

(12) Wat Chre Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>BaKan</td> <td>BoeungKhnar</td> <td>WatChre</td> <td>361652</td> <td>1398459</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		BaKan	BoeungKhnar	WatChre	361652	1398459
District	Commune	Village	UTM Reference								
BaKan	BoeungKhnar	WatChre	361652	1398459							
1.2 River basin	Pursat river basin/ BoeungKhnar Stream/Chambot river from DamNakAmpil weir										
1.3 Target group	1) Number of household= 926 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of Wat Chre weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	1,000Ha										
1.7 Necessity of project	In the late 1970's, system construction was completed, and the system lost the function after 2 years' operation. The system problem would be a lack of stable water source and deterioration of irrigation facilities. The water source problem could be mitigated by receiving water supply from the Damnak Ampil extension project in future stage. In order to utilize the water source effectively, re-construction of weir and rehabilitation of canal network would be required.										

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and	X	X	X	<ul style="list-style-type: none"> No impact will be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
minority group				
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <u>O&M</u> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
29. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, Stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Wat Chre Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures

proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Wat Chre Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(13) Anlong Khouch, Wat Leap, Kosh Khsach Water Harvesting and Recession Rice Rehabilitation Project

(i) Project Description

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	BaKan	O Tapornng, MeTeuk	Sras Mkak, Me Teuk, Kosh Khsach	359818	1405630
1.2 River basin	Pursat river basin/ O Tapornng Stream/BoeungKhnar Stream				
1.3 Target group	1) Number of household=1,394 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	2,600 Ha				
1.7 Necessity of project	The project comprises three typical water harvesting and recession rice systems. The Anlong Khouch and the Koah Khsach systems were constructed in the late 1970's. On the other hand, the Wat Leap ssystem construction was completed in 1994. Among three systems, deterioration of the Anlong Khouch is serious and requires total rehabilitation. The other two projects require partial rehabilitation of dyke system and comprehensive rehabilitation of canal systems.				

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p>

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	+/B	<ul style="list-style-type: none"> Soil erosion will be mitigated by dyke rehabilitation and drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	• This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers.	• Workshop, • stakeholder meeting	• Design and Construction Phase
9. Local Conflict Over	• Education programs are necessary for both	• Education	• Construction

	Mitigation Measures	Monitoring	
		Method	Timing
Interest	labors and community members to raise awareness so as to maintain security in the community during construction.	Programs	Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	on environmental impact including construction waste disposal.		
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	• Site Supervision	• Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	• Site Supervision	• Construction Phase

(iv) Conclusion

(1) Anlong Khouch, Wat Leap, Kosh Khsach Water Harvesting and Recession Rice Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Anlong Khouch, Wat Leap, Kosh Khsach Water Harvesting and Recession Rice Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(3) Mines and UXO risk in the Project is high according to the data from the Cambodian Mine Action Center (CMAC). Security of the site needs to be ensured prior to the Project implementation.



Signboard showing the Field already cleared by CMAC (Pursat Province)

(14) Lum Hach Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Boribo, RoLeaPha-ea</td> <td>AnChagnRoung, PonLey, PoPel, ProSneb, and other 7 communes</td> <td>TaingPrich, Prosneb, TaingThneum, Kdol, and other 27 villages</td> <td>425898</td> <td>1362360</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Boribo, RoLeaPha-ea	AnChagnRoung, PonLey, PoPel, ProSneb, and other 7 communes	TaingPrich, Prosneb, TaingThneum, Kdol, and other 27 villages	425898	1362360
District	Commune	Village	UTM Reference								
Boribo, RoLeaPha-ea	AnChagnRoung, PonLey, PoPel, ProSneb, and other 7 communes	TaingPrich, Prosneb, TaingThneum, Kdol, and other 27 villages	425898	1362360							
1.2 River basin/ water source	Boribo river basin/ Boribo river										
1.3 Target group	1) Number of household = 17,321 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project or program	1) Enhancement of rice production through rehabilitation of Lum Hach reservoir and existing irrigation system										
1.5 Type of project or program	1) Rehabilitation of existing irrigation system										

1.6 Objective area	3,700 Ha
1.7 Necessity of project/program	Water source for irrigation is limited in the Boribo basin. The Boribo, the largest river in the basin, originates from the Lum-Hack reservoir. Since the reservoir has no structure to control water, effective usage of storage water of the reservoir is not attained. In order to increase capacity of the reservoir and to realize effective water supply using limited water source, provision of water control facilities would be crucial. Rehabilitation of existing irrigation systems would be also a key issue to increase irrigated agriculture area.

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as agricultural production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
10. Water Use	X	X	+A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	+/B	<ul style="list-style-type: none"> Currently, significant erosion is observed in the system area due to sandy characteristics of soils. Erosion will be expected to be mitigated by reservoir construction and drainage improvement through the Project.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <p><u>O&M</u></p> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder.		
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

- (1) Lum Hach Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Soil erosion is considerably observed in the system area due to its dispersive characteristics of soil. This will be improved by the construction of reservoir and improvement of drainage conditions in the system area.
- (3) Among others, measures for involuntary resettlement are of importance recently in irrigation development in



**Soil Erosion in the System
(Kampong Chhnang
Province)**

Cambodia and Lum Hach Rehabilitation Project is not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(15) 7th January Canal Rehabilitation Project

(i) Project Description

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	Boribo, RoLeaPha-ea	BanTeayPreal, MeLum, Chork, ProSneb, and other 9 communes	TopTbeng, Prosneb, ChralornKok, Saorngl, and other 18 villages	425898	1362360
1.2 River basin/ water source	Small streams such as Khlong Anlong, Chrang, Svay, etc.				
1.3 Target group	1) Number of household = 5,887 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	2,000Ha				
1.7 Necessity of project	<p>The 7th January canal has a role of water source for more than 20 sub-systems. The canal was constructed in the late 1970's to collect water from streams, and then to supply water for irrigation sub-systems and pond systems located in downstream area. However, the canal lost the function because of natural disasters in the early 1980's. Although local people, government and other organizations made many efforts for repair work to sub-systems, they recovered only a part of the function.</p> <p>In order to recover the function, comprehensive rehabilitation of the 7th canal, and sub-irrigation systems are necessary.</p>				

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p>

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	• This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers.	• Workshop, • stakeholder meeting	• Design and Construction Phase
9. Local Conflict Over	• Education programs are necessary for both	• Education	• Construction

	Mitigation Measures	Monitoring	
		Method	Timing
Interest	labors and community members to raise awareness so as to maintain security in the community during construction.	Programs	Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	on environmental impact including construction waste disposal.		
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	• Site Supervision	• Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	• Site Supervision	• Construction Phase

