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IMPLICATIONS OF BULK WATER TRANSFER ON LOCAL WATER MANAGEMENT INSTITUTIONS

A Case Study of the Melamchi Water Supply Project in Nepal

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ABSTRACT

To mitigate a drinking water crisis in Kathmandu valley, the Government of Nepal initiated the Melamchi Water Supply Project in 1997, which will divert water from the Melamchi River to Kathmandu city's water supply network. In the first phase, the Project will divert 170,000 cubic meters of water per day (at the rate of 1.97M3/sec), which will be tripled using the same infrastructure as city water demand increases in the future. The large scale transfer of water would have far-reaching implications in both water supplying and receiving basins. This paper analyzes some of the major changes related to local water management and socio-economics brought about by the Project and in particular the changes in the local water management institutions in the Melamchi basin. Our study shows that traditional informal water management institutions were effective in regulating present water use practices in the water supplying basin, but the situation will vastly change because of the scale of water transfer, and power inequity between the organized public sector on one side and dispersed and unorganized marginal water users on the other. The small scale of water usage and multiple informal arrangements at the local level have made it difficult for the local users and institutions to collectively bargain and negotiate with the central water transfer authority for a fair share of project benefits and compensation for the losses imposed on them. The process and scale of project compensation for economic losses and equity over resource use are at the heart of the concerns and debates about the Melamchi water transfer decision. The Project has planned for a one-time compensation package of about US$18 million for development infrastructure related investments and is planning to share about one percent of revenue generated from water use in the city with the supplying basin. The main issues here are what forms of water sharing governance, compensation packages, and water rights structures would emerge in relation to the project implementation and whether they are socially acceptable ensuring equitable distribution of the project benefits to all basin communities. In addition, these issues of the Melamchi project discussed in this paper are equally pertinent to other places where rural to urban water transfer projects are under discussion.

Keywords: Institutional Impacts, Water Transfer, Melamchi Water Supply Project, Urban Water Supply, Water Rights, Local Water Management Institutions, Kathmandu, Nepal

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1. INTRODUCTION

To mitigate the drinking water crisis in Kathmandu city, which has resulted from the combined effects of inadequate water supply, increased water demand, and poor management of the available water resources, the Government of Nepal initiated the Melamchi Water Supply Project in 1997. This multi-purpose project aims at diverting water from the Melamchi River—located in upstream Mahabharata range—to the water supply network of Kathmandu valley[2], and includes substantial rehabilitation and improvement of the valley water supply services and management. In the first phase, the Melamchi Project plans to divert 170 Million Liter/day (at the rate of 1.97 m^3/sec, or 170,000 M^3/day), through a 26 km long tunnel to be built in the Shivapuri hills, North of Kathmandu. The project envisages tripling the volume of water transfer using the same tunnel infrastructure as city water demand increases, with the ambitious plan of meeting the city water demand for the coming 25 years. The planned project cost is of about US$464 million, to be completed by 2008/9[3]. The first phase of the project represents a case of both an intersectoral and an interbasin water transfer[4]. The project will, because of its scale and size, have large impacts on local water management and common property institutions in the Melamchi basin, the water supplying basin. This paper analyzes the implications of this project on local water institutions and local livelihoods in the Melamchi basin communities, and the related key public policies involved in a bulk water transfer project such as the Melamchi Project.

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[1] Corresponding author: madhu.bhattarai@netra.avrdc.org.tw.

[2] Kathmandu valley includes three major urban centers, Kathmandu, Lalitpur and Bhaktapur adjoining to each other. This Melamchi Water Supply Scheme (MWSP) is planned to serve the all water supply network of the Kathmandu vale, as well as newly developed peri-urban places in the valley.

[3] According to the recent communication from the Melamchi Project authority and others involved in the project, it is likely that the project will be delayed by more than 5 years of the scheduled time; this also means a substantial increase on the planned project costs. Recently, there are several other conflicts on implementing the project between Nepal government and ADB/Manila in relation to the privatization of the city water supply agencies. The tendering process adopted for privatization and contractual obligation of Nepal government and ADB/Manila—fixed in the late 1990s as per the circumstances of the mid 1990s—are being reviewed and reassessed in 2007. In fact, the Melamchi Project is so far one of the most debated water projects in Nepal.

[4] This project is intersectoral water transfer because water is being diverted from rural to urban uses, and it is also interbasin transfer as water is being diverted from the Koshi river to Bagmati river basin. Both river basins are part of the greater Ganga basin of the Indo-Gangatic plain.

This project is an example of a rapidly growing trend of intersectoral water transfer from a rural area to meet the burgeoning urban demand for water. In developing countries where the history of water transfer is not long, such large scale water transfer is managed and overseen by the Government. Although there are examples of water markets in South Asia, institutions that are targeted for managing the bulk water transfer across both sectors and basins are at an early, yet rapidly evolving phase. For example, in the last decade water markets were established in some parts of Tamil Nadu, a state with severe water-scarcity in India (Moench et al., 1999). There are major institutional and policy concerns related to large-scale water transfer projects such as equitable sharing of the resource, environmental justice, and overall technical and economic viability of the project itself. The public policy issues and concerns of intersectoral water transfer also vary by the scale of the project, location, relative water scarcity level, and institutional mosaic in the region (for case studies in South Asia see Moench et al., 1999). Bulk water transfer from rural to urban area also involves reallocating a high value resource from poor rural to relatively better-off urban regions in a country.

Taking a case study approach, this paper illustrates the ramifications of a bulk water transfer on local water management institutions in the water supplying basin, and related public policy issues. In particular, it evaluates some of the socioeconomic, hydrological, water management, and livelihood implications of the Melamchi Project on the water supplying basin. This includes discussing the distribution of the project benefits across the basins, but also looking at water rights issues at local level and an assessment of the project's planned compensation package. Finally, this study summarizes policy concerns and lessons on intersectoral and interbasin water transfers in the context of developing countries, particularly with the focus on threats to local resource management practices, compensation of local users and the processes involved in this.

