Silver Hill Foods—LIFE

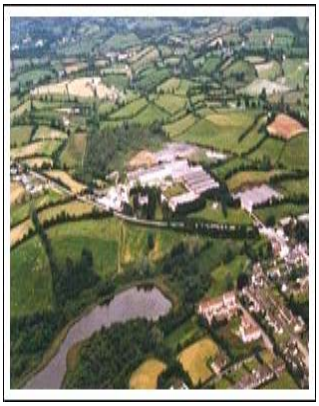
A Laymans Report

SILVER HILL FOODS

LIFE Project Number: 03ENV/IRL/000312

DEVELOPMENT OF A PROCESSING PLANT FOR THE TREATMENT OF DUCK SLURRY

Silver Hill Foods, is a fully integrated family owned duck company. Founded over 40 years ago by Ronnie and Lyla Steele in Emyvale Co. Monaghan, Ireland. The Company is one of Europe's largest duck farming enterprises. It breeds and processes approximately 3 million ducks per annum on its sites in the North East of Ireland and in Northern Ireland. The manner in which the ducks are grown is unique to Silver Hill Foods. The growing operation leads to the generation of between 70,000 and 80,000 tonnes of duck slurry per annum. This slurry has an average dry solids content of between 3% and 5%. The current management mechanism for this manure is via recovery to land. Upwards of 3000 hectares of land is required to dispose of the slurry and the company must manage the logistics and nutrient distribution of this material. Silver Hill Foods is located in an area of Ireland laden with intensive poultry, pig and mushroom growing operations and the competition for spread lands in this area is great. Silver Hill Foods must transport its slurry as far as 150 km from the site to suitable spread lands deficient in nutrients. Impending legislation in the form of the Nitrates Directive and in-situ phosphorus regulations are further regulating the application of manures to the spread lands hence were the situation to remain the same the cost of slurry recovery to land would be unsustainable for the company.



ABOVE: An Overhead view of the Silver Hill Foods Facility located in Emyvale, North Co. Monaghan, Ireland.

BELOW: A view of the New Duck Slurry Treatment facility at Silver Hill Foods.

Background to the "Duck Slurry" Project

For many years Silver Hill Foods Senior Management have been assessing feasible options for effecting a reduction in the volumes of slurry it must transport to suitable spread lands. In early 2001 the Company began to devote a lot of time to researching possible alternatives. Having identified the general direction that should be taken the Company set about a selection process for the best available technology. The Company management honed in on possible alternatives and devoted considerable resources to site visits across Europe, the United States and parts of Asia. After this research period it was decided that the best general route was to effect a separation of the liquid and solid in the manure. To dry the soilds by a suitable method. To treat the liquid from the dewatering phase to a level which would allow it to be discharged to river under legislative consent. For Silver Hill Foods this meant ensuring that 90% of the volume would no longer need to be transported off site. The decision to turn the dried slurry into a marketable fertiliser came at a later stage in the overall design.

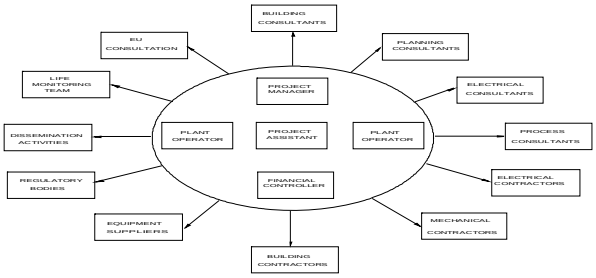
Inside This Report:

Silver Hill Foods and LIFE

Silver Hill Foods had been assessing the various technologies and options available to treat the duck slurry and had developed a rough project framework. At that point the idea was at the budding stage and needed to be developed. It was the Company Financial Director who having been involved in the brainstorming for an innovative approach to the treatment of duck slurry felt that the proposed project would fit the criteria of the LIFE "Call for Proposals". The Company set about contacting the Department of the Environment for details and subsequently successfully applied for the grant.

Project Framework

All activities of the project team were managed by the project manager. All activities were co-ordinated and planned on a team basis with all delegated responsibilities coming from this core.



