DRAFT EIS OF MULTI BEVERAGE PROCESSING PLANT IN HERA, TIMOR LESTE

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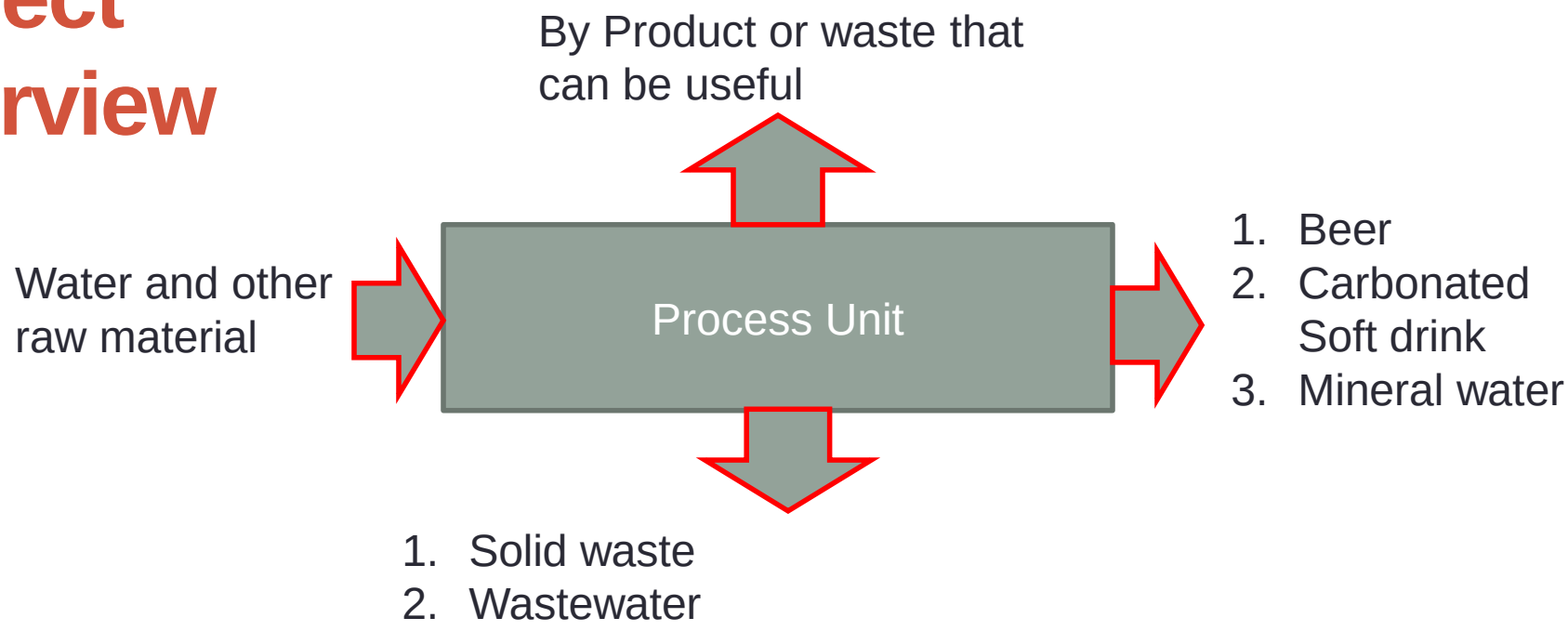
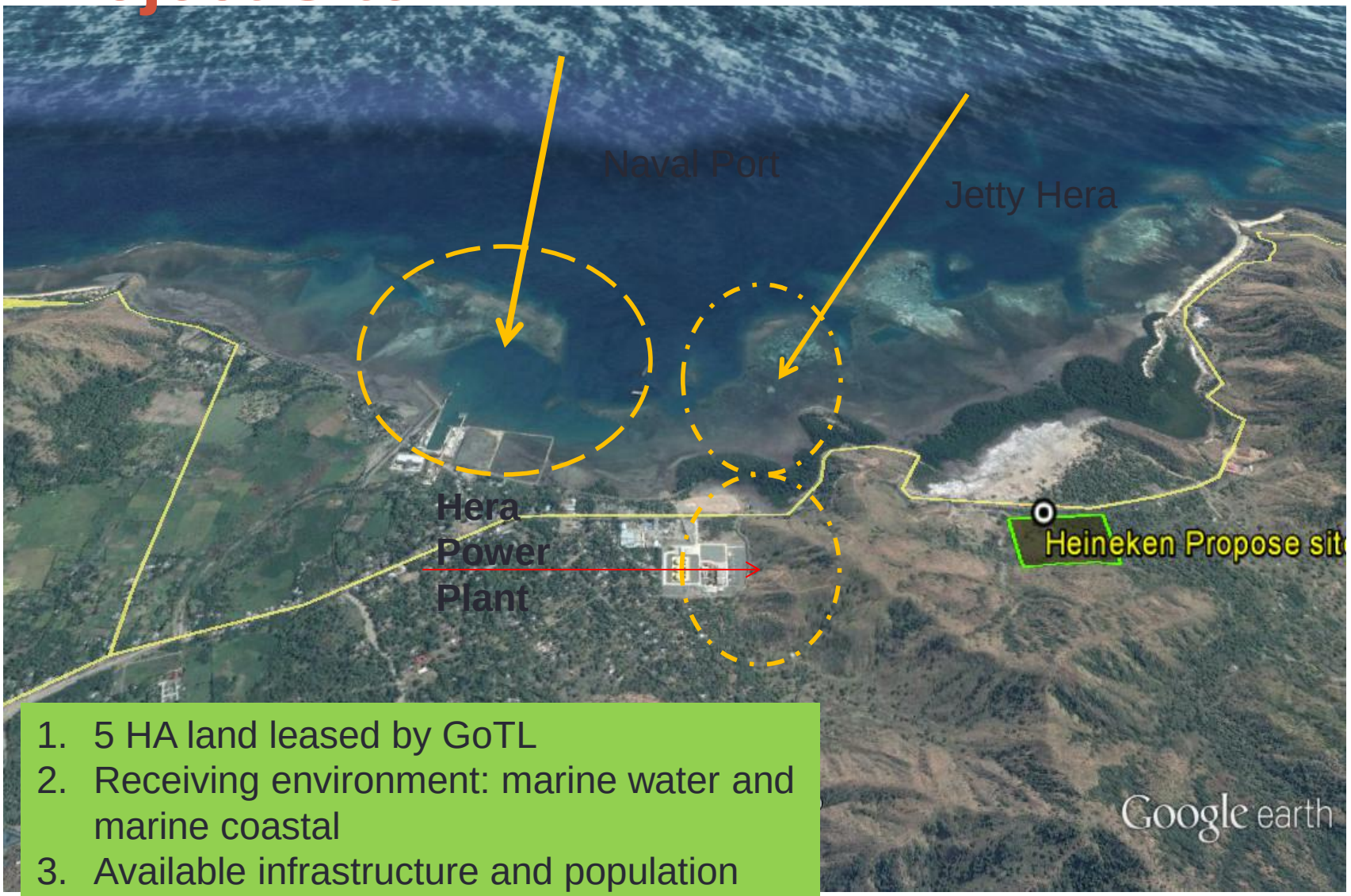
Project Overview



- Beer processing plant - annual capacity 300,000 HL
- Soft drink processing plant - annual capacity of 150,000 HL
- Packed mineral water - annual capacity of 150,000 HL
- The project will take 5 HA land in Aldeia Sukaer Laran, Suco Hera, east of Hera Power Plant

