IMPLEMENTING A LAND USE PLAN

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Abstract

In November 1987, a land use plan was drawn up for the farm Vleilands, and an implementation programme was started in the plough-out areas. The physical features, layout and management practices on the farm were assessed, and a land use plan was designed to suit local conditions. The structure of the land use plan and how it was developed are detailed. Practical problems, such as the difficulty in moving existing open drains and hardened roads, their solutions and resulting changes to the land use plan are described. The improvements in yields and overall management in the areas where the plan has been implemented, are discussed.

Introduction

Vleilands farm is situated about 10 km north east of the Amatikulu sugar mill in the Gingindlovu area on the Natal north coast (Figure 1). The farm is 186 ha with 166 ha of cane. The topography is gently rolling with slopes ranging from 4 to 6%. The farm is 40 m above sea level and receives 1 200 mm of rain per year. Soils are derived from the Middle Ecca parent material and are of the Katspruit, Valsrivier and Fernwood forms. The farm does suffer from wetness problems, and the soils are difficult to manage. Average soil depth is about 600 mm.

It was decided to plan the farm using a parallel layout. A parallel design was drawn up, but once work started on implementation in the field, it was necessary to modify the design due to practical problems. Where the plan has been implemented, there has been an improvement in yields and ease of management.

The Land Use Plan

Using soil and slope maps, the existing layout and present management practices from the assessment, a vertical interval was required for the conservation structures. The vertical interval (VI) was determined from the Nomograph for Sugarcane Panel Spacing (Platford 1987). This resulted in a VI of 5 m, giving a panel width of about 50 m.

