LINING OF THE ALAMO MAIN CANAL USING IMPERMEABLE LINER AND RETROFIT OF ITS EXISTING CHECK GATE STRUCTURES TO ATTEAIN REAL TIME CANAL CONTROL TO CONSERVE WATER AND ENERGY, AND SOLAR POWER PROJECT

January 22, 2015

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Alamo Main Canal Head Gate (Station 0+00) viewed from the North.

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1. EXECUTIVE SUMMARY

The Hidalgo County Irrigation District No.2 is located in the Lower Rio Grande Valley within the south-central portion of Hidalgo County, Texas; refer to the District's General Location Map Figure 1. The District is a member of Rio Grande Regional Water Authority (RGRWA) and was a cost share partner in the 2013 Lower Rio Grande Basin Study sponsored by the Bureau of Reclamation and RGRWA.

The Alamo Main Canal begins at 1.3 miles South of U.S. Highway 83 (Business 83) and one quarter of a mile East of Nebraska Ave. in the City of San Juan Texas; refer to the project location map **Figure 3**. The Alamo Main Canal is the District's primary facility used to convey water to the Northeast quadrant of the District. Water conveyed by the Alamo Main Canal is used to irrigate 9,507 acres of farmland. The canal is also used to deliver 4,327 acre-ft of raw water for municipal use. The interior side slopes of the earthen canal embankment are paved with a concrete apron that is in deteriorated state.

The District proposes to line the Alamo Main Canal with impermeable liner to reduce water losses to seepage and blowouts. Secondly, the District proposes to automate the Alamo Main Canal to operate it in real time **and ultimately conserve water and energy.** Thirdly, the District proposes to invest in **renewable energy** to power a metal building proposed for construction at the District's yard in San Juan, TX. The District proposes to install a 20 KW photovoltaic array system (solar panels) on the roof of a warehouse metal building and anticipates to place into the power grid **20,461 KWH / YR**. Project funds will be utilized to obtain the materials and equipment. The District proposal contributes to accomplish the goals of the FOA Section III.B criteria by achieving water conservation, implementing the use of renewable energy, increasing energy efficiency in water management, benefitting endangered species, and it will make water available to meet water supply needs.

The estimated project duration is **1,095** calendar days with completion date of December 2017. The project will be split in three phases. The total estimated project cost (all three phases) is **$5,422,701.78.** The District seeks approval of FY 2015 FOA R15AS00002 **under Section II.B Funding Group II**, and has capability to commit 81.6% of the of total project cost using funds from the District's Capital Improvements Fund. The District projects to utilize $500,000.00 from grant monies in FY 2015, $250,000.00 in FY 2016, and the remaining $250,000.00 in FY 2017.

The project is located within the District's right of way and complies with all environmental and cultural resources requirements.

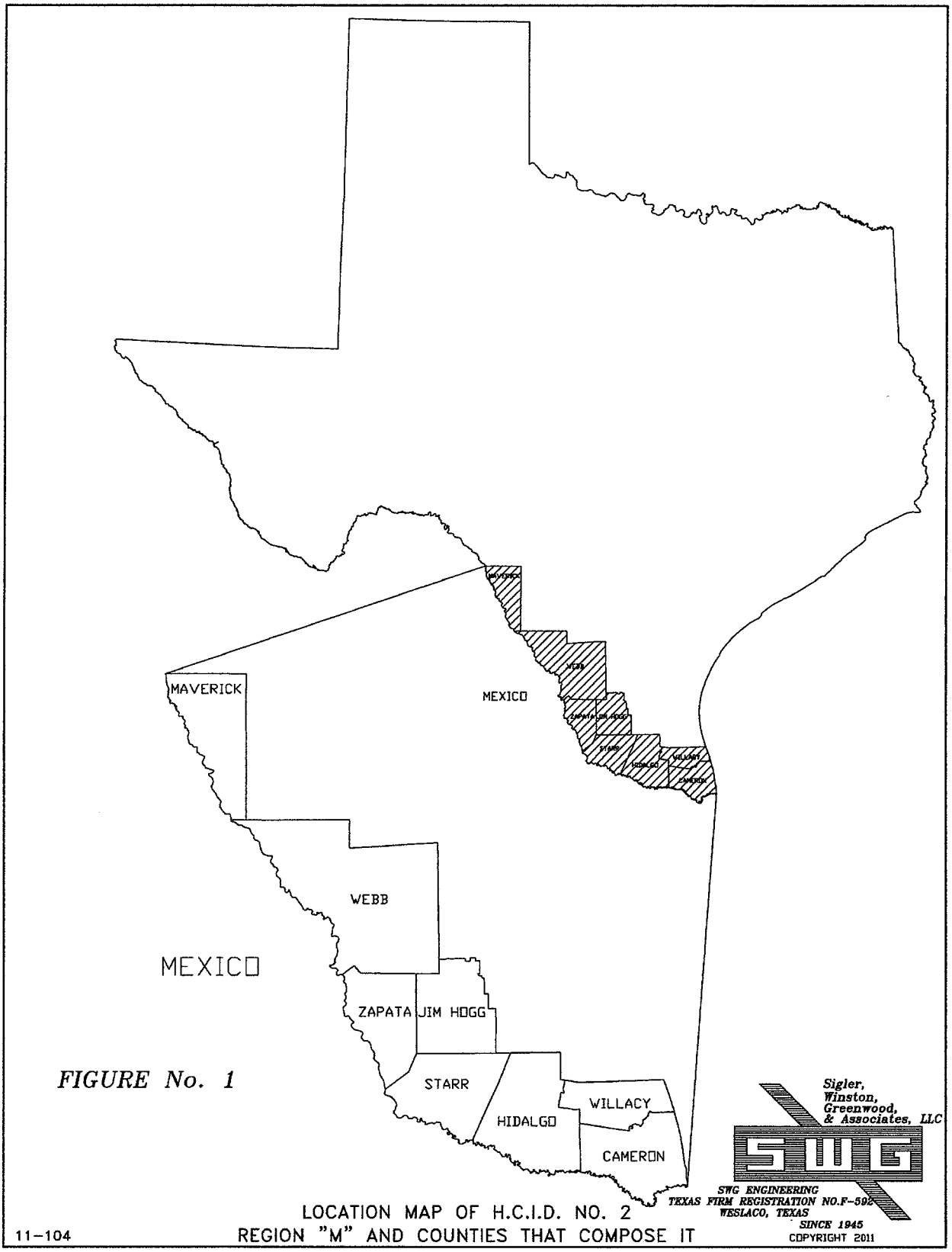


FIGURE No. 1

LOCATION MAP OF H.C.I.D. NO. 2
REGION "M" AND COUNTIES THAT COMPOSE IT

11-104

2. BACKGROUND DATA

The Hidalgo County Irrigation District No.2 (District) was created in 1920 under the laws of the State of Texas. The District is located in the Lower Rio Grande Valley within the south-central portion of the Hidalgo County, Texas; refer to the Districts General Location Map **Figure 1.** Hidalgo County is one of the eight counties within the Rio Grande Regional Water Planning Group (also known as Region M). Region M is one of sixteen (16) local bodies established by the State of Texas under Senate Bill No. 1 (SB 1) to coordinate long term water supply planning; **Figure 1** provides the map of Region M. The District encloses approximately 71,000 gross acres of land around the cities of Pharr, San Juan, and Alamo Texas; refer to **Figure 2.** The City of McAllen encroaches the western edge of the District and the City of Edinburg encroaches the northwestern edge.

The District holds water rights to divert from the Rio Grande 137,775 ac-ft per year for irrigation purposes, and 12,732 ac-ft per year for domestic, municipal, and industrial (dmi) use.

In addition, the District holds 6,140 ac-ft per year of dmi water rights for the City of McAllen, 4,710 ac-ft per year of dmi water rights for the City of Pharr, 2,030 ac-ft per year of dmi water rights for the City of San Juan, and 1,202 ac-ft per year of dmi water rights for the City of Alamo.

The District also contracts with the City of McAllen, City of Pharr, City of San Juan, City of Alamo, City of Edinburg, and the North Alamo Water Supply Corporation, a rural water supplier, to deliver raw water for dmi use.

The District currently serves 39,731 acres of farmland and has 1,399 active irrigation accounts. The current annual irrigation water demand is 50,231 ac-ft per year. The current annual domestic, municipal, and industrial water demand is 28,044 ac-ft. The District projects a slow decrease in the demand of irrigation water due to the continuous conversion of farmland to residential, commercial, and/or industrial development within the District's boundaries. The projected irrigation water demand by 2020 is 45,062 ac-ft per year. The population of the Rio Grande Valley is projected to triple over the next 50 years; therefore, the District projects an increase in the demand of raw water for municipal and industrial use. The projected municipal and industrial water demand by 2020 is 34,480 ac- ft per year.

Water rights for the Lower Rio Grande were adjudicated by the State of Texas in the late 1960's to domestic, municipal, industrial, and agricultural users. Year round, surface water from the Rio Grande is high in demand for domestic, municipal, industries and irrigation (agriculture) use. The surface water from the Rio Grande is always in **potential for shortfall**. In the mid 1990's, and again in 2011 through the present, the State of Texas suffered a state wide drought. As an alternative to surface water, the municipalities of the Rio Grande Valley became interested in ground water. For the most, ground water in the Rio Grande Valley is brackish. Few municipalities in the Rio Grande Valley have access to a good source of ground water. Some municipalities have been able to make use of the brackish water by blending it with surface water to meet the regulating body requirements for drinking water. Though this practice is only performed to meet the seasonal high demands (summer months). Based on Region M's Regional Water Plan, copy of which can be obtained from http://www.riograndewaterplan.org, the population within Region M is projected to triple by 2060. Therefore, the surface water from the Rio Grande will continue to be in potential for shortfall for years to come.

The primary use of the District's water is for agriculture (irrigation) use. The main crops grown within the District consist of citrus (grapefruit and oranges), sugarcane, cotton, grain sorghum, vegetables (cabbage, onions, and carrots), and pasture.

The District's major facilities consist of the following:

River Pumping Plant
Re-Lift Pumping Plant
Unit I – 7 Booster Pump Station
334.9 acre (1,800 acre – foot) Settling Basin
21 miles of lined canals
46 miles of earthen canals
225 miles of pipelines
74 miles of drainage ditches
85 miles of drainage pipelines

The District delivers, an annual volume of 26,832 ac - ft., thru the Alamo Main Canal. The District uses an average of 3.9 MKW-HR / YR of electric power from the grid to deliver water to the Alamo Main Canal. Water is lifted at two locations before it reaches the Alamo Main Canal. First, water is lifted from the Rio Grande at the River Pumping Plant thence at the Re-Lift Pumping Plant located at approximately 700 feet South of El Rancho Ave on the East side of 2nd Street in McAllen, TX.

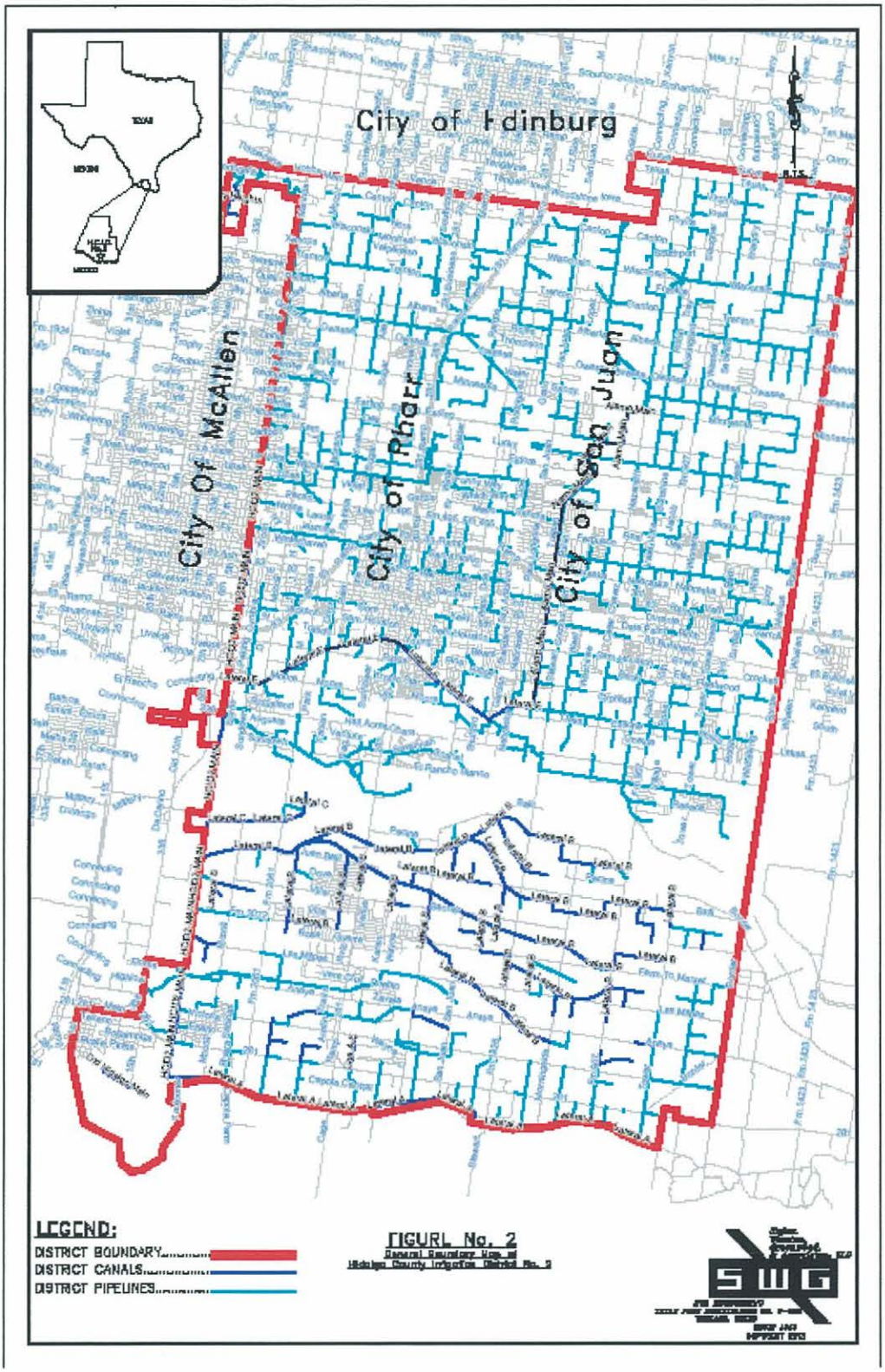
Hereby the District submits for consideration under Funding Group II the following proposal:

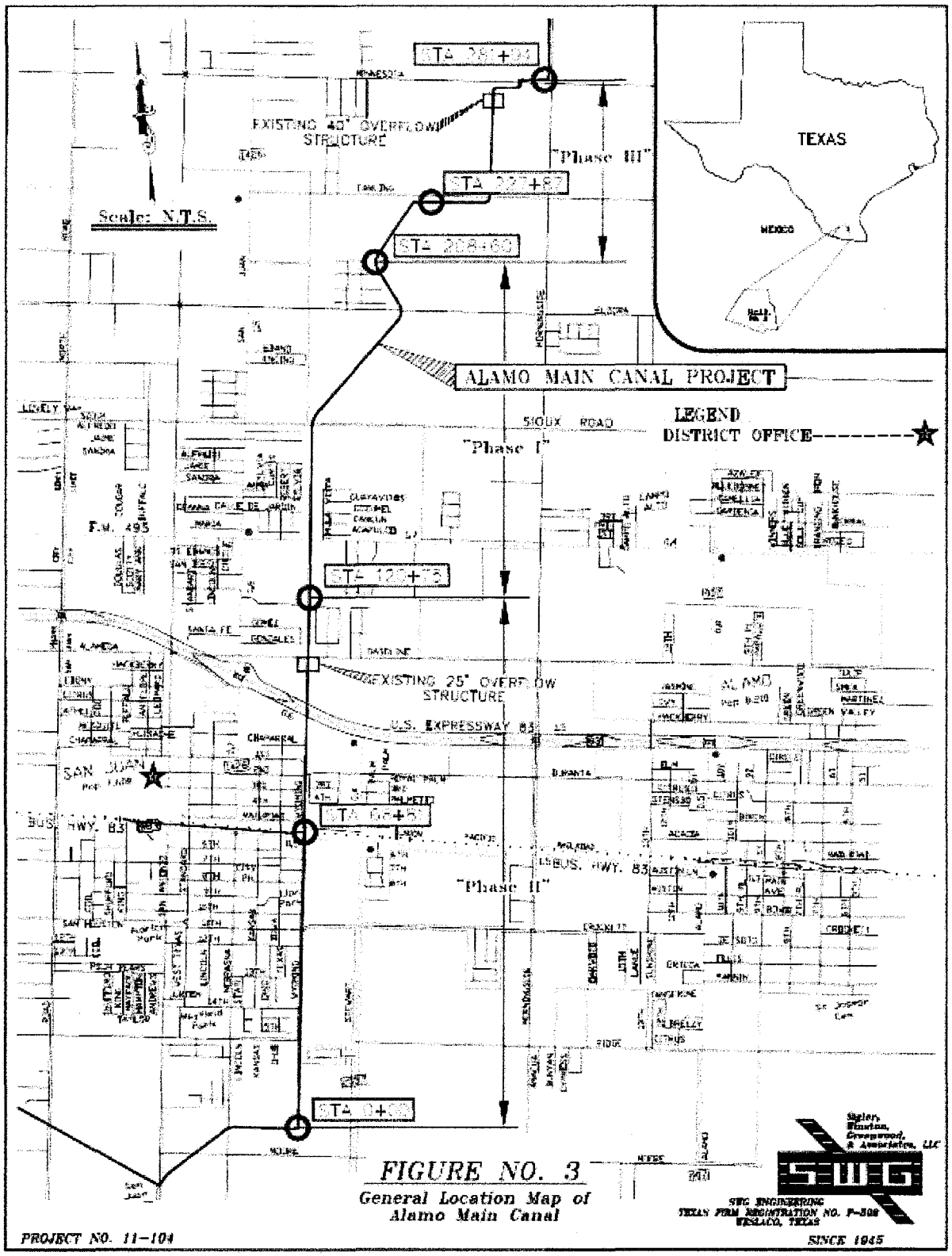
I. The District proposes to line the Alamo Main Canal with impermeable liner to reduce water losses to seepage. The District estimates **836 ac – ft** of water will be conserved (saved) by lining the canal which will translate into **120,384 KW-HR / YR** of electrical power not needed from the grid to lift and deliver the conserved water into the Alamo Main Canal.

