



The Hashemite Kingdom of Jordan

Ministry of Environment

Environmental Compensation Unit

Badia Ecosystem Restoration Program

Community Action Plan of Badia Ecosystem Restoration Program

Prepared by

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Detailed Work Plan of the Community Action Plan (CAP) of the Badia Restoration Program (BRP)

1. Background

1.1. UNCC Environmental Compensation Award to Jordan and Badia Restoration Program

In June 2005, the Governing Council (GC) of UNCC's awarded to Jordan the sum of \$160.582.073 million dollars for the rehabilitation and restoration of its damaged terrestrial ecosystems in the Badia by the influx of refugees with their livestock (1.8 million head of sheep, goats, and camels) (award no. 5000304) during the 1990/1991 Gulf war. The Badia Restoration Program (BRP), housed under the Ministry of Environment, was initiated to implement this UNCC award.

The main goal of BRP is to rehabilitate the ecological productivity of the Badia ecosystems for wildlife and sustainable grazing, by restoring the vegetation composition, structure and sustainability to allow wildlife populations to rebuild, and to provide a foundation for sustainable grazing practices across the entire Badia region. Even though, the program is managed by the Ministry of environment, it is an integral part of the national development efforts to promote agricultural growth, improve the livelihoods of the Bedouin population and reduce poverty with the development of sustainable pastoral and agro-pastoral production systems.

To achieve this goal, the BRP will be implemented in two main phases: a demonstration phase of 5-7 years, and a full implementation phase of about 13 to 15 years. The Program Management Unit (PMU) of BRP, in cooperation with the Independent Reviewers (IRs), developed a road map document for the first phase of BRP. The demonstration phase includes 4 sub-phases: (i) baseline study of the targeted community and demonstration sites, (ii) development and approval of community action plan (CAP), (iii) implementation of the CAP, and (iv) management of the restored sites.

The "Terms of Reference for Conducting Baseline Study at the Demonstration Sites within the Framework of the Badia Restoration Program" was developed for the first sub-phase of the Demonstration Phase in February 2009. The baseline study was conducted in 2009/2010 and characterized the biophysics of five selected demonstration sites and assessed the socioeconomic of the local communities living nearby or benefiting from the resources of the targeted areas. The baseline studies were conducted by five contractors/institutions working in Jordan Badia. These are: the Badia Research and Development Centre (BRDC), the Jordanian Society for Sustainable Development (JSSD), the Ministry of Agriculture (MoA), the National Center for Agricultural Research and Extension (NCARE), and the Royal Society for the Conservation of nature (RSCN). The BRDC and NCARE, JSSD,

MoA, and RSCN worked on Aranbah, Al-Bandan, Al-Qassab and Burqu watersheds, respectively. Biophysical and socio-economic characterizations provided information on the constraints and opportunity of each watershed and the communities using these areas. The findings of the baseline study and other sources of relevant information serve as a benchmark upon which a detailed Community Action Plan would be developed.

1.2. Biophysical Findings of BRP Baseline Studies

During the year 2010, biophysical surveys were carried out by the five implementing institution of the BRP. Results of the surveys were presented, in a formal workshop at NCARE during 15-16 September of 2010, to stakeholders and discussed among experts, local communities, PMU and scientific communities to identify the bolded lines for the community action plan (CAP). Needs of the local communities, particularly livestock owners, were also discussed and debated during the official international workshop on 23rd of September 2010, under the patronage of UNCC and JNFP. The main findings of both workshops were the urgent need to put BRP into action and to implement the CAP of BRP. The immediate needs of local communities were identified as water, forage, and veterinary services for livestock.

The main biophysical findings of BRP baseline studies can be summarized as following:

- a. The run-off Hammada and Marab ecosystems, if given the opportunity with proper intervention, have the potential to promote growth and production of the existing vegetation regardless of the prolonged history of destructive grazing and other irrational uses.
- b. In spite of the good rainfall in 2009/2010, the reported values of vegetation cover were low which reflected the severe degradation of rangelands due to prolonged history of irrational uses (destructive grazing, cultivation, uprooting of woody plants...) and very poor soil seed bank.
- c. The poor condition of vegetation indicates that natural recovery of degraded rangelands will last for many years before achieving substantial improvements. Although the “Roadmap” is in favor for the use of the natural recovery approach, the biophysical intervention approach, i.e. plantation of fodder shrubs within micro-catchment water harvesting techniques, seems more appropriate to improve forage productivity within relatively a short time.
- d. Frequent mobility of pastoralists with their tents and flocks, seeking for feed and water for their livestock, makes any attempt to protect and manage the designated lands during the initial stage of restoration a difficult task. Collaboration between local communities and The Royal Department for Environmental Protection (Rangers) is essential for the development of a framework for a sustainable protection of the targeted demonstration sites. Moreover, the

- construction of stock watering ponds and the proper distribution of these ponds on a geographical area will minimize the livestock and traffic movement and therefore minimize the land degradation.
- e. The physical and chemical properties of soils indicated that some of the range sites in targeted areas are not suited for cultivation. Capped and shallow soils of these sites increase the incidence of surface run-off on one hand and reduce water storage capacity on the other hand resulting in low productivity of vegetation biomass.
 - f. The flat range sites with a slope gradient less than 5% are not suitable for the micro-catchment intervention to plant fodder shrubs. However, there are sizable areas in some demonstration sites and the targeted watersheds suitable for this type of intervention.
 - g. Poor vegetation cover and low production of biomass were reflected in low values of grazing capacity and thus highlighted the need for many years to improve the capacity of targeted areas.
 - h. Veterinary services are lacking in these sites which adversely affected productivity of communities' livestock.

The main socioeconomic findings of BRP baseline studies can be summarized as following:

- a. The majority of rural and pastoral communities are misinformed about the objectives of the BRP and Environmental Compensation Award. Increasing the level of awareness about the objectives and expected benefits in the long run of this Project is top priority.
- b. There is a shortage in the number of cooperatives concerned with livestock. Moreover, the majority of livestock owners are not affiliated in cooperatives and only 11% of the targeted livestock owners are members in cooperatives.
- c. Overall population of sheep and goats in the watersheds and sites targeted by BRP baseline study totaled to around 600,000 heads.
- d. Based on mobility of sheep and goat flocks in targeted areas, three production systems were identified: nomadic, transhumance and sedentary. The majority of pastoral communities practiced the transhumant production where daily and seasonal mobility between villages and grazing areas is maintained to benefit from the scarce grazing resources to reduce costs of feeding. The animals raised under the transhumance production system are handfed for more than 9 months on traditional feedstuffs (barley grains, wheat bran and tibia or shredded straw) and grazed for 3 months on different grazing resources (native plants, cultivated barley at rangelands, and stubble grazing). The low contribution of grazing resources to the annual feeding calendar reflects the severity of degraded rangelands.

- e. The stockowners claimed that the governmental veterinary services in the targeted areas are poor. Moreover, the staff of veterinary clinics is inadequate as well as the vaccines and medicines are rarely found.
- f. The prevalence of critical diseases (foot and mouth, peste des petits ruminants, brucellosis...) is causing serious economic losses to the stockowners.
- g. The veterinary facilities in the area are lacking the essential equipment needed for disease diagnosis.
- h. Because of degraded grazing resources and its low contribution to the annual feeding calendar, the stockowners are against the idea of “destocking”. The Project will adopt the idea of increasing productivity per head as an entry point to promote “self-destocking”. Improving animal productivity per head can be achieved through the enhancement of nutrition and veterinary services. The substantial economic rewards expected from improving flock productivity in addition to reasonable beneficiary incentives are major tools to promote self-destocking at the initial stage of the proposed Project.
- i. There are many NGOs were established in the Badia. Unfortunately, the majority of them have nothing to do with livestock production or grazing resources. The NGOs in the area with potential to serve the purpose of this proposed Project will be potential partners.
- j. During meetings of PMU-BRP and other stakeholders with local communities, especially the last two workshops held in September 2010 in Amman, several issues were raised and strongly addressed by both community representatives and members. The community needs relevant to the BRP goal and objectives included: construction of stock water ponds, water spreading techniques, fodder plantation in micro-catchments, subsidy of feedstuffs, small scale production of forage crops, renovation of old water wells, capacity building of local communities on issues related to animal health, grazing practices, and processing of milk and wool.

1.3. Community Action Plan of the Demonstration Phase of BRP

The objective of the CAP is to identify the actions needed for implementing the BRP activities and developing the targeted watershed by: 1) defining the principles of restoration and ultimate targets; 2) determining the roles and responsibilities of each stakeholder; and 3) guide the implementation, monitoring, and evaluation of all BRP interventions.

The CAP will cover the various activities that will be conducted with the participation of the targeted communities and will also be one of the main instruments for up-scaling successful options in all the ecosystems of Jordan Badia during the full implementation phase. The CAP will consist of two main

plans (the integrated watershed management plan (IWMP) and the socioeconomic incentives plan (SEIP)). Each plan will focus on the following five major components:

- a) Building on the results of the baseline surveys to identify the technical, institutional and policy options (TIPOs) for the interventions in each watershed and target communities;
- b) Identifying the best incentives to foster the full participation of all stakeholders and sustainable collective uses of ecosystem plant and water resources;
- c) Formulation of a partnership with local communities, governmental institutions, NGOs and implementing institutions;
- d) Formulation of a Monitoring and Evaluation framework;
- e) Formulation of a communication and dissemination strategy to share the results of CAP implementation.

The baseline studies had been used to identify the technical intervention and socioeconomic incentives that can be applied in the targeted watersheds and communities to achieve the sustainable restoration of the targeted sites. For the IWMP, these technical interventions are: soil and water management, improvement of ecosystem productivity, and alternative grazing management. The following are the activities of the IWMP that will be conducted in the targeted watersheds:

- a) Water management that will consist of: (i) using indigenous knowledge and work with the communities to select sites of stock watering ponds; (ii) constructing micro-catchments water harvesting techniques for each ecosystem site with a slope gradient more than 5%; (iii) building water spreading techniques like stone and/or earth bunds and check dams.
- b) Improvement of ecosystem productivity by using three approaches: (i) natural recovery through paid protection by hiring community guards on parts of the watershed; (ii) revegetation using indigenous plants (e.g. *Atriplex sp*, *Salsola vermiculata*, *Artemisia sp* and others ...) in the micro-catchments; and (ii) implementation of rest-rotational grazing in all the targeted watersheds.

