Annexes to chapter 2

Annex 2.1. Coefficients of crops fertility compared to barley

Crop	Fertility coefficient	Crop	Fertility coefficient
Spring barley	1	Maize	11.9 (2.2)
Winter rye	1.1	Mixture of vetch and oats	6.25 (1.3)
Winter wheat	1.2	Red early clover with timothy:	
Winter triticale	1.5	- first year of use (two yields)	8.1 (1.7)
Winter barley	1.1	- second year of use (one yield)	5.1 (1.1)
Spring wheat	1.1	Red late clover with timothy:	
Oat	0.8	- first year of use (two yields)	8.8 (2.0)
Peas	0.5	- second year of use (one yield)	9.4 (1.7)
Mixture of peas and oat	0.9	White clover of first and second year of use (two-four yields)	8.9 (1.5)
Mixture of vetch and barley	0.7	Alfalfa with timothy (two-three yields)	11.7 (2.5)
Beans	0.7	Goat-rue (two-three yields)	8.1 (1.8)
Winter rape	0.7	Fodder timothy	9.5 (2.2)
Spring rape	0.3	True fescue	9.1 (2.3)
Winter small rape	0.6	Perennial ryegrass	9.1 (2.2)
Spring small rape	0.2	Meadow grass	6.4)1.9)
Sugar beat	7.8	Cocks-foot	12.1 (2.3)
Semi-sugar beat	13.9	Awnless bromegrass	10.8 (2.4)
Fodder beat	14.7	Cultivated pasture	- (1.5)
Potatoes	5.2		

Note: *Between brackets - coefficients for dry matter.*

Annex 2.2. Main causes of soil degradation and prevention measures

Causes of soil degradation	When and why it comes out	Protection and prevention measures
Soil erosion by water	Steep slopes, concentration of water flow. Stormy rain or sudden snow melting and surface run-off	Slopes covered by grass and forest, anti-erosion crop rotation, special soil cultivation, fields exposition, land cultivation
Soil erosion by wind	Open fields for wind, peat and sandy soils	Trees and bushes strips, crop rotations, special soil cultivation, stubble and straw partly incorporated to soil
Soil density	Use of heavy machines on wet soil. Worsening of soil structure in heavy soil	Crop rotation, special soil cultivation, technological tracks, liming, increased use of organic fertilizer
Water pollution	Uncontrolled use of sludge and effluents on agricultural land. Unbalanced fertilizing, negligence in pesticides use. Spilling of oil products	Use of effluents, sludge, fertilizer, pesticides according regulations. Proper storage of oil products, pesticides and fertilizers

Annex 2.3. Groups of soil according to the content of organic matter, humus and storage of main nutrient for crop

Soil group	Humus %		Total N %	Mineral N (NO_3+NH_4) kg/ha*	Mobile P_2O_5 mg/kg	Mobile K_2O mg/kg
	Sandy loam, loam and clay	Sand			according Egner-Rim-Doming (A-L)	according Egner-Rim-Doming (A-L)
Enough rich storage	> 3	> 1.5	>0.4	>90	151-200	151-200
Medium rich storage	2-3	0.5-1.5	0.2-0.4	61-90	101-150	101-150
Insufficient storage	1-2	0.05	0.1-0.2	31-60	51-100	51-100
Very little storage	0-1	-	< 0.1	<30	0-50	0-50

* Mineral nitrogen is determined for the soil layer 0-40 cm, other indicators for the layer 0-20 cm

Annex 2.4. Crop composition in V. Liutkevicius demonstration farm

Former crop composition in 1999	Area ha	% of the total area	Crop composition recommended for 2000	Area ha	% of the total area
Cereals	22.7	27.4	Cereals	12.2	14.8
Leguminous crop	11	13.3	Leguminous crop	15	18.1
Winter crop	13.5	16.3	Winter crop	15	18.1
Row crop	13.2	16.0	Row crop	8.2	9.9
Perennial grass	22.3	27.0	Perennial grass	22.3	27.0
			Cereals with underseeding	5	6.0
			Lay	5	6.0
Total	82.7	100.0	Total	82.7	100.0

