

CHAPTER IV

INFRASTRUCTURE IN LAO PDR

4.1 Why Lao PDR, and why roads?

To create a framework through which growth-centric infrastructure development can be pursued, but in a sustainable manner via the application of the principles of sustainable development I will build on the lessons that can be drawn from the specific experience of Asian Development Bank-sponsored rural road construction in the Greater Mekong Sub-region. I have chosen to set my case study in Southeast Asia, and Lao PDR in particular, for several reasons. First, quite simply that's where they are building the infrastructure these days. The incredible investment and construction boom that has proceeded across Indochina over the past two decades allows for plenty of examples of both good and bad development. As far as quality goes it's fairly average, the infrastructure is definitely not the best (see Europe or Singapore for that) and it's certainly not the worst (Bangladesh comes to mind), but there is definitely room for improvement. Furthermore, the nature of infrastructure development in the region, big bank funded and state-enterprise implemented is quite a familiar blueprint across the developing world.

The second question of course is why roads? The first reason is that Southeast Asia as a whole, has truly committed to transport infrastructure development, allocating huge sums over the past few decades towards the construction of roads, ports and other facilities, thus once again, providing a large array of examples for any intended research. However, the single biggest reason for choosing roads is the fact that in many ways they are generally representative of other types of infrastructure. Land transport facilities generally entail large investments to establish a network; private provision is not the most efficient form due to the externalities involved and economies of scale; and there is general agreement on its importance to economic development on the aggregate level. Furthermore, they seem to spawn a large amount of environmental externalities, many of which could be minimized without significant altering implementation

practices, so seemingly road construction would be the sector most in need of renovation. Thus, despite my focus on road construction in Lao PDR, I would hope that many of my recommendations would also apply to infrastructure development in general, as well as other types of projects in more varied locations. Furthermore, a significant knowledge gap exists regarding the negative environmental impacts of road construction. Most studies regarding infrastructure and the environment focus on much more large-scale projects, notably dams. In fact, every new dam project seems to attract intense criticism despite the size of its ecological footprint. Although these projects, due to their size, can have larger impacts on the environment, the cumulative effects of poor road construction can be just as severe, and frequently overlooked. Thus this study also serves to both promote awareness about roads while also filling an existing hole in the literature regarding infrastructural impacts on the environment. Following this case study I will apply each of my principles to perceived problems within the project.

4.2 The EWEC and Southern Lao PDR

The Lao People's Democratic Republic is a small, sparsely populated, land-locked country in Southeast Asia. It straddles the Mekong River and shares long borders with several nations, including Vietnam to the East, China to the North, Myanmar to the Northwest, Thailand to the west and Cambodia to the South. The geography of the country is rugged, consisting of mountains and highland plateaus that descend to meet the Mekong plain along Laos' western border with Thailand. Due to this varied and rough terrain and the low density of its population, Lao PDR is extremely diverse and is home to many ethnic minorities and local dialects. These factors have made centralization and development difficult for the national government in Vientiane, and in conjunction with acute poverty and a lack of basic infrastructure, the provision of services to the bulk of the country has proven difficult.

The Southern half of Lao PDR has long been one of the country's most inaccessible regions. The substantial mountains and rugged highlands running north to south along the region's spine has made transportation from Thailand to the West and Vietnam to the East difficult and unpredictable at best, denying the resource and agriculturally rich center of

Southern Laos adequate access to foreign markets. Although these existing transportation routes do provide access to Vietnam they are inadequate to support Laos' ever increasing export traffic, thus the Lao people, concentrated along the Mekong River, have traditionally looked West towards Thailand and its developed transportation system, for their connections to the rest of the world.



Figure 4.1: Political Map of Lao PDR

In 1992 the Asian Development Bank sponsored the creation of the Greater Mekong Subregion (GMS) a sub-regional economic cooperation program, designed to facilitate economic relations between member countries. Presently, the group has six member nations, including: Cambodia, the People's Republic of China, Lao People's Democratic Republic, Myanmar,

Thailand, and Vietnam. The focus of the GMS has been to promote the regional as a whole, as a unified and attractive center of growth, thus in order to facilitate linkages between member-states the program has taken a significant interest in planning and financing cross-border infrastructure projects.

The flagship program of the GMS has been the economic corridors program. The goal behind the corridor initiatives, as envisioned by the Asian Development Bank (2005) and the GMS framework is to develop an efficient trans-national transport system through which goods and people will be able to move around the Mekong region without significant difficulty or cost. Improvements in transport infrastructure are meant to play a key role in promoting growth in the region and helping to eliminate poverty. In order to improve intraregional transport the ADB (2005) has tried to focus investment in priority infrastructure sectors such as transport, energy, telecommunications, and tourism within pre-determined geographical areas to maximize development impact while minimizing costs. This initial investment by the ADB (2005) is meant to lay the infrastructural framework needed to encourage further development and business investment in areas through which the corridors pass. It is hoped that this concentration of investment, rather than monopolizing the advantages of development amongst those who live along corridor paths, will instead link marginalized communities through an improved transportation network, allowing benefits to disseminate equally throughout the region.

The East-West Economic Corridor spans four countries of the Greater Mekong Sub-Region, starting at Danang in south Vietnam and running west through Southern Laos, Northeastern and Central Thailand before culminating at Mawlamyine, in Southern Myanmar⁸. It was founded as a flagship program of the Asian Development Banks' GMS Strategic Framework, and seeks to form the only continuous land route linking the Indian Ocean and the South China Sea. Other corridors have been initiated, including the Southern Economic Corridor linking Bangkok, Phnom Penh and Ho Chi Minh City and the North-South Corridors which link the People's Republic of China's Yunnan province to the rest of Southeast Asia. The EWEC encompasses a road link about 1,450 kilometers long and beyond a few underdeveloped or

⁸ Refer to Figure 4.1.

missing sections, most of which are in Myanmar, it is complete and operating effectively (ADB, 2005).

