

Environmental & Social Impact Assessment Report (ESIA)

Fruit Processing Facility at Jarol

Mandi District
Himachal Pradesh



Submitted to
HP-Horticulture Development Project
Dyerton Bizhub, near Talland Bypass
Shimla-171001

Prepared by
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May 2021

Foreword

Himachal Pradesh Horticulture Development Project (HPHDP), HP in support of World Bank funding is presently manufacturing fruit processing products, mainly include 30 TPD apple juice concentrate, squash, pickle, fruit drinks etc. The existing facility is proposed to expand further with Ready to Serve Line (RTS) with capacity of 2000 LPH, automatic glass bottle filling line with capacity 500 LPH, wine processing plant of capacity 75000 LPA and vinegar processing plant of capacity 50000 LPA. The fruit processing facility is located in an area of 1.0 acre (4051.85 sqm) and NH-154 [NH-21 as per SOI topomap] is 16 m (W) away from site. The total water requirement for the fruit processing facility is around 36 KLD and around 30 KLD of waste water is generated during the process operations, for which a waste water treatment plant is provided. Around 6.6 tons/day of solid waste is generated during the process and the same is treated by compost process and the compost is finally used as manure. The funds allotted for upgradation of the existing facility is Rs. 15 crores.

With a view to assess the potential environmental impacts arising out of Jarol fruit processing facility, at Jarol, HPHDP retained Ramky Enviro Services Private Limited (RESPL), Hyderabad to undertake an Environmental & Social Impact Assessment (ESIA) study for various components of environment to prepare the Environmental & Social Management Plan (ESMP).

The Environmental & Social Impact Assessment report presents the baseline data covering one season monitoring for air, water, soil, noise, land, ecological and socio-economic components of environment with a view to identify, predict and evaluate the potential impacts due to the proposed fruit processing plant. An environmental and social management plan has also been delineated.

The co-operation and assistance rendered by the officials of HPHDP and HPMC, Shimla and project site officials at Jarol in the preparation of this ESIA report is greatly acknowledged.



Dr. B. Chakradhar
(Project Coordinator)
Ramky Enviro Services Private Limited

DATA CONTROL SHEET		
1. Report No: RESPL/HPHDP/ESIA/FPP/Jarol/03	2. First submission	February 2019
	3. Final submission	May 2021
4. Title of the Report :	5. Project Co-ordinator :	
Environmental & Social Impact Assessment Report for Fruit Processing Facility at Jarol, Mandi District, Himachal Pradesh	Dr. B. Chakradhar	
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9. Sponsoring Organisation & Address :	10. Type of Report : Consultancy Project	
Himachal Pradesh Horticulture Development Project, Dyerton Bizhub, near Talland Bypass Shimla-171001		
11. Key Word(s):	12. Pages : 215 + Annexures 22	
Fruit Processing, Apple Juice & Concentrate, Baseline data, Air, Water, Soil, Land environment, Socio-economic, impact identification evaluation, environmental management plans.		
13. Abstract:		
Jarol fruit processing facility is presently manufacturing 30 TPD apple juice concentrate, squash, pickle, fruit drinks. The facility is also proposed to expand further with Ready to Serve Line (RTS) with capacity of 2000 LPH, automatic glass bottle filling line with capacity 500 LPH, wine processing plant of capacity 75000 LPA and vinegar processing capacity of 50000 LPA. The ESIA report presents the environmental baseline data collected at project site within 2 km radius from processing plant for air, water, soil, noise, land, ecological and socio-economic components with view to identify, predict, evaluate the impacts and prepare an environmental management plan to mitigate any adverse impacts arising out of fruit processing operations.		
13. Distribution / Classification : Restricted		

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Project Coordinator
(Dr. B. Chakradhar)

Dr. B. Chakradhar (Key Expert)

Conducted 'site screening' to identify significant environmental issues. Identified risks (including labour, health and safety) and analysed associated impacts for all the key stages of the project cycle. Examined techno-commercially feasible solutions to mitigate such impacts and selected an appropriate solution with rationale. Proposed measures for air pollution management, identified sources, types and quantities waste generated and proposed methodologies for gainful utilization of waste.

Mr. V. Vijay Kumar (Key Expert)

Provided expert inputs in 'site screening', identified project's area of influence and finalized the plan for environmental baseline study. Conducted interpretation of primary data obtained from baseline studies and validated with secondary data. Identified laws and regulations applicable for this project and suggested requirements for compliance. Estimated water requirement/wastewater generation (both quality and quantity), prepared water balance diagram(s) and suggested water conservation measures and the most suitable wastewater treatment option after considering alternatives. Suggested measures for soil conservation.

Dr. Harish Srivatsava (Key Expert)

Methodology setting, collection of intervention specific in-situ baseline data and contribution in documentation of project specific structural impact on social system, demography, skill set, employment patterns, infrastructure facilities, settlement patterns. Peer learning & discussion to analyze positive and negative Impact on community eco-system. Proposed measures to gender inclusion and stakeholder engagement.

Mr. K. Anjaneyulu (Key Expert)

Provided Inputs for on-field-engagement, review of secondary data - published and unpublished, analysis of social baseline in-situ data collected from the field. Identified project specific impacts on functional aspects like - macro-economic indicators, forward and backward linkages, sectoral strengthening, health profile, crime rate and safety. Proposed measures for management of third party contractors, workers education, & awareness and strengthening of local economies.

Dr. TSS Jyothsna (Non-Key Expert)

Provided the details of requirement of water, sources of waste water and solid waste generation, and other information such as procedures etc., collected during site visit. Gave inputs for waste generation and mitigation strategies. Suggested alternative technologies for waste management, especially solid waste. Assisted the key experts and guided the support staff in preparation of the report.

Mr. Subash Koduri (Non-Key Expert)

Conducted literature survey necessary for better understanding of the intervention and collected necessary secondary information from multiple sources. Reviewed report and checked compliance with guidelines provided by HPHDP for preparation of Environment Impact Assessment Report. Assisted key experts and coordinated with other non-key experts and support team (such as GIS expert) with preparation of the report, especially related to engineering aspects such as updating layout plans etc.

Support Staff:

Prepared maps, layouts etc., conducted literature survey, editing/formatting of reports, conducted proof reading, contacted manufacturers/suppliers/vendors as and when necessary to arrive at EMP costing, web research on alternative technologies etc.

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Abbreviations

AAQ	:	Ambient Air Quality
ACF	:	Activated Carbon Filter
AIDS	:	Acquired Immunodeficiency Syndrome
ALOHA	:	Areal Locations of Hazardous Atmospheres
ANSI	:	American National Standards Institute
APCD	:	Air Pollution Control Device
APEDA	:	Agricultural and Processed Food Products Export Development Authority
APHA	:	American Public Health Association
APMC	:	Agricultural Produce Market Committee
ARAI	:	Automotive Research Association of India
ASHA	:	Accredited Social Health Activists
BATNEEC	:	Best Available Techniques Not Entailing Excessive Costs
BEO	:	Best Environmental Options
BMW	:	Bio Medical Waste
BOD	:	Biological Oxygen Demand
BP	:	Bank Practice
BP	:	Boiling Point
BS	:	British Standards
BSI	:	Botanical Survey of India
C&DWM	:	Construction and Demolition Waste Management
CA	:	Controlled Atmosphere
CCP	:	Critical Control Point
CFE	:	Consent for Establishment
CFO	:	Consent for Operation
CGWA	:	Central Ground Water Authority
CIP	:	Cleaning in Place
COD	:	Chemical Oxygen Demand
CPCB	:	Central Pollution Control Board

CSC	:	Common Service Centre
CSIR-NEERI	:	Council of Scientific & Industrial Research- National Environmental Engineering Research Institute
CSR	:	Corporate Social Responsibility
CTO	:	Consent to Operate
DDT	:	Dichloro Diphenyl Trichloroethane
DG	:	Diesel Generator
DIU	:	District Implementation unit
DMP	:	Disaster Management Plan
DMS	:	Degrees Minutes Seconds
DWPE	:	De Watering Poly Electrolyte
E & S	:	Environmental & Social
EC	:	Electrical Conductivity
EHS	:	Environmental Health and Safety
EIA	:	Environmental Impact Assessment
ELCB	:	Earth Leakage Circuit Breaker
ELULC	:	Effective Land Use Land Cover
EMC	:	Environmental Management Cell
EMP	:	Environmental Management Plan
EPA	:	Environmental Protection Act
ESIA	:	Environmental & Social Impact Assessment
ESMF	:	Environmental and Social Management Framework
ESMP	:	Environmental & Social Management Plan
ETP	:	Effluent Treatment Plant
F&EI	:	Fire and Explosion Index
FETI	:	Fire Explosive Toxicity Index
FGD	:	Focus Group Discussion
FIG	:	Farmer Interest Groups
FP	:	Flash Point
FPO	:	Farmer Producer Organization

FSI	:	Forest Survey of India
FVW	:	Fruit and Vegetable Waste
GDP	:	Gross Domestic Product
GC-ECD	:	Gas Chromatograph-Electron Capture Detector
GIS	:	Geographical Information Systems
GLC	:	Ground Level Concentration
GoHP	:	Government of Himachal Pradesh
GPH	:	General Process Hazard factor
HCH	:	Hexa Chloro Cyclo Hexane
HCV	:	Heavy Commercial Vehicles
HIV	:	Human Immunodeficiency Virus
HP	:	Himachal Pradesh
HPHDP	:	Himachal Pradesh Horticulture Development Project
HPHDS	:	Himachal Pradesh Horticulture Development Society
HPMC	:	Horticultural Produce Marketing and Processing Corporation Limited
HPSACS	:	Himachal Pradesh State AIDS Control Society
HPSAMB	:	Himachal Pradesh State Agriculture Marketing Board
HPSEB	:	Himachal Pradesh State Electricity Board
HSD	:	High Speed Diesel
IBA	:	Important Bird Area
IBRD	:	International Bank for Reconstruction and Development
ICAR	:	Indian Council of Agricultural Research
ICTC	:	Integrated Counseling and Testing Centre
IDA	:	International Development Association
IMD	:	Indian Meteorological Department
IRC	:	Indian Road Congress
IS	:	Indian Standards
IUCN	:	International Union for Conservation of Nature
JICA	:	Japan International Cooperative Agency
KII	:	Key Informant Interview

KPI	:	Key Project Indicator
LCA	:	Life Cycle Analysis
LCV	:	Light Commercial Vehicles
LDO	:	Light Diesel Oil
LED	:	Light Emitting Diode
LEL	:	Lower Explosive Limit
LOS	:	Level of Service
LULC	:	Land Use Land Cover
MoEF&CC	:	Ministry of Environment, Forestry and Climate Change
MP	:	Melting Point
MPC	:	Marginal Propensity to Consume
MPS	:	Marginal Propensity to Save
MSDS	:	Material Safety Data Sheet
MSIHC	:	Manufacture, Storage and Import of Hazardous Chemical
MSK	:	Medvedev–Sponheuer–Karnik scale
MSI	:	Mean Sea Level
NAAQ	:	National Ambient Air Quality
NACO	:	National AIDS Control Organization
NDMA	:	National Disaster Management Authority
NFPA	:	National Fire Protection Association
NGO	:	Non-Government Organization
NH	:	National Highway
NIHL	:	Noise Induced Hearing Loss
NIST	:	National Institute of Standards and Technology
NOC	:	No Objection Certificate
NPAG	:	Nutritional Programme for Adolescent Girls
NRSC	:	National Remote Sensing Centre
O&G	:	Oil and Grease
OHS	:	Occupational Health and Safety
OP	:	Operations Policy

OSHA	:	Occupational Safety and Health Assessment
PCB	:	Pollution Control Board
PCU	:	Passenger Car Unit
PCU	:	Project Coordination Unit
PDO	:	Project Development Objective
PET	:	Polyethylene Terephthalate
PF	:	Protected Forest
PHC	:	Primary Health Care
PIP	:	Project Implementation Plan
PIU	:	Project Implementation Unit
PM	:	Particulate Matter
PPE	:	Personal Protective Equipment
PRA	:	Participatory Rural Appraisal
PSF	:	Pressure Sand Filter
PUC	:	Pollution under Control
PWM	:	Plastic Waste Management
R&D	:	Research and Development
R&R	:	Resettlement and Rehabilitation
RCCB	:	Residual Current Circuit Breaker
REET	:	Rare Endangered Extinct Threatened
RF	:	Reserve Forest
SC	:	Scheduled Caste
SEIAA	:	State Environmental Impact Assessment Authority
SHC	:	Secondary Health Care
SHG	:	Self Help Group
SMF	:	Social Management Framework
SPCB	:	State Pollution Control Board
SPH	:	Specific Process Hazard factor
SPV	:	Special Purpose Vehicle
ST	:	Scheduled Tribe

STDs	:	Sexually Transmitted Diseases
STP	:	Sewage Treatment Plant
TDS	:	Total Dissolved Solids
TLV	:	Threshold Limit Value
TNA	:	Training Need Assessment
TSDF	:	Treatment, Storage and Disposal Facility
TSS	:	Total Soluble Solids
TSS	:	Total Suspended Solids
UEL	:	Upper Explosive Limit
UHF	:	University of Horticulture and Forestry
UHT	:	Ultra Heat Treatment
VCA	:	Value Chain Analysis
WB	:	World Bank
WHO	:	World Health Organization
WII	:	Wildlife Institute of India
WPA	:	Wildlife Protection Act
WTP	:	Water Treatment Plant
WUA	:	Water Users Association
ZSI	:	Zoological Survey of India

Executive Summary

1. Introduction

Himachal Pradesh, known as “fruit bowl of the nation” has become a major contributor to Gross Domestic Product (GDP) of the nation in terms of fruit production as it generates significant on-farm and off-farm employment leading to income generation and poverty reduction.

