, Irrigation Systems must have average use of more than 20,000 kWh/year
5. Irrigation System must serve 15 or more acres.

ITEM 11
STAGE II ELIGIBILITY

Irrigation Systems must meet the following criterion in order to be eligible for Stage II.

1. System must have had a previous Stage I Energy Review and meet Measure eligibility requirements.
2. System changes must be in accordance with acceptable standard engineering and design practices.
3. System must have a Site Inspection completed to determine energy savings potential.
4. For Level 2 through Level 4, the System must have a Verification Pump Test performed to determine energy savings.
5. For Level 4 Systems, additional eligibility criteria are described in Item 16.

ITEM 12
MEASURE ELIGIBILITY

Measures are analyzed separately to determine eligibility. A unique equipment list is associated with each Measure. Rate discount credits may be obtained for only the equipment associated with eligible Measures.

Existing Level 1 Irrigation Systems may qualify for Low Pressure and Pump Modification Measures.

Existing Level 2, 3 and 4 Irrigation Systems may qualify for Low Pressure, Mainline, and Pump Modification Measures.

For Level 2, 3 and 4, the Low Pressure Measure is eligible when the Total Resource Benefits of the Energy Savings exceeds this measure's Total Resource Cost determined by using the Regional Technical Forum's benefit/cost methodology and financial assumptions.

For Level 2, 3 and 4, Pump Modification Measures are eligible when the Total Resource Benefits of the energy savings exceeds this Measure's Total Resource Cost determined by using the Regional Technical Forum's benefit/cost methodology and financial assumptions.

For Level 1, if a Pump Modification is a stand alone Stage II Measure, calculated Stage I Pumping Plant efficiency must be at least 10 percent lower than that listed in the Achievable Pumping Plant Efficiency Table. (Insert copy of this Table -- it's not in this document).

Mainline retrofit is eligible for Level 2, 3 and 4 Irrigation Systems for those Mainline sections where energy savings is identified and when the Total Resource Benefits of the energy savings exceeds this Measure's Total Resource Cost determined by using the Regional Technical Forum's benefit/cost methodology and financial assumptions.

A list of the Measures and associated eligible equipment is provided below. A detailed list of equipment is included in Part III, Eligible Equipment.

Table 1 - Irrigation System Measures and Equipment Eligible for Rate Discount Credits

Measure	**Associated Equipment**
1. Low Pressure	Sprinkler Equipment
	Pumping Plant Equipment
	Fittings Equipment
2. Mainline	Mainline Equipment
	Pumping Plant Equipment
	Sprinkler Equipment
	Fittings Equipment
3. Pump Modification	Pumping Plant Equipment
	Fittings Equipment
	Sprinkler Equipment

ITEM 13
STAGE I ENERGY REVIEWS

For existing systems, the Stage I Energy Reviews determine the level of Stage II Measure eligibility, the energy savings potential, and estimates the rate discount credit. A Stage I Energy Review consists of various levels of complexity. These include a Pump Test for Level 1, a Simple System Energy Review for Level 2 and a Full System Energy Review for Level 3 and Level 4 Irrigation Systems. The level of Energy Review is geared to the complexity of the Irrigation System in order to recommend electrical energy efficiency measures and maintenance improvements for existing and Expanding Systems. For new or Expanding Irrigation Systems, Design Work may be provided.

To improve energy efficiency, recommended Measures include activities to reduce operating pressure and improve irrigation Pumping Plant efficiency. Measures to improve pumping plant efficiencies include irrigation pump rebuilding, replacement, or impeller trimming. Measures to reduce operating pressure include pipeline and fitting replacement, replacement of standard nozzles with low pressure or flow control nozzles or spray heads, or impeller trimming. If lift increases as the result of lowered water tables or increased flow or other reasons, the verification test may not show any Conservation.

Stage I Analysis Level Identification

Level 1: A Pump Test Analysis is required. This level applies to systems irrigating 15 or more acres. Information to be collected, if available, includes data listed in Item 13, Part I, A, B, C, D, E, and I.

Level 2: A Simple System Energy Review is required. This level applies to all Open Discharge systems and systems irrigating 35 or more acres. Information to be collected, if available, includes data listed in the Item 13, Part I, A, B, C, D, E, F, H, and I.

Level 3: A Full System Energy Review is required. This level applies to systems irrigating 70 or more acres. Information to be collected, if available, includes **all** data listed in Item 13, Part I.

Level 4: A Full System Energy Review is required. This level applies to systems irrigating 480 or more acres. Information to be collected, if available, includes **all** data listed in Item 13, Part I, and Item 16.

PART I
STAGE I ENERY REVIEWS

The following requirements shall be fulfilled as indicated above. If any information is obtained from a source other than shown below, indicate the source of such information. If the required information is not available, indicate accordingly.

A. General Information
   1. Analysis Identification Number
   2. Utility Name
   3. Pole or Location Number
   4. Account Number
   5. Photograph of System

6. Date of System Analysis
7. Analyst Name
8. System Layout Sketch

B. Motor Nameplate Data
1. Make
2. Serial Number
3. Rated Horsepower
4. Rated Voltage
5. Rated Amperage
6. Full Load RPM
7. Frame Size Number
8. Service Factor

C. Pump Nameplate Data
1. Make
2. Type
3. Model Number
4. Serial Number
5. Impeller Diameter
6. Number of Stages
7. Rated Head
8. Rated Flow

D. Power Input Data
1. Meter Constant (Kh)
2. Current Transformer Ratio (CTR)
3. Potential Transformer Ratio (PTR)
4. Number of Disk Revolutions and Time (Seconds) for Total Revolutions; or Voltage, Amperage, and Power Factor
5. Motor Revolutions Per Minute (RPM)

E. Pump Hydraulic Measurements
1. Discharge Water Velocity or Flow or velocity pressure
2. Pipe Inside Diameter
3. Discharge Pressure
4. Intake Pressure
5. Hydraulic Lift
6. Water Table Fluctuation
7. Airline Depth

F. Field, Lateral and Pivot Data
1. Pump Elevation
2. Highest Field Elevation
3. Lowest Field Elevation
4. Beginning and End Pressures of Critical Lateral or Pivot
5. Beginning and End Field Elevations for Critical Lateral or Pivot
6. Potential High Point Elevation for Critical Lateral or Pivot
7. Nozzle Sizes
8. Lateral and Pivot Pipe Diameter
9. Lateral Sprinkler Spacing

10. Length of Pivot
11. Number of Sprinkler Heads along Lateral

G. Pipeline Data
1. Diameters
2. Lengths
3. Riser Spacing
4. Material
5. Water Flow Rates
6. Water Velocities

H. Soil and Crop Information
1. Crop Types and Rotation
2. Crop Acreages
3. Soil Infiltration Rate (where obvious potential for run-off exists)
4. Soil Water Holding Capacity (where obvious potential for run-off exists)
5. Recommended Flow Rate per Acre (where obvious potential for run-off exists)

I. Fittings
1. Type
2. Size
3. Water Velocity
4. Friction losses

PART II
STAGE II ENERGY REVIEWS

Upon completion of installation of recommended energy efficiency improvements, a Stage II Energy Reviews will be conducted. A Stage II Energy Review consists of a visual inspection of the installed Measures, and for Level 2 though 4 systems, a pumping plant efficiency test. Results of the Pumping Plant efficiency test are compared with the Stage I Energy System Review, to determine actual energy savings. New or Expanding Systems are not eligible for Stage II rate discount credits. For Level 4 Systems, the Pump Test Evaluation shall include data described in Item 7, "Conservation Based on Actual Demand per Flow Reduction."

Conservation Rate Discount Credits are based on the estimated first-year energy savings (kWh) times the regional bulk power system value per kWh of those savings as determined using the Regional Technical Forum's methodology and financial assumptions.

Stage II Pump Test Evaluation

A Stage II Pump Test Evaluation should include the following field data and measurements. This Evaluation should be corrected to the critical elevation. Also, a comparison to the Stage I test should be made. In the event of a system change, e.g. hand move to center pivots, good engineering judgment must be exercised. If the Irrigation System is configured differently when the Stage II Pump Test is performed from the layout indicated in the Stage I sketch, e.g., the sprinklers are in a different position, appropriate engineering adjustments to head or flow must be included to reflect actual Energy Savings.

A. General Information
1. Identification number from Stage I
2. Address
3. Utility

4. Account Number
5. Date of Stage II Pump Test
6. Analyst Name
7. System Layout Sketch (A copy of the Stage I sketch with actual locations of system as tested is recommended.)

B. Motor Nameplate Data
1. Make
2. Rated Horsepower
3. Rated Voltage
4. Rated Amperage
5. Full Load RPM
6 Frame Number

C. Pump Nameplate Data
1. Make
2. Type of Pump
3. Model Number
4. Serial Number
5. Impeller Diameter
6. Number of Stages
7. Rated Head
8. Rated Flow

D. Power Input Data
1. Meter Constant (Kh)
2. Current Transformer Ratio (CTR)
3. Potential Transformer Ratio (PTR)
4. Number of Disk Revolutions
5. Time (Seconds) for Total Revolutions
6. Line Voltage
7. Amperage
8. Power Factor
9. Motor Revolutions Per Minute (RPM)

E. Pump Hydraulic Measurements
1. Water Velocity or Flow
2. Pipe Inside Diameter
3. Discharge Pressure
4. Intake Pressure
5. Lift
6. Water Table Fluctuation

PART III
ELIGIBLE EQUIPMENT

Stage II eligible equipment is listed below.