(iv) Conclusion

(1) 7th January Canal Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and 7th January Canal Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(16) Khvet Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Kbal Teuk</td> <td>Khvet</td> <td>422564</td> <td>1314964</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Kbal Teuk	Khvet	422564	1314964
District	Commune	Village	UTM Reference								
Teuk Phos	Kbal Teuk	Khvet	422564	1314964							
1.2 River basin/ water source	Boribo river basin/ Chreav stream										
1.3 Target group	1) Number of household = 330 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of Khvet weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	250Ha										
1.7 Necessity of project	<p>The proposed Khvet rehabilitation project is a typical small river irrigation system.</p> <p>The Khvet weir was constructed twice in French colonial period and in the 1970's. Both of them completely lost their function, and the system area has relied only on rainfall since the late 1970's.</p> <p>In order to cover irrigation area widely, re-construction of weir at the location of French colonial period would be necessary. In addition, rehabilitation of irrigation canals would be also required to irrigate existing cultivation area.</p>										

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
13. Topography and Geographical Features	X	X	X	• No impact will be expected.
14. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	• No impact will be expected.
16. Hydrology	X	X	X	• No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note
- : Adverse Impact
X : No Impact
+ : Positive Impact

- A : Great Impact
 B : Medium Impact
 C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	mitigation measures on environmental impact including construction waste disposal.		
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Khvet Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Khvet Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(17) Ta Ram Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Kbal Teuk</td> <td>Khvet</td> <td>424500</td> <td>1317058</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Kbal Teuk	Khvet	424500	1317058
District	Commune	Village	UTM Reference								
Teuk Phos	Kbal Teuk	Khvet	424500	1317058							
1.2 River basin/ water source	Boribo river basin/ Sre Bak Stream										
1.3 Target group	1) Number of household = 230 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of Ta Ram weir and rehabilitation of existing irrigation system										

1.5 Type of project	Rehabilitation of existing irrigation system
1.6 Objective area	180Ha
1.7 Necessity of project	<p>The proposed Ta Ram rehabilitation project is a typical small river irrigation system with a regulating pond.</p> <p>The Ta Ram weir was constructed in the upper reaches of the Sre Bak stream in the 1970's. After four years' operation, the system lost the function. The main canal dyke near the regulating pond has collapsed repeatedly.</p> <p>In order to recover the function, comprehensive rehabilitation would be required.</p>

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p>

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <p><u>O&M</u></p> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scoping

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder.		
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Ta Ram Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Ta Ram Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives



Environmental Issues Discussed during the Workshop at Ta Ram System

an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(18) Chak Teum, Trapeang Khlong, Don Pov Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Chieab</td> <td>KoshKhtum, TaNey, Chieab</td> <td>426405</td> <td>1331406</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Chieab	KoshKhtum, TaNey, Chieab	426405	1331406
	District	Commune	Village	UTM Reference							
Teuk Phos	Chieab	KoshKhtum, TaNey, Chieab	426405	1331406							
1.2 River basin/ water source	Boribo river basin/ O Khley stream										
1.3 Target group	1) Number of household=1,473 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through re-construction of weir and rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	980 Ha										
1.7 Necessity of project	The proposed project consists of three irrigation systems. The project is a typical combination system of irrigation pond and small river. The systems were constructed in the late 1970's. After a few years' operation, they lost their functions. Small river irrigation systems would need a weir for secure water supply, and rehabilitation of the dyke is necessary for the Chak Teun system.										

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	• No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	• No impact will be expected.
8. Cultural Heritage	X	X	X	• No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<u>Construction</u> • Conflict among labors and farmers, security deterioration would be expected. <u>O&M</u> • Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	• Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	• No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	• This would be due to inflow of labor during construction stage.
13. Natural Environment				
14. Topography and Geographical Features	X	X	X	• No impact will be expected.
15. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
16. Groundwater	X	X	X	• No impact will be expected.
17. Hydrology	X	X	X	• No impact will be expected.
18. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
19. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
20. Meteorology	X	X	X	• No impact will be expected.
21. Landscape	X	X	X	• No impact will be expected.
22. Global Warming	X	X	X	• No impact will be expected.
Pollution				
23. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
24. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<p>construction.</p> <p><u>O&M</u></p> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
25. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
26. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
27. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
28. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
29. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
31. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	for construction labors. Education and training program is also required to raise awareness of labors.		
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Chak Teum, Trapeang Khlong, Don Pov Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Chak Teum, Trapeang Khlong, Don Pov Rehabilitation Project is not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(19) Teuk Laak and Trapeang Thlan Rehabilitation Project

(i) Project Description

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	Teuk Phos	KhlongPoPork, Aphivat	TeukLaak, SreTaChey	442624	1333278
1.2 River basin/water source	Boribo river basin/ Pernang stream				
1.3 Target group	1) Number of household = 296 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	230Ha				
1.7 Necessity of project	<p>The proposed project consists of two systems, namely Teuk Laak and Trapeang Thlan. The project is a typical water harvesting system in undulated hilly area without secured water resource.</p> <p>These systems were constructed in the late 1970's. After a few years' operation, the dykes for water harvesting were damaged, and the systems lost their water source.</p> <p>In order to recover the function, rehabilitation of dyke and canals are necessary.</p>				

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<p>building should be carefully carried out.</p> <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	• This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support	• Workshop, • stakeholder meeting	• Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	programs and so forth, which contribute to maintain living condition of farmers.		
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal.		
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	• Site Supervision	• Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	• Site Supervision	• Construction Phase

(iv) Conclusion

(1) Teuk Laak and Trapeang Thlan Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Teuk Laak and Trapeang Thlan Rehabilitation Project is not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(20) Toul Champey Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Teuk Phos</td> <td>Chorng Morn</td> <td>Khset</td> <td>448882</td> <td>1326116</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Teuk Phos	Chorng Morn	Khset	448882	1326116
	District	Commune	Village	UTM Reference							
Teuk Phos	Chorng Morn	Khset	448882	1326116							
1.2 River basin	Boribo river basin/ Small stream										
1.3 Target group	1) Number of household = 468 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project	Rehabilitation of existing irrigation system										
1.6 Objective area	360Ha										
1.7 Necessity of project	<p>The proposed project is a typical irrigation pond system in undulated hilly area.</p> <p>The system was constructed in the late 1970's. Immediately after completion of construction work, the system lost the function.</p> <p>In order to recover the function, rehabilitation of the dyke system by construction of a new spillway and re-construction of intake structures would be a key issue. In addition, rehabilitation and additional construction of canals would be required because of insufficient canals in</p>										

	paddy fields.
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(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-C	-C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-C	-C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious	X	-C	X	<ul style="list-style-type: none"> This would be due to inflow of labor

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
diseases				during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	• No impact will be expected.
14. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	• No impact will be expected.
16. Hydrology	X	X	X	• No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note - : Adverse Impact