The state is far behind with respect to both the productivity and post-harvest technology when compared to other fruit producing states of India and other developing nations. The farmers of Himachal Pradesh are experiencing loss of horticulture produce due to shortcomings in post-harvest operations. Lack of post-harvest infrastructure facilities like processing equipment, cold chain facilities, storage and transportation incurred high loss of produce in the supply chain of fruits and vegetables. Considering the importance of horticulture in the state and the interlinked development of socio-economic conditions of the people, the project is very important as it would restore the environment and society.

The purpose of the overall project of Himachal Pradesh Horticulture Development project (HPHDP), is to support small farmers and agro entrepreneurs in Himachal Pradesh, to increase the productivity, quality and market access of selected horticulture commodities through identifying the major environmental and social impacts falling under the high risk category in the early stages of planning during the process of project intervention.

2. Policy, legal and administrative frame work

As part of ESIA report, all relevant environment & social acts, notifications and policies of Government of Himachal Pradesh (GOHP), Government of India (GOI) and World Bank (WB) were analysed.

Based on the location, nature of activities at Fruit processing facility and likely impacts on surrounding environment all applicable policy's, legislations, statutory clearances and administrative frame works to be complied with were identified.

The ESIA study and report was prepared in accordance with all applicable policies, legal and administrative frame works identified.

3. Project description

The existing “fruit processing unit at Jarol”, Mandi district, Himachal Pradesh is one of the fruit processing units of Horticulture Produce Marketing & Processing Corporation (HPMC), mainly include 30 TPD apple juice concentrate. The existing facility is proposed to expand further with Ready to Serve Line (RTS) with capacity of 2000 LPH, automatic glass bottle filling line with capacity of 500 LPH, wine processing plant of capacity 75000 LPA and vinegar processing plant of capacity

50000 LPA. The fruit processing facility is located in an area of 1.0 acre (4051.85 sqm) and NH-154 is 16 m (W) away from the site.

Nearest water bodies to the project site are viz., Jarol Khad at 30 m (W), Sundernagar lake at 7.6 km (N), Koldam Reservoir at 8.4 km (S). Bandli Wild Life Sanctuary is located at 0.93 km (E) from the project site. The project site is 16 m (W) away from NH-154.

The processing facility is very old operating since 1974 and required to be upgraded to meet the national / international norms so that improvements in environmental conditions, production costs are reduced for meeting the products competitive with price and better quality. The total water required for proposed upgradation of the project along with the existing facility is 36 KLD. The water for the facility will be obtained through natural stream from nearby mountain. Around 30 KLD of wastewater will be generated and treated in an ETP capacity of 50 KLD, keeping in view of future expansions. The treated water after conforming to regulatory standards is reused. The total power requirement of 250 kVA will be sourced from Himachal Pradesh State Electricity Board. New silent DG set of capacity 250 KVA, will be used in case of power failures. About 6.6 tons/day solid waste will be generated from the facility. The nature of solid waste will be majorly pomace, spoiled fruits, processed fruit packages, etc. The sludge from the treatment plant can be used as manure within the premises. The rejected fruits, peels, rejected cuttings; inner core/seed and separated solids from pulper, crusher from fruit processing unit will be collected and sold for reuse as cattle feed. Alternatively, these solid wastes can be composted (vermicomposting/Organic waste converter) and used as manure in the farms. The recyclables will be disposed to local vendors and compostable waste will be converted to compost and used as manure to farms, whereas the non-compostable solid waste will be disposed into local municipal bins.

4. Methodology of environmental & social impact assessment study

Purpose of the study is to introduce ESIA requirements & regulations into development activities to enhance project by helping prevent, minimize, mitigate or compensate for any adverse environmental and social impacts. ESIA is designed to be a flexible process to be integral part of project preparation by allowing environmental issues to be addressed in timely and cost-effective way. The step-wise activities are briefly explained below.

- **Identification and defining the project/activity:** This step defines the project with enough specificity to accurately determine the zone of possible impacts and to include activities that are closely connected with the proposal so that the entire scope of environmental impacts is evaluated.
- **Screening:** Determines whether a particular project requires preparation of an ESIA.
- **Scoping:** A process of determining major issues to be addressed in an ESIA.

- **Identification of impacts:** The process of determining the actual and potential environmental impacts due to the proposed/existing developmental activity.
- **ESIA documentation:** A final impact assessment report that addresses all the issues along with mitigation measures.
- **ESMP:** A plan along with estimated costs to ensure that the environmental quality of the area does not deteriorate due to the operation of the facility under study.
- **Decision/environmental approval from PCUs/PIUs:** Provided all regulatory requirements are met, a project development will/may proceed following the decision of PCUs/PIUs.
- **Project implementation & monitoring:** Monitoring ensures that required mitigation measures are being implemented.

5. Environment base line information

Meteorology

Meteorological data has been assessed in the month of August 2018, in the study area of 2 Km radial distance from the project site. Wind speed, wind direction, temperature and relative humidity were recorded on hourly basis during the study period.

The maximum and the minimum temperatures recorded are 26.4 °C and 16.8 °C respectively. The maximum and minimum relative humidity recorded at monitoring station during the study period was 84% and 65%. During study period the winds were predominantly recorded from East North East (ENE) followed by West North West (WNW). Calm conditions prevailed for 1.19% of the total time and the average wind speed for the season is 1.48 m/sec.

Ambient Air Quality

AAQ was monitored at five locations to find out concentration levels of particulate matter (PM₁₀& PM_{2.5}), SO₂ and NO_x. The 24 hourly average AAQ values recorded in the study area is presented below;

- 98th percentile of Particulate Matter <10µm recorded within the study area were in the range of **32.1 to 42.3 µg/m³**
- 98th percentile of Particulate Matter <2.5µm recorded within the study area were in the range of **20.1 to 24.4 µg/m³**
- 98th percentile of SO₂ recorded within the study area was in the range of **5.8 to 9.5 µg/m³**
- 98th percentile of NO_x recorded within the study area was in the range of **14.3 to 16.5 µg/m³**

The results were compared with the national ambient air quality standards (NAAQS) and found that the PM_{2.5} and PM₁₀, SO₂ and NO_x values for all the samples in the study area were within the limits prescribed for residential and rural areas.

Water Quality

Three water samples were collected from bore well, taps and one from surface water used by nearby villagers for their daily use and some important physical and chemical parameters were considered for depicting baseline status of the study area. The water samples were analyzed and compared with IS: 10500-2012 drinking water and IS 2296:1992 surface water standards.

The ground and tap water samples results are well within the acceptable limits as per the drinking water standards IS: 10500-2012. Whereas the surface water is falling under class A as per IS 2296:1992 standards.

Soil Quality

Three soil samples were collected to assess the existing soil conditions. The important physico - chemical parameters were determined and were compared with standards of Indian Council of Agriculture Research (ICAR), New Delhi. The analysis of values recorded in the study area is presented below

- pH values varying from **8.2 to 8.4** indicates the samples are falling in normal to saline class.
- Total organic carbon percentage is varying **1.59 to 3.07%** indicating that all the samples are falling in high range.
- Available potassium, nitrogen and phosphorus values varying between **158 to 270 kg/ha, 179 to 474 kg/ha & 14 to 27 kg/ha** respectively. This indicates that all the values are falling in medium range, except nitrogen value at the site is falling under low range and phosphorous value at Ropri falling under high range.

Land use and land cover (LULC)

Based on the analysis of LULC data of the present study it is noted that, study area is mostly dominated by Forest and Built up land which may cause to reduce forest land in future due to rapid urbanization as built area is fully densely populated area. The study area covers few water streams, and there are no such major water bodies found within 2 km radius from the project site.

Ambient noise quality

The main sources of noise in study area are due to domestic activities, industrial activities and vehicular traffic. Noise monitoring was carried out at five locations covering residential and commercial areas. The day levels of noise have been monitored during 6 AM to 10 PM and the night levels during 10 PM to 6 AM. The day

and night equivalents during the study period for commercial area were 54.6 dB (A) and 43.9 dB (A), silence area were 50.8 dB (A) and 40.9 dB (A). Whereas day and night equivalents in residential area were in the range of 52.6 dB (A) to 53.9 dB (A) and 42.3 to 42.7 dB(A) respectively.

The results were compared with AAQ standards in respect of Noise SO 123 (E) dt 14th Feb 2000 for Silence, Residential and Commercial area. From the results it can be seen that the day equivalents and night equivalents were within the specified standards, whereas in silent area the day and night equivalent of the noise are slightly higher than the standards.

Traffic study

A detailed traffic survey was conducted on nearby NH 154 from 6 AM to 11 PM which is a 4 lane 2 way road. The peak traffic volume of 1504 PCU/hr was recorded during 10 to 11 AM. It was observed that the existing level of service (LOS) of the road during peak hours is falling under "C" (Acceptable level of comfort; some delay). However, the widening activity for the road is being carried out. With the expansion activity and increase in the number of vehicles that visit the site, the traffic is not going to increase drastically and the level of services remains same. This implies that traffic will not have a major impact due to the proposed expansion.

Ecological environment

Based on the survey, primary and secondary data collected the proposed project is located in an urbanised area with surrounding of scrub protected and reserved forest. There are no wetlands or IBAs in the core and buffer zone within 2 km radius except the forests like PF (Near Saroni khad) – 700 m (E), Bandli PF – 1050 m (E), Baila PF – 1350 m (N), Bhawana PF – 1490 m (S), Dartak PF – 1650 m (W) falling in the buffer zone. There are no Rare Endangered Endemic Threatened (REET) species observed or notified in the study area (2 km), except REET species in Bandli wildlife sanctuary (ESZ) – 1000 m (E). According to topographical map, Jarol Khad – 30 m (W), Saroni Khad- 1000 m (E), Bobri khad- 1500 m (NE) from the project site but during primary survey, so only semi-aquatic macrophytes were observed.

Socio economic study

The prevailing socio-economic aspects of people in nearby villages in the core and buffer zone of the proposed project facility: The study area consists of around 5590 people out of which the male population is around 2844 and the female population is 2746. The male and female constitute 50.9% and 49.1% respectively and number of females per 1000 males is 965. The analysis of the literacy levels in selected villages of study area, reveals that an average literacy rate of 65.8% as per 2011 census data. However, the male literacy of the study area is 73.8%, whereas literacy rate among women, which is an important indicator for social change, is abysmally low as

57.6%. The marginal workers and non-workers constitute to 35.1% and 45.3% of the total population respectively.

