

		<p>For methods of contour bank construction refer to SASRI Senior Certificate Course notes or the DAEA publication, 'Conservation of Farmland in KwaZulu-Natal' (1998) ISBN 1-86871-029-7.</p> <p>Additional conservation measures</p> <ul style="list-style-type: none"> • Depending on soil type and slope, additional protection may be required such as minimum tillage, green cane harvesting and strip replanting. • To prevent uncontrolled storm water from open veld, stone outcrops or forestry areas flowing through a cane field, grassed storm water drains must be constructed to divert the run-off safely to a safe discharge area. <p>Spill-over roads</p> <p>These roads form part of a conservation management system and should only be used where circumstances allow, such as on extremely erodible soils.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Better Management Practice</p>	<p>Waterways are in place</p> <ul style="list-style-type: none"> • Waterways should be sited at the lowest point of selected natural depressions • In the absence of natural depressions, artificial waterways may be constructed at right angles to the natural contour and/or adjacent to the crest road • The waterway dimensions must conform to Land Use Plan specifications 	<p>Waterways (refer to Page 3-54: Diagram of Conservation Works)</p> <ul style="list-style-type: none"> • Waterways are the starting point when implementing a Land Use Plan (LUP). • They are hydraulically designed structures, suitably protected by vegetation or paving, that are designed to safely convey the discharge from conservation structures (contour banks) to a natural stream or river. • They should be sited at the lowest point of selected natural depressions. • If natural depressions do not exist, artificial waterways may be constructed, located at right angles to the natural contour, and/or adjacent to the crest road. • Minimum width and depth is based on specifications designed to ensure hydraulic stability. The minimum width at the top end of a waterway should be 4 m, and the minimum depth 0.3 m above the grass mat. Bottom end widths are determined using the SCS (USA Soil Conservation Service) method. A basic rule of thumb for waterways on slopes of up to 15% and catchments of less than 10 hectares is an increase in width of 0.4 m for every hectare of catchment.

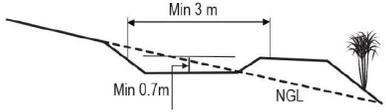
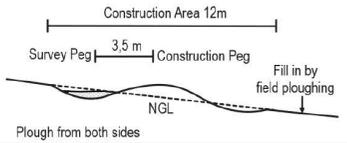
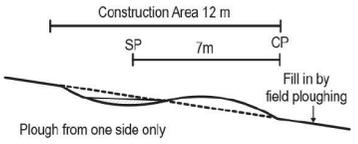
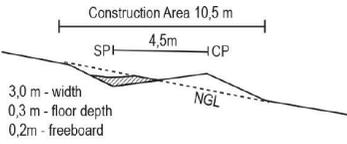
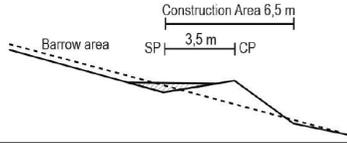
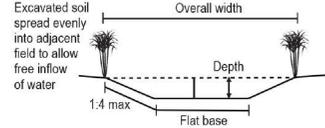
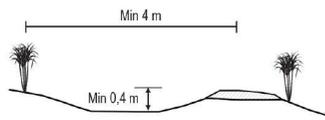
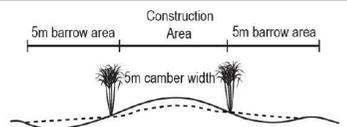
Better Management Practice	<ul style="list-style-type: none"> • Discharge ends of waterways are protected to prevent any undercutting • Earth waterways have been planted with a creeping grass suitable to the area • For new waterways, revetts have been spaced at 10m intervals across the main axis of the waterway to prevent erosion until such time as the vegetative cover is adequate • Additional protection where extraction routes cross waterways is in place • Verges have not been hoed for weed control • Waterways are not used as roads or paths • Waterways allow the free flow of surface water 	<ul style="list-style-type: none"> • Discharge ends of waterways, especially when spilling into rivers or streams with steep banks, must be protected to adequately prevent any undercutting. • Earth waterways should be planted to a creeping grass suitable to the area such as the grasses <i>Stenotaphrum secundatum</i> (coastal couch/buffalo grass), <i>Cynodon dactylon</i> (ngwengwe grass), <i>Paspalum notatum</i> (Bahia grass), <i>P. urvilli</i> (Vasey grass), and the sedges <i>Cyperus immensus</i> (Kwane grass), <i>Isolepus proliferia</i> (green trailing sedge), <i>Juncus lomatophyllus</i> (leafy juncus) and Kikuyu. They must be revetted to provide erosion checks that will remain operational until such time as the vegetative cover is adequate. The revetts should be spaced at 10 m intervals across the main axis of the waterway. Revetts consist of bundles of cane tops fastened in rows across the waterway, with the butt ends facing uphill. Each bundle is secured in place by wooden pegs driven through the bundle into the ground. • Where extraction routes cross waterways, additional protection is required in the form of stone packing, without changing the shape of the waterway. • Vegetated waterways should be kept mown and free from silt and debris. Waterway verges should not be hoed for weed control. • Waterways must never be used as roads or paths. • Movement of surface water into and down the waterway must not be hindered, i.e. water must be free flowing. • Waterway dimensions should be maintained; the waterway will require periodic re-establishment. • For more specialised waterways, growers should seek professional advice for designs. Final placement of waterways will depend on field and site conditions.
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Waterway dimensions