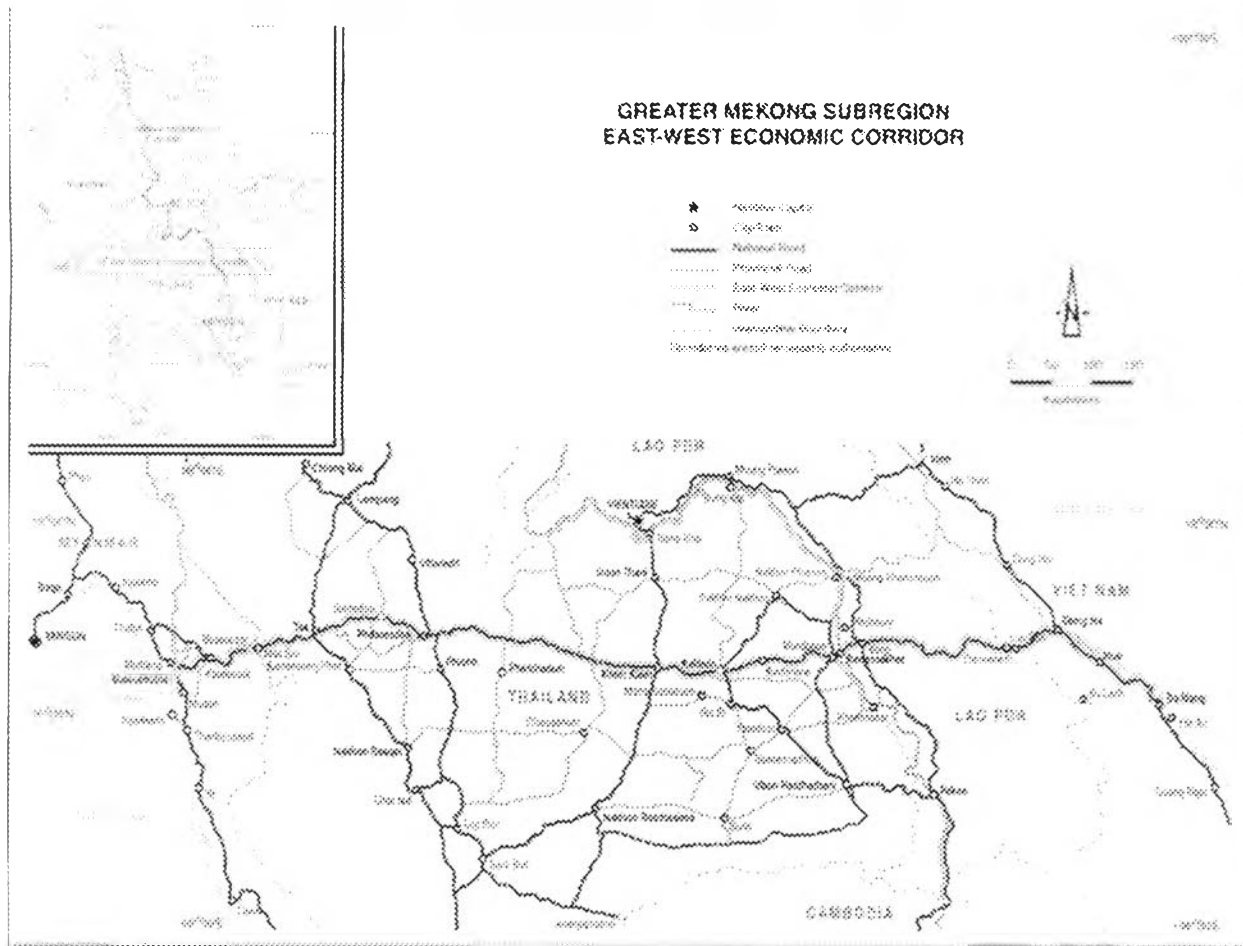


Figure 4.2: The East-West Economic Corridor (ADB-EWEC, 2005).

The principle infrastructure project initiated by the Asian Development Bank and the East-West Economic Corridor Program in Southern Lao PDR revolve around the rehabilitation of Highway 9, the trans-national road which connects the Thai-Lao border city of Savannakhet to the Vietnamese border in the east⁹. Prior to the start of this project, in 2000, Highway 9 was popularly referred to as a “moon surface,” on account of its dramatic craters and potholes, many

⁹ Refer to Figure 4.2.

of which were remnants of the conflict in Vietnam over three decades ago (Gill, 2007). In that condition Highway 9 was completely inadequate to handle car traffic during certain types of the year, let alone the significant amount of export cargo being generated in the regions fertile highlands (WB, 2007). Under these circumstances the route was all but forsaken by export traffic and the regions agricultural products and resources remained under-exploited while goods were shipped longer distances to cross through to Thailand at Pakse, where a bridge spanning the Mekong already existed and cargo could connect to Thailand's already developed transportation network. Despite the relatively easier trip from Southern Lao PDR to Thai ports, rerouting goods through Vietnam remains an attractive prospect. Even from Savannakhet, on the Thai border, the Vietnamese port of Danang is significantly closer than Bangkok, the current overwhelming port of embarkation for Lao exports¹⁰. For this reason, and due to the regions inclusion in the EWEC, the ADB approved US\$ 25 million of private and governmental loans in December of 1999 to improve and expand about 132 kilometers of Highway 9 (ADB 1728, 2006). Improvements, which were concluded in 2006, included repaving and widening of existing road surfaces while an additional US\$ 5.2 million was allocated to rehabilitate and create about 172 kilometers of rural access roads (ADB 1728, 2006).

The provinces in Southern Lao PDR through which the EWEC passes have reaped enormous economic benefits from the program. These improvements to Highway 9, as well the construction of the Second Thai-Lao Friendship Bridge, have opened up Southern Laos to the region. The border city of Savannakhet has benefited the most from these infrastructure projects and thus has been dramatically changed by the East-West Economic Corridor program. Traditionally the second largest city in Lao PDR, and located along the EWEC, opposite the Thai city of Mukdahan, Savannakhet has been a commercial hub in Laos. The Lao government has taken advantage of Savannakhet's location and inclusion in the EWEC by creating the Savan-Seno Special Economic Zone (SSEZ), consisting of two sites within Savannakhet Province (DDFI, 2003). The SSEZ has used a combination of economic incentives and liberal trade policies in addition to its advantageous position along the corridor to promote the city as an industrial centre and export processing point (DDFI, 2003). This economic boom generated

¹⁰ The exact distances from Savannakhet: 663 Km to Bangkok, 508 Km to Danang. Export Competitiveness, pg. 54.

ground on the Vientiane-Nongkhai route and on its own accounting for Lao PDR's entire 28% rise in exports for the year¹¹. This meteoric rise was not a coincidence and can be directly