6. Environment and social impacts of the project

The environmental impacts associated due to proposed project are classified into construction, operational and post operation phases and the possible impacts are assessed.

1) Construction period impacts

Construction activity is temporary activity till construction and establishment of new machinery takes place in the proposed project. To minimize the impacts during construction period necessary control measures will be adopted, so that the environmental damage is minimized. The positive and negative impacts due to this activity are given below.

Negative impacts

- Dust Generation during leveling of earth, movement of vehicles on unpaved roads, Unloading of raw materials and removal of waste material from site
- Emission of pollutants from vehicular exhaust
- Construction of various civil structures generates site runoff which results in significant pollution in the receiving water bodies during the rainy season.
- Washing of the construction equipment will also result in water pollution.
- Domestic wastewater from labor and staff present onsite
- Noise pollution due to foundation works, concreting works, piling, steel cutting and fabrication of structures, etc.,
- Noise generated from running of pumps, motors, construction equipment, etc., and movement of trucks carrying construction materials
- Construction & demolition waste consists of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets, plastic material, paper, etc.
- Municipal waste generation from construction workers
- Compaction of soils by earth moving equipment, vehicles used for construction purpose
- Erosion (wind and water) and modification of surface
- Disturbing natural drainage contours, slopes
- During construction phase, dust and noise pollution will be affecting nearby flora and fauna of the facility but necessary control measures will be taken up.

Positive impacts

- Improvement of local infrastructure (approach roads, street lights, etc.)
- Demand for housing, hotels, etc., will increase the earning of the local persons
- Temporary employment to local labour
- Improved business to local vendors

- More revenue to governing departments in form of taxes, fees, etc.

2) Operation period impacts

During operation period the fruits handling capacity of the project will be increased, so the local farmers will be able to utilize the services of the upgradation of the industrial unit. The positive and negative impacts due to this activity are given below.

Negative impacts

- Emissions (PM, SO₂ and NO_x) from stacks attached to DG sets.
- Emissions from vehicles carrying raw materials and finished products.
- Emissions arising from processing and handling of raw materials, finished products, intermediates products, etc.
- Emission of pollutants from solid waste handling and wastewater treatment plant area.
- The activities typically generate effluents containing organic loads, cleaning agents, salt and suspended solids. They may also contain pesticide residues washed from raw materials.
- Major waste water generation is from fruits washing, floor/equipment washings, etc.
- Domestic wastewater from eating areas and sanitary facilities
- Noise generation from conveyors and running of pumps, motors for pumping and transferring liquids etc.,
- Generation of solid wastes such as organic materials, including spoiled and rotten fruits
- Solid waste in the form of inedible materials and rejected products from sorting and other production process
- Sludge from wastewater treatment facilities
- Not maintaining proper storm water drains, rain water harvesting pits, etc.
- Increase in traffic problems due to increased movement of heavy vehicles
- Increase in accidents due to the speed of the vehicles

Positive impacts

- Additional employment due to proposed modernization
- Additional business for local traders
- Reduction in pollution due to improved pollution control measures
- Development of new project is aimed at providing goods and services to improve community's living standards.
- Projects therefore present an opportunity for the community to achieve economic and social development for the ultimate well-being of a community or nation.
- The proposed activities will be environmental friendly due to adopting of new technology meeting national standards

- During operation phase (such as increase in movement of vehicles) may cause increase in fuel and noise emissions which will be controlled by noise acoustics and other measures to minimal the effect on surrounding environment of the project site
- Since the facility is going only for upgradation of capacity, so no major impacts would be anticipated and will not leave any lasting and unmanageable adverse impacts on the ecosystems, flora and fauna.

3) Post-operation period impacts

During post operation period the impacts can be due to decommissioning of the industry and making use of the site for any other new activity, the industrial activity proposed modernization is planned as long term activity with life of the project up to 30 years. The negative and positive impacts envisaged are given below.

Negative impacts

- Dust generation due to de-commissioning of the industry on the neighbouring areas
- Emissions from vehicles carrying construction and demolition waste for disposing at designated area
- Increase of traffic on the roads due to movement of trucks
- Generation of scrap material (hazardous waste, electronic and electrical waste, e-waste, etc.,) which needs to be disposed as per the existing standards at the time of de-commissioning
- Loss of the employment to workers employed in the industry

Positive impacts

- Availability of developed land area having all required infrastructure
- Development of new activity suitable for the current period following all modern manufacturing environmentally friendly process
- Less man power more production having edge in the market for marketing the finished product at cheaper price than the competitor.

7. Mitigation measures

Air quality

Construction phase

Most of the construction dust will be generated from the movement of construction vehicles on unpaved roads. Unloading and removal of soil material acts as a potential source for dust nuisance. The control measures proposed to be taken up are given below

- Water sprinkling on main haul roads in the project area will be done, this activity will be carried out at least twice a day, as per the need frequency will be increased like on windy days.
- Temporary thin sheets of sufficient height (3m) will be used to erected dust dispersion into surrounding site atmosphere or all around the project site as barrier for dust control.
- Tree plantations around the project boundary will be initiated (where ever required) at the early stages by plantation of 2 to 3 years old saplings using drip irrigation or by regular watering so that the area will be moist for most part of the day.
- All vehicles carrying raw materials will be instructed to be covered with tarpaulin /plastic sheet, unloading and loading activity will be stopped during windy period.
- To reduce the dust movement from civil construction site to the neighbourhood, the external part of the building will be covered by plastic sheets.

Operation phase

- DG set is to be provided with adequate stack height as per regulatory guidelines for proper dispersion of gaseous pollutants.
- Internal roads will be concreted / asphalted to reduce dust emissions.
- Vehicles with PUC certification would be allowed for entering into the plant to avoid pollution of exhaust gases.
- Speed restriction will be followed within the project area and speed breakers will be provided at entry and exit points with proper sign board.

Odour

- Proper air flow control or negative air pressure within the unit, either through innovative design interventions, or installing odour control equipment will be maintained to abate odour.
- Fruit waste dump area will be delineated from the main activity area so as to eliminate potential public exposure to odour.
- Odour control equipment as mist air dry fog odour suppression systems or atomizers can be installed at odour generation source.
- Neutralizers such as sodium hypochlorite, potassium permanganate or commercial preparations as Ecosorb can be applied to control odour nuisance

Noise quality

Construction phase

- Noise generating equipment will be used only during day time for brief period based on its requirement.

- Proper enclosures will be used for reduction in noise levels. Where ever possible, the noise generating equipment will be kept away from the human habitation.
- Temporary thin sheets of sufficient height (3m) will be erected around the noise generating activity spread or all around the project site as barrier for minimizing the noise travel to surrounding areas.
- All vehicles entering into the project will be informed to maintain speed limits, and not blow horns unless it is required.

Operation phase

Acoustic enclosures, noise barriers or shields will be provided for DG set and pumps etc., and wherever possible they will be mounted on anti-vibration pads to minimize the noise. Regular maintenance will be carried out as per the schedule prescribed by the manufacturer for smooth functioning.

Water quality

Construction phase

- The treated wastewater can be reused for floor washing, vehicle washing, dust suppression etc.
- During site development necessary precautions will be taken, so that the runoff water from the site gets collected to working pit and if any over flow is, will be diverted.

Operational phase

- The raw water received is treated by cascade aeration followed by settling tank, to meet the water quality standards specified for domestic activities.
- Water used for domestic activities should meet IS 10500:2012 drinking water standards and inland surface water standards IS 2296-1992.
- Wastewater generated from the process shall be collected and treated in the proposed STP.
- The treated wastewater can be reused for floor washing, vehicle washing, dust suppression etc.

Waste management

Construction phase

- Waste produced from the construction activities within the facility area will be regularly collected in a storage area and protected with proper sheets to prevent any potential waste scatter
- Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.

- Materials, which can be reused for purpose of construction, leveling, making roads/ pavement will also be kept in separate heaps from those which are to be sold or land filled.
- Construction waste generated will be deposited at collection center made by local body or handed over to the authorized processing facilities of construction and demolition waste.
- Construction activities may generate some quantity of muck, which is managed by mixing it with straw, stone dust or rice husk, to reduce the adverse impacts.

Operation phase

The domestic solid waste will be collected from processing area and brought to one place, and it will be segregated into recyclable, and non-recyclable. The recyclables will be disposed to local vendors and compostable (rotten fruit waste) will be converted to the compost in the dump yard, whereas the non-compostable solid waste will be disposed into local municipal bins. There will be a minimal waste from the project site.

8. Conclusion

Due to the expansion and upgradation with advanced process facilities, the product quality enhances and the overall environmental aspects related to processing facility improve significantly. The people who are involved in the project will get benefited in terms of EHS improvements made within the project activities. The project may likely increase quality of life of the workers, improved sanitation, transportation and recreation facilities in work place and will improve to meet the prevailing standards and economy; the region will get benefitted with the proposed developmental activities of Jarol processing plant.

The environmental management plan provided to the processing unit will reduce significantly the emission levels and meet the prevailing regulatory standards of local pollution control boards and other agencies. This would also increase awareness among project workers regarding terms and conditions of employment, gender inclusivity, and also generate more employment opportunities to the indigenous/local people. It may trigger rapid growth of service sector and increase of household income in the project area. The study also highlighted certain risk mitigation measures to enhance awareness among workers and contractors through training programs on issues like child labour, safety and worker participation. There will be increased revenue to the state in the form of taxes & duties which will find its way to support and development of the region over all.

Chapter 1

Introduction

1.1 Purpose of the project

Himachal Pradesh, known as “fruit bowl of the nation” has become a major contributor to Gross Domestic Product (GDP) of the nation in terms of fruit production as it generates significant on-farm and off-farm employment leading to income generation and poverty reduction.

The state is far behind with respect to both the productivity and post-harvest technology, when compared to other fruit producing states of India and other developing nations. The farmers of Himachal Pradesh are experiencing loss of horticulture produce due to shortcomings in post-harvest operations. Lack of post-harvest infrastructure facilities like processing equipment, cold chain facilities, storage and transportation etc., have incurred high loss of produce in the supply chain of fruits and vegetables. Considering the importance of horticulture in the state and the interlinked development of socio-economic conditions of the people, the project is very important as it would restore the environment and society.

The purpose of the overall project of Himachal Pradesh Horticulture Development (HPHDP), project is to support small farmers and agro entrepreneurs in Himachal Pradesh, to increase the productivity, quality and market access of selected horticulture commodities through identifying the major environmental and social impacts falling under the high risk category in the early stages of planning during the process of project intervention.

1.2 Project identification

Global funding body, the World Bank acknowledges the need of horticulture and their farming practices in the present scenario as well the connecting link between post-harvest management practice losses, deteriorating environment conditions and adverse effects on the farmers involved in horticulture farming due to unsustainable practices. Accordingly, the bank initiated “Himachal Pradesh horticulture development project” with the main aim to boost horticulture sector in Himachal Pradesh. In view of this, the Government of Himachal Pradesh (GoHP) has received funding from the World Bank towards the cost of Himachal Pradesh Horticulture Development Project (HPHDP). The project implementing entity is Himachal Pradesh Horticulture Development Society (HPHDS). The overall objective of the project is to “To support small farmers and agro-entrepreneurs in Himachal Pradesh”.

As a part of the project, HPHDP has engaged M/s Ramky Enviro Services Private Limited as consultant for conducting Environmental & Social Impact Assessment

(ESIA) studies and Preparation of Environmental & Social Management Plans (ESMP) for moderate to major impact activities.

1.3 Description of components of project

As per the Project Implementation Plan (PIP), there are different types of project interventions. Project interventions have been categorized on the basis of environmental impacts as low-moderate and moderate–high impacts. The “low-moderate impact project activities” which are not expected to cause any significant impact does not require Environmental and Social Management Framework (ESMF); however, “moderate to major impact activities” which have activities falling under the high risk category, require Environmental and Social Impact Assessment (ESIA) studies and related Environmental and Social Management Plan (ESMP). As most of the post-harvest infrastructure facilities like pack houses, market yards and agro processing units have been categorized under “moderate to major impact activities”, these project interventions require ESIA and ESMP. The details of various interventions which are falling under moderate to major impact activities in HPHDP are given below.

