Dairy Green Ltd

Practical Engineering Solutions

Consents, Effluent, Stock water, Irrigation

Design through to Installation

Irrigation NZ Accredited Designer

Woldwide One Limited and *Woldwide Two Limited*

(WW1&2)

Effluent Management Plan

Version 2

1 June 2019 – 31 May 2020

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1 Collected Agricultural Effluent

1.1 Overview of the Proposed Effluent Collection, Storage and Irrigation System

Dairy Shed Effluent Systems

i. During adequate soil moisture conditions effluent is discharged from the dairy sheds directly to the travelling irrigators;

ii. When soil moisture conditions do not allow for direct effluent discharge from the dairy sheds, effluent from the dairy sheds is pumped to the storage ponds;

iii. Each dairy unit has its own effluent storage pond;

iv. Effluent is stored in the ponds until soil moisture conditions allow for irrigation to occur;

v. Slurry effluent from the storage ponds is discharged to land via slurry tanker at very low depth or by umbilical system; and

vi. A rainwater diversion is used in the off season.

Wintering Barn Effluent Systems

i. Effluent flows by gravity or is scraped automatically 8 times per day to concrete collection channels, from where it is pumped to the storage ponds where it forms a slurry;

ii. Slurry effluent is stored in the pond until soil moisture conditions allow for irrigation to occur;

iii. Slurry effluent is pumped from the pond to the slurry tanker with a trailing shoe or umbilical system, for discharge to land at very low depth.

1.2 Effluent System Volumes

Effluent Sources – WW1 unit

i. Cowshed

ii. Rainwater captured on the yard area and milk vat stand area.

iii. The wintering barn will enable 625 cows to be wintered, with the effluent collected in the effluent storage pond adjacent to the wintering barn.

Effluent Sources – WW2 unit

i. Cowshed

ii. Rainwater captured on the yard area and milk vat stand area.

iii. The wintering barn will enable 625 cows to be wintered, with effluent collected in the effluent storage pond adjacent to the wintering barn.

iv. Silage pad – total area is 1,200 m^2. Leachate drains to the effluent storage pond. Rainwater is diverted to farm drainage.

v. Underpass – has its own effluent system with a dedicated sprinkler.

Effluent Volume

The total average effluent generated per day at WW1 dairy shed is 35 m^3. The total average effluent generated per day at WW2 dairy shed is 40 m^3.

The total volume of effluent generated by wintering a maximum of 1,250 cows in the barns throughout June and July, and during May, August and September is 2 X 3,048 m^3.

Effluent Storage Capacity

WW1 - The existing storage pond has a pumpable volume of approximately 4,281 m^3. The Massey Dairy Effluent Storage Calculator 90% storage probability volume is 3,257 metres cubed, so the pond has sufficient storage for 700 cows plus wintering barn effluent.

WW2 - The existing storage pond has a pumpable volume of approximately 3,751 m^3. The Massey Dairy Effluent Storage Calculator 90% storage probability volume is 3,203 metres cubed, so the pond has sufficient storage for 800 cows plus wintering barn effluent and silage pad effluent.

1.3 Effluent Application Rate and Depth

The irrigator system's application rates, application depths and uniformities are to be checked annually in accordance with section 4: Land Application "A Farmer's Guide to Managing Farm Dairy Effluent – A Good Practice Guide for Land Application Systems" (2015).

Application Depth

Travelling irrigators:

The average application depth of the travelling irrigators is 8-9 mm per application, this is achieved when the travelling irrigator is set at an appropriate speed. The specified pump will deliver 16 – 18 m^3 per hour. The travelling irrigator systems have a safety system, which automatically switches the systems off in the event of an effluent system failure, such as irrigator stoppage or breakdown.

Slurry tanker with a trailing shoe:

The slurry tanker's application depth is set by tractor speed. It has an on-board GPS system, allowing the area and travel speed to be monitored. At a travel speed of 8-9 km/hour, the application depth is 2 mm. By speeding up the tractor speed, the application depth is lowered to 1 – 1.5 mm.

The application depth for the slurry tanker will not exceed 2.5 mm per application.

Umbilical system

The umbilical system may be used as a contingency irrigation method. The umbilical system will apply effluent at a maximum depth of application of 3 mm for each individual application. Its application depth can be lowered by speeding up travel speed.

N Loading from effluent

Dairy shed effluent

Where the composition of the effluent is not known, use the following conservative figures as a guide.