- X : No Impact
 + : Positive Impact
 A : Great Impact
 B : Medium Impact
 C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their 	<ul style="list-style-type: none"> Water sampling 	<ul style="list-style-type: none"> Design and Construction

	Mitigation Measures	Monitoring	
		Method	Timing
	awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal.	• Quality analysis	n Phase
24. Soil Contamination	• In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM).	• Soil sampling and analysis	• O&M Phase
25. Waste	• As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal.	• Site Supervision	• Construction Phase
26. Noise and Vibration	• Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities.	• Site Supervision	• Construction Phase
30. Accidents	• Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders.	• Site Supervision	• Construction Phase

(iv) Conclusion

(1) Toul Champey Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Toul Champey Rehabilitation Project is not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(21) Chan Keak Rehabilitation Project

(i) Project Description

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	Kampong TraLach	O russey	KraLagn	471184	1317474
1.2 River basin	Boribo river basin				
1.3 Target group	1) Number of household = 151 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				

1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system
1.5 Type of project	Rehabilitation of existing irrigation system
1.6 Objective area	110Ha
1.7 Necessity of project	The proposed Chan Keak project is a typical irrigation pond system in recession area. The system was constructed in the late 1970's. After few years operation, system lost the function. The system requires rehabilitation of dyke and canals, construction of spillway, installation of intake gates.

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<u>O&M</u> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
13. Natural Environment				
14. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
15. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
16. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
18. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
19. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
20. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
22. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
23. Pollution				
24. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
25. Water Pollution	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
26. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
27. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
28. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
29. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
30. Offensive Odor	X	X	X	• No impact will be expected.
31. Sedimentation	X	X	X	• No impact will be expected.
32. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> Education Programs FWUCs strengthening program 	<ul style="list-style-type: none"> Construction Phase Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder.		
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

- (1) Chan Keak Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Chan Keak Rehabilitation Project is not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

Figures

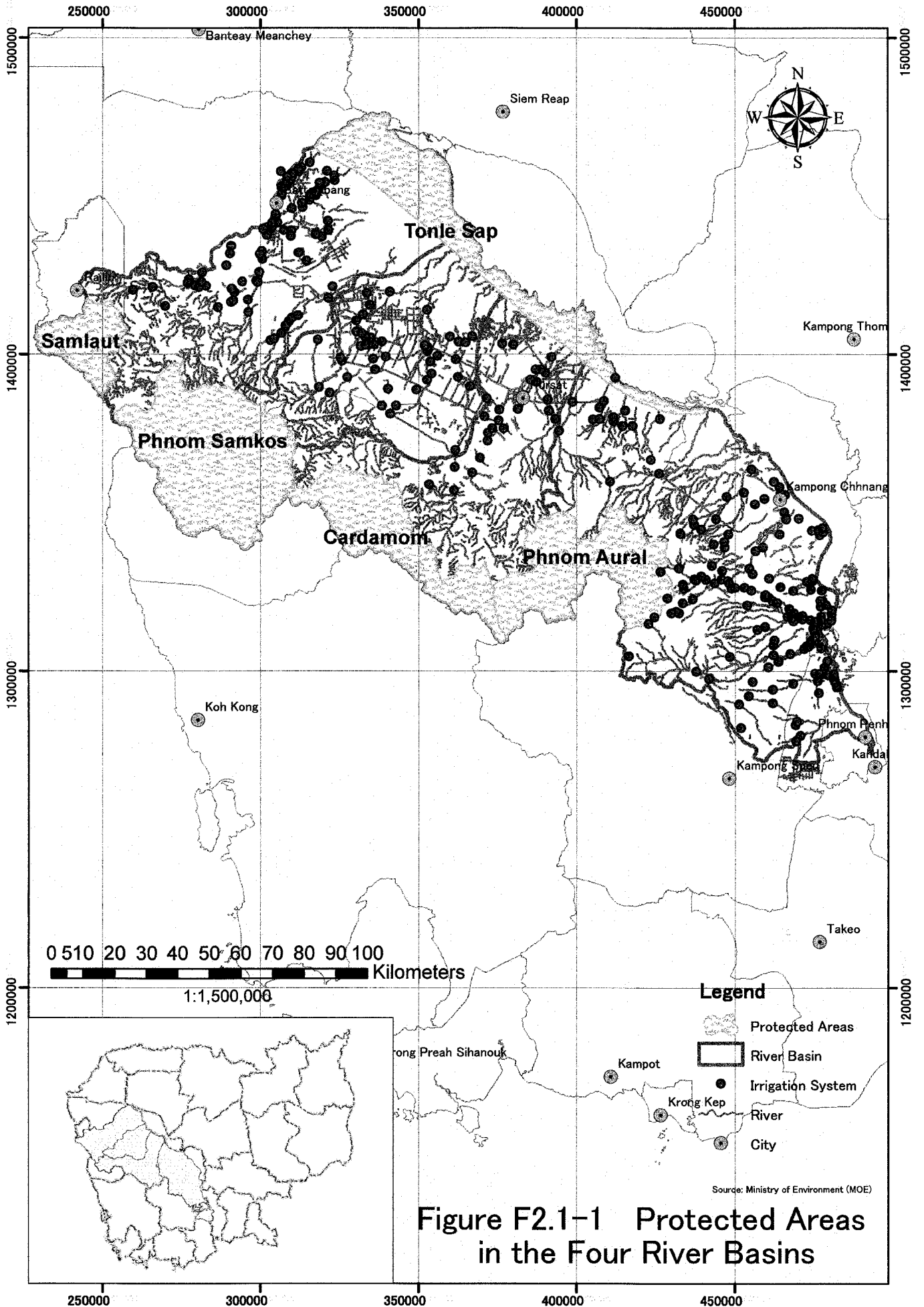
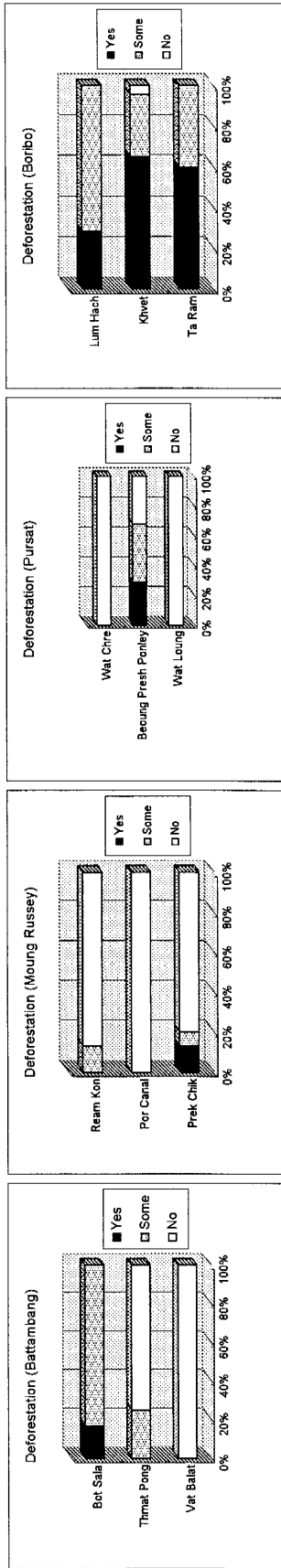