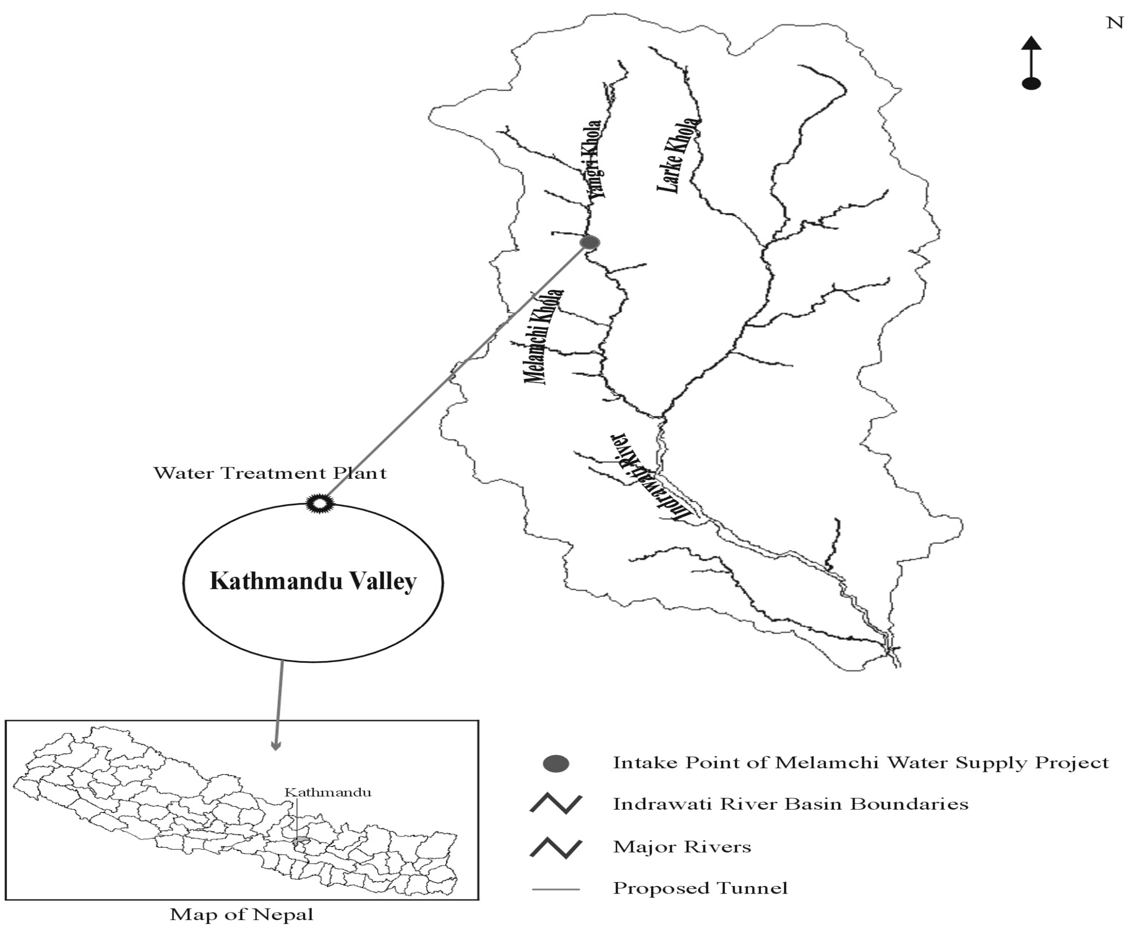
The field study in Melamchi basin was conducted using participatory methods. The primary data collected from series of short case studies in the Melamchi basin were later supplemented by information drawn from secondary sources. This was done by reviewing past studies and project documents in relation to this project and other related water resources documents in the area. The review also includes a detailed assessment of relevant government documents and gray literature, policy notes (regulations), and news on the Melamchi project published in the national media over the last decade.

Following this introductory section, the second section of the paper briefly introduces the different components of the project. The third section describes the hydrological and socioeconomic situation of the water exporting region. The fourth section provides a brief overview of the laws regarding water rights and how they evolved, and the implications of the project on water rights in the Melamchi river basin. The fifth section analyzes the costs and benefits to both donor and recipient communities and the effects of the project on the livelihoods of local people. The sixth section discusses the proposed compensation mechanism, and the last section provides a synthesis and our conclusion of the study.

2. PROJECT DESCRIPTION[5]

The Melamchi Water Supply Project (MWSP) is a interbasin and intersectoral water transfer project designed to meet the long term (over 30-40 years) water demand of three major cities of Kathmandu Valley (located in Bagmati basin) by diverting water from the Melamchi River located upstream of the adjoining Indrawati basin (part of the Koshi River). This is done by constructing a 26 km long tunnel along the Shivapuri range, with the capacity of 6m3/sec. In addition to infrastructure development, the project also plans for a comprehensive governance reform of the drinking water supply system of Kathmandu valley, which comprises the three major urban centers of the Kathmandu metro area (Kathmandu, Lalitpur, and Bhaktapur) and other smaller town centers in the valley. The location of the project intake and sketch map of water transfer is shown in Figure 1.

Figure 1. Catchment area of Indrawati River basin showing the Melamchi River and schematic diagram of water flow to Kathmandu valley and its location in Nepal



Source: Devised by authors

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[5] This short project description is based on the recent update and publications of the project.

The MWSP comprises three main components:

1. Physical Infrastructure Development. This includes the development of infrastructure facilities such as physical intake and river diversion structures, a 26 km long tunnel, 25 km access road to the tunnel sites, 15 km of main access road to the project intake site, 22 km of approach road, a water treatment plant with a capacity of 170,000 m3/day in Kathmandu, bulk distribution systems (transmission pipe lines and reservoirs in the Kathmandu valley), improvement of the city water distribution network and its wastewater system, including the construction of wastewater treatment plants in the city.
2. Social and Environmental Support. This includes project compensation programs in the Melamchi basin, which are grouped into three major categories: a) Social Upliftment Programs (SUP) for the Melamchi valley, b) Resettlement Action Plan (RAP), and c) Environmental Management Plan.
3. Institutional Reforms. This includes reforming the present institutional and management framework thus improving the governance of the Kathmandu city water distribution system (HMG/N 2004). The major proposed institutional changes are: (a) promulgation of the Municipal Water Services Act, (b) establishment of the Kathmandu Valley Water Authority to become the owner of assets and to develop and implement policies for water supply and waste water services, (c) Amendment of the Water Resources Act from 1992, (d) formation of the Groundwater Authority, (e) Groundwater licensing in the Kathmandu valley, (f) establishment of the National Water Supply Regulatory Board, which will have the tasks to fix the water tariff and supervise the water authority and other agencies, and (g) the private sector led management of Kathmandu valley water supply.

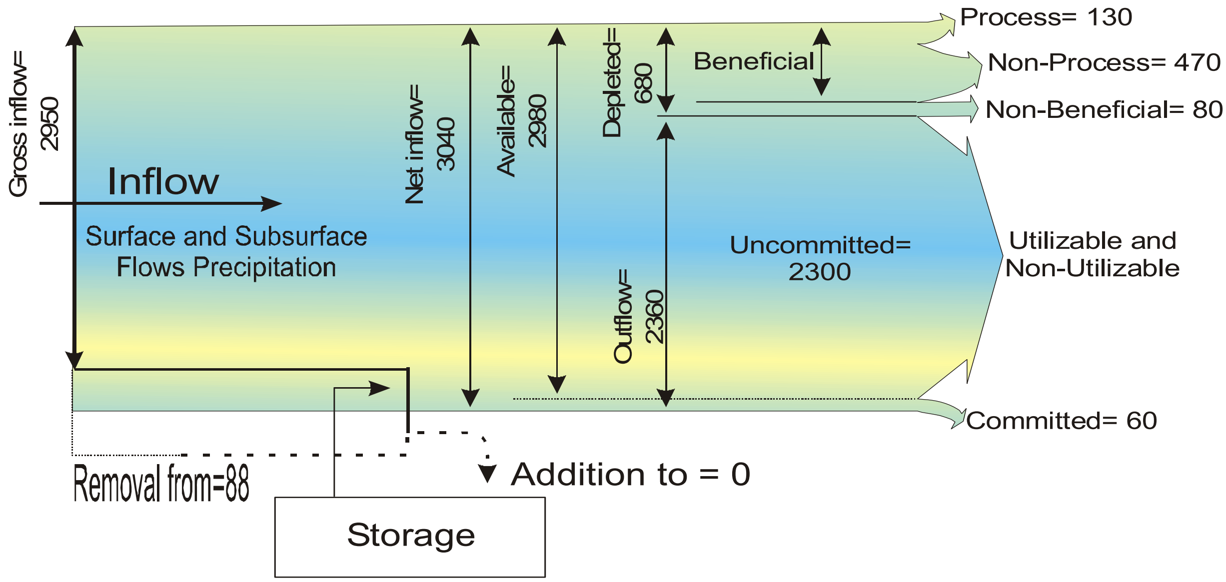
3. CHARACTERISTICS OF THE WATER EXPORTING BASIN: MELAMCHI RIVER[6]

Hydrological

The Melamchi water basin is a subsystem of the larger Indrawati basin, adjoining the Bagmati river basin, the water receiving basin. The Melamchi River has a catchment area of 330 km^2 up to the Melamchi Bazaar area. A water accounting analysis conducted for a period of 20 years (1971-1990) for the basin shows that forestry accounts for most of the water consumption in the basin. The analysis presented in Figure 2 shows an overall scenario of water use in the sub-basin with and without the Melamchi water supply scheme.