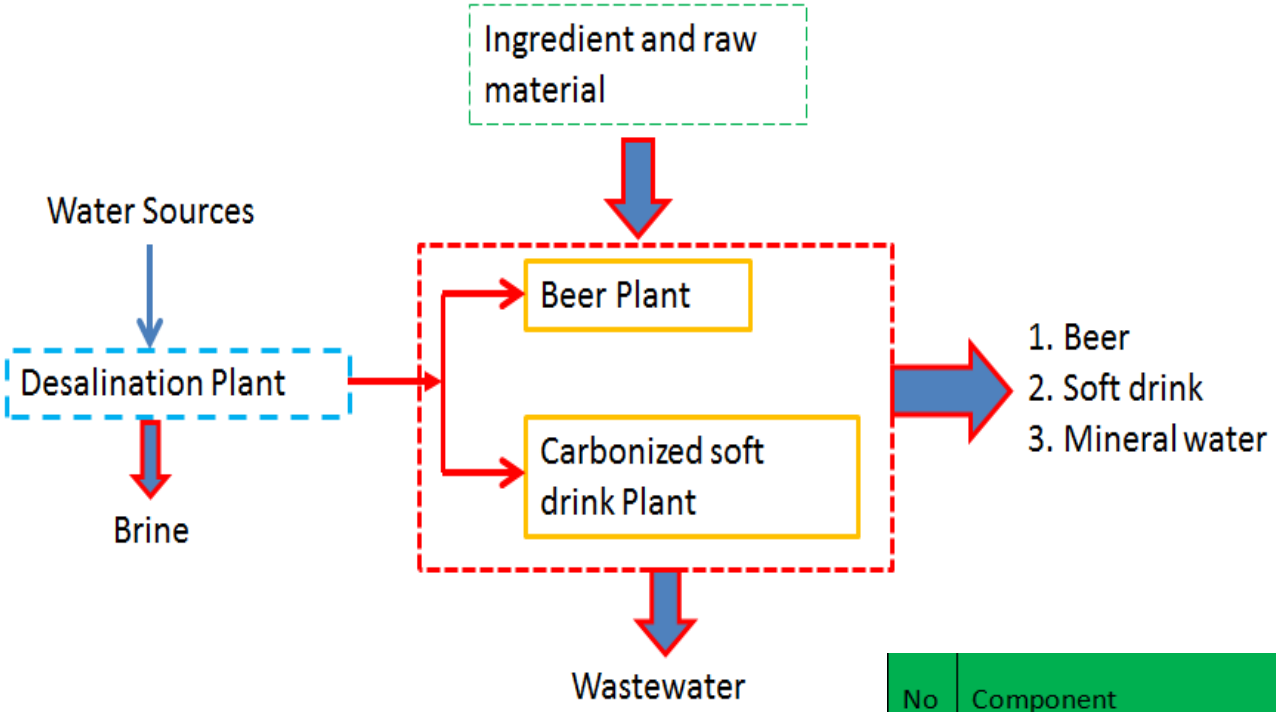
Concept and Layout Plant

Project Site



1. 5 HA land leased by GoTL
2. Receiving environment: marine water and marine coastal
3. Available infrastructure and population settlement in the program area

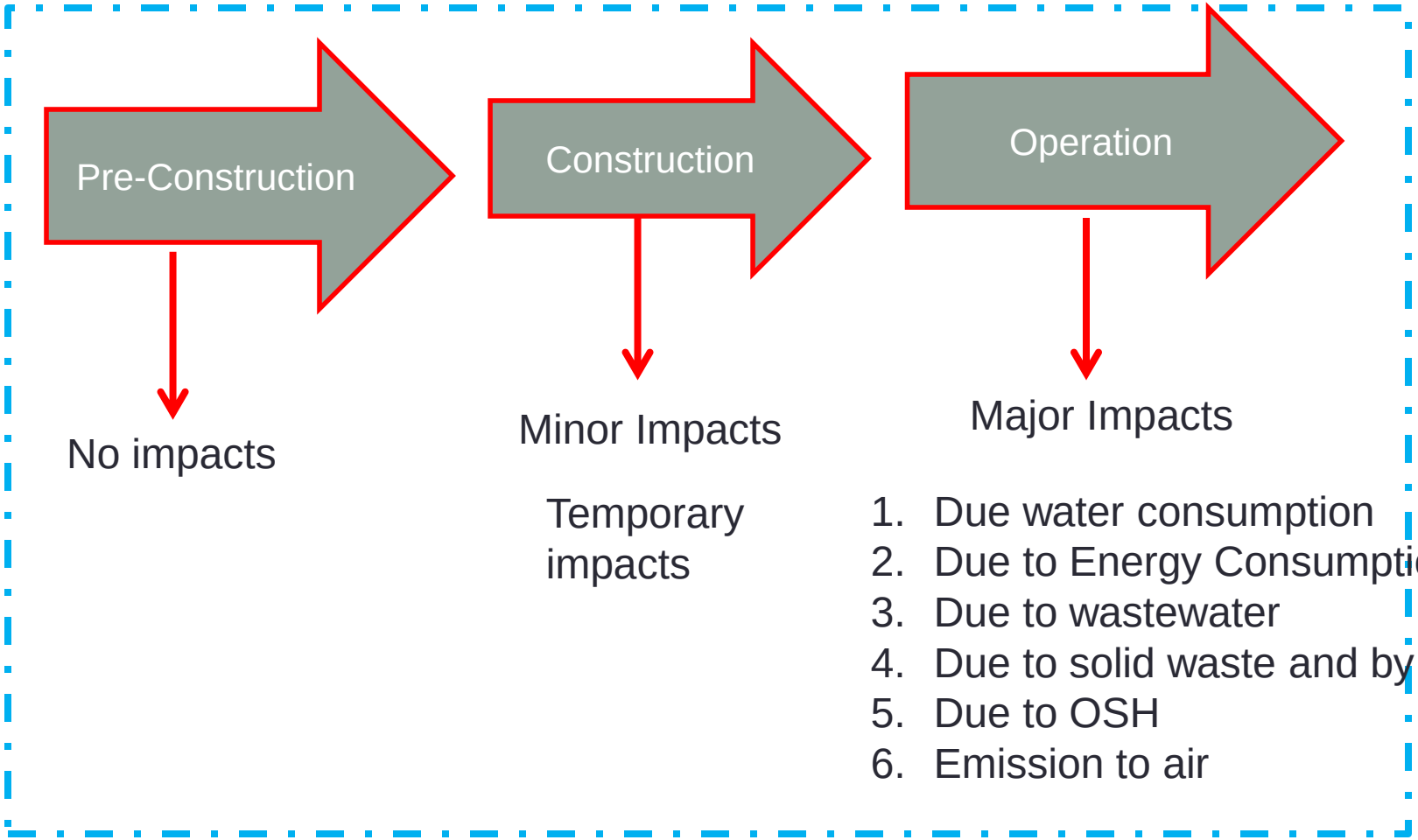
Project Component



1. Initial investment of $38 million
2. Operating cost of $7 per year

No	Component	Initial Investment Cost ($M)
1	Water extraction from groundwater	$ 0.40
2	Water treatment desalination plant	$ 3.50
3	Beer processing plant	$ 20.00
4	Soft drink processing plant	$ 3.60
5	Wastewater treatment plant	$ 2.00
6	Wastewater disposal system	$ 1.50
7	Operating cost (1 year)	$ 7.00
		$ 38.00

Project Implementation Stage and Impacts



Result of Baseline Data Collection

- Baseline Air quality
- Baseline of Marine water quality
- Survey of Ecological Resources (Mangrove, seaweed, seagrass, coral, fisheries)
- Baseline of groundwater quality pumping test and groundwater quality
- Baseline data collection of Social and Economic Condition

Air Quality Data

Parameter	Measuring result	Limit value
CO2, ppm	412	
Methane, ppm	1.78	
Nox, μg/NM3	3.9	400 (in 1 hour) and 150 (in 24 hour)
Sox, , μg/NM3	4	900 (in 1 hr) and (365 (in 24 hr)
PM10, μg/NM3	29	150
PM2.5,μg/NM3	15	65