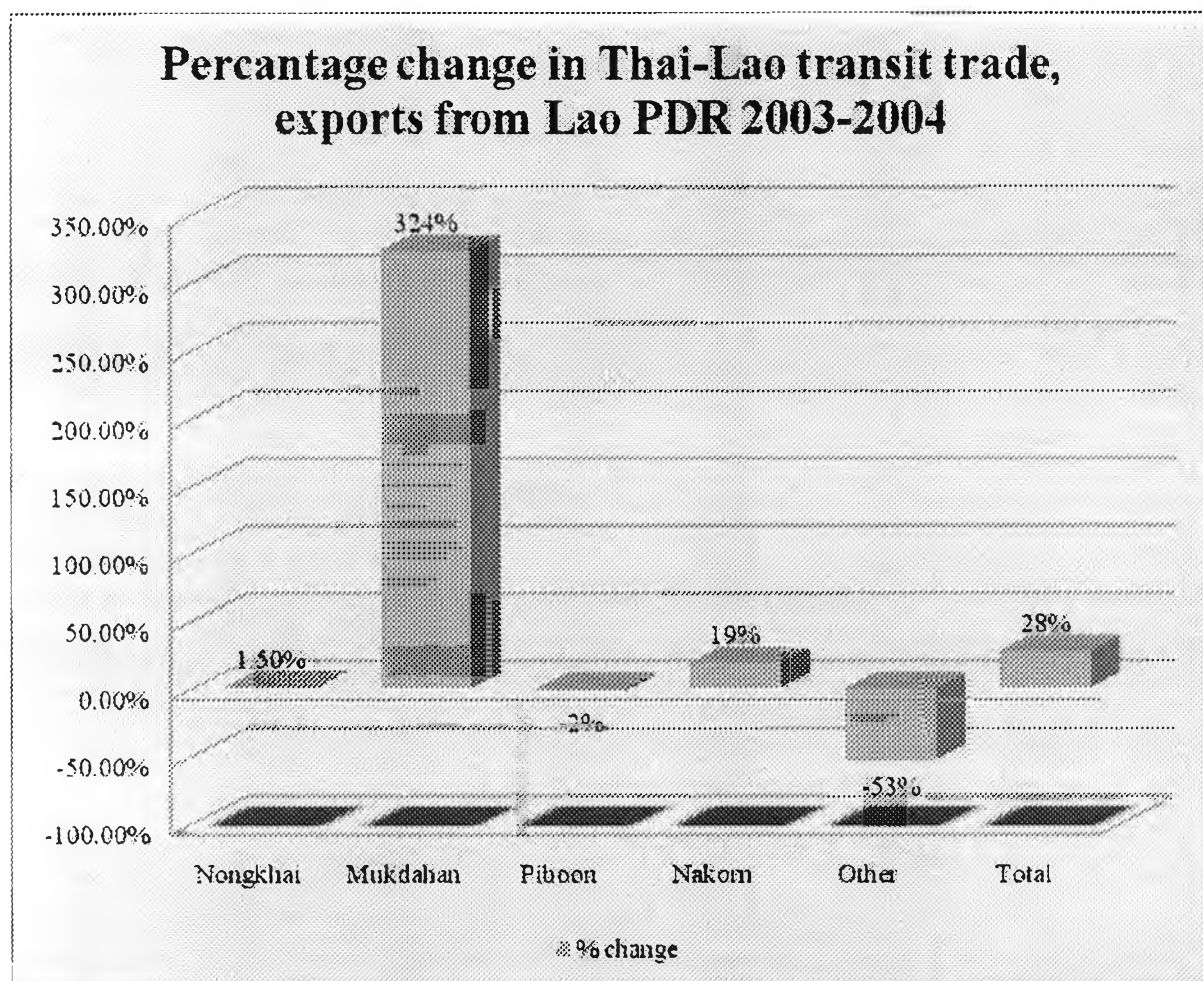


Figure 4.3: Percentage change in Thai-Lao transit trade, exports from Lao PDR from 2003 to 2004 (WB, 2007).

contributed to several factors, all related to the East-West Economic Corridor Program. The first reason is obvious, construction of transportation infrastructure, including the Second Thai-Lao Friendship Bridge, which was largely funded through ADB and EWEC related investment, allowed Savannakhet to become the export hub of Southern Laos. The region has always been a traditional source of Lao exports, producing large quantities of agricultural products (principally

¹¹ Refer to Figure 4.3.

coffee from the Boloven Plateau, but also tea, rubber, rice and other forest products like rosewood and teak (WB, 2007)), and also significant amount of garments, however before the construction of EWEC transportation network most of this had to be shipped north and then routed through Vientiane or shipped south to cross the river at Pakse¹². The improved access to Savannakhet from the Boloven highlands east of the city, brought about by the improvements to Highway 9, has turned the city into a clearing house for agricultural exports and the transportation sector has grown rapidly to be able to accommodate the new cargo flowing through the city and into Thailand (ADB, 2004). The EWEC has also affected traffic along the Mekong River. Although slower than land transport, Mekong shipping was more frequent prior to the creation of the corridor. However the goods carried on the river were not necessarily included in these figures, a significant amount of which goes unrecorded and is considered informal trade.

Another reason for this data shift becomes obvious when visiting Savannakhet and the newly founded Savan-Seno Special Economic Zone (SSEZ). The Lao government's rigorous policy of promoting investment towards export related industry in the province has paid off and the town is rapidly growing into an economic hub. Several major industries have moved in, including Oxiana Limited who has started a gold and copper mining operation in the province, and other trans-national corporations who are being induced to settle there through a mix of government incentives and tax breaks (Oxiana, 2005). The role of the EWEC in promoting exports has been critical towards stimulating the transport sector. Imports to Lao PDR generate much less growth than exports. In Laos most imports are meant for consumption or use within the more densely populated provinces along the Mekong. Exports, like coffee for example, are generally produced far from the border, requiring more complex transportation and supply chains which have become more profitable and efficient because of the improvements to Highway 9 and its associated road network.

This rise in exports has had a tremendously positive effect on the people living in Savannakhet. Several of the new corporations in Savannakhet, like Oxiana, have undertaken a

¹² Curiously, according to Manichanh Pansivongsay a writer for Laoplanet.net, a Lao PDR related blog site, the three major destinations for agricultural exports from Southern Laos are in order, Thailand, *Poland*, and the United States. A remnant of Lao PDR's Cold War era economic arrangements.

diverse range of infrastructure projects in the area, installing electricity transmission lines, providing safe drinking water, and refurbishing the districts hospital, greatly complementing the work done by the ADB and EWEC (ADB, 2004). Employment opportunities in the industrial, transport and service sectors have skyrocketed, pulling in large amounts of labor from rural areas. Furthermore, the improved access to roads, and hence to markets, has been key for poverty reduction in Savannakhet province. When the rural poor did not have road access, they were unable to purchase goods at the lowest price possible, nor could they sell their products at market, let alone export anything abroad (WB, 2007). This has changed with the EWEC and villages are now able to use these transportation links to increase income, gain better access to health care and education, and travel. Although exact data is not available for individual provinces it can be assumed that this growth would directly translate into improvements in the development indicators for Savannakhet. Improved access to health care and education directly contribute to higher literacy rates, school enrollments, and a reduction in the infant mortality rate, among others.

The benefits brought to Savannakhet and Southern Lao PDR in general due to the EWEC and the improvements to Highway 9 are apparent. An enlarged and improved transportation network can stimulate trade and investment while promoting healthy export-oriented growth. The Lao people directly benefit from this through increased job opportunities and higher demand for skilled labour, particularly within the transport sector. Those living outside of Savannakhet's urban areas also benefit from the EWEC through increased contact with both local and foreign markets as well as better access to health care and education. However it is important to note that these gains come at a price. The improvements to Highway 9 and its associated rural access roads have had significant impacts on the environment, many of which have not been fully acknowledged by the Asian Development Bank. These tradeoffs must be considered before we can fully conclude on the future sustainability of the East-West Economic Corridor in Southern Lao PDR.