[6] A key feature of the Melamchi River in relation to the project impact is reported here. For detailed discussions, see Bhatarai et al., 2002 and Mishra, 2001.

Figure 2. Finger diagram showing water account result in the Indrawati River Basin for dry year (unit in million cubic meters)



The average water flow in the Melamchi basin is about 10 m^3/sec per year, and the planned water diversion of 1.97 m^3/sec amounts to 62 million m^3 per annum, which is about 10 percent of the average annual river run-off in the Melamchi sub-basin (613 MCM)[7]. However, measuring the water diversion on an annual basis means little in terms of availability of water for the critical period of the dry season, because of high seasonal fluctuation in water level. This is because over 80 percent of the water flows within 3-4 months of the monsoon, as illustrated in Figure 3.

The monthly average river flow in the Melamchi River is no doubt higher than the planned water diversion. However, the average river flow drastically reduces during the dry season from January to May, when the demand for water is high in both the water supplying basin as well as in the recipient basin. The average river flow in the Melamchi River is more than 50 m^3/sec during the three months of the peak monsoon season (between July and September) as shown in Figure 3. But, the river flow reduces to a level of 4-5 m^3/sec during January to April. This is also the time when the water scarcity is acutely felt in both the Melamchi basin community (for dry season paddy irrigation, micro-hydro, and other uses) and the city water supply system in Kathmandu. After completion of the project, the water flow in the immediate downstream of the Melamchi River would reduce significantly during December to May (see Figure 3).

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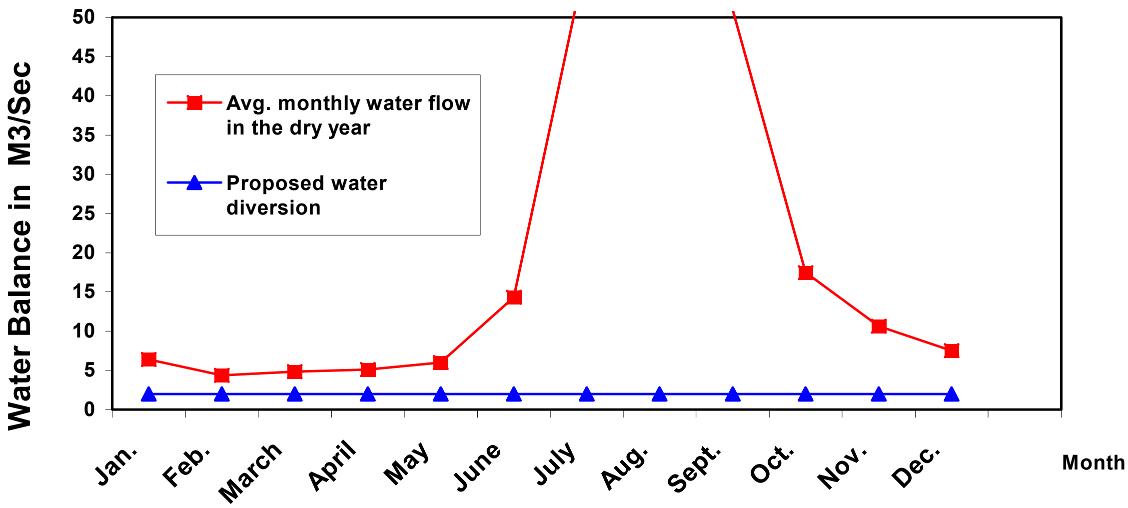
[7] In the second and third phase of the water transfer project, there is another plan to divert water form Yangri and Larke Khola (rivulets) to the same project intake point to augment the water supply in the Melamchi River (see figure 2); detailed discussions are in Bhattarai, et al. 2002; and in Mishra 2001.

Figure 3. Average monthly water flow in the Melamchi River sub-basin, and water balance at the project intake site after proposed water diversion



The project is designed to leave a minimum of 0.4 m^3/sec as an environmental flow for aquatic life downstream[8] (IUCN, 1999). This level was set by the project authority to meet the natural ecosystem requirements. The aggregate flow specified in the project document, however, reflects neither the temporal and spatial variations of water availability nor the "actual water uses/scarcity" scenario for various uses downstream. Some of the physical characteristics of the Melamchi River basin are summarized in Appendix 1.

Socio-Economic Features

The total population in Indrawati basin is about 40,000 (Rajkarnikar, 2000). Compared to the total annual water flow in the basin, the water requirements for the basic drinking needs of the basin community is minimal. In fact, for the drinking water, the communities depend mostly on 1-2 springs and river tributaries located upstream of the community (settlement) but not on the river itself. A majority of the farmers in the area are marginal farmers with subsistence farming dependent livelihoods, and only 12 % of the households own more than one hectare of farm land (Pun, 2001). During the dry season (January to May) the water flow is low and water scarcity is already felt. The project diversion may therefore adversely impact farmland located immediately below the water diversion point. The intensity of the impact, however, will also depend on the capacity and speed of the farming community to adjust to a new cropping pattern suitable to the low level of water supply.

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[8] There is uncertainty among the stakeholders and the water users downstream about the water availability to them after the project diversion. Information on minimum level of water to be released downstream of project intake point varies by the project documents, and the project authority has not specified it clearly to the basin communities as well.

Cropping pattern

The farmers in the lower part of the basin (*lower phant*) harvest three crops a year (main season paddy, wheat/potato, and spring paddy), whereas those residing at the higher elevation can grow only two crops (main season paddy and wheat/potato) a year. The spring paddy in the lower elevation is of significant importance for tenant farmers' livelihoods. The main season paddy production is mostly used for paying land rent to the land owner but the spring season produced paddy is retained as a tenant's share. Against the background of higher seasonality of water availability and huge implications of the project on community livelihoods, the next section will illustrate the current water rights system and the prevailing local water management institutions in the Melamchi basin.

4. WATER RIGHTS AND WATER MANAGEMENT INSTITUTIONS IN THE MELAMCHI AREA

Rights to use water in Nepal are governed by customary and statutory laws. The customary right over water is acquired through years of usage, whereas the statutory laws are approved by Parliament. An overview of the provisions of these water laws and how these laws have evolved over the years in Nepal are discussed below.

