

# ***Project Report***

*Little Salmon Carmacks First Nation  
Community Farm Irrigation Project*

***Proving Photo-voltaic Powered Irrigation Systems***

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# *Little Salmon Carmacks First Nation Community Farm Irrigation Project*

## ***Proving Photo-voltaic Powered Irrigation Systems***

### Introduction

The Little Salmon Carmacks First Nation (LSCFN) is situated in and around Carmacks, Yukon, a community of about 400 people with approximately 70% being LSCFN members.

Carmacks is located 185km north of Whitehorse on the North Klondike highway where the Nordenskiöld River enters the Yukon River. Several large bends in the Yukon River in this area create an interesting landscape as seen in the aerial photo to the right. In the photo, the Village of Carmacks is in the upper right, the LSCFN is mainly on the near island in the middle and the community farm is on the forested point in the upper mid-left that comes in from the land mass at the bottom of the photograph.



Picture credit:  
<http://www.yesnet.yk.ca/schools/tantalus/carmacks/carmacks-1.html>

The LSCFN is interested in sustainability and renewable energy and has a number of related projects completed, underway or in planning. One such project is a photo-voltaic (PV or solar electric panel) powered irrigation system installed at the above noted LSCFN community farm.

### Project Background

For several years the LSCFN has been operating a community greenhouse and farm.



The greenhouse provides a place where LSCFN citizens can work together to benefit from the collaboration and from the fresh locally-grown produce.

The greenhouse is heated with renewable energy (wood). It uses thermal mass to maintain temperatures and limit temperature swings and initially used a PV powered pump as a source of water from the Yukon River (there is now a supply line from the LSCFN administration building).

All vegetables are grown organically and the greenhouse has been a great success in this community. Complementary to the greenhouse is the LSCFN community farm, a field across the river where potatoes are grown.

In 2007, the Little Salmon Carmacks First Nation (LSCFN) approached the Energy Solutions Centre (ESC) regarding support for an irrigation project at the community farm. LSCFN was seeking funding options and technical support and eager to collaborate in a process that would bring greater yields to their community farm.

## Project Implementation

The ESC provided initial research into plausible systems and potential funding options and partners. The Yukon Government Agriculture Branch was contacted for assistance with irrigation design and funding while the ESC took care of the energy supply and pumping side of the project as well as partially funding the project. The LSCFN provided the initial project concept and much in-kind support as well as the final amount of funding.

### **Funding:**

Through the Yukon Agriculture Branch, core funding was secured from a program known as the Canada-Yukon Water Supply Expansion Program or CYWSEP.

The ESC also provided a substantial block of funding along with in-kind support for project management, design and system installation.

The LSCFN agreed to provide the remaining funding and in-kind support in the form of installation, system monitoring, reporting, and operations & maintenance.

The Agriculture Branch has assisted by coordinating access to the CYWSEP and through technical support in the form of irrigation design and installation assistance.

Source	Line Item	Contribution	
		In-Kind	Expense
CYWSEP	Solar water pumping system, storage tank and water lines.	0	8,000
ESC	System design and installation technician, system design, installation support, additional parts and contingency.	1,000	5,350
LSCFN		200	500
<b>Sub-totals</b>		<b>1,200</b>	<b>13,850</b>
<b>Total</b>		<b>\$ 15,050</b>	

### **Partners:**

An informal partnership on this project was formed with the main players including: the Little Salmon Carmacks First Nation, the Yukon Agriculture Branch and the Energy Solutions Centre. Furthermore, the ESC agreed to act as the project manager.