For the SEIP, the socioeconomic activities will include the following:

- a. Mobilizing the targeted communities around the objectives of BRP, through: (i) increasing the level of awareness of the targeted communities; (ii) organizing stockowners and increasing the role of cooperatives; (iii) providing incentives to the livestock owners; and (iv) establishment of income-generating projects
- b. Improvement the health and nutritional status of the targeted livestock, through: (i) capacity building of the staff of the veterinary services from both the community and government; (ii) providing the mobile clinics and upgrading the current veterinary clinics in the target areas; (iii)

establishing dipping facilities for external parasite control; (iv) providing improvement rams to livestock owners; and (v) providing the livestock with feedstuffs.

- c. Establishing improved marketing chains, through: (i) Review and assess the existing marketing chains; and (ii) providing the livestock owners with necessary equipments for milking and milk processing to enhance the quality of livestock products.

1.4. CAP Organizational Structure and Management and Formulation of Partnership

Given the scope of the constraints facing the communities, the implementing agency/contractor cannot succeed in fulfilling the CAP objectives without clear and strong partnership at three levels. The first level of partnership should be with the governmental institutions that are working in the Badia and with specific mandate that are pertinent to planned interventions. Among these institutions are the Ministry of Agriculture (MoA), Ministry of Water and Irrigation (MWI), Ministry of Planning and International Cooperation (MOPIC), National Center for Agricultural Research and Extension (NCARE), Jordan Armed Forces (JAF), Royal Jordanian Geographic Centre (RJGC), Department of Lands and Survey, Hashemite Fund for Development of Jordan Badia (HFDB). The second level of partnership should be with the NGOs, cooperatives and other relevant local institutions, which could serve as appropriate vehicles for working with the communities. However, at this level streamlining and working with selected NGOs with clear and relevant experiences could organize and promote full community involvement in the implementation of the planned activities in the selected sites/communities. Their involvement in capacity building, public awareness, income generating activities and data collection for the monitoring and evaluation (M&E) task will strengthen community participation. The third level of partnership should be at the level of the stockowners that have different production systems and also different needs. However, ensuring the participation of all the community members is critical to ensure that agreed grazing and water resources use schedules are respected by all members. The BRP considers that the best approach for the implementation would be to develop grazing management cooperatives.

Therefore, this work plan has identified the most important partners/collaborating institutions that will participate in the implementation of the planned IWMP and SEIP activities, as well as activities that can be implemented by each partner/institution.

2. Plan 1: Integrated Watershed Management Plan (IWMP)

2.1. Introduction

Recent findings of BRP baseline study indicated that the rangelands in the targeted areas are severely damaged, and the livelihoods of rural and pastoral communities are deteriorated. For the BRP, the focal issue is the improvement of land resources, through the implementation of IWMP, to ensure a sustainable flow of goods and services from these resources to local communities within the context of functional ecosystems.

Technologies for improved water use efficiency and management of scarce water resources in the area like Jordan Badia are available. However, many of these technologies are not widely implemented or are not seen as feasible by farmers. This can be attributed to a number of constraints, including technical, socioeconomic and policy factors, but most important is the lack of community participation in the development and implementation of improved technologies.

IWMP techniques are effective tools in rangeland restoration and in improving land productivity. Water harvesting is an excellent tool that can stabilize, sustain, and improve crop yield if properly employed in farming-systems together with the concept of "sustainable land use". However, the efficient use of this tool will be guaranteed only if local communities accept to use these tools to help them in improving their livelihoods.

Fodder shrubs planting under water harvesting techniques seems to be the most suitable solution for rangeland rehabilitation. Water harvesting will maximize the benefit from rainfall run off to increase fodder shrubs production. The most well-known plant species to suite drought and salinity conditions in the eastern Mediterranean arid land are *Atriplex*. It performs well in rangelands good reservation from plowing, grazing and other man misuse is taking place. The establishment of fodder shrubs, however, requires specific mechanization and agricultural machines. The experience in Jordan showed that Vallerani plow is the most suitable machine that can achieve this purpose. The machine is capable of constructing contour ridges and allows furrow opening in a good depth while loosening the soil below the base of the furrow which allows good water storage and root penetration and eventually good shrub establishment.

Check dams, a wadi flow diversion structure and re-distribution of floodwater (water spreading) will be used to conserve the soils and water through minimizing the erosive action of flowing water, reducing

water flow velocity and also encouraging soil-moisture storage as well as enhancement of biomass production.

Rainwater harvesting and its storage will be through the construction of water ponds. The stored water will be used for the purposes of livestock watering and irrigation of planted shrubs. Soil loss from the watersheds will be continuously depositing in the constructed water ponds. This will result in reducing the water storage capacity of these ponds. To reduce this phenomenon and to minimize the deteriorating conditions, a series of stone check dams will be constructed along the main wadies located in the upstream of the water ponds.

To this end, this work plan of IWMP was designed to achieve the following objectives and outputs.

2.2. Objectives of IWMP

The general objective of the IWMP is to restore the degraded rangeland and improve the production in Badia rangeland by more efficient utilization of rainfall through the proper and effective implementation of water harvesting plan and grazing management plan. The water harvesting technique will control the surface runoff, increase the soil moisture content, conserve the soil, improve the natural plant cover, and improve the vegetation production.

Specific objectives include:

- Restoring and rehabilitating the degraded rangelands of the targeted ecosystems through the effective use of soil and water resources and improve livestock production.
- Improving the capacity of communities' to manage common natural resources.
- Enhancing the efficiency and effectiveness of rainwater and runoff use, improve vegetative cover and reduce soil erosion through better rainwater management.
- Spreading the use of water harvesting structures as a sustainable and renewable water resource to help in ecosystem restoration and maintain the land and livestock productivity.
- Increasing the productivity of natural vegetation and shrubs in order to decrease feed demand for livestock animal in Badia rangeland area and increase the income of the participating livestock owners.
- Disseminating appropriate water harvesting techniques for rangeland restoration, risk management and drought mitigation.
- Improving on-site infiltration/soil-moisture.
- Reducing on-site soil erosion/soil loss.
- Reducing off-site destructive impacts of runoff (reduced flood peak).
- Reducing sediment delivery at downstream areas.
- Improving the grazing management and the structure and function of vegetation in the Badia

rangeland through implementing rest rotation and late grazing schemes.

2.3. Expected Outputs

- Secured water for livestock of the targeted communities.
- Developed and managed watersheds of the degraded ecosystems.
- Sustainable water harvesting systems and grazing management for sustainable rangeland/ecosystem restoration implemented by communities
- Valued positive changes in soil quality, vegetation cover, biomass production, and rain-water use efficiency.
- Improved rain water conservation and utilization for different purposes (shrubs plantation, livestock watering, and rangeland rehabilitation).
- Provisional recommendations/ training materials for extension of specific recommendations for water harvesting systems, and rangeland management for water-use efficiency.
- Improved information base and improved experience/expertise on water harvesting techniques and vegetation/shrub suitability.
- Promotion of effective WH techniques.

For smooth implementation of the IWMP and to achieve the above mentioned objectives and outputs, the implementing institution will deal with three important issues: (i) increasing the level of awareness of targeted communities to mobilize them around the objectives of the BRP and CAP, (ii) organizing the stockowners under a certain cooperative form, and (iii) building partnership with governmental, non-governmental and other organized institutions in the area.

2.4. Work Plan of the IWMP

This work plan provides the details of all proposed activities and interventions of the Integrated Watershed Management Plan (IWMP) of the CAP of the demonstration phase. This work plan is based on the findings of BRP baseline studies that were conducted in 2009/2010 on the targeted watersheds in Jordan Badia.

The IWMP will be conducted at five watersheds targeted by the BRP in the Jordan Badia where the demonstration sites were located. These targeted watersheds are: Aranbah (146 km²), Al-Qassab (1027 km²), Al-Bandan (1239 km²), Burqu (513 km²), and Al-Gelat (145 km²). Table (1) shows the watershed names, total area, potential rangeland area, type of restoration approach(s) that will be implemented, and suitable micro- and micro-catchment water harvesting structure.

Table 1: Watershed names, total area, potential rangeland area, type of restoration approach that can be implemented, and suitable micro- and macro-catchment water harvesting structure

Watershed name	Total area of watershed (km ²)	Potential rangeland area (km ²)	Restoration Approach that will be implemented			Check dams and water spreading	Water Ponds/Dam
			protection	Rest-Rotation	Fodder plantation within WHS		
Aranbeh	146	69	√	√	√	√	√
Burqu	513	43	√	√	√	√	√
Al-Bandan	1,239	136	√	√	√	√	√
Al-Qasab	1,027	122	√	√	√	√	√
Al-Gelat	145	50	√	√	√	√	√

The IWMP will include the following four main components:

- I. Water harvesting interventions
- II. Improvement of vegetation cover and productivity of degraded rangelands (plantation of fodder shrubs, protection, rest-rotation)
- III. Socioeconomic studies
- IV. Monitoring and evaluation

2.4.1 Component I: Water harvesting interventions

Water harvesting will include micro-catchment and macro-catchment interventions. The micro-catchment water harvesting interventions will include Vallerani continuous contour ridges, Vallerani contour semi-circular bunds (pits), stone and/or earth check dams, and water spreading to increase soil moisture storage from rainfall. The continuous ridges, contour semi-circular bunds (pits), and water spreading interventions will be implemented in sites with gentle slopes, which will be mainly in flat wadis of the targeted watersheds. Meanwhile, the Macro- catchment water harvesting techniques will include stock watering points (water ponds or Hafeers) and dams to secure water for watering the livestock and for irrigation of the planted fodder shrubs. The stone and/or earth check dams will be implemented in each watershed to stabilize wadi(es) flowing towards water storage structures. This technique will increase the functional life the water storage structures as less sediment will flow inside the structure with more stable stream bed ahead.