Annex 2.5. Grouping of crop

Crop	Crop groups
Winter rye, winter wheat, winter rape	Winter crops
Barley, oat, peas, beans, vetch, alfalfa, flax, spring rape	Spring crops
Sugar beet, semi-sugarbeet, fodder beet, Swedish turnip, fodder turnip, fodder carrots, potatoes, maize, fodder cabbage, sunflower	Row crops
Red clover, pink clover, birds'-foot trefoil, kidney vetch anthyllis, timothy, fescue, cock's-foot, meadow-grass	Perennial grass
Lupine, serradella, ryegrass, mixture of vetch and oat, maize for green fodder, red clover, pink clover, white sweet clover, sundial lupine	Green fallow (lay)

Annex 2.6. Crop's influence on the humus content in the soil

Crop	Decrease (- t/ha)	Increase (+ t/ha)
Cereals	1.0	
Leguminous crops	0.8	
Flax	1.1	
Potatoes	2.0	
Sugar and fodder beet	1.8	
Maize	1.4	
Mixture of vetch and oat for fodder	0.6	
Alfalfa, clover		2.0
First year mixture of clover and ear grass		1.5
Second year mixture of clover and ear grass		1.0

Annex 2.7. Crops increasing and exploring soil fertility in nine-field crop rotation scheme

Crop value as forecrop	Field number	Crop
Increases soil fertility	1	Fallow (mixture of vetch and oat)
Exploit/ exhaust soil fertility	2	Winter crop
Increases soil fertility	3	Row crop (fertilised with organic fertilisers)
Exploit soil fertility	4	Spring crop
Exploit soil fertility	5	Spring crop
Increases soil fertility	6	Perennial grasses of I use year
Increases soil fertility	7	Perennial grasses of II use year
Exploit soil fertility	8	Winter crop
Exploit soil fertility	9	Spring crop

Annexes to chapter 3

Annex 3.1. Soil optimal reaction and added yield after liming of the acid soil

Crop	Soil optimal pH			Added yield
	Sand	Loamy sand	Loam	t/ha
Winter rye	5.4	5.6	5.9	0.34
Winter wheat	-	5.8	6.5	0.62
Barley	5.1	5.9	6.2	0.81
Oat	5.2	5.3	6.0	0.37
Potatoes	4.8	5.3	5.6	2.32
Maize	5.7	6.3	-	11.08
Sugar beet	-	6.0	6.6	17.66
Mixture of clover and timothy for hay	-	5.8	6.4	2.55
Mixture of vetch and oat for hay	-	6.0	6.4	2.02
Lupine	5.2	5.2	5.3	-
Flax for stem	-	5.5	5.5	1.25

Annex 3.2. Recommended liming norms (active matter $CaCO_3$) t/ha

Soil texture												
Sand				Loamy sand and sandy loam				Loam and heavy loam, clay				Peat
Soil type												
Soddy podzolic			Soddy podzolic gleyic*	Soddy podzolic		Soddy podzolic gleyic		Soddy podzolic		Soddy podzolic gleyic		Bogs
Zones of Lithuanian agro-climate												
pH_{KCl}	Eastern and Central	Western	Eastern, Central and Western	Eastern and Central	Western	Eastern and Central	Western	Eastern and Central	Western	Eastern and Central	Western	Eastern, Central and Western
4.0	4.0	5.0	5.0	8.0	11.0	10.5	13.0	12.5	13.0	15.5	15.5	6.0
4.1	4.0	4.5	5.0	7.0	9.5	10.0	12.0	12.0	12.0	12.0	14.0	5.0
4.2	4.0	4.0	4.0	7.0	9.0	9.0	10.5	9.0	10.5	11.0	12.5	4.0
4.3	3.0	4.0	4.0	6.0	8.0	8.0	9.5	9.0	10.0	10.5	11.0	4.0
4.4	3.0	4.0	4.0	6.0	7.5	7.5	9.0	8.0	9.0	10.0	10.5	3.5
4.5	3.0	4.0	4.0	5.5	7.0	7.0	8.0	8.0	9.0	9.0	9.5	3.0
4.6	2.5	3.0	3.0	5.5	6.5	7.0	8.0	7.5	8.0	8.0	8.5	3.0
4.7	2.5	3.0	3.0	5.0	6.0	6.0	8.0	7.0	8.0	8.0	8.0	3.0
4.8	2.5	3.0	3.0	5.0	6.0	6.0	7.5	7.0	8.0	7.5	8.0	2.0
4.9	2.5	2.5	2.5	5.0	5.0	5.5	7.0	6.0	7.0	7.0	8.0	2.0
5.0	2.5	2.5	2.5	4.5	5.0	5.5	7.0	5.5	7.0	7.0	7.0	2.0
5.1	2.0	2.5	2.5	4.5	5.0	5.0	6.5	6.5	6.0	5.5	7.0	-
5.2	2.0	2.5	2.5	4.0	4.5	4.5	6.0	5.5	5.0	5.0	7.0	-
5.3	2.0	2.0	2.0	4.0	4.5	4.0	5.5	5.0	5.0	5.0	6.0	-
5.4	2.0	2.0	2.0	3.5	4.0	4.0	5.0	4.5	5.0	4.5	6.0	-
5.5	2.0	2.0	2.0	3.5	4.0	4.0	5.0	4.5	4.5	4.5	5.0	-