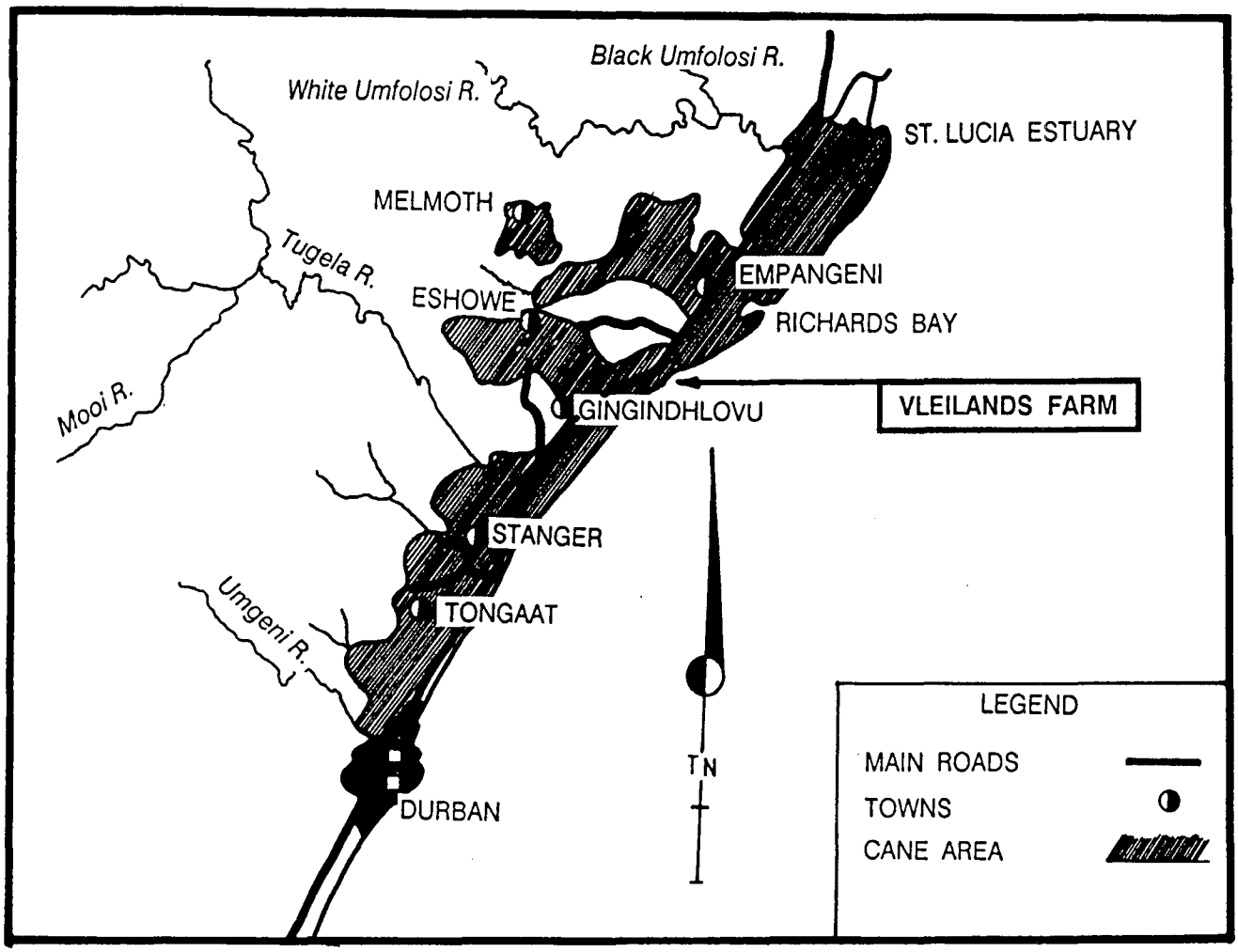

FIGURE 1 Map showing position of farm.

The parallel system

Due to the flatness of the topography, it was decided to design a parallel layout. This system comprises a series of structures which run parallel to one another, either along the crests or, where slopes are even, horizontally across the hillsides (Figure 2). Masterlines are pegged initially with the terraces or breaks pegged parallel to them. More artificial waterways are required with this system and, where terraces fall steeply, protection is required in the form of a creeping grass planted in the channel of the structure. A 50 m panel width was used as it corresponded to the requirements of the nomograph.

Adjustments to the initial plan

After implementing part of the plan in an area in the eastern section of the farm, where minor adjustments were required, it was decided to update the plan. This was done because it was found that there were more valley bottom areas than first expected, and most of these were wet. The valley bottom areas needed to be harvested at a younger age than the hillside areas. As the parallel layout incorporated some of the valley bottom areas into some of the hillsides, this presented a problem with management of these fields. The design was adjusted and drawn into the plan (Figure 3) with the valley bottom areas being highlighted and isolated. The result was a more conventional layout, with the parallel layout being confined to the crest areas.

A new field boundary map was drawn from the updated land use plan. This forms an important part of the implementation programme (Figure 4).

The implementation programme

A map showing the ratoon status, a harvest and plough-out map and a crop performance map from the field records were drawn. From this, an implementation programme was prepared. Plough-out fields were selected first, followed by the poorly performing fields. It is possible to mark structures through recently harvested fields. This allows more rapid adoption of the new field boundaries. Implementation started in 1989 in plough-out fields, but no implementation took place in 1990. The implementation programme continued in 1991 in problem fields and was revised in 1992 for the 1992/93 season (Figure 5).