The timeframe for the implementation of water harvesting interventions will be commenced before the rainy season. The phases of implementation of these interventions will include the use of results from baseline surveys and a sequence of activities to identify and verify potential sites and this will include:

- I. Hydrological assessment and topographic survey of the watershed: This activity is necessary before making any suggestion about micro and/or macro-catchment water harvesting in the watershed. This activity will include the following sub-activities:
 - a) Delineation of the contour lines for the watershed by using the total station or orthophotos or by using the stereo images to generate the digital elevation model (DEM);
 - b) Generation of the slope map, flow direction, stream networks, flow accumulation map from the slope map and DEM;
 - c) Delineation and mapping of the boundaries of the watershed and each sub-catchments;
 - d) Collection and analysis of all the available geological, hydrological and hydro-geological data for the watershed. The meteorological data that will be collected from the nearest weather station will include the precipitation, number of rainy days, seasonal rainfall width, the number and depth of rain storms (rain events), the distribution of rainfall during the season, and evapotranspiration.
 - e) Conducting field survey at the watershed level to update the collected data, to define the surface processes that may impact watershed delineation, and to define different land use patterns within the watershed;
 - f) Calculation of the surface water budget for the watershed and each sub-catchment. This will include the calculation of run-off coefficient, runoff volume and peak runoff volume expected at different locations in the watershed
 - g) Prepare and present site-specific recommendations for the best usage of the surface water in the watershed;
 - h) Define the appropriate micro and macro water harvesting techniques applicable for each sub-catchment;
 - i) Map generation of the potential sites for water harvesting with appropriate water harvesting interventions. Large scale orthophotos or high resolution images will be used to identify boundaries and areas for micro-catchment water harvesting.
- II. Collection of biophysical information: Details on targeted watersheds will be collected from the institutions implemented the baseline study and from the Database and Information Unit (DBIU) at the HFDB. Also, this will include the determination of the baseline conditions of the drainage network at the site: by measuring the dimensions (length, depth and width) of the existing waterways and gullies and the contributing area for each considered waterway.
- III. Conducting field visits to the targeted watersheds: The baseline study identified the areas within the demo site that are biophysically suitable for implementing the different water harvesting techniques. Moreover, field visits will be conducted to the all targeted watersheds by experts from

IWMP' implementers, baseline study implementers, PMU, HFDB, MWI, representatives from cooperatives, representatives from local communities and livestock owner, and other relevant institutions and stakeholders. A major benefit of this activity will be the collection of unavailable biophysical information, delineation of the existing dams and stock water ponds in the different sub-catchments, identification and selection the land areas, within the watershed, that are biophysically suitable and proper for implementing soil conservation structures and micro-catchment water harvesting interventions, and identification of the most suitable locations for the construction of stock water ponds which are highly demanded by the community/livestock owners to water their animals. The field visits and identification of the proper interventions and location of micro and macro-catchment water harvesting will be a community-based approach through the participation of local communities and livestock owners.

IV. Design the water harvesting interventions: Following the above mentioned activities, detailed design of the micro and macro-catchment water harvesting techniques will be provided. Therefore, the design will be based on the output from previous stages (study phase) and will include the identification of the most suitable water harvesting (intervention and location) for the target watershed and sub-catchment.

- a) **For micro-catchment water harvesting techniques:** The design will include the identification of the type of the interventions (Vallerani continuous contour ridges and/or Vallerani contour semi-circular bunds (pits)), calculation of the ratio of catchment to cultivated area (C/CA), the distance between the fodder shrubs within the contour. The design of micro-catchment water harvesting techniques will be based on the slope of the selected area, run-off coefficient, rainfall, effective root zone, crop water requirement, and soil characteristics (water holding capacity, soil depth,...)
- b) **For soil conservation and water spreading techniques:** These techniques are usually stone check dams and stone bunds and will be implemented in the targeted watershed over relatively flat areas receiving substantial amounts of sluggish floodwater. Also, the stone and/or earth check dams will be implemented to stabilize wadi(es) flowing towards water storage structures to reduce the velocity of water flow, conserve the soil and moisture and reduce the sediment load moving with floodwater to the downstream area and thus will improve the life of water storage structures. The design of the check dams will start by surveying the sub-catchment, preparation of a topographic map with suitable scale, and focusing on the conditions of all gullies and wadies and determine exactly the length of the wadi section that requires stabilization, the slope of the wadi bed, its depth, and the slope of the banks. Stone check dams and stone bunds will be constructed at

Marab Amaish, Wadi Al Qassab, Wadi Aranbah, Burqu, and Wadi Al-Bis. The available stones and boulders in the area will be used in the construction.

- c) **For macro-catchment water harvesting techniques:** Detailed design of dams and ponds will be provided with detailed requirements and timetable for construction.
- V. Construction and implementation of water harvesting interventions:
- a) Field layout and implementation of micro-catchment water harvesting interventions (continuous contour ridges and contour semi-circular bunds (pits)): In this technique, the contour lines will be tracked in the selected sites with a suitable distance depending on the design of the water harvesting techniques, and the contour lines will be plowed and performed using the Vallerani machine/plow mounted on a tractor with a ridge height of 50-70cm. All contour lines will be planted with the most suitable and indigenous fodder shrubs (i.e. *Atriplex* and/or *Salsola*) and/or seeding with appropriate distances between seedlings depending on the design. Time of implementation will be on October, November, and December of each year.
 - b) Construction of Macro-catchment water harvesting and water spreading techniques: The construction of these techniques will have the following sequence:
 - 1. Preparation of a detailed design (sketches and necessary technical details) for the dams, water ponds, and check dams with detailed requirements, specifications and timetable for construction;
 - 2. Negotiation with local communities and livestock owners on the proposed potential sites and design of these interventions in order to capitalize on indigenous and technical knowledge, and to modify the structure plan and sites accordingly;
 - 3. Preparation of the tender document: this will include the preparation of call for proposal for the construction of the interventions, specifications, time of construction, contractual agreement with the contractor,....
 - 4. Selection and contracting the contractor who received the highest points in the technical and financial evaluation;
 - 5. The agreed design and locations of water harvesting interventions will be constructed on ground before the rainy season.
- VI. Awareness day, field visit and capacity building for community members

It is worth noting here that the baseline study identified the areas within the demo sites that are biophysically suitable for implementing the different water harvesting techniques. Moreover, the

members of soil and water harvesting thematic group (SWHTG) of the baseline study conducted several field surveys, during November 2010, to the all targeted watershed and selected the land areas, within the watershed, that are biophysically suitable for implementing soil conservation structures, micro and macro-water harvesting techniques. The results of these visits to each watershed are presented in table (2). The criteria used by the SWHTG for the selection of the suitable area for these structures and techniques and the number and location of the ponds are: the slope gradient; soil depth; soil water holding capacity; conditions and dimensions of all gullies and wadies flowing towards the proposed water storage structures; area of watershed and each sub-catchments; rapid assesment of surface water budget for the watershed and each sub-catchment (run-off coefficient, runoff volume and peak runoff volume expected at different locations in the watershed); and the suitable land topography for the construction of the pond.

Table 2: Watershed names, total area, potential rangeland area, land area suitable for micro-catchment WH and suitable macro-catchment water harvesting structure

Watershed name	Total area of watershed (km²)	Potential rangeland area (km²)	Micro-catchment WH (ha)	Water Ponds/Dam (1000m³) ⁽¹⁾	Check dams and water spreading (m)
Aranbeh	146	69	200 CCR 150 CSB	10 Ponds (1300)	4,500
Burqu	513	43	50 CSB	14 Ponds (1150)	3,000
Al-Bandan	1,239	136	100 CCR 500 CSB	8 Ponds (800)	500
Al-Qasab	1,027	122	650 CSB	8 Ponds (750)	10,000
Al-Gelat	145	50	100 CCR 250 CSB	7 Ponds (600)	5,000
Total	3,070	420	2,000	47 Ponds (4600)	23,000
CCR: Contour Continuous Ridges, CSB: Contour Semicircular Bunds (1): For more details see Appendix 1					

2.4.2 Component II: Improvement of vegetation cover and productivity of degraded rangelands (plantation of fodder shrubs, protection, rest-rotation)

These interventions are subsequent to the micro-catchment water harvesting techniques. These will include plantation of fodder shrubs and/or seeding of fodders in micro-catchments, protection for natural recovery of rangelands in some sites, and rest rotational and late grazing in other sites.

The implementation of rest-rotation grazing can be facilitated if the revegetated areas (area planted by fodder shrubs) are large enough to accommodate substantial numbers of animals during the rest period of native vegetation under restoration. The persistency of browse production by fodder shrubs compared to

forage production by native vegetation is relatively longer, which facilitates the adoption of resting grazing locations by pastoral communities. The local communities will share in the plantations of fodder shrubs to give them the feeling that their grazing rights of these plantations are secured.

I. Protection for natural recovery of rangelands

All the targeted watersheds, except the areas/sites that have been identified and allocated for rest-rotation grazing, will be completely protected to give the native plants and planted fodder shrubs an opportunity to recover from prolonged history of destructive grazing and other irrational uses (cutting of woody plants and improper cultivation practices). Protection of the targeted watershed will be entrusted to local guards and the Royal Department for Environmental Protection (Rangers).

II. Plantation of fodder shrubs in micro-catchments:

The baseline study findings indicated that the majority of the selected demo sites and the targeted watersheds are severely damaged and the natural recovery of the existing vegetation will last for long time. Therefore, the baseline study implementers recommended that it is necessary and advisable to revegetate these sites. The revegetation activities will include the plantation of fodder shrubs, in the area/locations that has been implemented with micro-catchment water harvesting techniques, to improve forage production per unit area but not necessary the biodiversity and structure of native vegetation. The revegetated areas serve, after three to four years, as an alternative feed resource, thereby acting as an incentive for livestock owners to participate in destocking, thereby alleviating grazing pressure on native vegetation and promoting natural recovery.

In this activity, the nine months old seedlings of indigenous fodder shrubs (*Atriplex halimus*, *Salsola vermiculata*...) will be transplanted, during November to December, in the prepared micro-catchments water harvesting techniques. The density of the fodder shrubs that will be planted will be calculated depending on the rainfall amount, crop water requirement, and the design of water harvesting techniques. The Planted seedlings will be monitored for survival, height and biomass production (see 3.4: Component 4: Monitoring and evaluation). The Plantation of fodder shrubs will have the following sequence:

- a) Construction and implementation of micro-catchment water harvesting techniques in the selected sites with a suitable distance depending on the design of the water harvesting techniques, and the contour lines will be plowed and performed using Vallerani machine/plow mounted on a tractor with a depth of 80-100cm;
- b) Drilling pits using the auger mounted on a tractor with the dimensions of 50 * 50 * 50 cm³. The distance between the holes (inter- and intra-spacing) will depend on the plant density and the water harvesting design;

- c) Transportation of the nine months old seedlings of indigenous fodder shrubs (*Atriplex halimus*, *Salsola vermiculata*...) from the nearest nursery to the targeted watersheds;
- d) Plantation of the fodder shrubs in the prepared holes;
- e) Irrigation of the planted shrubs with about 20litter/shrub immediately after planting;
- f) Monitoring and evaluation of the planted shrubs with the same attributes measured in the BRP baseline study (e.g. survival, height and biomass production) to track changes of the rangeland condition.