Sprinkler Equipment

The following is a list of sprinkler equipment that is eligible for conservation rate discount credits if this equipment is not already installed and operating properly. The Utility has the discretion to offer any or all of the following eligible equipment to the Irrigator:

A. Sprinklers and Nozzles
   1. Low pressure spray heads
   2. Low pressure impact sprinkler heads
   3. Low angle impact sprinkler heads and nozzles
   4. Flow control nozzles
   5. Flow control diffuser nozzles
   6. Low pressure stainless steel, brass or plastic nozzles
   7. Low pressure end and big guns
   8. Pressure regulators
   9. Associated hardware, materials and labor

B. Center Pivot
   1. Pressure regulators
   2. Drop tubes, goosenecks, elbows, nipples and bushings
   3. Booms
   4. Tubing brace/harness
   5. Swivel fittings, straps, hose and hose clamps
   6. One time computer assistance for the sizing of nozzles
   7. Low pressure end gun booster pump plus accessories
   8. Rental of equipment for the installation of eligible equipment
   9. Additional electric valves essential to control operation of newly added low pressure equipment on corner catchers
   10. Associated hardware, materials and labor

C. Handmove and Sideroll
   1. Swing pipes, flex pipes and elbows necessary for offsetting
   2. Sprinkler levelers necessary for offsetting
   3. Associated hardware, materials and labor

D. General
   1. Shipping, freight and tax for eligible equipment

Mainline Equipment

The following is a list of eligible pipeline equipment. The Utility has the discretion to offer any or all of the following eligible equipment to the Irrigator. The pipe shall be installed according to the Soil Conservation Services guidelines in effect at the time of installation.

A. Hardware
   1. Thrust blocks
   2. Saddles
   3. Cones and Tapers
   4. Couplers, Flanges and bolts
   5. Seals and gaskets
   6. Associated hardware, materials and labor

B. Valves
   1. Vacuum air relief
   2. Pressure relief
   3. Check valves
   4. Drain valves
   5. Gate valves
   6. Butterfly valves

C. PVC pipe
   1. PVC pipe
   2. Cleaning solvents and adhesives
   3. Reducers and expanders
   4. Sleeves, elbows and tees
   5. Transition connectors
   6. Risers
   7. Associated hardware, materials and labor

D. Steel Pipe
   1. Steel pipe
   2. Coated and uncoated steel pipe
   3. Welding labor and materials
   4. Reducers and expanders
   5. Sleeves, elbows and tees
   6. Electrolytic corrosion protection
   7. Risers
   8. Associated hardware, materials and labor

E. Installation
   1. Rental of equipment
   2. Trench digging
   3. Fill material
   4. Associated hardware, materials and labor

F. General
   1. Shipping, freight and tax for eligible components

Pumping Plant Equipment

The following is a list of eligible electrical and pumping plant equipment. The primary intent of these measures is to reduce Pumping Plant horsepower. Motor rewinds generally degrade the efficiency of the motor and are not eligible for rate discount credits. The Utility has the discretion to offer any or all of the following eligible equipment to the Irrigator:

A. Turbine Pumps
   1. Refurbishment of existing bowl assembly
   2. Bowls
   3. Impellers
   4. Camera inspection work
   5. Precipitate removal from well

6. High pressure well flushing
7. Shaft Repair
8. Impeller trim
9. Impeller unit balancing
10. Pump and lineshaft bearings
11. Spiders or lineshaft bearing supports
12. Parts to adapt new/modified pump to motor (Headshaft)
13. Screen or strainer assembly
14. Rust treatment of screens and strainers
15. Column to accommodate new bowl assembly
16. Headshaft
17. Seals
18. New coating of stainless steel powder, bronze, etc.
19. Shot peen for surface hardening and stress relief
20. Oil tubes
21. Airline or well access ports
22. Water level measuring gauge for airline
23. Associated hardware, materials and labor

B. Centrifugal Pumps
1. Pump replacement
2. Impeller
3. Impeller trim
4. Seals and packing
5. Balance of impeller
6. Bearings
7. Screens or strainer assembly
8. Associated hardware, materials and labor

C. Motors
1. Replacement with Premium Efficiency Motors
2. Motor base
3. Adjustable Speed Drives for electric motors over 200 HP
4. Brushes and bearings
5. Associated hardware, materials and labor

D. Electrical
1. Panel improvements
   a. Circuit breaker or overload relay
   b. Fuse disconnects
   c. Magnetic starter contacts and coils
   d. Surge capacitors
   e. Lightning arrestors
   f. Heater strips or fuses
   g. Phase failure units
2. Time clock or twist timer
3. Power factor correction capacitors
4. Associated hardware, labor, permits, and wiring material

E. General
1. Shipping, freight and tax for eligible components

Fittings Equipment

The following is a list of eligible fitting equipment. The intent of providing this list is to allow fittings when analyzed and appropriate or when necessary as part of other eligible measures. The Utility has the discretion to offer any or all of the following eligible equipment to the Irrigator:

A. Suction
   1. Screen or strainer assembly
   2. Piping
   3. Foot valve
   4. Flow straightener vanes
   5. Intake bells
   6. Gaskets or sealers
   7. Smooth elbows
   8. Eccentric tapers
   9. Flanges and couplers

B. Discharge
   1. Steel piping
   2. Associated nuts and bolts
   3. Gaskets and sealers
   4. Glycerin filled pressure gauge
   5. Tapered fittings and cones
   6. Check valves
   7. Smooth elbows
   8. Tees
   9. Flanges and couplers
   10. Discharge control valves

C. General
   1. Welding and materials
   2. Associated hardware, materials and labor
   3. Shipping, freight and tax for eligible components

ITEM 14
ENERGY REVIEW PROCEDURE DESCRIPTION
PART I

Stage I Procedures

An Irrigation System Energy Review is the procedure to examine Irrigation Systems to determine which Measures may be installed and the estimated acquired Conservation associated with such Measures. The procedures described here include the information necessary for Level 1 through Level 4 Irrigation Systems. Not all of the information is needed for Level 1 and Level 2.

The Analyst shall be qualified to discuss in general the following topics with no bias toward any specific form of energy:

- The Pacific Northwest Power Planning and Conservation Act - 1980.
- The Northwest Power Planning Council's 20-Year Plan.
- Financial and/or other assistance that is available from the utility and other sources.

Lotus 123 ™ templates are available from Bonneville to assist in the Level 1, 2, and 3 Analyses. The Analyst shall collect all data necessary and perform the Stage I Analysis consistent with standard engineering practices. (These templates need to be included in the electronic version of this document)

1. **General Information for Existing Systems**

(a) Include a clear photo of the Pumping Plant.
(b) Include the Irrigator's name and address, servicing Utility, account, pole or location number, Analysis Level, Analyst name and date the Analysis was completed. On each page of the report, include the Analysis identification number.
(c) Sketch the System layout as analyzed. Include the following:

(1) Show the highest and lowest irrigated field elevations.
(2) Show the pump location and elevation. Normally, if a transit is used, the pump elevation is arbitrarily set at +100' and the other elevations are referenced accordingly. Normally, if an altimeter is used, the Pumping Plant elevation is set at 0'. Close the loop by returning to the Pumping Plant and checking the altimeter reading, which should be +/- 2'. If out of range, adjust elevations per manufacturer's recommendations.
(3) When full-time endguns are mounted on center pivots, all Stage I testing shall be done with the endgun and any associated booster pump "on" or "off", as they will be operated after Stage II retrofit. "Corner-catchers" and endguns designed to operate part-time shall be "on" when both Stage I and Stage II Analyses are performed.
(4) Show location of Mainlines, risers, Distribution Lines, laterals, pivots, sprinklers, etc.
(5) For all mainline sections show the following:
- Location of all risers and spacing between risers
- Location, by riser, of all laterals as tested
- Material, diameter, length, flow, leaks of all mainline sections.

(6) For all laterals show the following:
- First and end pressure of each lateral
- Number of sprinklers on each lateral
- Average nozzle diameter for each lateral
- Average pressure along each lateral
  = First + 0.25 (Last - First), or on flat terrain the average pressure is usually 1/3 down the lateral.

- Diameter of all laterals
- Elevation of critical sprinkler as tested
- Potential critical sprinkler elevation if the lateral is not in critical position.

(7) For all pivots show the following:
- Pivot pipe diameter and length of pivot
- Pivot point and end pressure of each pivot
- Elevation of critical sprinkler as tested

- Potential critical sprinkler elevation if the pivot is not in the critical position. For instance, if the end sprinkler on a pivot is at +5' relative to the pumping plant and the highest point along the perimeter of the pivot is +15', then the critical position would be +15'. In this situation, the potential head savings is reduced when factoring in an evaluation adjustment of 10 feet.