Overview on Changes on Water Rights Structures in Nepal: Historical Perspectives

The first concerted effort by the state to regulate social systems and resource management in Nepal was the promulgation in 1854 of the *Muluki Ain*[9]*,* the National code, to be applied throughout the country. Although the early versions of the *Ain (code)* had several provisions to regulate land rights but very few provisions concerning water rights, the later amendments (of 1952 and 1963) have increasingly dealt with the issues of water rights. The *Muluki Ain* of 1963 dealt with the issues of water allocation among several cultivators, construction of the new canals and responsibility for the maintenance of the canals. It accorded the first rights to appropriate water from a common water source to persons who invest resources for appropriation (constructed irrigation canals, water diversion structures, etc.). It also stipulated that irrigated fields that have been traditionally getting water should not be deprived of water by any other water project coming later on; and linked irrigation rights to land rights. The different versions of the

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[9] The *Mulki Ain* is a "public act" which formalizes different practices and norms on sharing resources (natural resources and other resources) in the country. The *Muluki Ain* of 1854, the first legal code introduced and practices in Nepal, combined ancient Hindu sanctions and customary laws and fundamentals of common laws, and was also then modeled on the British and Indian codes. This act codified rules of behavior that had evolved over the centuries in Nepal, particularly among the dominant communities residing in the Kathmandu Valley at that time such as Newars, Ranas, upper class chetris and Thakuri, and Bahun. In terms of irrigation cost sharing, the amendment *of Muluki Ain* in 1952 stated "tenants could be evicted from the land if they fail to contribute labor for repair of canals". This was again amended in 1963 stipulating that registered tenants cannot be evicted from the land even for their failure to contribute labor for repair and maintenance of irrigation systems. (Khanal and K.C., 1997)

Muluki Ain do not clearly state whether riparian rights or prior appropriation rights should be given priority when distributing water across users.

Other Acts promulgated by the government in relation to water rights and allocation of water resources are: The Canal Act of 1961; The Canal, Electricity, and Related Water Resources Act of 1967; Water Resources Act of 1992. By promulgating these several Acts the state has increasingly asserted its right over the water resources. The Canal Act of 1961 exclusively dealt with irrigation, in particular with state constructed irrigation systems. Through this Act, the state attempted to claim the ownership right of water sources and the canal structures. This Act also states that farmers cannot establish rights to continue using water from a government canal only on the basis of customary usage. Through the Canal, Electricity and Related Water Resources Act of 1967 the government further attempted to control and regulate water sources. The Act of 1967 made clear that individual and private water rights are secondary to the rights of the state.

The Water Resources Act of 1992 is the first attempt to comprehensively address the use of available water resources in the country. At present, most of the policy directives and regulations of water resources agencies are guided by this act, which has in fact also vested the ownership of all the water resources present in the country to the state. Under this act, state is owner of all water resources. It also stipulates the requirement of licenses for bulk use of water resources except for purposes explicitly exempted by the Act. For the first time, it lays down priority order in water use. Drinking water and domestic use has highest priority followed by irrigation, agricultural uses, animal husbandry and fisheries, hydroelectricity, cottage industry, industrial enterprises, navigation and recreation uses. The Water Resources Act of 1992 has also recognized value of Water Users' Associations (WUA) in managing the water resources and it provides a legal basis to WUAs in managing the available water resources locally. A registered WUA can become a legal entity and the government can hand over the ownership of water related infrastructure it has developed to a WUA.

In addition to these statutory laws, customary laws coexist and also govern the water use at local level. For example, in most places of Nepal, customary law prohibits the construction of new canals up to a certain distance upstream of existing canals if water supply for the latter is going to be reduced significantly after the construction of the new canal (Pradhan, 2000; Pradhan et al., 1997). Generally, water rights in Nepal are secured through (Khadka, 1997):

- Use rights acquired by investing in infrastructure.
- Riparian rights that are based on the location of the land in relation to the canal.
- Customary use rights and prior appropriation rights.
- Use rights acquired through licenses with the aim to develop water resources for a specific purpose.

In Nepal, the conventional norm of property rights in irrigation water includes principles by which both the water distribution and the responsibilities for maintenance among individuals are governed (Yoder, 1994; Pradhan et al., 1997). Collective decisions and actions of users define incentives in proportion to the level of contribution to irrigation development.

Generally, water rights for irrigation are closely linked with land rights, and individuals without land rights are not entitled for irrigation rights as well. In this system, the rights to use water lie with the riparian land owners. The water rights go along with the land rights, either to the offspring or whoever gets the ownership of the riparian land. Water rights are also linked to the tenure system. All the cultivators, whether land owner or tenant farmer, who contribute resources (cash, labor, or kind) for system development, repair and maintenance, hold water rights.

Water Rights Structure in the Water Supplying Basin and Implications of MWSP

Previous studies in Nepal (Dixit, 1997; Pant and Bhattarai, 2001) and in other countries of Asia (see Meinzen-Dick and Pradhan, 2002; Moench, et al., 1999; Bruns and Meinzen-Dick, 2000) have demonstrated that the underlying structures of water rights are critical for assessing the implications of water reallocation decisions. This is also important for determining the level of project compensation in this respect (see, WCD, 2000). In this section, we summarize water rights structures commonly adopted in the Melamchi basin, and implications to water transfer decisions. Water rights in the Melamchi basin are generally governed in three ways, such as:

(a) customary practice based on prior use,
(b) physical position of the agricultural plots (priority for head-enders), and
(c) social norms (based on social needs and value).

Customarily, no new irrigation system can be constructed within 100 meter upstream of the existing intake, unless there is sufficient flow in the river to feed both systems. This is similar to the prior appropriation rights for allocation of the water resources.[10] The most common prevailing customary basis for claiming water rights in the basin are: contribution for the construction of the infrastructure; land holding in thee command areas; buying of water rights from others (Pradhan, 1989).

The social norms of the area accord higher priority on water uses for irrigation followed by *Ghattas*—the water-operated stone wheel for grinding grains—and water mills, which use water-operated turbines for grinding grains and extracting oil from oilseeds. The installation of micro-hydro plants for rural electrification, in recent years, has in fact also reemphasized the higher importance of communal water rights over other minor private water rights. .

At present, water from the Melamchi River is used for multipurpose uses. Some of the major water uses are shown in Figure 4. In recent years, some new water activities such as creation of micro-hydro power plant and water mills have been emerged in the basin area. Local communities have so far managed the allocation of water for various uses, following traditional practices. They have also devised complex water sharing mechanisms to deal with scarcity of water, especially during the lean water supply period from December to May. The users' adherence to their customary practices has been so far effective in containing conflicts between the systems in the Melamchi area. However, it is not clear how