The Process

The Silver Hill Foods Duck Slurry Treatment Process involves the following:

The maceration and homogenisation of the duck slurry to process determined quality

The pumping of the slurry through a dewatering press effecting solid / liquid sepa-ration

The drying of the solid within the press to a specified dryness and subsequent removal of dried material from the press

The Blending of the dewatered liquid with process water from the Silver Hill Process Factory

The removal of gross solids in this blend via a Dissolved Air Flotation Mechanism

The treatment of the Liquid through an Anaerobic Digestion Plant

The Capture and utilisation of biogas generated in an engine generating Electricity and Heat

The forward feeding of the Anaerobic liquor to a conventional waste water treatment plant

The discharge of the effluent to surface water under legislative consent.

From Idea to Reality— Final Process Design to Project Beginning

With the general concept for the Project decided the next stage was establishment of firm process design calculations and a fixed process. This was carried out with the help of a number of external consultants who assisted in areas of process calculation, process design, equipment identification and equipment selection. When all of these major decisions were made the Project management had to decide on site locations, and the scope and extent of the infrastructural works to be carried out.

Again consultants in the area of architectural and civil engineering were employed to design the site and obtain relevant planning permissions for same.

The next stage after the design stage was complete was to integrate the conceptual design to suit the chosen technologies.

On another front the Company had to obtain a brand new Integrated Pollution Prevention and Control Licence in order to operate the plant and again external consultants were brought in to advise and assist in this task.

The points above, most of which were dealt with at the initial stages of the project were key to the successful implementation of the project.

A key component in this foundation stage was the knitting together of all aspects of the plan by the core project management team.

Procurement and Construction

As will be explained in detail at a later stage the project was managed well from a financial point of view. This was a function of great attention to detail at the procurement stage and during the construction stage. A key factor in the success of the project was the decision by Company Directors to project manage the work internally. This lead to a lot of savings across the board, particularly in the areas of procurement of equipment and construction services. Every single piece of plant was negotiated on an individual basis by the Company directors and the project design and project management teams.

In early 2004 construction began on the project on a green field site and it continued for approximately 1 year after that date. The construction phase was completed successfully with the result being a state-of-the-art processing building, housing the dewatering / drying press and process control rooms and laboratory. Also prominent are the plant tanks and service areas coupled with a chemical store and power house.

One key problematic area in the construction phase of the project was the volume of stone required to stabilise the site.

Installation and Commissioning

The installation phase and commissioning phase of the project ran side by side. A key decision for the project management team was whether to commission each of the pieces of plant individually or wait until the full process could be integrated. The former was the decision and for 6-8 months all of the relevant pieces of machinery were being installed or commissioned.

The installation of the equipment went without major fault. It would be true to say however that everyday there were issues to be dealt with by the project management team but no problem was insurmountable.

Commissioning began on the pumps and pump stations where they were filled with water and the pumps tested. Each of the main holding tanks were also filled with water and leak tested. The Dissolved Air Floatation was tested on clean water and then fully commissioned on process water from the Silver Hill Foods Duck processing factory.

The Anaerobic Digestion Plant was Commissioned on cold water and upon full commissioning of the boiler system and secondary heating circuit the reactors were heated.

The plate and frame press was the last major piece of plant to be commissioned and mechanically the plant worked well. Other issues became apparent in this commissioning phase however which will be discussed at a later stage.

One item remains to be commissioned and that is the Combined heat and power plant. (CHP Plant). An absence of sufficient biogas has halted the commissioning stage for this part of the process. Reasoning for this again will be highlighted in the projects results section of this report.

Ancilliary works carried out on the existing waste water treatment plant at Silver Hill Foods to enable it to cope with the increased hydraulic loading were commissioned and with the running of the plant the hydraulic loading rates were brought to the expected levels. The plant performed extremely well at the design loading rates ensuring legislative compliance with the emission limits as set by the Environmental Protection Agency.

Equipment Installed and Process Flow.

HOMOGENISATION TANKS, MIXERS, MACERATORS,PUMPS AND PUMP STATIONS

Slurry enters the plant from the on-site growing farm and is diverted through a macerator and into a pump station comprising 2 pump sets. Set 1 supplies Homogenisation Tank 1 and set 2 Supplies Homogenisation tank 2. This equipment enables the reception of the slurry into the plant from the Silver Hill Foods Farm and the storage of the slurry. In the homogenisation tanks the slurry is blended to a predetermined consistency and tested in the laboratory until it is deemed satisfactory for processing

SLUDGE DRYING PRESS AND ANCILLIARY EQUIPMENT

Once homogenised the sludge is pumped via 2x30 kw Seepex progressive cavity pumps into the 135 chambers of the plate and frame press where it is dewatered. The solid material remains within the press and the liquid goes to a slurry water holding tank from where it is mixed with process water from the Silver Hill Foods Factory.