Annex 3.3. Draft figures[1] for annual manure production per one animal and the amount of nutrients in manure (all figures are ex storage)

Type of barn Housing system	Type of manure	Amount of manure	DM	Amount of nutrients kg/tonnes manure		
		tonnes per year	%	N	P_2O_5	K_2O
Sow with 18 piglets under 20 kg						
With bedding	Solid	4.4	20	6.10	1.43	4.66
Fatling pigs (one animal from 20 to 100 kg weight per fatling cycle of 180 d.)						
On slatted floor; washing with water	Slurry	3.3	3.0	1.17	0.55	0.66
On slatted floor; self-passing flow	Slurry	1.9	7.0	3.06	1.44	1.62
In deep pigsty with bedding	Solid	2.6	25	5.20	2.15	4.25
In shallow pigsty; transporter	Semi-solid	1.05	15.0	3.50	1.70	2.80
Cows of milk productivity of 3000 kg*						
Tethered housing; indoor-outdoor	Solid	8.0	18.0	4.20	1.10	5.60
Loose housing in boxes; indoor-outdoor	Slurry	14.9	9.0	2.18	0.80	3.90
On deep litter; indoor-outdoor	Solid	12.3	22.4	4.12	1.80	5.59
Cows of milk productivity of 5000 kg*						
Tethered housing; indoor-outdoor	Solid	9.1	18.0	4.50	1.29	5.70
Loose housing in boxes; indoor-outdoor	Slurry	17.7	9.5	2.60	0.90	4.10
On deep litter; indoor-outdoor	Solid	14.0	20.4	4.70	1.16	5.85
Cows of milk productivity of 7000 kg*						
Tethered housing; indoor-outdoor	Solid	10.1	18.0	5.10	1.29	5.78
Loose housing in boxes; indoor-outdoor	Slurry	19.7	10.0	3.05	1.00	4.15
On deep litter; indoor-outdoor	Solid	15.4	18.7	5.20	1.32	5.85
Calves (one animal under 6 months old)						
Loose housing; on deep litter	Solid	3.2	23.0	3.20	1.30	5.40
Tethered housing; in individual pens	Solid	2.6	22.0	3.30	1.27	5.31
Heifers from 6 to 24 months old (on average)						
Loose housing on deep litter without pasturing	Solid	10.7	23.2	4.00	1.45	5.91
Loose housing in boxes	Slurry	13.0	10.0	2.15	0.80	3.40
Tethered individual housing	Solid	7.2	18.5	4.80	1.46	5.98
Fatling cattle (under 420-500kg weight or between 6 and 18-21 months old)						
Loose housing on deep litter	Solid	14.0	19.4	4.80	1.30	5.66
Loose housing in boxes	Slurry	18.1	8.5	2.60	0.80	3.50
Tethered housing	Solid	9.5	17.0	4.51	1.27	5.71
Beef cow with calf*						
On deep litter; indoor-outdoor	Solid	11.2	20.0	4.45	1.15	5.37
Horses (500 kg)*						
In stalls on deep litter; indoor-outdoor	Solid	7.2	36.7	7.00	3.22	8.07

[1] In 2001 a project on improved normatives of the amount of manure from various animal species and the fertilisation value standards will be elaborated. The project has participation of experts from institutions in Lithuania (LIA, LIAS and LAAS) and Denmark (DAAC, DIAS). The present draft figures are based on data determined in Lithuanian scientific institutions earlier, partly on draft figures from the mentioned project and partly on foreign figures.