1 mm of irrigated dairy shed effluent depth equals:

2.5 kg per hectare of N

3.0 kg per hectare of K

0.3 kg per hectare of P

If 10 mm depth of effluent is irrigated over 1 ha, the nutrient application will be:

25.0 kg per hectare of N, 30.0 kg per hectare of K and 3.0 kg per hectare of P

Note: Due to animal health issues, it is advised that not more than half the annual potassium requirement be applied per application of effluent i.e. the annual requirement of potassium (is 60 - 80 kg per hectare per annum).

Wintering barn effluent

The nutrient concentration of wintering barn effluent is much higher due to lack of dilution. The slurry effluent in the ponds is predominantly composed of wintering barn effluent, with minor dilution from rain falling on the pond and dairy shed effluent, which is diverted to the ponds when ground conditions are unsuitable for irrigation.

The nutrient content of pond effluent (slurry) has been tested as part of a 2011 AgResearch study "Characterising dairy manures and slurries – Case study 15." The nutrient content of slurry at the applicant's pond was measured at:

N 3,200 g/m^3
P 800 g/m^3
K 4,400 g/m^3
S 400 g/m^3

Applying 15.2 m^3/hectare applies slurry effluent at a depth of 1.5 mm. Discharging slurry effluent at 15.2 m^3/hectare applies:

N 49 kg
P 12 kg
K 67 kg
S 6 kg

Annual N loading from effluent

Dairy platform – a maximum of 150 kg N/ha/year

Horner Block – currently a maximum of 150 kg N/ha.

Note: If consent is granted as requested, a maximum of 250 kg/ha/year from slurry will be applied to the Horner Block. Slurry is applied at very low depth using the slurry tanker with the trailing shoe. A maximum of 5 loads of slurry per year at 1.5 mm depth gives a loading of 245 kg N.

1.4 Effluent Irrigation Records

As each paddock is irrigated the daily pumping time will be recorded. This will also provide an annual record of the total depth of effluent applied.

Application Logbook

As each paddock is irrigated the irrigator placement location and date is recorded in a farm diary and on a map. These provide an annual record of when and where effluent and slurry have been applied.

The following good management practice measures are consistently used:

- The travelling irrigator systems are always operated at high speed system. This results in an application depth of 8-9 mm per application;
- The slurry tanker with the trailing shoe is operated with the aid of an on-board GPS system. The volume of effluent applied per hectare is controlled. This ensures a low application depth is achieved (< 2.5 mm).
- A visual assessment of uniformity and intensity of effluent application is carried out daily to ensure each system is operating properly;
- Care is taken to monitor drainage to ensure there are no adverse effects from effluent application;
- Irrigation records will be used in any discussions with compliance authorities and as data for use in nutrient/fertiliser application planning.

Maintenance Logbook

Exercise book at each dairy shed with a page for each of the following recording the relevant date, time, person responsible and action taken.

i. Pond levels

ii. Pump servicing and maintenance

iii. Fail safe/controller maintenance

1.5 Effluent irrigation decisions

Drainage monitoring and crack formation monitoring is carried out daily on an ongoing basis, which helps to inform decision making on effluent discharge.

The following effluent decisions are made on farm prior to the discharge of effluent:

Slurry

- Check Heddon Bush soil moisture site to determine if the current soil moisture is suitable for irrigation;
- Ensure ground is dry enough (cannot use tractor with slurry tanker and trailing shoe machine if ground conditions are unsuitable as the slurry tanker weighs over 50 T when full of slurry);
- Check for any cracks in the discharge area – if any cracks present do not discharge slurry where the cracks are, either move to an area with no cracks or do not discharge;
- Check wind direction to ensure the wind direction is not towards neighbouring houses;
- Use GPS system to control the volume applied per hectare to apply 1.5 mm depth. Increase speed of tractor if a lower application depth is required.

Dairy shed effluent

- Check Heddon Bush soil moisture site to determine if the current soil moisture is suitable for irrigation;
- Check for any cracks in the discharge area – if any cracks present do not discharge slurry where the cracks are, either move to an area with no cracks or do not discharge;
- Check wind direction to ensure the wind direction is towards neighbouring houses;
- Ensure travelling irrigator is operating on a high-speed setting, which will apply effluent to a depth less than the soil moisture deficit.

1.6 Deep drainage of nitrogen – cracking and fissures

To reduce the occurrence of deep drainage of nitrogen and microbes, the formation of deep cracks and fissures will be prevented as much as possible. This will be achieved by:

- Keeping a higher pasture cover;
- Discharging effluent little and often to ensure the soil moisture is kept as high as possible, preventing the soil from drying out and cracking.