(8) The critical pressure is the lowest possible pressure on the Irrigation System. This is typically the highest sprinkler elevation or the farthest away from the Pumping Plant or a combination of the two.

2. **Motor and Pump Nameplate Data**
Include the number of pumps in the System. Number the pump and motor combinations. Indicate if it is a main or booster pump, in series or parallel.

(a) Record all the motor information that is reasonably attainable, i.e. all distinguishable information from the motor nameplate.
(b) Record all the pump information that is reasonably attainable, i.e. all distinguishable information from the pump nameplate.

(1) Record net positive suction head required.
(2) Measure the pumping water level with a sounder or airline. Record the airline pressure (in psi) when the airline is pumped full of air. The pumping water level is equal to airline length minus the resultant of the pressure times 2.31.
(3) Indicate if pumping water level is estimated or measured.

3. **Power Input Data**
The total nameplate horsepower connected to the meter **MUST** be recorded. Exclude pivot HP, generally 1 to 1 ½ HP per tower.

(a) Utility Meter

(1) Record the number of disc revolutions (usually = 10).
(2) Record the meter constant (Kh) found on the face of the meter.
(3) Record the PTR (It will usually be 1, 2, or 4). This equals the Nameplate Voltage of Meter divided by the Nameplate Voltage of the Motor.
(4) Record the CTR/multiplier (this will usually be 1, 40 or 80).
(5) Time the spinning disc inside the watt-hour meter for 10 revolutions or approximately one minute. Use the black bar on the disc for reference.

(b) Multimeter

(1) Record the voltage between each phase. Average these readings.
(2) Record the amperage of each phase. Take these readings on the motor side of the power factor correction capacitors. Average these readings.
(3) Record in percent the average lagging power factor for each phase. Take these readings on the motor side of the power factor correction capacitors.

4. **Hydraulic Measurements and Calculations**

(a) Flow

(1) Record the measurement device. i.e. transit time, ultrasonic, Doppler, Hall, Collins, Piro, bucket-hose-and-timer, etc. DO NOT rely on the Irrigator's flow meter.
(2) Record the pipe material at the point where flow measurement was taken.
(3) Measure (if possible) and record the inside pipe diameter at the point where flow measurement was taken. If measurement is not possible, record the pipe diameter found in the appropriate table of appendix, or use manufacturer's specifications. Indicate whether measured or estimated from table.
(4) Measure and record the water velocity in the pipe.
(5) Calculate the flow.

(A) GPM = 2.448 X Velocity (ft/sec) X pipe diameter squared (inches), or
(B) To calculate flow per sprinkler nozzle, use the Rainbird ™ slide rule; University of Idaho Sprinkler Guide; formula e.g., the nozzle diameter squared times the square root of the nozzle pressure, with this result times 29.8; or
(C) Use bucket-hose-and-timer method to find the average flow per sprinkler by calculating the flow per lateral by multiplying the number of sprinklers per lateral times the number of sprinklers. Sum all of the laterals and compare to the flow measurement taken at the pump. These should be fairly close (+/- 5%) if no major leaks are present; or
(D) Direct reading from electronic equipment.

(b) Head

(1) Record the pump discharge pressure in psi. Use an accurate liquid-filled gauge. DO NOT rely on the Irrigator's gauge. If measured on the pump volute, correct for velocity head e.g. reading is approximately 2 percent to 10 percent low.
(2) Record hydraulic lift in feet. This is the vertical distance from the water level to the center of the pressure gauge on the discharge side of the pump.
(3) If applicable, record the suction pressure in inches of mercury (in. Hg.) and multiply by 1.139. Use this number in the total head calculation by adding it to the discharge pressure. For a positive suction pressure, subtract from the discharge pressure to determine total head.
(4) Record yearly well water table fluctuation in feet, if known by irrigator. Use the lowest average number.

5. **Fittings**

If proposed to be retrofit, fittings' losses **MUST** be calculated. The analyst **MUST** include fittings' losses from the inlet to the discharge gauge, i.e., intake/column friction + discharge head + friction losses from the discharge to the discharge pressure gauge. If the pump is a booster, the analyst **MUST** include the losses from the suction pressure gauge to the discharge pressure gauge. Use an appropriate equation to calculate these losses e.g. $V^2/2g*K$, Hazen-Williams, Darcy-Weisbach, Mannings.

6. **Calculations**

(a) Total Dynamic Head (TDH) in feet equals discharge pressure (psi) times 2.31 plus pumping lift (ft) plus fittings losses (ft), or, discharge pressure (psi) times 2.31 minus suction pressure (psi) times 2.31 plus fittings losses.
(b) Water Horsepower (WHP) equals flow in GPM times TDH divided by 3960.

(c) Input Electric Horsepower (EHP) equals 4.826 times disc revolutions times Kh times PTR times CTR divided by time in seconds, or, 2.322 times average volts times average amps times average power factor divided by 1000.
(d) Pumping Plant Efficiency (Eff) equals WHP divided by EHP times 100.

7. **Field, Lateral and Pivot Data**

(a) Determine if the critical sprinkler is located on a center pivot or set System. Use this sprinkler pressure to determine the existing pressure.
(b) Determine whether the field could benefit from flow or pressure control strategies. Generally for set systems, if the field elevation varies more than 15' or the sprinkler pressures vary more than 6 psi, it is recommended. For center pivot systems, flow or pressure control is necessary if the field elevation varies more than 8'. Identify if runoff is or will be a problem. If it will be a problem, take this into account when recommending low pressure.
(c) For recommended sprinkler pressure, the minimums are 35 psi for set systems and 20 psi for pivots.
(d) For pressure regulator loss, add 5 psi to the recommended pressure, unless manufacturer data indicates otherwise.

8. **Design Pressure**

(a) The design pressure for the system is normally chosen between the lowest or average pressure. If neither the lowest nor average make sense, then another pressure can be used. For instance, if the critical lateral goes over a hill, then the sprinkler at the top of the hill can be used, or, if only 10 percent of the field is at a high elevation, and the Irrigator decides that some yield can be sacrificed, the pressure(s) at the high elevations can be ignored.
(b) Mainline pressure adjustment should be calculated by hand and recorded. The pressure adjustment needs to be calculated only if the critical lateral is not in the critical position. The pressure adjustment is equal to the difference in mainline pressure between the mainline riser at the position where the critical lateral would be if it were in the critical position and the mainline riser where the critical lateral was tested. This adjustment is added to the critical pressure if the critical lateral is moved toward the pump and subtracted if the critical lateral is moved away from the pump. This yields the adjusted critical pressure.
(c) The sprinkler head savings (SHS) equals the adjusted critical pressure minus the recommended pressure minus pressure regulator loss. Multiply the result by 2.31 to obtain head savings (ft).

9. **Mainline**

(a) Record length, inside Mainline diameter, friction factor (C value) and proposed flow for the existing mainline section(s). Calculate velocity, Hf/100', and total friction. Do this for each mainline section of differing diameter, C value or flow. Round final velocity results to the nearest 0.1 feet-per-second.
(b) It is typically cost effective to retrofit sections of mainline that have water flowing in excess of 7 feet-per-second for more than 100 feet. Use a larger diameter or parallel mainline to calculate proposed total friction and total head reduction. Adjust the inside diameter or flow until the retrofit velocity is less than or equal to 5.0 feet-per-second.
(c) Record the sum of the potential head reduction for all mainline sections.

(d) Hf/100' is calculated using the Hazen-Williams equation. Total friction is calculated by multiplying Hf/100' and length (per 100'). The total head reduction is calculated by subtracting retrofit total friction from current total friction. Potential total head reduction is the sum of retrofitted Mainline sections.

10. **Head Reduction Savings**
To calculate the total head savings, add the low pressure sprinkler or nozzle savings to the Mainline retrofit savings to the Fittings loss savings to the partially closed valve savings. The partially closed valve savings can be estimated from the pump curve or by measuring pressure loss across valve. Ensure that all of the numbers are in consistent units.

11. **Pumping Plant Savings**

(a) The TDH should be determined as follows:

(1) For parallel systems, do not add the TDHs together.
(2) For series systems, add the TDHs together.
(3) If the system is a combination of series and parallel pumps, then combine them as in (2) above.

(b) The total GPM should be determined as follows:

(1) For parallel systems, add the flows together.
(2) For series systems do not add the flows together.
(3) If the system is a combination of series and parallel pumps, then combine the GPM values as in (2) above.

(c) The total WHP, EHP, and BHP are additive, i.e. doesn't matter if the pumps are in series or parallel.
(d) The proposed TDH will have to be determined for each pump in the Irrigation System. If no changes in TDH are necessary, then record the existing TDHs as the proposed TDH. If changes are necessary, the analyst will need to determine which pumps(s) will need trimming. The way to do this, would be to subtract the head savings from the TDH of the existing pump(s) to be trimmed. The total proposed TDH is equal to the total existing TDH minus the system total head savings.
(e) The proposed GPM must be recorded for each of the pumps and the total proposed flow calculated as in calculation 11(b) above.
(f) Record the proposed efficiency values for each pump. The analyst MUST judge between using a value(s) from the Achievable Pumping Plant Efficiency table, pump curve or keep the efficiency the same as in the existing Pump Test.