Sheep*						
Loose housing on deep litter in pens	Solid	1.05	42.3	6.20	1.60	7.80
Hens (100 units)						
On deep litter	Solid	4.3	44	13.9	12.4	9.1
In coops without litter	Semi-solid	6.6	15	9.75	7.2	1.5
Chicken broilers (1000 units)						
On deep litter	Solid	7.9	40	11.0	10.0	8.0
In coops without litter	Semi-solid	9.0	13	9.50	7.5	4.0
Ducks, geese, turkeys (100 units)						
On deep litter	Solid	9.6	30	10.0	7.0	9.0

** Animals are kept in barn 220 days per year*

Note*: Nutritive values of various manure types in the Annex are calculated according to the forage ration. Nitrogen losses from manure in barn, during storage and grazing on pastures are subtracted. Losses of manure mass and nutrients, that may arise because of spreading time, incorporation time and measures are not subtracted.*

*Annex 3.4. Amount of nutrients taken by crops from soil**

Crop	Production type	Nutrients kg/t**		
		Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)
Winter wheat	Grains	22.8	11.8	20.0
Winter rye	Grains	21.0	10.1	125.0
Spring wheat	Grains	21.6	7.4	20.0
Barley	Grains	21.4	9.2	20.9
Oat	Grains	23.5	10.7	21.1
Mixture of cereals	Grains	25.3	10.7	20.1
Buckwheat	Grains	30.0	15.0	40.0
Pea	Grains	60.0	14.0	25.0
Fodder bean	Grains	67.0	17.0	22.0
Vetch	Grains	60.0	14.0	16.0
Lupine for fodder	Grains	58.0	19.0	47.0
Serradella	Grains	65.0	14.0	10.0
Flax	Straws	12.0	5.2	10.1
Flax	Linseed	74.8	32.7	64.8
Sugar beet	Roots	3.3	1.7	5.8
Potatoes	Tubers	4.7	1.6	5.5
Cabbage	Heads	5.5	1.6	5.0
Fodder root-crop	Roots	3.8	0.8	6.6
Fodder root-crop	Seeds	64.0	14.0	16.0
Maize	Green mass	2.7	1.0	4.5
Annual grasses	Hay	17.5	5.0	19.8
Annual grasses	Green mass	3.2	1.1	3.6
Perennial grasses (leguminous)	Dry matter	20.2	5.8	25.4
Perennial grasses	Hay	16.9	4.9	21.4
Perennial grasses	Green mass	3.0	0.9	3.8
Perennial grasses	Seeds	64.0	14.0	16.0
Cultural meadows	Hay	19.5	4.4	23.2
Cultural meadows	Green mass	3.5	0.9	4.1
Cultural pastures	Hay	21.2	6.5	27.7
Cultural pastures	Green mass	4.9	1.3	5.4

*Amounts of nutrients taken by crops that are given in the table will be improved in the year 2001 when the project on fertiliser normative is elaborated. The project has participation of experts from institutions in Lithuania (LIA, LIAS and LAAS) and Denmark (DAAC, DIAS). The shown figures about crop's uptake of plant nutrients are important for setting of fertiliser norms and nutrient balance for soil. Leguminous provide themselves with nitrogen, therefore nitrogen taken out by harvest is not compensated by fertiliser and fertilisation by nitrogen is not planned.

**Including the amount of nutrients accumulated in secondary production (straws, leaves and stalks).

Annex 3.5. Example of fertilization plan

Field No	Area ha	Previous crop	Crop of the year	Expected Yield t/ha	Data of soil analyses			Crop need for nutrients kg/ha			Cow manure, 40 t/ha			Mineral fertilizer					
					pH	P_2O_5 mg/kg	K_2O mg/kg	N	P_2O_5	K_2O	N kg/ha	P_2O_5 kg/ha	K_2O kg/ha	N	kg/ha	P	kg/ha	K	kg/ha
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	5	Grass	Winter wheat	5.0	6.5	130	150	114	59	100	0	0	0	Ammon. Nitrate	345	Super-phosphate	295	Potassium chloride	167
2	5	Winter wheat	Sugar beet	45	6.7	145	160	148	76	261	61.0	21.0	152	Ammon. Nitrate	256	Super-phosphate	275	Potassium chloride	182
3	5	Sugar beet	Spring barley	4	6.4	125	135	86	37	84	44.0	7.0	35	Ammon. Nitrate	124	Super-phosphate	150	Potassium chloride	82
4	5	Spring barley	Grass (clover)	5.5 SM	6.6	135	130	101	29	127	0	0	0	-	0	Super-phosphate	145	Potassium chloride	212
AVG for 1 ha														Ammon. Nitrate	179	Super-phosphate	216	Potassium chloride	161