III. Rest rotational and late grazing

Rest rotational and late grazing schemes will be implemented on a suitable area in each watershed and will last for 4-5 years. Rest rotational and late grazing technique means resting certain locations in the targeted watersheds for the entire season or year to provide vegetation adequate time to recover from grazing or cutting. Resting of grazing locations is important for maintaining the vigor and productivity of vegetation especially the key forage species. The abundant coverage of plants in the rested locations will reduce soil erosion and enhances soil organic matter.

In this technique, the areas/locations delineated within each targeted watersheds for rest-rotation will be divided into two parts; the first part will be grazed during the grazing season of even years (in 2010, 2012, 2014...) where the second part will be grazed during the grazing season of odd years (2013, 2015, 2017...).

It is worth noting here that the baseline studies and the field surveys conducted by SWHTG identified the areas within the demo sites and watershed that are biophysically suitable for implementing the protection, plantation of fodder shrubs in micro-catchments, and implementation of rest rotational and late grazing schemes. The results are presented in table (3).

Table 3: Watershed names, total area, potential rangeland area, type of restoration approach that can be implemented

Watershed name	Total area of watershed (km ²)	Potential rangeland area (km ²)	Restoration Approach (km ²)		
			protection	Rest-Rotation	Fodder plantation within WHS
Aranbeh	146	69	48	17.5	3.5
Burqu	513	43	32.5	10	0.5
Al-Bandan	1239	136	95	35	6

Al-Qasab	1027	122	86.5	29	6.5
Al-Gelat	145	50	32.5	14	3.5
Total	3070	420	294.5	105.5	20

2.4.3 Component III: Socioeconomic activities

This procedure will be followed in all activities of the IWMP and CAP of BRP. The participation of targeted communities and livestock owners in selection and implementation and monitoring and evaluation will form an important tool for the BRP in the restoration process and will improve the level of involvement of local communities in the BRP. This component will be discussed in details below in the socioeconomic incentives plan.

2.4.4 Component IV: Monitoring and Evaluation program of the IWMP activities:

This component is aimed at evaluation of all activities of IWMP (i.e. water harvesting techniques and revegetation). It is directly related to assess the water resource and its capturing potential, and options for water utilization. The Monitoring and Evaluation (M&E) Component will include the collection of all data that is required to evaluate the performance of the different interventions of IMWP and to determine their suitability to the site/watershed in addition to where can these interventions be scaled out. Data to be collected will include, at least, the same attributes measured in the BRP baseline study (i.e. meteorological data (precipitation, number of rainy days, seasonal rainfall width, the number and depth of rain storms (rain events), the distribution of rainfall during the season, and evapotranspiration), vegetation attributes (cover, survival rate, plant height, frequency, density, diversity, biomass production, grazing and carrying capacity), soil physical and chemical properties, moisture storage in the total area, changes in the soil loss from the sub-watershed by monitoring the sediment concentration of runoff, and socioeconomic impact and social acceptance to water harvesting activities) to track changes of the rangeland condition.

At least one area of 0.5-1.0 ha per targeted watershed will be delineated and fenced to serve as a reference area for monitoring purposes. The same attributes measured in the BRP baseline study will be monitored inside and outside the fenced areas to track changes of present rangeland condition.

The activities that will be conducted and the data that will be collected and analyzed inside and outside the fenced areas (reference area) will include:

- I. Metrological data:** several actions and procedures will be followed to collect data needed for the calculations of water balance and estimation of soil erosion in each targeted watershed. These will include:
 - a) Installing one tipping-bucket rain gauge with data logger at a representative site in each targeted watershed;

- b) Recording of rainfall amount and intensity, on hourly basis, from the installed tipping-bucket rainfall gauge;
- c) Collection of other climatic and weather data from the nearest weather station(s). Data will be collected every 2 weeks.

II. Monitoring and evaluation of implemented water harvesting interventions: The following measurements will be taken for Monitoring and evaluation of implemented water harvesting interventions:

- a) **Soil moisture measurements:** Soil moisture measurements will be taken using the gravimetric method. Measurements will cover the soil layers up to the root zone of the plants. The frequency of measurements will be 24hrs after a rainfall event or once weekly during the rainy season when there is no rainfall, and once monthly during the rest of the year. Soil moisture measurements will be taken for inside the reference area, both catchments and cultivated area for water harvesting techniques, protected area, and rest-rotational area.
- b) **Soil erosion measurements within the micro-catchments water harvesting:** Metal pins will be used to monitor changes in soil surface level as a mean to measure soil erosion inside micro-catchments water harvesting. The pins will be fixed starting from the top of the continuous or the intermittent ridges, down to the planting row, and upstream towards the next ridge at an interval of one meter. The measurements will be taken once a year after the end of the rainy season.
- c) **Soil quality measurements:** Soil infiltration rate (using double ring infiltrometer) and soil samples covering a depth of 60cm will be collected once a year at the end of the rainy season (mid of May) for laboratory analysis. Analysis will include, at least, the same physical and chemical attributes measured in the BRP baseline study (i.e. texture, bulk density, water holding capacity, organic matter content, salinity, CaCO₃, pH, N, P, and K). Soil infiltration rate and soil samples will be taken from inside the reference area, from the planted row and from between the rows (both catchments and cultivated area) for water harvesting techniques, protected area, and rest-rotational area. Sampling soil at certain depth intervals will enable the examination of silt deposition resulting from erosion.
- d) **Soil erosion measurements in waterways and gullies:** Metal pins (50 cm long) will be used to monitor changes in depth and width of the waterways and/or gullies. Three rows of pins will be fixed along each side of the waterway at 25cm intervals. Five or six gullies and/or waterways will be selected for measurements and will cover areas affected by interventions as well as areas not affected by interventions. Several sections (4-5) will be selected along the waterway for installing the pins at points that will enable the head cutting in these waterways. The lateral distance from

the edge of the waterway to each of the pin rows will be measured once a year after the end of the rainy season. The contributing area for the selected waterways will be determined.

- e) **Water storage:** The volume of water stored in water pond (Hafeer) and dams will be recorded after each runoff event.

III. Monitoring and evaluation of the planted shrubs: The following data will be collected on shrubs:

- a) Survival rate (percentage): Number of living shrubs will be recorded weekly for 1 month after planting then monthly;
- b) Vegetation cover percent for shrubs
- c) Plant dimensions: Parameters will be measured once a year (in mid May) and it is an indirect method to estimate biomass. Plant dimensions to be measured will include: plant maximum height (the vertical distance from ground level to the highest perennial portion of shrub); maximum width (the horizontal distance along the widest axis of shrub crown); diameters (D1 & D2) (additional perpendicular axis at 45° to intersection of the maximum width, and minimum width), plant maturity;
- d) Yield and biomass (productivity): Browse production per shrub will be estimated by the reference unit technique once a year (in mid May). Reference unit is a non destructive technique used to estimate browse biomass of shrubs. It involves selection of a standard unit as a biomass comparison for other plants during sampling. The biomass is estimated according to the number of reference units rather than by plant weight. Moreover, five shrubs from the planted shrubs will be randomly selected and cut to ground level. Weights of browse (leaves and small twigs < 0.5 mm in diameter) and wood will be recorded for each shrub. Shrub weights will be used later for calculating the water-use efficiency

IV. Monitoring and evaluation of the native vegetation (grasses): The following data will be collected on native vegetation for inside the reference area, both catchments and cultivated area for water harvesting techniques, protected area, and rest-rotational area. It should be taken into account that the method used for collecting the attributes inside the reference area will follow the estimation method (no harvesting):

- a) Percentage cover (visual estimation as percent of ground covered by plant canopy of the species) will be recorded once a year on March to April. This will include: total vegetation coverage; stone cover and root mat cover (%); coverage (%) of forage species; coverage (%) of non forage species; coverage (%) of shrub species; and coverage (%) of herbaceous species.
- b) Emergence date.

- c) Flowering date.
- d) Maturity date
- e) Density and species relative density (mature and young) for all species (annuals and perennials).
- f) Species composition (list of all species)
- g) Biomass (fresh and dry weight, kg/ha) of forage species
- h) Biomass (fresh and dry weight, kg/ha) of non forage species
- i) species frequency
- j) Plant Diversity: Species richness and Shannon Diversity Index
- k) Abundance and Relative abundance

3: Socioeconomic Incentives plan (SEIP)

3.1. Introduction

The production system in Badia is very fragile system, with severe resource degradation specially soil and vegetation. This is resulted from insufficient rainfall, overgrazing, plant uprooting and mismanagement of the resources by the communities. Alternative practices and collective management will be implemented in order to conserve the natural resources, therefore participatory approach management of the ecosystems in the Badia seems to be one of an attractive idea to improve the livelihoods of the people in that area.

Participation of beneficiaries and community members in the planning and implementation of the activities in their areas is essential for the success of any efforts aiming at the restoration of the Badia ecosystems and the livelihood of these communities.

As these communities in the targeted areas face complex issues, the participation will help in understanding their priorities and needs. The socioeconomic plan will enhance the participation of the communities by providing package of incentives that can serve as a viable model in helping communities to face their social and economic problems and to be active partner in the restoration and rehabilitation process of the Badia ecosystems

3.2. Targeted areas

The targeted communities for implementing the socioeconomic plan will be mainly those communities that are included in the baseline studies. These are:

- **Al- Ruweished** which is located at the far east of the Eastern Badia, around 210 km from Al-Mafraq city. Al-Ruweished is bordered nationally by Al-Ashqaf from the west and Al-Karameh from the east, and bordered regionally by Iraq, Syria, and Saudi Arabia. Al-Ruweished area includes all the villages of Al-Ruweished, Al- Manshieh Al-Ruweished Bridge, Salhiet Al-Noeem, Rawdat Al-Bandan, AlFeda, East and West Reshieh. The total number of the population in this area is about 9,264. The main tribes in the area are, Al- Ghaiath, Ahl Al-Jabal, Bani Khaled Al-Noeem and A-Rowalla.
- **Al-Bandan community:** The social origin of al-Bandan community extends to Rwalah tribe and the total of citizens now is 90 people, distributed on 12 families (a family includes 8-12 persons equally males and females), living in 10 houses and a tent (Guesthouse of the head of the group). Al-Bandan village was established in 1993 as a settlement in permanent houses, and the stability of the community was emphasized after establishing a basic school at Rawdat al-Bandan village.