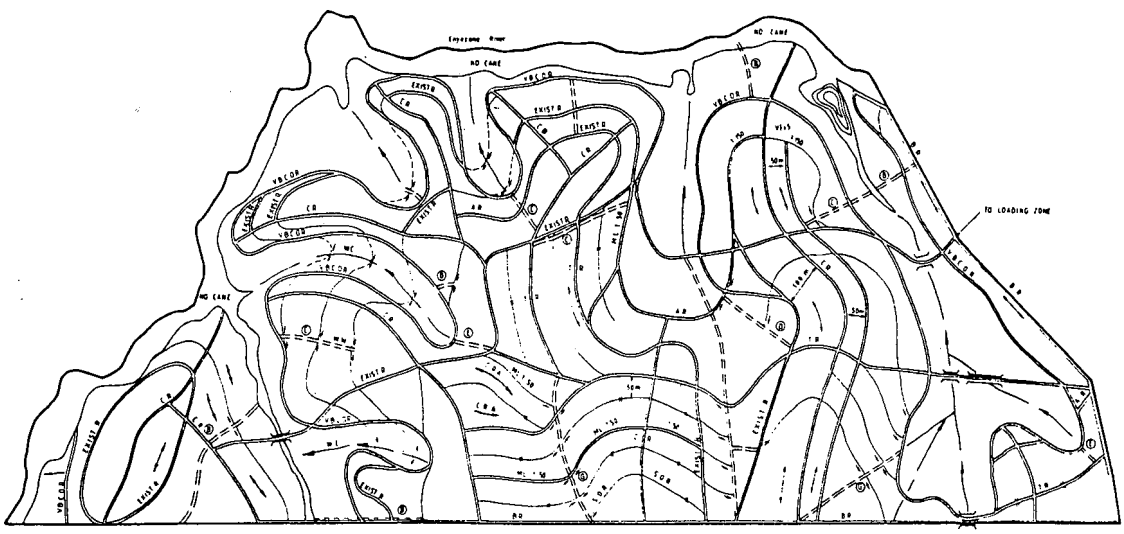

FIGURE 2 Parallel layout.

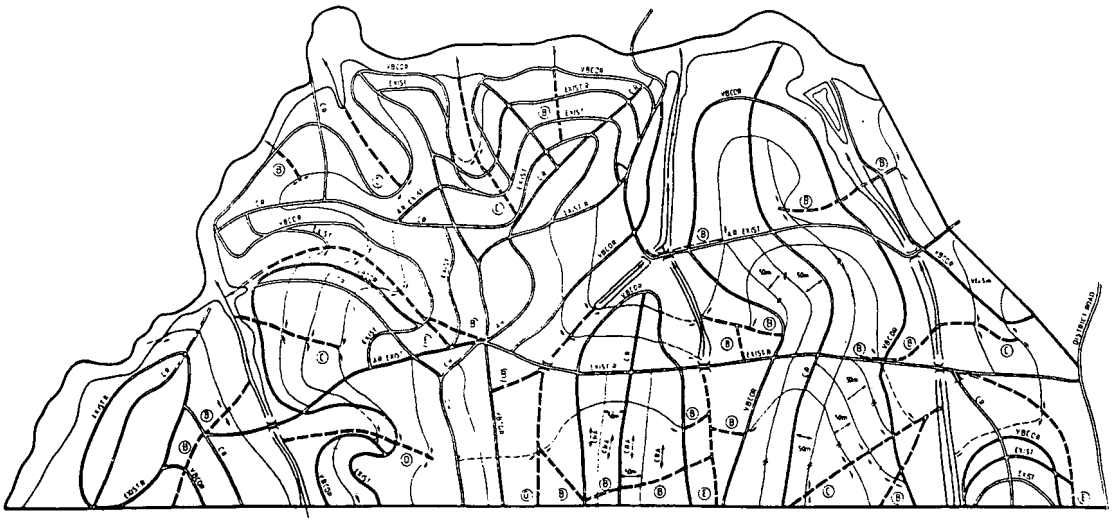

FIGURE 3 The updated LUP.