24-hour Monitoring and data collection of baseline data

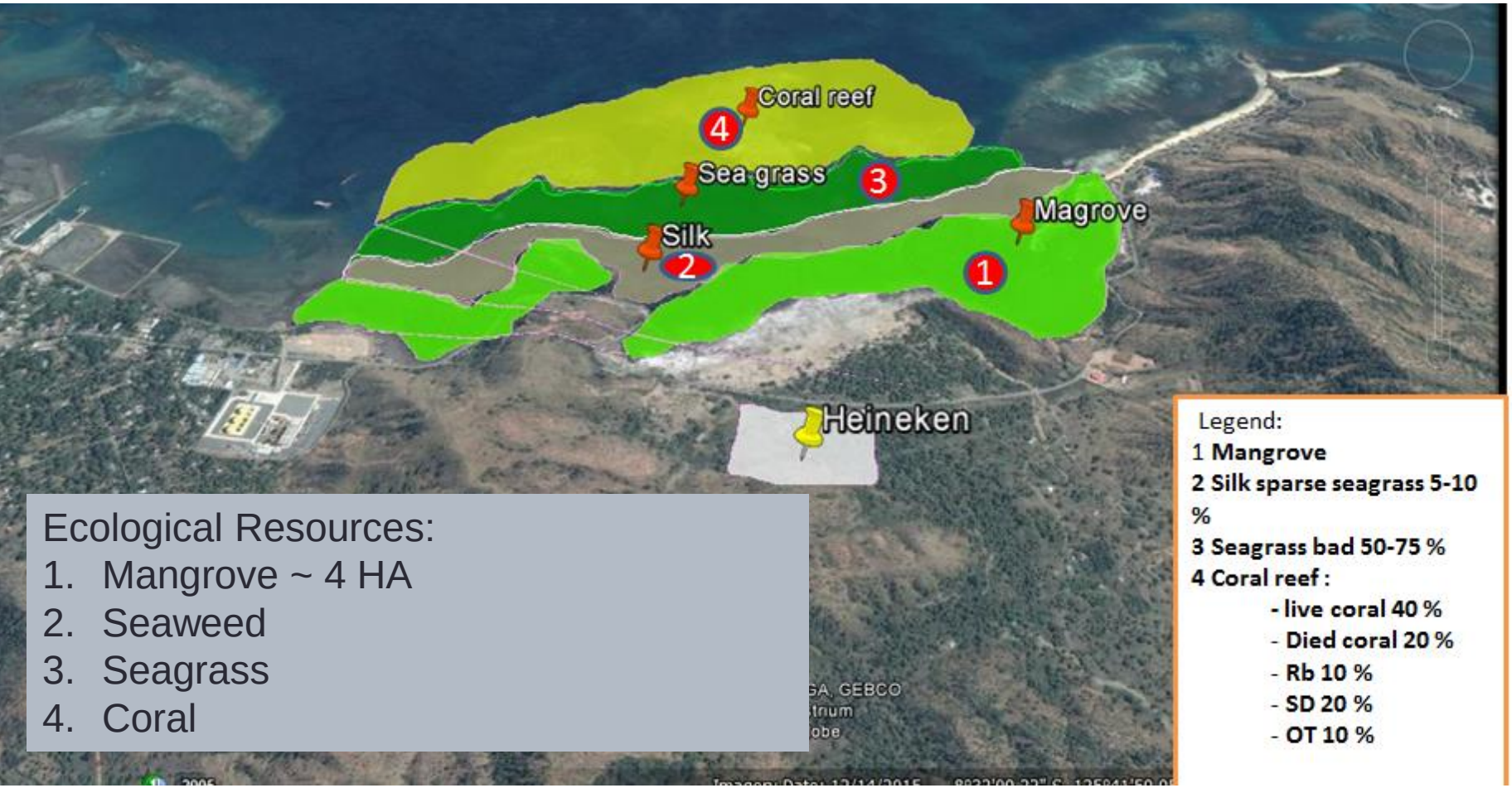
Baseline Data of Marine Water Quality

No	Parameter	Unit	Test Results	Standard*
Physical				
1	Turbidity	NTU	0.95	>3
2	Smell	-	No smell	-
3	Suspended Solid	mg/L	3.5	80
4	Solid Waste	-	Negative	0
5	Temperature	^0C	29.7	Natural
6	Oil Layer	-	Negative	0
Chemical				
1	pH	-	7.27	6.5 – 8.5
2	Salinity	$^0/_{00}$	31.6	Natural
3	Total Amonia	mg/L NH_3-N	<0.01	0.3
4	Sulfida	mg/L H_2S	<0.01	0.03
5	Total Hydrocarbon	mg/L	<1	1
6	Total Fenol	mg/L	<0.001	0.002
7	Nitrat	mg/L	0.422	-
8	Surfactan (deterjen)	mg/L LAS	0.235	1
9	Oil and Fat	mg/L	2.8	5
10	TBT (tri butyl tin)	mg/L	<0.001	0.01
Soluble Heavy Metal				
1	Mercury	mg/L Hg	0.00018	0.003
2	Copper	mg/L Cu	0.189	0.05
3	Zinc	mg/L Zn	0.259	0.1
4	Cadmium	mg/L Cd	0.193	0.01
5	Lead	mg/L Pb	0.044	0.05
Bacteriology				
1	Total Coliform	MPN/100 mL	7	1000

Result:

1. All the four measurement shows no concern on the marine ecosystem
2. Ecological healthy (SI index)
3. Only a concern is the soluble heavy metal such as Cu, Zn, Ca, Pb that are elevated compares to the standard)
4. The measurement result provide the information for the future reference

Survey of Ecological Resources



Ecological Resources:

1. Mangrove ~ 4 HA
2. Seaweed
3. Seagrass
4. Coral

Result of Ecological Survey

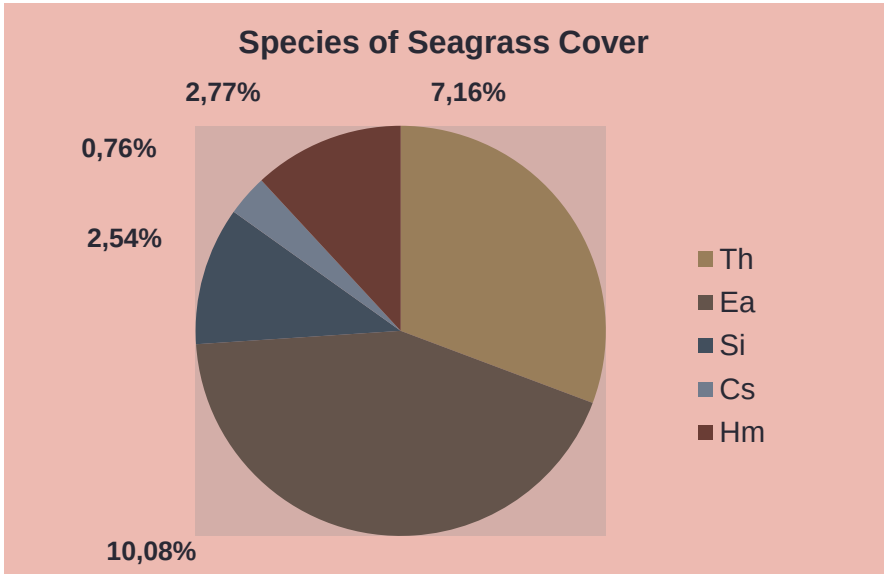
- 4 HA of mangrove was observed with dominant species of Reizophora
- Wide spread of seaweed and seagrass around the project boundary of beach and sea
- Combination of living and dead corals that is valuable for fish and people
- Marine

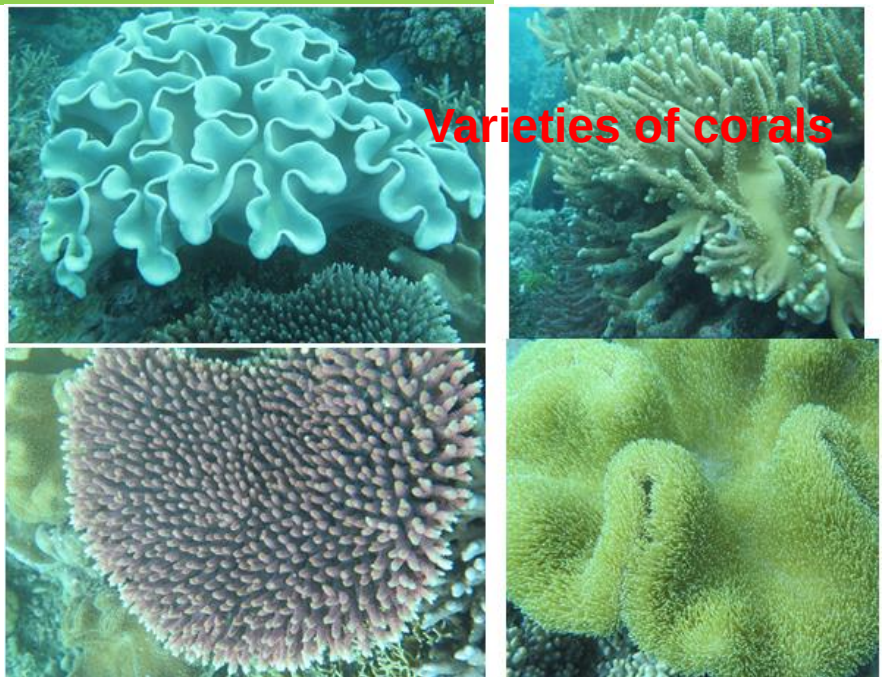
Biodiversity Indicator

Location	ID Simpson (D)	ID Shannon-Wiener (H')
S1	0.744	1.6
S2	0.856	2.2
S3	0.9	2.3
S4	0.89	1.53

Result of Ecological Survey

Mangrove species	%
Avicenia alba	1%
Avicenia marina	1%
Brugueira cylindrica	5%
Ceriops tagal	4%
Lumnitzera littorea	3%
Rhizophora apiculata	49%
Rhizophora mucronata	6%
Sonneratia alba	29%
Xylocarpus granatum	4%