II. The District proposes to automate the Alamo Main Canal to operate it in real time. The District currently operates the Alamo Main Canal manually. The District's canal operator travels the canal several times a day to adjust the manual slide check gates; therefore, the current source of energy needed to operate the facility comes from fossil fuel (gasoline) used by the operator's vehicle. The District estimates **1,185 ac – ft** of water will be conserved (saved) by changing to real time operation which will translate into **170,640 KW-HR / YR** of electrical power not needed from the grid to lift and deliver the conserved water into the Alamo Main Canal. In addition, the **District proposes to utilize renewable energy to power the automated field equipment** consisting of overshot gates also known as flume gates, flowmeters, SCADA, radios, water level sensors, and other field instrumentation required to operate the canal in real time. The District estimates it will consume **2,198 KWH / YR of renewable energy to power the automated field equipment.**

III. The District proposes to utilize **renewable energy** to provide power to a warehouse metal building proposed for construction at the District's yard in San Juan, TX. The District commits to utilize a Sixty Five Thousand Dollar ($65,000.00) allowance for turnkey installation of a 20 KW photovoltaic array system (solar panels) on the roof of the proposed metal building. The District estimates to **produce 27,469 KWH / YR** from a 68 ft X 22 ft exposure area made with eighty (80) solar panels. **20,461 KWH / YR** of surplus power produced by the solar panels will be placed into the electrical power grid.

The District's schedule is to complete all the project components in three years beginning during the 2015 Fiscal Year and ending during the 2017 Fiscal Year. The photovoltaic array (solar panels) project is scheduled for the 2015 Fiscal Year. The Alamo Main Canal Improvements, summarized above, will take place in three phases as illustrated by Figure 3 and outlined in Section 16 Project Budget.


City of Edinburg
City Of McAllen
City of Rhar
City of San Juan
LEGEND:
DISTRICT BOUNDARY
DISTRICT CANALS
DISTRICT PIPELINES
FIGURE No. 2
SWG


TEXAS
MEXICO
Scale: N.T.S.
EXISTING 40" OVERFLOW STRUCTURE
"Phase III"
ALAMO MAIN CANAL PROJECT
LEGEND
DISTRICT OFFICE
SIOUX ROAD
"Phase I"
F.M. 495
EXISTING 25" OVERFLOW STRUCTURE
U.S. EXPRESSWAY 83
SAN JUAN
BUS. HWY. 83
"Phase II"
ALAMO
FIGURE NO. 3
General Location Map of Alamo Main Canal
PROJECT NO. 11-104
SINCE 1945

The District has had the opportunity in the past to work with the U.S. Bureau of Reclamation and firmly believes the District's proposal is eligible and satisfies all criteria established under Sections III.B.1 Task A- Water Conservation, III.B.2 Task B – Energy-Water Nexus, III.B.3 Task C – Benefits to Endangered Species, and III.B.4 Task D – Water Markets, all under Funding Group II. Below is a list of the most recent projects on which the District has had the opportunity to work together with the U.S. Bureau of Reclamation.

Project Name	Status	Project Description
River Pump Station	Completed in 1983	Construction of the River Pump Station.
Wisconsin Canal Improvements	Completed in 2004	Replacement of the open canal with a 48" r.c.p. with flexible joints.
Re-lining of Lateral A Canal	Completed in 2005	Relining of the canal using 8-20-8 geocomposite liner covered with 3" of shotcrete.
Replacement of Unit I – 18	Completed in 2008	Replacement of an existing concrete mortar joint pipe-line with r.c.p. w/ flex-joints.
Rehabilitation of the Lateral E Canal	Completed in 2012	Replacement of the existing check gates with integrated Rubicon Flume ™ Gates to operate the canal facility in real time.
Rehabilitation of the Lateral A Canal	Completed in 2013	Replacement of the existing check gates with integrated Rubicon Flume ™ Gates to operate the canal facility in real time.

3. TECHNICAL PROJECT DESCRIPTION

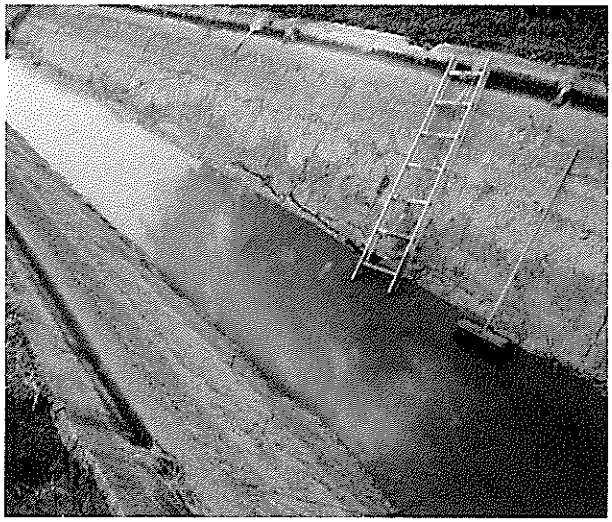
3.1 Lining of the Canal with Impermeable Liner

The Alamo Main Canal begins at approximately 1.3 miles South of U.S. Highway 83 (Business 83) and at approximately a quarter of a mile East of Nebraska Avenue in the City of San Juan Texas; refer to project location map **Figure 3**. The Alamo Main Canal was constructed utilizing the insitu earthen material located adjacent to it. Based on the Soil Survey Book of Hidalgo County, the native soils used in the construction of the canal embankments mainly consist of Sandy Clay Loam with a permeability ratio of 0.6 to 2.0 in/hr. Concrete liner was added to its interior side slopes and bottom at a later date. The concrete liner has reached its service life and is currently found in deteriorated condition; refer to picture 1. Horizontal cracks in the concrete liner stretch form the beginning of the canal at Station 0+00 to the end of canal at Station 281+94. Water leaks through the cracks thence seeps through the earthen embankments.

Of more concern is the damage created by water scouring. In some segments of the canal, water scours behind the concrete liner creating a cavity in the earthen embankment. With time, water eventually erodes through the canal embankment to create an orifice or canal rupture. In recent years the District has been forced to interrupt service two times per year to repair canal ruptures also known as canal blowouts; refer to picture 3. The canal has to be emptied from Station 0+00 to Station 281+94 for the repair crew to safely perform repairs. The most recent canal blowout occurred on December 4th, 2013; pictures are available upon request. In the next page are a few pictures that clearly reflect the condition of the existing concrete liner. It is estimated that the District loses **75 ac-ft** of water to canal blowouts.

The District proposes to line the canal using **Canal 3 ® 8-20-8 geosynthetic membrane geocomposite** manufactured by Huesker or equal. The geosyntetic membrane geocomposite consists of a top 8 oz polypropylene nonwoven geotextile bonded to 20-mils of a polyethylene geomembrane bonded to a bottom 8 oz polyester nonwoven geotextile. The top nonwoven polypropylene textile provides puncture resistance and the bottom 8 oz polyester nonwoven textile provides increased interface friction for improved adhesion to the existing canal surface. The existing concrete liner will be power washed and cleaned. Broken concrete liner sections and orifices will be patched to provide an even surface. The geocomposite liner will be installed over the cleaned exiting concrete liner and then covered with three (3) inches of fibrous reinforced shotcrete to secure it in place; **refer to Figure 4A.** Control joints will be constructed at every 10 feet, and expansion joints at every 100 feet. Minimum steel reinforcement will be required in some areas. The shotcrete cover will protect the geocomposite from sharp objects and U.V. lighting. **The expected service life of the geosynthetic membrane geocomposite liner is fifty (50) years.** By lining the canal with **Canal 3 ® 8-20-8 geosynthetic membrane geocomposite (impermeable liner)**, the District will conserve water by significantly reducing seepage and the potential for blowouts. Water conserved will translate into energy savings by reduced pumping. The District has used **Canal 3 ® 8-20-8 geosynthetic membrane geocomposite** in the same manner with excellent results. In 2004, the District lined the Lateral A Canal with **Canal 3 ® 8-20-8 geosynthetic membrane geocomposite** .

Picture 1. Visible horizontal cracks just North of FM 495.



Picture 2 Left bottom of ladder - Visible Orifice.

Picture 3 Repair of Canal Blowout.

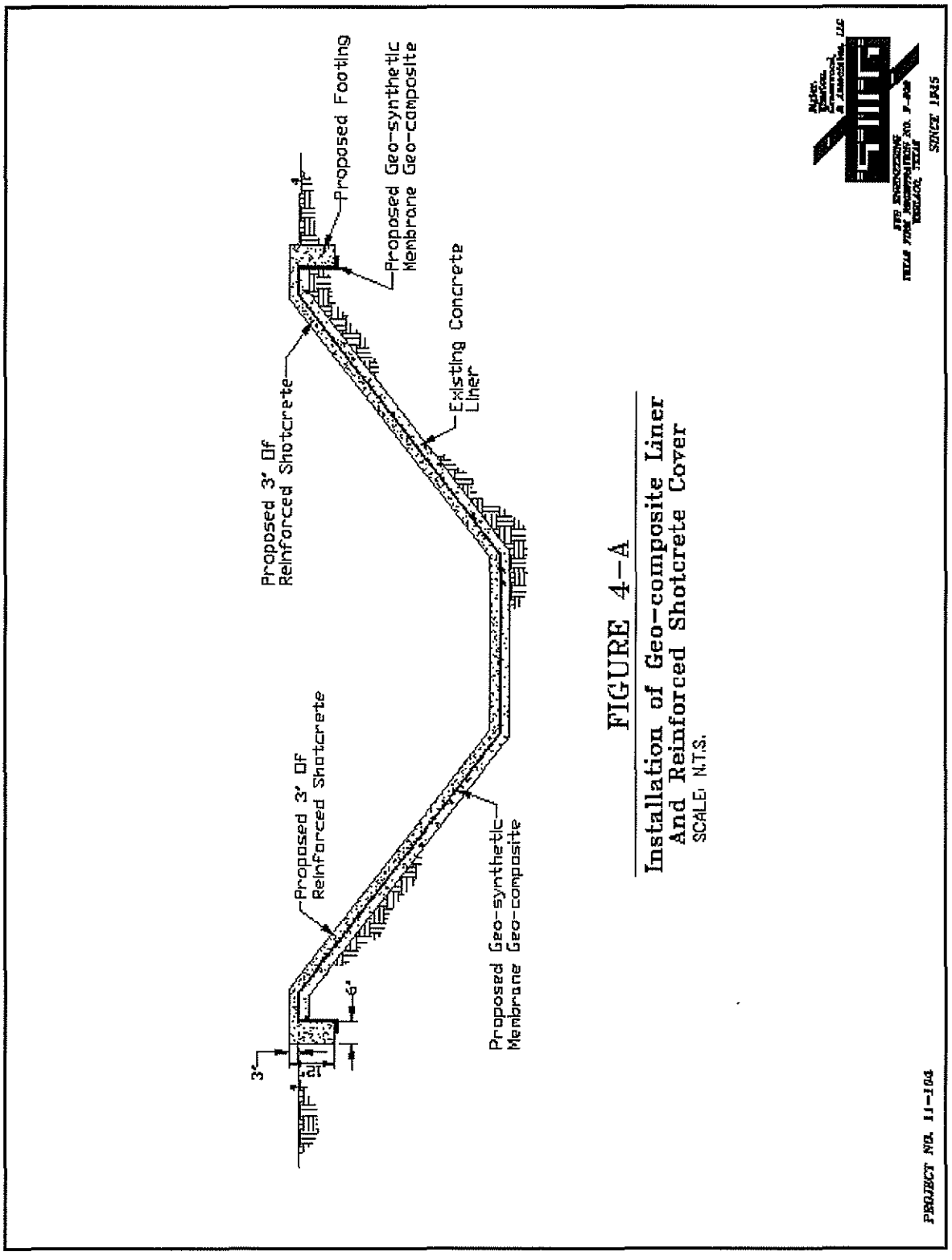


FIGURE 4-A

Installation of Geo-composite Liner And Reinforced Shotcrete Cover

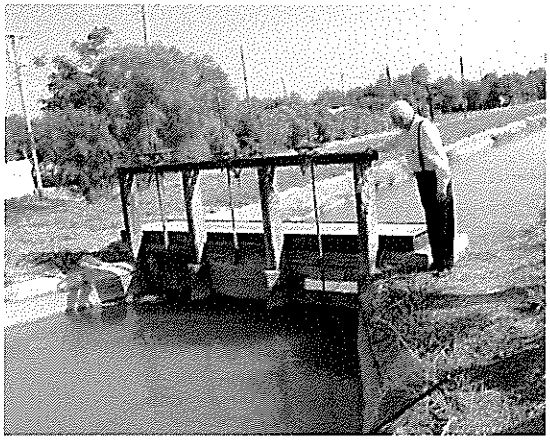
SCALE: N.T.S.

3.2 Canal Automation & Replacement of the Existing Slide Check Gates and Add Flowmeters

Another source of significant water losses rests in the operational method and existing manual slide check gates. The canal operator maintains the canal sections at the highest operational level possible thereby maintaining the highest volume of water available in each section (pool) to meet the variable demands. The canal operator travels the canal several times a day to adjust manually the slide check gates up or down to either lower or raise the water surface elevation of the canal sections (pools). The operator lags behind the demand and makes adjustments to the presented conditions resulting in an inefficient operation with some of the canal sections overflowing while other sections lowering below the operational level.

The existing canal check gate structures were field surveyed recently and each was assigned a field station beginning with Station 0+00 at the Main Head Gate. **Figure 3** provides the location of each of the canal's check gate structures with corresponding field station. **The District proposes to improve the operation of the canal from the Main Head Gate (Station 0+00) to Station 281+94; a segment equivalent to 28,148 linear feet. The proposal consist of replacing the existing check gates at Station 68+81, 120+75, 208+60, and 227+87 using fully integrated Rubicon FlumeGate ™ or equal, add two (2) 42" flowmeters SlipMeter ™ or equal at Station 120+75, add two (2) 42" flowmeters SlipMeter ™ or equal at Station 281+94, and add hardware, software, and SCADA to operate the system in real time and ultimately conserve water and energy. Pictures of current condition of Station 68+81 and Station 120+75 can be found below.** At Station 120+75, one flowmeter will be installed at the I-22 turnout and the other at the I-7 turnout. At Station 281+94, one flowmeter will be installed at the West Canal turnout and the other at a 60 inch pipe at the end of the canal system.