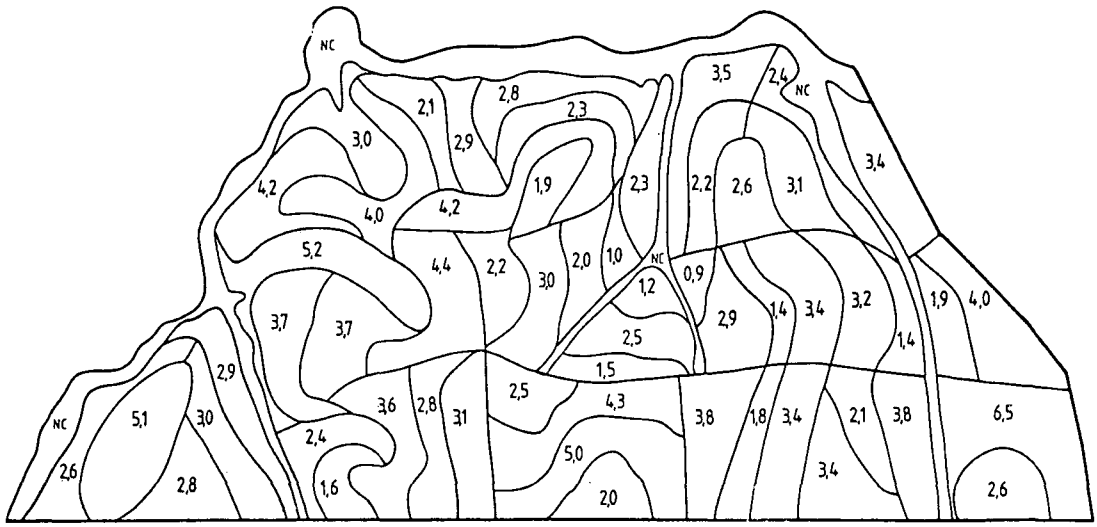

FIGURE 4 New field boundaries.

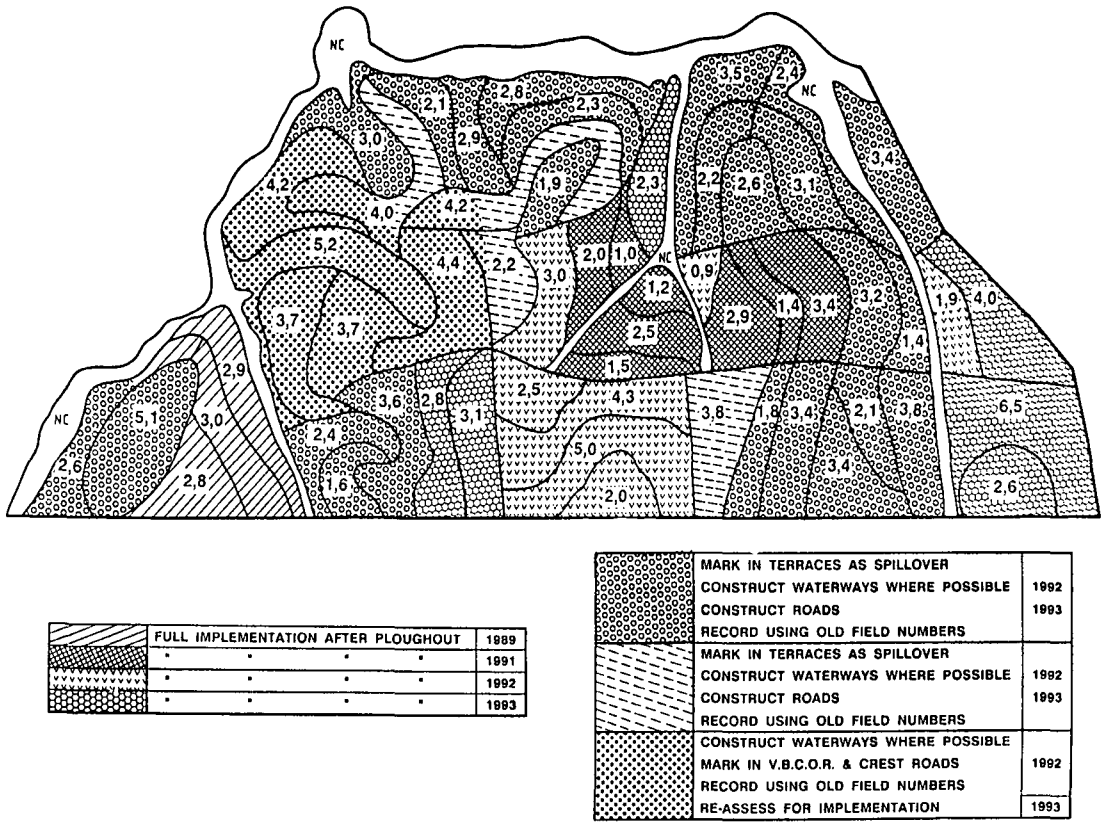

FIGURE 5 Implementation programme.

