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| ENGG1000 CVEN SUS 2014 Sustainability Assignment |
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# Site Description and Project Background

Sandikhola is a village located within the mountainous regions of Nepal that is within moderate distances of waterways and natural springs. Due to its proximity to clean sources of water as well as its elevation, Sandikhola requires the need for a steady and sustainable water supply system, as well as a multiuse and sanitation system to maximise the usage of the precious resource.

## Water Supply System

A series of concrete pipelines are constructed from a nearby waterway to Sandikhola, with mild deflections to connect the pipes to villages between the two locations. These pipes are laid about 1 metre under the ground with periodic stations set up along their path for regular maintenance. A large primary pump is set up along the banks of the river to transport water along the pipelines to the Sandikhola and nearby villages, with secondary pumps situated at stations to maintain pressure and flow rate. Rainwater from nearby catchments can be funnelled and redirected down transmission pipes to a double tank reservoir. A series of mesh covers are placed over openings to the reservoir to prevent the entry of soil and debris from degrading the quality of water.

## Multiuse System

The reservoir will be constructed with three primary outlets each serving a specific purpose. One of these outlets will provide a supply of water to livestock of the Sandikhola village. This is separated from the other outlets to minimise and if possible, prevent any contamination as a result of animal excrement. A second outlet will provide water to pumps near gardens and plantations to allow for a quasi-irrigation system. The final outlet is designed for human use, with water diverted to public tap stands for domestic duties, filtration and treatment system for human consumption and to ECOSAN toilets.

## Sanitation System

The sanitation system used will be the ECOSAN toilets. Urination and defecation are separated and stored for a period of time before being utilised as soil fertilizer. Defecation can have its odour vastly diminished by the removal of water, a task achievable through the addition of sawdust. Urine is a solution high in nitrogen and phosphorus, and after mild treatment can be added to the irrigation system to greatly improve quality and yield of crops.

# Screening

Due to Sandikhola’s relative isolation from society and large cities, any environmental impacts that occur as the result of the project will be amplified by a variety of reasons. Most importantly, unless proper education is provided or a trained professional is stationed to constantly observe changes in the local environment, maybe of the potentially catastrophic impacts may go unnoticed until it is too late. In a similar sense, due to Sandikhola’s location and the great difficulty of transportation to access it, it is extremely difficult for any impacts to be rectified without the spending of large numbers of resources and time. As a result of these factors, an Environmental Impact Assessment is necessary to prevent any wide scale ‘threats of irreversible environmental damage’ as per the precautionary principle from occurring.

# Scoping

Due to the large variety of activities that take place during the construction of the project, a large range of likely impacts need to be taken into consideration.

A primary concern of this proposal is the necessity for drilling and excavation to occur. These excavations, unless combined with sufficient research may cause irreversible geological damage to the bedrock which can trigger a variety of problems. The collapse of this bedrock may trigger minor landslides, amplifying the damage to the local ecosystem as well as possible contaminating the nearby waterways and groundwater which the village heavily relies on.

Similarly, due to the requirements of a moderate power supply to operate the multiple water pumps, the implication that fossil fuels are required for the operation of these pumps in addition to the products of the various chemicals reactions catalysed by the high temperatures need to be considered. In essence, any machinery within the station has the potential to pollute and cause moderate ecological harm to the local environments through atmospheric, aquatic and geological means.

Another factor that needs to be considered is the high levels of nitrogen and phosphorus available in the urine collected by the ECOSAN toilets. Without proper management and care, the spillage of these high nutrient solutions into waterways has a moderate potential for eutrophication. Eutrophication creates a snowballing effect through the trigger of rapid algal growth that may lead to the complete destruction of an aquatic ecosystem.

# Public Consultation

Due to the introduction of a modern and moderately complex technology, the lack of experience in its operation will most likely result in accidents that may threaten the health and safety of the village members in addition to possibly damaging the local environment. In order to maintain a high level of inter-generational equity, focus must be put on the fundamental education of the village members on the various functions and impacts that the proposal can achieve. This may be achieved through the provision of jobs operating the various pump stations with a trained professional to help accelerate the level and spread of understanding through the village.

# Assessment

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| **Magnitude** | | | | | |
|  | Spill and leaks | Waste products | Roads/Transportation | Excavation | Transmission Lines |
| Soil | 3 | 5 | 4 | 9 | 3 |
| Plants | 4 | 6 | 5 | 9 | 4 |
| Aquatic Wildlife | 9 | 3 | 1 | 6 | 1 |
| Terrestrial Species | 4 | 6 | 4 | 3 | 2 |
| Scenic views/ Aesthetics | 3 | 5 | 7 | 8 | 8 |
| Noise Pollution | 1 | 2 | 6 | 9 | 2 |
| Health and Safety | 7 | 4 | 5 | 4 | 5 |

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| **Importance** | | | | | |
|  | Spill and leaks | Waste products | Roads/Transportation | Excavation | Transmission Lines |
| Soil | 1 | 3 | 4 | 9 | 2 |
| Plants | 2 | 2 | 2 | 7 | 2 |
| Aquatic Wildlife | 9 | 3 | 1 | 3 | 1 |
| Terrestrial Species | 3 | 2 | 3 | 4 | 3 |
| Scenic views/ Aesthetics | 2 | 2 | 6 | 8 | 7 |
| Noise Pollution | 1 | 1 | 3 | 5 | 1 |
| Health and Safety | 4 | 2 | 5 | 4 | 6 |

As the project is moderately large in scale, the impact and risks of the multitude of activities take place during the construction and upkeep of the proposal have been considered in the Leopold Matrix above. As seen from the matrix, activities that have the potential for high impacts are primarily spills/leaks and excavations. As a result, an enhanced level of attention should be paid to the prevention/reduction of the likelihood of these impacts occurring. Environmental safeguards such as pH buffers, containment pools around pumps as well as scaffolding on rock walls during excavation will vastly decrease the potential for environmental impacts. As a result, the need for a clean and sustainable water supply system for Sandikhola and its various benefits greatly outweighs the moderately low risk of large environmental damage. Although alternatives such as atmospheric water generators exist, the requirement for toxic chemicals/extremely high levels of energy deem it unsustainable. Similarly, although ventilated pit latrines are practical as a sanitation system, their risk of leachate contaminating groundwater systems and the eventual the lack of available land violates the intergenerational equity principles.

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