Total need of fertilizer for 20 ha farm is 5050 kg ammonium nitrate, 4075 kg super-phosphate, 4385 potassium chloride

Columns 1-5 are filled from field plan indicating estimated yield.
Columns 6-8 are filled using soil agrochemical data from laboratory analyses.
Columns 9-11 are filled with the amount of nutrients taken from soil (Annex 3.4.) multiplied by expected yield.
Nutrient supplies from manure (columns 12-14) are calculated using Annex 3.3. First and second year nitrogen, phosphorus and potassium uptakes from manure may be found in Chapter 3 Table 3.1. Manure application of 40 t/ha for sugar beets was taken in our example; therefore, coefficient of first year nutrient uptake was used for sugar beets and second year uptake for spring barley.
Need of mineral fertilisers (columns 15-20) is calculated as following:

- For manure fertilized crops it is necessary to subtract the amount of nutrients coming with manure (columns 12-14) from nutrient need (columns 9-11) depending on the coefficient of nutrient uptake given in Chapter 3 Table 3.1. Nitrogen fertilisation of clover is not planned (column 16).
- Nitrogen need in the form of ammonium nitrate is calculated keeping in mind that it contains 34 kg N per 100 kg.
- Phosphorus need in the form of super-phosphate is calculated keeping in mind that it contains 20 kg P_2O_5 per 100 kg.
- Potassium need in the form of potassium chloride is calculated keeping in mind that it contains 60 kg K_2O per 100 kg.

Notes: *1. If other types of fertilisers are used then their need is calculated according to the concentration of nutrients in the fertiliser.*
2. If nutrient storage in the soil is sufficient then fertilisation plan is made according to the amount of nutrients taken by crop yield. When nutrient storage in soil is too high or too low then fertilisation norms are adjusted correspondingly.

Annexes to chapter 4

Annex 4.1.Record book of plant protection measures

No	No of crop rotation field	Name of plant sprayed	Name of preparation	Norm kg/ha, kg/t	Date of spraying	Area ha, t, m^2	Diseases, pests, weeds
1	2	3	4	5	6	7	8

Annexes to chapter 5

Annex 5.1. Draft figures of annual amount of nitrogen applied on farmland per year from one animal including nitrogen left in pastures during the grazing period[2]

Type of barn and animal housing	Type of manure removal and storage	Ex animal kg	Left in pasture kg	In storage with litter kg	Ex storage kg	Applied on farmland kg
Sow with 18 piglets under 20 kg						
In shallow pigsty	With transporter or other way	43.1	0	46	34.5	34.5
Fatling pigs (one animal from 20 to 100 kg weight per fatling cycle of 180 d.)						
On slatted floor	Washing away with water or self-passing flow	5.4	0	5.4	3.8	3.8
In shallow pigsty	Transporter or other way	5.4	0	5.4	3.8	3.8
In deep pigsty	Stored in pigsty	5.4	0	8.5	6.8	6.8
Cows of milk productivity of 3000 kg						
Tied housing	Transporter	76.8	30.5	49.4	42	72.5
Loose housing in boxes	Washing away with water	76.8	30.5	46.7	32.7	63.2
In deep barn	Stored in barn	76.8	30.5	56.3	50.7	81.2
Cows of milk productivity of 5000 kg						
Tied housing	Transporter	106.5	42.3	67.3	57.2	99.5
Loose housing in boxes	Washing away with water	106.5	42.3	64.6	45.2	87.5
In deep barn	Stored in barn	106.5	42.3	74.2	66.8	109.1
Cows of milk productivity of 7000 kg						
Tied housing	Transporter	134.9	53.6	84.5	71.8	125.4
Loose housing in boxes	Washing away with water	134.9	53.6	81.7	57.2	110.8
In deep barn	Stored in barn	134.9	53.6	91.4	82.2	135.8
Calves (one animal under 6 months old)						
In deep barn	Stored in barn	10.8	0	12.3	10.5	10.5
From 4 months on slatted floors	Washing away with water	10.8	0	11.8	10	10
Tied housing	Transporter or other way	10.8	0	12.3	10.5	10.5
Heifers from 6 to 24 months old (on average)						
In deep barn	Stored in barn	39.8	0	46.7	42	42
On slatted floors	Washing away with water	39.8	0	40.3	28.2	28.2
Tied housing	Transporter	39.8	0	41.8	35.6	35.6
Fatling cattle (to 420-500 kg weight or between 6 and 18-21 months old)						
In deep barn	Stored in barn	66.8	0	75.1	67.6	67.6
On slatted floors	Washing away with water	66.8	0	67.4	47.2	47.2
Tied housing	Transporter	66.8	0	68.9	58.5	58.5

