

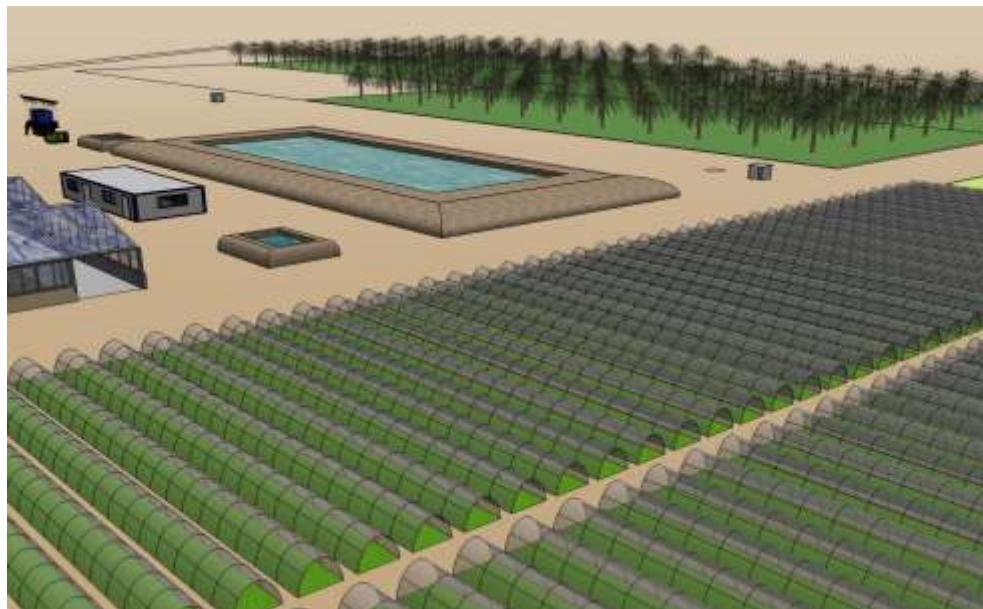
  	 D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	
---	--	-------------------	--------------------------------	--

eni iraq b.v.

“Sustainable Integrated Pilot Water / Agricultural Projects”

Contract 155/2010/LC/ZU

PROJECT DETAILED ENGINEERING & EXECUTION DOCUMENT



02	Issue for Approval	F. Garbati P. University of Florence	D. D'ippolito Sustainable Projects Coordinator	W. Flospergher M. Perioli HSE & CI Mgrs	15-Jun-2012
01	Issue for Comments	F. Garbati P. University of Florence	D. D'ippolito Sustainable Projects Coordinator	M. Perioli HSE & CI Mgr	23-Apr-2012
00	Issue for Comments	F. Garbati P. University of Florence	D. D'ippolito Sustainable Projects Coordinator	M. Perioli HSE & CI Mgr	12.Jan-2012
REV	REASON FOR ISSUE	RESPONSIBLE	ACCOUNTABLE	ENDORSED	DATE

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 2 of 219
---	---	-------------------	--------------------------------	------------------

Index

1. INTRODUCTION	16
1.1. Purpose	16
1.2. Execution	16
1.3. Project outputs	16
1.4. Intended audience	17
1.5. Project team	17
1.6. Procurement/Contracting arrangements	17
1.7. Scope of work	17
1.8. List of definitions and abbreviations	18
1.8.1. List of definitions	18
1.8.2. List of abbreviations	18
1.9. Values and calculations	19
1.10. Updating	19
2. Management	20
2.1. Organization and staffing	20
2.2. Provision of facilities and equipment	21
3. Implementation	22
3.1. Farm structure	22
3.2. Work breakdown	22
3.3. Farm layout	24
4. AQUACULTURE	25
4.1. Introduction	25
4.2. Hatchery/Nursery Unit	25
4.2.1. Description	25
4.2.2. Equipment	25
4.2.3. Setting-up	26
4.2.4. Procurement	27
4.2.5. Process	27
4.3. Grow-out Unit	27
4.3.1. Description	27
4.3.2. Equipment	28
4.3.3. Setting up	28