4.3 At What Cost?

Although the EWEC program has brought significant economic benefits to the region it has also faced good deal of criticism during its construction and implementation over a variety of social and environmental issues. Much of this has centered on the programs faltering progress in connecting Myanmar with the rest of the corridor. Prominent human rights organizations have urged the ADB to cease construction in Myanmar, arguing that due to current military regime implementing development programs in Burma is impossible without incurring widespread human rights abuses (ERI, 2007). To support this claim they cite testimonials of forced labor used to construct roads, displacements, and loss of livelihoods due to deforestation (ERI, 2007). Instead of trying to link Myanmar to the region, many feel that the ADB should be working to isolate it in order to force political change.

Furthermore, several negative social impacts have been anticipated from the Corridor program as well. Migration, already a sensitive issue in the Mekong region, is expected to rise due to the increased ease of travel throughout the region. Increased migration allows nations like Thailand to meet future labor needs while providing an outlet for labor-rich nations like Vietnam and Cambodia (Ishida, 2005). The opportunity to pursue better work prospects across borders also allows those living in the poorest of GMS countries additional opportunities to increase their income and eliminate absolute poverty. However, with these flows of people comes the risk of the spread of diseases, like HIV/AIDS, Tuberculosis, Avian Flu, etc. The smuggling of both illegal substances (drugs, wildlife, forestry products, etc.) and human beings will also be facilitated by the increased flows of migrants as well as by the mixing of different populations uprooted from their traditional social support systems (Mekong, 2006).

Another critique of the corridors program remains rooted in the conflict between the least-developed and the comparatively more developed nations in the GMS over who derives the most benefit from these investments. Some findings have shown that increased trade will increase the trade deficits of Cambodia, Laos, and Myanmar (CLM), the region's poorest states (Ishida, 2005). These deficits will increase, despite an overall rise in exports, because the CLM countries have a less diverse export portfolio and will have difficulty competing with imports from the more industrialized nations of Thailand, Vietnam and China. This report, however, doesn't claim that these deficits should halt the corridor program rather that they are a necessary

hurdle in order to promote sustainable, export-oriented foreign direct investment in the CLM countries (Ishida, 2005). Another point of contention has been between the transit nations (Lao PDR and Cambodia) and the end-point nations (Vietnam in particular) over perceived imbalances in investment. Vietnam has received an extremely large proportion of the investments made within the EWEC. For example, improvements to Highway 9, the road spanning Southern Laos and linking the Thai and Vietnamese borders received funding in loans up to US\$25 million, while improvements to the various Central Vietnamese port facilities, including Danang, integrated loans totally an additional US\$127.8 million¹³. Including the recent construction of the Hai Van tunnel, as well as other infrastructure related projects, the total EWEC related investment to Vietnam stands at a figure of about US\$ 387 million (ADB, 2007). Laos in comparison, by the start of 2007, had only received a significantly smaller sum of US\$ 205 million, most of which has gone in to road and infrastructure improvements around the Savannakhet economic zone (ADB, 2007). The purpose of this intensive investment in Vietnam is to of course benefit all of the nations in the GMS by providing land-locked nations like Laos access to the sea. However, despite the constant improvement of overland connections the links between Laos and Vietnam are still not adequately developed. Under the Agreement on Road Transport signed in 1996 between Laos and Vietnam (Sompeth, 2007), eight checkpoints were designated, the most prominent of which is located in the central region of the country at Lao Bao, along the EWEC. These passages see much less transit traffic than the Thai-Lao routes. While they provide shorter access to the sea than alternative routes through Thailand, the roads are currently narrower, slower, and more difficult to traverse. Furthermore, they cannot support any significant amounts of container traffic without further improvements (Sompeth, 2007). Vietnam's ports do not offer the same quality of service as Thai ports. Most of the Lao imports and exports transiting Vietnam use the port of Danang although three other ports, Cua Lo, Xuan Hai, and Quy Nhon, are occasionally used to a lesser degree (Sompeth, 2007). The port Vung Ang, which was constructed specifically for Lao cargo by the government of Vietnam, is not currently an attractive option for Lao exports and has largely been ignored. Thus, despite the large amounts of investment in Vietnam's infrastructure Laos still must send the majority of its

¹³ The exact breakdown in investments are as follows: US\$28.7 million for Nghe An-Cua Lo, US\$24.4 million for Ha Tinh-Xuan Hai, US\$19.9 million for Cua Viet, US\$44.9 million for Da Nang, US\$16.9 million for Quy Nhon. (ADB, 2007)

export traffic through North-Eastern Thailand, largely forsaking, for the time being, any potential benefits of shipping through Vietnam.

However, despite the variety of social issues stemming from the EWEC's construction, the wide variety of environmental issues it has raised can be considered the largest threat to the projects long-term sustainability. The environmental concerns linked with the East-West Economic Corridor are multi-dimensional and complex. Two threats stand out in particular. First, deforestation, traditionally a severe problem within the GMS can be associated with several destructive environmental effects, such as soil erosion, water diversion, and flooding. Furthermore, the associated destruction of habitat and regional bio-diversity has an aggravated effect on local populations who depend on these resources for survival. Second, the increase in human impacts, directly related to increased traffic along the corridor, has the potential to strain existing infrastructure such as waste management, water treatment and sewage, to the breaking point further degrading the environment while reducing the quality of life for local people. These two issues must be examined and corrected if the sustainability of the EWEC is to be ensured and the Lao people are to benefit from the rapid economic growth being generated by these projects.

Although the roots of some of these issues can be directly linked to the creation of the corridor, it is important to note that the environment in Southern Lao PDR was already under threat long before the ADB pursued these projects. However, the EWEC has served to aggravate and accelerate existing environmental hazards, particularly deforestation. Deforestation has been an issue within the GMS for decades. In Thailand and Vietnam forest cover has been nearly depleted since the mid 1980's (TRIC, 2008). Some estimates show that between 1980 and 1990 about nine million ha of GMS forests were lost, with Thailand leading in percentage lost (ADB, 2006). Forest loss in Lao PDR has been more recent, but just as startling in its extent. Recent findings have shown that the forest cover in Laos has diminished substantially in the past 15 years (Lao PDR, 2007). Furthermore, some studies have shown that that rate of deforestation is the highest per capita of any nation in the world¹⁴. Several factors are to blame for this rapid

¹⁴ The exact numbers for the Lao People's Democratic Republic: (288 m² per person per year), compared with Malaysia (176), Thailand (63), and Nepal (60). (ADB, 1999)

decline in forests. In Laos the rate of deforestation is nearly two times as rapid as the population growth rate, thus population pressure, a convenient excuse in several other Asian nations, cannot be the sole cause (Mongabay, 2006). Rather commercial logging, long a problem in the GMS and one of the main causes of deforestation has directly benefited from the improvements to Highway 9, which have enabled loggers to more easily penetrate previously inaccessible forested areas and more easily transport their timber to foreign markets. Furthermore, the construction of roads near or through forested areas has had a proven affect on the decline of these forests through a combination of factors including the expansion of agriculture, the physical scars left by construction projects, and increased human development along roadways.