Figure F2.1-1 Protected Areas in the Four River Basins

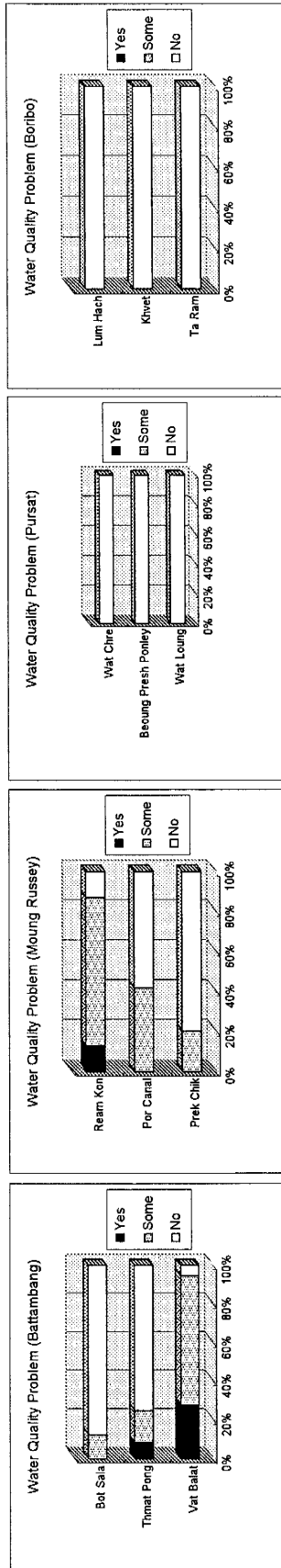
Natural Environment

Do you find following problems in your irrigation system?

N-1. Deforestation in the Watershed



N-2. Quality problem on irrigation water due to, for example, urbanization nearby



N-3. Water pollution in the downstream, eutrophication, for example, by excessive application of chemicals and fertilizer

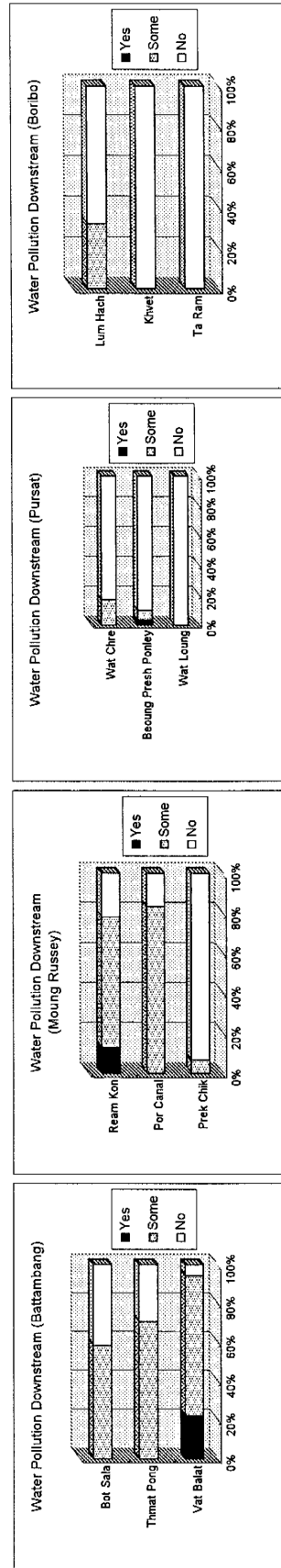
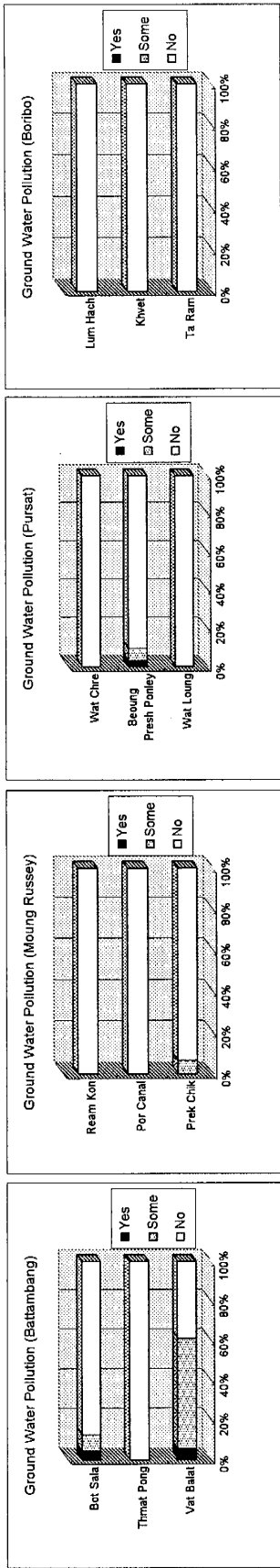
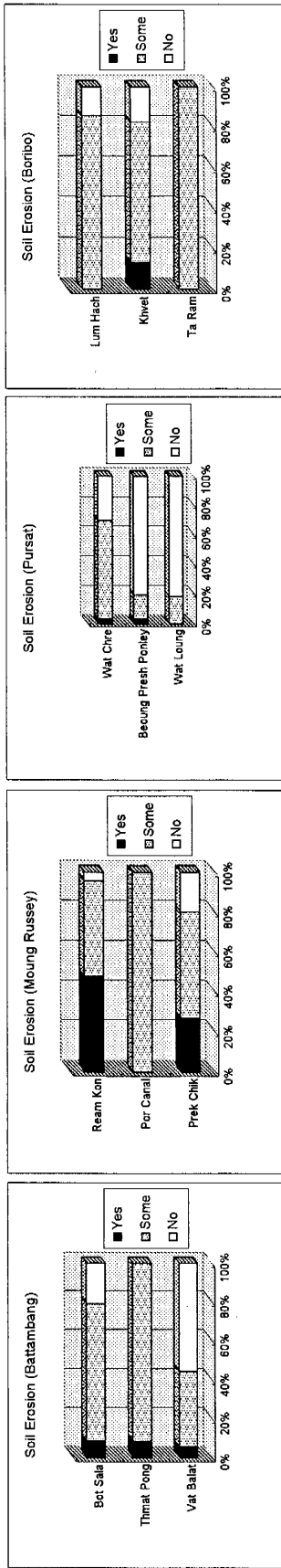


Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (1/7)

N-4. Ground water pollution (for example, due to chemicals and fertilizer)



N-5. Soil erosion (for example, due to flooding)



N-6. Water logging, drainage problems in the system

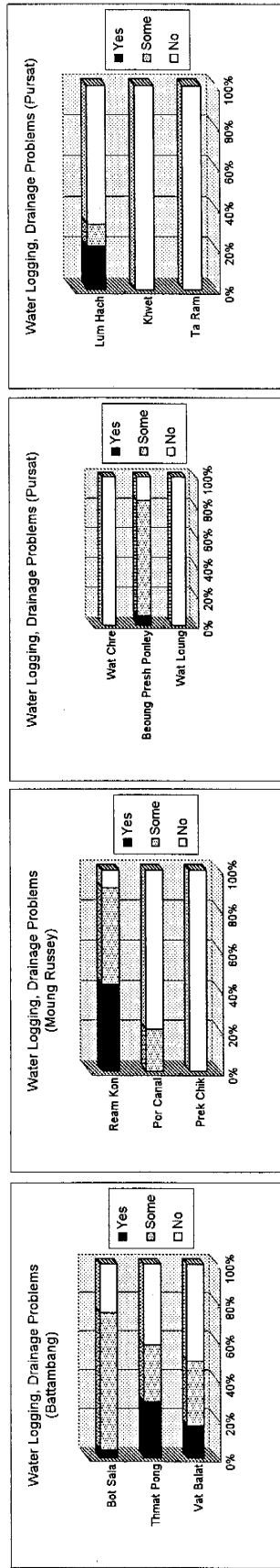
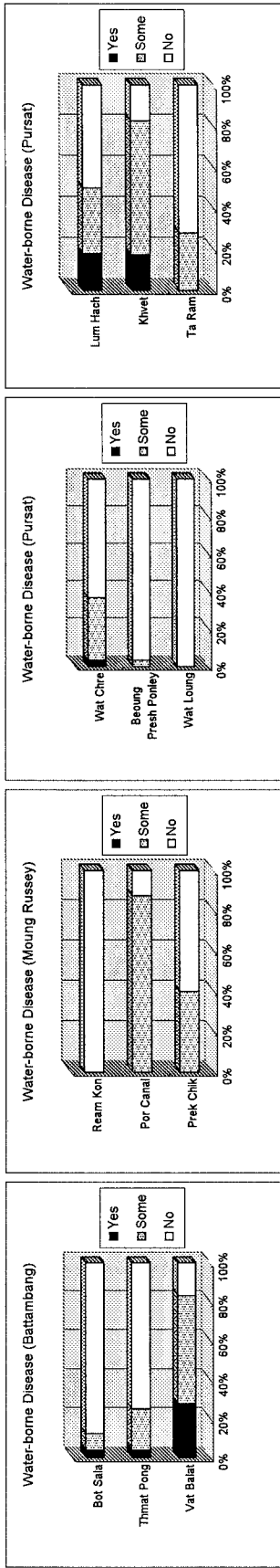
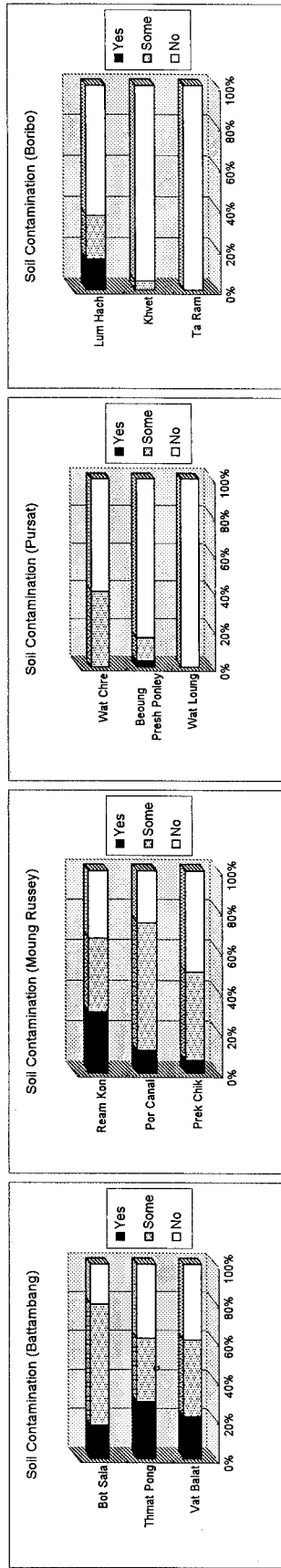


Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (2/7)

N-7. Water-borne disease such as malaria and dengue (for example, due to standing water in the system)



N-8. Soil contamination in the field (for example, by chemicals, fertilizer or any other substances)



N-9. Salinity problems in the field

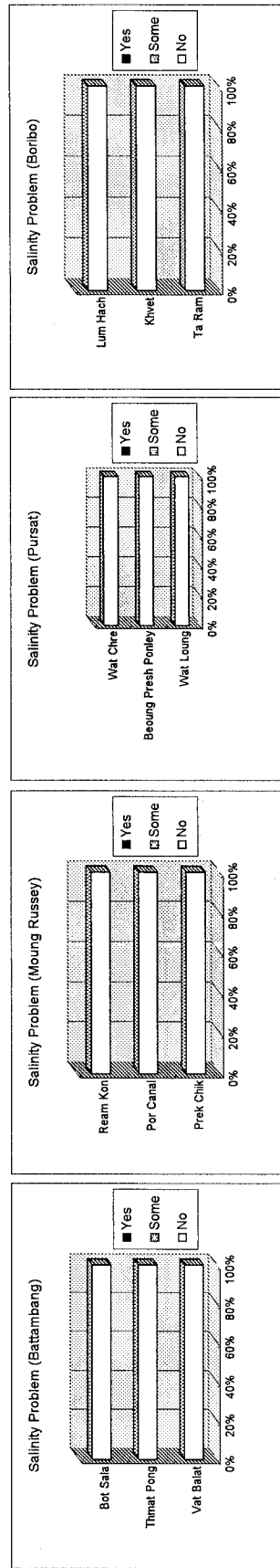
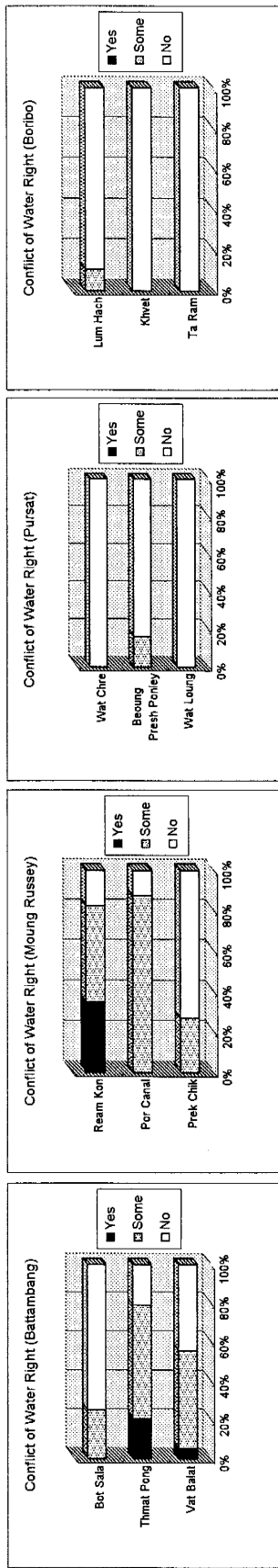