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 3 of 219
---	---	-------------------	--------------------------------	------------------

4.3.4. Procurement	29
4.3.5. Process	29
5. CULTIVATIONS	30
5.1. <i>Introduction</i>	30
5.2. <i>Greenhouse</i>	31
5.2.1. Description	31
5.2.2. Equipment	32
5.2.3. Setting up	33
5.2.4. Procurement	33
5.2.5. Cultivation process	34
5.3. <i>Open field</i>	35
5.3.1. Description	35
5.3.2. Equipment	35
5.3.3. Setting up	36
5.3.4. Procurement	37
5.3.5. Cultivation process	37
5.4. <i>Date palm</i>	39
5.4.1. Description	39
5.4.2. Equipment and materials	39
5.4.3. Setting up	40
5.4.4. Procurement	40
5.4.5. Cultivation process	40
5.5. <i>Casuarina</i>	42
5.5.1. Description	42
5.5.2. Equipment and materials	42
5.5.3. Setting up	42
5.5.4. Procurement	43
5.5.5. Cultivation process	43
5.6. <i>Barley</i>	44
5.6.1. Description	44
5.6.2. Equipment and materials	44
5.6.3. Setting up	44
5.6.4. Procurement	45
5.6.5. Cultivation process	45
5.7. <i>Bermuda grass</i>	46

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 4 of 219
---	---	-------------------	--------------------------------	------------------

5.7.1.	Description	46
5.7.2.	Equipment	46
5.7.3.	Setting up	46
5.7.4.	Procurement	46
5.7.5.	Cultivation process	46
6.	ANIMAL REARING	48
6.1.	<i>Introduction</i>	48
6.2.	<i>Poultry</i>	48
6.2.1.	Description	48
6.2.2.	Animals and equipment	49
6.2.3.	Setting up	49
6.2.4.	Procurement	49
6.2.5.	Breeding process	49
6.3.	<i>Sheep</i>	51
6.3.1.	Description	51
6.3.2.	Animals and equipment	51
6.3.3.	Setting up	52
6.3.4.	Procurement	52
6.3.5.	Breeding process	52
7.	WATER PURIFICATION	54
7.1.	<i>Description</i>	54
7.2.	<i>Equipment</i>	54
7.3.	<i>Setting up</i>	55
7.4.	<i>Procurement</i>	55
8.	IRRIGATION AND WATER DELIVERY SYSTEM	56
8.1.	<i>Introduction</i>	56
8.2.	<i>Wells</i>	57
8.2.1.	Reference data	57
8.2.2.	Distribution system	57
8.2.3.	Equipment and materials	57
8.2.4.	Procurement	57
8.3.	<i>Hatchery/Nursery</i>	58
8.3.1.	Reference data	58
8.3.2.	Distribution system	58
8.3.3.	Equipment and materials	59

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 5 of 219
---	---	-------------------	--------------------------------	------------------

8.3.4. Procurement	59
8.4. <i>Grow out ponds</i>	60
8.4.1. Reference data	60
8.4.2. Distribution system	60
8.4.3. Equipment and materials	60
8.4.4. Procurement	61
8.5. <i>Greenhouse</i>	62
8.5.1. Irrigation data	62
8.5.2. Distribution system	62
8.5.3. Equipment and materials	63
8.5.4. Procurement	63
8.6. <i>Open field</i>	64
8.6.1. Irrigation data	64
8.6.2. Distribution system	64
8.6.3. Equipment and materials	65
8.6.4. Procurement	66
8.7. <i>Date palm</i>	67
8.7.1. Irrigation data	67
8.7.2. Distribution system	67
8.7.3. Equipment and materials	68
8.7.4. Procurement	68
8.8. <i>Casuarina</i>	69
8.9. <i>Barley</i>	70
8.9.1. Irrigation data:	70
8.9.2. Distribution system	70
8.9.3. Equipment and materials	70
8.9.4. Procurement	71
8.10. <i>Bermuda grass</i>	72
8.10.1. Irrigation data:	72
8.10.2. Distribution system	72
8.10.3. Equipment and materials	73
8.10.4. Procurement	73
8.11. <i>Reverse osmosis unit</i>	74
8.11.1. Reference data	74
8.11.2. Distribution system	74

