

**Table 1: Proposed Sustainable Environment and Natural Resources Management Indicators for the ASWAP**

Pillar/Component	Main Issue Relating to the Pillar/Component	What needs to be monitored (Indicators)	Means of Verification	Assumptions	Remedial Measures Proposed
<p><b>Programme I. Food Security and Nutrition</b></p> <p>i) Increase maize productivity through implementation of the FISP to increase average maize yield</p>	<p>Increased soil erosion due to expansion of land under maize and cultivation of marginal lands for maize production</p>	<ul style="list-style-type: none"> <li>• Estimated total soil loss (MT/Ha/p.a)</li> <li>• Adoption of conservation farming, manure application and agro-forestry technologies to improve soil fertility and reduce erosion</li> </ul>	<p>Trial Samples</p> <p>LRCD reports</p> <p>DCP reports</p> <p>Forestry Department reports</p>	<p>FISP continues</p> <p>Farmers expand cultivation to marginal areas due to the FISP</p> <p>enhanced capacity at DLRC</p>	<ul style="list-style-type: none"> <li>• Promotion of appropriate conservation technologies, such ridge alignment, vetiver hedge rows, manure application e.t.c.</li> <li>• legume intercropping for soil fertility enhancement</li> <li>• use of drought tolerant varieties</li> <li>• adoption of conservation farming and agro-forestry technologies e.g. area and number of farmers</li> </ul>

	Unsustainable use of agro chemicals(fertilizers, pesticides and herbicides) would lead to pollution of water bodies that will pose a threat to human and aquatic life	<ul style="list-style-type: none"> <li>• water quality</li> <li>• Excess growth of noxious aquatic weeds due to increased nutrient load in water bodies</li> </ul>	Central Water Laboratory Water Quality reports		Quality control checks by competent authorities (pesticides boards, MBS)
		Type and quantity of agrochemicals sold	Pesticide Control Board reports		Train staff and farmers in appropriate herbicide handling
	River bank and catchment degradation leading to exposure of rivers and siltation.	<ul style="list-style-type: none"> <li>• Estimated total soil loss</li> <li>• Area of river bank and catchments rehabilitated</li> </ul>	DLRC and MoIWD Reports		<ul style="list-style-type: none"> <li>• Aforestation</li> <li>• Discourage river bank cultivation by legislation</li> <li>• Farmers not cultivating within 15-30m from the river</li> <li>• Adoption of appropriate conservation technologies such as ridge alignment, vetiver, hedge rows e.t.c.</li> </ul>
	Disturbance/destruction of fish breeding areas due to siltation resulting from upland cultivation	<ul style="list-style-type: none"> <li>• Fish stock levels</li> </ul>	Department of Fisheries		<ul style="list-style-type: none"> <li>• Promote soil conservation practices and catchment</li> <li>• protection of major rivers</li> </ul>

ii. Percent of post-harvest losses reduced from 30% to 15%	Implications of use of pesticides in grain storage to human health.	Type and quantity of agrochemicals sold	Pesticide Control Board reports DCP progress reports	increased yield of maize and other grains	<ul style="list-style-type: none"> <li>• Promote use of environmentally friendly Pesticides</li> <li>• Sensitise users on the safe and appropriate use of pesticides</li> </ul>
iii) Promote diversification of food production for improved nutrition at household level - Legume production increased (MT/ha)	Increased area under legume cultivation increasing soil's susceptibility to erosion and degradation.	Estimated total soil loss	APES and Forestry reports	FISP continue supporting seed legume	<ul style="list-style-type: none"> <li>• Discourage cultivation of marginal areas</li> </ul>
iv) Increase household irrigated horticultural crops productivity	Increased amount of water abstracted for horticultural crop production reducing water flow downstream	Water flow rate in rivers	Irrigation Department	Many farmers willing to adopt technologies	<ul style="list-style-type: none"> <li>• Promote recommended irrigation water management practices</li> <li>• Promote recommended production practices</li> <li>• promote organic farming</li> </ul>
	Increase in chemical load in the soil (agrochemicals) leading to water contamination	Water quality	Water quality reports - Ministry of Irrigation and Water Dev.	Many farmers able to afford the chemicals	<ul style="list-style-type: none"> <li>• Intensify targeted surveillance in risk areas</li> <li>• Promote use of bio-secure disposal technology</li> </ul>