- Fruit/Vegetable Grading and Packing Units
- Controlled Atmosphere Stores
- Fruit/Vegetable Processing Units
- Fruit/Vegetable Market Yards

➤ Fruit/Vegetable grading and packing units

Grading of fruits and vegetables after harvesting is an essential step in post-harvest management. All the operations involved in grading and packing units will affect the quality of the end product and its further roles in value chain management. Grading of fruits and vegetables is done on the basis of physical characteristics like weight, size, colour, shape, internal quality etc.

➤ Controlled Atmosphere Stores

A Controlled Atmosphere (CA) is an agricultural/ horticulture storage method in which the concentrations of oxygen, carbon dioxide and nitrogen, as well as the temperature and humidity of a storage room are regulated so as to increase the storage period of the product without ruining its quality. Both dry commodities and fresh fruits and vegetables can be stored in controlled atmospheres stores. CA storage is most commonly used for apples where the combination of altered atmospheric conditions and reduced temperature allow prolonged storage with a slow loss of quality. Under CA conditions the quality and the freshness of fruit and vegetables are retained and many products can be stored for longer than usual.

➤ Fruit/Vegetable Processing Units

Processing of fruits and vegetables is very important to produce products for direct consumption and as food ingredients. During processing, the main objectives are to preserve the colour, flavor, texture, and nutrition while prolonging the shelf life of perishable fruits and vegetables. Fruits are generally processed for juice/ squash/ jam/ pickle etc. The basic processes used in the production of fruits and vegetables include washing, peeling, blanching, cooling, size reduction, grinding, freezing, dehydration, canning etc.

➤ Fruit/Vegetable Market Yards

Fruit/vegetable markets play a crucial role in the vertical coordination of food markets, equilibrating supply with demand and facilitating price formation.

1.4 Project need & objectives

The need of the project is to provide suitable technical expertise for organizing the harvesting, grading, packing, processing and marketing systems in Himachal Pradesh. Fruits and Vegetables being perishable need quality packing and sensitivity while handling. The perishable nature of the commodity makes the role of cold storages very important, processing units will maintain the supply during year and in particular for periods when supplies are low and generates income for the producer and seller and make commodities available for far of areas.

A large proportion of fruits produced in developing countries are at risk of loss through spoilage. To overcome this, producers sell their marketable surplus within a short time after harvest at give-away prices. However, income could be increased significantly if produce is stored appropriately or processed, since fruit prices double or even triple only a few months of harvest.

The main objectives of the given project under HPHDP are:

- To assist the horticulture department in assessing the potential impacts of proposed activities and updating existing safeguard instruments with respect to different World Bank safeguard policies.
- To understand the current conditions of the area, and how the project needs to be implemented considering these conditions.
- To enhance horticultural competitiveness by increasing long term productivity and farm incomes in an environment marked by changing market patterns.
- To assess and predict the possible environmental changes that could occur, once the project is underway.
- To identify and evaluate potential environmental impacts and suggesting alternatives / design mitigation measures.

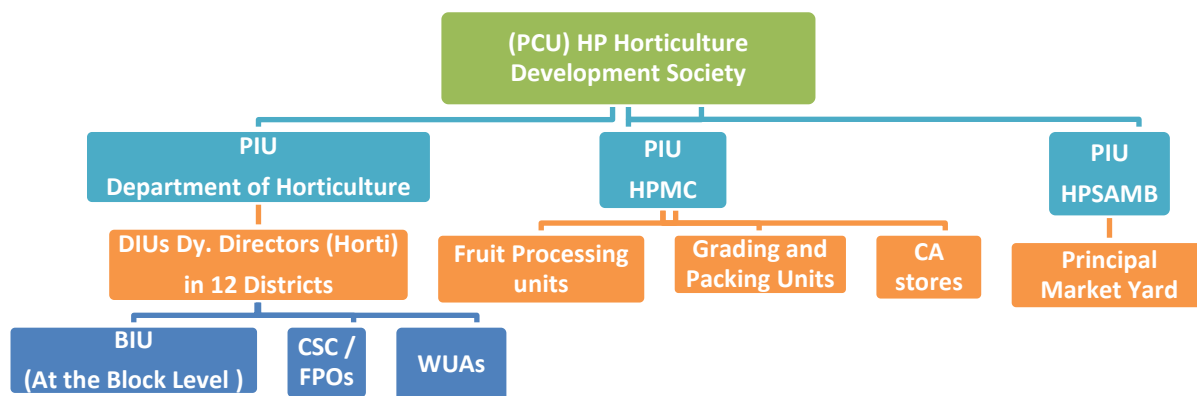
The main objective of the processing facility is as follows

- Reduce post-harvest losses
- Increase the shelf-life of the fruit by processing to edible products
- Increase food security
- Add variety to the diet
- Improve nutrition and health
- Add value to the fruit and generate increased income
- Create employment opportunities in producing areas

1.5 Project implementation strategy

The key agencies involved in implementation of the project are HP Horticulture department, HP Agricultural Marketing Board, HP Horticultural Produce Marketing and Processing Corporation Limited (HPMC) and University of Horticulture and Forestry Nauni (UHF). Project Coordination Unit (PCU) headed by the project director and Project Implementation Units (PIU) under the heads of the departments involved in the project have been created for coordination and implementation of the project. The flow chart of implementation agencies are given below:

Implementing Agencies



During the implementation of the project various activities will be conducted by the concerned Line Departments / PIUs. These activities involve procurement in the areas viz. works, goods / equipment and consultancy services. All procurements under the HPHDP to be carried out by PCU, various PIUs and implementing units would be done as per the World Bank's procurement procedure. Procurement of all goods, works and services under the project shall be carried out in accordance with

The World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" and "Guidelines:

The processing facility at Jarol is established in the year 1974 (Reference: Project Implementation Plan 2016-17 to 2022-23; Page No. 284) by HPMC which is one of the largest processing units in HP, now it is proposed for expansion by upgrading the existing facilities and adding few additional facilities for processing within the existing land area. Some of the old units are also replaced during upgradation process.

1.6 A brief history of the project

The project will address key gaps in the horticulture sector in Himachal Pradesh with the aim to transform the sector (and the overall rural economy) to being more productive, efficient and profitable. By doing so, it will contribute to the key aspects of the GOI, GoHP and the Bank's strategic objectives related to faster and broader agriculture sector growth and inclusive development. The Project Development Objective (PDO) is "to support small farmers and agro-entrepreneurs in Himachal Pradesh, to increase the productivity, quality and market access of selected horticulture commodities" and the Key Project Indicators (KPI) are:

- a. Productivity (in ton/ha)
 - of rejuvenated apple orchards
 - of new plantations of selected horticulture crops
- b. Quality: Percentage of grades A, B and C apples produced
- c. Market access: Share of selected horticulture commodities sold through new marketing channels for apple and tomato
- d. Direct project beneficiaries are expected to be 1,50,000 in number, of which, female beneficiaries will be 33%.

The project will achieve the PDO by:

- i) Improving producers' access to knowledge and climate resilient production technologies so that producers are able to respond to climate changes and climate variability and emerging market opportunities;
- ii) Promoting investments in agribusiness, fostering backward and forward linkages in the value chains for horticulture products, facilitating access to finance for agribusiness entrepreneurs and where appropriate, push for process, regulatory and/or policy change and
- iii) Supporting the development of an improved platform for market-related information and intelligence, alternative market channels developed outside of regulated markets, piloting negotiable warehouse receipts for horticulture commodities and improved services provided by modernizing the promising traditional wholesale markets.

The existing "fruit processing unit at Jarol", Mandi district, Himachal Pradesh is one of the fruit processing units of Horticulture Produce Marketing & Processing Corporation (HPMC), with a present production capacity 30 TPD apple juice concentrate and proposed to expand further with Ready to Serve Line (RTS) with

capacity of 2000 LPH, automatic glass bottle filling line with capacity of 500 LPH, wine processing plant of capacity 75000 LPA and vinegar processing capacity of 50000 LPA within an existing an area of 1.0 acre (4051.85 sq.m). A variety of products such as apple juice concentrate, pickles, squashes and drinks etc., are made at the facility.

1.7 Summary of the general scope of ESIA

Fruit & vegetable grading and packing units /Fruit processing units/ Controlled Atmosphere stores / market yards etc., produce wastes which vary in nature and composition. These wastes need special attention and should be disposed of appropriately. At each stage of operation, the impacts have to be assessed and suitable mitigation measures are to be proposed. Therefore preparation of intervention specific ESIA/ESMP is an important tool in view of environment protection and optimal utilization of resources. Carrying out ESIA and ESMP for the identified project interventions would:

- Generate baseline data for various environmental parameters
- Predict significant adverse impacts
- Identify feasible alternatives in terms of technology
- Propose feasible options to reduce environmental impacts
- Propose mitigation measures to reduce, offset, or eliminate major impacts
- Gives an idea about cost estimates involved in taking environmental safeguard measures

Chapter 2

Policy, Legal and Administrative Framework

2.1 Introduction

The ESIA/ESMP report will be prepared by considering the key applicable environmental/social acts, notifications and policies of Government of HP, Government of India and World Bank applicable to this project.

2.2 Applicable National Regulatory Acts and Notifications

All developmental projects, subject to the applicability are required to strictly comply with the relevant National Environmental Laws and Regulations of the Government of India and respective State laws and regulations. The important laws and regulations applicable for the project are given below.

- 1 Wild life (Protection) Act, 1972 and its amendments
- 2 The Water (Prevention and Control of Pollution) Act, 1974 and its amendments
- 3 The Forest (Conservation) Act, 1980 and its amendments
- 4 The Air (Prevention and Control of Pollution) Act, 1981 and its amendments
- 5 The Environmental (Protection) Act, 1986 and its amendments
- 6 Central Motor Vehicle Act /Rules 1989
- 7 The Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, 2000 and its amendments
- 8 The Batteries (Management and Handling) Rules, 2000 and its amendments
- 9 The Noise Pollution (Regulation and Control) Rules, 2000 and its amendments
- 10 Ozone Depleting Substances (Regulation and Control) Rules, 2000
- 11 Food Safety & Standards Act (Integrated food law), 2000
- 12 Environmental Impact Assessment Notification, 2006 and its amendments
- 13 Guidelines/Criteria for evaluation of proposals/requests for ground water abstraction (with effect from 16.11.2015) and its amendments
- 14 Solid Waste Management Rules, 2016 and its amendments
- 15 Construction and Demolition Waste Management Rules, 2016 and its amendments
- 16 Bio-Medical Waste Management Rules, 2016 and its subsequent amendments
- 17 Plastic Waste Management Rules, 2016 and its subsequent amendments
- 18 Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendments
- 19 E-Waste (Management) Rules, 2016 and its amendments
- 20 Himachal Pradesh Fire Fighting Service Act, 1984 and its amendments
- 21 Himachal Pradesh Ground water(Regulation and Control of Development and Management) Act 2005 (Act No. 31 of 2005)
- 22 Diesel generator sets: Stack height (Emission regulations part IV) COINDS/26/86-87

23 NGT order dated 30.04.2019 for water and effluent discharge standards

Some of the above mentioned laws are applicable at the time of pre-construction and some are applicable at the time of operation of the project. The applicability of the above regulations / guidelines / laws is given in **Table 2.1**.