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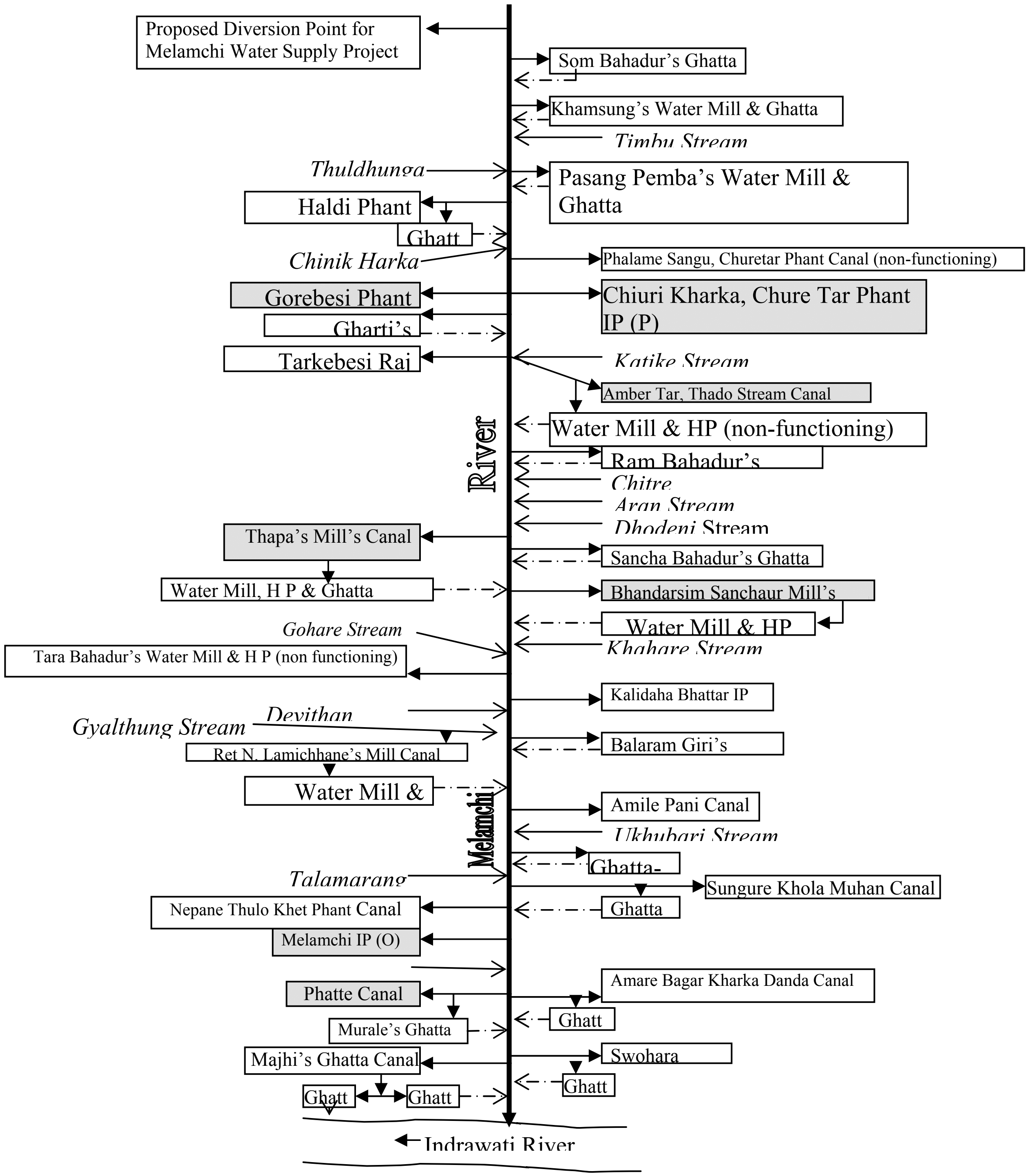
[10] In fact, this customary practice adopts mix of both riparian and prior appropriation based water allocation.

the roles and effectiveness of these institutions will be modified after a major portion of water is transferred out of the basin by the project.

Figure 4. Flow Diagram of Melamchi Khola



Explanatory Note: Ghatta - Traditional water mill used for milling grains; Water Mill - Improved turbine type water mill used for several purposes including milling/grinding of grains; IP – Irrigation Project; (P) – Planned; (O) – Ongoing ; HP – Hydro Power.

Although customary practice would undeniably grant access to the river's water to the current users, the enactment of Water Resources Act of 1992 has bestowed all the rights of water to the central government, which can decide how it allocates the water. The 1992 Water Act recognizes only the use right on water uses but not the ownership right of the local communities, unlike in other countries, where ownership rights are also usually exercised by the water users. For example, the legislative provision in State of Nevada in the United States prohibits inter-state water transfers that impact the current water rights (Booker et al., 1998). In the case of the Melamchi project, the government has decided to give the authority to decide on the water transfers to a government subsidiary managing the water supply in the Kathmandu valley. The water transfer may bring several changes in the water rights structures in the basin, some of them are summarized below.

Customary vs. acquired water rights

Bulk water transfer will have implications on water users who have acquired rights now from customary norms (or based on the traditional practices). In some cases in the Melamchi basin, the same canal water is used for irrigation, running micro-hydro, and water mills. Both the micro-hydro users and the mill owners have obtained the water use right from farmers by priori negotiations and investment in major repair and maintenance of the canal. Micro-hydros, in addition to providing economic and social benefits to the community, have also provided new investment opportunities such as electricity based small cottage industry, electricity operated water mill, household use electricity related appliances, etc.

In the scenario of reduced availability of water after the water diversion by the project, the micro-hydro users may have to forgo their newly acquired water rights from the irrigation users, as the low flow in the canal might not be sufficient to simultaneously running micro-hydro as well as irrigating the fields, especially during the dry season. The project could potentially thus affect the micro-hydro users downstream of the project intake site and their livelihoods. In case the micro-hydro users decide not to forgo the electricity use then they may have to reduce water use for water mills and irrigation (for more details, see Bhattarai et al., 2001).

Negotiated rights

Mill owners are another group of current users who will be potentially adversely affected from the water transfer decision. The mill owners negotiate water rights for milling with the farmers, and the mill owners' rights are secondary as they have to close down the mill and let the farmers irrigate the field during the time of low-flow in the river. Even before water is transferred by the project, there is water scarcity in certain locations downstream during the dry season.[11] The planned diversion of water will thus affect operation of the water mills and it will impose direct economic costs to the mill owners, as they do not have '*de jure'* right.[12] In the case of reduced operation days of water mills, some of these households may have to travel to nearby villages to obtain mill services, unless the water operated turbines can be replaced by other power sources such as electricity, or diesel.

Land-based rights

The water rights in the basin, as in other parts of Nepal, are largely linked to land rights, wherein the first priority of water use is assigned to irrigation. In this context, the water diversion by the project will have large equity implications with respect to benefit sharing between land owners and tenants, who are usually landless cultivators; and between irrigation users in general versus other water users. The livelihoods of the basin community are largely dependent on the success of farming. A reduced availability of water for irrigation during the spring also means reduced opportunities for employment in the farming sector, and thus an overall loss of employment in the community if other alternatives are not provided in time. This is of significant importance in a remote mountain area like the Melamchi basin with already very limited employment opportunities in the area, and the only remaining option for these tenants and farm laborers would be to migrate to the nearby cities like Banepa or Kathmandu. The diversion of water by the project may lead to loss of agricultural income during the spring season, and of overall income of tenant farming households and farm laborers, unless other income generating opportunities are provided (for details on loss of farm income, see Bhattarai et al., 2005).

Non land-based rights

The prior water use right of *Ghatta* owners*,* although recognized in the community, is usually not enforced in practice during the lean season of water supply largely due to their lower social status and economic power in the community compared to the irrigated farmers and other well to do households. The *Ghatta* owners usually cannot assert their right against the powerful irrigation users. Given the situation now, the *Ghatta* owners' livelihoods will be adversely affected if not enough water is ensured at the downstream of the intake point.