Pumping Test and Groundwater Quality

Location of Pumping test and potential production well

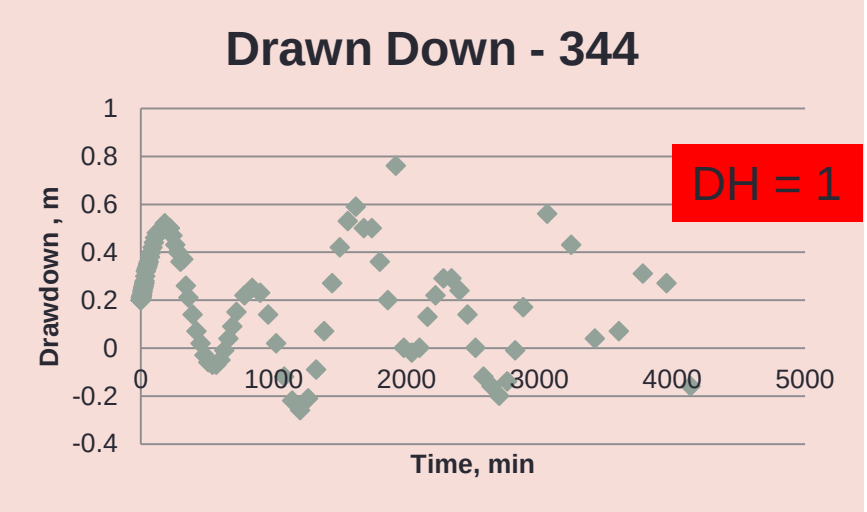
Testing Condition

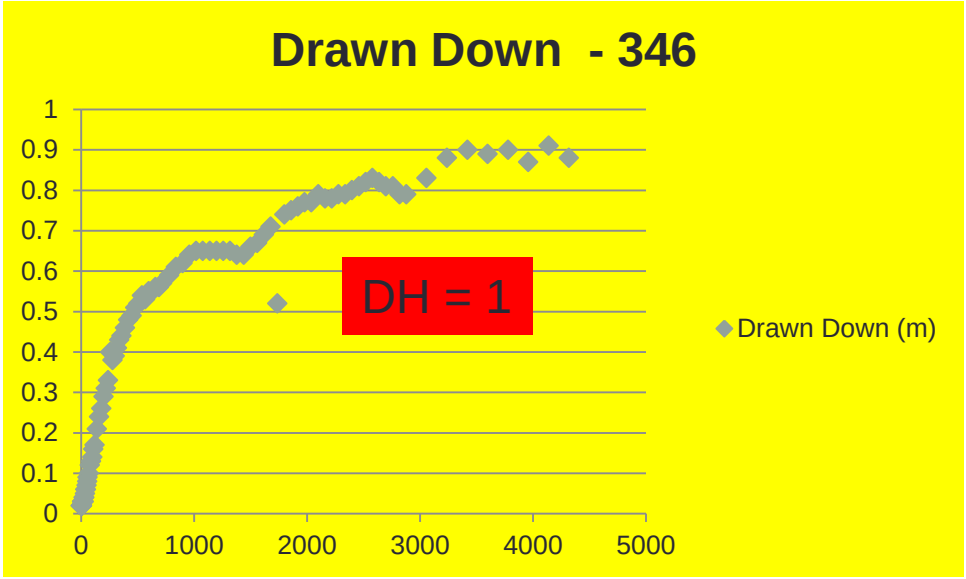
1. Pumping test in one location , then monitoring the drawdown in 3 locations
2. Pumping rate ~ 4 L/s
3. Duration of test 3 days

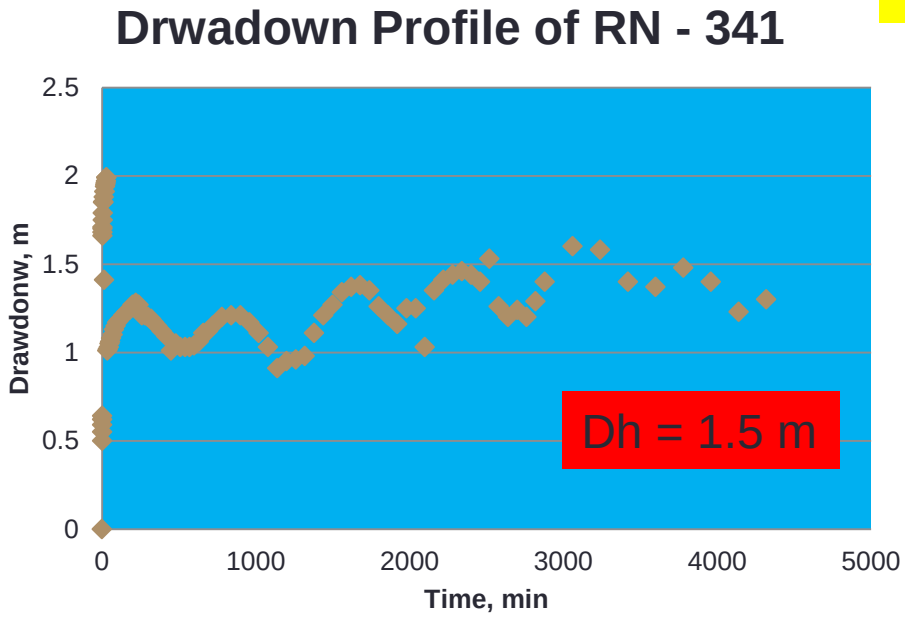
Result:

1. Three potential production wells are independent, meaning that the aquifer is different
2. The average drawdown during the testing was 2-3 meters, from the total water thickness of 10-30 m
3. The quality of water is brackish (1000- 5000) mg/L in salinity

Pumping Test and Groundwater Quality







Groundwater Quality

Test Parameter		HTSA # 347	HTSA # 344b
pH value at 25^{0}C		6.8	6.6
Conductivity at 25°C	µS/cm	1494	1918
Total Suspended Solids	mg/l	2	3
Total Dissolved Solids	mg/l	1,405	1,902
Turbidity	NTU	1.4	3.1
Salinity	ppt	0.5	0.8
Free Chlorine	mg/l	< 0.02	< 0.02
$NH_3 + NH_4^+$	mg/l	0.31	0.33
$NO_3^- + NO_2^-$	mg/l	0.05	0.01
Potassium	mg/l	1.14	2.49
Sodium	mg/l	219.1	314.6
Magnesium	mg/l	27.05	30.52
Calcium	mg/l	17.14	25.76
Strontium	mg/l	1.13	1.56
TOC	mg/l	33	86
DOC	mg/l	23	61
UV 254	cm^{-1}	0.024	0.024
Barium	mg/l	0.04	0.09
CO_3^-	mg/l	< 1.0	< 1.0
HCO_3^-	mg/l	656.7	855.7
Chloride	mg/l	74.7	102.6
Fluoride	mg/l	1.4	1.5

Test Parameter		HTSA # 347	HTSA # 344b
Sulphate	mg/l	46.2	37.6
Silica	mg/l	46	50
Boron	mg/l	2.55	4.66
Arsenic	mg/l	< 0.05	0.18
CO_2	mg/l	104.7	250.9
Total Alkalinity	mg/l	656.7	855.7
Total Hardness	mg/l	154.2	190.0
Total *Coliform*	CFU/100ml	< 1	< 1
Escherichia coli, (35°C, 24 hr)	CFU/100ml	< 1	< 1
Iron	mg/l	< 0.01	0.02
Manganese	mg/l	0.01	0.09

Result of Groundwater Investigation

- Drawdown at pumping rate of 4 L/s or 240 L/minutes does not cause any significant that may be a concern
- Recovery time really quick, that shows the large aquifer storage or water storage is reasonable large enough compare to pumping rate
- Salinity is high (brackish) that require further treatment for the consumption and industrial usage
- Observation of drawdown at pumping rate of 10 L/second would be need in order to know the profile of drawdown at the actual withdrawal capacity
- Quality of groundwater in general is good, except the salinity, total hardness, alkalinity, that are naturally high and typical in coastal location and in type of aquifer that contain high carbonate

Impacts During Pre-Construction and Construction Phases

- Temporary impacts that can be mitigated on the project site
- Noise and vibration
- General Occupational Heath and Safety (OSH) concern
- Temporary disturbance of air and water quality
- Soil erosion and sedimentation, solid and liquid waste from worker's activities
- Localized flooding
- Temporary air quality degradation

Impacts Assessment – Pre- and Construction

Type of activity	Potential Impacts /factor of concern
Site preparation and grading	soil erosion
	Sedimentation
	Slope Stability
	Loss of vegetation
	Air quality
	Disturbance of water body
Construction and decommissioning	Noise and Vibration
	Solid waste
	Wastewater discharge from workers
	Hazardous Material
	Land contamination
OHS - Hazard	Over-exertion
	Slips and Falls
	Work in Heights
	Struck By Objects
	Moving Machinery
	Dust
	Confined Spaces and Excavations
	Other Site Hazards
Community Health and Safety	General Site Hazards
	Disease Prevention
	Traffic Safety

Operation & Maintenance Phase

1. High water consumption (large volume of water) that will be pumped out from the groundwater
2. High energy consumption - Reverse Osmosis (RO) for desalination and bottled water production; steam generation for Heat Exchanger (HE) for beer processing, soft drink processing, wastewater treatment
3. By Product that can potentially become a problem without proper handling
4. Wastewater as 50% of water used will become wastewater
5. Solid waste
6. Greenhouse gas emission
7. Climate Change impacts

High Rate of Water Consumption – Groundwater pumping

Heineken decided to utilized groundwater in the local aquifer with the capacity of 600 L/min