A press heating and vacuum cycle initiates and the solids are dried over a period of 2.5—4 hrs. When the drying cycle finishes the press discharges and dried duck manure is dropped onto a conveyor at a minimum of 65% dried solids content and a maximum of 91%. This material is then brought to available spreadlands or pelletised in the Company pelleting plant for sale as a horticultural fertiliser.

DISSOLVED AIR FLOTATION TANK

The slurry water and the process water are mixed according to process requirements and pumped from the process balance tank to the Dissolved Air Flotation Tank. The Primary function of this tank is to ensure that the Suspended solid content of the mixed forward feed remains below 350mg/L. Any sludge removed at this stage is returned to the homogenisation tanks and reworked through the drying press.

Equipment Installed and Process Flow ctd.

ANAEROBIC DIGESTION PLANT

The effluent from the Dissolved Air Flotation Tank is pumped via pump station P-05 to the Anaerobic Digestion Plant. The AD plant is fed from the Digester Feed tank by a 5.5kw progressive cavity pump. There is a design hydraulic retention time of around 16 hours and the liquor flows to a break tank from where it is either recycled through the plant or forward fed from the plant via a final effluent pump to the refurbished waste water treatment plant at Silver Hill Foods. Gas pressure across the plant is controlled by a series of liquid manometers and the gas is fed via a piping Network to the gas handling system. The system was favoured because of its ability to effect an 85% reduction in COD. The gas, a very beneficial by-product of the system is a bonus. This unit operates at zero cost as a standalone unit with correct operation and feeding and this represents one of the more innovative steps in the plant design.

GAS HANDLING SYSTEM

As stated above the gas generated via the anaerobic digestion of the slurry water and the process water combined is fed via a pie network to the gas handling system. This comprises of three main components. The first is the Emergency Gas Flare. Set to activate where gas pressures exceed a certain limit. This prevents the potential hazards associated with the storage of gas. The primary equipment for the utilisation of the gas is the Combined Heat and Power plant. This will receive the gas at a pressure of 25 mbar and combust the gas to drive a generator. The generator will produce 145 kW of electrical energy which will be used in the new facility and also water will be heated by the engine exhaust to supplement the heat requirement of the plant. Finally the primary heat source for the plant (a 1000 kw water heater) was fitted with a dual fuel burner which can operate on oil or biogas and can be used during downtime on the Combined Heat and Power plant.

Waste Water Treatment System

The effluent from the Anaerobic Digestion Plant is fed to the Aeration Basin / Anoxic Zone of the Silver Hill Foods waste water treatment plant. This plant has been altered to have 2 very distinct zones within one Tank. The first 1/3 of the tank is where Nitrification occurs brought about by the aeration of the biomass (2.5mg/L oxygen). This involves breaking down the ammoniacal fraction of the waste to Nitrate and Nitrite. The remaining 2/3 of the tank is operated at a much lower oxygen level (0.1—0.5 mg/L) This effects the breakdown of the nitrogenous components of the waste. Phosphorus reduction chemicals are then added to the effluent and the effluent stream is clarified and discharged.

PROJECT RESULTS

There were 5 major tasks in the project which were as follows: 1. Preparation of final design and procurement of equipment. 2. Installation of infrastructure and civil works 3 Installation, commissioning and optimization of equipment 4. Management and Reporting 5. Dissemination of Project Results. Each of the tasks were addressed at a very early stage in the project and specific plans formulated to successfully complete them. Silver Hill Foods are content that each of the issues that the project set about addressing have been completed. The over riding question is " Have Silver Hill Foods Developed a dedicated process train for the Treatment of Duck Slurry". In fulfilling the primary objective of the project the answer is YES.

A key concern for the Silver Hill Foods Project team was whether they would adequately meet the Dissemination requirements of the project. At the early stages Silver Hill Directors made it clear that widespread dissemination of project activities would have to be conducted. The project website was constructed immediately and information updated regularly. A very large number of people visited the site from all over the world and a lot of interest was raised in the project through exposure on national television and radio.