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[11] Despite plenty of water flows during the monsoon, there is a seasonal water scarcity in this remote mountain of the Melamchi basin largely due to low level of water control structures available there now (e.g. water dams).

[12] Water mills in the area are usually installed under bank loan scheme, thereby the lost income in the dry season caused by the Melamchi water transfer may adversely affect the mill owners' repayment capacity.

The prior water use right of *Ghatta* owners, although recognized in the community, is usually not enforced in practice during the lean season of water supply largely due to their lower social status and economic power in the community compared to the irrigated farmers and other well to do households. The *Ghatta* owners usually cannot assert their right against the powerful irrigation users. Given the situation now, the *Ghatta* owners' livelihoods will be adversely affected if not enough water is ensured at the downstream of the intake point.

Melamchi Project Implementation and Local Participation

In the Melamchi basin, water use is mostly based on informal arrangements among water users. These informal arrangements are working well at the local level, so until today there was no need to formalize these allocation rules, because of the small scale of activities and adherence to the customary practices among the water users. However, it is likely that this situation will not continue to exist for a long time, as some informal water management institutions are already threatened in their existence because of the external shocks induced by the project.

The involvement of the informal water institutions and local elected bodies was very limited during the project design phase, especially with regards to the project compensation schemes. However, NGO participation, through development of an NGO Participation Plan (NGOPP), is recently being encouraged for implementation of the Social Upliftment Programme (SUP) as part of the project, in coordination with the concerned Village Development Committees (VDCs) and District Development Committees (DDCs).

This, in fact, is an acknowledgement of the significant role of NGOs and local communities in project implementation, and is a positive sign in bridging the gap between the local people and the project management. Inclusion of civil society and local institutions in the construction and implementation of such large-scale water development projects is rarely practiced in Nepal, thus making the norms for local participation developed in this project significant in many ways.

5. ECONOMIC IMPLICATIONS OF WATER TRANSFER DECISION

Project Benefits to the Kathmandu City

Our rapid assessment shows that there will be considerable economic benefits from the project for the urban residents of Kathmandu valley. For example, the economic value of the additional water transferred from Melamchi to the valley after the diversion, will be in the range of about US$22 million per year during the first phase of the project.[13] When the project starts to operate at its full capacity by 2015 (i.e.,

[13] This is based on water service fees of US$0.40/$M^3$ (or Nepali Rs. 30/M^3 in constant price of 2000) as set in the Melamchi Project implementation plan, and after reforms in the city's water management institutions. This annual project benefit is derived under assumptions of about 10 % of distribution losses in the city's supply network and after privatization of the city water supply scheme, and improved management of water supply scheme. Rehabilitation of the existing water supply scheme and reduction of water losses are components of the city water supply reforms scheme attached with the Melamchi water diversion project. It is expected that such reforms would reduce the present water supply leakages of over 40% to less than 10 % in the future.

0.5 million cubic meters per day, or $5.9M^3$/sec of water transfer), the gross water service fees collected will be approximately US$67 million/year.[14](For details on the economic benefits of the project, see Bhattarai, et al., 2005.) These are only the direct economic benefits of the project to the water utility company in terms of the increased gross revenue, which is in fact only a part of the total project benefits to the city residents or to society in general. The total economic benefits generated by the project from improved water supply in the city, including associated secondary benefits (for example the improved public health benefits)[15] would be much higher than the financial returns. Of course, this also requires large investments in infrastructure, and adequate operation and maintenance as well as management, including investments for wastewater management in the city. In addition, the project benefits generated for society also greatly depend on several other institutional and management reforms of the city water distribution system.

The total societal level economic benefits of the project (accrued largely to the urban residents) will be about US$37 million per annum during the first phase of the project, assuming an opportunity cost of bulk water supply of US$1/$M^3$. This is, however, only 50% of the current tanker supplied bulk water price in the city, and taking into consideration of project benefits only for 8 months of the non-monsoonal season from November to June. The projected higher total societal benefits of the project (estimated at opportunity cost and taking into both direct and indirect benefits) than that of the direct economic benefits of the project (only from the additional gross revenue generated out of the volume of water transferred) is due to very high level of water scarcity level in the city (Kathmandu valley) now. The total project benefits (estimated at opportunity cost level) will however increase to about US$111 million[16] per year after 2015 when the project transfers water at its full capacity (details illustration of these different types of project economic benefits are in Bhattarai et al., 2005).

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[14] The project benefits are estimated under certain assumptions such as: the projected volume of water diversion takes places; water service fees that will be set by the city water distribution authority as per agreement with the lead external project financing agency (Asian Development Bank); water service tariff in Nepali currency (Rs.) is maintained at a constant US$ value level over time, etc.

[15] There would be substantial level of secondary benefits by improving drinking water supply into an acute water scarce city like Kathmandu with over 1.2 million inhabitants. Some of these include: benefits from increased health and sanitary levels, and costs saving at the household level due to less use of energy for water treatment purpose at household level (energy price has doubled within the last two years) such as water pumping costs, water lifting cost, water boiling or treatment costs, etc. Likewise, project such as this will also have secondary costs (such as generation of additional waste water treatment costs). The estimation of all of these secondary benefits and costs (ex-ante impacts) of the water transfer decision are, however, beyond the scope of this paper.

[16] This is estimated by multiplying the annual water transferred (111 millions M^3 per year, assuming 8 months of dry season and a distribution loss of 10%) by minimum trice of bulk water supply (tanker supply water) in the city now (at US$1/$M^3$). In fact, many the private households in the city are already procuring the drinking water now from the water tank operated by private owners at more than US$1/$M^3$, and the average household willingness to pay for the city water supply is also much higher than the currently adopted city water charge (see, Tiwari, 2000 and Whittington, *et al.*, 2002).

Economic Costs to the Water Supplying Basin

One of the major economic costs (direct and tangible costs) imposed by the project in the Melamchi basin communities is the permanent loss of about 80 ha of farmland due to construction of the project intake site, an access road, and other infrastructure facilities. Likewise, the project will also lead to the displacement of about 75-80 households from their present location (Pant and Bhattarai, 2001). Due to the reduced flow in the Melamchi River after the diversion of water, about additional 110 ha of spring paddy land and nearly 15 *Ghattas* along the Melamchi River downstream of the project diversion site are likely to be adversely affected during the dry season (recurring seasonal loss). The Project plans to compensate some of the direct and tangible project inflicted losses such as land acquisition, damage of assets like house, trees, etc., but there are no clear provisions in the project compensation scheme to compensate for damage on non-land use based activities such as fishing, operating a *Ghatta*, or other minority water uses. This omission likely stems from the dominance of land-based property rights institutions in the country, and also highlights the lack of recognition of various other forms of water rights by the government agencies, as noted earlier.