Impacts:

1. Land subsidence – can cause structural damage (National road, Heineken facility itself)
2. Groundwater contamination from sea water intrusion
3. Water stress or crisis for local community
4. High energy requirement for pumping
5. High rate of wastewater to be treated
6. High cost to be paid

High rate of Energy Consumption

Total average annual energy consumption for the proposed plant size = 13,500,000 KWh/year

Average consumption per hectolitre product - beer and soft drinks

Year 2004	Unit	Soft drinks only	Breweries only	Average all bevarage sites
Electricity	Kwh/hl	4.5	9,7	9.5
Thermal	Kwh/hl	5.2	29.5	27.4
Total energy	Kwh/hl	9.7	39.2	36.9
Water	Hl/hl	2.2	4.7	4.4

1. Beer = 300,000 HL (hecto liter)
2. Soft drink = 150,000 HL
3. The utilization of this rate will generate revenue to GoTL but at the same time affect environment

Energy Consumption

- Pumping of groundwater
- Desalination plant to remove the salt from freshwater
- Process of heating and cooling within the process production will consume large energy within the processing plants
- Pumping of machinery or equipment and other lighting
- Currently the project owner plan to use power supply from EDTL
- The high consumption of energy will have positive and negative impacts that will be a concern

Environmental Issue of Energy Consumption

- High rate of carbon footprint and contribute to Green house gas emission
- Global warming (heat effect)
- Contribute to high operating cost
- Occupational health and safety
- Heath and safety of community

Wastewater

Large amount (300 L/min) of wastewater with high BOD/COD and other pollutant

Typical Ranges Of Brewery Untreated "End-Of-Pipe" Wastewater Effluent

PARAMETER	TYPICAL RANGE
Water to beer ratio	4 - 10 liter/liter
Wastewater to beer ratio	1.3 - 2 liter/liter lower than water to beer ratio
Biochemical Oxygen Demand (BOD)	600 - 5,000 ppm
Chemical Oxygen Demand (COD)	1,800 – 5,500 ppm
Nitrogen	30 - 100 ppm
Phosphorus	30 - 100 ppm
pH	3 - 12
Total Suspended Solids (TSS)	200 – 1,500 ppm

Coastal marine water, surrounding soil, will receive the waste loading from the beverage plant

Ecological Sensitive:

1. Mangrove
2. Coral
3. Seaweed, seagrass
4. Fisheries

The receiving environment

Environmental Issue related Wastewater

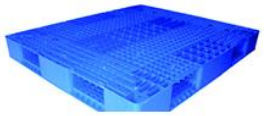
- Oxygen depletion in the receiving waterbody which the Hera bay
- Eutrophication (algae over growth)
- Odor emission
- High Suspended solid can cause high turbidity in the marine water body
- Low or high (normal range of PH 6-8)
- Greenhouse gas emission (CO_2 and Methane)

Solid waste and Byproduct

BREWING	PACKAGING	FOOD SERVICE	CONCERTS/ EVENTS
Spent Grains	Cardboard/Paper	Food	Food
Spend DE	Wood Pallets	Cardboard	Cardboard
Spent Yeast	Aluminum/Metal	Aluminum/Metal	Aluminum/Metal
Spent Trub	Glass	Glass	Glass
	Plastic	Plastic	Plastic

Source of solid waste


Bottles


Plastic pellet


Plastic Wrap


Cardboard – packaging


Wood pellets


Bottle and cup

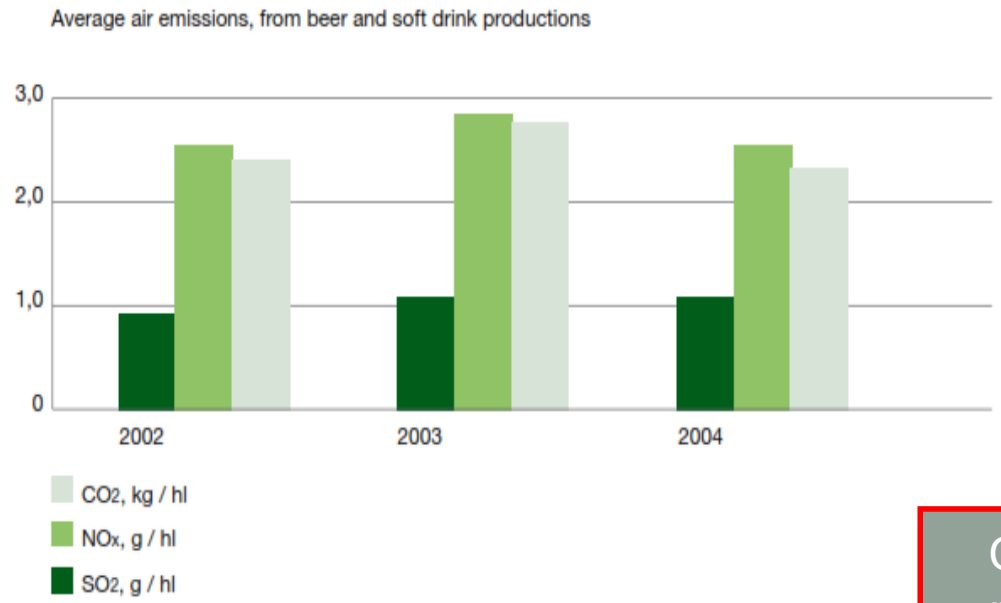
1. Average annual rate of solid waste and byproduct ~ 5000 ton/year
2. This rate will become a concern without proper handling
3. The environmental issue of the solid waste can contribute more waste loading into the marine environment

Environmental Problem of Solid waste

Problem (without proper handling)

1. Required Space to store
2. Environmental health and safety
3. Overtime the waste will become a hazardous material – the waste will decompose
4. Ultimately will pollute the marine environment (high BOD/COD, PH, nutrient, etc.)

Potential Emission Rate– Direct from the Plant



Emisison Paramter	Amount/year, Ton
CO2	750.00
Nox	0.72
Sox	0.30

Given the capacity of plant in Timor Leste

Emission problem:

1. Minor contribution to the greenhouse gas emission
2. Contribution to the local air pollution

Occupational Health and Safety

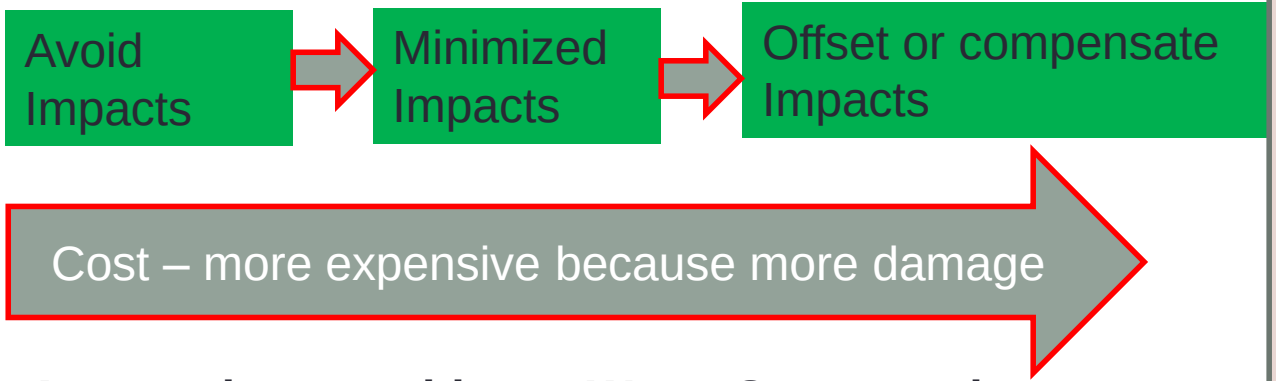
- **Explosion to risk – Organic dust from grain storage and milling**
- **Exposure to Chemical (Refrigerant and CO2)**
- **Physical Hazards (**Level (falling), Slippery, Use of machine and tools, Collision (transport equipment such as forklift, truck, and containers, etc), Dust, Pressurize gas/water system, Heat and Cold system/area
- **Exposure to Noise and Vibration (from various machineries that are operating within the facility)**

Community Health and Safety

1. Water availability and quality : Large consumption of groundwater by Heineken will affect the accessibility of community to freshwater
2. Structural safety and facility: Public and Community may have access to the facility
3. Life and Fire Safety (extended fire hazard can affect the community)
4. Traffic safety (from delivery raw material and product)
5. Disease and Presentation
6. Emergency Preparedness and Response

Solution – Mitigation Measures

- **Groundwater problem and water consumption**
- Energy consumption
- **Wastewater (liquid waste)**
- Solid waste
- Air emission
- OHS
- Community Health and Safety