4.4 Deforestation

As it travels East across Sothem Laos, from the Thai border to Vietnam, Highway 9 crosses some of Laos' most pristine forested areas. The land around Savannakhet, bordering Thailand along the Mekong River, is Lao PDR's most populous region and thus has been deprived of most of its forest cover for quite some time. However, to the east, as the elevation increases so does the forest cover. Between the town of Phin and the Vietnamese border Highway 9 threads its way between two of Laos' largest protected areas¹⁵, the Phou Xang Hae and Dong Phou Vieng Nation Protected Areas (NPAs). The EWEC sponsored improvements to Highway 9 have and will continue to have an effect on the increased deforestation of the area. Firstly, the improvements to the road itself have physically altered the forest. The Asian Development Bank has not made data specific to the roads' impact readily accessible; however the Mekong Institute has observed the impacts of a similar, and concurrent, construction project to upgrade Highway 1 in Lao PDR's stretch of the Northern Economic Corridor. Using these observations we can gauge the effect of Highway 9's improvements on the forests due to the analogous nature of the two projects. Highway 1, like Highway 9, encroaches upon NPAs, and according to the Mekong Institute's (2006) observations the project has caused great destruction to the forests in the area. The first improvements to the highway entail an expansion of the road itself, in the case of Highway 1 to a two-lane paved street. To do this, the construction

¹⁵ Refer to Figure 4.2.

companies in charge of the project cut a corridor of trees to a significant distance out from both sides of the highway, spanning its entire length (Mekong, 2006). Furthermore, in many places trees were cleared to a range well beyond what was required to widen the road (Mekong, 2006). In regards to Highway 9, the improvements to which cover a distance of about 208 kilometers, this accounts for a significant loss of forest cover (ADB, 2004). Furthermore although some of the construction camps, like the main Chinese contractor camp in segment C1, required some clearing of forested area in order to facilitate construction, deforestation surrounding several camps was significantly beyond what was required (IUCN, 2004).

Another significant concern is the expansion of rural access roads (RARs) which come in tandem with improvements to the main provincial highways. Designed to provide rural villages access to Lao PDR's improving highway system these small, usually unpaved, roads account for a significant proportion of the benefits that rural people stand to gain from the EWEC. However, they have also directly contributed to the deforestation of the region. Again, the data concerning Highway 9's RARs is conspicuously absent from the available ADB records however information concerning similar projects can shed some light on their effect within the EWEC. These small roads do not individually have nearly as large of an effect on forest cover as the improvements to the larger highways, however the sheer amount of these feeder tracks, about 325 kilometers worth in a similar project in northern Lao PDR, add up to a considerable amount of forest that needs to be cleared for their expansion and rehabilitation (ADB, 2000). Even more problematic is the type of terrain that these roads normally pass through. Because Highway 9 passes so close to two of Lao PDR's largest NPAs it is inevitable that its associated RARs pass through protected land, requiring that previously protected land be cleared. Furthermore, unlike the long-established national highways, these RARs are relatively new, traversing largely undeveloped and un-cut highland forests, particularly along the eastern portion of Highway 9. The relatively slow growth, low productivity, and often poor soil of these humid montane forests means that the land has a more difficult time recovering even long after construction has been completed, marking this type of ecosystem as particularly vulnerable to the expansion of RARs along the EWEC (Young, 1994).

Road construction indirectly contributes to deforestation as well. Access to highways encourages a shift from subsistence agriculture to market-based cash-crop production within local areas (Mekong, 2006). This transformation, encouraged by the EWEC, is indirectly affecting forest areas. Throughout Lao PDR, large scale plantation farming is encroaching upon the forest. The rise in mono-culture rubber plantations, in particular, receives most of the blame; however large-scale banana, coffee, and bio-fuel farming have also contributed to significant forest clearing (Mekong, 2006). This type of farming has a dramatic effect in Lao PDR's highland regions, where ethnic minority groups, long satisfied with subsistence farming, have begun to switch to cash-crops. Their brand of slash and burn farming has taken a significant toll on highland forests where large swaths are being cleared at an alarming rate (Mekong, 2006). This effect is not limited to the highlands however, the World Wildlife Foundation has observed that this shift can have a degrading effect within a 50 kilometer radius of the highway; unfortunately the dramatic proliferation of RARs should significantly enhance the impact of cash-crop substitution on the forests throughout the EWEC's radius (WWF, 2005).

Commercial Logging is still the principle cause of deforestation in Southern Laos and the improvements to Highway 9 have encouraged its proliferation. The IUCN team noted that some trees were marked for preservation, yet these were just the high-value timber trees, those with low or no timber value were clear-cut, way beyond what was required (IUCN, 2004). Unfortunately discretion in this regard was left to contractor who did not make extra efforts to minimize their ecological impacts. Aside from the logging associated with construction some road sections, notably in segment C2 and C3, including the Xaisomboun Special Region, experienced a sharp rise in commercial logging parallel to that carried out by the contractors (IUCN, 2004). This can be attributed to the improved access that logging companies gained to previously unexploited forests via the newly cleared road corridor. The improved access to rural areas provided by the RARs give loggers broad access to previously un-exploitable timber resources. Furthermore, the improvements to the highway itself allow timber to be transported more cheaply and efficiently, creating further incentives for additional cutting. This trend has been previously observed in Thailand during the early 1980's where an explosion in road construction directly contributed to the rapid cutting of its forests by commercial loggers (Cropper, Griffiths, Mani, 1999). This scenario is certainly possible in Laos where even its

protected forests are threatened by illegal logging activities, made possible by the RARs and all of the major logging areas are now linked to their primary markets in Thailand and China via highways funded largely by the Asian Development Bank.

This destruction of forests throughout Southern Laos will have several severe social and consequences if not properly mitigated or curtailed. The associated loss of bio-diversity is doing irreparable and unpredictable harm to the region. Lao PDR is home to several endangered species including the Tiger, Asian Elephant, and wild water buffalo all of which are severely pressured by the loss of habitat due to deforestation (WWF, 2005). Furthermore, the loss of potentially beneficial plants, insects or other materials is an irreplaceable and immeasurable blow to all mankind.

The increased access to Southern Laos' most remote forests has also increased the flow in trade of illegal wildlife products, further damaging the regions' bio-diversity. For the same reasons as commercial loggers, reduced transport costs and ease of access, the EWEC also encourages poaching, a trade that has been steadily expanding in the GMS (WWF, 2005). Improved access to markets in China and increased road traffic across borders has made illegal shipments of wildlife even more difficult to monitor (WWF, 2005). This increase in poaching poses the greatest threat to protected areas, whose' previous inaccessibility provided its animals with a larger degree of protection than what can now be offered.