Our estimates show that the opportunity cost associated with the loss of gross returns of paddy in the Melamchi basin would be about US$350/ha/per crop season.[17] The total economic loss of spring paddy of 110 ha downstream of the project intake, would be about US$39,000 per year.[18] Agricultural production involves farm employment as well as other forward and backward linkage activities; therefore, the economic loss of not cultivating 110 spring paddy will be higher at the community level than the direct loss inflicted upon the farmers and land owners. This can be expected as loss of employment, a deterioration of community level food security, and loss of community level other related farm and non-farm employment

The Project also adversely affects the *Ghatta* owners (and fishing community), who already have much less bargaining power in the community. Although these *Ghatta* owners have acquired water use rights by paying a monthly service of about NRs.10 (US$0.15) to the VDC, they had very little voice during the design of the compensation package program. Similarly, the fishermen living there, who sometimes earn up to NRs.500 (US$7) a day during November-January, voiced the opinion that they might not have enough fish catch in the future after the water diversion, thereby also losing a significant level of income. Under the existing land renting system in the basin, tenants pay all the income from their earnings from main season rice to the landowner and retain the produce from the spring and winter crops as their share of cultivating the land. This means that the tenant farmers would bear the brunt of reduced income caused by low water availability during the dry season. Given the history of project compensation in Nepal so far, these groups of users are not likely to be compensated for their loss. As noted

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[17] On the assumption of Nepali Rs. 1320 per *Ropan*i of returns (in 2000 prices), and 20 *Ropani = 1 ha* of land.

[18] During the spring season, some of these crop-fields may be, however, shifted from paddy to less water requiring crops such as potato, wheat, or maize, etc. Then the level of project adverse effects downstream will be certainly less than this.

earlier, most of the adverse impact of the water transfer will also be concentrated within 1-2 km downstream of the project intake site.

The absence of an authority that could collectively negotiate on behalf of the local communities significantly affects the institutional linkage between the local water users and water management institutions and the Melamchi Project authority. Our study found that elected local representatives and local governmental agencies were also apprehensive about the central government's overriding role on water management, and their underestimation of the role of local institutions like the DDC during the project design phase. Although the Water Resources Act of 1992 gives the DDCs a mandate for planning and development of the water resources within their jurisdictions, they had a minimal role in planning and development of the project. They could have played an important role in establishing linkage between the local people and the project authority.

In summary, the Melamchi project has not given enough attention to the dry season water needs of the communities downstream of the project site. In the absence of a formal institutional mechanism, the priority for irrigation use might overlook the needs of other uses. The existing informal institutions might be able to buffer the scarcity situation to some extent, but it is probable that water scarcity in the basin may alter the existing informal water institutions and facilitate the evolution of formal water allocation institutions governing water rights among different uses and users. As management becomes intense due to the increased water scarcity, demand for more formal allocation arrangements would also increase, because users will have to draw operational rules for the distribution of water.

6. MELAMCHI PROJECT COMPENSATION SCHEME

The scale and process of project compensation to adversely affected households, who bear all the present financial loss as well as future opportunity costs of such decisions, are crucial to improve the total welfare and livelihoods in the water-supplying basin and to ensure the overall sustainability of the project. Intuitively, project compensation is given to compensate losses caused by the project interventions to existing right holders in exchange of the use rights of the resources in question. In the case of an intersectoral (interbasin) water transfer project, the compensation mechanism, in principal, should cover losses of existing right holders of land and water resources who are adversely affected during the process of the water transfer. In the whole process, water rights issues are crucial, and hence need to be intrinsically embedded in designing the scale and the process of compensation structures in an intersectoral (and interbasin) water reallocation project. As discussed above, non-land based water rights should also be taken into consideration in such designs, in addition to the land right based compensation.

The prevailing norms followed in the region give priority to compensating for damage to the land and land-based property, and other tangible damages, over other forms of losses. A project compensation scheme that is based only on land rights, or formal resource use rights, may, therefore, not adequately address all the externalities and indirect adverse effects (secondary or third party effects) caused by the water transfer, such as future loss of employment and loss of other water-based business opportunities in the water exporting basin. In particular, the

Melamchi Project compensation package has not addressed the losses incurred by those who make an earning from the property of other right holders, such as tenant farmers and farm labor, fishers, and *Ghatta* owners. They may lose their source of livelihoods after the water is diverted. Considering the scale of additional benefits generated by the Melamchi Water Supply Project (increased water revenue and other related tangible benefits in the water recipient city, as noted earlier), it justifies compensation for both the direct as well as the third party losses in the Melamchi basin communities. And even more, such a water transfer scheme should provide a better path for improving the overall welfare of people living in the Melamchi basin, which is already a resource poor area compared to Kathmandu.

The Melamchi Project includes a compensation scheme of about US $18.5 million for general welfare improvement activities in the Melamchi basin to mitigate some of the economic, social, and environmental effects imposed by the water-transfer project.[19] The two major components of the project compensation package are: a) the Resettlement Action Plans (RAP), with a budget of US$15 million, and b) the Social Upliftment Programs (SUP), with a budget of US$3.5 million (MWSB, 2000a; 2000b).

The RAP is designed for land acquisition, resettlement of the households displaced by the project, and for provision of local infrastructure (access community road, school, etc). The SUP has been established to mitigate direct and indirect project impacts of the water diversion scheme and to provide a long term strategy for the improvement of the living conditions of the people residing in the Melamchi valley. The SUP has components of health, education, income generation, community development, rural electrification, and buffer zone management programs.

In addition, there is also a plan to share the benefits of actual water volume transferred into the Kathmandu city with the Melamchi community at a rate of NRs. $0.25/m^3$, i.e. about 1 percent of water levy collected at the planned water rate. This seems low considering the scale of benefits accrued to the city residents, and the permanent loss of water and other water-use related opportunities in the Melamchi basin. Still, this is a step forward, as there is no such provision of benefit sharing with the water exporting community so far.

In 2002, the Nepal Government has set up the Melamchi Project Compensation Fixation Committee (CFC) at district level in each of the three districts where compensation will have to be paid. The CFC is comprised of representation from several related government agencies in the district, has the responsibility to look after compensation payment by the project. It has also formulated different sets of rules to establish land prices for compensation by the project. There are, however, some concerns among the local communities about the process of determining land prices for acquisition, particularly the exclusion of the Melamchi basin communities in the decision making process. Also, the bureaucratic process adopted for setting the compensation level was largely set up without any involvement and consultation of local stakeholders.

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[19] This comes to about 4 % of the total project costs (MWSP). Considering the current development stage and socioeconomic activities in the Melamchi basin area, this level of compensation package represents a considerable sum.

Lately, the project has started to involve elected District and Village level authorities (DDC and VDCs) in the implementation of the social activities (SUP) of the project. In fact, the local demand for project compensation was for 5 percent of the revenue collected from the urban water supply. At present, the local users lack appropriate institutional mechanisms to negotiate with the powerful government agency for compensation. Here, a greater involvement of NGOs in the project compensation activities and even of the elected institutions such as VDC and DDC, would help bring forward some of these coordination and benefit-sharing negotiation processes.

7. DISCUSSIONS AND CONCLUSIONS

The Melamchi Water Supply Project represents a situation that is becoming a common phenomenon in many parts of the developing world. Growing urban areas are taking water out from the rural hinterlands, and even from areas beyond the closest basin. Such intersectoral transfers of water will have large implications on underlying water institutions, governance, and water laws operating in a society (also see Meinzen-Dick and Pradhan, 2002), even more in regions where agricultural productivity is already low and the agricultural sector in general is not developed enough to feed a rapidly growing population. What institutional arrangements are effective to handle such intersectoral water allocation process is however little explored issue in the literature (see Molle, 2006).

The present case study shows that the multiple water rights exercised by the local people, based on the arrangements that have evolved over a long period independently of formal legal systems, are overlooked when large scale projects like the Melamchi Water Supply Project are implemented. In addition to economic issues of water transfers, we have analyzed equity concerns regarding resource use in such a water transfer scheme, and its implications for the functioning of formal and informal local water management institutions in the water supplying basin.

