### Executive Summary

**Sustainable Solutions Agricultural Consulting LLC provides a variety of agronomy and engineering services and is committed to helping farms produce the best crops in the most environmentally conscientious manner possible. We strive to increase your productivity and returns with better management and planning. We bring to our clients 20 years of experience in plant, soil and water management where yield and quality optimization goes hand in hand to a more sustainable agricultural environment and maximized economic returns.**

**Our company offers consulting services in a variety of crops such as potato (chip, french fry and fresh market), barley (feed and malt), wheat, canola, lettuce, spinach, broccoli, corn, soybean, oats, pastures (grasses and legumes), sorghum, green manures (radish, sorghum sudan, mustard, rye).**

**We offer extensive engineering experience on pump test, water flow measurement, nozzling chart for center pivot systems, center pivot systems performance evaluations and percent speed chart.**

**Working in countries like USA, Canada, Dominican Republic, Uruguay, Argentina, Peru and Honduras gives us the knowledge and experience to serve in different parts of the world as well.**

### General Company Description

**The company is dedicated to serve with advice on agricultural and irrigation practices, hands-on agronomy and potato storage management to the agricultural community.**

Mission Statement: **Our mission is to apply and responsibly execute best management practices for the crops grown in any part of the world where we can make a difference in obtaining better yields and quality of foods.**

### Products and Services

**List of Services**

***New Land Selection and Soil Cultivation***

When new land is identified as a potential rental or purchase, a thorough evaluation is necessary. This service provides information about:

Soil type classification using a digital map or by soil sampling if government or other digital data is not available, topographic land maps to identify best practices for soil erosion control and farming practices.

Soil fertility, it is critical to measure and make correct decisions on what is needed to grow the best crops and to do a cost analysis BEFORE the facts.

Soil pest breakdown (nematode identification and their effect on crop development and cost analysis)

Water quality and availability to match peak season demand for different crops. Water samples are sending to the lab for quality analysis. Measurements or calculations on total water capacity. Best irrigation system suitable for the land.

Hard pan depth detection and weed infestation level (type and pressure). Best crop rotation for each field will be developed.

Best management practices in soil cultivation. Evaluation of machinery sequence. Determination of plowing depth. Determination of what machinery is best employed pre-plant and post-harvest dependent upon soil and crop type and topography.

***Potato and Grains Machinery Calibration***

It is critical to review and calibrate all machinery BEFORE they start working AND during the time they are working. This service provides the information needed to have all machinery well calibrated. It includes:

Inspection and measurements not exclusive to seed treatment, planting, cultivating, spraying, and harvesting equipment to maximize plant stand counts and capitalize yield. We can evaluate seed treatment coverage, seed planting depth and planter speed, spacing, % skips, % doubles. We can also assess potato digging and harvesting equipment for bruise minimization and grain harvest for tail losses.

Grain harvester inspection for tail and headers losses

***Potato Seed Size Profile before and after Cutting***

Buying first and cutting seed later are one of the earliest tasks in the potato production plan. The seed size profile gives our clients the information necessary to: communicate within seed and commercial growers BEFORE the seed is shipped to the commercial farm and make sure the size profile is in the desired range. It provides the seed growers the information they need to inform their clients what seed size they have for sell in storage per variety. It helps all growers (seed and commercial) to adjust their cutters to their seed size goal at planting time. The service includes:

Samples of seed pieces are taken during seed cutting. Seed pieces are individually weighted and a seed size distribution is obtained. Calibration of seed cutters are recommended on-site based on this information. Seed rate per acre based on average final seed size and planting distance per variety is also included. See appendix 1.

For storage seed evaluation, samples of whole tubers are taken during harvest at their final destination site or in storage before shipping. Tubers are individually weighted and a tuber size profile distribution is obtained.