Project Management and reporting went according to plan with the one exception where the team would have liked to submit an interim report however project constraints at the time meant this did not happen.

Assessment of Success with Project Deliverables

PROJECT MILESTONE	TASK	PROJECT OUTCOME
Completion of overall system design	Design and Procurement of Equipment	Complete
Regulatory Approval from the EPA	Design and Procurement of Equipment	Complete
Completion of selection process for successful bidders	Design and Procurement of Equipment	Complete
Ready site for equipment delivery	Preparation of Infrastructure and Civil Works	Complete
Amend effluent plant for acceptance of new hydraulic loading	Preparation of Infrastructure and Civil Works	Complete
Dewatering Unit and Anaerobic Digester in Operation	Installation, Commissioning and evaluation of equipment	Complete
Effluent Plant operating within licence conditions	Installation, Commissioning and evaluation of equipment	Complete
Combustion unit and drier in operation	Installation, Commissioning and evaluation of equipment	To be completed
Overall system to be operating as an integrated unit	Installation, Commissioning and evaluation of equipment	To be completed
Establishment of a Steering Committee	Management and Reporting	Completed Differently
Preparation of Progress Report	Management and Reporting	Complete
Preparation of Interim Report	Management and Reporting	Not completed
Submission of Final Report	Management and Reporting	Complete
Distribution of Brochures	Dissemination of Results	Complete
Website in Operation	Dissemination of Results	Complete
Meetings with network of purchasing Managers in EU Countries	Dissemination of Results	Complete
Commencement of workshops, open days and other public visits	Dissemination of Results	Complete

Project Conclusions

The Duck slurry Project was a major success in that it achieved what was set out to be achieved -
A dedicated process train was developed to recycle duck slurry.
A very transferable process train was developed which can be used as a model for other industries in other very different sectors.
The Project team committed to publicise widely the achievements and shortcomings of the project and this has been achieved.

The major short-falling of the project has been the failure to date of the plate and frame press to achieve the target throughput and the associated knock-on effect of this where-by not enough gas can be generated to run the CHP. This is being addressed currently with a major refit taking place to the press to increase throughput.

Is the project deemed to have failed as a result of this ? We do not believe so and are confident in our own ability to see the project through to a successful conclusion.

The project highlighted the fact that a small to medium sized enterprise like Silver Hill Foods can innovate and be a world leader in areas not to the core of their business and the National awards and commendations received for the project serve to highlight this.

The Company has benefited greatly from the project through the exposure generated from the dissemination activities. It has helped raise the Company profile Nationally and internationally.

The Future Of The Project

With the completion of every LIFE Project there is understandably the question of whether the project was a success or not and also the question of whether with the cessation of funding the project will cease. In the case of this project Silver Hill Foods remain 100% committed to the completion of all goals and targets as set out by the project and to the achievement of 100% of the design capacities of the installed plant. The main driver in this for Silver Hill Foods was the management of a waste management issue which with the passage of time during the LIFE Project has not gone away. In actual fact the issue has been brought to prominence in Ireland with the pending implementation of the EU Nitrates Directive.

The Project during the LIFE timeframe has in fact been expanded to include a dedicated pelleting line for the dried product produced through the drying plant. The Company have allocated considerable resources to the marketing of this product and found that both the Irish and UK horticultural markets would be very receptive to the product. With the throughputs not at design specification just yet the Company have suspended the marketing efforts until a constant market supply can be delivered.

Post LIFE Dissemination Plan

Whilst the Company will not be as vigorous in its dissemination plan as it had been during the life of the project, it will not be resting on its laurels as regards promoting the project, its innovation and the Company. The Company will update its website and ensure that anybody who has taken an interest in the project since its inception will be able to contact the Company via its contact details to the rear of this publication. Site visits will also be continued and permitted on a case by case basis subject to bio- security suitability at the time.

The Company are grateful for the assistance of the LIFE Unit and would be keen to promote the project to their satisfaction and also the work they do.

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DUCK SLURRY PROJECT

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THE DIRECTORS, MANAGEMENT AND PROJECT MANAGEMENT TEAM AT SILVER HILL FOODS WOULD LIKE TO EXPRESS ITS SINCERE GRATITUDE TO ALL WHO HAVE ASSISSTED US THROUGHOUT THIS PROJECT.

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