Before each effluent application a visual assessment will be carried out to check for any cracks in the soil. If cracks do occur the areas with cracking will be avoided and the activity will be moved to another part of the property where there are no cracks. If there are substantial cracks and no areas suitable to discharge effluent, then effluent will be stored until the soil moisture level improves and cracking disappears. Given the cracks are more likely to occur after prolonged dry periods in the summer, the effluent storage facility will provide adequate storage volume for these events.

2 Effluent System Management

2.1 Person in Charge

The person in charge of the effluent management systems will be the farm managers;

Jacques Jooste (WW1) 027 45545550

Deepinder Singh (WW2) 021 2942532

2.2 Effluent System training

Training

All new staff will be trained in the operation of the effluent system as and when employed. Details are to be recorded in the staff training log.

Resources – Shed Operations Manual.

i. Effluent system operational guidelines - also displayed in the pump houses;

ii. Irrigation map marked up with drainage outfalls, irrigation areas etc; and

iii. Copies of Environment Southland consents.

2.3 Effluent Minimisation

There are management practices and operational methodologies that can be used to minimise effluent voided on lanes, tracks and hardstands and around gateways. These include:

i. Allowing the herds to walk in rather than be driven;

ii. Splitting the herds into small herds for faster movement;

iii. Not using tracks and lanes as standoffs;

iv. Do not supplement feed cows on or along the edges of lanes;

v. Wet the yard before the cows arrive;

vi. Minimisation of freshwater shed water use in yard hose down; and

vii. Ensure there are no excessive volumes lost through the D gate platform washer.

2.4 Effluent Pumping

The specified travelling irrigator pumps will deliver 16 – 18 m^3/hr approximately depending on the distance of the irrigator from the pump and the height above the pump (i.e. static head).

2.5 Discharge Area

The proposed effluent discharge area is the majority of the dairy platform and part of the Horner Block (97 hectares as per the Appendix 1 Discharge Map), less buffers from dwellings, bores, waterways and boundaries. The area available is in excess of 400 hectares approximately.

2.6 Paddock Selection

Paddocks will be selected according to their moisture status and grazing management history. A sequence of paddocks can be pre-planned for effluent irrigation. As each area is grazed and then spelled for the required period it can then be irrigated.

Prior to irrigation occurring a visual assessment of the soil will be made along with data from Environment Southland's soils moisture irrigation site at www.es.govt.nz. If paddocks are pugged or are likely to have very low infiltration rates the effluent irrigation depth will be reduced or the paddock rescheduled for irrigation after the soil conditions have improved.

The critical factor is that paddocks will not be irrigated with effluent when, or where, irrigation could result in the soils reaching field capacity. Field capacity is the point at which drainage starts either by passing down through the soil profile or flowing over the surface (overland flow).

Effluent irrigation is to be avoided when the soil temperature is less than 5º C.

The following will be marked up on the dairy shed map. These will be updated each year as re-grassing rotations, drainage, fencing changes etc. affect the relative risks.

High and low risk

At least 50 hectares is considered to be in the low risk soil category for effluent discharge due to matrix drainage properties with the remaining area considered to be in the high-risk. The low risk area is found where free draining soils are found, mid to east farm.

There are low risk soils at the Horner block. These are found mid-west of the block.

The maximum application depth per application using high rate travelling irrigators on Category D and E soils will be less than 10 mm per application.

Therefore, the discharge of dairy effluent needs to be carefully managed with deferred irrigation used when necessary.

Tile lines

These, where known, are marked on maps in the FEMP. Irrigation should not be carried out directly over them if there is any risk of irrigation causing drainage.

Wind

Consideration needs to be given when high winds are predicted for example in the equinox seasons to ensure that spray drift does not end up in unintended places such as within minimum distances from waterways or outside the farm boundary.

2.7 Coverage Area

There shall not be any discharge of effluent onto land within:

i. 20 metres of any surface watercourse;

ii. 100 metres of any potable water abstraction point;

iii. 20 metres of any property boundary;

iv. 200 metres of any residential dwelling other than residential dwellings on the property;

v. Effluent shall not be discharged onto any land area that has been grazed within the previous 7 – 10 days;

vi. Effluent shall not be discharged over tiles/mole drains where the soil is at or near field capacity; and

vii. Effluent shall not be discharged where the soil shows evidence of cracking.

2.8 Effluent Irrigation - Conditions

Field Moisture Conditions

Paddocks to which effluent is to be applied will be visually inspected, prior to irrigation to gain an understanding of an any high traffic areas to be avoided, location of water troughs, tiles, drains etc.

Near Field Capacity

When soils are near field capacity, the depth of application is to be limited to less than the soil moisture deficit. During operation of the systems, the irrigated areas will be checked to ensure there is no ponding. If necessary, effluent is to be pumped to the storage ponds. The slurry tanker with a trailing shoe can achieve very low application depths, so can be used when soils are closer to field capacity.