A basic co-educational school: 11 males, 13 females, 3 classrooms, 6 teachers. Inhabitants of the village mainly depend on pasturing, livestock breeding, seasonal farming, trading in livestock products besides too few other minor activities. The only source of power available in the area is comprised of solar cells mounted on three houses, and the community depends on Water Authority to provide them with water from Ruwaished via tanks.

- **Al-Ghayyath community:** The social origin of al-Ghayyath family extends to Ahl Al-Jabal tribes. The total number of citizens of this community is 1855, distributed among (230) families living in (209) houses. The village was founded in 1997.
- **Wadi Al- Qassab and Salhiat Al-Naimeh:** This site is located 32 km southern east of Al-Rweished district; it is inhabited with nomadic Bedwin in summer season. The number of livestock owners is 40 owners with population of 600 inhabitants. The number of population in Salhiat Al Neimeh village is about 150 inhabitants with 5 livestock owners own 8000 heads of sheep.
- **Safawi communities:** The targeted communities are: Safawi, Manshiat Showfan, Manshiat Al Khalifh and Alya Al Shwaier. The Safawi community is the biggest community among the others, it is located in the free zone, which extends about 80 Km east of Alhamad Alordouny and 5 Km east of Wadi Al- Safawi till Hura Alnaqurish with 50 Km, and about 50 Km north Alazraq and 45 Km south of the Syrian borders. The Safawi community is located 95 km from the center of Mafarq Governorate, while Manshiat Al Khalifh is located 14 Km to the east of Safawi community. The total population of all four communities is 2825 inhabitants, and the poverty percentage reaches 47.4% of the total population. Safawi area hosts many tourist and historical locations. The agricultural land in Safawi is known as a postural area that is rich with wild flora.
- **Dair Alkhahf District:** The total population of the targeted communities is 5179 people distributed over 10 villages in addition to Jawa Archeological site where some livestock owners with their tents used to live around. All people in the target area belong to a Bedouin society which is built on a tribal basis. These villages consist of four tribes. The tribal values and norms in the target area are very strong. Settled Bedouin keep up strong ties and loyalties to their tribes.

3.3. Main findings of the socioeconomic baseline study

3.3.1. Income Resources

The main income sources at the targeted areas come from the following activities:

- Livestock.
- Governmental and Military employment
- Labors.

3.3.2. Flock Composition and Flock Structure

The study showed that the number of livestock in the targeted areas is around 600000 heads according to Ministry of Agricultural records.

The socioeconomic survey showed that 53.5 % of livestock owners have mixed flocks (sheeps and goats); 32.1% of them have sheeps only, and the remaining (14.3% of them) have goats only. Furthermore, it was found that the percent of males in sheep and goats, under the transhumant production system, was 6%, and 8.4 % respectively. On the other hand, females showed a higher percentage in sheep (94%) than in goats (91.6 %).

In this system there is 78% productive ewe of sheep while there are 76.6% productive goats. In addition, yearling ewes lamb constituted 10.4% for sheep and 5.3% for goats. The mature rams and goats have accounted 3.8% and 4.4% correspondingly. Replacement rams comprised 0.2% and goat is 0.9%.

3.3.3. Cooperatives

The study showed that there are 74 cooperatives in the targeted areas. These cooperatives can be classified, according to the purpose of establishment into: 37 as multi purposes cooperatives, 25 as agricultural cooperatives, 8 as sheep cooperative and 4 for other purposes

3.3.4. Problems and Constraints

The main problems and constraints facing the targeted areas and communities are:

- Unemployment: The baseline study shows that the unemployed men and women of target areas is 45% and 90%, respectively. The following are the reasons for the high percent of unemployed in the targeted areas:
 - Unemployment by public sector
 - Lack of private sector investment
 - external workers competing on local jobs
 - Low rate of graduated and trained people to open new employment opportunities
 - Limited crop farms activities
 - Majority of land owned by government
- Poverty: The baseline study indicates that 60% of the target communities are suffering from poverty. This is due to the following:
 - Lack of government fund
 - Land tenure
 - Unemployment
 - Low productivity of the livestock
 - Lack of income generation projects
- High cost of the feed: This problem is one of the major problems that the livestock owners face.

- Market constraints for livestock productivity: The causes of this problem are the lack of markets and market chain for marketing of livestock products and the lack of factories for milk and wool.
- High cost of the energy sources
- Poor veterinary services: According to the baseline study, the livestock owners in the targeted areas complained of the poor veterinary services and the lack of qualified veterinary personnel.

3.4. Justification of the Incentives

Unless it makes tangible economic sense to them, target communities are unwilling to cooperate in rehabilitation the rangeland and restore the ecosystems of the Badia in the course of their production and consumption activities.

One of the main objectives of the Badia rehabilitation and restoration program is to improve the livelihood of local communities and to participate in the restoration program and to sustain the implemented activities.

Incentives can be used, designed and implemented to motivate Badia communities to cooperate in rangeland management in sustainable manner.

Incentives can present valuable tool for both natural resources conservation and sustainable livelihood development

3.5. Objectives: The main objectives of this component are:

- Provide livestock owners with feed
- Increase the level of awareness and understanding the values of goods and services of rangelands by outreaching local communities to participate effectively in management of rangelands and development of sustainable livelihoods.
- Develop the institutional capacity for community-based management of rangelands in targeted locations through effective legal, infrastructure and human resources development.
- Enhance the communities to participate in the rangeland management for the targeted locations.

3.6. Outputs

- The targeted communities participate in the program activities.
- Institutional capacity for community-based management of rangelands in targeted locations developed and strengthened.
- Partnership with cooperatives, and other organized institutions built.

- Practical model for the incentives is implemented.
- barley grains will be distributed to the livestock owners as a livestock feed

3.7. Work Plan of SEIP

The implementation of the various activities of the IWMP will have direct impact on the communities as it would limit their access to the grazing resources during restoration periods. Moreover, each community has its own stakeholder composition and realities and as such incentives must be tailored to reflect these differences. In general, the communities during the various meetings and appraisal surveys have identified four types of incentives: (i) compensation options, (ii) service delivery to improve animal productivity and health to prevent the high rates of abortion and mortality, (iii) enabling frameworks that will provide them with more exclusion rights to manage access to improved ecosystems and marketing infrastructure; and (iv) awards.

The **compensation incentives** include two main options. The first one is the provision of subsidized feeds (barley grains, wheat bran, and tibia) during the periods where they do not have access to grazing areas to compensate them with the losses that they are incurring. The second option is the introduction of alternative sources for fuel wood to prevent the uprooting of shrubs. The project plans to introduce solar units, which have been implemented in the area and several community members were sponsored and trained in India on the maintenance of these solar units.

The **service delivery incentives** will focus on health, productivity and management. The high mortality and abortion rates reported by the various communities suggest that the poor delivery of veterinary services is a real constraint. The communities suggested the introduction of improved Awassi rams to enhance flock productivity and improve the delivery of veterinary services to curtail economic losses associated with diseases and neonatal mortality. The experiences of community para-vets have been successfully implemented in many developing countries and in Jordan, the lessons learned from these projects could be used to better shape the animal health and productivity task. In addition, other interventions would include (i) upgrading existing veterinary clinics and providing mobile clinics in target areas to better serve all community members (sedentary and the nomadic and semi-nomadic stockowners, who reported many animal losses); (ii) establishing dipping facilities; (iii) upgrading veterinary laboratories in the area to better anticipate and prevent the spread of diseases. Moreover, new animal husbandry options will be promoted. Such options may include: selection and culling, nutrition, records keeping, reproductive management, milk processing, fattening lambs.

Regarding the **enabling incentives** include marketing and land tenure issues. The program will facilitate the development of Badia marketing institutions and infrastructures focusing on Badia plants and animal products to improve the marketing of those products to increase and diversify Bedouin households' income generation strategies. These incentives could serve as leverage to the reduction of herds and stability of household incomes.

Therefore, the SEIP includes two types of incentives as follows:

- **Indirect incentives:** Vaccines, veterinary services, milking machines, mini dairy plants, and alternatives for the energy will be provided to the livestock owners through the cooperatives. Other activities including income generation projects will be financed
- **Direct incentives:** Barley grain will be provided to the livestock owners to encourage them to participate in rangeland rehabilitation and conservation .This will be achieved by providing 1.5 kg of barley grain for each head for few months in two years.

3.7.1. Indirect Incentives

3.7.1.1. Veterinary Services

3.7.1.1.1. Justification

The livestock owners in the targeted areas which are remote areas complained from the lack, or the absent, of veterinary services, dips and extension. In addition, livestock owners in the Badia complained of diseases that are transmitted by insect vectors. Therefore, the provision of mobile clinics of the 4 x 4 truck brand and dips with the necessary vaccines and medications (such as Enterotoxemia and Neobacter vaccines) will meet the demands of livestock owners and provide adequate veterinary services for their animals.

3.7.1.1.2. Objectives

Veterinary Services' objectives are aligned with the needs of stakeholders. Achievement of these objectives requires broad interaction of all livestock owners, veterinary staff and departments of the Ministry of Agriculture. The main objectives of the veterinary services program are:

- Protect the Badia livestock from the occurrence of adverse animal health events. (Adverse animal health events can result from the real or perceived impacts of diseases, pests, vectors, toxins, or natural disasters on public health, productivity, or trade)
- Improve the productivity of Badia livestock and monitor the health-related attributes of animal products and veterinary biologics.
- Enhance the health status of Badia animal by anticipating and responding to new or emerging threats and managing, controlling, or eradicating those already identified.

- Create a highly effective animal health model to protect Badia animals from disease.