[2]Amounts of nitrogen given in the table will be improved in year 2001 when the project on fertiliser normative is elaborated. The project has participation of experts from institutions in Lithuania (LIA, LIAS and LAAS) and Denmark (DAAC, DIAS).

Beef cow with calf						
In deep barn	Stored in barn	80.8	32.1	56.2	50.6	82.7
Horses (500 kg)						
In stalls	Various way of manure removal	77.5	30.8	59.3	50.4	81.2
Sheep						
In shallow or deep barn	Various way of manure removal	5.8	2.3	5.4	4.6	6.9
Hens						
On deep litter	Stored in barn	0.77	0	0.87	0.8	0.8
In coops without litter	Transporter or other way	0.77	0	0.77	0.71	0.71
Chicken broilers						
On deep litter	Stored in barn during feeding cycle	0.06	0	0.07	0.06	0.06
In coops without litter	Transporter or other way	0.06	0	0.06	0.06	0.06
Other poultry (ducks, geese, turkeys)						
On deep litter	Stored in barn	1.79	0	1.96	1.81	1.81

Note: *Nitrogen amounts in Annex 5.1 are calculated according to indoors period forage ration. The amount of nitrogen in bedding material is added. Nitrogen losses from manure in barn and during storage are subtracted. The amount of nitrogen left in pastures in form of faeces and urine during grazing and nitrogen losses that may arise during application and incorporation of manure are not subtracted.*

Annex 5.2. Draft coefficients for calculation of animal units (AU)

Type of barn and animal housing	Type of manure removal and storage	AU units per animal	Number of animals per AU
Sow with 18 piglets under 20 kg weight			
In shallow pigsty	With transporter or other way	0.35	2.9
Fatling pigs (one animal from 20 to 100 kg weight per fatling cycle of 180 d.)			
On slatted floor	Washing away with water or self-passing flow	0.04	26.3
In shallow pigsty	Transporter or other way	0.04	26.3
In deep pigsty	Stored in pigsty	0.07	14.7
Cow of milk productivity of 3000 kg			
Tied housing	Transporter	0.73	1.4
Loose housing in boxes	Washing away with water	0.63	1.6
In deep barn	Stored in barn	0.81	1.2
Cows of milk productivity of 5000 kg			
Tied housing	Transporter	1.00	1.0
Loose housing in boxes	Washing away with water	0.88	1.1
In deep barn	Stored in barn	1.09	0.9
Cows of milk productivity of 7000 kg			
Tied housing	Transporter	1.25	0.8
Loose housing in boxes	Washing away with water	1.11	0.9
In deep barn	Stored in barn	1.36	0.7
Calves (one animal under 6 months old)			
In deep barn	Stored in barn	0.10	9.5
From 4 months on slatted floors	Washing away with water	0.10	10.0
Tied housing	Transporter or other way	0.10	9.5