***Potato and Grains Plant Stand Count***

The plant stand count is obtained after plants are emerged. This service will help to identify planter’s calibration accuracy, emergence issues due to seed rot and seed not germinated, and final population obtained between others. The measurements consist of:

Potato: 2 trials per field to obtain the average number for final plant population, % skips, % doubles, % seed not germinated, and % seed rot. A profit loss analysis could be done with this information based on the total plants missed and an average yield per plant. See appendix 2

Grains: 5 trials per field to obtain the average number for final plant population, plants/ft2 , and % seed rot/not germinated

***Soil and Plant Fertility***

Soil Nutrient Analysis must be well interpreted and well adjusted for field conditions and variety type. The recommendations will utilize the proven principles of the Kinsey/ Albrecht system of soil fertility management. Correct and raise the overall soil fertility to improve and maintain yields and crop quality would be the objective of the recommendations.

* *Soil:*

Soil samples will be sent to Kinsey Agricultural Service Lab and to the farm lab to compare numbers *(After having enough samples to correlate with Farm lab, the Farm lab numbers are used for calculations).*  Farm Lab should run analysis for % of Base Saturation of Ca, Mg, K and Na, NPK, and micro nutrients including Boron.

* A complete fertilizer proposal on managing and balancing soil nutrients (N, P, K, Ca, Mg, Na, Cu, Zn, B, Fe, Mn) and Lime/Gypsum recommendations are issued based on crop type.

Calcium and Magnesium amendments recommendations are based on base saturation percentages of Ca, Mg, K and Na and NOT on pH.

* Fertilizer placement and type (dry and/or liquid) recommendations.
* Field evaluation for Variable rate fertilization application. Cost analysis. Help identifying the best technology available for mapping ( i.e. aerial photos, soil electric conductivity, satellite images, yield monitor maps)

See appendix 3.

* *Plant:*

When the soil has its nutrients balanced, plants should have enough potassium, phosphorous, zinc, iron and copper to produce maximum yields unless leaching is a major factor. On the other hand, Nitrogen leaches more easily than other nutrients and every crop has its own demand for this nutrient. That’s why a petiole program helps to maximize timing management and total amount of nitrogen applications. The petiole program has to start early in the crop-cycle for nitrogen and other nutrients best management.

A petiole program for each crop variety will be developed. Each variety has different nutrient management; the best management for each nutrient will be developed. Training on petiole sampling is included. See appendix 4.

***Irrigation Scheduling***

Irrigation scheduling depends on 6 major factors: crop type and development stage, weather, soil type, disease management, type of irrigation system and total water capacity from source (Gallons per minute). We assist farmers in developing irrigation scheduling programs to assure proper timing and amounts of water delivery and applications. Technology such as infra red pictures taken from airplane to ID irrigation problems, fertility issues and different soil types to build a fertility variable rate zone map could be contracted.

The soil moisture deficit is determined at the time of visit. Calculations on when to start irrigations and the amount of water applied per irrigation are calculated for one week in advance and detailed in an irrigation scheduling sheet. Other factors such as disease (above and below ground), and weather forecast are taken into consideration for the calculations on timing and amount of water to apply. See appendix 5.

If soil moisture probes are utilized by the farm, software parameters are set for soil field capacity and desired soil moisture deficits. When to start irrigations and the amount of water per irrigation will be displayed. Training on soil moisture probe management and practical utilization.

***Engineering Services***

These services provide to our clients with the information necessary to optimize irrigation water distribution, maximize water resources and water management. The services include:

Total flow measurement from the source (well, pond, river, other) and center pivot velocities are measured to obtain a % Speed Chart. See appendix 6.

Total flow measurement from pump

Center pivot nozzle chart and recommendations. See appendix 7

Pump Test. Includes: Pump efficiency, flow measurement, pumping water levels, static water levels, pressure at pivot, well cascading identification and air sucking because lower static water levels. See appendix 8

Water Monitoring- this service is provided along the season in a weekly basis to monitor: static and pumping water levels from well or other sources, pressure at pivot, water flow calculation based on pressure, flow meter readings if installed. See appendix 9

***Integrated Pest Management***

Scouting fields is the way to identify diseases and insects in crops. Developing an IPM program for the farm or improving the existing one is what this service is about. An intense scout of the field is done paying special attention to critical areas (i.e. wet spots, field edges, weak crop spots).