(1) Total plant efficiency (existing) is equal to (total WHPe/total EHPe) * 100.
(2) Total plant efficiency (proposed) is equal to (total WHPp/total EHPp) * 100
(3) Annual hours of operation is kW divided by average kWh.
(4) Acre inches is calculated as:

(GPM) * (Op Hrs/Yr)/(452.6 * Irrigated Acres).

12. Equations:

PARALLEL PUMPS

TDH1 = TDH2 = TDH total
GPM1 + GPM2 = GPM total

SERIES PUMPS

TDH1 + TDH2 = TDH total

GPM1 = GPM2 = GPM total

COMBINATION PUMPS

$$\frac{TDH1 + (TDH2 + TDH3)}{2} = TDH\ total$$

GPM1 = GPM2 + GPM3 = GPM total

13. Energy Use

For each year, preferably the last five, that the Utility has kWh usage data, record the year and kWh values. If the kWh usage for a particular year will not be used, note it. At the Analyst's discretion, the high or low year(s) (+/- 30%) may be excluded to account for excessively dry/wet years or land removed under PIK, under-utilization, CRP, etc. Average these usage figures.

14. **Energy and Measure Cost**

Average energy cost is calculated by dividing the Utility bill by kWh used. Measure cost may be estimated by securing bids (recommended in the case of Level 3 and Level 4 systems) or based on the Utility's historical experience with identical equipment repair and/or replacement.

15. **Energy Savings**

The potential energy conservation (kWh/yr) is calculated as follows for each Measure. Meter Portion (MP) is nameplate horsepower tested divided by nameplate horsepower on meter. Balance Factor (BF) means horsepower reduction savings divided by the sum of individual Measure savings.

(a) Low Pressure savings:

$$\frac{\text{Sprinkler Hear Savings (ft)*GPMi*kWh*Meter Portion*Balance Factor}}{3960*EFFi*EHPi}$$

(b) Flow Savings:

$$\frac{\text{(GPMi -GPMf)*TDHi*kWh*Meter Portion*Balace Factor}}{3960*EFFi*EHPi}$$

(c) Fitting Savings:

$$\frac{\text{Fitting Head Savings (ft)*GPMi*kWh*Meter Portion*Balance Factor}}{3960*EFFi*EHPi}$$

(d) Mainline Savings:

$$\frac{\text{Mainline Head Savings (ft)*GPMi*kWh*Meter Portion*Balance Factor}}{\text{3960*EFFi*EHPi}}$$

(d) Valve Savings:

$$\frac{\text{Valve Head Savings (ft)*GPMi*kWh*Meter Portion*Balance Factor}}{\text{3960*Effi*EHPi}}$$

(e) Efficiency Savings:

$$\frac{\text{(EFFf - EFFi) * kWh * Meter Portion * Balance Factor}}{\text{EFFf}}$$

(g) Horsepower Savings

$$\frac{\text{(HPi - HPf) * kWh * Meter Portion}}{\text{HPi}}$$

Conservation Rate Discount Credits for each measure are based on the estimated first-year energy savings (kWh) times the regional bulk power system value per kWh of those savings as determined using the Regional Technical Forum's (RTF) methodology and financial assumptions. If the measure also reduces water use, then it may also produce addition regional bulk power system benefits by reducing water diversion and increasing hyrdo-electric production. The RTF's methodology provides an estimate of these additional benefits based on the location in the region of the irrigation water withdrawals and return flows.

Once the annual energy and water savings of the measure or activity have been determined, the Utility should use the software program developed by the Regional Technical Forum to convert a measure's first year energy and water savings into its regional power system value. This software and instructions for installing and using it are available at: www.nwppc.org/rtf/XXXXXXXX).

16. New or Expanding System Design Requirements

The purpose of these activities is to promote the design of sprinkler Irrigation Systems that are both energy and water efficient. As part of a pre-design meeting, the Analyst shall discuss with the Irrigator low pressure sprinkler application technology. Design of the system will consider the following criteria:

(a) Crop types and rotation schedule
(b) Cropping patterns
(c) Irrigated acreage
(d) Soil type
(e) Soil depth
(f) System type
(g) Water management strategies
(h) Application rate and efficiency
(i) ET rates expected

(j) Piping system friction losses
(k) Field elevations
(l) Low pressure application
(m) Water supply source
(n) Pumps and fittings
(o) Soil infiltration rate
(p) Soil water holding capacity
(q) Recommended flow rate per acre

Set system design results shall include, but not be limited to, information on irrigation interval, number of laterals, irrigation time per set, nozzle type and size, sprinkler spacing, pipe type, pipe length and size, pump head and flow requirements, and motor size. Non-stationary system design shall include, but not be limited to, information on head and flow requirements, pipe type, pipe length and size, sprinkler packages and types, motor size, and system speed. A follow-up meeting with the Irrigator is required to review design study.

ITEM 14
PART II
INSTALLATION PROVISIONS

1. General

(a) These specifications provide minimum requirements for work accomplished under the WaterWise Program. These specifications are intended for use between the Utility and Bonneville.
(b) The Utility shall provide Installer provisions to be used between the Utility and Installers.
(c) These specifications are based on the most recently published NEC Codes and regulations and are intended to meet or exceed applicable existing NEC Codes and regulations. NEC Codes and regulations, however, are updated periodically and are also subject to change through the NEC Code processes at State and local jurisdictions. Therefore, the specifications, NEC Codes, and regulations shall apply as follows:

    (1) Measures shall be installed in accordance with these specifications, all applicable State and local NEC Codes and Federal regulations, and the most recent versions of the National Electric Code.
    (2) Where State or local NEC Code and specification requirements are in conflict, the most stringent of the requirements shall apply. When State or local NEC Codes are less restrictive, Bonneville may approve their use in lieu of these specifications. Such approval must be requested in writing by the Utility and approved in writing by Bonneville prior to installation of the Measure.
    (3) In cases where a specific application is not addressed in the specification, NEC Codes, or regulations, the Utility shall determine the appropriate action consistent with the NEC Codes and these specifications. Utility decisions in these instances shall be thoroughly documented in the Irrigator's file.

(d) The Utility reserves the right to add more restrictive requirements to the provisions contained in this specification or require that additional provisions defined by the Utility be met.

2. Definitions

For purposes of this specification, the following definition applies.

(a) "NEC Code" - The most recent edition of the National Electric Code (NEC) written by the National Fire Protection Association (NFPA) and associated codes.

3. Specifications For Determining Measures Eligible for Conservation Rate Discount Credit

(a) The Utility shall be responsible for determining Irrigation System Conservation Measures eligible to be installed in each system per the WaterWise Program.

(b) Conservation Rate Discount Credits shall not be granted for materials or labor associated with maintenance, repair work, or new installations unless specifically allowed for in the WaterWise specifications. Examples of such work not covered under the WaterWise Specification include, but are not limited to, the following:

(1) adding column length
(2) well casing and drilling
(3) portable mainline
(4) purchase of new laterals
(5) painting of equipment
(6) extension of mainline to serve new ground
(7) pivot tower equipment
(8) pond dredging and lining
(9) updating electrical equipment to new NEC Code
(10) deepening wells

Such work identified to be beyond the scope of the Conservation and Renewable Resource Rate Discount Program must be separately arranged and financed by the Irrigator.

ITEM 14
PART III
EQUIPMENT SPECIFICATIONS

The following equipment specifications should be used as a guide for the equipment used for analyzing Irrigation Systems. All equipment should be portable.

1. Flow Measurement Equipment

(a) Velocity meters are designed to be used under a variety of operating conditions. An Analyst should have access to a velocity meter which is capable of measuring under the following conditions:

Water Velocity:	1 - 12 feet/second
Water Temperature:	32 - 105 degrees Fahrenheit
Pipe Pressure:	5 - 150 psi
Pipe Diameter:	3 - 14 inches
Air Temperature:	32 - 100 degrees Fahrenheit

Pipe Material:	Steel, Aluminum or Plastic
Wall Thickness:	1/16 to ¼ inch
Fluid Medium:	Water with up to 0.1% suspended solids. Air bubbles may or may not be entrained.

(b) Additional Meter Specifications: Accuracy: +/- 5% of water velocity
Electronic velocity meters should be checked periodically (at least once per year) against a pitot-tube and manometer measurement device to verify calibration.

2. *Pressure Gauges*

(a) Pressure gauges are designed to be used under a variety of pressure conditions. All gauges shall be marked in 2 psi increments. An Analyst should have access to pressure gauges which are capable of measurement under the following conditions:

Pipe Pressure:	20 to 200 psi (in. Hg)
Air Temperature:	32 - 105 degrees Fahrenheit

(b) Additional specifications

Accuracy:	+/- 2%
Threads:	¼ inch (NPT)

These gauges shall be checked annually for proper calibration by comparing pressure against a new gauge. Replacement must be made if differences are greater than 2 percent. Although not required, it is recommended a glycerin-filled gauge be used to reduce needle vibration produced by the Pumping Plant.