Additionally, the impact of the construction camps on deforestation has already been noted, however another serious impact of the camps is the poaching of the areas wildlife by construction workers for food. Although it was determined not to be a widespread practice, the IUCN monitoring team noticed at one camp a large pile of bird feathers (not chicken or duck) and animal hair, which when noticed was quickly covered up by construction staff¹⁶. However, just because monitoring only uncovered one instance of this practice it does not mean that animal poaching is not more widespread. Un-restrained hunting of animals for food can seriously affect the areas wildlife populations, harming the biodiversity of the region.

¹⁶ Ibid., 23.

Local communities will be the first to be affected by this decline in bio-diversity. Rural people have traditionally relied upon the forest to support their livelihoods. Meat and plant life, gathered through hunting and foraging serve to supplement the diets of many Lao people, particularly those in highland areas. Villagers have also been able to supplement their earnings by selling or trading forest products, income that could mean the difference between survival or starvation for many of the region's poorest. Without these forest resources many rural people have been forced to migrate close to main roads to find job opportunities. Furthermore, this loss of traditional livelihood has directly encouraged the shift from subsistence farming to cash-crops which on its own further contributes to deforestation. Another consideration is the prospect of eco-tourism, already a rapidly expanding sector within the Lao economy, which relies on the forests in order to pull visitors. Local people stand to gain significantly from this trend, due to the job opportunities and markets opened by the tourism industry, however without the forests eco-tourism is doomed to fail in Laos.

Deforestation is threatening to deplete all forestry resources in the region while seriously threatening the reliability of water resources as well. Throughout the GMS forests are intricately linked to the water. New roads alter the flow of pre-existing creeks, streams, and gullies which can have a dramatic impact on a regions ecosystem. Water rapidly runs off of the all-weather paved roads, like Highway 9, and is funneled by roadside ditches or culverts, sometimes directly to streams. Increased run-off associated with this type of diversion can increase the effects of erosion, reduce percolation and aquifer recharge rates, alter the shape of pre-existing streams and rivers, and dramatically increase stream discharge rates (Forman & Alexander, 1998). In forests, this combination of road-related runoff and deforestation significantly degrades the water-storing capacity of the land, dramatically increasing the likelihood of flooding. This connection has been verified, as data collected shows that the percentage of road cover in a basin directly correlates with its flood frequency (Forman & Alexander, 1998). This increase in flood vulnerability is most damaging to local populations, particularly the poor who are unable to adapt as quickly. Although flooding is a common occurrence throughout Southern Laos, it is its increased unpredictability which has put the region's population in jeopardy.

Soil erosion is also greatly aggravated by road construction and deforestation. Road construction increases the natural instability of the soil, particularly in montane zones. New roads also undercut slopes which can cause catastrophic slope failure at the road bed (Young, 1994). Furthermore, rocks and soil, discarded after the construction process are extremely vulnerable to run-off and inadequate drainage systems. These factors combined with the loss of tree roots, a key factor towards soil stabilization, due to deforestation, all contribute to a higher chance for natural disasters such as mudslides, landslides, and flashfloods greatly jeopardizing the lives of the local people who live near these roads (Young, 1994). Agriculture is also affected by soil erosion. As soil erodes the first layer to go, the top soil, is the most fertile. Thus, deforested land, or areas along roads, where most people live, are generally poorer and produce lower yields of crops. Furthermore, poor soil holds less moisture leaving it more prone to either unpredictable flooding or drought during the dry season. Again it is the region's poorest who are the most at risk from these effects.

In addition to higher erosion rates surfaces exposed by roads and deforestation also contribute to the increased sedimentation of water run-off (Foreman & Alexander, 1998). Some of this sediment accumulates as it flows downhill and is subject to further erosion. However, the majority of sediment eventually filters down to lower altitude floodplains, rivers or streams where it can affect lowland agriculture, alter channel morphology, and threaten aquatic habitats (Foreman & Alexander, 1998). Finer sediment, common in road run-off from drainage ditches, can greatly affect the turbidity of water sources which inhibits aquatic plants, small invertebrate, and fish, damaging aquatic ecosystems (Foreman & Alexander, 1998). Furthermore, it has been shown that logging roads commonly produce more erosion and sediment yield, than forested areas, due to the stronger bonds within the soil and a lower level of waste (Foreman & Alexander, 1998). In short, road construction, like the expansion of Highway 9 and the RARs, accelerate run-off and sediment levels which degrade aquatic ecosystems and water quality in low-land areas, like the Mekong Basin. Deforestation further contributes to the process because deforested areas are less resistant to erosion. Furthermore, due to their higher percolation capacity, forests are able to act as a natural sponge, filtering run-off of harmful chemicals like pesticides, improving water quality (Hirsch, n.d.). Unfortunately, the levels of harmful

chemicals in the Mekong and other rivers continue to rise, partly because of the loss of forests as a natural filtration system.

Deforestation in Southern Lao PDR can directly be contributed, as least partially, to the improvements to Highway 9, the expansion of its associated rural access roads, and the East-West Economic Corridor in general. This deforestation has been aggravated by two primary factors; the construction of the roads themselves and the rise in logging caused by the increased access to forests and improved transport networks provided by the EWEC. Additionally, deforestation has caused several adverse environmental effects, including soil erosion, loss of bio-diversity, increased sedimentation of water sources, and the degradation of in the quality of water resources. These factors have all combined to adversely affect the livelihoods of those living along Highway 9 and its RARs, and in the case of sedimentation and run-off even those living far away from the EWEC, in the lowland basin of the Mekong, have been adversely affected. It is important to note that in several cases this environmental degradation was unwarranted, and had the projects been implemented more responsibly, with a stronger concern for natural capital, then the Highway's impacted could have been mitigated.

4.5 Water Quality

The upgrades to Highway 9, in addition to the completion of the Second Thai-Lao Friendship Bridge, have greatly increased the traffic flowing along the EWEC and through Lao PDR. In addition to the current increases to transit trade, the Asian Development Bank has predicted that trade on the East-West Corridor will double between 2000 and 2010 and double again during the next decade (UNDP, 2007). Previously this traffic transited out from Laos via Thailand, due to the ruggedness of Highway 9 and its undesirability as an export channel. However with the improvements to Highway 9, this route is due to experience a rapid rise in export traffic bound for the ports in Vietnam. These increases translate to a significant rise in the number of people, who expect access to basic utilities, flowing through a previously rural and inaccessible region of Laos. This increase cannot occur without incurring problems. The non-transportation related infrastructure such as water treatment, sanitary systems, and waste

management, of this largely rural area is already in poor shape, or simply non-existent, and will not be able to handle such a large influx of people without serious upgrades. The losers from in this dilemma will not be those traversing the corridor, but rather the local people who live along Highway 9, and rely on these other infrastructure mechanisms during their daily lives.

