CASE STUDY

ace
Aparima Community Environment

John White for 99 South Ltd - Rurikaka Creek, Orepuki Catchment

WHAT IS A SEDIMENT TRAP?

Sediment in drains and streams is largely made up of soil (clay, silt and sand) and gravel. A sediment trap is an area where the runoff from land will collect and settle for sufficient time to allow any sediment in suspension to drop out before the water drains away through an overflow or spill way. Heavy, coarse material will drop quickly, while the finer material will take longer. Any measure that spreads water out and slows down the flow, will allow sediments to drop out.

There are many different types of sediment traps.

- Ponds are generally the most common type and are formed by excavation into the ground or by the construction of an embankment. They are designed so water leaves at a rate that will allow suspended sediment to settle out.
- Drains can and do catch sediment. Sections of a drain can be engineered to increase the amount of sediment that they collect.
- Swales are relatively flat grassed areas with gently sloping sides and a gentle longitudinal slope. They are generally used to transport runoff following a heavy rain. Water flows though these areas at a low velocity so that the grass or other vegetation acts as a filter to remove sediment.

MAP 1: Location of property and where the sediment trap structures and areas of works are located. This map gives an indication of the close proximity to the coast and the topography of the property.

CASE STUDY

99 South Ltd is a dairy operation located just south of the Orepuki township, milking approximately 850 cows, with 400-500 cows wintered on the dairy platform. The topography of the property is rolling with a number of small gully systems, critical source areas and open waterways present.

The property is located within the Ruikaka Creek catchment that is part of the wider ACE Orepuki Catchment. Due to its close proximity to the coast and Longwood Forest, this area is subject to higher rainfall and coastal weather systems. The catchment is relatively small when compared to others in the wider Aparima catchment.

MAP 2: Aerial version of the above map showing location of sediment trap structures and areas of work on farm.

SEDIMENT TRAPS CONSTRUCTION PLAN

The landowner was interested in installing some sediment traps on his property for both water quality and biodiversity values and sought advice from Environment Southland to determine the best locations for the construction of sediment traps and wetland areas.

Environment Southland identified a number of potential locations on the property as outlined below. Some areas were able to be linked together to allow for work to be undertaken in stages as time and finances allowed. All sites utilised small gully's, critical source and swale areas where runoff and overland flow naturally migrated to.

Environment Southland then provided a more detailed breakdown and a plan for each of the proposed sites which are discussed in more detail below.

SITE ONE

Site one involved the construction of three sediment trap areas to capture material flowing off a small gully system above. As shown in the images below, you can see that this site includes a series of ponds with an initial receiving area, which then overflows to a second and third ponding areas before being discharged into an adjacent waterway.

Construction for this site was completed in 2016/2017 and appears well established with fencing and plantings.

IMAGE 1: Aerial photo showing closer detail of site one prior to construction.

The gully areas are visible as the dark green areas at the bottom of the image that join together near the centre of the image. Prior to constriction this area had poor drainage and was not considered to be a highly productive area of the property.

IMAGE 2: This image is the same as location as the previous image approximately 4 years after the completion of the sediment trap structures. You can easily see the pond areas where water velocity is slowed to allow suspended sediments to drop.

Table 1: *Key calculations for Site 1 sediment trap (performance details estimated from NIWA guidelines)*

Catchment area	17 Ha
Wetland area	0.9024 Ha
Wetland percentage of catchment	5.3%
Total suspended sediment capture	100%
Total Nitrogen assimilation	45%
Phosphorus assimilation	50%
Bacteria reduction	The open water exposed to sun and wind kills bacteria

Environment Southland have estimated an N loss from the 17Ha catchment area of 40kg/Ha giving a total loss of 680kg per year. With the implementation of this system, it will result in an N reduction of 306 kg/year. In addition, the wetlands are located in the peat and lignite physiographic zones that have a greater ability for the removal of N so this will also increase the N % reduction performance.

It has been determined that this site is effective for water quality mitigation with the added value of an area of non-productive land now used to benefit water quality by capturing nutrient, reducing the need for additional drainage and also reducing the need for annual waterway maintenance for nuisance weed growth and sediment build up.

SITE ONE- POST CONSTRUCTION IMAGES 2016/2017

IMAGE 3: Facing west, the upper pond area post construction. Note the recently constructed bank to the right of the image.

IMAGE 4: Looking West, the second pond area can be seen to the left, with the bank in the centre of the image separating ponds two and three.