The District proposes selection of the fully integrated Rubicon FlumeGate ™ and **SlipMeter ™** since this a complete package offered by the Rubicon Water Company that includes all components as the hardware, software, SCADA package, radios, tower, antennas, solar panels, aluminum walkways, and all necessary equipment to **operate the gates and flowmeters remotely from the District's Office in real time. Upgrading the Alamo Main Canal system to operate in real time** will allow the District to conserve water by reducing significantly overflow spillage resulting in energy savings by reduced pumping and by reduced driving currently needed to manually adjust each gate.



Station 68+81

Station 120+75

The proposed fully integrated Rubicon FlumeGate ™ will be constructed of high quality marine grade aluminum with expected forty (40) years service life. The gates will be equipped with a programmable logic controller (PLC), water level sensors in the upstream side of the gate, and SCADA instrumentation to be remotely operated. The fully integrated flume gates will also be able to measure flow and to communicate to each other. The gates will have capability to self adjust to meet a targeted performance whether it be flow or water elevation. The FlumeGate ™ will be provided from factory with one 12 Volt DC deep cycling battery pack, and an integral 16 foot tall aluminum mast to support an **85 Watt solar panel** that will charge the batteries and the SCADA radio antennal. **Figure 5** provides a generic detail of the proposed actuated flume gates.

The implementation of modern equipment as the one offered by Rubicon Water into the District's canal operation improves the efficiencies in the distribution and application of the water. The SCADA instrumentation will allow the operator to remotely set the flows at each gate, or position the gate to maintain the level in the upstream side of the gate structure at a specified level. **In automatic control, the gates will self adjust to meet a target performance, either at a set flow or a water level.** Each gate will release a flow to maintain the level of the pool downstream by continually reading the next gate's upstream level. As water is taken from a pool through a turnout, it is replenished from the pool upstream. In this manner, only the total demand from each pool is drawn through the head gate(s). The gates will be equipped with highly accurate level sensors and **gate position motors that will enable the gate to reliably and accurately measure the flows through the gate**. The sensitive controls will allow each pool to be maintained at the highest operational level thereby maintaining the highest volume of water available in each pool to meet the variable demands.
The main operation center is located at the District's Main Office where a radio, tower, antenna, PC workstation, network gateway, and license software are already installed. Flow and water surface elevations will be transmitted to the PC workstation. The data will be available real time and will be saved electronically. From the main operation center, the District will have capability of adjusting the gates to deliver a specific flow, or set these to operate the canal pools at specific water surface elevations, **and monitor the operation of the canal system overall**.

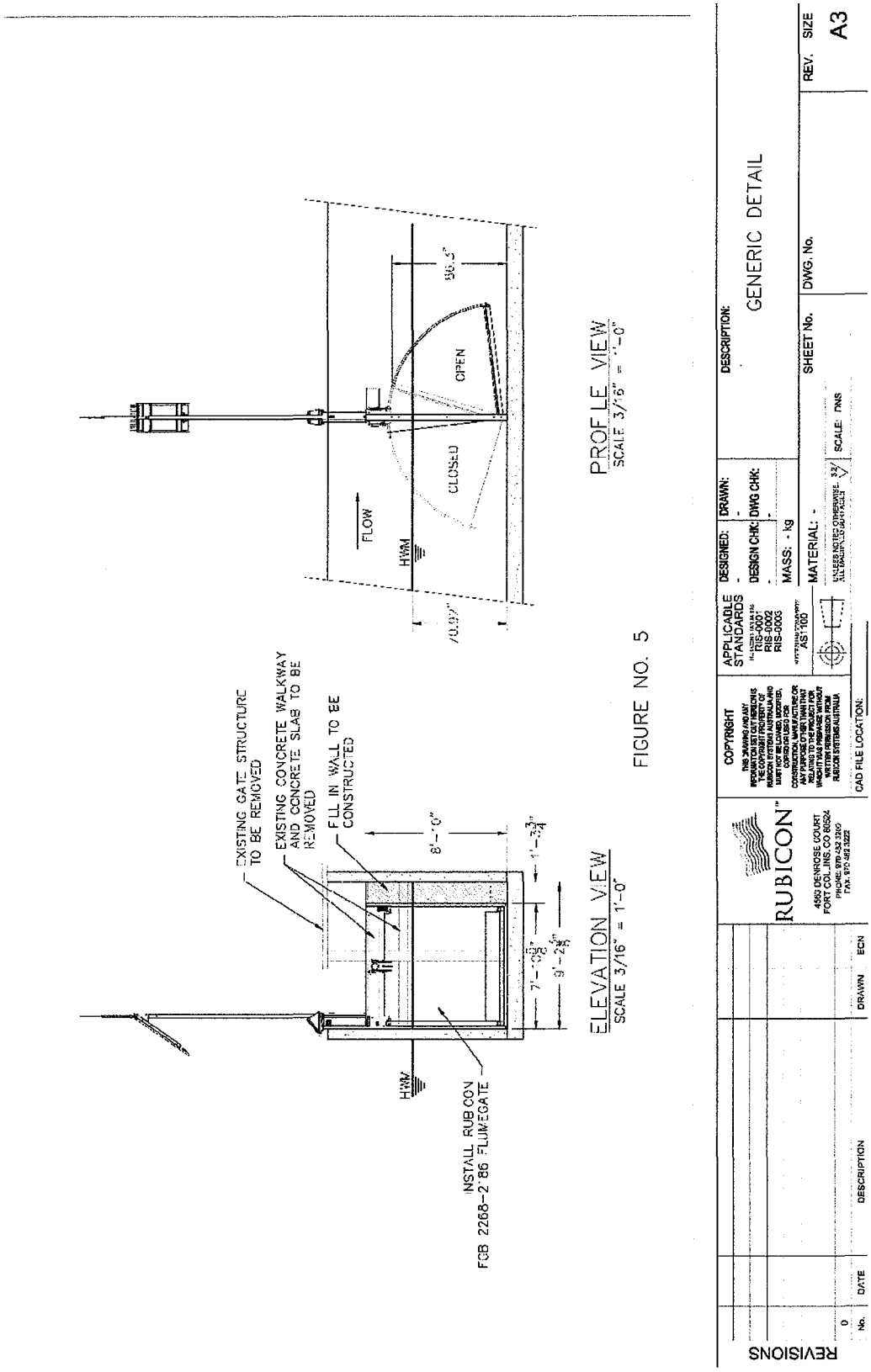
Improvements will be required to install the new actuated flume gates. Improvements will mainly consist of removing the existing check gates, demolishing the existing reinforced concrete gate structures, and construct new reinforced concrete gate structures. The new reinforced concrete gate structures will provide structural support for the proposed actuated flume gates. The frame of the new gate will be epoxy anchored to the new reinforced concrete gate structure. A manual slide gate will be provided to bypass the automated gate only in case of malfunctioning. The manual gate will remain closed during normal operation. **Figure 5** provides a generic detail of the proposed improvements.

The SlipMeter ™ is also manufactured by Rubicon Water. It consists of a self contained slip gate with a meter box installed in the upstream side of the gate. It is also constructed of high quality marine grade aluminum with expected forty (40) years service life. The SlipMeter ™ uses an acoustic array as main component to measure flow, which is accurate at high and very low flow rates. This capability provides flexibility for the District to service all crop types. The SlipMeter ™ can be remotely pre-set to turn on and off automatically to deliver a constant and accurately measured flow rate and volume. The SlipMeters ™ will have capability to self adjust to meet a targeted performance whether it be flow or volume. The SlipMeters ™ will be provided from factory with one 12 Volt DC deep cycling battery

pack, and an integral 16 foot tall aluminum mast to support an **85 Watt solar panel** that will charge the batteries and the SCADA radio antennal. **Figure 6** provides a generic detail of the proposed SlipMeters.

The SlipMeter ™ will also be controlled from the main operation center. The flow will be transmitted to the PC workstation. The data will be available real time and will be saved electronically. From the main operation center, the District will have capability of adjusting the SlipMeter ™ to deliver a specific flow, or a specific volume. Improvements needed to install the SlipMeters ™ will mainly consist of removing the existing slide gate at the specific turnout, remove the concrete apron and excavate the inner side slope of the canal to cast in place a reinforced concrete headwall for the SlipMeters ™. The frame of the SlipMeters ™ will be epoxy anchored to the new reinforced concrete headwall. **Figure 6** provides a generic detail of the proposed improvements.

The District will maintain the canal facility operating while construction work takes place. The work area will be isolated with cofferdams, and bypassed with pump units. The District will procure construction services and award the contract to the qualified bidder who submits the most competitive bid price. The District will turn the canal to the contractor during the low demands beginning in late July and ending in December.


EXISTING GATE STRUCTURE TO BE REMOVED
EXISTING CONCRETE WALKWAY AND CONCRETE SLAB TO BE REMOVED
FILL IN WALL TO BE CONSTRUCTED
INSTALL RUBICON FGB 2268-2'86 FLUMEGATE
HWM
FLOW
CLOSED
OPEN
ELEVATION VIEW
SCALE 3/16" = 1'-0"
PROFILE VIEW
SCALE 3/16" = 1'-0"
FIGURE NO. 5
RUBICON
GENERIC DETAIL
A3

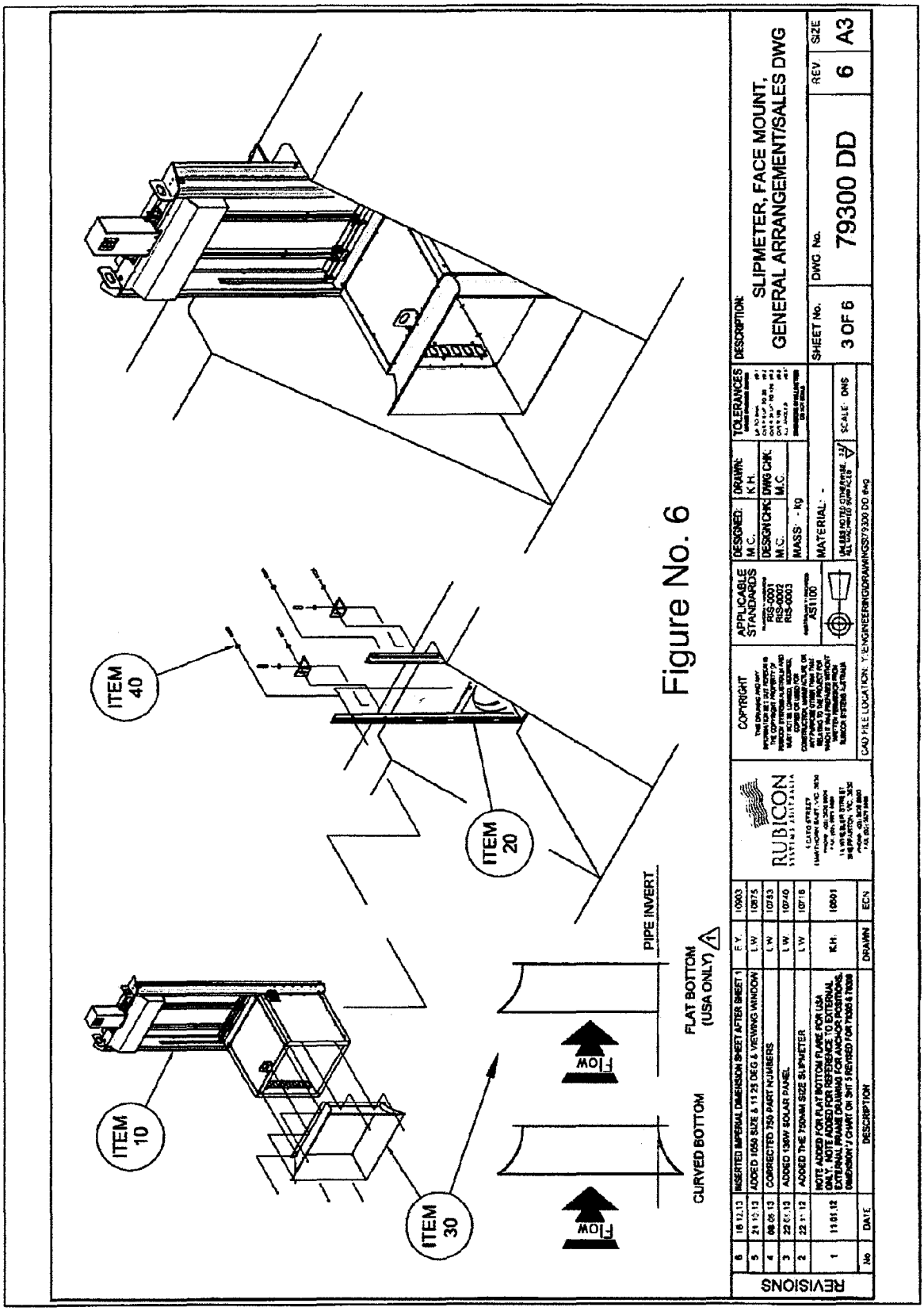

ITEM 10
ITEM 20
ITEM 30
ITEM 40
FLOW
FLOW
PIPE INVERT
FLAT BOTTOM (USA ONLY)
CURVED BOTTOM
SLIPMETER, FACE MOUNT, GENERAL ARRANGEMENT/SALES DWG
79300 DD
SHEET No. 3 OF 6
SIZE A3
REVISIONS
RUBICON

Figure No. 6

4. EVALUATION CRITERION A: WATER CONSERVATION

Subcriterion No. A.1 Quantifiable Water Savings

A.1 (1) Lining of the Canal with Impermeable Liner
Excessive seepage is occurring through the cracked concrete lining. Ponding tests conducted by The Irrigation Technology Center, Texas A&M University System (ITC) show results from three different tests at three separate locations on the North Alamo Main (http://idea.tamu.edu/documents/2004/tr324.pdf) .

The losses reported range from .55 to 2.05 Gal./ft.^{2}/day. The soil under test location SJ 9 (Sta 242+20 to 265+65) consists of Raymondville clay loam and a Hidalgo sandy clay loam. The soil underlying test sites SJ11 (183+80 to 192+60) and SJ 10 (Sta 160+35 to 183+80) consist of Hidalgo Sandy Clay loam. These are the two predominate soil types in the area where the canal is located. The seepage test results vary greatly between the tests locations. Dr. Guy Fipps[1] states *"We found a clear relation between the overall condition rating of concrete lined canals and measured seepage loss rate".*

The loss in the report listed includes evaporation and turnout gate losses. The District will adjust all slide gates at each turnout to reduce the losses. These improvements are included in the project budget. As part of this project, turnout gates that are no longer in service will be eliminated and the remainder will be rehabilitated. For the purpose of calculating water loss, we will take a composite average of the seepage test and remove the evaporation loss.

Test ID	Approx. Station Nos.	Wetted Perimeter (ft)	Test Segment Length (ft)	Submerged Surface Area (ft^2)	Evap Loss (gal/day)	Total Loss (gal/day)	Actual Seepage Rate (gal/ft^2/day)
SJ9	242+20 to 265+65	16.75	2,426	40,636	877	82426	2.03
SJ10	183+80 to 192+60	18.0	880	15,840	402	8,627	0.55
SJ11	160+35 to 183+80	16.0	2,345	37,520	767	19,869	0.53
Total			5,651	93,996	2,046	110,922	**1.18**

[1] Fipps, Guy. 2000. Potential Water Savings in Irrigated Agriculture for the Rio Grande Planning Region (Region M). Final Report. Texas Agricultural Extension Service, Texas Agricultural Experiment Station, Texas A&M University System. December 22..

Canal Station	Wetted Perimeter (ft)	Distance (ft)	Seepage rate Gal/ft^2/day	Loss Gal/day	Loss ac-ft/yr
0+00 to 120+75	25	12,075	1.18	356,212	399
120+75 to281+94	17	16,119	1.18	323,347	362
Total					761

Water to be saved by lining the canal with an impermeable liner is 761 **ac-ft / yr.** The actual seepage occurring is most likely higher than this volume. The District Manager estimates that this amount could be increased by (5%) due to the deterioration of the canal lining since the seepage test.