3.7.1.1.3. Expected Outputs

- Establishment of Veterinary services program that respond effectively to adverse animal health events and continue to improve the Badia animal health emergency response capabilities.
- Recruitment , a competent, committed, and diverse workforce that provides high quality service

3.7.1.1.4. Methodology

The mobile clinics and dips will be equipped with necessary vaccines, equipment and tools needed for vaccination, disease diagnoses and small operations. The delivery of these vaccines will be practiced by veterinary staff. The mobile units will be distributed in the target areas and will manage by the Ministry of Agriculture and the cooperatives .The proposed number of these mobile clinics and dips are estimated according to the availability of vet services and the number of the sheep and goats in the target areas. The Veterinary specialists determined that every 12 thousands heads needs one mobile clinic and one dip. The mobile clinic in each of the targeted area will be supplied with a high definition portable ultrasound (a total of three will be purchased). Specifications of these ultrasounds will be provided by the MoA, NCARE and JUST The specification for the mobile clinics and vaccines will be provided by the MoA, NCARE and JUST.

3.7.1.1.5. Activities

The veterinary services will include the following activities

- Establishment of Mobile clinic and vaccines
- Establishment Dipping Vehicles

Table (4) shows the number of mobile clinics, dips, improvement rams and the quantity of vaccines that will be distributed during the period 2010 until 2015.

Table 4: Number of the mobile clinics, dips vaccines and improved rams that will be provided for the targeted livestock owners during (2010-2015).

Items	Mobile Clinics				
	12/2010 To 5/2011	6/2011 To 6/2012	7/2012 To 6/2013	7/2013 To 6/2014	7/2014 To 6/2015
Mobile clinics	3	4	6	6	6
Providing the livestock owners with Vaccines	For 200,000 heads	For 200,000 heads	For 200,000 heads	For 200,000 heads	For 200,000 heads
Sheep Dips	2	4	6	8	10

3.7.1.2. Market Services

3.7.1.2.1. Justification

The baseline study shows that there are two major options for meat marketing in the target areas; either direct sale at livestock markets in Rwaished or Mafrq, or sale to the traders operating throughout the region. Milk is mainly marketed through local Jabanah. The project will identify market opportunities of animal products and contribute to the removal of market constraints in order to expand the portfolio of income generation options available to poor households. In addition to encouraging small producers to join together to establish marketing bodies to better access niche markets and assist them in promotion of their products.

In addition, the baseline study indicated that the milk production of Awassi sheep in the targeted areas was between 70 and 100 kg in addition to about 50 kg or more was taken by the lamb. The milk production is much below the potential yield because of low health and nutritional status and unimproved flocks of Bedouin. Lactation yield of Awassi sheep varies between 90 and 130 kg. Stockowner is used to sell the milk to cheese maker (Jabbanh) who comes to flock location in the Badia during milk season. To get better value out of the produced milk, this project propose qualifying the household of the livestock owner to process their milk and therefore get better value out of it

3.7.1.2.2. Objectives

- Expand the domestic and international marketability of Badia animal's products,
- reduce the costs of marketing of the animal products
- create new business and jobs at the Badia areas

3.7.1.2.2. Expected Outputs

- Improvement of market access and promote timely and efficient certification for exports of Badia animals products
- Local demand on the Badia Milk products will be raised and Badia Milk market will be grows

3.7.1.2.4 Methodology

The approach that will be used to distribute the milking machines and mini dairy plants will depend on the existing cooperative(s). These cooperatives will be facilitated through providing mini dairy plants and milking machines to the cooperatives members. The numbers of these plants and machines are determined according to the needs of the members of these cooperatives and their participation in implementing and adopting the project activities. The project will provide the cooperatives the necessary equipments of small ruminant's milking machine and milk processing equipments to livestock owners after training the livestock owners on milk processing. NACRE will execute this activity

- The marketing system of the livestock products will be studied to indicate the constraints and opportunities .In addition a slaughter house and market for livestock will be established in the target areas. This activity will be executed by MoA and NACRE

3.7.1.2.4. Activities

The main activities that will be implemented through the supporting market services program will be as follows:

- Assessing the Market of Livestock Products
- Milking machine
- Mini dairy plants
- Establishment of Slaughter house

Table no (5) shows the distributed of these activities during the period of 2010 to2015.

Table (5): Animal production marketing assessments, and number of mini dairy plants, milking machines and slaughter house that will be provided to the target communities and during (2010-2015)

Items	Units				
	12/2010 To 5/2011	6/2011 To 6/2012	7/2012 To 6/2013	7/2013 To 6/2014	7/2014 To 6/2015
Mini Dairy plants	5	10	15	20	20
Milking Machines	10	40	60	80	100
Animal production marketing assessments	1				
slaughter house		1			

3.7.1.4. Alternative sources for bio-fuel

3.7.1.4.1. Justification

The baseline study shows that the communities of the Badia are cutting the shrubs to use them as a source of fuel. Providing the livestock owners with units of energy sources will help in shrubs conservation and rehabilitation of vegetation cover.

3.7.1.4.2. Objectives

- To reduce cutting the rangeland shrubs
- Help protecting the rehabilitated rangeland areas

3.7.1.4.3. Expected outputs

Protection of the rangeland areas that will be rehabilitated by the project

3.7.1.4.4. Methodology

The approach that will be used to distribute the solar units will depend on the existing cooperative(s). These cooperatives will be facilitated through providing these units. The numbers of these units will be determined according to the needs of the members of these cooperatives and their participation in implementing and adopting the project activities

Table (6) shows the proposed number of solar units that will be distributed to the target communities during (2010-2015)

Table (6) Number of solar units that will be distributed to the target communities during (2010-2015

Items	Solar units				
	12/2010 To 5/2011	6/2011 To 6/2012	7/2012 To 6/2013	7/2013 To 6/2014	7/2014 To 6/2015
Providing solar unit	0	40	60	80	100

3.7.1.5. Income Generation Projects

3.7.1.5.1. Justification

Badia rehabilitation projects include an income-generation component to address the problem of lack of income which generally acknowledged as root causes of poverty at Badia areas. The income-generation component can be realized to assist households to start an alternative income-generating activity.

In this approach, the loan is used to facilitate the self-employment of community members to replace the income previously earned by the breeding of livestock. As a result, the overall economic condition of the household should not decline when the breeding of the livestock will be not the main income resource for the community members.

The propose revolving funds has an extremely important role to play in decreasing the dependency on the livestock breeding business even n if it does not directly contribute to income generation. In fact, the income generation projects used to manage risks and smooth consumption in a poor household which may be important in the rehabilitation of the target areas.

3.7.1.5.2. Objectives

The income generations revolving funds will be implemented in the target areas to:

- Improve Community living conditions through the provision of income alternatives.
- Diestock the livestock numbers in the target areas
- Sustain the range land rehabilitation and environmental conservation.

3.7.1.5.3. Expected Outputs

Income Generation Funds will lead to the following achievements:

- **Empowerment:** Bringing together low-income persons, particularly women, into a group has the additional benefit of empowering them, giving them a sense of responsibility, while freeing them from historically dependant relationships.
- **Leadership:** The income generation funds have several leadership posts that can be rotated throughout the membership to allow all participants an opportunity to exercise a leadership role.
- **Skills development:** To manage the affairs of the income generation projects, members often need to learn and gain basic skills to guarantee the efficiency of income generation activity implementation.
- **Efficient and Sustainable Participation in the rangeland rehabilitation and Badia ecosystems restoration:** The diversification of income will decrease the dependency on the livestock breeding business which achieve the destocking of the livestock and decrease the its pressure on the rangeland in the target areas

3.7.1.5.4. Methodology

One of the methods for delivering income generation revolving funds is through a group structure, such as solidarity cooperatives, a self-help community group or an Agriculture Credit Cooperation. For income generation funds, these groups lower the per person delivery costs, as well as the acquisition and screening costs, and serve as an important collateral substitute. By lowering the costs and the risk of default, the group makes it possible to provide financial services to the target community who would otherwise not have access.

Also it is important to recognize that savings and credit groups also play a valuable role in achieving social objectives that can therefore contribute to the sustainability of Badia Rehabilitation Project interventions. Additionally, these funds will be released after a conducting environmental impact assessment and feasibility study for each project that will implemented in that areas.

3.7.1.5. 5. Activities

The main projects that can generate income for these cooperatives are:

- Feed Blocks Projects
- Providing livestock owners with camels

Table no (7) shows the number of projects that will be funded during 2010-2015

Table no (7) Number of projects that will be funded during 2010-2015

Items	Project				
	12/2010 To 5/2011	6/2011 To 6/2012	7/2012 To 6/2013	7/2013 To 6/2014	7/2014 To 6/2015
Feed Blocks Projects	0	5	5	8	8
Providing livestock owners with camels	0	75	75	100	150

3.7.1.6. Increasing level of awareness of the targeted communities

3.7.1.6.1. Justification

Increasing the public awareness especially the stockowners is of vital importance to mobilize the entire community around the objectives of the proposed Project. A supportive and collaborative community is of vital importance for the success of projects dealing with management of natural resources of collective ownership or use.

3.7.1.6.2. Objective:

- To promote to the communities to understanding the objectives of the project
- To encourage the communities to adopt the project techniques
- To inform the communities about the issues that affect their areas ecosystems

3.7.1.6.3. Expected Outputs

- Level of awareness of environmental issues to gain support for rangeland and Badia Ecosystems protection, environmental cost-recovery and sustainable development of resources.
- Widespread support from the communities members to the project activities which will be achieved by motivating a change in their behavior and attitudes

3.7.1.6.4. Methodology

The project will recruit an expert in public awareness and a community facilitator who will formulate a public awareness thematic group to increase the level of awareness of the community and gain its support. The public awareness expert will design and implement the needed programs and activities to inform the local communities in targeted areas about the different aspects of the Project.

The communities must feel that they are the actual custodians of this Project, and the enhancement of their livelihoods depends on their devotion to achieve the planned objectives

3.7.1.6.5. Activities

The public awareness programs will includes the following:

- Festivals and Launch days

- Films
- Documentaries/DVDs
- Television programs
- Performing arts
- Web sites/pages
- Wildlife exhibitions
- Educational materials
- Publications, including literature.
- Newsletters
- Field Days

3.7.1.7. Capacity Building Programs

3.7.1.7.1. Justification

According to the baseline study, the livestock owners in the targeted areas complained of the poor veterinary services and the lack of qualified veterinary personnel. In addition they complained that most of them did not have the ability and the Knowledge to introduce the most efficient techniques of livestock breeding and management. In response to that, the current veterinary staff from the governmental veterinary clinics located in the target area and members from the targeted communities will be trained on various aspects of infectious and non-infectious diseases. More focus will be directed towards control of trans-boundary infectious diseases and neonatal mortalities.