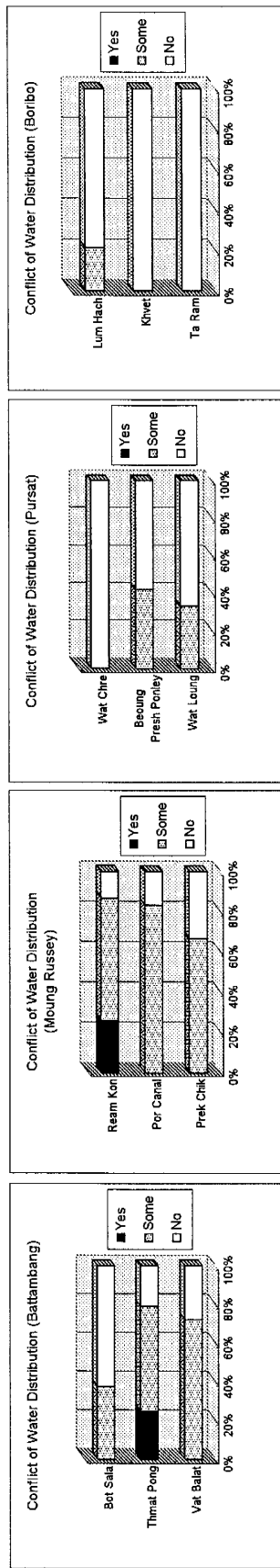
Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (3/7)

Social Environment

S-1. Conflict of water right with other system



S-2. Conflict of water distribution between the upstream and the downstream in the system



S-3. Conflict of land allocation

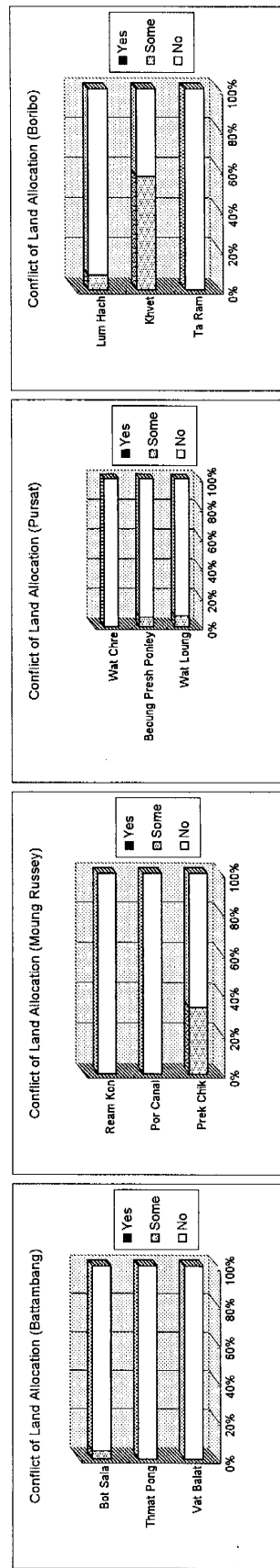
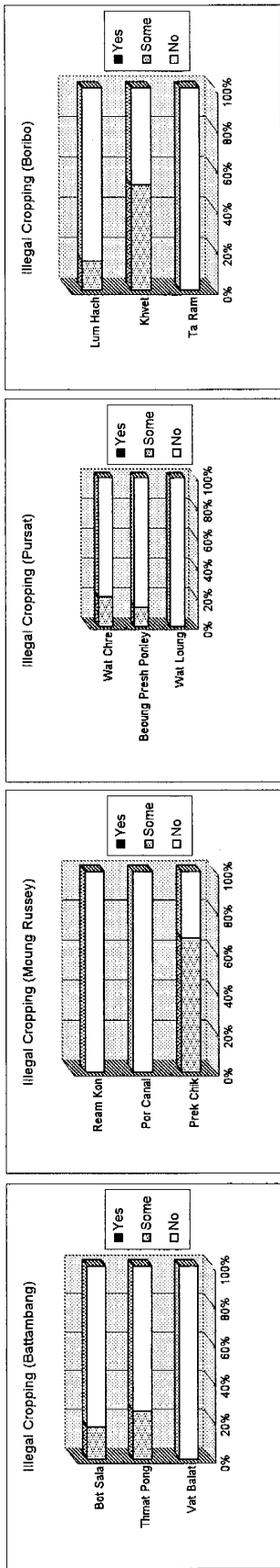
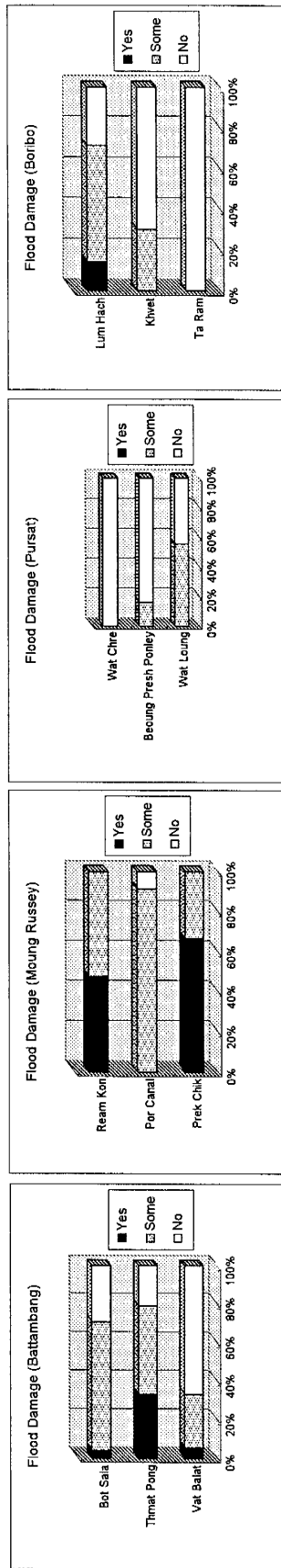


Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (4/7)

S-4. Illegal cropping in the reservoir area or canal



S-5. Flood damage in the system



Others

O-1. Is there any historical/cultural heritage in the system?

