A	**Project title:**
	Vertical drainage efficiency on the West Fergana salinizated lands. Main parameters of vertical drainage system (VDS) definition under conjunctive operation of vertical and horizontal drainage

B	**Topic n° : 2**	Sub-topic n°: 2
1)	1	Technical field n°: 2

C	**Project location**	
	Fergana province, Besharyk district, state farm "Yakkatut"	
	Country: Republic of Uzbekistan	Area: 678 ha
	Precise details if possible	
	Country(ies):	Locality(ies):
	City(ies):	Others(s):

D	**Duration of the project:**	
	Year in which the project was started 1960	Project completed: 1982 Expected completion date: 1970, 1980

E	**Organizations and technical staff involved**	
1	Supervisor/project coordinator (SURNAME, First name): Tashtemir Bekmuratov	100 %
	Organization: SANIIRI	Staff resources
	Address: 11, Karasu-4, Tashkent telephone: E-mail: fax:	
	Other counterparts: Organizations (full name or acronym) Surname First name	2)
1		%
2		%
3		%
4		%
	Other collaborators: man-years	

F	**Funding agencies**	
	F u l l n a m e o r a c r o n y m	Percentage of project finance provided
1	Ministry for Land Reclamation and Water Management	100 %
2		%
3		%

G	**Summary of research project (see instruction on page 1)**

1 Objective and technical fields:
VDS efficiency definition. Main system's parameters under conjunctive operation of vertical and horizontal drainage providing optimal territory drainability, soil water-salt regime regulation and fertility improvement, crops yield increase.

2 Scientific and technical approach:

Salinizated soils desalinization, soil fertility improvement. Soil optimal reclamation regime establishment and support by means of VDS operation regulation.

Meaning: VDS operation regulation providing optimal soil water-salt regime.

3 Environment characteristics:

Climate is sharply continental. Average air temperature is 13.6 ^{0}C, average monthly temperature in June is 25.6-29.5 ^{0}C, maximum is 43-44 ^{0}C, minimum -24 ^{0}C. Annual precipitation is 97-124 mm. Average wind velocity is 2.4 m/sec. Number of days with strong wind (>15 m/sec) exceeds 50 days. Evaporation from water surface is 1450-1500 mm. Relative air humidity is 64 %, 80-82 % in December-January and 44-46 % in June-July.

Aridity coefficient is 16.5.

Area is flat with slope 0.0015-0.002.

Lithology: Loam (6-18 m) which underlaid by gravel-pebble layer (14-33 m). Loam permeability coefficient is 0.5 m/day, for unsaturated zone soils is 0.22-1.08 m/day, for aquifer is 12.5-22.4 m/day. Full field moisture capacity is 22.7 %, water specific yield is 0.11. Soil density is 1.56, porosity is 0.43. Groundwater level up to 1.5 m spread over 68 % of the area. Artesian water head exceeded groundwater level 0.2-0.7 m. Area of groundwater salinity more than 3 g/l exceeded 78.7 %.

Areas with middle and strong soil salinization encompassed 37-46.3 % of the total area, with strong salinization - 37-46.3 %.

Cotton yield varied within 2.23-2.8 t/ha. Groundwater level depletion rate under natural conditions is 0.013 m/day, artesian water depletion rate is 0.015 m/day. Water supply (1970) was 8100 cu.m/ha, water expense per 1 t of cotton was 2654 cu.m. (Op+A)/ET was 1.23 (1970). Irrigation water salinity was 0.5-1.0 g/l, for artesian water 0.5-1.0 g/l, for pumped water 0.45-1.6 g/l (1962).

4 Parameters of Pilot Projects and Technical Solutions:

Irrigated area is 678 ha (gross), 550 ha (net), land use efficiency is 0.81.

Crop pattern: cotton - 63.7-67.9 %, alfalfa - 10.6-12.7 %, corn - 1.0-2.9 %. Irrigation network is earthen, its extent is 14.05 km (21 m/ha).

Water supply is performed from Aktaun-say canal, its efficiency is 0.9-0.95, efficiency of all system - 0.65-0.7. Collector-drainage network extent at the initial stage was 27.4 km (40.48 m/ha), from which 11.6 km with depth 1.5-2.0 m. Open collectors' depth is 3.0-3.5 m, small collectors - 2.5-3.0 m. VDS of 7 wells depth 22.7-60.7 m has been constructed. Drilling diameter was 500 mm, casing tube diameter - 426 mm, screen length - 7-18 m; discharge was 60-70 l/sec, specific yield 5.4-7.5 l/sec/m. One well's drained area was 90-100 ha.