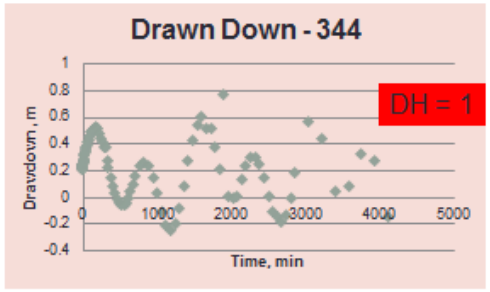
Among these problems, Water Consumption Wastewater, and solid are the major issues:

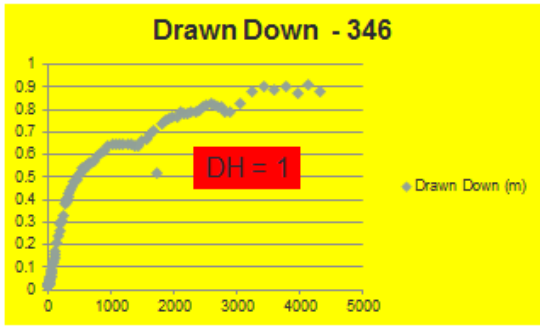
Hierarchy of Mitigation Measures:

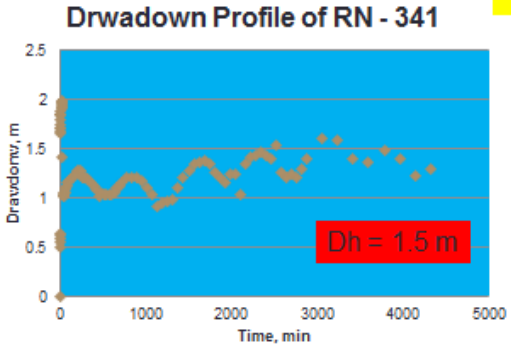
1. **Always tray to avoid the Impacts**
2. **If avoid is not possible, the minimize**
3. **Sometime avoid and minimize is not enough, then compensation or offset will be applied**

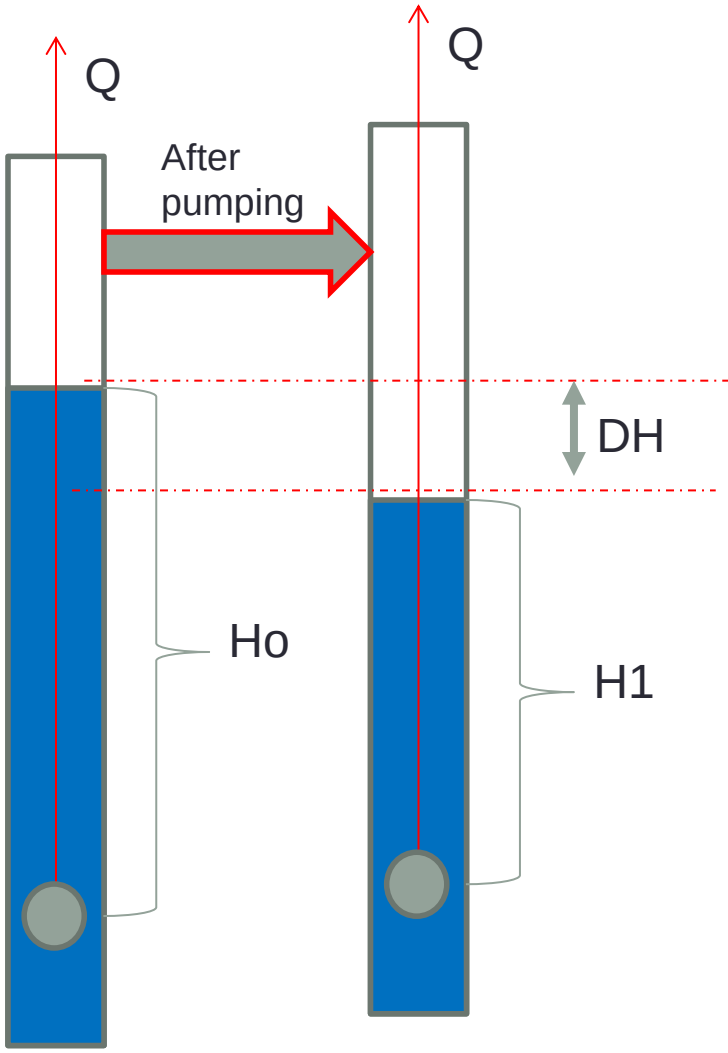
Groundwater - Pumping Rate

Pumping rate should be less than the rate of sustainable yield









DH of the each production well from testing is reasonably small ~ 0.5 – 2 meter) and quick recovery. This means that for the pumping rate of 200 L/min, the aquifer is sustainable. However, required testing with the capacity of 600 L/min to analyze the DH

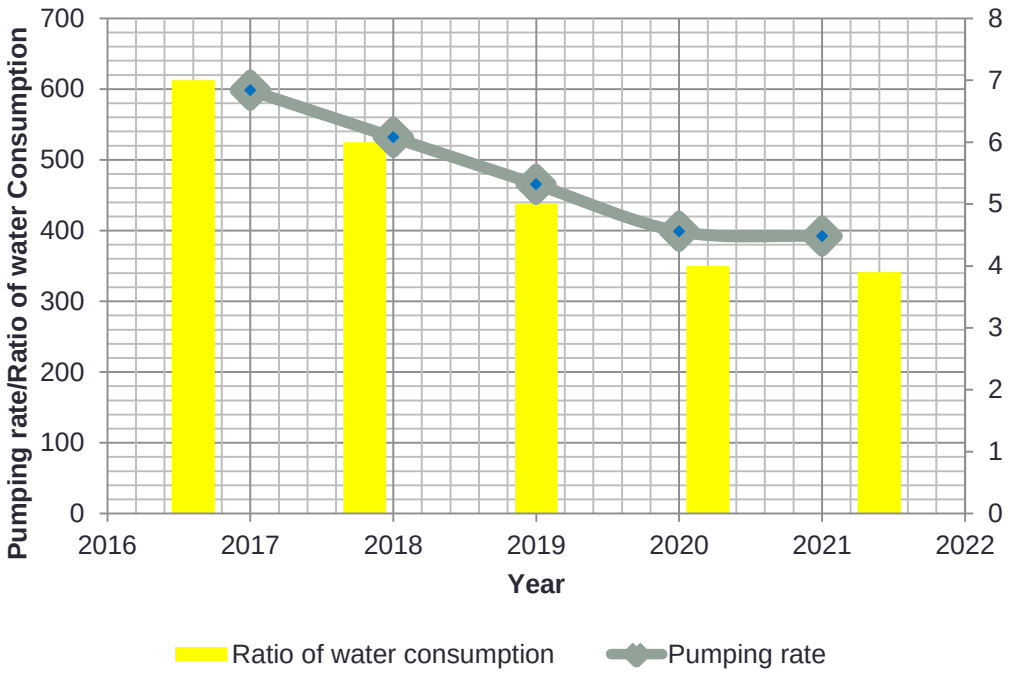
Operation of Production well – Mitigation

Avoidance: (1). Use Seawater; (2). Water source from upland river. By using this, the groundwater problem can be avoided

Minimize: (1). Reduce the rate of utilization, (2). Enhance groundwater recharge at upland, (3) Applies water conservation within the facility to achieve the reduction of water utilization, (4) monitor pumping, water use line, to achieve no. 1

Compensate/offset : (1). Provide water to the community, (2). Recharge the groundwater aquifer with treated wastewater

Reduction of water consumption



Water consumption trend:

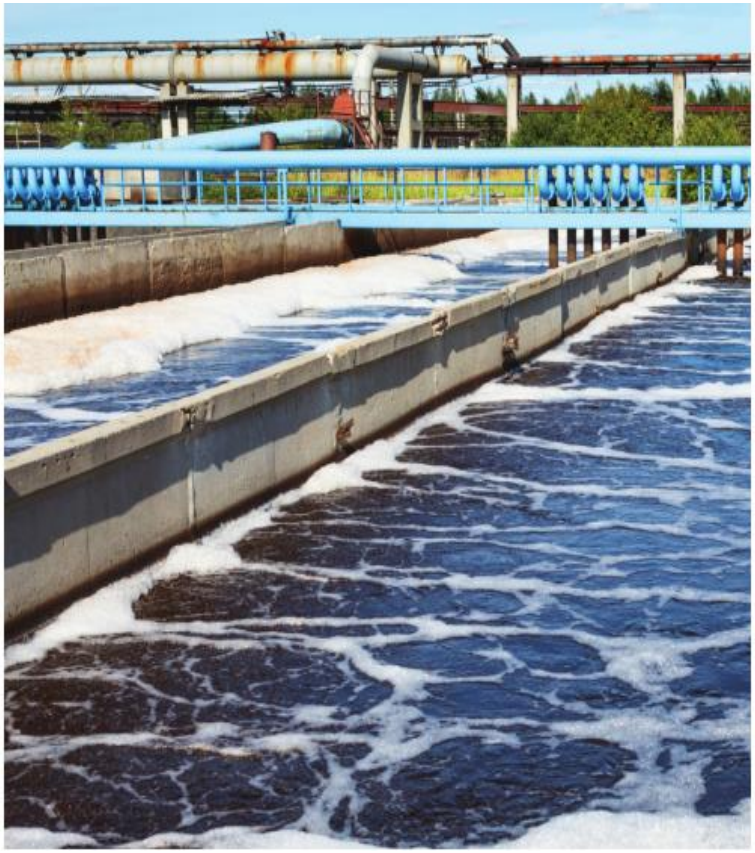
1. Year 1, the plant consumed around 600 L/min
2. Year 2, the water consumption will be reduced to 500
3. Year 3, the water consumption will be reduced to 400 L/min