SITE ONE IMAGERY FROM SITE VISIT – OCTOBER 2022

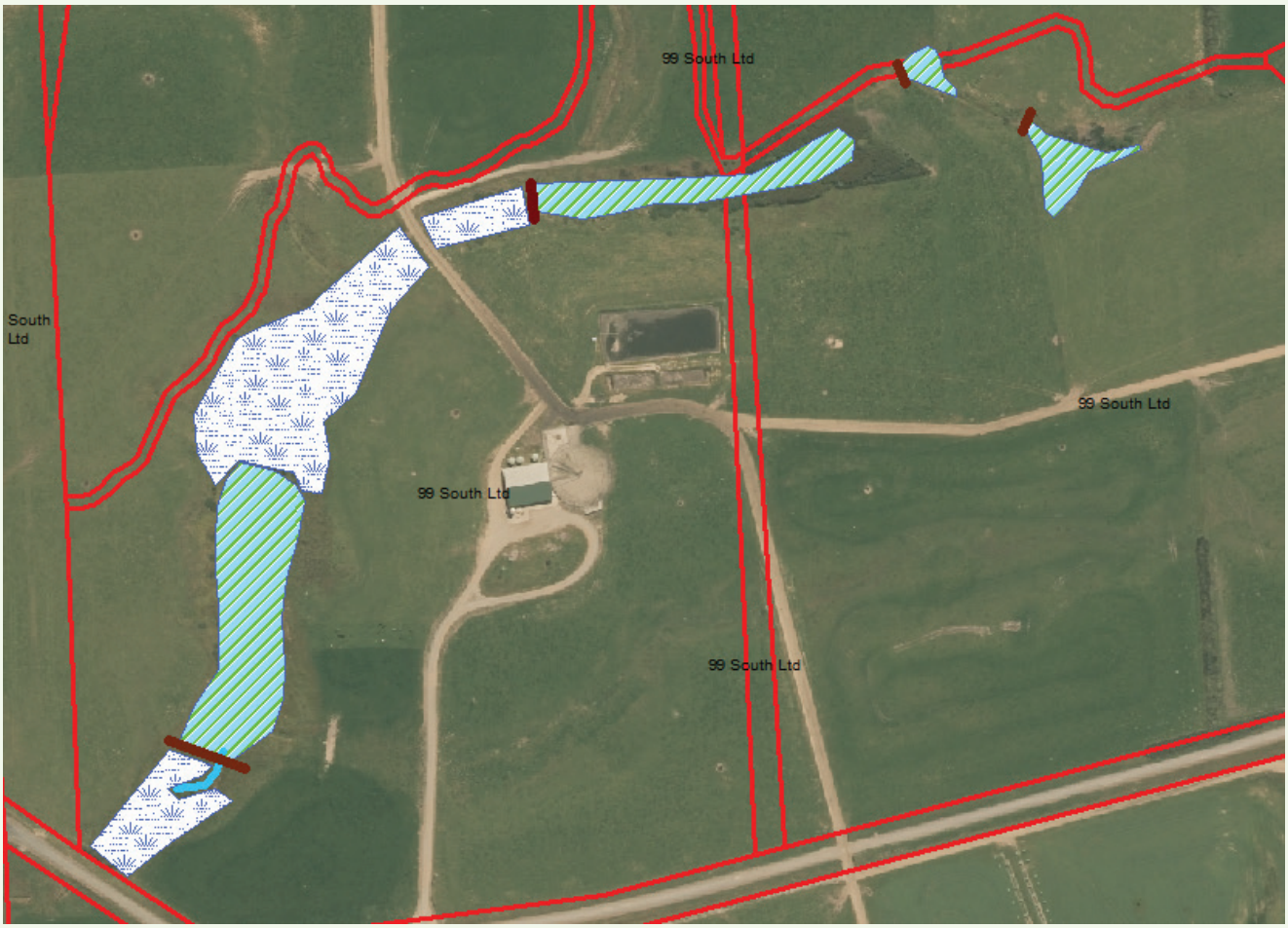
IMAGE 5: Standing on the sediment trap bund area between ponds two and three looking south towards the catchment area for this series of sediment traps.

IMAGE 6: Looking west at the second pond area. The bank separating the second and third pond is to the right.

IMAGE 7: The third pond area looking north west. Water flows out of this final pond via an overflow into an adjacent waterway.