5 Methodology:

Field observations on water, salt and water-salt balance elements movement within unsaturated zone, groundwater and total water-salt balance. Feasibility study of optimal reclamation regime and VDS operation.

Balance stations were equipped by all necessary metering devices.

Systems analysis was taken as a methodology for data obtained processing.

6 Results:

VDS was operated with well discharge 10-45 l/sec. Average annual VDS efficiency was 0.3-0.64, average monthly - 0.7-0.9. Under such operation in combination with horizontal drainage necessary land drainability was achieved for optimal regulation of soil water-salt regime.

Mean annual drainage modulus was 0.14-0.25 l/sec. Groundwater level lowering rate was 0.15-0.8 m/day (0.013 m/day under horizontal drainage), artesian head lowering rate was 0.1-0.6 m/day.

High reclamation VDS efficiency under intensive underground inflow from outside influenced on groundwater regime and salinity, soil water-salt regime, yield and crop water consumption. VDS operation allowed: to regulate groundwater level within 1.8-3.56 m, in growing period 1.8-2.66 m. Artesian water head was 0.1-0.7 m lower than groundwater level. During long period of VDS operation area with groundwater salinity 3 g/l was cut down to 29 % (1975) against 78.7 % (1970). Area of non-salinizated lands increased from 138 ha (20.4 %, 1970) to 386 ha (57 %, 1980).

Area of middle salinizated lands decreased from 250 to 30.4 ha (45 %) during the same period. Soil desalinization within 1 m-layer was achieved, salt content decreased from 2 to 0.6 % (solid

residue) and from 0.01 to 0.015 % (chlorine-ion). Unsaturated zone soils salt content decreased from 1.5-2 to 1.0-0.6 % (solid residue) and from 0.05 to 0.01-0.015 % (chlorine-ion). (Op+A)/ET ratio was 1.04-1.23.

During VDS operation negative water-salt balance was achieved within unsaturated zone and cover loam.

In 1970, 1972, 1975 from total water supply 15145 cu.m/ha there were: Op=9670; A=751; (II-O)=4724;

from 15400 cu.m/ha: Op=9488; A=1608; (II-O)=4305;

from 14702 cu.m/ha: Op=9132; A=463; (II-O)=5107.

Drainage outflow was 8.0; 6.4 and 5.5 th.cu.m/ha respectively. Total evaporation was 7-7.75 th.cu.m/ha. Salt removal from cover loam to depth of 78 m was 29.9-39.51 t/ha. Desalinizating discharge ($\pm$ 9) within unsaturated zone balance was -1554 (1970), -2959 (1972), -358 (1975) cu.m/ha. Cotton yield growth was achieved 3.8 t/ha (1980) against 2.8 t/ha (1970), 3.5 t/ha (1975). Water expenses per product unit were cut down within 1970-1975 on 500 cu.m/t. Specific discharge for production unit was 2159 cu.m/t (1975) against 2654 cu.m/t (1970). Active zone of water exchange under VDS operation achieved 70-80 m and salt exchange - within cover loam.

Forecast calculations for groundwater level within 1.5; 1.9; 2.45; 3.0; 3.5; 4 m show that for optimal water-salt regime water supply should be given as follows:

- by agricultural crops irrigation with fresh surface water (0.5-0.79 g/l): 8890, 7910, 6780, 6325, 6420, 6510 cu.m/ha;
- the same by saline water to 3 g/l: 11510, 9670, 7890, 6235, 6420, 6510 cu.m/ha. It is found that half-hydromorphic regime is optimal under groundwater level regulation within 2.5-3.0 m.

Optimal regime could be achieved under irrigation norm 6325-6700 cu.m/ha (net field). Under automorphic regime optimal soil water-salt regime could be achieved by minimum expenses of irrigation water (5520-6000 cu.m/ha). With transition to hydromorphic regime (groundwater level is 1.5-1.9 m) water expenses for optimal regime creation are 8890 cu.m/ha.

H	Suggested key-words		
1	Vertical drainage	4	Soil salinization
2	Water-salt regime	5	Reclamation regime
3	Water-salt balance	6	Drainability

I	Most recent publications (maximum 3)				
1	*Author(s):* T.Bekmuratov				
	Title: Soil water-salt regime regulation under artesian water influence and VDS operation				
	Publication details: Long-term field investigations results (VDS parameters: discharge, specific yield, radius of influence, efficiency) are considered. Drainage modulus dynamics, groundwater level regulation, soil desalinization, irrigation norms, providing optimal water-salt regime, are determined.				
	Year of publication: 1982	free access [x]		restricted [ ]	confidential [ ]