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 6 of 219
---	---	-------------------	--------------------------------	------------------

8.11.3. Equipment and materials	74
8.11.4. Procurement	74
9. CONSTRUCTIONS	75
9.1. Ponds and basins	75
9.1.1. Description	75
9.1.2. Setting up	75
9.1.3. Procurement	75
9.2. Hatchery/nursery, LS Boxes and Guesthouse	75
9.2.1. Description	75
9.2.2. Setting up	77
9.2.3. Procurement	77
9.3. Shelters	77
9.3.1. Description	77
9.3.2. Setting up	78
9.3.3. Procurement	78
9.4. Greenhouse	78
10. ENERGY	79
10.1. Introduction	79
10.2. Power data	80
10.3. Power supply	80
10.4. Materials and equipment	81
10.4.1. Procurement	81
11. TRAINING	82
11.1. Management	82
11.2. Aquaculture	82
11.3. Cultivations	84
11.4. Animal rearing	85
11.5. Water management	86
12. TECHNICAL SUPPORT	88
12.1. Aquaculture	88
12.2. Cultivations	89
12.3. Animal rearing	90
12.4. Water management	90
12.5. Constructions	91
13. OTHER PROJECT COMPONENTS	92

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 7 of 219
---	---	-------------------	--------------------------------	------------------

14. BILL OF QUANTITIES (MATERIALS AND SERVICES)	93
15. ANNEXES	113
15.1. Annex A – SIPWAP breakdown	114
15.2. Annex B – SIPWAP work loads	123
15.3. Annex C - Proposed Farm layout	125
Annex D – Aquaculture rearing process	126
15.3.1. Hatchery/nursery	126
15.3.2. Grow out	132
15.4. Annex E – Process execution cards	138
15.5. Annex F – Irrigation schemes	160
15.6. Annex G – Constructions	168
15.6.1. Ponds	168
15.6.2. Hatchery/nursery and LS Boxes	168
15.6.3. Shelters	168
15.7. Annex H - Power supply schemes	176
15.8. Annex I – Specifications for power generators	179
15.8.1. Generator A	179
15.8.2. Generator B	181
15.9. Annex J - Composting	183
15.9.1. Description	183
15.9.2. Setting up	184
15.9.3. Structures and equipment	184
15.9.4. Procurement	185
15.9.5. Process	188
15.9.6. Training	189
15.9.7. Costs	189
15.10. Annex K – Feed production with waste from messes	191
15.10.1. Description	191
15.10.2. Setting up	191
15.10.3. Structures and equipment	192
15.10.4. Procurement	192
15.10.5. Process	192
15.10.6. Training	192
15.10.7. Costs	193
15.11. Annex L – Fish processing unit	194

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 8 of 219
---	---	-------------------	--------------------------------	------------------

15.11.1. Description	194
15.11.2. Setting up	194
15.11.3. Structures and equipment	194
15.11.4. Procurement	195
15.11.5. Process	195
15.11.6. Training	196
15.11.7. Costs	196
15.12. Annex M - Masonry techniques for constructing LS buildings	198
15.12.1. Description	198
15.12.2. Setting up	200
15.12.3. Procurement	201
15.12.4. Training	201
15.12.5. Costs	201
15.13. Annex N - Geothermal systems for cooling and heating of LS structures	202
15.13.1. Description	202
15.13.2. Setting up	203
15.13.3. Procurement	203
15.13.4. Costs	204
15.14. Annex O - Electricity production with the use of a wind turbine	205
15.14.1. Description	205
15.14.2. Setting up	206
15.14.3. Structures and equipment	206
15.14.4. Procurement	206
15.14.5. Process	206
15.14.6. Costs	207
15.15. Annex P - Water lifting with the use of a wind mill	208
15.15.1. Description	208
15.15.2. Setting up	208
15.15.3. Structures and equipment	209
15.15.4. Procurement	210
15.15.5. Costs	210
15.16. Annex Q – Low technology hydroponics	211
15.16.1. Description	211
15.16.2. Setting up	212
15.16.3. Structures and equipment	217