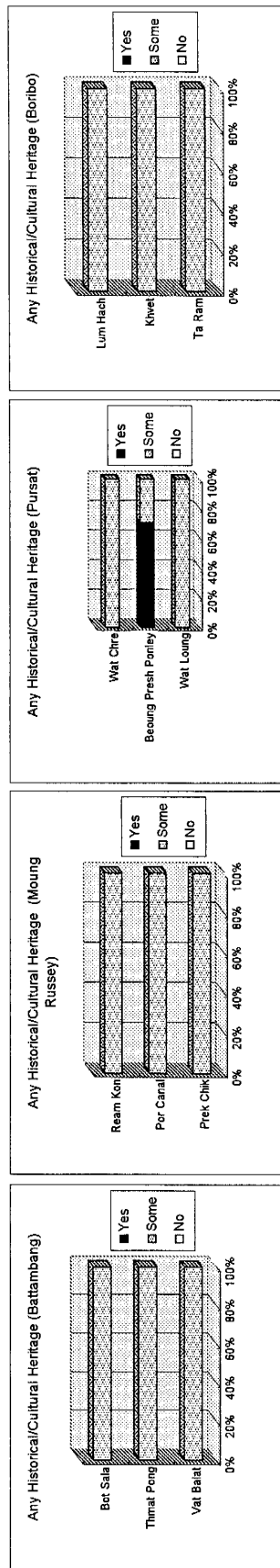
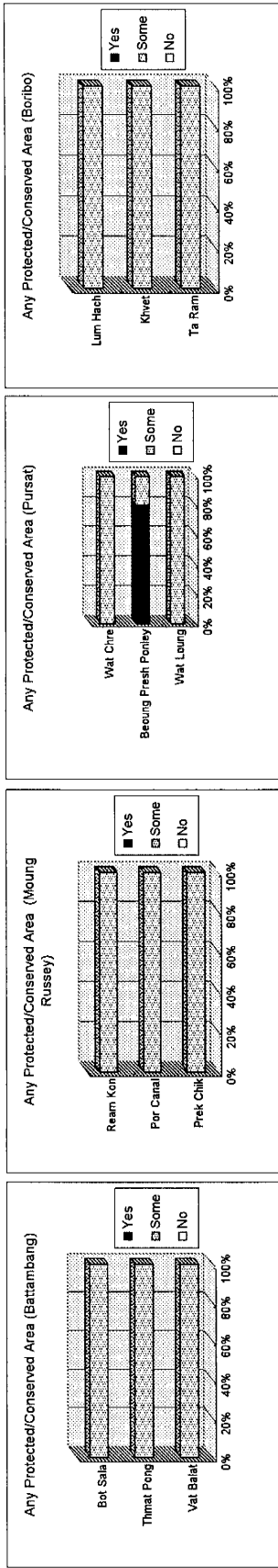
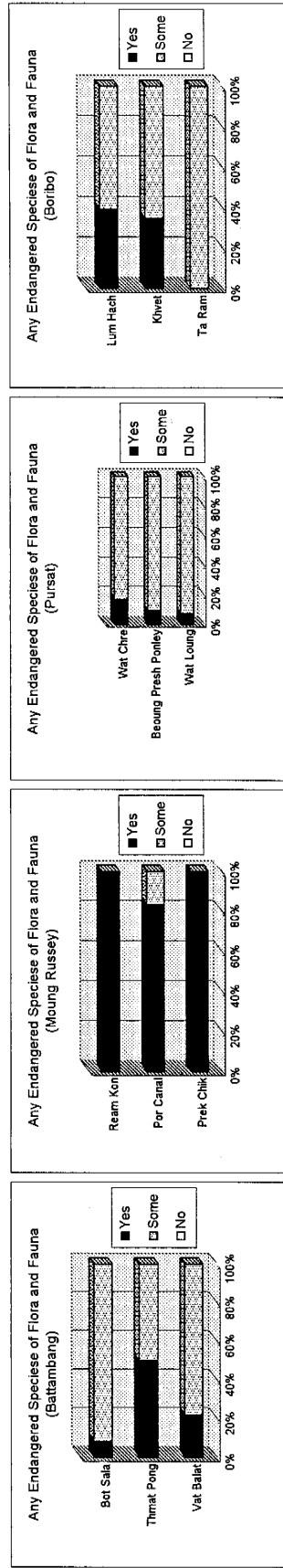


Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (5/7)

O-2. Is there any protected/conserved area in the system?



O-3. Is there any endangered species of flora and fauna in the system?



O-4. Is there any precious ecology in the system?