SITE TWO

The construction of second site, which is made up of many smaller sections, was completed in January 2022. Environment Southland identified three potential locations/ areas for this work as outlined in map 3 below. Environment Southland then provided a more detailed breakdown and a plan for each of the proposed sites.



MAP 3: *Location of proposed areas for sediment trap bund construction and areas for wetland development.*

CONSTRUCTION PLAN

Environment Southland staff undertook a ground inspection and also took a series of levels to identify areas where four bunds could be created to create shallow open waters and for wetlands to be established and/or restored located to the west of the dairy shed.

Within the proposed area, there is a section of established willows that already contains a bunded area and is already effectively capturing sediment. Cleaning sediment out of this area is difficult due to the presence of the thick stand of willows, and is something the landowner may have to consider if this was to be cleaned in the future.

All of these areas were already fenced for stock exclusion. Some areas for wetland restoration will require some additional planting to be undertaken, particularly flax and Carex secta species, but this can be developed over time. Continued weed control is essential.

Table 2: *Key calculations for Site 2 wetland performance (details estimated from NIWA guidelines)*

Catchment area	100 Ha
Constructed wetland size	3 Ha
% of catchment in wetland	3%
% of Sediment collected	80% +
% of N reduced	60%
% of P reduced	40%
Bacteria kill	High %

SITE TWO- POST CONSTRUCTION

IMAGE 8: Sediment trap at the top of the catchment area.

IMAGE 9: Bund at the base of the first sediment trap pond area at the top of the catchment. Bund number 1.

IMAGE 10: Well established stand of willows and flaxes capturing sediment.

IMAGE 11: Bund located to the north of the dairy shed- Image taken approximately nine months after construction- January 2022

IMAGE 12: Bund located to the north of the dairy shed- Image taken during site visit in October 2022. Bank has been planted out in flaxes.

IMAGE 13: Bund at the bottom of the catchment immediately post construction looking east – January 2022.

IMAGE 14: Bund at the bottom of the catchment immediately post construction looking east – January 2022.

IMAGE 15: Northern or top end of the large wetland area

IMAGE 16: Middle of wetland area to the west of the dairy shed

IMAGE 17: Wetland area above bottom bund, looking north west with existing vegetation present

IMAGE 18: Looking south towards the downstream/final bund. Vegetation in this area is existing

IMAGE 19: Bund at the bottom of the catchment looking west during site visit – October 2022

IMAGE 20: Wetland area beyond the final bund looking south. Bottom of catchment.

COSTS

Site One Sediment Traps installed in 2016/2017	It took approximately 20 digger hours to construct the bunds to form the series of three sediment traps in an existing gully/ critical source area. The bund between ponds two and three is also used as a track so rock was used in its construction for additional stability. The cost of the rock material for this section was approximately $1,500. Two culvert pipes were installed a pre-determined heights to act as overflows between the sediment traps. Upon completion of the work, planting was undertaken at the site at a cost of approximately $4,000. The cost of planting can be highly variable due to the age/size of seedlings and of planting is completed by a contractor. There were no additional costs for fencing.
Site Two Sediment Traps and Wetlands installed January 2022	It took approximately 20 digger hours to construct the bunds to form the series of sediment traps and wetlands in an existing gully/ critical source area. Large rock was installed on the overflow areas of the bunds to prevent erosion, particularly during high flow events. The cost of the rock material for this site was approximately $2,000. Upon completion of the work, planting was undertaken at the site at a cost of approximately $2,000. The cost of planting can be highly variable due to the age/size of seedlings and of planting is completed by a contractor. Fencing was also undertaken upon completion. This involved moving some existing fencing to accommodate the new sediment traps and wetland area. The cost for this work was approximately $2,000 which included staff time and materials.
Ongoing costs	Cleaning will be undertaken when required which will largely depend in the farming activities occurring within the catchment areas. There is also the potential for ongoing costs related to maintaining and adding plantings to these areas. As mentioned above, costs can be variable depending on plant size and if the work is being undertaken by a contractor.

SUMMARY

An important element to a cost effective and efficient sediment trap is choosing the best location - designing it to suit the situation and ensuring it is accessible for maintenance and removal of sediment to be put back on the paddock.

There are many factors to consider, each of which needs to be tailored to each site. These factors include the shape, size, depth and presence of any existing waterways.

Environment Southland have produced a guide to sediment trap construction that provides more details around the factors that need to be considered. Environment Southland staff are also on hand to visit your site to discuss the best options and put together a plan specific to your property.