Additional losses are incurred when the canal ruptures. The District empties the canal to conduct repair work when the canal ruptures. The canal has an average wetted perimeter of 25 feet from Station 0+00 to Station 120+75 and 17 feet downstream Station 120+75.

Water Lost to Canal Ruptures is calculated as follows:

Station	Wetted Perimeter, Ft	Water X-Sect, SF	Average X-Sect, SF	Segment Length, Ft	Volume, CF	Vol. ac-ft
Downstream 0+00	25	57				
Upstream 68+81	25	85	71	6,881	488,551	11
Downstream 68+81	25	80				
Upstream 120+75	25	93	86.5	5,194	449,281	10
Downstream 120+75	17	34				
Upstream 208+60	17	60	47	8,785	412,895	9
Downstream 208+60	17	36				
Upstream 227+87	17	40	38	1,927	73,226	2
Downstream 227+87	17	36				
Upstream 281+94	17	39	37.5	5,407	202,763	5

Total Estimated Volume Lost per Canal Rupture 37

***Total Estimated Volume Lost per Year to Canal Ruptures 75**

*Based on two canal ruptures per year.

Total Volume of Water to be Saved by Lining the Canal with an impermeable liner is = 761 + 75 = **836 ac – ft / year**

The District's average annual water pumped form the Rio Grande over the past five years is 50,231 acre feet. The water to be saved by lining the Alamo Main Canal with an impermeable liner is lost to

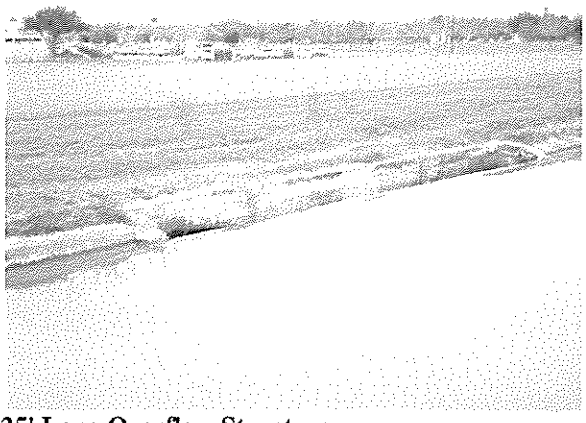
seepage into the ground and is captured by drains to flow into the Laguna Madre. The conserved water that is not marketed will remain in the Falcon Lake and Amistad Reservoir System.

The expected post project seepage/leakage losses are 6 to 10% maximum or equivalent maximum of **84 ac – ft / yr**. This estimate comes from previous performance of a similar project. The results are based on actual ponding test conducted by The Irrigation Technology Center, Texas A&M University System (ITC) in the Lateral A Canal after it was lined with **Canal 3 ® 8-20-8 geosynthetic membrane geocomposite.** This information can be obtained from a report titled "Evaluation of Canal Lining Projects in the Lower Rio Grande Valley" Dated July 2009 by Askar Karimov, Eric Leigh, and Guy Fipps. The anticipated annual transit losses reductions are 15.8 ac – ft / mile – yr.

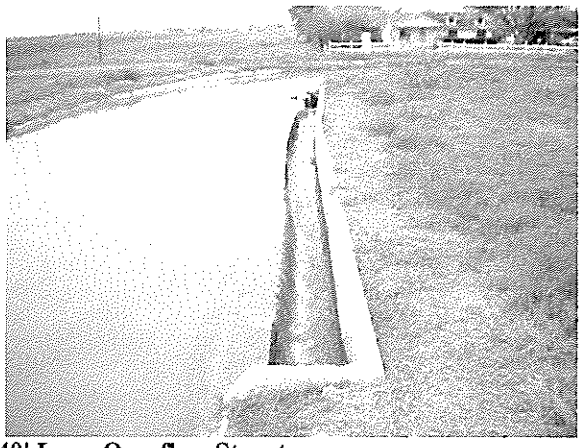
The actual canal loss seepage reductions can be verified by conducting a ponding test.

A.1 (4) Canal Automation

The Alamo Main Canal conveys an average annual volume of 26,832 ac-ft. Overflow spillage results out of the current operation of the canal check gates. The canal facility is operated at maximum capacity to maximize the deliveries to the users. During operation, the canal rider adjusts the check gates up or down to either lower or fill the different sections (pools) of the canal. The objective is to maintain the water surface elevation as high as possible in each pool. Overflow occurs when users close the turn out. Water lost to overflow either spills over a 25 foot long broad crested weir located at 800 linear feet North of Expressway 83 or over a 40 foot long broad crested weir located at approximately 1,350 linear feet West of Cesar Chavez Rd and 160 linear feet South of Minnesota Rd. Both structures are identified in **Figure 3**. The overflow structures are set below the canal liner's elevation. Water overflowing into these structures drains into the District owned drainage ditch system and eventually reaches the Laguna Madre. Pictures of these structures can be viewed below.



25' Long Overflow Structure



40' Long Overflow Structure

The Alamo Main Canal conveys water year round even during seasons of low demand. While the operator makes every effort possible to maintain the water surface level below the overflow structures, he lags behind users. On an average the canal overflows **approximately one quarter (1/4) of an inch above both the 25' and 40' long overflow structures. The District proposal to automate the Alamo Main Canal from its beginning at Station 0+00 (Main Head Gate) to its end at Station 227+87 will**

assure that the canal be operated below the elevation of both overflow structures. The estimated volume of water to be conserved from preventing overflowing the canal is **380 ac-ft / yr (146 + 234)**; calculations of the water saving are found below.

Broad Crested Weir Overflow Structure in the Alamo Main Canal

Days of Operation	350	Days
Hours of Oeration	24	Hours

Discharge over Borad-Crested weirs is expressed by the equation: $Q=CLH^{3/2}$

Where:
C - weir coefficient.
L - weir length in feet.
H - head over weir in feet
Q - Discharge in cfs

Weir Length 25 ft

Head, in	Head, ft	C	Discharge, cfs	Discharged Vol., ac-ft/yr
0.25	0.02	2.8	0.21	146

Weir Length 40 ft

Head, in	Head, ft	C	Discharge, cfs	Discharged Vol., ac-ft/yr
0.25	0.02	2.8	0.34	234

The calculations above accounted for 15 days of down time per year needed for repairs of maintenance.

In addition, water savings will result from improved water management practices by maintaining a high operating pool level, the user is assured constant water pressure (head pressure); thus, completing the irrigation quicker. **The District estimates users can become 3% more efficient with canal automation without additional on the farm improvements.** The canal pressure helps deliver a higher volume of water which helps the user push the water faster through the field resulting in a reduced volume of water penetrating the soil layer (wasted water). The District conveys an annual volume of 26,832 ac - ft., through the Alamo Main Canal. Three percent of the total volume conveyed **is 805 ac - ft** of water that could be saved by preventing excessive permeation.

The net total estimated water to be saved by replacement of the check gates is 380 ac – ft / yr (canal automation) + 805 ac – ft / yr (efficient deliveries) = 1,185 ac – ft / yr.

Since the pressure in the canal will be maintained, the annual farm delivery volumes will be reduced as a result of reduced seepage into the farmland.

Water savings can be verified upon completion as detailed in Subcriterion No. F.3 – Performance Measures.
Subcriterion No. A.2 – Percent of Total Supply

From Subcriterion No. A1 (a) above, the estimated amount of water to be conserved by lining the canal with impermeable liner and by automation is **2,021 acre –foot (836 + 1,185)**. **The Percentage of total supply is 2.6 %** as calculated below:

Percentage of Total Supply = (2,021ac – ft / 78,275 ac – ft) X 100% = **2.6 %**

5. EVALUATION CRITERION B: ENERGY WATER NEXUS

Subcriterion No. B.1 -- Implementing Renewable Energy Projects Related to Water - Management and Delivery

Solar Power Project
The District proposes to install eighty photovoltaic arrays (solar panels) on the roof of a proposed warehouse metal building. The warehouse will be constructed a the District's yard in San Juan Texas and it will have rough dimensions of 100 feet by 100 feet. The warehouse will be constructed without an AC unit, and will be used to store pipe, materials, and equipment. The photovoltaic array panels will take an area of 68 feet long by 22 feet wide as illustrated by Figure 7 below. The power produced by the photovoltaic arrays will be used for the warehouse's lighting fixtures. The light fixtures will consist of high bay 120 to 277 Volt 400 Watt. It is estimated that 6 fixtures will be required to cover a 100 ft X 100 ft area. The calculated **power demand** to light the building through out a normal workday consisting of 8hrs is 19.2 KWH/Day or **7,008 KWH/YR; refer to the energy consumption calcuator.**

The photovoltaic array system will have a **20 KW capacity**. It is estimated that the photovoltaic arrays will **produce 27,469 KWH / YR**; refer to the photovoltaic calculator (PVWatt ®) print out as obtained from the National Renewable Energy Laboratory. The photovoltaic arrays will have micro inverters, and the power produce will be channeled to a main panel that will connect to the power company's meter; refer to the attached flowchart. This arrangement will allow for unused power to be place into the power grid. It is estimated that the photovoltaic array system will produce **20,461 KWH / YR** (27,469 – 7,008) of surplus power that will be placed into the electrical power grid.

The benefits of the District's solar power project are that the photovoltaic array system utilizes solar radiation to produce power without the use of hydrocarbons, without generating by products in the process as carbon dioxide or monoxide, and without the need of water. The beneficiaries will be the users in the power grid. As stated above the system will generate surplus power that will be place into the power grid. The photovoltaic array system will not use water

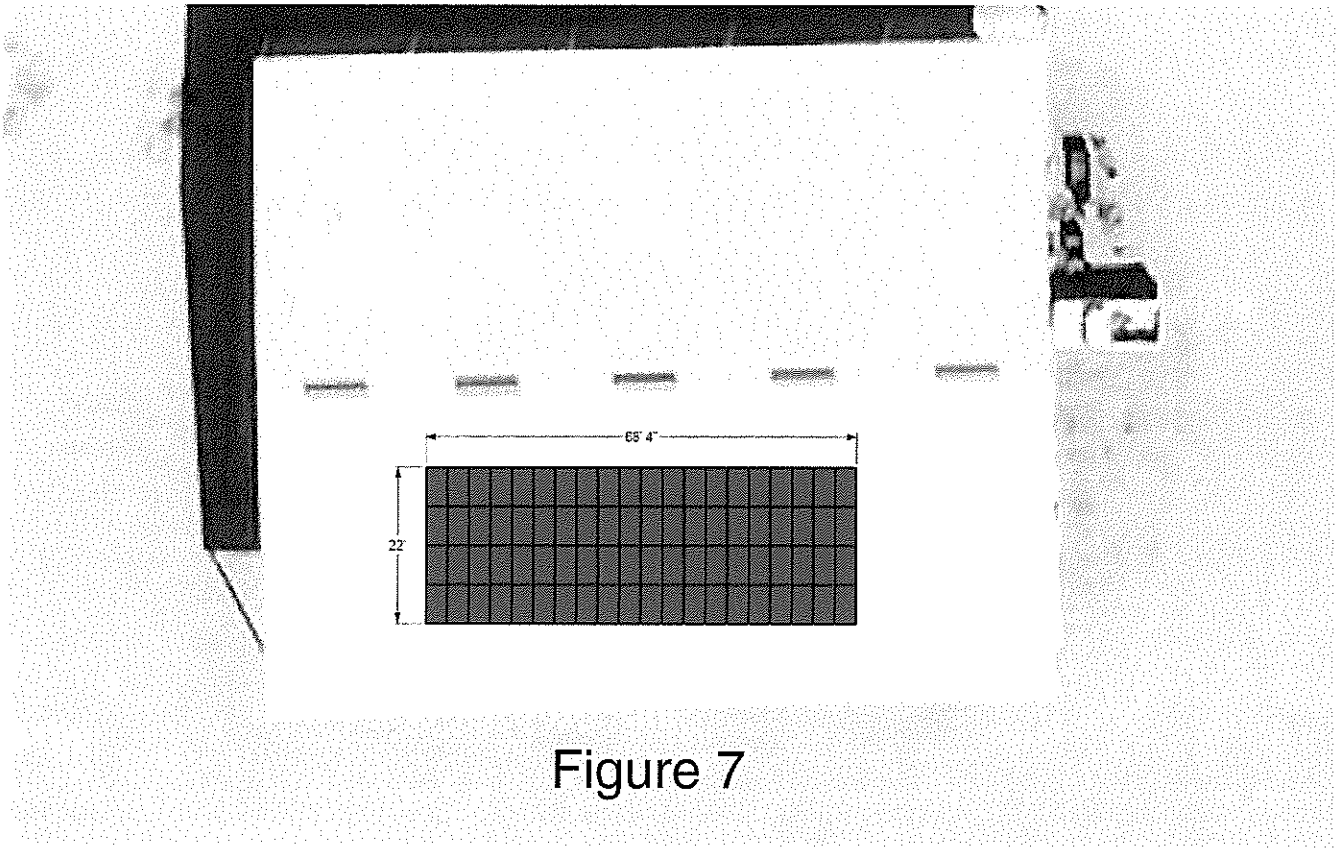


Figure 7

PVWatts Calculator

NREL

RESULTS

27,469 kWh per Year *

Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)	Energy Value ($)
January	3.40	1,674	184
February	3.96	1,746	192
March	4.84	2,339	257
April	5.18	2,375	261
May	5.92	2,787	306
June	6.23	2,795	307
July	6.42	2,954	324
August	5.92	2,717	298
September	5.29	2,375	261
October	5.23	2,439	268
November	3.87	1,804	198
December	2.97	1,462	160
Annual	**4.94**	**27,467**	**$ 3,016**

Location and Station Identification

Requested Location	326 N. Standard St. San Juan, TX 78589
Weather Data Source	(TMY2) BROWNSVILLE, TX 49 mi
Latitude	25.9° N
Longitude	97.43° W

PV System Specifications *(Residential)*

DC System Size	20 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	10°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Initial Economic Comparison

Average Cost of Electricity Purchased from Utility	0.11 $/kWh
Initial Cost	3.30 $/Wdc
Cost of Electricity Generated by System	0.20 $/kWh

These values can be compared to get an idea of the cost-effectiveness of this system. However, system costs, system financing options (including 3rd party ownership) and complex utility rates can significantly change the relative value of the PV system.

RapidTables

Online Reference & Tools

Energy consumption calculator

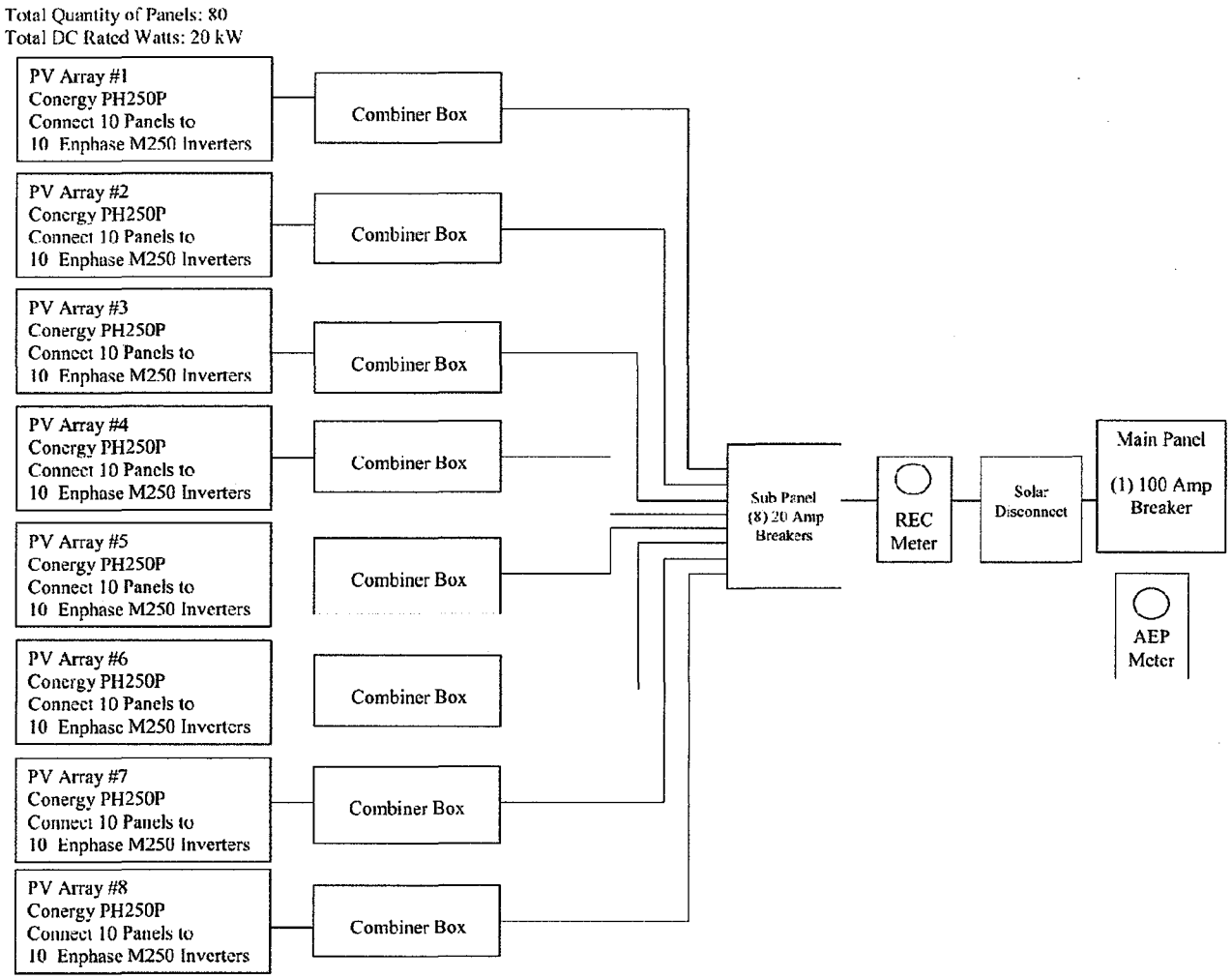
Energy consumption calculator. kWh calculator.