3.7.1.7.2. Objectives

- To improve the efficiency of rangeland rehabilitation and management of livestock investments
- To achieve sustainable management of the natural resources and rangeland on which community livelihoods depend
- To rehabilitate the community members to find profitable employment opportunities

3.7.1.7.3. Expected Outputs

- Knowledge increased among different concerned stakeholders and livestock owners on the rangeland rehabilitation and nature conservation and Badia Ecosystems restoration
- Communities members understand, appreciates and supports the project activities
- Employment opportunities will be created that will improve the lively hood of the target communities

3.7.1.7.4. Methodology

The training of veterinary staff and the livestock farmers will take place at the Faculty of Veterinary Medicine at the Jordan University for Science and Technology (JUST). Course contents will be organized by the project manager, livestock specialist and the JUST official. The training will be organized to express farmers' needs according to the baseline study and MoA needs. This training will be in the form of "training of trainers" to aid and facilitate transfer of gained knowledge to other veterinary staff and livestock owners. This activity is considered a major milestone in this project

3.7.1.7.5. Activities

The training program will include the following activities:

- Training the Veterinary staff about the diseases of sheep and goats ,veterinary skills and the tools of increasing the birth and reduce the death of sheep and goats
- Training the farmers about the proper approaches of livestock breeding and management.

Table no (8) shows the number of veterinary staff and livestock breeders who will benefit from the capacity building program during the period 2010 until 2015.

Table 8: Number of veterinary nurses and livestock owners that will be trained in the target communities during (2010-2015)

Items	Number of Veterinary Nurses				
	12/2010 To 5/2011	6/2011 To 6/2012	7/2012 To 6/2013	7/2013 To 6/2014	7/2014 To 6/2015
Training of the Veterinary Nurses and livestock farmers	10	15	15	15	15

3.7.2. Direct Incentives

- Barley grain

3.7.2.1. Justification

Based on the baseline study findings, three production systems were identified: nomadic, transhumance and sedentary. The majority of pastoral communities practiced the transhumant production where daily and seasonal mobility between villages and grazing areas is maintained to benefit from the scarce grazing resources to reduce costs of feeding. The animals raised under the transhumance production system are handfed for more than 9 months on traditional feedstuffs (barley grains, wheat bran and tibia or shredded straw) and grazed for 3 months on different grazing resources (native plants, cultivated barley at rangelands, and stubble grazing). The feed subsidy should be provided due to the following critical facts:

- Low productivity of rangeland areas;

- Very poor soil seed bank, due to eroded soil surface;
- The output of the several meeting with the targeted livestock owners and cooperatives indicating that all livestock owner suffer from high feed prices and the average flock size reduced by more than 40% for the last 10 years due to that. The continuous decline in the flock size will affect negatively on the national food security, social security, and national security.
- At least the BRP needs 5-7 years to restore the vegetation cover, so the farmers can rely on range land for months.

3.7.2.2. Objectives

- To enhance the livestock owners to participate in the implementation project activities
- To protect the rehabilitated rangeland from the grazing
- To reduce the cost of livestock feed that paid by the communities members

3.7.2.3. Expected outputs

- Protection of the rehabilitated areas
- Grazing management plan will be developed to use the rehabilitated areas properly
- Improvement the income of the participated livestock owners.

3.2.7.4. Methodology

The main beneficiaries of the proposed incentives will be all the livestock owners in the targeted areas where the average flock size ranged from 50 head in Aranbah to 250 head in Al-Bandan site.

The barley grains model will be determined by the “Range Incentives Committee, RIC” which will be formed in the targeted areas to be responsible for the delivery of agreed incentives. Suggested members of the proposed RIC would include: The Governor of the area, manger of the Directorate of Agriculture, Cooperatives representatives, two representatives from the technical staff of the project (veterinary, sheep production), a representative from PMU-BRP, and the Project Manager.

3.2.7.5. Activities

The main activity is subsidizing the consumption quantities of barley. Table (6) shows the quantitative of barley that will be distributed during the period 2010 until 2015.

Table (9): Quantity of barley that will be provided to the targeted livestock owners during (2011-2012)

Items	Quantities of Barley grain				
	12/2010 To 5/2011	6/2011 To 6/2012	7/2012 To 6/2013	7/2013 To 6/2014	7/2014 To 6/2015
Providing Barley grain	50,000 heads x 48 days	400,000 heads x 100	500,000 heads x 100	600,000 heads x 100	600,000 heads x 100

	x1.5kg	days x1.5kg	days x1.5kg	days x1.5kg	days x1.5kg
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3.8. Monitoring and Evaluation

The monitoring and evaluation of socioeconomic plan will include the collection of indicators for efficiency, equity and environmental sustainability. The following are the main indicators that will be monitored:

1. Livestock indicators

- Health
- Productivity
 - Milk
 - Meat
 - Wool
- Feed
- Drinking water

2. Livelihood Indicators

- Living standards
- Knowledge and education

3. Cooperatives Indicators

- Mini dairy plants
- Rangeland Management
- Level of cooperation
- Marketing
- Sustainability

4. Time table of the Integrated Watershed Management and Socioeconomic Incentive Plans of the CAP of the BRP

The time table and activities of the IWMP and SEIP are presented in Table (10A, 10B, and 10C):

Table 10A: Timetable and work plan for IWMP and SEIP of CAP during the period from 30/12/2010 to 30/5/2011.

Component	Activity	2010	2011					responsibility
		12	1	2	3	4	5	
Administration and management	Recruitment of project staff							MoA
	Contracting the partners							MoA
1. Water harvesting interventions	1.1 Hydrological assessment and topographic survey of the watershed							MoWI
	1.2 Collection of biophysical information							MoA, NCARE, MoWi, partners
	1.3 Conducting field visits to the targeted watersheds							MoA, NCARE, MoWI, partners
	1.4 Design the micro WH							NCARE
	1.5 Implementation of micro WH	150 ha (80 ha in Qasab and 70 in Bandan)						NCARE
	1.6 Implementation of check dams and WS	Topographic Survey				Construction 2000 m (1000 in Aranbah and 1000 in Qasab)		MoA
	1.7 Construction of macro WH		Detailed design		Community negotiation & tender document	2 ponds (3Construction of in Aranbah and 1 in Qasab)		MoWI
	1.8 Public awareness and field day							MoA, NCARE, MoWi, partners
								MoA, community, Rangers
2. Improvement of vegetation cover and productivity	2.1 Protection for natural recovery of rangelands							MoA, NCARE
	2.2 Plantation of fodder shrubs in micro-catchments	Drilling the pits & transportation of seedlings	Plantation & irrigation					MoA, NCARE
	2.3 Rest rotational and late grazing							MoA, community, Rangers
3.Socioeconomic activities	3.1 participation of targeted communities planned activities							MoA, NCARE, MoWi, partners
	3.2 Increasing level of awareness of the targeted communities							MoA, NCARE, partners
	3.3 Capacity Building of the staff of the veterinary services							MoA, NCARE, JUST
	3.4 Upgrading the current veterinary clinics in the target areas							MoA, JUST
	3.5 Establishing dipping facilities for external parasite control							MoA, JUST
	3.6 Providing the Mobile clinics							MoA, JUST
	3.7 Providing incentives to the livestock owners							MoA, NCARE

	3.8 Review and assess the existing marketing chains							MoA, NCARE
	3.9 Providing necessary equipments for milking and milk processing to livestock owners							MoA, NCARE
	3.10 Providing alternative sources for fuel wood							MoA, NCARE
	3.11 Organizing stockowners and increasing the role of cooperatives							MoA, NCARE
4. Monitoring and Evaluation								MoA, NCARE, MoWi, partners

Table 10B: Timetable and work plan for IWMP and SEIP of CAP during the period from 1/6/2011 to 30/5/2012.

Component	Activity	2011							2012		responsibility
		6	7	8	9	10	11	12	1-5		
1. Water harvesting interventions	1.1 Rehabilitation of water wells and improve water quality for livestock watering	Rehabilitation of Jaber Well			Rehabilitation of Hamzeh Well				Rehabilitation of Sweilmah Well		
	1.2 Implementation of micro WH						550 ha (180 Aranbah, 130 Bandan, 140 Qasab, and 100 Gelat watersheds).				NCARE
	1.3 Implementation of check dams and WS	Construction 5000 m (1000 Aranbah, 500 Bandan, 3000 Qasab, and 500 Gelat watersheds).							Construction 2000 m (Burqu watershed)		MoA
	1.4 Construction of macro WH	Construction of 9 ponds (4 Bandan, 1 Qasab, 1 Aranbah, 2 Gelat, 1 Burqu)							Construction of 4 ponds (2 Aranbah, 2 Burqu)		MoWi
	1.5 Public awareness and field day										MoA, NCARE, MoWi, partners
2. Improvement of vegetation cover and productivity	2.1 Protection for natural recovery of rangelands										MoA, community, Rangers
	2.2 Plantation of fodder shrubs in micro-catchments							Drilling the pits & transportation of seedlings	Plant ation & irriga tion		MoA, NCARE
	2.3 Rest rotational and late grazing										MoA, community, Rangers
3.Socioeconomic activities	3.1 participation of targeted communities planned activities										MoA, NCARE, MoWi, partners
	3.2 Increasing level of awareness of the targeted communities										MoA, NCARE, partners
	3.3 Capacity Building of the staff of the veterinary services										MoA, NCARE, JUST
	3.4 Establishing dipping facilities for external parasite control										MoA, JUST
	3.5 Providing the Mobile clinics										MoA, JUST
	3.6 Providing incentives to the livestock owners										MoA, NCARE
	3.7 Providing necessary equipments for milking and milk processing to livestock owners										MoA, NCARE
	3.8 Providing alternative sources for fuel wood										MoA, NCARE

	3.9 Organizing stockowners and increasing the role of cooperatives									MoA, NCARE
	3.10 Providing Improvement Rams									MoA, NCARE
	3.11 Establishment of income-generating projects									MoA, NCARE, partners
	3.12 Construction of waste water treatment plant in Al Rwaished area									MoWI
4. Monitoring and Evaluation										MoA, NCARE, MoWi, partners

Table 10C: Timetable and work plan for IWMP and SEIP of CAP during the period from 1/6/2012 to 30/5/2013, 1/6/2013 to 30/5/2014, and 1/6/2014 to 30/5/2015.