15.16.4. Procurement	217
15.16.5. Process	218
15.16.6. Training	218
15.16.7. Costs	219

    D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 10 of 219
--	-------------------	--------------------------------	-------------------

List of figures

Figure 4.1 – Proposed layout for the hatchery/nursery unit	26
Figure 5.1 - Land use calendar for years 1 to 3	31
Figure 5.2 - Layout of open field tomato plots.....	37
Figure 8.1 - Farm hydraulic network scheme.....	56
Figure 10.1 - Loads and connection scheme with cable sections	80
Figure 15.1 - Project Development Timing draft scheme	114
Figure 15.2 - SIPWAP components breakdown chart	115
Figure 15.3 - SIPWAP components chart for a 2-step implementation (step 1).....	115
Figure 15.4 - SIPWAP Work Breakdown of activities	116
Figure 15.5 - SIPWAP Work Breakdown of activities for a 2-step implementation.....	119
Figure 15.6 - SIPWAP detailed Gantt chart of activities for Pilot Project Dvlpmnt	120
Figure 15.7 - SIPWAP detailed Gantt chart of activities for setting up of step 1	122
Figure 15.8 - Previewed workloads (1 work day = 6 h)	123
Figure 15.9 - Proposed farm layout.....	125
Figure 15.10 - Injection of hormone in different carps	127
Figure 15.11 - Summary of the treatment applied in the hatchery to the female spawners	128
Figure 15.12 - Summary of the treatment applied in the hatchery to the male spawners	128
Figure 15.13 - The incubation of fertilized eggs takes place in Zug jars.....	129
Figure 15.14 - An example of solar aerator (from www.ruralenergy.wisc.edu).	136
Figure 15.15 - An example of solar feed dispenser (from www.aquaculture-com.net/feeders.htm)....	136
Figure 15.16 - Hatchery-Nursery hydraulic network scheme	160
Figure 15.17 - Fish pond hydraulic network scheme	161
Figure 15.18 - Greenhouse hydraulic network scheme	162
Figure 15.19 - Farm general hydraulic system layout (see figure 15.6)	163
Figure 15.20 - Open field irrigation network scheme	164
Figure 15.21 - Date palm irrigation network scheme.....	165
Figure 15.22 - Barley irrigation network scheme	166
Figure 15.23 - Bermuda grass irrigation network scheme	167
Figure 15.24 - Shelter with midfeather (section plane)	169
Figure 15.25 - Shelter with brooding, heating, midfeather, perches (section plane)	170

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 11 of 219
---	---	-------------------	--------------------------------	-------------------

Figure 15.26 – Chicken shelter rendering	171
Figure 15.27 - Total maximum power needs schedule (period = 15 days)	177
Figure 15.28 - Maximum power needs schedule for different farm units (period = 15 days)	178
Figure 15.29 Section of the platform with composting material	185
Figure 15.30 – Platform (measures in cm if not specified)	185
Figure 15.31 – Silo (measures in cm if not specified).....	186
Figure 15.32 - Layout of carp processing unit.	195
Figure 15.33 - Earth collectors connected to a heat pump for air-conditioning of interiors	203
Figure 15.34 - Wind pump scheme and connections from well to basin A	209
Figure 15.35 - Connection between timbers.....	212
Figure 15.36 - Shading sheet	213
Figure 15.37 - Lateral sight of greenhouse.....	213
Figure 15.38 - Front side of nursery	214
Figure 15.39 - Lateral sight nursery.....	214
Figure 15.40 - Hydroponic compound.....	215
Figure 15.41 - Lettuce cultivated in rows of containers filled with carbonized rice hull	216
Figure 15.42 – Hydraulic system	216

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 12 of 219
---	---	-------------------	--------------------------------	-------------------