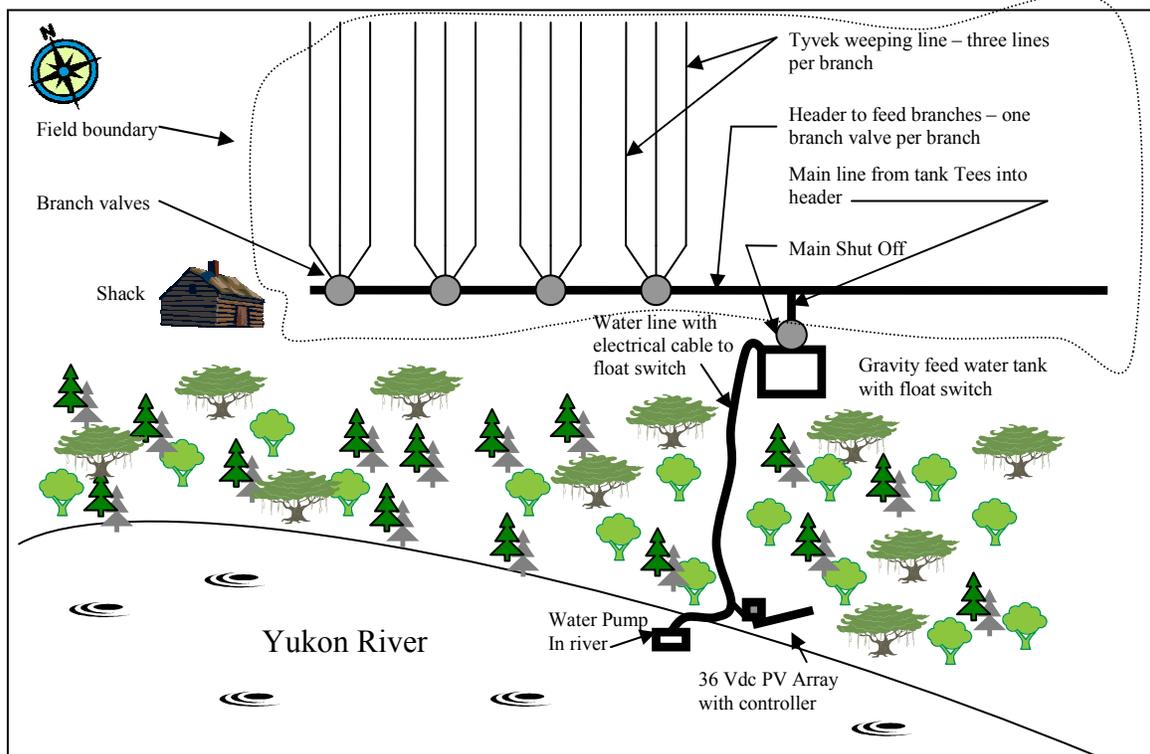
Other agencies involved in this project were the CYWSEP and Sow's Ear Energy, a local contractor with expertise in energy efficient building and renewable energy systems.

### **Design:**

The basic system design was drawn up by the ESC, with details added by Sow's Ear Energy and the Agriculture Branch. The system is a PV-powered water pump feeding a storage tank that irrigates by gravity-feed.

## Design Details:

- In the river is a Grundfos pump that can be powered by 30 to 300Vdc or 90 to 240 Vac. It is self-priming and protected from dry-pumping by a water sensor that prevents it from pumping unless there is water to pump (e.g., in case river water levels drop). From time to time the pump assembly must be moved to accommodate rising and falling water levels.
- Providing power to the pump is a 3-panel array of 12 Vdc PV panels mounted on a rack and secured to the river shore on concrete piles. The rack faces due south and is tilted towards the sky approximately 55° back from vertical. There are no batteries in this system so as long as there is enough solar energy to activate the pump, it will pump water – assuming the float switch is closed.
- The float switch is in the storage tank by the farm field. It controls whether or not the pump will pump depending on the water level in the storage tank. The cable from this switch parallels the water line through the forest to the river.
- There is a Grundfos electronic controller attached to the PV array rack that coordinates and controls the power flow and signals from the control (float) switch. The system can also be turned off with the controller.
- A 1.5" water supply line runs from the pump through the river side forest to the storage tank beside the field.
- The 1,250 gallon water storage tank is on a stand about 2 feet above the level of the field to enable gravity feed.
- The tank will feed self-regulating Tyvek© irrigation lines by way of a header feeding several branches of the Tyvek© lines. As water leaves the tank a float switch controls when the pump needs to be activated to refill the tank.
- The system is fully automatic but will be monitored by LSCFN staff.