Drier Ground

As the soil moisture deficit increases, the speed of the travelling irrigator can be reduced to increase the application depth of effluent.

Cracks

Managed as detailed in section 1.6.

2.9 Drainage Monitoring

Map

i. There will be a map in the cowsheds, also in the FEMP that shows all known tile lines along with their outfalls (and any open inlets);

ii. This will be updated as the tile network is expanded or unknown installations are located; and

iii. It is to be updated when paddocks are re-moled.

Tile End Marks

i. All tile outfalls are marked on the watercourse banks with a yellow painted stake; and

ii. Each has a unique identifier.

Monitoring

i. Tile outfalls will be regularly monitored when effluent irrigation is occurring in their vicinity or when it is possible that there may be moles that run to the tiles; and

ii. If there is any discolouration of drainage water, irrigation will stop immediately;

iii. Data from a monitoring bore should be used to inform on effluent related decision making.

2.10 Solids' Removal

Timing

i. De-sludging the storage ponds is carried out when there are paddocks to be cultivated or lea awaiting cultivation; and

ii. Emptying will only be done when ground conditions are suitable.

Discharge of solids

Solids can either be spread thinly, less than 10 mm thick on short pasture or on crop ground where they can be worked in.

2.11 Off Season Water Diversion

All the sources of effluent are fitted with "not in use" clean water/rainwater diversion systems. These are separate from the roof water systems. The areas from which the rainwater is to be diverted will be well washed with clean water and inspected for any effluent residues prior to the diversion being enacted. The location of these diversion points is on the dairy shed plan in the shed office.

3 Monitoring, Maintenance and Operating Procedures

3.1 Daily

i. Minimise water use at the cow shed;

ii. Check the irrigation system for operating faults during and following use;

iii. Monitor the condition of the storage ponds, as well as effluent height in the ponds;

iv. Evaluate the soil moisture situation and calculate the optimum settings for the next effluent application;

v. Check and record in the log any tile outfalls draining from the irrigation area after effluent irrigation;

vi. Check effluent receiving area for evidence of cracks prior to irrigation. Where cracks are present avoid irrigation;

vii. Update the effluent irrigation log with settings, location, depth and method of application;

viii. Check lane/track edge cutouts to ensure they are not blocked and there is no risk of large single point discharges (especially after heavy rainfall events); and

ix. Check the trough in the paddock the cows are leaving to ensure it has not been leaking due to animal activity.

3.2 Weekly

Storage Facilities

i. Check inlet and outlet pipes are clear of blockages;

ii. Check and clean grates and sumps in dairy shed, yard, winter barns;

iii. Check galleries/floor drainage around storage structures; and

iv. Check and record leak detection inspection wells at effluent ponds.

Effluent Pump, Motor and Controls

i. Check pumps and motors, grease if required;

ii. Check mechanical switch gear is operating efficiently;

iii. Note and follow up any unusual noises when pumps are operating;

iv. Check anti siphon devices for blockages; and

v. Note operating pressure during irrigation and confirm it is in the normal range.

Pipelines

i. Check for leaks and blockages in pipes and joiners; and

ii. Check for hydrant leaks.

Safety

i. Check guards and fittings;

ii. Signage; and

iii. Equipment.

3.3 Annual Maintenance

i. Check pumps and motors and have them serviced by a qualified technician;

ii. Service slurry tanker system;

iii. Assess condition of pipeline, repair and replace failing parts;

iv. Update irrigation maps for new fences, tiling, moling etc;

v. Train of new staff in system operation; and

vi. Refresher and training of all staff in the, purpose and use of safety equipment and fittings.

3.4 End of Season

i. Ensure storage ponds are pumped down;

ii. Turn on rainwater diversion for dairy sheds;

iii. Drain pumps and/or set frost lamps;

iv. Check pumps and pipes for wear and tear and perform required maintenance.

3.5 Beginning of Season

i. Turn off rainwater diversion in dairy sheds; and

ii. Prime pumps and check their operation.

3.6 Breakdowns

i. In the event of power failure, pump or motor breakdown:

- Contact repairer immediately to assess problem;
- Limit or cease water use in the dairy yard and scrape effluent; and
- Complete repairs or install the back-up pump before the next milking, depending on the storage available. Where necessary, arrange for a backup petrol, diesel or PTO driven pump.

ii. In the event of pipe blockages:

- For underground pipes: Clear using on-farm equipment. Otherwise contact blocked drain repairer to water blast;
- For drag hoses: open camlock joiners to locate and clear blocks in pipe sections; and

- If not able to clear blockages, replace the blocked section.