Table 2.1: Statutory Clearances and Authorizations required during pre-construction

S. No	Regulatory Requirement	Applicability for proposed facility	Regulatory Authority	Remarks
1	Prior Environmental Clearance under EIA Notification, 2006	Not applicable	MoEF&CC / SEIAA	Project does not fall under the purview of the notification
2	Consent for Establishment during pre-construction and consent to operate during operation under Water Act and Air Act	Applicable Project involves generation of wastewater and air pollution	State PCB	Application has to be submitted to PCB in the prescribed application for obtaining CFE and CFO
3	Environmental Standards, industry specific, Ambient air, wastewater under EPA act 1980	Applicable Project has DG set, Wastewater generation, etc.	State PCB	Follow the standards suggested by CPCB/ MoEF&CC for DG sets, Wastewater discharge, ambient air quality standards, etc.
4	Authorization under MSIHC rules 2000	Not applicable	State PCB	Hazardous chemicals used are less than threshold quantity listed in Part I of schedule 1 or in column 2 of part II
5	Authorization under BMW Rules 2016	Applicable Project generated BM waste from First aid boxes	State PCB	Application has to be made in Form II for obtaining one time authorization
6	Authorization under PWM rules 2016	Applicable Project generates plastic waste	State PCB	Handover the segregated plastic waste to urban local body or gram panchayat or agencies appointed by them or registered waste pickers or recyclers or agencies
7	Meeting the rules under Noise Pollution rules 2000	Applicable Project uses noise generating equipment	State PCB	Measures to be taken to see that the noise levels in any area/zone shall not exceed the ambient air quality standards in in respect of noise as specified in the schedule

8	Following Solid Waste Management Rules, 2016	Applicable Project generated municipal waste from canteen, etc.	State PCB and Local authorities and village panchayats	Segregate and store the waste generated in three separate streams – bio-degradable, non-biodegradable, domestic hazardous wastes in suitable bins and handover segregated waste to authorized waste pickets or waste collectors as per the directions of local authorities
9	Following the Batteries (Management and Handling) Rules, 2000	Applicable Batteries are used for DG set / inverters	State board and CPCB	Ensure that used batteries are not disposed of in any manner other than depositing with the dealer / manufacturer / registered recycler / reconditioner or at the designated collection centers
10	Authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	Applicable Waste oil, ETP sludge etc., is generated	State PCB	Hazardous waste generated should be managed by taking steps viz. prevention, minimization, reuse, recycling, recovery, utilization including co-processing, safe disposal
11	E-Waste (Management) Rules, 2016	Applicable Electric and electronic waste generated	State PCB	Ensure that E-waste generated is channelized through collection center or dealer of authorized producer or dismantler or recycler or the designated take back service provider of the producer
12	Clearance under Wild life (Protection) Act, 1972	Not applicable	National Board for Wild Life	NOC requires if the project site falls in Eco sensitive zone of national parks, sanctuary, conservation reserve.
13	Clearance under The Forest (Conservation) Act, 1980	Not applicable	State forest department /MoEF&CC	Forest clearance is required if the land of the project is inside the forest area.
		Applicable	State forest department	Tree cutting in the project area required permission as MoEF&CC letter dt 18.02.98
14	Disposal of Construction and Demolition waste as per C&DWM Rules, 2016	Applicable C & D waste during	State PCB / local authority	Every waste generator shall keep the construction and demolition waste within the premise or get

		initial stages of the project development or expansion		the waste deposited at collection center so made by the local body or handover it to the authorized processing facilities of construction and demolition waste
15	PUC certificate for vehicles used as per Central Motor Vehicle Act /Rules 1989	Applicable Vehicles are used for transportation of fruits and fruit products	Regional transport authority/ State Government	All vehicles used for transportation of fruits and fruit products requires PUC certificate every six months
16	Himachal Pradesh Fire Fighting Service Act, 1984 and its amendments	Applicable	State board Department of Home	<p>The prescribed regulatory requirement is applicable for the present subproject since it requires the owners / occupiers to take required precautions for fire prevention and fire safety.</p> <p>There should be proper access to building, with sufficient exists, proper fire extinguishers and smoke management system , alarm systems etc. as referred in the act.</p>
17	The Himachal Pradesh Fire Fighting Services (Amendment) ACT 2000 (Act No. 16 of 2000), Insertion of section 15-A	Applicable	State board Department of Home	<p>15-A. No Objection Certificate-</p> <p>All building plans in respect of buildings of above 15 meters of height, industrial units and commercial establishments dealing with or using explosive and highly inflammable substances shall require `` No Objection Certificate`` from the Director of Fire Services or Chief Fire Officer</p>
18	Himachal Pradesh Ground water(Regulation and Control of Development and Management) Act 2005 (Act No. 31 of 2005)	Applicable	Himachal Pradesh Ground Water Authority	<p>The prescribed regulatory requirement is applicable for the present project as the intervention proposes rainwater harvesting for conservation and ground water recharge.</p> <p>To improve the ground water situation, suitable</p>

				areas may be identified for rainwater harvesting for ground water recharge.
19	Diesel generator sets: Stack height (Emission regulations part IV) COINDS/26/86-87	Applicable	CPCB	The prescribed regulatory requirement is applicable for FPU since it involves DG sets as power backup and accordingly the minimum stack height for DG set is to be provided and maintained.
20	NGT order dated 30.04.2019 for water and effluent discharge standards	Applicable	MoEF&CC	The prescribed regulatory requirement is applicable for FPU since it involves waste water generation during activities like floor cleaning, washroom purposes and other washing activities for which the applicable discharge standards should be complied with.

2.3 Applicable World Bank Policies/ Guidelines

As the project is funded by the World Bank, in addition to environmental laws and regulations notified by GOI / the State of HP, the project has to comply with World Bank Operations Policy / Bank practice (OP/BP), "Environmental Assessment OP/BP 4.01". The policy aims to avoid adverse impacts on the environment and on affected people and/or communities; minimize, mitigate and/or compensate for adverse project impacts, if unavoidable; help borrowers to strengthen their safeguard systems, and to develop their capacity in managing the environmental and social risks. The details of policies and regulatory framework, year, objectives and their applicability to the present assignment are enclosed in **Table 2.2**.

Table 2.2: Summary of regulatory framework in respect of environment and their applicability to the project

World Bank Operation policy/Bank practice	Applicability	Explanation	Relevance/Implications for ESIA/ESMP
Environmental Assessment OP/BP 4.01	Yes	Some of the activities and approaches that the project involve have the potential to influence both the environmental setting and social fabric within a given landscape and, therefore, an assessment is required triggering this policy.	The proposed intervention is a Fruit Processing unit. Will influence both environmental and social aspects within project boundary and its vicinity, ESIA/ESMP

World Bank Operation policy/Bank practice	Applicability	Explanation	Relevance/Implications for ESIA/ESMP
		The potential impacts need to be identified and mitigated for ensuring sustainability of investments.	will identify potential impacts and propose appropriate mitigation measures
Natural Habitats OP/BP 4.04	Yes	Even though the project will not take up any activities inside critical natural habitats and protected areas, some of the proposed interventions, particularly expanding area under horticulture, increase the risk of encroachment into natural areas. Other planned infrastructure and agro-marketing infrastructure could be located in the proximity of natural areas and if not developed appropriately, could adversely impact these.	Efforts shall be put in to avoid establishment of proposed projects / activities inside/in the proximity of critical natural habitats and protected areas. In an unlikely event, where the impact on natural habitats cannot be avoided, measures shall be proposed to either minimize or mitigate the potential impacts. Sites where mitigation is not possible, will be rejected.
Forests OP/BP 4.36	No	Proposed interventions are unlikely to result in any changes in forest management practices and will not involve any major felling of trees in forestlands.	It is unlikely that the proposed project /intervention may result in any changes in forest management practices. Even in the non-forest land, ESIA/ESMP shall clearly spell out avoiding/minimizing felling of trees.
Pest Management OP 4.09	No	This policy is triggered as the use of chemical fertilizers and pesticides is prevalent at various stages of apple and vegetable cultivation in the State. Since the project is primarily intended to enhance productivity through technological and managerial interventions, there are chances of increased use of chemical fertilizer and pesticides resulting in significant impact on the local environment including	Since the proposed project is limited to post-harvest activities the pest management policy is not applicable. However, use of eco-friendly pest control agents would be suggested for controlling the pests in the grading packing, storage and processing units. The pesticide residues from selective samples would be

World Bank Operation policy/Bank practice	Applicability	Explanation	Relevance/Implications for ESIA/ESMP
		implications for the quality of soil and moisture regime, water environment, public health as well as livestock population. To prevent and control the chances of increased use of pesticides by farmers, there is a need of greater public awareness and understanding in the areas of interventions, besides change in existing practices entailing extensive use of chemical and pesticides. An Integrated Pest Management Plan is developed for proposed interventions. No banned pesticides (formulated products that fall in WHO classes IA and IB, or formulations of products in Class II) would be procured under the project.	analyzed and necessary treatment and mitigation measures would be suggested accordingly.
Physical Cultural Resources OP/BP 4.11	No	There is no excavation planned and investments will not impact existing Physical Cultural significance.	It is not anticipated that the proposed interventions will undertake construction, excavation at sites that are of culturally significant.
Safety of Dams OP/BP 4.37	No	There are no interventions proposed on new and/or existing dams.	Not applicable
Projects on International Waterways OP/BP 7.50	No	There are no interventions proposed under the International waterways.	Not applicable
Projects in Disputed Areas OP/BP 7.60	No	There are no disputed areas in the project areas.	It is unlikely that the proposed project will be developed in disputed area
Indigenous Peoples OP/BP 4.10	Yes/No	If project intervention area involves indigenous people, meaningful discussions shall be carried out for taking them into confidence.	ESIA/ESMP shall focus on meaningful consultations, community support and participation, inclusion of tribal families, taking

World Bank Operation policy/Bank practice	Applicability	Explanation	Relevance/Implications for ESIA/ESMP
			into account their special socioeconomic and cultural needs.
Involuntary Resettlement OP/BP 4.12	No	If involuntary resettlement is anticipated for any of the proposed project interventions necessary R & R rules have to be followed	Not applicable

The ESIA will be addressing all the environmental and social issues related to the project intervention covering all the above said regulations, rules, guidelines, of national and World Bank.

Chapter 3

Description of the Proposed Project

3.1 Project details

Jarol has one of the fruit processing units of Horticulture Produce Marketing & Processing Corporation (HPMC), with a capacity of 30 TPD apple juice concentrate with proposed expansion of Ready to Serve Line (RTS) with capacity of 2000 LPH, automatic glass bottle filling line with capacity of 500 LPH, wine processing plant of capacity 75000 LPA and vinegar processing plant of capacity 50000 LPA. A variety of products such as apple juice concentrate, pickles, squashes and drinks etc., are made at the facility. The salient features of the project site are given in **Table 3.1**.

Table 3.1: Salient features of the project site

Location	Jarol (V), Sundernagar (T), Mandi (D)
Geographical co-ordinate	31° 27' 44.01" N 76° 51' 42.58" E
Elevation	678 m
Total land area	1.0 acre (4051.85 sqm)
Nearest railway station	None in the vicinity of the project
Nearest highway	NH-154, 16 m (W)
Nearest water body	Jarol khad – 30 m (W) Sundernagar lake, 7.6 km (N) Koldam reservoir, 8.4 km (S)
National parks/Wildlife sanctuaries	Bandli WLS (ESZ), 1.0 km (E)
River	Sutlej, 5.4 km (S)
Project cost (Upgradation)	Rs. 15 Crores

The processing facility is very old and required to be upgraded suiting international norms so that production costs are reduced for meeting the products competitive on price and quality. With present technology the corporation is manufacturing 1 kg of apple juice concentrate for about 13 kg of apple as compared to the 8-9 kg being used in the latest technology. There is a need for a complete technology up gradation and capacity enhancement. The present capacities are grossly inadequate to meet the present and future requirement.

The production capacities of the processing plant existing and after proposed up gradation are given in **Table 3.2**. The topographical map of the study area (2 km radius), Google map, project layout, contour map and site photographs are shown in **Figure 3.1** to **3.5** respectively.

Table 3.2: Production details

Details	Existing		Expansion		
	Apple Juice Concentrate	Ready to Serve Line	Glass bottle filling line	Wine processing plant	Vinegar processing plant
Fruit processing	30 TPD	2000 LPH	500 LPH	75000 LPA	50000 LPA

- ❖ NH-154 is as per the latest National Highway numbering is represented as NH-21 in the topographical map, which is in older format and non-editable.