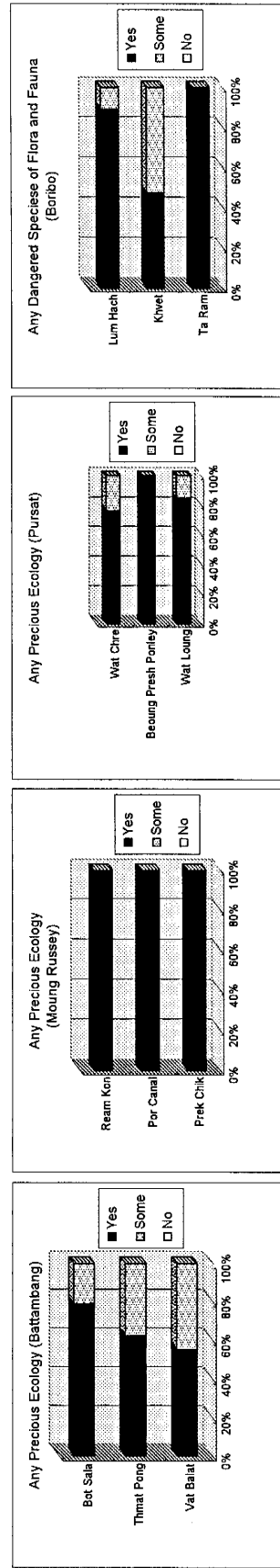
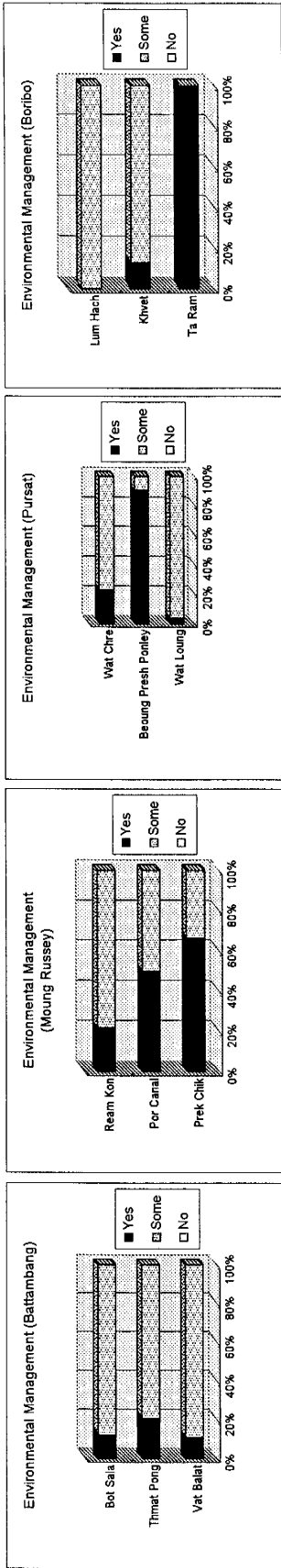
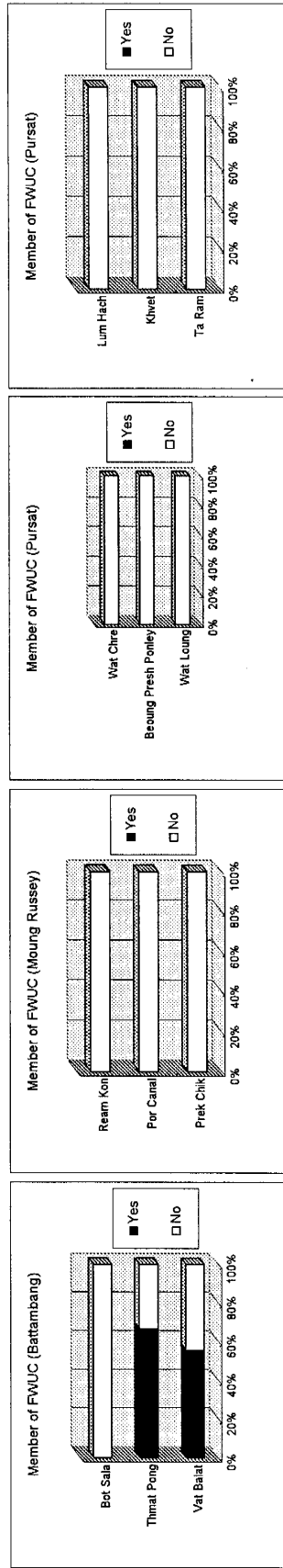


Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (6/7)

O-5. Are you doing any environmental management activities, either by group or individuals?



O-6. Are you a member of Farmer Water Users' Committee?



O-7. If there is no FWUC here, are you interested in establishing FWUC?

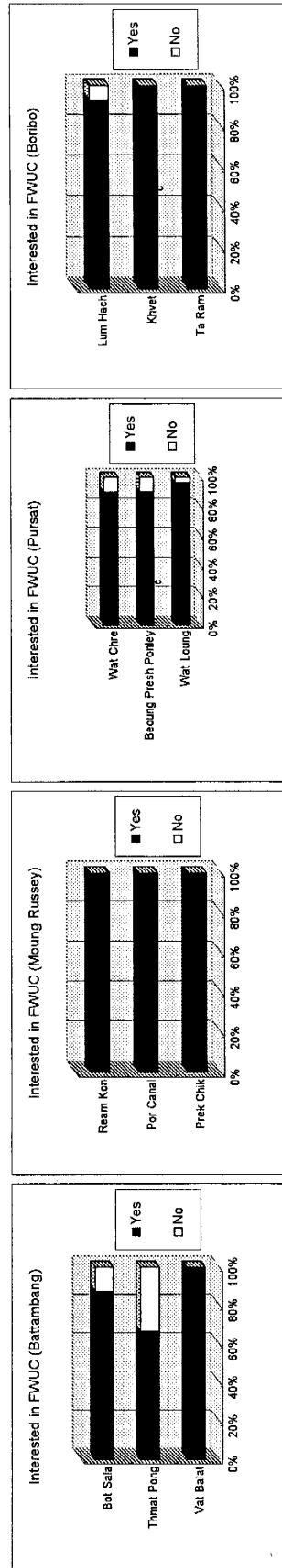


Figure F2.2-1 Natural and Environmental Condition based on the Result of Environmental Questionnaire at Sample Areas (7/7)

Attachment



**Basin-Wide Basic Irrigation and Drainage Master Plan Study
in the Kingdom of Cambodia**

Questionnaire for Environmental Aspect in the Irrigation System

We would like to ask you whether there are any problems related with environment in the system. Please complete and return this form.

Date: _____

Province: _____

_____ Kampong Chhnang

_____ Pursat

_____ Battambang

Irrigation System: _____

Natural Environment

Do you find following problems in your irrigation system?

	<u>Yes, seriously</u>	<u>Yes, but not serious</u>	<u>No, never seen</u>
Deforestation in the watershed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality problem on irrigation water (due to, for example, urbanization nearby)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Water pollution in the downstream (Eutrophication, for example, by excessive application of chemicals and fertilizer)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Ground water pollution (for example, due to chemicals and fertilizer)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Soil erosion (for example, due to flooding)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Water logging, drainage problems in the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Water-borne disease such as malaria and dengue (for example, due to standing water in the system)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Soil pollution in the field (for example, by chemicals, fertilizer or any other substances)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			
Salinity problems in the field	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If Yes, Reason:			

Social Environment

Do you find following problems in your irrigation system?

	<u>Yes, seriously</u>	<u>Yes, but not serious</u>	<u>No, never seen</u>
Conflict of water right with other system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conflict of water distribution between the upstream and the downstream in the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conflict of land allocation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Illegal cropping in the reservoir area or canal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood damage in the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Others

Is there any historical/cultural heritage in the system?

Yes No

If, Yes, please specify

Is there any protected/conserved area in the system?

Yes No

If, Yes, please specify

Is there any endangered species of flora and fauna in the system?

Yes No

If, Yes, please specify

Is there any precious ecology in the system?

Yes No

If, Yes, please specify

Are you doing any environmental management activities, either by group or individuals?

Yes No

If, Yes, please specify

Are you a member of Farmer Water Users' Committee?

Yes No

There is no FWUC here. (pls. go to next question)

If, No

Reason:

If there is no FWUC here, are you interested in establishing FWUC?

Yes No

For all

Reason:

Thank you very much for your cooperation! Your opinion will be really useful for our Study.