Detection and identification of pests with recommendations on herbicides, fungicides, insecticides, nematicides to apply after a thorough inspection of the field. Different chemistries and timing of application are discussed with clients.

Nematodes ID and their best management practices (crop rotation, fumigation, nematicides, and biological control) are discussed with clients. Sampling protocol and the laboratory to send the samples are included in the recommendations. Grid mapping development. See appendix Nematode Grid.

An IPM sheet with recommendations is issued. See appendix 10, 11.

***Potato Storage Evaluation and Monitoring***

This service is provided in a weekly basis (once a week) and starts after the bin is full until holding temperature is achieved, after that, is up to the client the frequency of visits. A complete storage evaluation, including air measurements and the use of an infra red camera to detect insulation problems are included in this service. Early, mid and late storage are detailed separately.

**Early Storage**: a complete storage inspection is done during this visit.

Air velocities are measured for all laterals and total CFM for the storage is calculated.

Detection of air flow problems in laterals.

Calculations on air velocities in plenum, humidicell, exhaust, return and fresh air intake

Recommendations on minimum air capacity for the storage.

Plenum, top of pile and return temperatures are measured.

Relative humidity in plenum and top of pile are measured.

Measurements are compared towards panel box data.

Humidity system inspection.

Temperature and RH sensors calibration recommendations.

The entire top surface pile is scanned for temperature.

Temperature gradient between top and bottom of pile is calculated.

The entire building is scanned for temperature leaks through doors and insulation problems are detected using infra red camera. See appendix 12.

Best management recommendations are developed based on measurements, weather and tuber condition. See appendix 13.

Mid Storage: plenum and top of pile inspection is done during this visit.

Lateral air velocities are re-measured if bin is partially filled.

Plenum, top of pile and return temperatures are measured.

Relative humidity in plenum and top of pile are measured.

Measurements are compared towards panel box data.

Humidity system inspection.

Temperature and RH sensors calibration recommendations.

The entire top surface pile is scanned for temperature measurement.

Best management recommendations are issued based on measurements, weather and tuber condition.

Late Storage: plenum and top of pile inspection is done during this visit.

Plenum, top of pile and return temperatures are measured.

Relative humidity in plenum and top of pile are measured.

Measurements are compared towards panel box data.

Humidity system inspection.

Temperature and RH sensors calibration recommendations.

Conditioning planning for shipping.

Best management recommendations are issued based on measurements, weather and tuber condition.

***Crop Best Practices Management Program***

Based on detailed information from each field, a BPM Program is developed for each crop, field and farm. The BPM Program includes **farm management** recommendations on tillage, fertility program, irrigation, soil erosion control, crop rotation and crop optimization, pests, planting and harvest, storage and a total cost of production could be developed.

***Potato Yield and Size Profile Assessments***

This service provides the necessary information to decide when to kill vines or when to start harvest to maximize yield. The information is stored to compare historical data and identified which variety or varieties behaved better in which field.

Average yield and a size profile determination are assessed on a 10’ linear strip. 2 trials per field are performed. See appendix 14.

***Training***

We offer different training topics with trainers that have vast experience working in direct contact with crops and a hands-on approach is provided in each area. The training areas are:

Soil fertility. Managing the correct Base Saturation Percent on Ca, Mg, K and Na. How these macro nutrients affect NPK, micro nutrients and soil natural biology development. Soil sampling protocol and what to ask the laboratory for analysis.

Potato Storage Management. The basics of storage management and the importance of ventilation, humidification and insulation on the potato quality and total sellable tons.

Potato Crop Management. Practical tips for the whole potato crop process from seed cutting to storage and shipping.

Irrigation scheduling and water management. Soil moisture deficit calculation, irrigation schedule calculation (days), water amounts calculation (inches, mm), irrigation systems evaluations (center pivot, flood, sprinkler), soil moisture probes best utilization.

Other Areas. If there is a need for training in any other area(s), we can find the experts to assist you!

\*\*Note- the services Soil and Plant Fertility, Center pivot nozzle chart and Training are individual services and will be quoted separately.