Typical appliance:	-- select --	
Power consumption:	2400	watts (W)
Hours of use per day:	8	h/day
	Calculate Reset	
Energy consumed per day:	19.2	kWh/day
Energy consumed per month:	576	kWh/month
Energy consumed per year:	7008	kWh/year

Energy consumption calculation

The energy E in kilowatt-hours (kWh) per day is equal to the power P in watts (W) times number of usage hours per day t divided by 1000 watts per kilowatt:

$$E_{(\mathrm{kWh/day})} = P_{(\mathrm{W})} \times t_{(\mathrm{h/day})} / 1000_{(\mathrm{W/kW})}$$



Facilities that enable the use of renewable energy

In order to implement the addition of the FlumeGate ™ and SlipMeter ™, power is required for the proper operation of the system. One of the advantages of installing and utilizing a Rubicon FlumeGate ™ or equal solution is the fact that it is powered by 100% renewable energy. The proposed model will contain 2 to 3 sealed lead acid gel type batteries capable of maintaining a capacity of 22Ah and will produce 12V dc in order to operate the equipment such as motors, control and instrumentation built into each flume gate. In order to recharge each battery the gates are equipped with a solar panel capable of producing 75 watts.

On average the gate is opened about twice a day, therefore the system can last up to 2 days without a solar recharge under normal modulation conditions. It is important to note that in order to keep the power consumption minimal, the motor must be of relatively small size (under 5 HP) consequently the movement of the gate is accomplished by a gear reduction ratio box. The gate model is completely stand-alone and self sufficient, meaning that line power is not required. The only maintenance that must

be done from an electrical stand point is the replacement of the batteries every 3-5 years depending on the operating conditions and environmental temperatures.

The photovoltaic module used in the Rubicon flume gate is the BP 375 module which has a total solar collecting surface of .594 m^2. As mentioned earlier the solar panel is capable of producing 75 watts, therefore the collecting power is 75 watts/.594 m^2 or 126.29 Watts/m^2. Now in order to ensure that the cells produce their peak power, a solar study was conducted with the help of the Texas Commission on Environmental Quality (TCEQ) monitoring station known as CAMS43 located in Mission, TX a city of Hidalgo County. The study can be found online at http://www.tceq.state.tx.us/cgi-bin/compliance/monops/yearly_summary.pl where the solar radiation will be displayed for the entire 2010 year if selected as an option. The solar insolation was measured for the entire 2010 year and the values were processed from langley's/minute to watts/m^2 by using the conversion factor that 1 langley/minute is equal to 697.4 Watts/m^2. Each month was then analyzed in order to ensure that the minimum value of 126.29 Watts/m^2 was met. Detailed calculations can be provided if requested.

January Data		**BP 375**	**BP 375 Production**
Maximum Isolation (watts/m^2)	739.17	126.29	**0.594 m^2 area**
Average Isolation (watts/m^2)	138.06		**(Units in kWH)**
Number of Production Hours in Month (hrs)	84.00		
Calculated Number of (kwh/m^2)	11.60	10.61	6.30
February Data			
Maximum Isolation (watts/m^2)	868.88	126.29	
Average Isolation (watts/m^2)	282.21		
Number of Production Hours in Month (hrs)	331.00	331.00	
Calculated Number of (kwh/m^2)	93.41	41.80	24.82
March Data			
Maximum Isolation (watts/m^2)	960.93	126.29	
Average Isolation (watts/m^2)	378.86		
Number of Production Hours in Month (hrs)	341.00		
Calculated Number of (kwh/m^2)	129.19	43.06	25.57
April Data			
Maximum Isolation (watts/m^2)	1017.41	126.29	
Average Isolation (watts/m^2)	360.41		
Number of Production Hours in Month (hrs)	338.00		
Calculated Number of (kwh/m^2)	121.82	42.69	25.35
May Data			

Maximum Isolation (watts/m^2)	1031.36	126.29	
Average Isolation (watts/m^2)	410.78		
Number of Production Hours in Month (hrs)	280.00		
Calculated Number of (kwh/m^2)	115.02	35.36	21.00
June Data			
Maximum Isolation (watts/m^2)	1004.16	126.29	
Average Isolation (watts/m^2)	447.28		
Number of Production Hours in Month (hrs)	297.00		
Calculated Number of (kwh/m^2)	132.84	37.51	22.27
July Data			
Maximum Isolation (watts/m^2)	1022.29	126.29	
Average Isolation (watts/m^2)	395.89		
Number of Production Hours in Month (hrs)	290.00		
Calculated Number of (kwh/m^2)	114.81	36.62	21.75
August Data			
Maximum Isolation (watts/m^2)	991.61	126.29	
Average Isolation (watts/m^2)	445.14		
Number of Production Hours in Month (hrs)	290.00		
Calculated Number of (kwh/m^2)	129.09	36.62	21.75
September Data			
Maximum Isolation (watts/m^2)	942.79	126.29	
Average Isolation (watts/m^2)	369.86		
Number of Production Hours in Month (hrs)	321.00		
Calculated Number of (kwh/m^2)	118.72	40.54	24.07
October Data			
Maximum Isolation (watts/m^2)	878.64	126.29	
Average Isolation (watts/m^2)	403.09		
Number of Production Hours in Month (hrs)	341.00		
Calculated Number of (kwh/m^2)	137.45	43.06	25.57
November Data			
Maximum Isolation (watts/m^2)	758.70	126.29	
Average Isolation (watts/m^2)	326.51		
Number of Production Hours in Month (hrs)	359.00		

Calculated Number of (kwh/m^2)	117.22	45.34	26.92
December Data			
Maximum Isolation (watts/m^2)	696.64	126.29	
Average Isolation (watts/m^2)	298.21		
Number of Production Hours in Month (hrs)	391.00		
Calculated Number of (kwh/m^2)	116.60	49.38	29.32
		Total	**274.72**

As shown above, the photovoltaic cell production is less than what is actually radiated from the solar resource; therefore the cells are capable of producing 100% of its power throughout every month of the year. Knowing that the photovoltaic cells have a collecting area of .594 m^2 then the calculated production for the BP 375 module can be obtained.

The total production **is 274.72 kilowatt hours per flume gate per year**. The proposed improvements to the Alamo Main Canal will contain 4 gates and 4 flowmeters, therefore a total energy production of **2,198 KWH / YR** by the system is expected. The main benefits behind the self-sustaining flume gates is the fact that since power doesn't have to be imported from a line provider, losses are nullified on the existing electrical grid system, which translates to less wasted energy.

Subcriterion No. B.2 –Increasing Energy Efficiency in Water Management

Energy efficiencies are expected to result from the water to be conserved by reduced pumping. The Alamo Main Canal is located downstream of the District's Re-Lift Pumping Plant. The District lifts the water first at the River Pumping Plant thence at the Re-Lift Pumping Plant before it is delivered into the Alamo Main Canal.

Tables 1 and 2 contain the three year record of the monthly power consumed and volume of water pumped at both pumping plants. **Tables 1 and 2 can be found after the Project Budget Section.** The calculated average KWH per AC-FT of water pumped at each pumping plant can be found at the bottom of the right most column. **Base on the data furnished in Table 1 and 2, the expected yearly energy savings to result from water conservation are 291,024 KWH / YR which was calculated as follows:**

The Total calculated averaged used KWH / ac – ft at both pumping plants is:

$$78 + 66 = 144 \text{ KWH / ac - ft}$$

Energy Savings (KWH/Yr) = Yearly water savings (ac - ft) X KWH / ac - ft

Energy Savings = 2,021 ac – ft / YR X 144 KWH / ac – ft = **291,024 KWH / YR**

Other forms of energy efficiencies are also expected to result from improved water management practices. The canal operator monitors the canal three times per day for an estimated driven distance of 60 miles per day. After improvements the District conservatively estimates the canal operator will make a single trip per day on a 5 day work week saving two trips for a total saved 40 miles per day or equivalent 3.6 gallons of fuel per day. **The District expects to save 764 gallons of fuel per year or equivalent 27,303.6 KWH / YR.**

6. EVALUATION CRITERION C: BENEFITS TO ENDANGERED SPECIES

The Jaguarundi (Felis Yagouaroundi Cacomilti), a native cat species federally recognized as an endangered species since the mid 1970's, is believed to have inhabited the shrub lands of the Lower Rio Grande Valley before land was cleared for agricultural use. The U.S. Fish and Wildlife (FWS) Recovery Plan Action Status updated December 2013.
(http://www.fws.gov/southwest/es/Documents/R2ES/GulfCoastJaguarundi_FinalRecoveryPlan_Dec2013.pdf)
Recovery Strategy involves the assessment, protection , reconnection, and restoration of sufficient habitat to support viable populations of the Gulf Coast jaguarundi in the borderlands of the U.S. and Mexico;

The ocelot (*Leopardus pardalis*) is listed as endangered throughout its range in the western hemisphere where it is distributed from southern Texas and southern Arizona through Central and South America into northern Argentina and Uruguay. The ocelot is also listed as endangered by the State of Texas. In south Texas, the ocelot inhabits dense thornscrub communities on Laguna Atascosa National Wildlife Refuge (LANWR) and on private lands in three Texas counties. The ocelot requires dense vegetation. Habitat conversion, fragmentation, and loss comprise the primary threats to the ocelot today. Human population growth and development continue throughout the ocelot's range. The Draft Recovery Plan by FWS is similar to the jaguarondi.
http://www.fws.gov/southwest/es/documents/r2es/draft_ocelot_recovery_plan-first_revision.pdf
The water required to create dense habitat necessary for the recovery of these species is delivered by the irrigation district in the area.

The Santa Ana National Wildlife Refuge is a 2,000 acre tract of brush land that connects with the wildlife corridors that the U.S. Fish and Wildlife Service (USFWS) has along the banks of the Rio Grande. Wildlife corridors are tracts of land or habitat that are linked and allow wildlife to travel from one location to another to find food, shelter, a mate and a place to raise offspring. The Santa Ana National Wildlife Refuge is located outside and adjacent to the District's south boundary, and it stretches from U.S. Hwy. 281 to the banks of the Rio Grande . This USFWS refuge is home of approximately 400 bird species, 450 types of plants, half of all butterfly species found in North America, and such rarities as the indigo snake and Altamira oriole. The Santa Ana Wildlife refuge website states "Santa Ana is strategically located where subtropical climate, gulf coast, great plains and Chihuahuan desert meet. Here, next to the Rio Grande, you will find Sabal palms growing alongside prickly pear cactus, habitat for the ocelot and jaguarundi, two endangered cat species known to still prowl the deep forest." http://www.fws.gov/refuge/Santa_Ana/wildlife_and_habitat.html)

Other endanger species in Hidalgo County TX, are:
Northern aplomado falcon (E) Falco femoralis septentrionalis
Ocelot (E) Leopardus pardalis
Star cactus (E) Astrophytum asterias
Texas ayenia (E) Ayenia limitaris
Walker's manioc (E) Manihot walkerae

The refuge's staff states that water is critical to sustain the Jajuarandi's prey species. The District delivers 330 ac – ft / yr of water to the Santa Ana Wildlife Refuge via the Lateral A Canal. The water is used to maintain three ponds located within the Refuge. Water is needed to provide a stable habitat for prey species and as a result improve the habitat for the Jaguarandis' recovery. This past November 2014, the Refuge solicited the District to upgrade the irrigation delivery at the Lateral A Canal to connect additional dry lakebeds within the Refuge's property. The additional water demand is estimated at 200 ac – ft / yr for a total upgraded demand of 530 ac – ft / yr. The District will utilize the conserved water to supply the additional 200 ac –ft of water per year.

North San Juan Park
The nature park was recognized by the Natianal Wildlife Federation and the Texas Parks and Wildlife Department on February 20, 2008 as one of Texas' Best Backyard Wildlife Habitats.
The park attracts species of wildlife as birds, insects, and mammals. Ninety (90) percent of the vegetation consist of native trees, shrubs, and flowers. During the month of February, instruction is offered on how to manage native plants to help these flourish.

The District delivers 9 ac-ft per year to the North San Juan Park via direct from the Alamo Main Canal. The water savings to result from the proposed improvements will assure delivery of water to the nature park in the future.

7. EVALUATION CRITERION D: WATER MARKETING

The Lower Rio Grande is an over appropriated basin and any new water rights are unavailable. Water rights are administrated by the Texas Commission on Environmental Quality (TCEQ). The TCEQ has a Rio Grande Watermaster program that monitors releases from the international reservoirs and Texas diversions from the Rio Grande. The Rio Grande Watermaster performs the water accounting for the Rio Grande water rights. Within the Rio Grande Watermaster Program, water can be marketed from one water right owner to another water right owner for the same type use water. It is a very active market in which domestic, municipal, industrial, mining, and irrigation water can be sold and transferred to any like water right.

This District is probably the most active water marketer within the Rio Grande Watermaster Program. The District actively provides water for agricultural, industrial, municipal, and mining purposes to other water right holders from Amistad Reservoir to the Gulf of Mexico. In recent water shortage years, the District marketed irrigation water to farmers within other irrigation districts who were short on supply. The District also markets water for industrial purposes in Starr, Webb, and Hidalgo Counties. The District continues to provide water for municipal use to various cities and water supply corporations all along the River.

The District has had a long standing relationship with the Bureau of Reclamation and has been able to accomplish many conservation projects since the late 1970's. The accomplishment of these conservation projects has afforded the District to market its conserved water to users outside of the District's boundaries.

This grant, if approved, will allow for a 3 year project that estimates will yield 2021 acre feet of water. Before the end of this project, the District plans to initiate the conversion of 2,000 acre feet of Class A irrigation rights to municipal use to accommodate the needs of our cities and of surrounding communities.

8. EVALUATION CRITERION E: OTHER CONTRIBUTIONS TO - WATER SUPPLY SUSTAINABILITY

Subcriterion No. E.1 – Addressing Adaptation Strategies in a WaterSMART Basin Study

The supply issues facing the Lower Rio Grande River basin are extremely complex, ranging from a multi-national to local scale. First, because the study area is shared by both the U.S. and Mexico, numerous issues are presented both politically and technically. Flows within the Lower Rio Grande River are dependent upon reservoir operations and run-off emanating from both the U.S. and Mexico, which is complicated by issues relating to required reservoir releases pursuant to stipulations set forth in the 1944 U.S.-Mexico Water Treaty.