## Installation:

Installation to date has occurred in three stages with one stage remaining. On a snowy day in October of 2007 all main components were taken to the site with waterlines placed, the PV rack assembled, the concrete piles poured and the tank support built.



In early June, 2008 the site was again visited to complete the installation and test the system. All wiring was completed and the water tank was connected. After a short system test to confirm pump operation this stage was complete. At this point only the irrigation lines and a few other related parts remained to be installed.

In late June, 2008 Sow's Ear Energy made a final visit to the site to finalize water storage and energy elements of the system. A remaining section of water supply line and a main shut-off valve for the storage tank were added and another test was performed to confirm the function of the system before winterizing the system (see **Obstacles** below).

The final installation stage will involve adding the irrigation lines, raising the PV rack (see **Remaining** below), commissioning the system and familiarizing LSCFN personnel with operating the system. This should take place in September 2008 (see **Obstacles** below).

All installation has taken place with Cory Gordon of Sow's Ear Energy, as the contractor, leading and coordinating the installation with the assistance of ESC staff, Agriculture Branch and staff and citizens of the LSCFN. Matt Ball of the agriculture branch will manage the design and installation of the irrigation lines. He will also work with LSCFN to create a crop plan.

## Project Status

As of July 10, 2008, the majority of the project is complete with all aspects of the energy and water supply and storage systems complete and tested. The water delivery (irrigation) elements of the system have yet to be installed and have been delayed due to unanticipated issues (see below) that resulted in the field not being planted this year. Therefore the irrigation lines will be added in the fall when the PV array will also be raised to deal with potential high water years.

## **Obstacles:**

Although the energy and water storage elements of the system were ready in June and the irrigation lines could have been added swiftly, a combination of factors resulted in the field not being planted this season. Delays in the upgrade of the access road, concerns about bear-safety, personnel issues and a need to plant sooner rather than later led to a choice by LSCFN to plant a different, privately owned field and to leave the LSCFN community farm to lie fallow for this year. Because of this the PV-powered system will actually be used until spring of 2009 and has been winterized.

## **Remaining:**

In September of 2008, the final installation stage will include the addition of the irrigation lines in preparation for their use in the spring of 2009. At this time the PV rack will be also raised by 30 to 60cm to deal with future high water levels. This decision was made after initial installation since the 2008 Yukon River levels were at the maximum of what the system could endure.

Besides the final installation stage future tasks include:

- Frequent observation of the system to ensure it meets the needs and expectations of the LSCFN and the technical expectations of the ESC.
- Manual logging of system operation and corresponding weather conditions
- Development of a maintenance regime and protocols for dealing with winterizing, spring system start-up, and high and low water periods
- The ESC will monitor the performance of the system, evaluate the value of such systems, create a fact sheet regarding the system performance and make recommendations for those considering such systems.

## Project Participants

Two branches from the Government of Yukon and the Little Salmon Carmacks First Nation cooperated in bring this project to fruition with the assistance of a contractor.

The main contacts are listed here:

### Little Salmon Carmacks First Nation

- George Skookum
  - 867-863-5576
- Dawn Charlie
- Chris Gull
- Phil Bolin

### Energy Solutions Centre

- Shane Andre
  - 867-393-7062
- Sean MacKinnon
  - 867-393-7067

### Sow's Ear Builders (Contractor)

- Cory Gordon
  - 334-2076

### Yukon Agriculture

- Matt Ball
  - 867-393-7410

## Acronyms

CYWSEP	Canada-Yukon Water Supply Expansion Program
ESC	Energy Solutions Centre
LSCFN	Little Salmon Carmacks First Nation
PV	Photo-Voltaic (refers to solar electric generation)
Vac	Volts DC (direct current)
Vdc	Volts AC (alternating current)