List of tables

Table 3.1 - Main project components	23
Table 3.2 - Farm setting up main activities	23
Table 3.3 - Reference distances between units	24
Table 5.1 - Surfaces and crop rotation of vegetable crops	30
Table 5.2 - Dates Production in the first ten years.....	39
Table 8.1 - Losses of head for different PE pipe diameters (50 m manifold, 2.5 l/s discharge).....	65
Table 8.2 - Losses of head for different PE pipe diameters (320 m pipe, 5 l/s discharge).....	65
Table 10.1 - Maximum power needs for different farm units	79
Table 11.1 Training program for farm management.....	82
Table 11.2 - Aquaculture training program for farm Technicians	83
Table 11.3 - Cultivations training program for farm Technicians.....	84
Table 11.4 – Animal rearing training program for farm Technicians	85
Table 11.5 - Water management training program for farm Technicians	86
Table 12.1 - Assistance needs for aquaculture component.....	88
Table 12.2 - Assistance needs for cultivations component.....	89
Table 12.3 - Assistance needs for animal rearing component	90
Table 12.4 - Assistance needs for water management component.....	91
Table 12.5 - Assistance needs for Constructions component	91
Table 14.1 - Training costs.....	94
Table 14.2 - Assistance costs	94
Table 14.3 - Nursery/Hatchery	95
Table 14.4 - Grow-out pond	95
Table 14.5 - Greenhouse	96
Table 14.6 - Structure details of the greenhouse.....	97
Table 14.7 - Covering details of the greenhouse.....	98
Table 14.8 - Automation system details of the greenhouse	98
Table 14.9 - Cooling/heating system details of the greenhouse.....	98
Table 14.10 - Tomato open field	99
Table 14.11 - Date palm	100
Table 14.12 - Barley.....	100

   	D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 13 of 219
---	---	-------------------	--------------------------------	-------------------

Table 14.13 - Bermuda grass	101
Table 14.14 - Casuarina	101
Table 14.15 - Chicken rearing	102
Table 14.16 - Sheep rearing.....	102
Table 14.17 - Reverse osmosis unit	102
Table 14.18 – Total costs for productive modules	103
Table 14.19 - Water management (hydraulic equipment, installations and connections).....	103
Table 14.20 – Constructions: Ponds	108
Table 14.21 – Constructions: Basins.....	108
Table 14.22 – Constructions: Buildings	108
Table 14.23 – Constructions: Sheep rearing.....	109
Table 14.24 – Constructions: Chicken rearing.....	110
Table 14.25 – Total costs for Constructions	111
Table 14.26 - Power supply	112
Table 14.27 – Other costs.....	112
Table 14.28 – Total costs for Project set-up.....	93
Table 15.1 - Recommended quantities of organic and chemical fertilizers	132
Table 15.2 - Size of feed in relation to the size of juveniles	134
Table 15.3 - Example of the chemical composition of a carp artificial feed	135
Table 15.4 - Formula of a feed for juveniles of carp in advanced phase of growth.....	135
Table 15.5 - Quantity of feed for day	135
Table 15.6 - Materials and weights	172
Table 15.7 - Screws abacus.....	173
Table 15.8 - Boards and sizes	174
Table 15.9 - Boards for the nest	175
Table 15.10 - Maximum power needs schedule for different farm units	176
Table 15.11 Generator A specifications	179
Table 15.12 - Generator B specifications	181
Table 15.13 - Training program for tomato residuals composting	189
Table 15.14 - Training program for food waste composting.....	189
Table 15.15 - Composting of tomato residuals	189

    D.E.I.S.T.A.F. Università degli Studi di Firenze	Date June 2012	Doc. N°. 155/2010/LC/ZU-IC1	Page 14 of 219
--	-------------------	--------------------------------	-------------------

Table 15.16 - Composting of food waste	190
Table 15.17 - Training program for food waste processing and feed production	193
Table 15.18 - Feed production	193
Table 15.19 - Training program for fish processing and storage management	196
Table 15.20 - Fish processing and storage.....	196
Table 15.21 - Training program for farm management	201
Table 15.22– Masonry building of office, nursery/hatchery and fish processing buildings	201
Table 15.23- Geothermal heating/cooling system	204
Table 15.24 – Electricity production with a wind turbine	207
Table 15.25– Water lifting with wind mill pump.....	210
Table 15.26 - Training program for hydroponics.....	218
Table 15.27– Low technology hydroponic system	219