Component	Activity	1/6/2012 to 30/5/2013		1/6/2013 to 30/5/2014		1/6/2014 to 30/5/2015		Responsibility
		6-12	1-5	6-12	1-5	6-12	1-5	
1. Water harvesting interventions	1.1 Rehabilitation of water wells and improve water quality for livestock watering		Rehabilitation of dab'an 5 Well					
	1.2 Implementation of micro WH	540 ha (170 Aranbah, 130 Bandan, 140 Qasab, 50 Burqu, 50 Gelat).		470 ha (130 Bandan, 140 Qasab, 200 Gelat).		290 ha (140 Bandan, 150 Qasab).		NCARE
	1.3 Implementation of check dams and WS	Construction 2500 m (Aranbah watershed).	Construction 2750 m (1000 Burqu, 1250 Qasab, and 500 Gelat watersheds).	Construction 2750 m (Qasab watershed)	Construction 2500 m (1000 Qasab, 1500 Gelat watersheds).	Construction 2500 m (Gelat watersheds).	Construction 1000 m (Bandan watershed).	MoA
	1.4 Construction of macro WH	Construction of 7 ponds (5 Burqu, 1 Qasab, 1 Aranbah)	Construction of 8 ponds (2 Bandan, 3 Qasab, 3 Gelat)	Construction of 7 ponds (1 Burqu, 2 Aranbah, 2 Bandan, 2 Qasab)	Construction of 9 ponds (5 Burqu, 2 Gelat, Aranbah 2)			MoWI
	1.5 Public awareness and field day							MoA, NCARE, MoWi, partners
2. Improvement of vegetation cover and productivity	2.1 Protection for natural recovery of rangelands							MoA, community, Rangers
	2.2 Plantation of fodder shrubs in micro-catchments	Drilling the pits & transportation of seedlings	Plantation & irrigation			Drilling the pits & transportation of seedlings	Plantation & irrigation	MoA, NCARE
	2.3 Rest rotational and late grazing							MoA, community, Rangers
3. Socioeconomic activities	3.1 participation of targeted communities planned activities							MoA, NCARE, MoWi, partners
	3.2 Increasing level of awareness of the targeted communities							MoA, NCARE, partners
	3.3 Capacity Building of the staff of the veterinary services							MoA, NCARE, JUST
	3.4 Establishing dipping facilities for external parasite control							MoA, JUST
	3.5 Providing the Mobile clinics							MoA, JUST
	3.6 Providing incentives to the livestock owners							MoA, NCARE

	3.8 Providing necessary equipments for milking and milk processing to livestock owners							MoA, NCARE
	3.9 Providing alternative sources for fuel wood							MoA, NCARE
	3.10 Organizing stockowners and increasing the role of cooperatives							MoA, NCARE
	3.11 Providing Improvement Rams							MoA, NCARE
	3.12 Establishment of income-generating projects							MoA, NCARE
	3.13 Construction of waste water treatment plant in Al Rwaished area							MoWI
4. Monitoring and Evaluation Component								MoA, NCARE, MoWi, partners

Appendix 1: Proposed Ponds/dams in the Targeted Watersheds

Appendix 1A: Proposed ponds/dams in the targeted watersheds for the period from 1/12/2010 to 30/4/2011.

Pond #	Pond/Dam Name	Capacity (1000m ³)	Pond coordinate		Wadi Name	Watershed Name	Date of Construction	Cost (1000\$)
			North	East				
60	Duekhlet Steeh	100	°32.5744	°38.6267	Doikhlet Steeh	Al-Qasab	11/2010 – 4/2011	141
-	Aranbeh	50	°32.2721	°37.0435	Al-Luhfi	Aranbeh	11/2010 – 4/2011	141
22	Al-Luhfi	50	°32.1903	°37.1969	Al-Luhfi	Aranbah	1/2012 – 4/2012	141

Appendix 1B: Proposed ponds/dams in the targeted watersheds for the period from 1/5/2011 to 30/6/2012.

Pond #	Pond/Dam Name	Capacity (1000m ³)	Pond coordinate		Wadi Name	Watershed Name	Date of Construction	Cost (1000\$)
			North	East				
-	Tal'et Salman Al-Sufly	100	°32.5165	°38.6683	Tal'et Salman	Al-Qasab	5/2011 – 12/2011	141
51	Abu Hefneh	100	°32.2356	°38.2313	Abu Hefneh	Al-Bandan	5/2011 – 12/2011	141
-	Al-Badan	100	°32.3492	°38.1573	Abu Hefneh	Al-Bandan	5/2011 – 12/2011	141
50	Hefaish	100	°32.4448	°38.188	Hefaish	Al-Bandan	5/2011 – 12/2011	141
-	Marab Amesh Dam	100	°32.2874	°37.0358	Al-Luhfi	Aranbah	5/2011 – 12/2011	212
-	Al-Biss	50			Al-Biss	Al-Gelat	5/2011 – 12/2011	71
33	Marab Al- Muhdith	100	32.3491	37.8786	-	Borqo'	5/2011 – 12/2011	141
52	Omm Mahfor	100	31.9457	38.2295	Dumethat Omm Mahfor	Al-Bandan	5/2011 – 12/2011	141
61	Al-Twayya	100	31.2429°	36.2213°	Al-Twayya	Al-Gelat	5/2011 – 12/2011	141
17	Al-Luhfi 2 Dam	200	°32.2719	°37.118	Al-Luhfi	Aranbah	1/2012 –6/2012	212
23	Hlahel	100	°32.2781	°37.3795	Hlahel	Aranbah	1/2012 –6/2012	141
37	Marab Al- Khodary	100	°32.6432	°37.8263	Al- Khodary	Borqo'	1/2012 –6/2012	141
38	Tal'et Z'leh	100	°32.6767	°37.8206	Northen Tal'et Za'leh	Borqo'	1/2012 –6/2012	141

Appendix 1C: Proposed ponds/dams in the targeted watersheds for the period from 1/7/2012 to 30/6/2013, 1/7/2013 to 30/6/2014, and 1/7/2014 to 30/6/2015

Pond #	Pond/Dam Name	Capacity (1000m ³)	Pond coordinate		Wadi Name	Watershed Name	Date of Construction	Cost (1000\$)
			North	East				
39	Marab Al- Khodary 2	100	°32.6853	°37.8553	Inside the Khodary Marab	Borqo'	7/2012 – 12/2012	141
40	Marab Al- Khodary dam	250	°32.6679	°37.8897	Outlet of Khodary Marab	Borqo'	7/2012 – 12/2012	282
41	Al-Faidah	50	°32.5765	°38.2481	Al-Roished	Al-Qasab	7/2012 – 12/2012	71
18	Rajel Dam 2	250	°32.3777	°37.1726	Rajel	Aranbah	7/2012 – 12/2012	212
46	Al-Mo'zalia 1	50	33.1224	38.6608	Freaja	Borqo'	7/2012 – 12/2012	71

47	Freaja	50	33.1598	38.5616	Freaja	Borqo'	7/2012 – 12/2012	71
48	Al-Mo'zalia 2	50	33.1317	38.7504	Freaja	Borqo'	7/2012 – 12/2012	71
34	Al-Gossain 2	100	°32.4065	°37.9984	-	Al-Bandan	1/2013 – 6/2013	141
35	Mgatt	100	°32.4635	°38.0343	Al-Mahdath	Al-Bandan	1/2013 – 6/2013	141
55	Al-Qasaib 1	100	°32.2744	°38.8677	Al-Roished	Al-Qasab	1/2013 – 6/2013	141
56	Al-Qasaib 2	100	°32.3315	°38.7065	Al-Roished Al-Qasaib	Al-Qasab	1/2013 – 6/2013	141
	Al-Gelat Dam	50			Al-Biss	Al-Gelat	1/2013 – 6/2013	71
54	Wadi Mahfoor	100	32.1105	38.8743	Mahfoor	Al-Qasab	1/2013 – 6/2013	141
-	Um Khurma	100	31.2309°	36.1214°	Um Khurma	Al-Gelat	1/2013 – 6/2013	141
-	Abu shawamer	100	31.1656°	36.3332°	Abu shawamer	Al-Gelat	1/2013 – 6/2013	141
36	Khoimat	100	°32.5532	°37.8891	Al-Ga'a	Borqo'	7/2013 – 12/2013	141
24	Al-Ga'a	100	°32.2098	°37.3998	Al-Ga'a	Aranbah	7/2013 – 12/2013	141
57	Abu Hefneh	100	°32.2914	°38.5335	Abu Hefneh	Al-Bandan	7/2013 – 12/2013	141
58	Al-Qasaib 3	100	°32.4339	°38.5538	Al-Roished	Al-Qasab	7/2013 – 12/2013	141
59	Tal'et Salman	100	°32.4953	°38.7752	Tal'et Salman	Al-Qasab	7/2013 – 12/2013	141
21	AL-Jothom Dam	300	32.5610	37.3587	AL-Jothom	Aranbah	7/2013 – 12/2013	300
53	Omm Tweiss	100	32.0156	38.5128	Dumethat Omm Toeiss	Al-Bandan	7/2013 – 12/2013	141
42	Al-Resheh 1	50	°32.8034	°38.0599	Al-Resheh	Borqo'	1/2014 – 6/2014	71
43	Al-Najaili 1	50	°32.8809	°38.1371	Reshet Al-Najaili	Borqo'	1/2014 – 6/2014	71
44	Al-Najaili 2	50	°32.9711	°38.3796	Reshet Al-Najaili	Borqo'	1/2014 – 6/2014	71
45	Al-Resheh 2	50	°32.8618	°38.3856	Al-Resheh	Borqo'	1/2014 – 6/2014	71
49	Um Tarafat	50	°32.7924	°38.5653	Reshet Um Tarafat	Borqo'	1/2014 – 6/2014	71
19	Al- Fahda	30	32.2083	37.2311	Rajil	Aranbah	1/2014 – 6/2014	50
20	Abu Torfa	20	32.2572	37.3793	Abu Torfa	Aranbah	1/2014 – 6/2014	30
5	Makhroq 2	100	31.1719°	36.8412°	Makhroq	Al-Gelat	1/2014 – 6/2014	141
9	Al- Tharwa	100	31.1581°	36.7396°	Al- Tharwa	Al-Gelat	1/2014 – 6/2014	141