Problems and their solutions

Roads

The original draft of the land use plan showed a change to the existing cane extraction system. To move some of the roads would create a problem because major crossings existed. Also, two of the main extraction roads had been hardened. Although the roads were not in the best positions, it was decided to retain them. As the roads ran almost horizontally across the slope, they would carry water in places causing them to erode. There would also be a problem where water carrying terraces crossed these roads.

Water was moved away from these roads by:

- placing cut-off drains on the uphill side of the road, thus preventing water from moving through the field and onto the road,
- siting small artificial waterways along the edge of the road to allow terraces to discharge into them rather than cross the road,
- cambering major extraction roads and placing mitre drains at appropriate intervals.

FIGURE 6 Road after upgrading.

Drains

Waterways were sited according to the information given by the formlines; but when implementation of these waterways began it was discovered that some open drains were in existence where the waterways were sited. Some of these were incorrectly placed but were too deep to move. The capacity of some of the open drains was insufficient to handle the discharge from the terraces whereas others were big enough but were steep sided and eroding. Filling in the drains in some instances was feasible, but the larger drains presented a major problem.

The planned waterways were implemented by:

- covering up the smaller drains and constructing a waterway in their place, which is protected with cane top revetts, thus preventing the movement of loose soil,
- checking the capacity of the larger drains to ensure that they will cope with the expected flow and shaping the sides to give a 1:1 slope, and planting with grass,
- increasing the bases of the larger drains, where required, to a minimum of 2 m,
- placing revetts horizontally across the slope where an E horizon is exposed on the side slopes of the drain,
- protecting the discharge end of the terraces spilling into the modified drains by using sand bags filled with concrete and placed to prevent any waterfall action.

Wet spots

Where drains had been filled in, wet spots sometimes appeared, which impeded infield work. Removal of the drains had been necessary as many small infield drains were incorrectly positioned and made infield operations very difficult.

The wet spots were remedied by first constructing the conservation terraces. In some instances more terraces were required than initially planned, due to the position of the wet spots. These terraces cut off the water supply to the wet spots. Where the terraces were unsuccessful in drying up the wet spots, subsurface pipe drains were laid from the wet spot to the nearest terrace and along the channel of the terrace to the waterway.

FIGURE 7 Drain after upgrading.

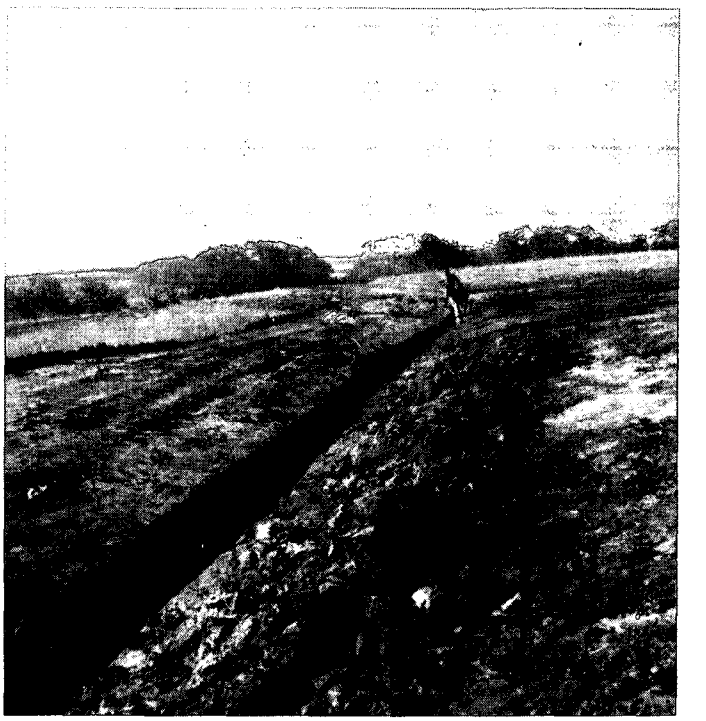

FIGURE 8 Placing pipe drains in the terrace.