3.7 General:

i. Under no circumstances are storage facilities to overflow;

ii. There shall be no ponding of effluent in the discharge area;

iii. Make full use of the discharge area;

iv. There shall be no discharge of effluent to frozen or snow-covered ground;

v. The discharge will be managed to ensure aerosols, spray drift and odour do not travel past the property boundary; and

vi. The general state of the effluent receiving area is to be monitored, particularly areas where environmental contamination with effluent could be a problem. This includes races, silage storage and feeding areas. Preventative action is to be taken before problems arise.

4 Other Environmental Issues

4.1 Lanes and Races

Run-off from races can in some situations constitute an illegal discharge to land. These will be mitigated by:

i. Ensuring that lanes and races are not used as feed pads, cow yards, or herd holding areas;

ii. Ensuring that riparian vegetation is adequate to treat storm water;

iii. Checking after heavy rain the lane/track edge cut-outs, to ensure they are not blocked and there is no risk of large single point discharges;

iv. Install nib boarding or kerbing to prevent point source discharges from lanes and tracks to waterways occurring;

v. Gateways – to avoid compaction around the gateways and reduce lane edge wear, where possible bring the cows out of the paddock at a different gate to which they were let in; and

vi. Ensure that swales away from culverts are kept clear, and discharge is directed away from the waterway.

Annual maintenance to races can often result in the "run back" shaping over culverts and lane edge discharge cutouts not being restored. All lane edges and culverts will be checked after lane maintenance.

4.2 Silage pad

A concrete silage pad (1,200 m^2) is located adjacent to a wintering barn. It is constructed on a dry site. The silage pad has concrete walls and a dual drainage system; one for clean rainwater and one for silage leachate. Under the stack and immediately in front of it, the drains are opened into the leachate channel. This takes leachate to a sump from where it is pumped into the effluent storage pond and irrigated appropriately. The sumps in the rest of the pad are open to the farm drainage system so that clean rainwater can be diverted. Rain landing on the silage cover does not mix with leachate and is diverted to the farm drainage.

A second silage pad has been constructed on a dry site underlain by compacted clay. Rain landing on silage covers does not mix with leachate and is diverted to the farm drainage. It is managed to ensure that no leachate flows off the pad at any time and any leachate is contained at the pad.

Only wilted silage is used and stacks remain covered to minimise leachate

4.3 Underpass

An underpass connects the block north of Wrey's Bush Highway with the dairy platform south of the highway. The underpass has its own effluent system, with a dedicated sprinkler. The sprinkler irrigates rainwater and effluent that collects on the underpass at low rate and depth to nearby paddocks.

The underpass is inspected regularly to ensure that the effluent system in operating correctly and that there is no ponding of rainwater/effluent at the underpass.

5 Emergency Response

5.1 Storage Overflow

Where the slurry ponds are approaching full very low application depth effluent irrigation (<1.5 mm depth) will be carried out on the driest part of the farm available. The slurry tanker with a trailing shoe or umbilical system will be used to achieve this.

5.2 Ponding

Should light ponding be detected effluent irrigation will immediately stop. Checks will be made to ensure that there is no overland flow or that the ponding is not draining into tile lines.

5.3 Drainage

Overland Flow

See Ponding Section 5.2.

Discharge Ex-Tile and/or Effluent in Open Drains

i. Attempt to immediately contain the contaminants by damming the drain. This will be done by dumping a bale(s) of straw or hay in the drain and pressing down with the front-end loader, depending on drain size;

ii. Alternately earth and silage wrap will be used to seal or form the required plug; or

iii. Pump out and disburse with the vacuum tanker; and

iv. Inform ES - Compliance

5.4 General Procedures

vii. Follow consent conditions/notes, mitigate effects;

viii. Advise Regional Council where the consent requires this;

ix. Seek help; and

x. Advise authorities.

5.5 Emergency Contacts

Abe de Wolde 027 2272537

Environment Southland – 0800 768 845 or 03 2115115

Dairy Green Limited – 03 215 4381

6 Review

Review whole effluent management plan and update by 1 June each year – and complete the version control below.

Version	Date	Reviewed	Distribution List
1.0	22 August 2017	JS	A & JJ de Wolde
1.2 (part of FEMP)	15 July 2018	Nessa Legg, Dairy Green Limited	A & JJ de Wolde
1.3 (part of FEMP)	25 Feb 2019	Nessa Legg, Dairy Green Limited	A & JJ de Wolde
2. (EMP)	3/9/19	Nessa Legg, Quinton Scandrett, Dairy Green Ltd	A & JJ de Wolde
3.			