In 1999 the Lao government established National Center for Environmental Health and Water Supply (known as Nam Saat), an emergency organization tasked with National Center for Environmental Health and Water Supply. Nam Saat has been somewhat successful in providing access to clean piped water in urban areas, particularly those bordering Thailand and the Mekong

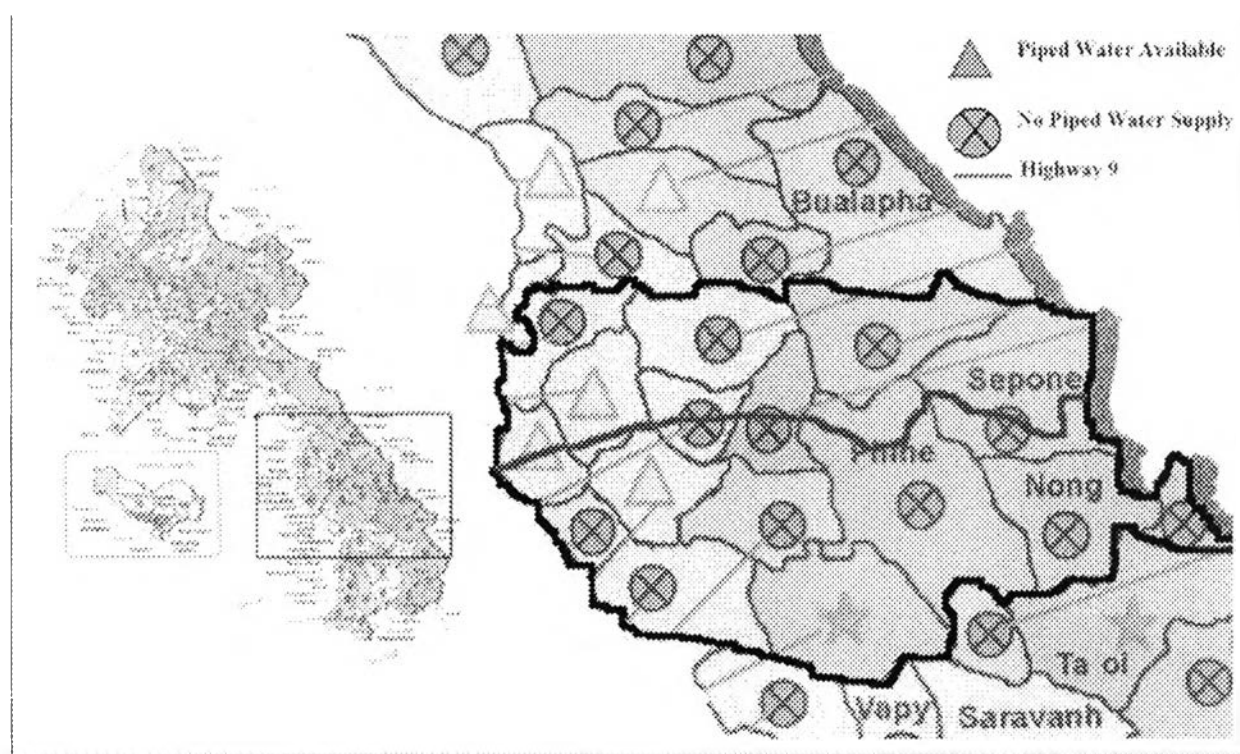


Figure 4.4: Availability of Piped Water within Savannakhet Province, Lao PDR (By District) (WASA, 2005).

River, where the majority of Lao people live. However by 2004 only 43% of Lao PDR's rural population had access to an improved water source, a significant shortfall from the Millennium Development Goal's target of 80% by 2015 (UNMDG, 2005). Furthermore, as of February of

2005, only 3 of Savannakhet Provinces' (Lao PDR's most populous province) 15 districts had access to clean, piped, drinking water (WASA, 2005). Four of the six provinces that Highway 9 traverses do not have piped water systems in place¹⁷. Not surprisingly the two that do encompass both the town of Savannakhet and its surrounding countryside, a region that has been the focus of intense investment by the ADB, the Lao government, and other foreign donors. In the four rural highland provinces that do not have access to piped water, local people are responsible for providing and maintaining their own water sources; there is no government legislation or intervention to assist them (WASA, 2002). Therefore the quality and reliability of water sources along Highway 9 can greatly vary from village to village. Most use a combination of communal and private sources including public stand posts, shallow wells, boreholes, or surface water through a variety of filtration mechanisms. Unfortunately the rising turbidity, due to sedimentation, of water resources has degraded the quality of surface water supplies (WASA, 2002). Deforestation has affected ground water as well. The associated loss of soil percolation means that the ground absorbs water at a much slower rate and sources such as wells are more easily depleted (Foreman & Alexander, 1998). Also, roads can affect the flows of sub-surface as well as surface water. Road crossings can effectively block drainage passes and ground water flows, effectively lowering the water table in down slope areas, potentially rendering current well systems useless (Foreman & Alexander, 1998). Furthermore, in many rural areas maintenance or service times for wells and other water containment devices by private contractors can be slow and unreliable, thus if a village loses its water supply it can be some time before it is restored (WASA, 2002).

As the 2004 IUCN monitoring mission notes, considering the excessive vegetation and forest clearing that has taken place areas adjacent to the road site, soil erosion will very likely become a major issue in the years to come. Additionally, road related construction activities, such as slope cutting in mountainous areas, will only serve to increase erosion. Contractors have exacerbated this situation even further by dumping soil, excavated from associated quarries, on slopes, where it will naturally destabilize and flow downhill during wet seasons. The effect of the road on rainy season soil erosion could have been mitigated through proper water diversions, or even better, if the project plan had taken account of natural waterways and made allowances

¹⁷ Refer to Diagram 4.4.

not to disturb them. However, this seems to have been ignored, and in many segments of the highway channels for water diversion are absent. Furthermore, many pre-existing channels have been blocked, both by the path road as well as by excess soil that has been dumped following excavations (IUCN, 2004). While no plans exist to contain this erosion, either by creating new channels or stabilizing slopes (IUCN, 2004).

The effects of this erosion will be varied, however those who will suffer the most is clearly the local populations living along the highway. The monitoring team notes that the lack of diversions have the potential to create havoc in the area during the rainy season, causing major erosion in the existing channels and damaging the surrounding agricultural fields (IUCN, 2004). Furthermore, erosion, paired with excess deforestation and the lack of may lead to flash floods in some areas, which will both seriously affect the safety of local communities while potentially damaging the road (IUCN, 2004). Finally, the blocking of pre-existing water channels may also create supply problems for the communities and wildlife downstream, which depend on small channels for water particularly during the dry season (IUCN, 2004). Finally, these effects could have a significant effect on the region's water quality. Not providing water diversion and letting the water accumulate exacerbates the deterioration of water quality due to stagnation. Similarly, the blocking water channels for fishponds, a practice that developers have been readily providing for local communities, also can lower water quality (IUCN, 2004). Furthermore, the large amount of sediment flowing downhill, into both streams and rivers, can have a significant effect on the region's water supply. Already the Lao PDR's rivers, such as the Mekong, are suffering from sedimentation. Sedimentation can decrease the quality of the water for human purposes like drinking and agriculture, but it can also seriously affect fish and wildlife populations all along the breadth of the river. Furthermore, if sedimentation gets sever enough it can restrict or even block the flow of the waterway, causing untold damage.