3. *Voltmeter*

(a) An Analyst should have access to a multimeter which is capable of measurement under the following conditions:

Power:	AC
Cycles:	60 Hertz
Voltage:	120 - 600 volts
Amperage:	5 to 600 amps
Air Temperature:	32 - 105 degrees Fahrenheit

(b) Other Meter Specifications

Accuracy:	+/- 3% + number of digits
Protection:	1000 v input
Includes Voltage leads:	Min. length 36 inches
True RMS	

4. *Clamp-on Current Meter*

(a) An Analyst should have access to a current meter capable of measurement under the following conditions:

Power: AC
Cycles: 60 Hertz

Voltage:	120 to 600 volts
Amperage:	5 to 600 amps
Air temperature:	32 - 105 degrees Fahrenheit

(b) Other Specifications

Accuracy:	+/- 2% of reading
Conductor Size:	1½ inches

Allows for current measurement without breaking circuit tested.

5. RPM Meter

(a) An Analyst will need to measure RPM of the pump for variable speed or belt drive units. An Analyst should have access to a stroboscope or contact RPM meter which is capable of measurement under the following range of conditions:

RPM:	500 - 4000
Air Temperature:	32 - 105 degrees Fahrenheit

(b) Additional Specifications

Accuracy: +/- 1 for last digit
Reflecting tape not normally needed

6. Well Sounder

(a) An Analyst should have access to a well sounder which is capable of measurement under the following conditions:

Well Depth: 10 to 600 feet

(b) Other Specifications

Detection: Amperage or Voltage meter

7. Power Factor Meter

(a) An Analyst should have access to a power factor meter capable of measuring the power factor under the following conditions:

Volt Range:	100 to 600 Volts; 60 Hz
Maximum Current:	600 amps
Minimum current:	3 amps
Accuracy:	+/- 3% of full scale

(b) Other Specifications

Reads power factor directly (leading or lagging) for 0 to unity. Single phase, split phase, three phase balanced or unbalanced loads, 4 wire three phase.

8. Altimeter

(a) An Analyst should have access to a barometer/altimeter capable of measuring altitude under the following conditions:

Calibration Ranges:

Pressure:	17.7 - 32.5 in Hg
Altitude:	Sea Level to 8,000 feet
Markings:	2 ft increments
Temperature:	32 - 105 degrees Fahrenheit
Absolute press accuracy:	+/- 0.015 in Hg over range

(b) Other Specifications

Differential altitude capability
Altitude and altimeter setting capability

ITEM 15
PROGRAM FORMS

SCHEDULE A
IRRIGATED AGRICULTURE PROGRAM
(SAMPLE FORM)

STAGE I ACTIVITY **Reporting Period ___/___/___ to ___/___/___**

ESTIMATED ENERGY SAVINGS AND STATISTICAL INFORMATION

						Estimated Savings			
Member ID	Project Ref Number (Cust. Act #-#-Yr)	Level	Nameplate Horsepower (HP)	Admin Cost ($)	Total Measure Costs ($)	Low Pressure (kWh)	Mainline (kWh)	Pump Mods (kWh)	Eligible for Stage II (yes/no)

Total Energy Savings **$_____**

Total Project Administrative Cost **$_____**

Marketing and Indirect Costs **$_____**

Total Costs $_____

SCHEDULE B

IRRIGATED AGRICULTURE PROGRAM

(SAMPLE FORM)

STAGE II ACTIVITY **Reporting Period ___/___/___ to ___/___/___**

ESTIMATED ENERGY SAVINGS AND STATISTICAL INFORMATION

			Project Cost							
Member ID	Project Ref Number (Cust. Act #-#-Yr)	Level	Admin Cost ($)	Total Measure Cost ($)	Initial Horsepower (HPi)	Final Horsepower (HPf)	Initial Flow (GPMi)	Final Flow (GPMf)	Verified Savings (kWh)	Irrigators Cost ($)

Total Energy Savings **$_____**

Total Project Administrative Cost **$_____**

Marketing and Indirect Cost **$_____**

Total Implementation Costs $_____

Irrigation Management
Reporting Form

(Sample)

Farm	Date
Irrigator	Address
Utility	Utility Acct. #
Analyst	

Year	Crop	Acres	Agrimet ET (inches)	Agrimet Station Location

Annual Energy Use (kWh)	Year

Has irrigator participated in WaterWise Stage I or Stage II?

Stage I		Stage II	
Yes	No	Yes	No

If yes, complete the following:	If yes, complete the following:
Were Stage I recommendations installed without going through WaterWise Stage II? Yes ❑ No ❑	Date Stage II work completed / /
Date Installed:	Verified energy savings (kWh)

Notes:

Irrigation Management Worksheet
(Sample)

Name Auditor

Address Phone

Field Name/Description Date

Walk Through Inspection

Nameplate HP HP	Meter Demand kW	Pump Pressure psi
Valve OK Needs Work	Well Yes No	Offsets Yes No
Pipe/Gaskets OK Needs Work	Electrical Safety OK Needs Work	Gage Petcock Yes No
Leaks OK Needs Work	Time Clock Yes No	Levelers Yes No
Trash Screening OK Needs Work	Runoff OK Needs Work	Fittings OK Needs Work
Nozzle Wear OK Low Med. High	Pr. Reg/Flow Control Yes No	Nozzle Sizes OK Needs Work
Sprinkler Func. OK Needs Work	Sprinkler Plug OK Needs Work	Elevation Diff. ft.

Power (HP) = 4.72 X #. Revs. X Kh*Multiplier = HP
time (sec.)

Pumping Depth (if known)= ft.

WATER APPLICATION

Circle Irrigation System Type: Handline Side Roll Solid Set Center Pivot (see Page 3)

Sprinkler Flow Rate

Sprinkler Nozzles "by " or gpm Sprinkler Type

Sprinkler Pressure psi Adjusted Sprinkler Pressure psi

Sprinkler Flow rate (alternate)= **Volume**= gal. X 60 = gpm
Time sec.

Total Flow rate = gpm

Application Rate

Lateral Size in. Lateral Spacing ft.

Sprinkler Spacing ft. Application Rate (gross) in./hr.

Application Rate (net) = Gross X 0.7 in./hr.

Operation Time

# of Risers

# of Laterals

Set Time hr.

Net Depth Applied - Net Application Rate in./hr. X Set Time hr. = in.

Moves per day

Cycle Time (# risers/(# moves per day X # laterals)) = days

Irrigation Management Worksheet
(Sample)

Name Auditor

Irrigation Scheduling

Crop		Root Zone	ft.
Soil Type		Holding Capacity	in./ft.
Allowable Depletion	%	Acreage	Acres

Current Soil Moisture

1. Average Soil Moisture %
2. Readily Available Water (RAW) = AD X RZ X HC = in.
3. Currently available moisture in soil reservoir = ((SM+AD-1)*HC*RZ = n.
4. Current Depth to Fill Root Zone = RAW - Line 2 = in.
5. Peak Crop Water Use: (in./day) **HOTLINE NUMBER**

Set Sprinkler Section

6. Time to fill Root zone (set sprinkler)= Line 4/Net Application Rate= hr.
7. Maximum Time to fill root zone (set sprinkler)=RAW/Net Application Rate= hr.
8. Time between set sprinkler irrigation at peak crop use=RAW/Line 5= days
9. Irrigation Cycle Time (from page 1) days

Center Pivot Section (fill in Page 3 first)
Number of hours operation per week at Peak Crop Water Use @ 85% Efficiency:

3729 X Peak Crop Water Use in./day = hrs. out of 168 hrs.
Application Rate gpm/acre

Recommendations:	Potential Savings:	Factor:
☐ New Nozzles	10%	0.90
☐ New/Rebuild Sprinklers	5%	0.95
☐ Flow Control Nozzles	5%	0.95
☐ Pressure Adjustment	3%	0.97
☐ Change Operating Time	(1- factor)	(line 7/current set time)
☐ Fix Leaks	5%	0.95
☐ Safety		
☐ Full Hardware Audit		
☐ Install Pressure Gauges		
☐ Other		

Potential Savings = (1 - factor) X HP X 0.746 X Ann. hrs = kWh/year.
If more than one recommendation for potential energy savings is made to the irrigator, multiply individual factors together to get factor to substitute into equation.

Irrigation Management Worksheet
(Sample)

Name Auditor

Center Pivot Water Application

Design Flow Rate gpm (from sprinkler printout)
Design Pivot Pressure psi
Measured Pivot Pressure psi
Sprinkler Type (Circle): Impact Spray Drops Booms
End Gun: (Circle) Yes No On Off

Length of Wetted coverage ft.
Acreage=(**Length of Wetted Coverage**)^2 = acres
13866

Tower Length (Mark End Tower and End Boom)	
1.	ft.
2..	ft.
3..	ft.
4.	ft.
5.	ft.
6.	ft.
7.	ft.
8.	ft.
9.	ft.
10.	ft.
11.	ft.
12.	ft.
13.	ft.
14.	ft.
Total	Ft.

System Flow Rate (choose one method)

Method 1. Measured Flow Rate gpm

Method 2. Flow Rate Estimated by Nozzle and Pressure
End Tower Sprinkler Nozzle Size in.
Measured Sprinkler Pressure psi
Sprinkler Flow rate gpm

Method 3. Center Pivot Flow Rate Estimated by Timing The Sprinkler Volume
Sprinkler Flow rate = **Volume** gal. X 60 = gpm
Time sec.