A **2013 Lower Rio Grande Basin Study** by the Bureau of Reclamation and Rio Grande Regional Authority, which HCID2 is a member (cost share partner) stated "The magnitude and frequency of water supply shortages within the study area are severe, even before projecting the effects of climate change. Based on an analysis of the currently adapted Region M Plan, which is incorporated in the State Water Plan,1 the population in the eight-county region is expected to grow from 1.7 million in 2010 to 4.0 million in 2060, resulting in the need for an additional 592,000 ac-ft/yr, or about 35%, of the total water demand. The State Water Plan identified strategies to meet those needs. This study determined that climate change may likely increase the shortage by an additional 86,438 ac-ft/yr, and this was the focus of this Basin Study."

This recently completed **Lower Rio Grande Basin Study** conducted by the Bureau of Reclamation **considered on farm and irrigation system water conservation as a management strategy** and states "According to the Texas Project for AgWater Efficiency, as much as 80% of all agricultural conservation in the Lower Rio Grande area occurs within irrigation district conveyances. The Basin Study further states that that water conservation projects such as these are "a vital component of a portfolio of strategies specifically targeted to alleviate the predicted supply imbalance in the study area, **but would be better pursued through other opportunities, including Reclamation's WaterSMART Water and Energy Efficiency Grants**, with the potential to implement conservation programs." The completed study can be obtained from

http://www.usbr.gov/WaterSMART/bsp/docs/finalreport/LowerRioGrande/LowerRioGrandeBasinStudy.pdf

Subcriterion No. E.2 – Expediting Future On- Farm Irrigation Improvements.

As stated in Subcriterion No A.1(4) above, water savings will result from improved water management practices by maintaining a high operating pool level, the user is assured constant water pressure (head pressure); thus, completing the irrigation faster. **The District estimates users can become 3% more efficient with canal automation.** The canal pressure helps deliver a higher volume of water which helps the user push the water faster thru the field resulting in a reduced volume of water penetrating the soil layer (wasted water). The District conveys an annual volume of 26,832 ac - ft., thru the Alamo Main Canal. Three percent of the total volume conveyed **is 805 ac - ft** of water that could be saved by preventing excessive permeation.

The 2013 LRGV Basin Study states that "According to the Texas Project for AgWater Efficiency, as much as 80% of all agricultural conservation in the Lower Rio Grande area occurs within irrigation district conveyances. For example, insufficient "head" at the delivery point, also related to previous "push water" discussions in this Basin Study, can make it difficult to deliver irrigation water evenly over the span of a field no matter what irrigation methods or technologies are used. Approximately 50% of the area experiences insufficient head. Similarly, certain irrigation technologies, such as drip and microirrigation, require near continuous delivery of relatively small amounts of water. Most existing irrigation conveyance and distribution systems were designed to deliver large volumes of water over relatively short time periods."

With the lining of the Alamo Main Canal with an impermeable liner, the canal could serve as a reservoir to accommodate the use of drip systems. One such applicant has recently solicited the District for a tie-in to the canal to provide a water source for a drip system to an organic farm for educational purposes.

The District has also assisted landowners that have been awarded Environmental Quality Incentives Program (EQIP) funds from the Natural Resource Conservation Service (NRCS) for on-farm conservation measures. The EQIP provides financial and technical assistance to agricultural producers to improve soil, plant, animal, air, and related resources. The District has participated with the construction of pipelines in lieu of open field canals.

The improvements in efficiencies from this project will increase the opportunities for in the installation of on the farm improvements in irrigation technologies.

Subcriterion No. E.3 – Building Drought Resiliency.

As stated in the previous sections, surface water is in high demand in the Lower Rio Grande Valley, and most ground water is brackish. Adding to the list of facts, the Rio Grande Valley receives on an average

24 inches of rainfall per year, and the average annual pan evaporation is approximately 60 inches. Last, it is known that the municipalities of the Rio Grande Valley will stress if another drought reoccurs.

The Lower Rio Grande Valley experienced an exceptional drought in 2012 and 2013. Recently, droughts in 2009 contributed to losses of $19 million for south Texas farmers. Dry land farming was most affected, although irrigated agriculture lost nearly $1.5 million. (Agrilife News, Texas A&M University, Nov. 13, 2009) Other reports have estimated the annual regional impact of agricultural water shortages costs the local economy $135 million and 4,130 jobs. (J. R. C. Robinson et al. / Water Policy 12 (2010) 114–128 Mitigating water shortages in a multiple risk environment) The economic impacts of unmet irrigation water demands directly contribute to reduced economic activity in other sectors and the slowing or reversal of job growth in the region. In the long term, an economic slowdown could result in water districts forgoing projects that could increase efficiency and provide adequate service to all users. With the shift to urbanization in the region, while continuing to rely on existing scarce supplies, these impacts can be expected to intensify in the future.

The 2013 Basin Study states "Another issue related to irrigation demand is the amount of "push water" needed to enable delivery of water from the river, through the irrigation system of canals and/or pipes, to its final destination of either agricultural or M&I delivery points. One of the concerns regarding the availability of water in the study area pertains to the delivery of water to municipal users during severe drought periods, when irrigation water use may be curtailed or completely eliminated as the total supply of U.S. water stored in Amistad and Falcon Reservoirs falls to low levels. Under the current Rio Grande operating rules, the available supply of water in the reservoirs for irrigation use is gradually depleted as irrigation diversions are made during periods when the inflows to the reservoirs are low. During extended periods of continued irrigation use and low reservoir inflows, the available quantity of irrigation water stored in the reservoirs diminishes.

Should such conditions occur, as they neared in 2013, rediced releases of irrigation water would be made from Falcon Reservoir. This would mean that deliveries of municipal water from the reservoir to entities in the Lower Rio Grande Valley would have to be made without the normal "carrying water" provided by the irrigation water deliveries. Under these circumstances, the normal water losses due to such factors as seepage and evaporation could be proportionally substantial and could potentially disrupt the ability of municipal users to obtain their water. Another concern under these conditions is whether or not the existing diversion facilities on the Lower Rio Grande would be able to physically withdraw water from the river because of the potentially lower river levels. "

Increasing the delivery system efficiencies will increase the likelihood that the District will be able to deliver municipal water during periods of droutght. The District fared well in 2013 when other districts were running low on supply. As mentioned previously, this District has accomplished several conservation projects which enable it to provide water to its 6 municipal water users without any threat of running out. Our agricultural producers were also able to irrigate as needed and without restriction.

All the Lower Rio Grande Valley Water Right holders have a collective interest in water conservation. Water conserved is available for future use or remains in the Rio Grande system to be distributed to other users. In addition, conserved water results in power conservation. For example, since the District is a non-profit public entity, power cost savings and conservation efforts will benefit all the end users

including the farmers, and the municipal customers, including North Alamo Water Supply Corporation, citizens of Alamo, McAllen, Pharr, San Juan and Edinburg.

Subcriterion No. E.4 – Other Water Supply Sustainability.

The District's project will address water supply shortages by making the water to be conserved available for future domestic, municipal, and industrial demand. Further, the project will generally make more water available in the water basin. Lastly the project will also benefit endangered species by making every effort to save as much of the valued surface water available for ponds and lakes. The District's project concurs with the recommended strategies of the Regional Water Plan to conserve water. The project will have full support from Region M, and Rio Grande Regional Water Authority, and the community over all.

Reclamations **2013 Lower Rio Grande Basin Study** state "Another issue related to irrigation demand is the amount of "push water" needed to enable delivery of water from the river, through the irrigation system of canals and/or pipes, to its final destination of either agricultural or M&I delivery points. One of the concerns regarding the availability of water in the study area pertains to the delivery of water to municipal users during severe drought periods, when irrigation water use may be curtailed or completely eliminated as the total supply of U.S. water stored in Amistad and Falcon Reservoirs falls to low levels. Under the current Rio Grande operating rules, the available supply of water in the reservoirs for irrigation use is gradually depleted as irrigation diversions are made during periods when the inflows to the reservoirs are low. During extended periods of continued irrigation use and low reservoir inflows, the available quantity of irrigation water stored in the reservoirs can be reduced to zero.

The District's project will increase awareness of water and energy conservation, and efficiency. The District project will make use of the latest technology and renewable energy. It will serve as a raw model for the community including municipalities, educational entities, political subdivision, organizations, and the private sector.

The project will increase awareness of renewable energy because of the solar panels on the shop roof. The efficiency of the solar project will be easy to track and may spur an increased look at this source of energy for other projects.

The **2013 LRGV Basin Study** stated "In summary, the worst-case scenarios (Scenarios 4, 5, and 6) for climate impact on water availability in the Lower Rio Grande Basin for surface water result in declines of about 25 to 35% for irrigated agriculture and mining uses when compared to baseline conditions. Another way of looking at these declines is to surmise that projected worst-case reliability decreases in these sectors from 66.7 to 31.2% would result in less than one-half of the water being available as there is in the baseline calculation. Municipal and industrial water rights dependent on Amistad and Falcon Reservoirs are expected to have their full authorized supplies available."

The District supplies municipal water to in Hidalgo County, the 2010 Census states that Hidalgo County Texas is 91% Hispanic with 35% of the persons below poverty level.

9. EVALUATION CRITERION F: IMPLEMENTATION AND RESULTS

Subcriterion No. F.1 -- Project Planning

Water conservation improvements for the Alamo Main Canal have been in the District's scope of work since 2004. The Alamo Main Canal is the District's primary facility used to convey water to the Northeast quadrant of the District. Water conservation improvements for the Alamo Main Canal were proposed for amendment into Public Law 106-576 on 2009 and was enacted by the House of Representative in June 2, 2009 (H.R. 1393), but has not been enacted by the Senate. Public Law 106-576 was signed into law on December 28, 2000. The One Hundred Seventh Congress of the United States of America directed the Secretary of Interior, through the Bureau of Reclamation to administer the Act. The purpose of Public Law 106-576 is to investigate and identify opportunities to improve the supply of water in counties of the State of Texas which are located within the Rio Grande Regional Water Planning Area known as Region "M" as designated by the Texas Water Development Board, and counties of Hudspeth and El Paso, Texas.

In April 2005 the U.S. Bureau of Reclamation prepared a Project Report. At that time the project report proposed two main components to conserve water and energy. First, the report proposed to reduce leakage thru the existing cracked concrete liner by relining the canal using an 8-20-8 geocomposite made with 20 mil EVA geomembrane sandwiched between two 8 oz geo-textile layers. To secure and keep the geocomposite from floating, 3 inches of shotcrete cover was proposed. Second the report proposed to reduce overflow spillage by automation of primary control structures and real time flow rate monitoring of the canal system. **The relining and automation of the canal will certainly fulfill the recommendations of the 2005 U.S. Bureau of Reclamation Project Report.** Furthermore, the proposed products offered by Rubicon Water offers the added capability of **self adjustment.** Different from human monitoring, the **Total Channal Control ®** software adjusts continuously the gate position to maintain a set water surface elevation in the corresponding canal pool. This technology was not known to be available at the time the report was prepared. Copies of the Project Report can be available upon request.

The District's proposal to line the canal and attaining total canal control to achieve water and energy conservation is also consistent with the 2010 Regional Water Plan of Region M. The Regional Plan recommends strategies for reducing projected irrigation water needs as follows:

1.) Agricultural Water Conservation (conveyance systems)
2.) On Farm Water Use Efficiency

The Region M's Regional Water Plan can be downloaded from http://www.riograndewaterplan.org.

Furthermore, the District's proposal of relining the canal and attaining total canal control to achieve water and energy conservation is also consistent with the District's own Water Conservation Plan and Drought Contingency Plan which were filed with the Texas Commission on Environmental Quality (TCEQ) in August 2009 and January 2010 respectively.

Subcriterion No. F.2 – Readiness to Proceed

Sigler, Winston, Greenwood, & Associates, hereafter SWG, has completed a preliminary design. Minor modifications to the plans are needed and final plans can be completed by April 2015. There are no delays expected to result from the environmental compliance. A project schedule is attached after Tables 1 and 2.

Subcriterion No. F.3 – Performance Measures

The canal will be operated for six months before it could be hydrostatically tested (pond test). The District will monitor the water surface elevation of the canal and will program the gates to operate at the highest permissible water level without spilling. The canal operator will check on the condition of the new liner and make visual inspection daily to look for any soft areas. The water surface elevation will be monitored at the main operation center using the manufacturer's software. The gates may have to be adjusted upon performance.

Real time flow monitoring will provide the data necessary to evaluate and improve the efficiency of the water deliveries. With the addition of the total canal control system (having flow measurement at each flume gate), the District will be able to identify losses occurring within the various reaches of the canal. Through identification of system losses, the District will have capability to eliminate inefficiencies resulting of mismatches between supply and demand.

Replacement of the Canal Liner
The District can schedule a ponding and seepage test six months after improvements are complete to quantify losses through the liner. The test can be conducted by a non-bias organization as the Irrigation Technology Center, Texas A&M University System or an independent testing laboratory. Test results can be compared and verified against the ponding test conducted in November 2003.

Canal Automation & Replacement of the Existing Slide Check Gates
The Districts objective is to operate without spilling water; therefore, the District will program the gates to maintain the water surface elevation in the canal pools below the elevation of the spill structure (broad crested weir). The software package offered by Rubicon ® will have capability of saving electronically the water surface elevations; thus, offering capability to prepare a performance measure report. The District proposes to test the performance of the canal control system after the gates, SCADA, and all equipment has been installed. The proposed test duration is one month. Once the test is completed, the monitoring report, or record of water surface elevations, will be submitted to the District's engineer to evaluate the performance.

Solar Cell Project
The District will have capability to meter the amount of power placed in the power grid. Records could be obtained from the power supplier.

Subcriterion No. F. 4 – Reasonableness of Costs

The total estimated project cost including all three phases is **$5,422,701.78.** The estimated amount includes labor, materials, equipment, and installation of the flume gates including but not limited to

temporary construction of the coffer dam to isolate the work area and manage the by-pass at each check gate structure; an itemized breakdown of the construction cost estimate can be found under the Budget Proposal Section.

The expected life of the Canal 3 ® 8-20-8 geosynthetic membrane geocomposite is 50 yrs and the flume gates is forty (40) years for a total project life average of 45 years. Reasonableness of costs is calculated as follows:

$$\frac{\text{Total Project Cost}}{\text{ac - ft conserved X Improvement Life}} = \$5,422,701.78 / (2,021 \text{ ac – ft X } 45 \text{ yrs}) = \mathbf{\$\ 59.63 / ac – ft - yr}$$

10. EVALUATION CRITERION G: ADDITIONAL NON-FEDERAL FUNDING

Non-federal funding $4,422,701.78
Total Project Cost $5,422,701.78 = 81.6% non-federal funding

11. EVALUATION CRITERION H: CONNECTION TO - RECLAMATION PROJECT ACTIVITIES

The U.S. Bureau of Reclamation has been active in the Rio Grande Valley for many years. The Bureau has helped the local irrigation districts through various federal programs. Public Law 106-576 is the most recent federal program through which the U.S. Bureau of Reclamation has been able to assist the local irrigation districts improve the efficiency of its respective delivery systems to attain water and energy conservation. Numerous projects enacted under Public Law 106-576 have been completed in the Rio Grande Valley through the assistance of the U.S. Bureau of Reclamation including two from the District; those being the closure of the Wisconsin Canal and the re-lining of Lateral A Canal.

In the early eighties, the U.S. Bureau of Reclamation assisted the District in constructing the River Pumping Plant. This facility delivers the water that the Alamo Main Canal conveys.

In the past three years the Hidalgo County Irrigation District No. 2 has succeeded in obtaining Water Smart Grants to automate the Lateral E and Lateral A canals, both projects have been completed.

Most recently, the U.S. Bureau of Reclamation completed a Basin Study in cooperation with the Rio Grande Regional Authority (RGRWA) and its 53 member entities, and I collaboration with the Texas Region M Planning Group (Region M), Texas Water Development Board, Texas Commission on Environmental Quality (TCEQ), and International Boundary and Water Commission are conducting a Basin Study (Study) to evaluate the impacts of climate variability and change on water supply imbalances within an eight county region along the U.S./Mexico border in South Texas. The eight county area of RGRWA includes Hidalgo County and the Hidalgo County Irrigation No. 2, a member of the RGRWA.

12. ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

The construction activities associated with the canal relining and retrofit of the existing check gate structures will have no impact to the surrounding environment. The District will maintain the canal facility operating while the rehabilitation of the liner and gates takes place. The work area will be cofferdam, and pumping will be needed to bypass around the work area. An earthen dam will be constructed upstream and downstream of the work area to isolate it. The earthen material will be hauled into the job-site from a local materials supplier. The earthen material will be hauled offsite after the retrofit has been completed.