Figure 3.1: Base map of the study area (2 km radius)

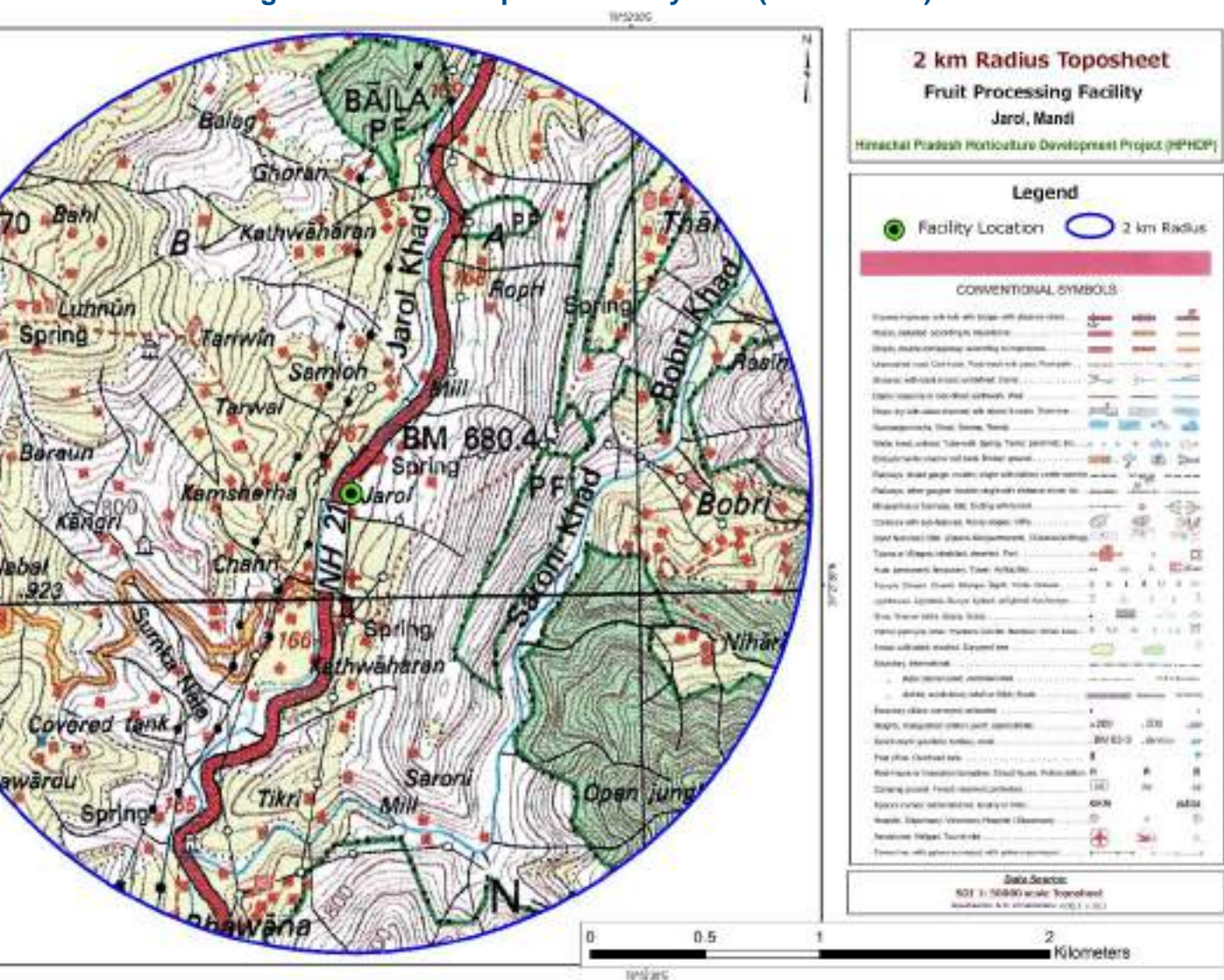


Figure 3.2: Google map of the study area

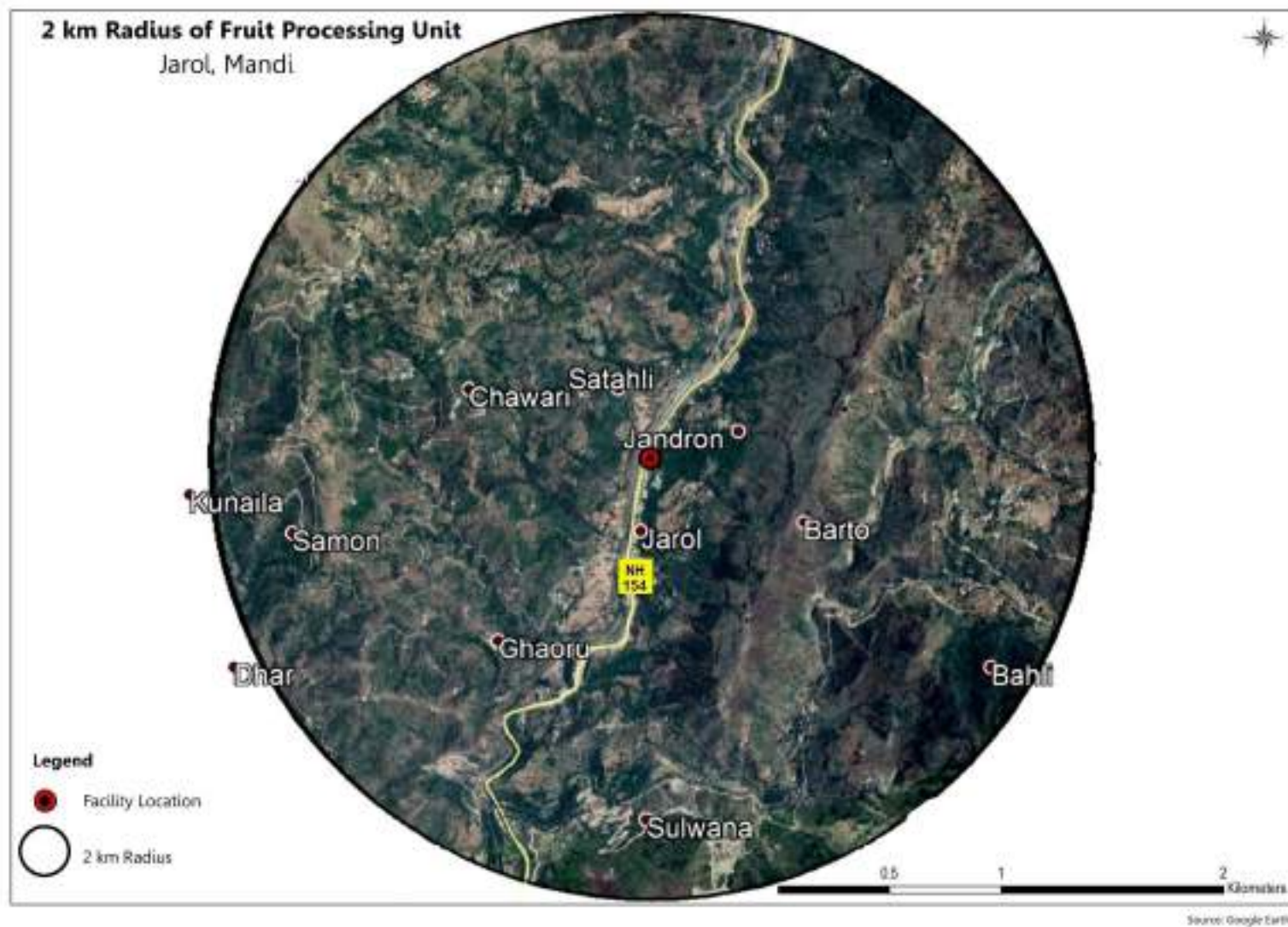


Figure 3.3: Project layout

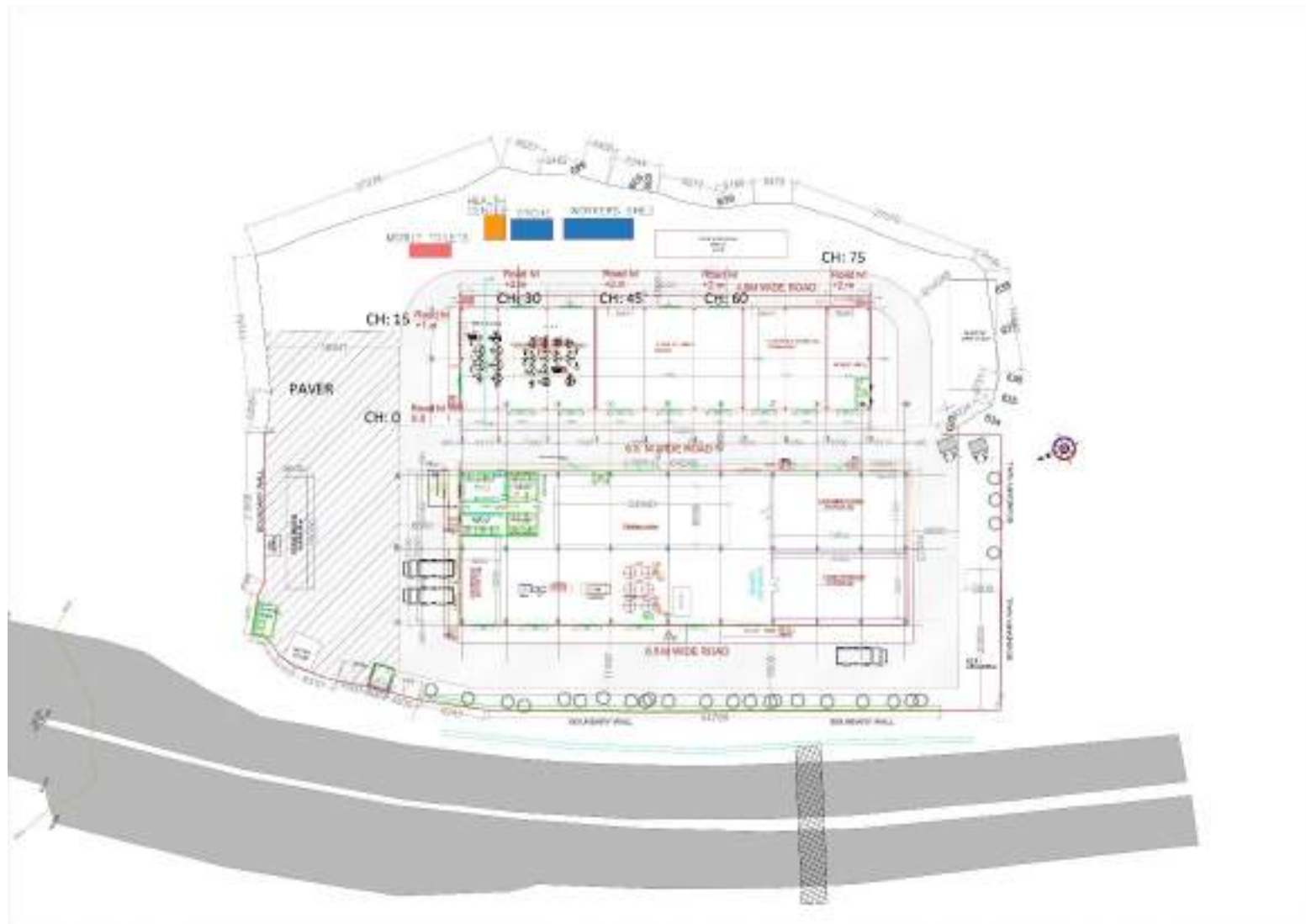


Figure 3.4: Contour map

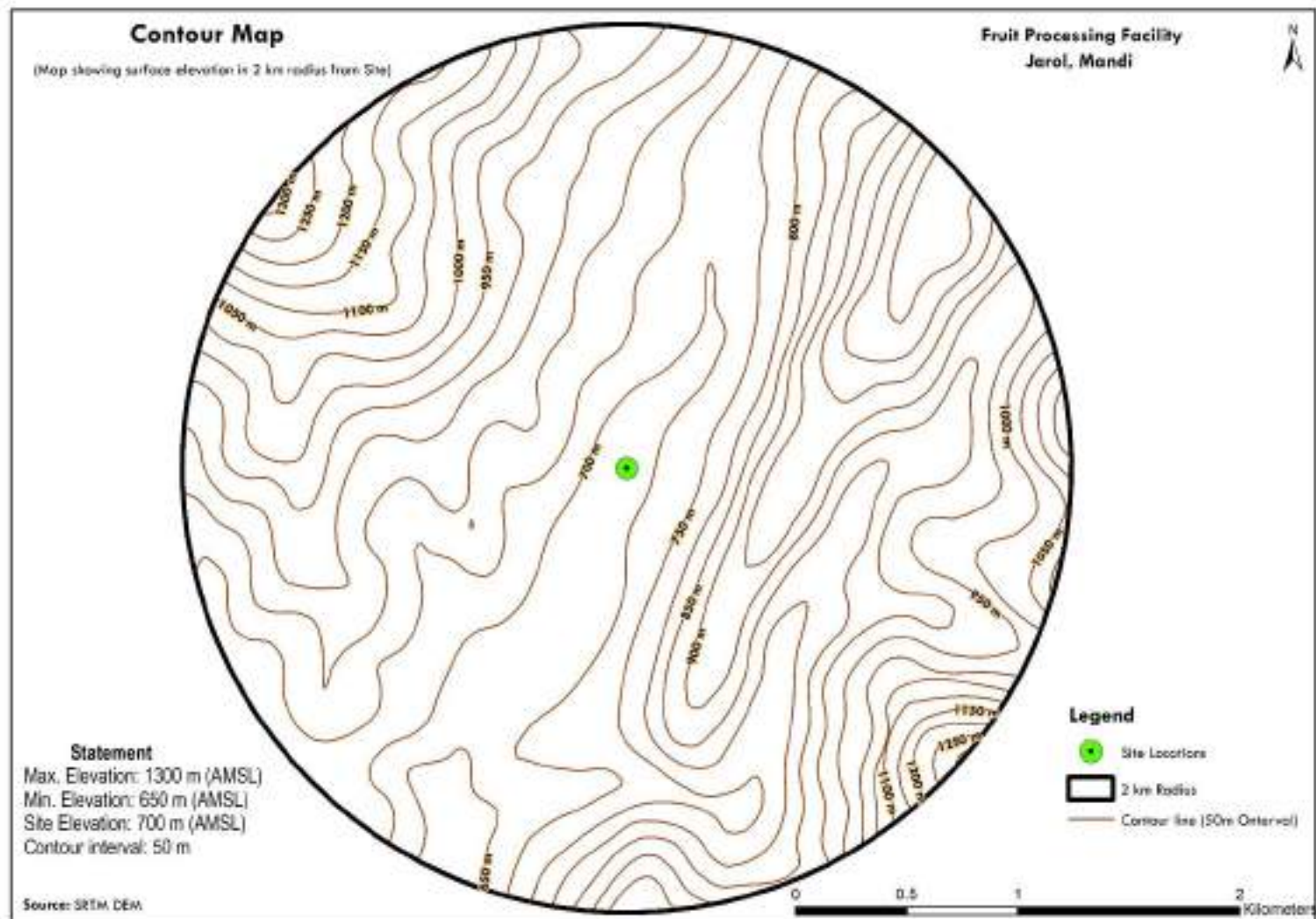


Figure 3.5: Site photographs



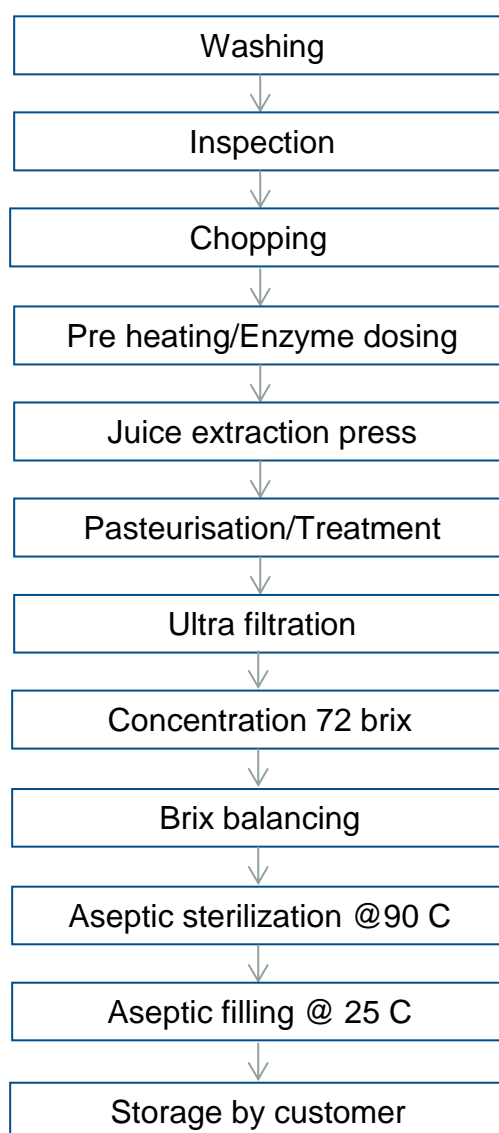
3.2 Process description and technology involved

Processing (preparation of juices, jams, squash, pickles and cider vinegar) increases the shelf life of fruits and vegetables. Processing steps include preparation of the raw material (cleaning, trimming and peeling) followed by cooking, canning or freezing.

3.2.1. Apple juice concentrate processing - Existing and Upgradation facility

Apple juice is processed and sold in many forms. This processed apple juice can be in several styles: clarified juice, crushed apple juice, “natural” unfiltered juice, or apple juice concentrate, either frozen or high brix. The production process of AJC can be broadly categorized into washing, inspection, crushing, juice extraction, filtration, evaporation, sterilization & aseptic packaging. Flowchart depicting apple processing to apple juice concentrate at Jarol is given as **Figure 3.6**.

Figure 3.6: Flowchart for apple juice concentrate (Existing and Upgradation)



Note:

Source: Feasibility Study - Horticulture Produce Marketing and Processing Corporation (Government of Himachal Pradesh), January 2019

Process equipment details

Some of the common equipment used for processing of fruits during production of Juice is given below.

1. Silos
2. Hopper
3. Conveyor
4. Bucket elevator
5. Washing, storage tank
6. Crusher
7. Pumps
8. Turbo refiner
9. Belt press/Hydraulic press
10. Treatment tank (Addition of enzymes)
11. Centrifuge
12. Ultra filtration system
13. Evaporator
14. Aroma recovery plant
15. Storage tanks
16. Sterilization
17. Aseptic filler with double head
18. Pasteurization
19. Boiler
20. Cold stores

Process description

a. Washing, Inspection & Crushing

Raw material brought from the farm undergoes the two stages washing. After washing, the material is transferred on inspection belt. Sorted material will fall down to the mill. A cutting line is controlled by system automated. During pulp the milling with use of membrane pump, enzyme preparation is added which aid the effectiveness of pressing press. The fruit pulp from the mill is preheated at certain temperature. Then, fruit pulp is pumped to pulp tank and it will take to next step in the production of juice and concentrate.

b. Juice yielding

Correctly performed pressing stage will guarantee maximum yield of juice from raw material. An extrusion process starts with pre filling. Pulp is pumped to the press. It is fully automated process owing to the self- optimizing press control system, which determines the level of product extrusion at each process stage. Constant cylinder rotation during the pressing cycles and expanding ensures the most advantageous loosening of the pulp pressed, thus guaranteeing maximum pressing efficiency.

Closed system guarantee the process hygiene without Juice losses as well as simple and automated washing process. Juice pressed in the press flows down to intermediate tanks.

c. Pasteurisation, De-aromatisation & Ultra-filtration

Unclassified juice from presses is directed from intermediate tanks to the section of pasteurisation & aroma recovery in evaporation station. The Pasteurisation take place in the temperature from 95 to 105°C and it is to inactive enzymes, obtain juice microbiological stabilisation, starch gelatinisation and protein denaturation. Evaporation station ensures high process efficiency, rapid evaporation and low steam consumption. Automatic controlling with visualisation enables the operator to control the parameters of pasteurised juice on a current basis.

Pasteurised juice is pumped to De-pectinization tanks. De-pectinization process is carried out in acid-proof tanks made by B&P Engineering which are equipped with stirrers. After De-pectinization process the unclassified juice is pumped to the batch tank from which is then taken to Ultrafiltration System. Ultrafiltration stage starts with pumping of unclassified juice from De-pectinization tanks to the batch tank. Ultrafiltration system is a fully automated Cross-Flow filtration device. De-pectinized unclassified juice reaches the batch tank and a high-efficiency centrifugal pump pumps juice with high velocity through membrane modules. A thin top layer is formed on the surface of membranes and some liquid penetrates through membrane channel as a ready product to the permeate tank. Retentate is condensed to obtain maximum concentration. Then it may undergo dia-filtration to obtain extraction. After ultrafiltration process, juice is fed to fined juice tanks and it is taken again to evaporation station in order to condense it.