Application Rate (choose one method)

Method 1. Measure pivot flow rate.
Application Rate = System Flow Rate gpm = gpm/acre = Acreage= acres

Method 2. Application Rate Estimated From Sprinkler At End Tower
Sprinkler Spacing ft.
Application Rate = 6933 X Sprinkler Flow Rate gp,
Length to Sprinkler ft. X Sprinkler Spacing (ft.) = gpm/acre

Measured Pivot Speed

Distance Between Flags ft.
Time Between Starts min sec.
Speed = Distance time min.

Revolution Time = Length to End Tower ft. X Timer Setting %= hr.
@ 100% 955 X Speed ft./min

Setting Pivot Speed

Desired Application Depth = in.

Time to apply 1.0 inch: 453 = hrs. Application Rate gpm/acre

Timer Setting = Revolution Time @ 100% hrs.= %
Depth in. X Time to apply 1.0 in. hr.

ITEM 16
LARGE IRRIGATORS

Due to the size and complexity of Large irrigators' Irrigation Systems and the magnitude of potential costs and energy savings, some of the requirements described in the prior WaterWise program specifications are not adequate to allow for their appropriate evaluation. This Item is intended to provide additional guidance for evaluating these systems.

Part 1
Stage I Energy Reviews

Pump Testing and Energy System Reviews are conducted to locate system components which could, through retrofit, produce energy savings. Stage I Energy Reviews determines eligibility of the irrigation system for installation of energy conservation Measures.

Part 2
Eligibility

1. Large irrigators may not receive funding through other Bonneville or Federally funded sources for the same Project, unless otherwise agreed.
2. Each potential energy conservation measure item will be analyzed for cost effectiveness. A Measure is considered cost-effective if its estimated total resource cost is less than or equal to its expected benefits to the region. The maximum benefits of irrigation energy efficiency improvements depend on several factors. The most important of these are its first year kWh savings, its anticipated water savings (if any), the expected life of the measure (See Table 2 below) and whether the measure will defer the need for local distribution system capacity expansion.

Conservation Rate Discount Credits for each measure are based on the estimated first-year energy savings (kWh) times the regional bulk power system value per kWh of those savings as determined using the Regional Technical Forum's (RTF) methodology and financial assumptions. If the measure also reduces water use, then it may also produce addition regional bulk power system benefits by reducing water diversion and increasing hyrdo-electric production. The RTF's methodology provides an estimate of these additional benefits based on the location in the region of the irrigation water withdrawals and return flows.

Once the annual energy and water savings of the measure or activity have been determined, the Utility should use the software program developed by the Regional Technical Forum to convert a measure's first year energy and water savings into its regional power system value. This software and instructions for installing and using it are available at: www.nwppc.org/rtf/XXXXXXXX).

Table 2 - Typical Project Life for Irrigation Equipment	
Measure	**Typical Life***
Low Pressure Nozzles	5 years
Pumps and Pump work	10 years
Drop Tubes	10 years
Steel pipe, fittings	15 years
Mortar Lining (installed to AWWA specifications)	15 years
PVC Pipe (installed to SCS specifications)	15 years
*Note that the equipment life is based on how long the measure can reasonably be expected to deliver the estimated savings. Actual measure lives may be shorter or longer due to factors such as current irrigation management, crop mix, water availability, technological improvements, etc.	

Part 3
Stage I Review

Bonneville may review each Large irrigator on a case-by-case basis and, at a minimum, the following items may be considered:

1. Project Cost-Effectiveness. A proposed project's Total Resource Benefits should generally be equal to or greater than its Total Resource Costs as determined using the Regional Technical Forum's methodology and financial assumptions.
2. Initial horsepower and final horsepower. How the horsepower is being reduced, and if numbers appear reasonable.
3. Velocities and friction losses in pipeline under existing and retrofit conditions. An independent calculation of velocities and friction in pipe may be made by Bonneville.
4. How system is operated and when pipe branches have flow going to laterals. Operating hours per year and operating hours at peak flow (on a multiple pump, multiple mainline, multiple lateral and pivot system, only during peak operating hours and maximum flow conditions will friction loss reductions have any significant effect) for each pipeline branch.
5. Proposed kWh savings/year. In most instances, the reduction of horsepower will **not** be multiplied by hours of operation per year as in small systems. This is because the system typically will not run a full flow condition for the entire operating season, but only during the critical irrigating months.

Part 4
Stage II Verification

1. One season of metering of the existing condition is required to assist the analyst/engineer in establishing the base energy usage, flows, hours of use, and pressures.

2. A Verification Pump Test shall be performed (Stage II) to measure the actual reduction in horsepower, friction losses, pressure, and energy usage. Bonneville and analyst/engineering personnel may visit the site during installation.
3. In situations where pre- and post-Metering are required, once the Measures are installed and a Verification Pump Test is performed, metering shall be conducted for the following irrigation season. Data from Metering shall be analyzed on not greater than weekly intervals, taking the following items into consideration:
   - Crops grown
   - Weather patterns
   - Other varying conditions from year to year

4. The Analyst will verify energy savings with adjustment using the accumulated metered data, if applicable, along with the Stage I and Stage II Pump Test results.
5. After successful review by Bonneville, conservation rate discount credits can be authorized and claimed.

ITEM 17
INTRODUCTION TO IRRIGATION WATER MANAGEMENT

The purpose of Irrigation Water Management is to facilitate the efficient use of energy and water resources by optimizing the operation of the irrigation system through the application of irrigation water management techniques.

It consists of four options that offer various approaches to irrigation water management to allow Utilities to use the techniques that are most appropriate for their circumstances:

Option I is the “Media Approach” which involves the dissemination of crop ET information through the local news media.

Option II is the “On-Site Approach” which involves the dissemination of irrigation water management information to the irrigator through an on farm visit by a qualified specialist.

Option III “Computer Based Approach” utilizes a computer linkup between consultant and irrigator to transfer irrigation scheduling information at the convenience of the irrigator.

Option IV “Utility Designed Approach” permits the Utility to offer an irrigation water management approach other than as defined in the above options in order to meet specific, unique requirements relative to the irrigators in their service territory.

An evaluation protocol is included in order to determine the impact of the WaterWise program on energy and water use. This procedure requires minimal data collection by the Utility of items such as: yearly energy use, cropping pattern, acreage, ET data, etc.

Startup and Administrative costs associated with each of the above options are eligible for Conservation and Renewable Resource Rate Discount Credits up to the maximum permitted by Bonneville's Conservation and Renewable Resource Discount Program's Implementation Policies. A recommended maximum rate discount credit for Administrative cost is specified for each option.

ITEM 18
IRRIGATION WATER MANAGEMENT - MEDIA APPROACH
OPTION I

The Media Approach involves the dissemination of crop ET information through the local news media. This can be an effective technique for water management especially for the farmer who irrigates a small acreage, and may actually be all the additional information required.

1. Eligibility

All Utilities are eligible to offer this service to irrigators in their service territory.

2. Requirements

(a) The source of ET information must be the AgriMet, CIMIS or PAWS weather station systems.
(b) At a minimum ET data must be made available to the irrigator on a weekly basis on an established interval.
(c) ET data shall be distributed from the beginning to the end of the local growing season.
(d) Distribution method may be newspaper or weekly periodical.
(e) ET data shall be published for each of the major crops grown in the area for which there is ET data available from the AgriMet, CIMIS or PAWS systems.
(f) The following information must be disseminated each time for each crop:

(1) Location for which information is supplied
(2) Starting date for the crop
(3) Daily ET rate (expressed in inches) for each day of the interval between dissemination dates.
(4) Seasonal ET to date
(5) ET for last 7 days

3. Records

The Utility must keep one copy per season of the disseminated information on file for 3 years from the end of each season that this option is offered.

4. Rate Discount Credits

Rate discount credits for Administrative costs are limited to $250.00 per year per weather station per publication per year for each growing season.

ITEM 19
IRRIGATION WATER MANAGEMENT - ON-SITE APPROACH
OPTION II

The On-Site Approach involves the dissemination of irrigation management information to the irrigator through an on-farm visit by a qualified specialist. This option includes personal contact with the irrigator to explain irrigation management in detail, which is specific to the irrigator's circumstances.

1. Eligibility

All Utilities are eligible to offer this service to irrigators meeting the following criteria:

(a) Irrigation system must serve a minimum of 15 irrigated acres but not more than 479 irrigated acres.
(b) Irrigation system must be operating during the on-farm visit.
(c) Irrigation system must use electric power from the Utility.
(d) The information required in section 2(a) of this option must be available.
(e) Irrigation system must have been operated for the full irrigation season preceding participation in this option.

2. Requirements

A site visit must be performed. This visit may be performed in conjunction with a Stage I Energy System Review or a Stage II Energy System Review.

(a) For the year of participation in this option, and for the preceding year, the following information must be furnished to the Utility. The format for submittal of this data is illustrated on the sample reporting form.