v) Increased poultry production	Increases risk of environmental health problems resulting from important poultry diseases, e.g. avian influenza and Newcastle disease	Number of people/cases exposed/at risk	<ul style="list-style-type: none"> <li>• Vet reports from DAHLD</li> <li>• Hospital reports</li> </ul>	Inadequate control measure to contain outbreaks from outside the country	
vi) Improve quality and quantity of poultry feed					
vii) Increased goat herd size & productivity	Overgrazing and reduction of vegetative cover leading to land degradation	<ul style="list-style-type: none"> <li>• Estimated total soil loss</li> <li>• Stocking rate</li> </ul>	<p>LRCD reports</p> <p>DAHI reports</p>	Goats are left to graze freely	<ul style="list-style-type: none"> <li>• Promote stall feeding supplementation</li> <li>• Promote pasture establishment</li> <li>• Ensure adherence to use of recommended stocking rates</li> <li>• Training of extension workers in sustainable livestock production</li> <li>• Training of farmer groups in sustainable livestock production</li> </ul>
viii) Increased cattle production	Overgrazing leading to land degradation	<ul style="list-style-type: none"> <li>• Estimated total soil loss</li> <li>• Stocking rate</li> </ul>			<ul style="list-style-type: none"> <li>• Promote use of sustainable livestock management</li> <li>• Promotion of use and conservation of communal grazing areas</li> </ul>

ix) Increase household pig productivity	Disposal of dead pigs during culling of affected pig units is a source of environmental hazard	No. of people/cases exposed/at risk	Vet. Reports from DAHLD	Disposal facilities are not adequate	<ul style="list-style-type: none"> <li>Promote use of appropriate disposal facilities</li> <li>Sensitisation of proper disposal mechanism</li> </ul>
x) Increased fish productivity - Increased fish catch landing (MT) from off-shore waters	Pollution of off-shore waters	Water Quality	water quality reports	Fishers are adopting appropriate technologies on off-shore fishing practices	Promote appropriate technologies on off-shore fishing
xi) Increased fish production from cage culture	Pollution of water from excess feed around fish cages	Water quality	Periodic M&E reports from DoF	Excess left over feed around fish cages	<ul style="list-style-type: none"> <li>Promote adherence of recommended procedures when placing cages</li> </ul>
	Introduction of exotic fish species may lead to the loss of lake fish biodiversity	<p>Reduction of indigenous fish species</p> <p>Extinction of indigenous species</p> <p>Type and <u>Numbers of exotic species</u> introduced</p>	Monitoring reports		<ul style="list-style-type: none"> <li>Reinforce registration</li> <li>Monitoring fingerling production</li> </ul>

xii) Increased pond aquaculture production (MT)	Limited water availability for other uses	<ul style="list-style-type: none"> <li>Flow rate</li> <li>Water quality</li> </ul>	DoF reports Survey reports		<ul style="list-style-type: none"> <li>Promote irrigation night storage reservoirs for pond aquaculture</li> <li>Establish ponds in appropriate sites</li> <li>Promote use of water rights</li> </ul>
<b>Programme II: Commercial agriculture and market development</b> -Increased agricultural exports for improved balance of trade and income	Increased pollution and waste disposal as we enhance productivity, processing, and exports	<ul style="list-style-type: none"> <li>Effluent levels</li> <li>Water quality</li> </ul>	MBS reports MWID reports		<ul style="list-style-type: none"> <li>Promotion of waste management disposal</li> <li>Enforce adherence to disposal regulations</li> </ul>
<b>Program III. Sustainable agricultural water management</b> (Increased area under sustainable irrigation)	Reduction of water available in water bodies for other uses	<ul style="list-style-type: none"> <li>Flow rate/ Recharge rate</li> <li>Quantity of water abstracted</li> </ul>	MWID reports		<ul style="list-style-type: none"> <li>Promote catchment area protection around irrigation schemes</li> <li>Promote water users associations</li> <li>Promote sustainable water management</li> </ul>
	Change in water quality (Eutrophication)	Water quality	Water quality reports - MWID		Promote recommended irrigation and agricultural practices
	Increased malaria and water borne diseases	Number of cases at nearby health facility	Hospital reports		<ul style="list-style-type: none"> <li>Promotion of construction of sanitary facilities in</li> </ul>

					<p>irrigation schemes</p> <ul style="list-style-type: none"><li>• Promotion of portable water</li><li>• Good drainage</li></ul>
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Table 2: TEN SELECTED INDICATORS

Food Security and Nutrition

Impact/Outcome	Output	Process
Estimated total soil loss( i, iii, )	Adoption of conservation farming, manure application and agro-forestry technologies to improve soil fertility and reduce erosion	Type and quantity of agrochemicals sold(i, ii)
Water quality	Area of river bank and catchment rehabilitated	Type and numbers of exotic species introduced
Excess growth of noxious aquatic weeds to increased nutrient load in water bodies	Number of people/cases exposed/ at risk to poultry diseases	
Fish Stock Levels	Stocking rate (livestock)	
Water flow rate in rivers	Reduction of indigenous fish species	
Extinction of indigenous fish species		

Commercial Agriculture and Market Development

Impact/Outcome	Output	Process
Water quality	Effluent levels	

Sustainable Agricultural Water Management

Impact/Outcome	Output	Process
Water quality	Number of cases of malaria and water borne diseases at nearby health facility	
Flow rate	Quantity of water abstracted	
Recharge rate		