d. Concentration

The heart of the line for producing fruit concentrates is multi-staged evaporation station with a dropping juice film used for condensing apple juice and soft fruit (coloured). During the entire juice production process, raw material reaches the evaporation station twice: for the first time, as unclassified juice before ultrafiltration process in order to be pasteurised and De-aromatised. For second time, as fined juice in order to be subjected to processes of initial and final condensation, inter-stage filtration and product cooling. The product goes through subsequent evaporation stages to obtain an appropriate concentration degree. Juice condensed in the evaporation station is cooled down and pumped in pipelines to the equalisation tank and after standardisation to storage tanks.

e. Sterilization & Aseptic packaging

After concentrate at 70-72° Brix is pumped through a paper filter in order to eliminate potential black spots which might be generated inside the evaporator for several reasons. In fact, finished product will not be accepted internationally if black spot is

present into the concentrate. Finished product can now go for aseptic filling. If standardization is necessary product can pass into the standardization tank or directly go to aseptic sterilizer-cooler where product is being sterilized by increasing its temperature up to 95–105°C (depending upon pH) and holding it for 30 to 60 seconds and cooling it to 35-40°C prior entering the aseptic drum filler. The best store temperature for the aseptic drums is still better by <10°C.

Now product is aseptic and cannot be contaminated from the outside environment and bacteria. Shelf life at ambient temperature is longer than 18 months however it is recommended that if the product is filled into big tanks of 20m³ or more for more than 2 months it should be stored into cold rooms at <10°C in order to maintain the best colour and taste.

3.2.2. Ready to Serve Line (RTS) with Aseptic Brick Filling Line

In order to prepare ready to serve (RTS) beverages suitable to fill various packaging of various capacities. The beverage will be made out of natural juice/pulp contents of 10-12% (Based on the recipe) and 10-15% dissolved sugar mixed with other ingredients and duly blended with good quality water. Fibrous contents in the beverage will be homogenized to achieve uniform consistency. The blended and homogenizer beverage will be processed by heating up to 90-95 Degree C and cooling up to 70-75 Degree C suitable for filling in PET Bottles, a cleaning in place systems will ensure the cleaning of all equipment's and pipe lines having in contact with the product will be cleaned to meet the highest sanitary standards in the food processing industry. the process flow chart is given in **Figure 3.7**.

The complete system consists of the following sections

1. Sugar Syrup Preparation System.

To prepare 60-65 brix sugar syrup by dissolving raw sugar in to the hot water and heat the same up to 80 °C, then filter the same thru the filter fabric, then cool to ambient temperature in a heat exchanger. The cooled syrup will be stored in tank and the same will be connected to SS centrifugal pump. The system will be suitably piped, and inter connected with flow plates for incorporating with the cleaning in place system.

2. Pulp Dilution and Blending system.

The pulp/concentrate will be collected in a stainless steel tank and the required quantity can be transferred to the blending tanks through a centrifugal pump. The required quantity of sugar syrup and processed water will be added in to the blending tank and mixed properly by an agitator to reach the desired brix of the beverage. The ready beverage will be transferred to the storage tank through the homogenizer (in case the pulp contain fibrous materials)The homogenized beverage will be sent to pasteurizer for further processing. Necessary pipes, fittings and flow

plates will be provided to operate both the tanks separately for product and CIP application.