    (1) crops grown;
    (2) acreage for each crop irrigated;
    (3) annual ET data from the nearest Agrimet/CIMIS/PAWS station for each crop grown on the farm for which data is available.
    (4) location of nearest AgriMet/CIMIS/PAWS station,
    (5) annual energy usage in kilowatthours for the system.

(b) Maximum 2 years participation per farm.
(c) During the initial farm visit the specialist must provide the irrigator with a soil probe (minimum 36 inch length), or other soil sampling device approved by Bonneville used to determine soil moisture.
(d) Minimum on-site review requirements:

    (1) General (for all types of systems)

(A) Pump Characteristics
(B) Soil Characteristics
(C) Crop
(D) Acres
(E) Soil moisture using any device listed in 2(c) above

(2) Center Pivot Systems

(A) Time of revolution
(B) Application rate
(C) Pressure

(3) Other sprinkler systems

(A) Time of set
(B) Number of sprinklers
(C) nozzle sizes
(D) Pressure
(E) Application rate

(4) Flood systems

(A) flow rate
(B) length of run
(C) time of set

(e) Electrical energy use must be recorded.
(f) Minimum items of discussion with the irrigator during the initial visit are described below.

(1) Explain ET and how to use the data for irrigation scheduling;
(2) explain how to determine soil moisture content using tool(s) supplied;
(3) explain how to determine amount of irrigation water needed to refill the soil profile within the crop's root zone;
(4) explain relationship of application rate, duration of irrigation, relationship between energy/pump efficiency and irrigation efficiency, and soil moisture requirements;
(5) explain how to efficiently operate the irrigation system covering topics such as time of set, rotation speed, application rate, net application, gross application, etc.
(6) If the irrigator has not participated in a Stage I analysis, participation should be encouraged if appropriate and the contact person at the Utility should be identified.
(7) If the irrigator has participated in Stage I analysis, the benefits of Stage II if appropriate should be discussed and the contact person at the Utility should be identified.

(g) During the initial on-site visit the specialist shall furnish a written report to the Irrigator. A copy of each written report must be furnished to the Utility. The sample worksheet illustrates the minimum required information.

(h) The on-site visit must be supported by written documentation furnished to the Utility. The sample reporting form illustrates the minimum required information, which is described in section (a) of this item.

(i) During the initial on-farm visit the potential energy savings must be identified. This information must be included in the written documentation furnished to the Utility. If the potential savings identified during the initial on-farm visit exceeds 2250 kWh, then the year following the initial on-farm visit the specialist shall make a second on-site contact and submit the appropriate required documentation for each farm for which a rate discount credit was claimed for the initial visit. Upon written request, Bonneville may grant exceptions for cause.

(1) The sample worksheet illustrates the following data for identifying the potential savings for each recommendation to the irrigator:

Recommendation	**Potential Savings**	**Factor**
New nozzles	10%	0.90
New/rebuild sprinklers	5%	0.95
Flow control nozzles	5%	0.95
Pressure adjustment	3%	0.97
Fix leaks	5%	0.95
Change operating time	**1**/	**2**/

1/ For a change in operating time, potential savings expressed as a percent equals (1- factor) times 100.

2/ For a change in operating time, factor equals maximum time required to fill root zone divided by the present irrigation set time, where maximum time is calculated as readily available water (RAW) divided by net application rate. If factor is equal to or greater than 1 potential energy savings are not associated with this recommendation.

(2) To calculate the potential savings: If only one recommendation for potential energy savings is made, the corresponding factor is substituted as the "multiplier" in the following equation; if more than one recommendation is made, the corresponding factors are multiplied by each other to obtain the "multiplier" which is substituted into the following equation:

Potential savings = (1-multiplier) * hp * 0.746 * annual operating hours, where hp is the electrical horsepower of the irrigation system. Potential savings is expressed as kWh.

3. Records

The Utility must keep one copy of each written documentation furnished to support the on site visit by the specialist, as illustrated by the sample reporting form, for three (3) years from the end of each season that this option is offered.

4. Payment

Utility may receive rate discount credits for two types of administrative costs under this Option to implement Irrigation Water Management activities:

(a) A one-time rate discount credit of $1,500 for startup costs, limited to the first two (2) years that the Utility implements this Option; and
(b) Utility may request an rate discount credits for additional administrative costs under one of the methods described below:

(1) A rate credit in the amount of $225 for the first year per farm and $125 for the second year per farm, upon completion of sections 2(h) and 2(i) of this Option; or
(2) A rate credit in the amount of $175 in the first year per farm upon the initial on-farm visit, and the remaining $50 upon completion of sections 2(h) and 2(i) of this Option, and a rate credit of $75 in the second year per farm upon the initial on-farm visit, and the remaining $50 upon completion of sections 2(h) and 2(i) of this Option.

(c) A completed Schedule A (sample form provided) may be submitted at the time that a rate credit is requested. Rate discount requests may be entered in the "Admin. Cost" section of Schedule A (Stage I Activity). From the following table, enter the appropriate code (in the "Level" column) and amount (in the "$" column):

CODE	Activity Represented	Rate Credit Amount
OPII-1A	Initial on-farm visit for first year	$ 175.00
OPII-1B	Submitting required documentation	$ 50.00
OPII-1C	Combined OPII-1A & OPII-1B	$ 225.00
OPII-2A	Initial on-farm visit for second year	$ 75.00
OPII-2B	Submitting required documentation	$ 50.00
OPII-2C	Combined OPII-2A & OPII-2B	$ 125.00

ITEM 20
IRRIGATION WATER MANAGEMENT - COMPUTER BASED APPROACH OPTION III

A water management technique utilizing a computer linkup between consultant and Irrigator to transfer irrigation scheduling information at the convenience of the Irrigator.

1. Eligibility

All Utilities are eligible to offer this service to Irrigators that irrigate a minimum of 70 acres, use electric power from a Utility and for which the information in section 2(a) of this option is available.

2. Requirements

(a) For the year of participation in this option, and for the preceding year, the following information must be furnished to the Utility. The format for submittal of this data is illustrated on the sample reporting form.

(1) crops grown;
(2) acreage for each crop irrigated;
(3) annual ET data from the nearest AgriMet/CIMIS/PAWS station for each crop grown on the farm for which data is available.
(4) identify location of nearest AgriMet/CIMIS/PAWS station; and,
(5) annual energy usage in kilowatthours for the system.

(b) Soil moisture must be defined in terms of volumetric soil moisture; i.e. inches of water per foot of soil profile.
(c) Crop water requirements must be updated each weekday in the computer database, and the computer must be accessible 24 hours per day to the participants. Crop water requirements for Saturdays and Sundays must be updated the following Monday in the computer database.
(d) Crop water requirements must be determined through application of AgriMet, CIMIS, or PAWS station data.
(e) Full, complete and accurate annual irrigation season records for the purpose of verifying the number of participants and scheduled acres under this option must be submitted to the Utility in order to claim rate discount credits. These records shall include an individual record for each participating farm including at least the following information. A sample reporting form is furnished.

(1) name of farm;
(2) name of Irrigator;
(3) crops;
(4) number of acres for each crop;
(5) number of times computer system accessed;
(6) time distribution of computer access;
(7) soil moisture measurement technique.

(f) Each year, except as described in section 4 (c) of this option, the consultant must have an initial on-farm orientation (which includes baseline soil moisture determination) with the Irrigator at the beginning of the Irrigator's participation under this option. During the initial on-farm orientation the consultant must explain the irrigation scheduling system to the Irrigator. If appropriate, the consultant must discuss the WaterWise Program during the initial on-farm orientation.

(g) The consultant must verify participants' access to the computer scheduling system to verify the required minimum accessing of the computer as described in section 4(a) of this option.

3. Records

The Utility must keep a copy of each written documentation furnished to support the on-farm visit by the consultant, as illustrated by the sample reporting form, for 3 years from the end of each season this option is offered.

4. Payment

(a) All rate discount credits for Administrative costs under Option III are dependent upon the Irrigator's accessing the computer at least 10 times at a minimum interval of 5 days during the growing season for the crop(s) scheduled under this option.

Rate discount credits for Administrative costs will not be made for participation of the same farm for Option III during the year of the initial on-farm visit for Option II.

(b) Utility may receive rate discount credits for three types of Administrative costs under this Option to implement Irrigation Management activities:

(1) A one-time rate discount credit of $1,500 for startup costs, limited to the first two (2) years that the Utility implements this Option; and
(2) Utility may request additional rate discount credits for Administrative costs in accordance with sections 4 (c) and 4(d) below. The rate discount credit for the initial on-farm orientation can be made after the visit to the farm. The remainder of the rate discount credit will be based on acreage under water management.