Known species listed or proposed to be listed as a Federal endangered or threatened species, or designated Critical Habitat in the project area **will not be affected** by the constriction activities. Construction work will be confined within the canal alignment.

There are no wetlands or other surface waters inside the project boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States".

The Alamo Main Canal was constructed in 1915. The original structure consisted of an unlined earthen canal. It was lined at a later time with concrete. In 1986 the canal was renovated to add 5 to 6 inches of depth, and the existing check gate structures were constructed at that time. Reinforced concrete walkways were also added to each check gate structure in 1986.

The District is listed on the National Register of Historic Places.
There are no known archeological sites in the proposed project area.

The project will not have a disproportionately high and adverse effect on low income or minority populations.

The project will not limit access to ceremonial use of Indian sacred sites or result in other impacts on tribal lands.

The project will not contribute to the introduction, continued existence, or spread of noxious weeds or non-native species known to occur in the area.

13. REQUIRED PERMITS OR APPROVALS

There are no known permits or approvals required. All work will be performed within the District's canal right of way.

14. OFFICIAL RESOLUTION

See attached.

15. PROJECT BUDGET

The District has capability to commit 81.6% of the total project cost using funds from the District's Capital Improvements Fund. The District will procure for construction services for a complete product.

There will be no other Federal partners contributing with funds towards the District's 81.6% percent cost share.

The District does not have any pending funding requests that have not yet been approved.

Below is the Summary table of non-Federal and Federal funding sources.

Non Federal Funding = $4,422,701.78

Table 3. Summary of non-Federal and Federal funding sources.

Funding Sources	Funding Amount
Non-Federal Entities	
1. Hidalgo County Irrigation District No. 2	$ 4,422,701.78
Non-Federal Subtotal:	$ 4,422,701.78
Other Federal Entities	
1. N/A	$0
Other Federal Subtotal:	$0
Requested Reclamation Funding:	$1,000,000.00
Total Project Funding:	$ 5,422,701.78

Table 4. Funding Group II Request			
	Yr 1 (FY 2015)	Yr 2 (FY 2016)	Yr 3 (FY 2017)
Funding requested	$500,000.00	$250,000.00	$250,000.00

Budget Proposal

The District will procure for construction services following the State of Texas bidding and procurement laws. Salaries and wages were obtained form the latest Davis Bacon list. The number and type of laborers per activity were estimated. The labor unit cost per hour was estimated by adding the wage rate of each laborer plus contract bonding, plus contractor's overhead and profit.

Equipment cost was obtained from actual estimates. The gate manufacturer submitted a preliminary estimate for the flume gates, SCADA, hardware, radio, tower, antenna, cable, and other equipment. The District already owns licensed software, work station, and other electronic equipment needed for automation. The preliminary estimate was adjusted to reflect contract bonding costs, plus contractor's overhead and profit. The rate of the portable pump to by-pass was estimated from past records on a similar project.

Material cost as earthen material for the construction of the temporary dams, concrete and steel to construct the new check gate structures were estimated from past record of tabulation of bids on similar work. The material estimate is inclusive of labor, material, equipment, fuel, tools, and incidentals necessary to perform the work complete in place.

Demolition and removal of existing reinforced concrete was estimated from past record of tabulation on similar work. The demolition work is inclusive of labor, equipment, fuel, tools, and incidentals necessary to remove from the site of work and dispose of the concrete rubble.

The District projects to perform improvements in three phases as follows:

- Phase I (FY 2015) from Station 120+75 to 208+60 and **Solar Project.** The total projected cost to complete Phase I is **$1,650,141.66**
  The District projects to utilize $500,000.00 from grant monies in FY 2015.

- Phase II (FY2016) from Station 0+00 to 120+75. The total projected cost to complete Phase II is **$2,462,033.64**
  The District projects to utilize $250,000.00 from grant monies in FY 2016,

- Phase III (FY2017) from Station 208+60 to 281+94. The total projected cost to complete Phase III is **$1,310,526.48**
  The District projects to utilize $250,000.00 from grant monies in FY 2017.

The itemized breakdown of the project cost can be found in the next page.

Entity: Hidalgo County Irrigation District # 2
Date: 01/13/15
Project: Alamo Main Canal
Eng.: Sigler, Winston, Greenwood & Associates
Alfonso Gonzalez, P.E.
PHASE I FY 2015 - Engineer's Preliminary Construction Cost Estimate

Item No.	Description	Quantity	Unit	Unit Cost	Recipient Funding	Reclamation Funding	Total Cost
1	FlumeGate, 1 at each structure; includes frame, aluminum walkway, sensors, batteries, controller, operator interface, solar panel, & charging subsystem. Includes calibration, startup, commissioning & training.	2	EA	$41,000.00	$53,650.31	$28,349.69	$82,000.00
2	Slipmeter, 1 at each turnout; includes frame, sensors, batteries, controller, operator interface, solar panel & charging subsystem. Includes gate calibration, startup, commissioning, & training.	2	EA	$32,000.00	$41,873.41	$22,126.59	$64,000.00
3	SCADA System - Radio, tower, antenna, cables, and equipment	1	EA	$12,500.00	$8,178.40	$4,321.60	$12,500.00
4	By-pass pumping - Minimum capacity 100 cfs.	60	day	$450.00	$17,665.34	$9,334.66	$27,000.00
5	Earthen material for construction of temporary dams.	200	CY	$75.00	$9,814.08	$5,185.92	$15,000.00
6	Construction of new check gate structures.						
	STA. 120+75						
	Labor to remove exist. check gates and demolish existing concrete structure.	16	HR	$125.00	$1,308.54	$691.46	$2,000.00
	Light crane to remove exist. check gates.	1	day	$750.00	$490.70	$259.30	$750.00
	Removal of exist. reinforced concrete column, beam, and walkway.	5	CY	$1,250.00	$4,089.20	$2,160.80	$6,250.00
	Labor to form and cast new reinforced conrete gate structure; this item includes excavation, setting forms and steel reinforcement.	40	HR	$125.00	$3,271.36	$1,728.64	$5,000.00
	Structural Concrete.	25	CY	$550.00	$8,996.24	$4,753.76	$13,750.00
	Steel Reinforcement.	375	LB	$15.00	$3,680.28	$1,944.72	$5,625.00
	Labor to install the Flumegate.	8	HR	$125.00	$654.27	$345.73	$1,000.00
	Light crane to install the Flumegate.	1	day	$750.00	$490.70	$259.30	$750.00
	STA. 208+60						
	Labor to remove exist. check gates and demolish existing concrete structure.	16	HR	$125.00	$1,308.54	$691.46	$2,000.00
	Light crane to remove exist. check gates.	1	day	$750.00	$490.70	$259.30	$750.00
	Removal of exist. reinforced concrete column, beam, and walkway.	4	CY	$1,250.00	$3,271.36	$1,728.64	$5,000.00
	Labor to form and cast new reinforced conrete gate structure; this item includes excavation, setting forms and steel reinforcement.	40	HR	$125.00	$3,271.36	$1,728.64	$5,000.00
	Structural Concrete.	20	CY	$550.00	$7,196.99	$3,803.01	$11,000.00
	Steel Reinforcement.	300	LB	$15.00	$2,944.22	$1,555.78	$4,500.00
	Labor to install the Flumegate.	8	HR	$125.00	$654.27	$345.73	$1,000.00
	Light crane to install the Flumegate.	1	day	$750.00	$490.70	$259.30	$750.00

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Entity: Hidalgo County Irrigation District # 2
Date: 01/13/15
Project: Alamo Main Canal
Eng.: Sigler, Winston, Greenwood & Associates
Alfonso Gonzalez, P.E.

PHASE I FY 2015 - Engineer's Preliminary Construction Cost Estimate Cont'd

Item No.	Description	Quantity	Unit	Unit Cost	Recipient Funding	Reclamation Funding	Total Cost
7	Construction of two reinforced concrete headwalls for Slipmeters at the I-22 & I-7 Turnouts at STA. 120+75						
	Labor to remove exist. slide gates.	16	HR	$125.00	$1,308.54	$691.46	$2,000.00
	Light crane to remove exist. slide gates.	1	day	$750.00	$490.70	$259.30	$750.00
	Removal of exist. concrete liner.	2	CY	$1,250.00	$1,635.68	$864.32	$2,500.00
	Labor to form and cast new reinforced conrete gate structure; this item includes excavation, setting forms and steel reinforcement.	40	HR	$125.00	$3,271.36	$1,728.64	$5,000.00
	Structural Concrete.	10	CY	$550.00	$3,598.50	$1,901.50	$5,500.00
	Steel Reinforcement.	20	LB	$15.00	$196.28	$103.72	$300.00
	Labor to install the Slipmeters.	8	HR	$125.00	$654.27	$345.73	$1,000.00
	Light crane to install the Slipmeters.	1	day	$750.00	$490.70	$259.30	$750.00
8	Geosynthetic Membrane and Construction of Fibrous Reinforced Concrete Liner						
	Clean and Power Wash of Existing Concrete Liner.	168,379	SF	$0.50	$55,082.89	$29,106.69	$84,189.58
	Placement of Geosynthetic Membrane Geocomposite (This item includes tucking).	202,055	SF	$1.55	$204,908.35	$108,276.90	$313,185.25
	Construction of Reinforced Concrete Liner.	183,686	SF	$3.75	$450,678.18	$238,145.68	$688,823.86
	Detail work at existing turnouts including removal and reinstallation of existing gates.	8	Ea.	$1,200.00	$6,281.01	$3,318.99	$9,600.00
	Anchorage and detail of Geo Composite at check structures and road crossings.	2	Ea.	$1,000.00	$1,308.54	$691.46	$2,000.00
9	Solar Panel Project.	1	EA	$65,000.00	$42,527.68	$22,472.32	$65,000.00
	Total Construction Cost Estimate				$946,223.70	$500,000.00	$1,446,223.70
	Engineering Fees in Connection to Preparation of Grant Application				$1,000.00		
	Field Surveying Services				$28,924.47		
*	Engineering Fees in Connection to Preparation of Plans & Specifications				$122,929.01		
	Environmental Review				$28,924.47		
**	Construction Inspection Services	2	MO	$5,610.00	$11,220.00		
	Performance Measure Report				$10,920.00		
	PHASE I - Total Estimated Project Cost				**$1,150,141.66**	**$500,000.00**	**$1,650,141.66**

NOTES:
This estimate was prepared with the basic information available at the time. A more precise estimate can be prepared at the time preliminary drawings become available. Excluded from the estimate are any necessary permit fees, right of way acquisition fees, utility adjustments which may consist of but shall not be limited to conflicts with existing irrigation lines, high pressure gas lines, drain lines, canals, etc...

*Engineering fees in connection to preparation of construction plans, contract documents, and technical specifications.
**Construction inspections at random once a week for 3 hour period including preparation of monthly construction status reports.

Entity: Hidalgo County Irrigation District # 2
Date: 01/13/15
Project: Alamo Main Canal
Eng.: Sigler, Winston, Greenwood & Associates
Alfonso Gonzalez, P.E.
PHASE II FY 2016 - Engineer's Preliminary Construction Cost Estimate

Item No.	Description	Quantity	Unit	Unit Cost	Recipient Funding	Reclamation Funding	Total Cost
1	FlumeGate, 1 at each structure; includes frame, aluminum walkway, sensors, batteries, controller, operator interface, solar panel, & charging subsystem. Includes calibration, startup, commissioning & training.	1	EA	$57,000.00	$50,426.84	$6,573.16	$57,000.00
2	SCADA System - Radio, tower, antenna, cables, and equipment	1	EA	$12,500.00	$11,058.52	$1,441.48	$12,500.00
3	By-pass pumping - Minimum capacity 100 cfs.	30	day	$450.00	$11,943.20	$1,556.80	$13,500.00
4	Earthen material for construction of temporary dams.	100	CY	$75.00	$6,635.11	$864.89	$7,500.00
5	Construction of new check gate structures.						
	STA. 68+81						
	Labor to remove exist. check gates and demolish existing concrete structure.	40	HR	$125.00	$4,423.41	$576.59	$5,000.00
	Light crane to remove exist. check gates.	1	day	$750.00	$663.51	$86.49	$750.00
	Removal of exist. reinforced concrete column, beam, and walkway.	5	CY	$1,250.00	$5,529.26	$720.74	$6,250.00
	Labor to form and cast new reinforced conrete gate structure; this item includes excavation, setting forms and steel reinforcement.	80	HR	$125.00	$8,846.81	$1,153.19	$10,000.00
	Structural Concrete.	25	CY	$550.00	$12,164.37	$1,585.63	$13,750.00
	Steel Reinforcement.	375	LB	$15.00	$4,976.33	$648.67	$5,625.00
	Labor to install the Flumegate.	8	HR	$125.00	$884.68	$115.32	$1,000.00
	Light crane to install the Flumegate.	1	day	$750.00	$663.51	$86.49	$750.00
6	Geosynthetic Membrane and Construction of Fibrous Reinforced Concrete Liner						
	Clean and Power Wash of Existing Concrete Liner.	311,938	SF	$0.50	$137,982.64	$17,986.11	$155,968.75
	Placement of Geosynthetic Membrane Geocomposite (This item includes tucking).	374,325	SF	$1.55	$513,295.42	$66,908.33	$580,203.75
	Construction of Reinforced Concrete Liner.	340,295	SF	$3.75	$1,128,948.87	$147,159.09	$1,276,107.95
	Detail work at existing turnouts including removal and reinstallation of existing gates.	5	Ea.	$1,200.00	$5,308.09	$691.91	$6,000.00
	Anchorage and detail of Geo Composite at check structures and road crossings.	16	Ea.	$1,000.00	$14,154.90	$1,845.10	$16,000.00

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Entity: Hidalgo County Irrigation District # 2
Date: 01/13/15
Project: Alamo Main Canal
Eng.: Sigler, Winston, Greenwood & Associates
Alfonso Gonzalez, P.E.

PHASE II FY 2016 - Engineer's Preliminary Construction Cost Estimate Cont'd

Item No.	Description	Quantity	Unit	Unit Cost	Recipient Funding	Reclamation Funding	Total Cost
	Total Construction Cost Estimate				$1,917,905.45	$250,000.00	$2,167,905.45
	Engineering Fees in Connection to Preparation of Grant Application				$1,000.00		
	Field Surveying Services				$43,358.11		
*	Engineering Fees in Connection to Preparation of Plans & Specifications				$184,271.96		
	Environmental Review				$43,358.11		
**	Construction Inspection Services	2	MO	$5,610.00	$11,220.00		
	Performance Measure Report				$10,920.00		
	PHASE II - Total Estimated Project Cost				**$2,212,033.64**	**$250,000.00**	**$2,462,033.64**

NOTES:

This estimate was prepared with the basic information available at the time. A more precise estimate can be prepared at the time preliminary drawings become available. Excluded from the estimate are any necessary permit fees, right of way acquisition fees, utility adjustments which may consist of but shall not be limited to conflicts with existing irrigation lines, high pressure gas lines, drain lines, canals, etc...

*Engineering fees in connection to preparation of construction plans, contract documents, and technical specifications.
**Construction inspections at random once a week for 3 hour period including preparation of monthly construction status reports.

Entity: Hidalgo County Irrigation District # 2
Date: 01/13/15
Project: Alamo Main Canal
Eng.: Sigler, Winston, Greenwood & Associates
Alfonso Gonzalez, P.E.