Natural water courses

Some of the natural water courses flowing through the farm were in a very poor condition. They were actively eroding and had steep sides. This impeded extraction of cane where terraces discharged into them. Cane had been planted to the edge of the water course and most of the indigenous trees had been removed.

As the land use plan was implemented, cane was removed from the edge of the water courses for a horizontal distance of about 5 m. These areas were allowed to revert to natural grass, and indigenous trees were planted. Where the terraces discharged into the water courses, gabion baskets were placed to form a combination of retention weir and crossing. This had the effect of stabilising the water course as well as providing safe crossing places which reduced the infield haulage distance.

FIGURE 9 Water course after upgrading.

The benefits

Where the land use plan has been implemented there have been noticeable benefits:

- **Variety selection:** dividing the areas up into valley bottoms, hillsides and hilltops allows a choice of suitable varieties. Previously the whole farm was planted to one variety. With better variety selection yields were improved,
- **Drainage:** wetness problems were solved, which resulted in fewer open drains, easier infield operations and better cane growth and yields,
- **Extraction:** cane removal from the planned areas became more efficient. Distances to the loading zone were reduced, which resulted in better tractor use and a better controlled, cost effective harvesting operation. There was less damage to cane stools in the field, because the tractor used the terraces for access. This also increased yield,
- **Soil erosion:** building conservation works reduced soil erosion to acceptable levels. Good surface water management allowed the crop to use water more efficiently, improving yields and enabling the cane to survive the severe drought during 1991-1992,
- **Management:** this has become more efficient with an improvement in weed control and fertiliser application. Field access and inspection of the crop became easier and more frequent.

Discussion

The land use plan has been used as part of the normal annual planning on the farm. The implementation costs are included in the normal re-establishment costs. Eight to 10% of the farm is re-established annually; but this figure can be increased and the implementation of the land use plan could be completed by 1996.

Fields which previously had problem areas are now easier to manage. In the first area in which the land use plan was implemented in September 1989, cane yields were increased from 55 to 94 tons per ha. The second area in which the plan was implemented was also low yielding, averaging 66 tons per hectare at 24 months of age, but after the plan was implemented in January 1991, a yield of 80 tons per hectare at 15 months of age was achieved. The third stage of the implementation took place in September 1991. The area concerned had extraction and wetness problems, with yields steadily decreasing. By building terraces and waterways, these problems have disappeared and yields have stabilised. The fourth stage of the implementation occurred in July 1992. Again there were drainage problems in this area, with cane extraction being inefficient and slow. Terrace roads and crest roads were constructed together with waterways, and these structures have solved most of the problems.

Implementation so far has taken place only in the plough-out areas. Future implementation will take place where possible, in recently harvested areas, by marking the positions of terraces and waterways. New field numbering, with improved field shapes, will be started once the marking has taken place. The extent of the implementation will depend on the flexibility of the budget.

Conclusion

The land use plan has had a major influence on the improvement in the yields by:

- preventing soil erosion, so retaining the soil depth,
- improving surface water management, allowing increased water use and better plant growth,
- improving surface and subsurface drainage, resulting in improved cane growth,
- improving field shape and size, allowing for better fertiliser and herbicide application,
- positioning roads for extraction efficiency, thereby reducing infield damage and reducing haulage distances,
- improving road surfaces and gradients so reducing wear and tear on tractors and equipment.

The introduction of the land use plan has improved conditions on the farm and is therefore worth the time and effort. Its initial cost has been covered by the major benefits now being reaped over the whole farm. These are sustainable rewards for applying sound conservation principles embodied in the land use plan.

Acknowledgements

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REFERENCES

Platford, GG (1987). A new approach to designing the widths of panels in sugarcane fields. *Proc S Afr Sug Technol Ass* 61: 150-155.