(c) For a remote accessed computerized irrigation scheduling system without frequent on-farm soil moisture measurements, rate discount credits for Administrative costs are limited to $100 each year for an initial on-farm orientation (which includes baseline soil moisture determination) with the Irrigator plus $0.25 per acre scheduled. Each year the initial on-farm orientation must occur at the beginning of the Irrigator's participation in this scheduling approach. Each year at the beginning of the growing season for each farm participating in this option, the soil moisture must be determined using a technique such as the feel method, gravimetric sampling or other standard soil moisture measuring technique in order to establish base line soil moisture conditions for a field of each crop scheduled. After two successive years of participation in this option for which the Utility receives a rate discount credit for Administrative cost for the Irrigator affected, the requirement for an initial on-farm orientation (including the determination of baseline soil moisture) each year is optional at the discretion of the consultant and Irrigator. The rate discount credit of $100 for Administrative costs may be claimed only when an initial on-

farm orientation (which includes baseline soil moisture determination) is performed, and the appropriate documentation is submitted.

(d) For a remote accessed computerized irrigation scheduling system with frequent on farm soil moisture measurements, rate discount credits for Administrative costs are limited to $175.00 per field monitored plus $2.50 per monitored acre. An initial on-farm orientation with the Irrigator must occur at the beginning of the Irrigator's participation in this scheduling approach.

(1) Rate discount credits for Administrative costs may not be claimed for more than 1500 acres per farm participating in this irrigation scheduling approach.
(2) Throughout the irrigation season soil moisture must be measured at least weekly, and the soil moisture data supplied to the irrigator at least weekly. Soil moisture measurements shall be made by the neutron probe method or by a technique approved by Bonneville.
(3) Rate discount credits are limited to only those acres which are monitored. Monitoring requires a minimum of two soil moisture measurement sites per field being scheduled. A field is considered to be a contiguous area, containing a minimum of 70 acres irrigated by a sprinkler, drip or flood irrigation system

(e) A farm may use both of the computerized irrigation scheduling approaches described above. Although, rate discount credits for scheduled acres may not be made for the same acres under both computerized irrigation scheduling approaches.

(f) A Schedule A (sample form provided) must be submitted at the time that a rate discount credit is requested. Payments based on acreage also require the documentation described in sections 2(a) and 2(e) of this Option. Rate discount requests may be entered in the "Admin. Cost" section of Schedule A (Stage I Activity). Enter the number of acres or fields (in the "Acres" column), and from the following table, enter the appropriate code (in the "Level" column) and amount (in the "$" column):

CODE	**Activity Represented**	**Rate Discount Credit**
OPIII-1A	Initial on-farm orientation	$ 100.00
OPIII-1B	Submitting required documentation (per acre scheduled)	$ 0.25
OPIII-2A	Each monitored field (per field monitored)	$ 175.00
OPIII-2B	Submitting required documentation (per acre monitored)	$ 2.50

ITEM 21
IRRIGATION WATER MANAGEMENT - UTILITY DESIGNED APPROACH OPTION IV

In order to meet unique needs of its area, a Utility may offer a water management option of a design other than those mentioned in Items 3 through 5. This allows maximum flexibility for Utility and irrigator participation. The Utility designed option must satisfy items (a) through (g) of the following criteria and must not merely replicate Options I, II or III.

(a) Plan must be approved by Bonneville prior to implementation of the plan and before any costs are incurred.
(b) The plan must be cost effective determined using the Regional Technical Forum's methodology and assumptions. Rate Discount Credits, including administrative payments, cannot the Regional Bulk Power System Value of the energy and water saved.
(c) Verification of energy and/or water savings is mandatory. An acceptable verification plan will describe the basis of claimed energy or water savings. It will explicitly address the baseline from which savings are calculated, data requirements, adjustments, analysis algorithms and methods of determining persistence of savings. The plan will list the non-program factors that are likely to cause variation in energy use and state the method of addressing them so that they do not mask program performance. The plan must differentiate between the energy savings attributable to the "hardware program" and irrigation water management.
(d) Rate discount credits for this option is based on verified energy and/or water savings. Rate Discount Credits for energy and/or water savings will be determined in accordance with Bonneville's Conservation and Renewable Resource Rate Discount Program Implementation policies and guidelines.
(e) If any of Options I through III are incorporated into Option IV, rate discount credits may not exceed the level stated under those options.
(f) The plan must have a goal statement that describes the expected goals of the option and how they will be achieved.
(g) The plan must describe how verification data and records will be maintained.
(h) Examples of features that might be offered under Option IV are:

- aerial photography,
- infrared photography,
- infrared gun plant stress sensing.

(i) A Utility Designed Approach under Option IV may also include:

- Providing technical or other support and assistance in the development or marketing of other agricultural water management projects of regional significance.

- Other proposals for research, development and demonstration involving agricultural water use and management.

ITEM 22
IRRIGATION WATER MANAGEMENT - ENERGY AND WATER SAVINGS ASSESSMENT

Energy consumption for irrigated crops is correlated with the amount of water applied, and the amount of water applied is directly correlated to irrigation water management. Therefore, the data required for determining the effects of irrigation scheduling is the annual energy and water use and the seasonal ET data. The change in the farm's position with respect to these these values for any year compared to the baseline year is indicative of the effects of irrigation water management. The farm's position with respect to these values in not important; the important thing is the ***change*** in the farm's position with respect to these values. The change can show the result of irrigation water management.

The baseline data for the comparison is the energy use (kWh) and ET data (Agrimet/CIMIS/PAWS) for the year preceding the farmer's participation in the WaterWise irrigation water management activities. The ratio of the energy use to seasonal ET for the participation year is compared to the ratio for the baseline year. The change in the ratio of these numbers is a measurement of the impact of the irrigation water management activities on energy use.

The seasonal water requirement for a crop is proportional to the weather, crop type, and application efficiency. If any of these factors vary then the water requirement is effected. The seasonal water requirement (ET data as calculated from the Agrimet/CIMIS/PAWS system) is used instead of the seasonal water applied, because the seasonal water applied to a crop is also dependent on the irrigation water management practices of the farmer. Using ET as calculated from Agrimet/CIMIS/PAWS eliminates the effect of the irrigation water management practices of the farmer. Therefore only one (energy use) of the two variables (seasonal water requirement and energy use) used for the comparison to determine energy savings is effected by irrigation water management. Application efficiency may be assumed constant for short-term comparisons, unless the farm participates in the WaterWise program for irrigation system harware improvements. The effects of weather can be minimized by using yearly ET data from the Agrimet/CIMIS/PAWS system. The effects of yearly variations in crops and acreages are minimized by using the total seasonal water requirement in the comparison.

EXAMPLE:

Baseline year

Crop	ET	Acres	Water Requirement
A	30	1000	30,000
B	24	2200	52,800
C	28	600	16,800

Total water requirement = 99,600 ac-in

Participation year

Crop	ET	Acres	Water Requirement
A	34	1400	47,600
B	26	1700	44,200
C	30	500	15,000

Total water requirement = 106,800 ac-in

metered kWh	= 878,500	metered kWh	= 894,800
ratio	= 8.82	ratio	= 8.38

ET is the value calculated from the Agrimet/CIMIS/PAWS system, expressed in inches.

Water requirement is the product of ET multiplied by acres, expressed in acre inches.

Total water requirement is the sum of the water requirement for all crops, expressed in acre inches.

Metered kWh is the annual energy use for the farm as metered by the Utility.

Ratio is the quotient of metered kWh divided by total water requirement.

The difference between the ratios of the energy use to total water requirement (-0.44) represents a decrease of 5 percent (0.44/8.82 * 100) for the participation year compared to the baseline year. Although the total energy use is greater for the year of participation in irrigation water management activities, there is a savings when comparing energy use to the total water requirement for the mixture of crops and acreages. This is indicative of the impact of the irrigation water management activities.

Except for the Large Irrigator classification of participants, this procedure is very descriptive of the effect of irrigation water management on energy use. Limited results are achieved with some of the large irrigation systems because of the effects of varying flow requirements of the system throughout the irrigation season and the nonlinear relationship between friction loss and flow rate. However, these effects are evident primarily during the peak of the irrigation season, when ET demand is the greatest. Irrigation water management practices will have the least impact at this time because the maximum demand requirement is the design criteria for most systems. The opportunity for energy and water savings from improved irrigation water management pratices usually exists during the early and later parts of the irrigation season when ET demand does not require continuous maximum flow rates. Therefore, the above described method for determining the impact of irrigation management practices is still applicable within reasonable limits, depending on the complexity of the system.

ITEM 23

COMPLETED UNIT

For purposes of Bonneville's Conservation and Renewable Resource Rate Discount Program, a Completed Unit of Irrigation Conservation is a completed Stage II Installation in the Irrigation System Improvement portion of the WaterWise Program specification or Option II or Option III of the irrigation water management portion of the WaterWise Program specifications.

Energy Savings Terminology

For the purpose of this WaterWise Program, the following terms are defined:

(a) “Verified” means the measured Energy Savings determined by performing a Stage II Energy Review in accordance with these specifications.

(b) “Estimated Energy Savings” means the apparent savings for Option II and Option III of irrigation water management participants based on the appropriate metering and assessment procedure as described in these specifications.

Completed Unit Energy Savings

Completed Units will be attributed Energy Savings pursuant to the evaluation protocols set forth in these specification and by the Regional Technical Forum.

Part II
Administrative Costs

To be determined through Bonneville’s process

Part III
Rate Discount Credits

To be determined through Bonneville’s process

Part IV
Program Records

To be determined through Bonneville’s process

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