The reduction can be achieved by implementing EMP such as water conservation within the facility and water reduction program. By doing so, the rate of groundwater withdrawal will be reduced. **Groundwater is sustainable**

Mitigation Measures (Water Consumption)

- Limit and control pumping rate at production well at lower rate than sustainable yield
- Do not used groundwater is if the volume in the aquifer is limited compare to the rate of utilization
- Implement water conservation in washing process in packing
- Optimize cleaning in Place (CIP) to avoid unnecessary loss
- Evaluate closed-loop system for water used in pasteurization tower by recirculating. This reduce the use of freshwater

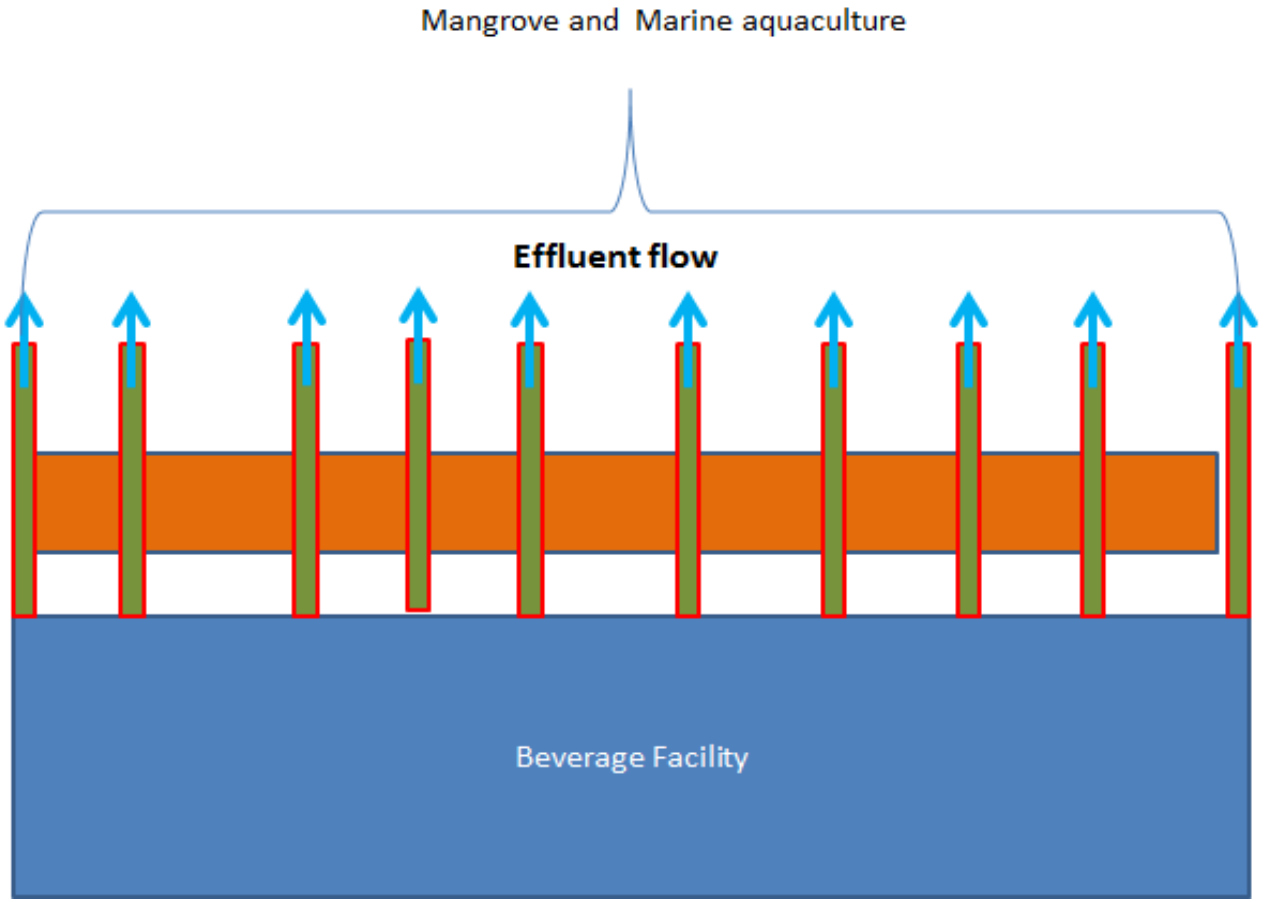
Wastewater Treatment System



1. **PH equalization : to adjust PH to 6-8, in the range, it is acceptable to environment**
2. **Physical treatment: Separation of solid waste from liquid waster – Remove larger solid waste**
3. **Biological Treatment of anaerobic system** - Reduce BOD/COD and nutrient
4. **Biological treatment of aerobic system -** Reduce BOD/COD and nutrient
5. **Sedimentation system :**
6. **Sludge process**
7. **Disinfection**
8. **Disposal to the drain or reuse water**

Solution to the wastewater is to use the best available technology to treat the waste water up to the level that is acceptable to environment

Disposal of Wastewater Effluent



Q = 300 L/min

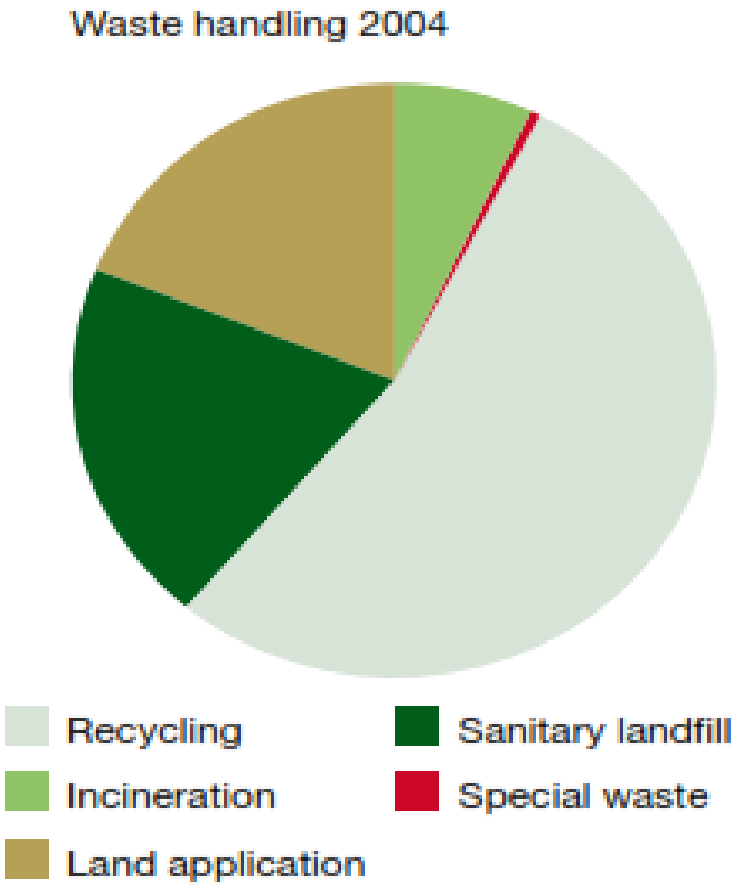
Split into 10 discharge point, this means that each discharge point will have rate of 30 L/min. by doing so the soil will has capacity to retain the effluent

The result: (1). During the normal flow: no wastewater will enter the marine coastal
(2). During the rainy season, when the soil is saturated, the wastewater will enter the marine environment

Wastewater –Treatment and Disposal

- **Avoidance**: Can not be avoided (unless stop the operation)
- **Minimize: (1).** Reduce the rate of utilization, (2). Treatment with the BAT (best available technology), (3) Applies water conservation within the facility to achieve the reduction of water utilization, (4). Enhance the of reuse treated wastewater, (5). Proper solid waste management, (6). Leak detection to ensure all wastewater enter the treatment system.
- **Compensate/offset :** (1). Provide water to the community, (2). Recharge the groundwater aquifer with treated wastewater