The Melamchi river (and Indrawati basin), when measured on an annual aggregate level of water availability, is a water surplus basin. However, as in most of the monsoon dependent river systems in the Himalayan range, the seasonal variation of water flow in the Melamchi River is very high, and over 80-90 percent of total annual water flow takes places during the 3-4 months of monsoon (June-September). The available information indicates that the remaining water flow, after the diversion by the Melamchi Project, in dry season (January to May) may be inadequate to meet the needs of the community residing immediately 1-2 km downstream of the Melamchi Project intake. The impact of the project further down will be less severe as several other streams contribute to increase the flow of the river.

Our study suggests that the local water institutions in the Melamchi basin have evolved over a long time through agreements, various negotiation processes, and compromises among the various water user groups. A significant aspect of these agreements is to accommodate the need of various users and at the same time maximizing the benefit from the available water through various alternative uses. These local customs, traditional institutions, and Farmer Managed Irrigation Systems (FMIS) related institutions are capable of handling most of the small-scale water allocation issues. These same institutions have not been put through the test of negotiating formal water rights along rivers and large-scale water transfers with a powerful partner like the Kathmandu city water supply authority (or the central water authority of the Nepalese government). A better understanding and analysis of these practices during the project design phase might have minimized some of the negative implications of the project interventions. Usually, the few powerful sections of the society are the ones to get compensated in such large-scale water sector infrastructure projects in Nepal as is the case in most of the South Asia (see, Dixit, 1994).

Despite these potential challenges, the Melamchi Project has provided an opportunity to bring various stakeholders together to enhance their ability to deal with a seasonally decreased availability of water and to negotiate with different actors for a reasonable share of the benefits created by the intersectoral water transfer and to ensure equitable use of resources across the regions. The recognition of all of these minor water rights in the communities and compensation to the water right holders (including informally defined) in the case of Melamchi Project also reflect the success of the project in meeting local concerns, and not just meeting the demands and voices of a few powerful sections of the society.

Locally elected institutions (such as DDC and VDC) and local NGOs have also been involved in the implementation of some components of the Melamchi Water Transfer Project, which is in fact an unusual case in such a large-scale water infrastructure project in Nepal, comparing to the cases in the past. Involvement of local institutions will certainly help in the development of more participatory water management practices in Nepal. Until recently, the mandate of locally elected institutions in water resources sector in practice was confined only to provide financial support to small-scale projects, despite the much bigger role assigned to them through the Local Governance Act (1998) in planning and co-ordination of development activities.

The Melamchi Project has approved a project compensation package of US $18.5 million, spread over 7-8 years, to the Melamchi area and many villages there around to share benefits and to mitigate the adverse impacts of the project. Most of the activities under this package will be implemented under the authority of the District Development Committees. Considering the scale of long term negative disruption associated with the intersectoral water transfer decision, and the unpredictable third party effects, the nature and scale of the compensation package is quite important, and should not be understated. At the end, the success of the implementation of the project compensation scheme would ultimately determine the actual implications of the project in the water supply basin, and the nature and scale of the project’s impacts (positive and negative) on the society. In fact, the nature and types of water rights adopted in a society would affect how much compensation the water supplying community should claim and/or are entitled to get. The government policy designed to mitigate damages done by the water diversion should take into account both direct and indirect damages to the local communities induced by the project, and not only consider the direct project damage, as adopted by the Melamchi project case now and others in the past.

In the literature on intersectoral water reallocation, it is commonly perceived that fixing the water rights would resolve the problem of intersectoral water reallocation and compensation to those adversely affected in the process. However, it is observed that a distinction has to be made between ownership rights and use rights. The ownership right allows allocation, use, transfer, and selling of use rights. Use rights on the other hand are exercised by the water users only for specified purposes. The water users who currently enjoy customary 'use rights' occasionally also share it with other users, either for economic reasons or for a larger community interest, as discussed in section four of this paper. Over the time, such arrangements in turn can create disputes between customary right holders (such as irrigation users) and other types of right holders who would obtain their rights through negotiation. Ignoring these water rights issues can have severe social implications at the micro level water reallocation and households' livelihoods. Water rights issues are important in two aspects. Firstly, contradiction on issues related to customary use rights and rights obtained through negotiation, either for the installation of water mill or for installation of micro-hydro plant, may lead to more water related conflicts in the future due to changing nature of the negotiation as per changes on the nature and types of technology and economic incentives of water uses by each types. Thus, it is important to ensure an appropriate balance among the customary water rights (for irrigation/*ghatta*), commercial water rights (for water mill), and social water rights (microhydro-electricity) by regulating the water management practices, which up to date had been carried out informally. Secondly, the livelihoods of poor households are closely linked to water right issues; as most of the rights of minor users (or non-consumptive users such as of fishing communities) are considered secondary rights that are not legally guaranteed by water acts.

Among small holder farming communities, establishing effective water rights and enforcing them is also not a simple task. Despite a lack of stakeholder consultation processes during the design of the project, the project implementation process has highlighted importance of micro level issues. This could serve as a lesson for the design and implementation of other similar water projects in the future. The detailed implications of water transfer for the affected local communities can, for example, be better understood through a detailed micro level analysis. Likewise, unintended adverse impacts of this project have become visible only after the project is in full operation. A series of thorough participatory impact assessments, along with the standard project appraisal process (EIA and project feasibility), and a continuous and genuine stakeholder consultation process could, in principle, avoid some of these adverse impacts of the project.

The intersectoral water transfer project produces differential level of impacts for the rural and urban sectors, and in the case of the Melamchi Project, the effectiveness of the water transfer decision can be assessed by analyzing additional value generated by the project, the process adopted for benefit-sharing, the governance of the project management, and the nature and level of compensations provided to the adversely affected households. Considering the amount of benefits generated by the water transfer decision, it is fair to demand that the project compensation scheme should be able to compensate for all the direct and indirect losers in the Melamchi basin, including those users who currently do not have formally recognized water rights. Otherwise, the urban residents will get additional benefits at the expense of already a resource poor Melamchi basin community, which may be bearing all the opportunity costs of the water transferred by the Melamchi Project.

APPENDIX A.

Physical Characteristics of Melamchi River Basin

SN	Description	Unit	Quantity
1	Total Length of River: Main stream	km	41
2	Tributaries	No	14
3	Catchment area of MDS intake	km^2	157
4	Catchment area of River	km^2	330
5	Catchment area of the nearest River gauge	km^2	122
6	Elevation at Intake from Mean Sea level (msl)	m	1445
7	Elevation at tunnel end from msl	m	1410
8	Elevation at confluence with Indrawati river from msl.	m	820
9	Elevation of the river origin from msl	m	5863
11	Average monthly max flow at Intake	m^3/s	10.92
12	Average monthly min. flow at Intake (March)	m^3/s	2.55
13	Average monthly max. flow at confluence	m^3/s	76.00
14	Average monthly min. flow at confluence	m^3/s	5.62
15	Slope of the river	%	12
16	Distance at Intake from Confluence	km	20
17	Average annual rainfall in intake of catchment	mm	3212
18	Average Annual rainfall in the Melamchi basin	mm	3050

Source: HMGN/NWSDB, 2000; and Mishra, 2000

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