Heifers from 6 to 24 months old (on average)			
In deep barn	Stored in barn	0.42	2.4
On slatted floors	Washing away with water	0.28	3.5
Tied housing	Transporter	0.36	2.8
Fatling cattle (under 420-500 kg weight or between 6 and 18-21 months old)			
In deep barn	Stored in barn	0.68	1.5
On slatted floors	Washing away with water	0.47	2.1
Tied housing	Transporter	0.59	1.7
Beef cow with calf			
In deep barn	Stored in barn	0.83	1.2
Horses (500 kg)			
In stalls	Various way of manure removal	0.81	1.2
Sheep			
In shallow or deep barn	Various way of manure removal	0.07	14.6
Hens			
On deep litter	Stored in barn	0.0080	124
In coops without litter	Transporter or other way	0.0071	141
Chicken broilers			
On deep litter	Stored in barn during feeding cycle	0.0006	1632
In coops without litter	Transporter or other way	0.0006	1632
Other poultry (ducks, geese, turkeys)			
On deep litter	Stored in barn	0.0181	55

Annex 5.3. Example of animal unit (AU) and animal density calculation for a farm

Animal	Housing, manure removal or storage system	One animal makes AU	Number of animals	AU on a farm
Sow with 18 piglets under 20 kg weight				
In shallow pigsty	With transporter or other way	0.35	2	0.70
Fatling pigs (one animal from 20 to 100 kg weight per fatling cycle of 180 d.)				
In shallow pigsty	With transporter or other way	0.04	32	1.28
Cow of milk productivity of 5000 kg				
Tied housing	With transporter	1.00	20	20
Calves (one animal under 6 months old)				
Tied housing	With transporter or other way	0.10	5	0.5
Heifers from 6 to 24 months old (on average)				
Tied housing	With transporter	0.36	18	6.48
Fatling cattle (under 420-500kg weight or between 6 and 18-21 months old)				
Tied housing	With transporter	0.59	8	4.72
Horses (500 kg)				
Loose housing in stalls	Various way of manure removal	0.81	1	0.81
Sheep				
In shallow or deep barn	Various way of manure removal	0.07	5	0.35
Hens				
On deep litter	Stored in barn	0.0080	25	0.2
Total AU				**35.04**
Fertilised land ha				43.70
ANIMAL DENSITY, AU per ha				**0.80**

Annex 5.4. Minimal zooveterinarian distances between animal farms and other buildings not connected to the designed farm

Name of facility	Distance from the barn m
Livestock, pig, sheep, horses farms	150
Fur and rabbit farms	300
Poultry farms	200
Industrial poultry farms	1000
Meat-bone dust production plants	1000
Plants of building materials, enterprises of technical and technological agro service, feed production plants	100
Milk processing plants, productivity to 10 t per day	100
Milk processing plants, productivity more than 10 t per day	200
Slaughterhouses and meat processing plants, productivity to 10 t per shift	300
Slaughterhouses and meat processing plants, productivity more than 10 t per shift	1000
Stoppages for fruits, vegetables, potatoes and grain	50
Railway	100
Road, when traffic intensity, vehicles per day:	
More than 7000 (I category);	150
3001-7000 (II category);	70
701-3000 (III category;	50
250-700 (IV category);	20
other cases	10
Storage for mineral fertilizer	200

Annex 5.5. Minimal distances of animal farms to water bodies in the aquifers protective zones

Description of water body	Distance from the barn m
To the borderline of water bodies, when slope of terraces no more than 10 degrees or width of the terrace no more than 150 m	100
To the upper edge of the slope of terrace when width of the terrace less than 150 m	50
From upper edge of the bank when only bank protective zones are determined – straightened rivers and channels of watershed smaller than 10 km^2, and for lakes, and ponds when water surface is less than 0.5 ha	50

Annexes to chapter 6

*Annex 6.1. Volumes of solid manure, liquid manure and slurry per one animal for 1 month manure storage **

Animal	With bedding		Without bedding	
	Manure m^3	Urine m^3	Slurry m^3	Water for cleaning m^3
Cow of milk productivity of 3000 kg	1.47	0.41	1.37	0.60
Cow of milk productivity of 5000 kg	1.68	0.47	1.58	0.75
Cow of milk productivity of 7000 kg	1.86	0.53	1.76	0.80
Calf under 6 months old	0.29	0.04	Not recommended	
Heifer from 6 to 24 months old	0.80	0.22	0.73	0.30
Fatling cattle from 6 to 21 months	1.06	0.29	0.99	0.45
Beef cow with calf	1.39	0.38	Not recommended	
Sow with 18 piglets under 20 kg	0.49	0.13	0.43	0.15
Fatling pig from 20 to 100 kg	0.12	0.04	0.12	0.15 (0.03)**
Horse	1.33	0.00	Not recommended	
Sheep	0.19	0.00	Not recommended	
1000 chicken broilers	0.83	0.00	Not recommended	
100 hens	0.46	0.00	1.1	
100 other poultry (ducks, geese, turkeys)	1.00	0.00	Not recommended	