Current water supply mechanisms are not adequate or sustainable to support the local populations that rely on them given the environmental pressures they face due to Highway 9 and its related issues like deforestation. To expect these sources to absorb an even larger demand from non-local and transient peoples is simply not realistic. Villages that rely on surface water who suffer from turbidity and the general sluggishness of their filtration measures will not be

able to increase water output without significant upgrades (WASA, 2002). Furthermore, villages that rely on groundwater sources will also not be able to keep up with demand because their wells are already in jeopardy of drying up due to the increased environmental pressures associated with the Highway. Thus current water supply mechanisms cannot sustainably support development along the EWEC in Southern Lao PDR.

No urban areas of Lao PDR have access to a comprehensive piped sewer system (WASA, 2002). The small-bore sewage pipe system, recently installed in a limited area of Vientiane, does not even function properly. In other places, where they exist, sanitation facilities are onsite and the responsibility of the individual household (WASA, 2002). Only 20% of Laos' rural population has access to these, including pour to flush toilet systems or simple pit toilets (only 50% of which are considered improved); however the vast majority of Lao PDR's rural population, including those living along Highway 9, have no access to sanitation facilities what so ever. Currently there is no agency responsible for sanitation countrywide and progress to meet the UN's Millennium Development Goal regarding sanitation has been slow (WHO & UNICEF, 2004).

Highway 9 also directly contributed to water supply contamination in several ways. For example, the IUCN monitoring crew noticed a variety of activities in the construction camp which were causing land contamination. These include spilled oil and fuel in nearly all of the camps, as well as indiscriminate dumping of chemical solvents in the Chinese Camp of segment C1 (IUCN, 2004). Furthermore, solid waste management was generally poor in every camp. IUCN reports excessive amounts of trash dumped in the vicinity of camps, while one camp reportedly dumped its trash in an adjoining stream (IUCN, 2004). Observers also noticed improper disposal of toxic trash, in fact one camp was littered with parts of lead batteries (IUCN, 2004). This improper solid waste disposal can have serious ecological effects noticeably on the quality of both ground surface water. Additionally, the waste disposal program in several camps consisted of indiscriminate burning of all solid waste, a practice which releases untold levels of harmful toxins into the atmosphere (IUCN, 2004).

Additional damage to the region's water quality is done through the camps poor management of their wastewater. In several camps it was observed that both liquid and solid waste end up in water bodies flowing through areas downhill (IUCN, 2004). At the Nam Ja camp in segment C3 for example, all the liquid and solid waste excluding the toilet waste enters the river, polluting what would otherwise be a clean body of water (IUCN, 2004). Furthermore, in the main Chinese Camp, although wastewater from the toilets is collected in a tank and not disposed out in the open, wastewater from the kitchen and bathrooms is discharged via channel out in the open and eventually flows into the nearby Sekong River (IUCN, 2004). While in other smaller camps, there is no provision of wastewater tanks for toilets and thus everything is discharged out in the open. These practices significantly degrade the quality of both ground and surface water in the areas, and those to suffer the most are once again the local people. These local communities are not connected to any water provision services, thus they are totally reliant on natural sources for meeting all their needs. This contamination severely greatly jeopardizes the health of those relying on this water, while seriously calling into question the future sustainability of the project.

In rural areas, where no sanitation facilities exist and wastewater goes untreated, the possibility of contaminating water supplies is very real. The Lao government has made efforts to educate rural people about risks involved with waste water, particularly to those who rely on surface water or shallow ground water resources, however current efforts have proven to not be adequate as contamination is still possible, placing villagers at risk to water-borne infectious diseases like E. Coli and other common pathogens associated with waste water and solids. (WHO, 2003) The relatively low population of those living along Highway 9 means that the likelihood of water source contamination is still relatively low. However the steady growth of Lao PDR's population and their likely settlement along Highway 9, combined with the steady transit traffic flowing through the corridor all add up to a large increase in waste-water and solids that the local environment must process. Unfortunately there are limits to how much human waste the deforested areas along Highway 9 can absorb, greatly increasing chances for water supply contamination. Thus, unless rural sanitation facilities are improved the sustainability of water resources along the EWEC is in serious doubt, jeopardizing the health and welfare of the local people who live there.

Thus, not only has Highway 9 brought economic and social benefits to the people of Southern Lao PDR, but it was also wrought long-term ecological harm. Through the depletion of the region's natural capital stock (through deforestation, land degradation, etc.), the development, without significant intervention, is not sustainable. The loss of the forests, while also contributing to global problems like global warming, seriously threaten the local population's livelihoods, clean water and food sources, etc., thus its benefits cannot be projected to continue indefinitely into the future, the very definition of unsustainability. Throughout the next few sections I will apply identify the shortcomings in the planning and construction of Highway 9 and the EWEC and from that derive principles that, if applied, could have contributed to a more sustainable construction of Highway 9 and the EWEC in Southern Lao PDR. Although this development has already taken place in the region, and thus some of its harms maybe irreversible, I hope that my recommendations can help to improve the process of future road construction in the region, and indeed future infrastructure development in general.

4.6 Conclusion

This case study of Highway construction in Southern Lao PDR perfectly highlights the ways in which poor infrastructure development can ravage the natural environment, threatening the sustainability of local ecosystems as well as the way of life of local peoples. Although Highway 9 has brought tremendous economic advantages to the region, through poor construction practices and lack of oversight the project has wrought more harm than good. It is important to note that Highway 9 is not an isolated case. Indeed infrastructure t has been implemented with damaging side affects across the globe, notably in under-developed regions like Latin America, Asia, and Africa where construction booms have fueled infrastructure development that has been rushed and haphazard. Although a simple solution to this problem would be to limit the amount of infrastructure projects being pursued this is not realistic due to the immense economic benefits that a project could provide. Rather what is needed is a way in which infrastructure practices can be reformed, and through the application of the principles of sustainable development the ecological impact of infrastructure development can be minimized.

In the next chapter a framework is proposed to meet this challenge. It accepts a definition of sustainable development, which focuses on the preservation of the natural capital stock, and applies it to the four stages of infrastructure development: Planning, implementation, monitoring and accountability. Considering the examples illustrated in the case study recommendations are provided which would reduce the strain of development on natural capital during each phase. It is hoped that if this framework were to be applied to future infrastructure development, in Lao PDR or elsewhere, then the sustainability of such development would be enhanced, highlighting infrastructure benefits while mitigating its consequences.