Solid waste handling



Mitigation Measures (Solid waste and by products

- Optimal use of raw material to increase yield and reduce the generation of solid waste
- Valuable by product that has commercial value should be explored by (collecting and selling them and do not dump into effluent stream)
- recycle the broken cans/glasses and other solid waste that can be recycle and reused
- Utilize sludge as fertilizer in the farming system
- Proper collection of solid waste and handling in proper location (Tibar landfilling)

Mitigation Measure (Emission to the air of odor and dust)

- The source of odor is from wort boiling process and therefore, the mitigation is to collect the vapor and condense it
- Cyclone and bags filter should be used to collect and recover dust that arise during the handling of raw material such as grain and flour from malt processing unit

Mitigation Measures (Energy Consumption)

- Install energy meter throughout the facility to measure the energy consumption
- Develop the hot water balance within the system to examine the possibility of heat recovery from all the process
- Recover heat from wort cooling to pre-heat water for mashing the next batch
- Use high gravity brewing
- Control and optimize evaporation in wort boiling, where 6 to 10% of wort is deliberately boiled off (various mechanism to control this)
- Ensure effective insulation of steam, refrigeration, tunnel pasteurization, etc.
- Optimize refrigeration system operation by various factors
- Ensure that pressure in the compressed air system is as low as possible
- Optimize the operation of large motors within the facility

Mitigation Measures (Occupational Health and Safety = OHS)

- Potential explosion risk (Ovoid dust accumulation in working area, provision of electrical grounding, use explosion proof electrical motor connection in high risk area, integration of explosion relief vents in the facility, etc.)
- Exposure to chemical hazard (use proper handling to the chemical according professional standard guideline)
- Physical hazard: use proper guideline and apply Personal Protection Equipment (PPE) to the workers while performing the physical works that has high potential of physical hazard)
- Exposure to noise and vibration (Use appropriate PPE)
- More detail of the solution are provided in the report

Monitoring Program and Performance Indicator

- The Implementation of various propose mitigation measures should be monitored in order to ensure the plans are implemented
- The monitoring program always referring to the standard reference or performance indicator which can be set by Heineken or referring to other best practice in the related industry
- By comparing the reference data (baseline data) and standard regulatory guidelines, the project can be assured that the impacts are controllable and managed

Performance Indicator

Pollutants	Units	Guideline Value
pH (WWTP)	pH	6 – 9
BOD_5	mg/l	25
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Temperature increase	°C	<3[b]
Total coliform bacteria	MPN[a] / 100 ml	400
Active Ingredients / Antibiotics	To be determined on a case specific basis	

Notes:
[a] MPN = Most Probable Number
[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

Outputs per Unit of Product	Unit	Benchmark
By-products [a] (Solid waste)		
Spent Grains	kg/hl beer	16-19
Yeast & Lees		1.7 - 2.9
Kieselguhr		0.4 – 0.7
Liquid Wastes		
Liquid Effluents	hl/hl beer	3 – 6
Beer Loss	%	1 - 5

Notes:
[a] Input and Output Figures for Large German Breweries (capacity over 1 million hl beer) EC (2006

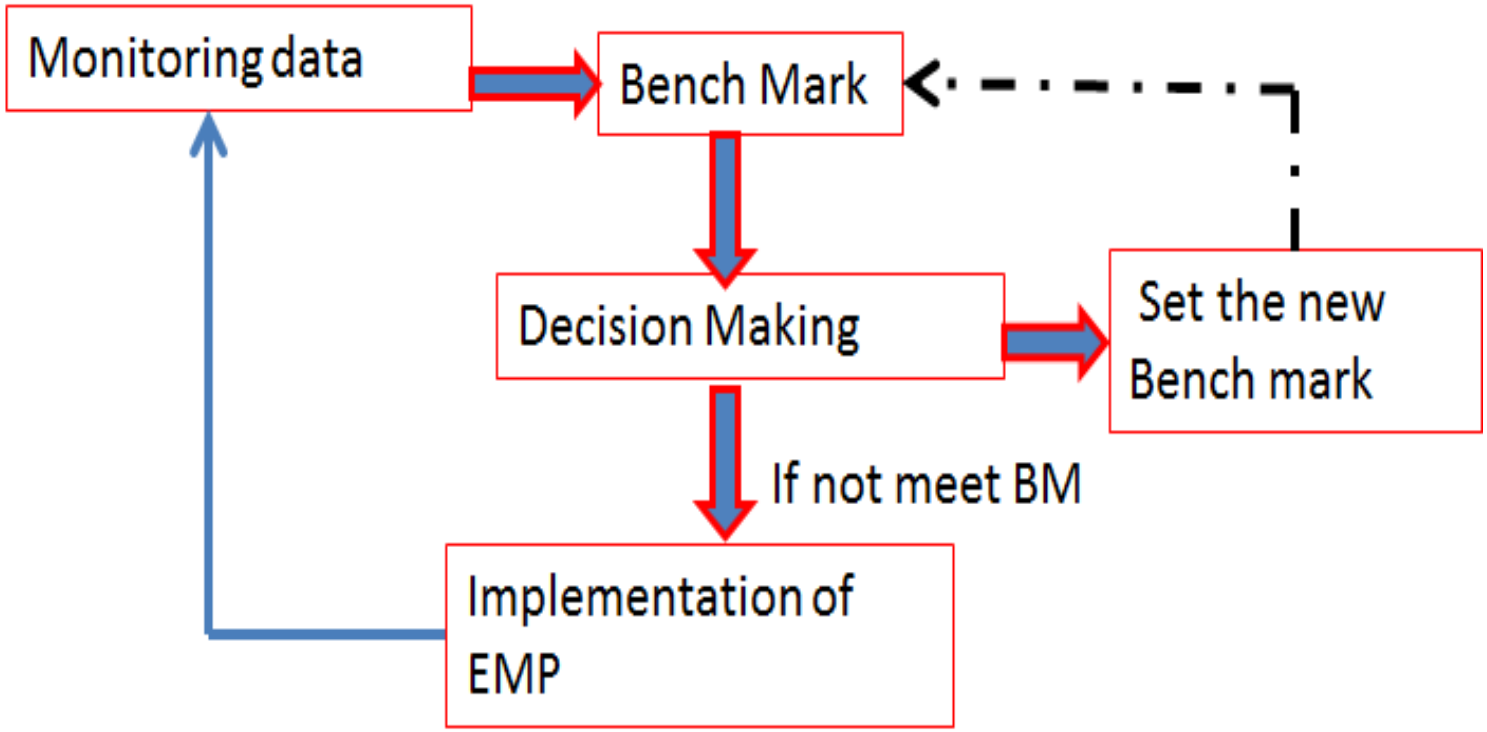
Outputs per Unit of Product	Unit	Benchmark
Energy [a] (Resource Utilization)		
Heat	MJ/hl	85–120
Electricity	kWh/hl	7.5–11.5
Total Energy	MJ/hl	100-160
Water [a]		
Water consumption	hl/hl beer	4 - 7

Notes: [a] Input and Output Figures for Large German Breweries (capacity over 1 million hl beer) EC (2006)

Safety parameters and indicators (OHS)

Parameters	1. Fatal accidents	Fatalities, own staff and contractor personnel
	2. Accidents resulting in permanent disability	Permanent disabilities, own staff
	3. Accidents resulting in absence from work	Accidents, own staff and contractor personnel
	4. Lost days	Absence due to an accident, own staff in calendar days
	5. Workforce	Expressed in Full-Time Equivalents (FTE)
Performance indicators	1. Accident frequency	Own staff, number of accidents resulting in absence from work per 100 FTE
	2. Accident severity	Own staff, lost days from work per 100 FTE

Monitoring Data, Benchmark and EMP



1. Monitoring the important key parameters (Water use, groundwater level, energy use, rate of waste generation, etc.) during implementation of EMP
2. The data will be compared with the BM, if is too far from BM, then perform the audit and analysis to know where is the problem
3. Implement the EMP
4. If the monitoring data already equal to BM, then set new BM to achieve more efficacies

Conclusions Remarks

- Proposed project of multi-purpose beverages by Heineken will utilize 600 L/min of water from the groundwater system and treat the water prior to utilization.
- The process production also required extensive use of energy which will be fulfilled by the supply from EDTL
- The process production will produce beverages as desired products and waste (liquid and solid waste) that required a proper handling to avoid the negative impacts to the environment
- The major impacts during the operation are related to the resources utilization (water, energy, and raw material) that will also generate waste (solid waste, liquid waste, and emission)
- The occupational, health, and safety (OHS) and community health and safety are also a concern that can be managed by various EMP
- The impacts can be managed in minimized. Heineken has strong commitment to the concept of sustainability, where safety and minimum risk of environment is the central pillar of sustainability in their operation
- Control and monitoring program by the regulatory agencies however is necessary to ensure the compliancy to the regulation with the end result of good quality of environment at one hand but still generate economic benefits