Category	Catchment Area (ha)	Slope %		
		2% - 5%	5% - 10%	10% - 30%
A	1 - 4	4m	4m	4m
B	5 - 6	4m	5m	5m
C	7	5m	6m	6m
D	8	5m	6m	7m
E	9 - 10	6m	7m	8m
F	11 - 12	6m	8m	9m
G	13	8m	9m	10m
H	14	8m	10m	11m
I	15	9m	10m	12m
J	16 - 17	10m	12m	13m
K	18 - 20	10m	12m	14m
L	21	11m	13m	15m
M	22	12m	14m	16m
N	23 - 24	12m	15m	17m
O	25	13m	16m	18m
P	26 - 27	14m	17m	19m
Q	28	14m	17m	20m
R	29 - 30	15m	18m	21m

For more detailed design refer to the DAEA report, 'Standards and Norms for Soil and Water Conservation Planning in KwaZulu-Natal', by WB Russell. Cedara Report No. N/A/93/32 dated 1/10/1994.

Diagram of conservation works

STRUCTURE	TYPE	CROSS- SECTION (not to scale)	GRADIENTS	SURFACE	USE
STORM WATER DRAIN			From 1:500 to 1:150 Dependent on length, catchment size and soil type	Soil	To catch water from unprotected catchments above layout scheme
CONTOUR BANKS	BROAD BASE up to 5%		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period. To allow movement of vehicles over the structure
	BROAD BASE up to 12%		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period. To allow movement of vehicles over the structure
	BENCH Shallow soils <400 mm deep		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period.
	IMPROVED BENCH Moderate Deep soils >400 mm deep		1:250 to 1:150 Dependent on length and soil type	Soil	To control inter-panel erosion during fallow period. To allow movement of vehicles from the panel above to the road.
WATERWAYS	NATURAL Grassed		Up to 30% up and down slope	Planted with creeping grass: Revets	To collect concentrated flows of water from terraces. Placed in natural drainage lines.
	ARTIFICIAL Grassed		Up to 20% across slope	Planted with creeping grass: Revets	To collect concentrated flows of water from terraces. Can be placed across slopes. (Avoid if possible)
ROADS	CREST		Variable up to 8%	Hardened	Cane extraction
	TERRACE	See 'CONTOUR BANKS' above	1:250 to 1:150	Hardened	Cane extraction
	DIAGONAL	See 'BENCH CONTOUR BANKS' above	Constant 8-12% maximum	Hardened	Where crests are over 10%. Cane extraction.



Contour bank



Broad based conservation structure (contour bank)



Grassed waterway



In-field machinery can cause compaction



Grassed waterway