PHASE III FY 2017 - Engineer's Preliminary Construction Cost Estimate

Item No.	Description	Quantity	Unit	Unit Cost	Recipient Funding	Reclamation Funding	Total Cost
1	FlumeGate, 1 at each structure; includes frame, aluminum walkway, sensors, batteries, controller, operator interface, solar panel, & charging subsystem. Includes calibration, startup, commissioning & training.	1	EA	$40,000.00	$31,261.37	$8,738.63	$40,000.00
2	Slipmeter, 1 at each turnout; includes frame, sensors, batteries, controller, operator interface, solar panel & charging subsystem. Includes gate calibration, startup, commissioning, & training.	2	EA	$32,000.00	$50,018.18	$13,981.82	$64,000.00
3	SCADA System - Radio, tower, antenna, cables, and equipment	1	EA	$12,500.00	$9,769.18	$2,730.82	$12,500.00
4	By-pass pumping - Minimum capacity 100 cfs.	60	day	$450.00	$21,101.42	$5,898.58	$27,000.00
5	Earthen material for construction of temporary dams.	200	CY	$75.00	$11,723.01	$3,276.99	$15,000.00
6	Construction of new check gate structures.						
	STA. 227+87						
	Labor to remove exist. check gates and demolish existing concrete structure.	40	HR	$125.00	$3,907.67	$1,092.33	$5,000.00
	Light crane to remove exist. check gates.	1	day	$750.00	$586.15	$163.85	$750.00
	Removal of exist. reinforced concrete column, beam, and walkway.	5	CY	$1,250.00	$4,884.59	$1,365.41	$6,250.00
	Labor to form and cast new reinforced conrete gate structure; this item includes excavation, setting forms and steel reinforcement.	80	HR	$125.00	$7,815.34	$2,184.66	$10,000.00
	Structural Concrete.	20	CY	$550.00	$8,596.88	$2,403.12	$11,000.00
	Steel Reinforcement.	300	LB	$15.00	$3,516.90	$983.10	$4,500.00
	Labor to install the Flumegate.	8	HR	$125.00	$781.53	$218.47	$1,000.00
	Light crane to install the Flumegate.	1	day	$750.00	$586.15	$163.85	$750.00
7	Construction of two reinforced concrete headwalls for Slipmeters at West Canal & Turnouts at STA. 120+75						
	Labor to remove exist. slide gates.	16	HR	$125.00	$1,563.07	$436.93	$2,000.00
	Light crane to remove exist. slide gates.	1	day	$750.00	$586.15	$163.85	$750.00
	Removal of exist. concrete liner.	2	CY	$1,250.00	$1,953.84	$546.16	$2,500.00
	Labor to form and cast new reinforced conrete gate structure; this item includes excavation, setting forms and steel reinforcement.	40	HR	$125.00	$3,907.67	$1,092.33	$5,000.00
	Structural Concrete.	10	CY	$550.00	$4,298.44	$1,201.56	$5,500.00
	Steel Reinforcement.	20	LB	$15.00	$234.46	$65.54	$300.00
	Labor to install the Slipmeters.	8	HR	$125.00	$781.53	$218.47	$1,000.00
	Light crane to install the Slipmeters.	1	day	$750.00	$586.15	$163.85	$750.00

Continues in Page 2

Entity: Hidalgo County Irrigation District # 2
Date: 01/13/15
Project: Alamo Main Canal
Eng.: Sigler, Winston, Greenwood & Associates
Alfonso Gonzalez, P.E.

PHASE III FY 2017 - Engineer's Preliminary Construction Cost Estimate Cont'd

Item No.	Description	Quantity	Unit	Unit Cost	Recipient Funding	Reclamation Funding	Total Cost
8	Geosynthetic Membrane and Construction of Fibrous Reinforced Concrete Liner						
	Clean and Power Wash of Existing Concrete Liner.	140,568	SF	$0.50	$54,929.48	$15,354.69	$70,284.17
	Placement of Geosynthetic Membrane Geocomposite (This item includes tucking).	168,682	SF	$1.55	$204,337.65	$57,119.45	$261,457.10
	Construction of Reinforced Concrete Liner.	153,347	SF	$3.75	$449,422.98	$125,629.29	$575,052.27
	Detail work at existing turnouts including removal and reinstallation of existing gates.	5	Ea.	$1,200.00	$4,689.20	$1,310.80	$6,000.00
	Anchorage and detail of Geo Composite at check structures and road crossings.	16	Ea.	$1,000.00	$12,504.55	$3,495.45	$16,000.00
	Total Construction Cost Estimate				$894,343.54	$250,000.00	$1,144,343.54
	Engineering Fees in Connection to Preparation of Grant Application				$1,000.00		
	Field Surveying Services				$22,886.87		
*	Engineering Fees in Connection to Preparation of Plans & Specifications				$97,269.20		
	Environmental Review				$22,886.87		
**	Construction Inspection Services	2	MO	$5,610.00	$11,220.00		
	Performance Measure Report				$10,920.00		
	PHASE III - Total Estimated Project Cost				**$1,060,526.48**	**$250,000.00**	**$1,310,526.48**

NOTES:

This estimate was prepared with the basic information available at the time. A more precise estimate can be prepared at the time preliminary drawings become available. Excluded from the estimate are any necessary permit fees, right of way acquisition fees, utility adjustments which may consist of but shall not be limited to conflicts with existing irrigation lines, high pressure gas lines, drain lines, canals, etc...

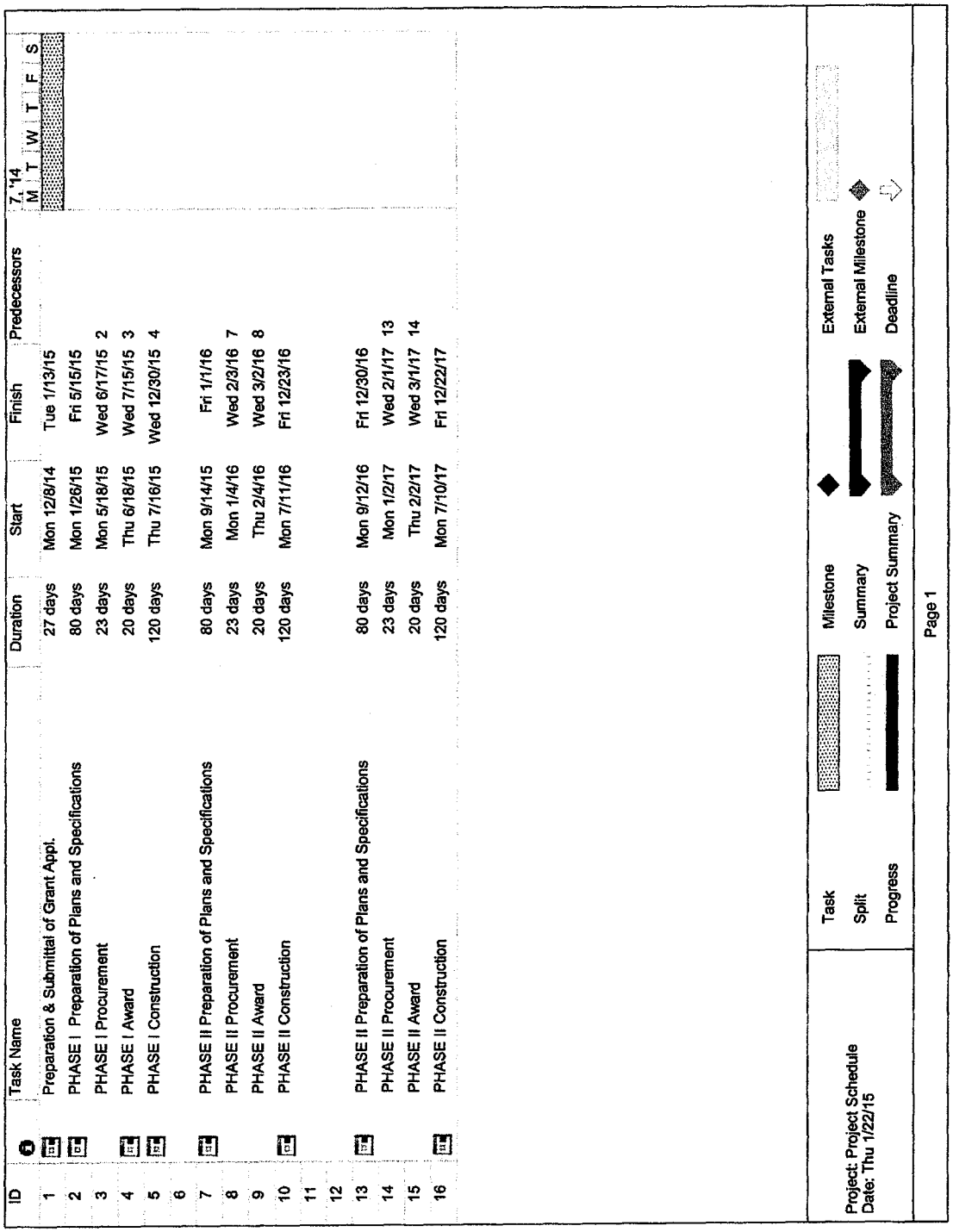
*Engineering fees in connection to preparation of construction plans, contract documents, and technical specifications.
**Construction inspections at random once a week for 3 hour period including preparation of monthly construction status reports.

TABLE 1. RECORD OF MONTHLY POWER USED AND VOLUME OF WATER PUMPED - AT THE RIVER PUMPING PLANT

PERIOD	KWH	PUMPED VOL (AC-FT)	KWH / AC-FT
12/15/10	535,123.68	6,050	88
11/11/10	323,732.16	6,685	48
10/13/10	182,254.56	7,637	24
09/14/10	258,696.00	3,560	73
08/13/10	125,807.52	3,000	42
07/15/10	325,850.40	3,978	82
06/15/10	502,826.88	6,631	76
05/14/10	415,611.84	8,632	48
04/15/10	530,464.80	4,371	121
03/16/10	304,367.52	5,546	55
02/15/10	184,924.80	1,225	151
01/15/10	217,106.88	3,335	65
12/14/09	347,707.68	2,106	165
11/11/09	562,234.56	5,888	95
10/12/09	372,794.40	3,887	96
09/14/09	584,548.32	4,264	137
08/13/09	625,812.00	11,488	54
07/15/09	681,407.52	7,462	91
06/15/09	634,042.56	8,560	74
05/14/09	841,001.28	15,581	54
04/15/09	646,499.04	10,733	60
03/16/09	537,347.04	7,817	69
02/13/09	527,061.12	7,173	73
01/15/09	385,455.36	8,419	46
12/12/08	302,801.76	4,248	71
11/11/08	360,724.32	6,635	54
10/13/08	232,689.60	3,494	67
09/12/08	268,072.32	2,676	100
08/13/08	203,425.92	4,729	43
07/15/08	454,313.28	2,458	185
06/13/08	747,089.28	9,072	82
05/14/08	645,739.20	12,981	50
04/15/08	724,800.00	11,139	65
03/14/08	537,600.00	10,757	50
02/14/08	388,800.00	6,633	59
01/08/08	482,400.00	5,975	81
		AVERAGE KWH / AC-FT	**78**

TABLE 2. RECORD OF MONTHLY POWER USED AND VOLUME OF WATER PUMPED - AT THE RE-LIFT PUMPING PLANT

PERIOD	KWH	PUMPED VOL (AC-FT)	KWH / AC-FT
12/06/10	287,970	3,449	84
11/03/10	233,330	3,543	66
10/05/10	128,243	3,895	33
09/03/10	182,909	2,065	89
08/05/10	106,518	1,650	65
07/07/10	148,047	2,347	63
06/07/10	268,312	3,647	74
05/06/10	167,347	4,316	39
04/07/10	194,275	2,623	74
03/08/10	80,937	3,161	26
02/05/10	99,540	796	125
01/07/10	90,898	1,934	47
12/04/09	155,814	1,179	132
11/03/09	192,474	3,238	59
10/05/09	160,628	2,099	77
09/03/09	285,576	2,175	131
08/05/09	292,879	6,433	46
07/07/09	301,012	4,477	67
06/05/09	322,082	5,222	62
05/06/09	376,966	9,037	42
04/06/09	255,046	6,118	42
03/06/09	187,724	4,925	38
02/05/09	234,148	4,160	56
01/07/09	165,976	5,051	33
12/04/08	163,898	2,124	77
11/03/08	171,388	3,251	53
10/03/08	100,978	1,747	58
09/05/08	150,019	1,284	117
08/05/08	83,188	2,412	34
07/07/08	275,151	1,475	187
06/05/08	319,217	5,534	58
05/06/08	326,078	7,529	43
04/07/08	258,000	6,683	39
03/06/08	193,200	6,131	32
02/06/08	181,200	4,179	43
1/8/2008	241,200	3,525	68
		AVERAGE KWH / AC-FT	**66**



ID	Task Name	Duration	Start	Finish	Predecessors
1	Preparation & Submittal of Grant Appl.	27 days	Mon 12/8/14	Tue 1/13/15	
2	PHASE I Preparation of Plans and Specifications	80 days	Mon 1/26/15	Fri 5/15/15	
3	PHASE I Procurement	23 days	Mon 5/18/15	Wed 6/17/15	2
4	PHASE I Award	20 days	Thu 6/18/15	Wed 7/15/15	3
5	PHASE I Construction	120 days	Thu 7/16/15	Wed 12/30/15	4
6					
7	PHASE II Preparation of Plans and Specifications	80 days	Mon 9/14/15	Fri 1/1/16	
8	PHASE II Procurement	23 days	Mon 1/4/16	Wed 2/3/16	7
9	PHASE II Award	20 days	Thu 2/4/16	Wed 3/2/16	8
10	PHASE II Construction	120 days	Mon 7/11/16	Fri 12/23/16	
11					
12					
13	PHASE II Preparation of Plans and Specifications	80 days	Mon 9/12/16	Fri 12/30/16	
14	PHASE II Procurement	23 days	Mon 1/2/17	Wed 2/1/17	13
15	PHASE II Award	20 days	Thu 2/2/17	Wed 3/1/17	14
16	PHASE II Construction	120 days	Mon 7/10/17	Fri 12/22/17	

RESOLUTION

WaterSMART
Water and Energy Efficiency Grants

WHEREAS, the Hidalgo County Irrigation District No.2 (District) is applying with the United States Department of Interior-Bureau of Reclamation for grant financial assistance through the WaterSMART (Sustain and Manage America's Resources for Tomorrow) program, Funding Opportunity Announcement No. R15AS00002; and,

WHEREAS, Sonny Hinojosa, General Manager of the District, has reviewed the application and is hereby authorized to submit an application and enter into agreement on behalf of the District for the WaterSMART: Water and Energy Efficiency Grants; and,

WHEREAS, the District's Board of Directors support the application submitted; and,

WHEREAS, the District has sufficient funds in its Capital Improvements Fund to satisfy its portion of the cost share as specified in the funding plan; and,

WHEREAS, the District is committed to cooperate with the United States Department of Interior-Bureau of Reclamation to meet established deadlines for entering into cooperative agreements.

NOW, THEREFORE, BE IT RESOLVED that the Hidalgo County Irrigation District No.2 prays it is awarded the WaterSMART: Water and Energy Efficiency Grant and is fully committed to relining the Alamo Main Canal and retrofitting the existing gate structures with fully automated gates as expeditiously as possible to conserve energy and water and help increase future water supplies for agricultural, domestic, municipal, industrial, mining, and environmental purposes.

Passed and adopted this eighth day of January, 2015.
HIDALGO COUNTY IRRIGATION DISTRICT No.2

Karl Obst, President

Fred Schuster, Secretary

Randy C. Winston, P.E., President
Alfonso Gonzalez, P.E., Associate

SIGLER, WINSTON, GREENWOOD
& ASSOC.
SWG ENGINEERING, LLC
611 Bill Summers Intl Blvd
Weslaco, TX 78596
O 956.968.2194 F 956.968.8300
Firm Registration No. F-592

Joe B. Winston, Jr., P.E., Exec. VP

January 22, 2015

Re: WaterSMART Water & Energy
Efficiency Grants for FY 2015 FOA
No. R15AS00002

Mr. Shaun Wilken
Bureau of Reclamation
Mail Code 84-27852
Denver Federal Center, Bldg. 67. Rm. 152
6th Avenue and Kipling St.
Denver, CO 80225

Dear Mr. Wilken,

On behalf of Hidalgo County Irrigation District No. 2, enclosed please find one (1) original and (1) copy of the WaterSMART Water and Energy Efficiency Grants Application for FY 2015 FOA No. R15AS00002 for the Relining and Retrofit of two Existing Check Gate Structures of the Alamo Main Canal to Attain Real Time Canal Control and Conserve Water and Energy in 28,100 linear feet of canal segment.

If you have any questions or need additional information, please feel free to call.

Sincerely,
SIGLER, WINSTON, GREENWOOD
& ASSOC., INC.

Alfonso A. Gonzalez, P.E.

AAG:cz
Encls.

Cc: Mr. Sonny Hinojosa, General Manager, HCID No. 2, P.O. Box 6, San Juan, TX 78589