**If to calculate manure outcome during pasture season then the volume of manure and urine for all cattle types, horses and sheep has to be increased by 15%.*
***The amount of technological water when manure removes from the system itself.*

Annex 6.2. Example of manure pad calculation for 6 months manure storage (height of manure pile is 2.5 m)

Animal	Manure from one animal per 1 month m^3	Number of animals	Total volume of manure m^3 per 1 month
Cow of milk productivity of 5000 kg	1.68	10	16.8
Calf under 6 months old	0.29	2	0.58
Heifer from 6 to 24 months old	0.80	8	6.4
Fatling cattle from 6 to 21 months	1.06	6	6.36
Sow with piglets	0.49	1	0.49
Fatling pig	0.12	4	0.48
Horses	1.33	1	1.33
Sheep	0.19	5	0.95
Hens	0.0046	28	0.13
		TOTAL PER 1 MONTH m^3	**33.52**
		STORAGE PERIOD months **6**	
		MANURE TOTAL PER PLANNED PERIOD m^3	**201.12**
		HEIGHT OF MANURE PILE IN MANURE STORAGE m **2.5**	
		AREA OF MANURE STORAGE m^2	**80.5**

Note: *If to calculate the area of manure storage for another height of the pile then the height of the manure pile should be changed in the table and the stored manure volume should be divided by the needed height of the pile. If to calculate the area of manure storage for another manure storage period then the number of storage months should be changed in the table and the volume of manure should be multiplied by the needed number of months.*

Annex 6.3. Example of liquid manure reservoir calculation at the solid manure pad for 6 month manure storage

Animal	Liquid manure from one animal per month m^3	Number of animals	Total volume per month m^3
Cow of milk productivity of 5000 kg	0.47	10	4.70
Calf under 6 months old	0.04	2	0.08
Heifer from 6 to 24 months old	0.22	8	1.76
Fatling cattle from 6 to 21 months	0.29	6	1.74
Sow with piglets	0.13	1	0.13
Fatling pig	0.04	4	0.16
Horses	0.00	1	0.0
Sheep	0.0	5	0.0
Hens	0.0	28	0.0
		TOTAL PER 1 MONTH m^3	**8.57**
		STORAGE PERIOD months **6**	
		LIQUID MANURE TOTAL PER PLANNED PERIOD m^3	**51.4**
In addition washing effluents from barn and parlour, and water from precipitation for open reservoir can be calculated			
Additionally 0.3 m^3 of water is used per cow per 1 month	Number of cows	**10** x 0.3 x **6**=	**18.0**
Precipitation from manure pad (0.037 m^3 from 1m^2 per 1 month)	Area m^2	**80.5** x **6** x 0.037=	**17.9**
TOTAL VOLUME INCLUDING PRECIPITATION AND EFFLUENTS m^3			**87.3**

Note: *If to calculate the area of liquid manure reservoir for another storage period then the number of storage months should be changed in the table and the volume of liquid manure should be multiplied by the needed number of months*

Annex 6.4. Example of slurry reservoir calculation for 6 months manure storage

Animal	Volume of slurry from one animal m^3	Water for manure washing m^3	Total volume of slurry and water from washing m^3	Number of animals	Total per month m^3
Sow with 18 piglets till 20 kg	0.43	0.15	0.58	20	11.6
Fatling pigs	0.12	0.15	0.27	250	67.5
				TOTAL PER 1 MONTH m^3	**79.1**
				STORAGE PERIOD months **6**	
				SLURRY TOTAL PER PLANNED PERIOD m^3	**474.6**
In addition precipitation for uncovered reservoir can be calculated					
Precipitation from uncovered reservoir surface area S (0.037 m^3 for 1 m^2 per 1 month)			S x 0.037 x **6** =		Q
TOTAL VOLUME INCLUDING PRECIPITATION AND EFFLUENTS m^3			**474.6 +Q =**		

Note: If to calculate the volume of slurry reservoir for another storage period then the number of storage months should be changed in the table and the volume of slurry per 1 month should be multiplied by the needed number of months