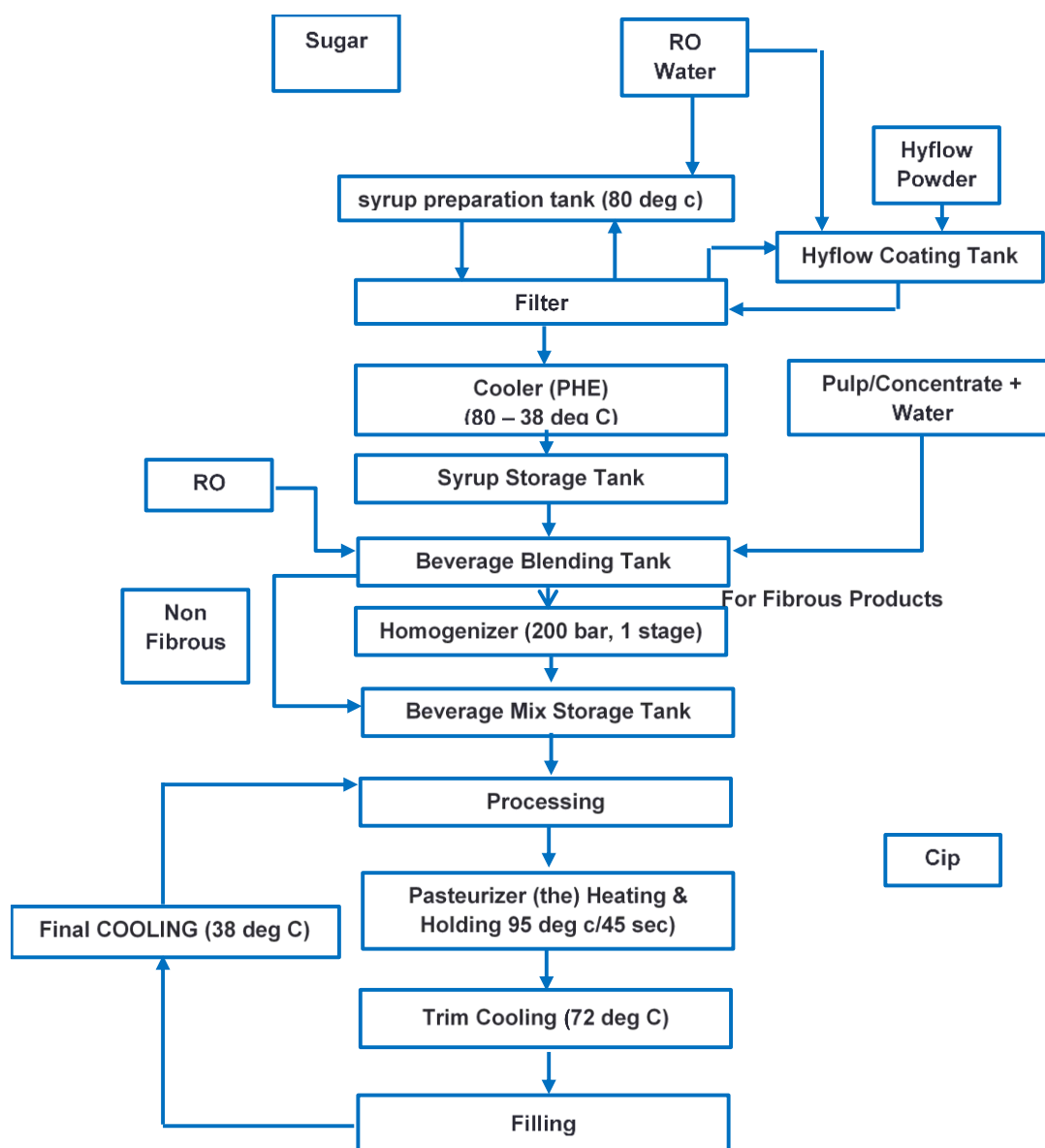
3. Beverage pasteurization plant.

To heat the blended raw beverage having less than 25 brixs, from ambient temperature of approx. 30°C, to 95°C, cool the same to 75°C, for filling in the PET bottles and return cooling provision will be provided to cool the return product to the balance tank at ambient temperature. The pasteurization temperature or the filling temperature of the product is not reached to the desired set temperature the beverage will be diverted back to the feed tank for re pasteurization. In the outlet of the pre heater module at around 60°C. The Pasteurized beverage will hold for 60 seconds [as specified by you] at a temperature of 92°C, in tubular holding tubes. The Pasteurized beverage will be cooled to 75°C by heat recovery section, and in case the product need to be returned to the balance tank due to any reason, the product will be passing thru the cooling module operated through the cooling tower water. The pasteurization plant is designed to carry out the Sterilization, at a flow rate of 50% of the product flow rate, Back wash and Cleaning in Place, for which additional change over valve are provided. Entire operation of the plant will be monitored, controlled and operated by an instrument panel having programmable logic controller.

4. CIP System

CIP (Cleaning in Place) means cleaning the equipment's and pipe lines at its place without dismantling from its position. Three tank CIP system provided along with the plant will take care of the cleaning requirement of all the tanks and pipelines as per the standard sequences. The timing and cycles will be pre-programmed in the PLC and the system will be operating accordingly. The pneumatically operated steam valve will control the temperature during the various sequence of the CIP. Sent to Aseptic Brick Filling Line.

Figure 3.7: Flowchart for Ready to Serve with Aseptic Brick Filling Line



3.2.3 Apple cider vinegar

Vinegar is made from variety of diluted alcohol products, to produce wine vinegar, cider vinegar. Acetobacters are microscopic bacteria that live on oxygen bubbles. Whereas the fermentation of grapes or hops to make wine or beer occurs in the absence of oxygen, the process of making vinegars relies on its presence. In the natural processes, the acetobacters are allowed to grow over time. In the vinegar factory, this process is induced by feeding acetozym nutrients into the tanks of alcohol. Herbs and fruits are often used to flavor vinegar.

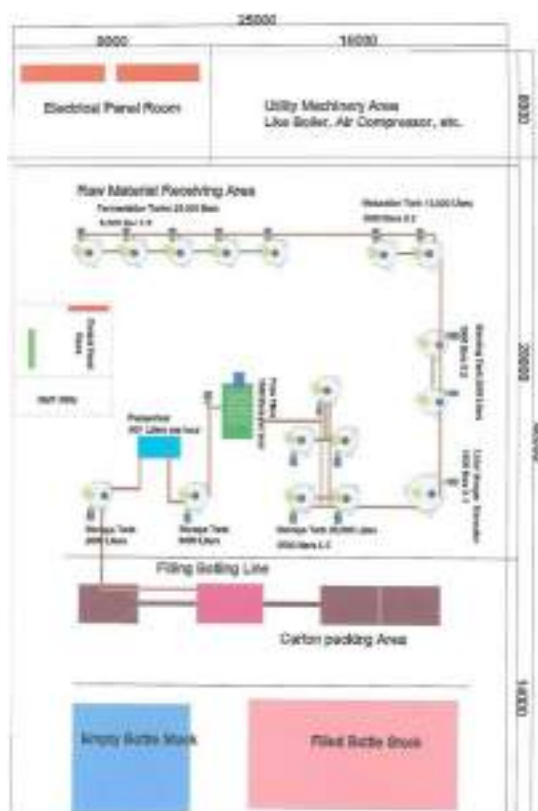
The submerged fermentation method is used in the production of wine vinegars. Production start with filling the juice in Vinegar Fermentation tanks this process is called Alcohol fermentation this process occurs in the absence of oxygen. Vinegar

Maturation Tank is Used for production of Mother Vinegar (Mother of vinegar is the gooeey film that appears on the surface of the alcohol product as it is converted to vinegar. It is a natural carbohydrate called cellulose. This film holds the highest concentration of acetobacters. It is skimmed off the top and added to subsequent batches of alcohol to speed the formation of vinegar. Acetozym nutrients are manmade mother of vinegar in a powdered form).

The juice which is converted in fermentation tank and the mother of Vinegar which is made in Maturation Tank is then mixed in a right proportion in Vinegar Blending Tank and send to Vinegar Generation tank. In this tank the Acetic Acid fermentation Takes place they are fitted with centrifugal pumps in the bottom that pump air bubbles into the tank. As the pump stirs the alcohol, acetozym nutrients are piped into the tank. The nutrients spur the growth of acetobacters on the oxygen bubbles. A heater in the tank keeps the temperature between 26-38°C. Within a matter of hours, the alcohol product has been converted into vinegar.

This Vinegar is send to holding tank and flavor is added if required. Then the Vinegar is send to storage tanks for ripening. Then the vinegar is piped to a plate-and-frame filtering machine. The stainless steel plates press the alcohol through paper filters to remove any sediment, usually about 3% of the total product. The filtered vinegar moves to the pasteurizer from pasteurizer it is directly sent to bottling and then labeling and carton packing.

Figure 3.8: Flowchart for apple cider vinegar



3.2.4 Wine processing facility

The production line is made such a way that vinegar fermentation tank and vinegar storage tank is also used for wine fermentation & ageing if required only when the vinegar making process is closed.

For white wine, the grapes quickly crushed and pressed in order to separate the juice from the skins, seeds and solids. This is to prevent unwanted color and tannins from leaching into the wine.

The Juice is filled in wine fermentation tank and yeast and SO₂ is added. Fermentation continues until all the sugar is converted into alcohol and dry wine is produced. The wine must ferment in the tank or vat for approximately three to fourteen days, depending on the type of wine being produced.

Wine then sent to maturation tank and after some time sent to wine blending tank to add flavor then to filtration to remove any solid particles if any, then sent to storage tank for ageing, after ageing the wine is sent for bottling. Our line is just for one or few days of ageing. Typically, racking is done at (0-5°C) for white wine. The temperature is maintained in tank by a water flow in the outer jacket of the tank and adjusting the temperature of the water.

For red wine, on the other hand, the Juice is left in contact with the skins and solid particles to acquire flavor, color and additional tannins.

The Juice is filled in wine fermentation tank and yeast and SO₂ is added fermentation continues until all the sugar is converted into alcohol and dry wine is produced. To add strength, varying degrees of yeast may be added. In addition, cane or beet sugar may be added to increase the alcoholic content. The wine must ferment in the tank or vat for approximately three to fourteen days, depending on the type of wine being produced.

After fermentation the red wine is then pressed in the pressing machine as done for white wine before fermentation. (After fermentation, red wines will be crushed again and pumped into another fermentation tank where the wine will ferment again for approximately three to seven days. This is done not only to extend the wine's shelf life but also to ensure clarity and color stability.)

Wine then sent to maturation tank and after some time sent to wine blending tank to add flavor then to filtration to remove any solid particles if any, then sent to storage tank for ageing after ageing the wine is send for bottling. Our line is just for one or few days of ageing. Typically, racking is done at (10 to 16°C) for red wine. The temperature is maintained in tank by a water flow in the outer jacket of the tank and adjusting the temperature of the water.

3.3 Infrastructure facilities for project

The infrastructure requirement for the processing plant can be broadly classified into the following two heads:

- Basic infrastructure
- Environmental infrastructure

The basic infrastructure covers the main requirements like

- Machinery/Equipment
- Water
- Power
- Roads & street lights
- Storm water drains

The environmental infrastructure covers

- Solid waste collection & disposal
- Effluent conveyance system & disposal
- Effluent Treatment Plant

3.4 Resource requirements

3.4.1 Land area

The up-gradation of the processing plant is proposed in the existing unit and also replacing some old equipment. The land breakup for various activities is given in **Table 3.3**.

Table 3.3: Land details

Description	Land (Sqm)	Land (%)
Built-up area	2045.3	50.47
Roads	1847	45.58
Open spaces	159.55	3.93
Total	4051.85	100

3.4.2 Water

The details of water required from different activities of the project before and after upgradation of the facility are given in water balance **Table 3.4**.

Table 3.4: Water balance - KLD

Details	Water required			Wastewater	Remarks
	Existing	Upgrading	Total		
Domestic	5	1	6	5	Treated in ETP (50 KLD)
Industrial	24	6	30	25	
Total	29	7	36	30	
Source of water: Natural stream from nearby mountain Storage capacity of fresh water 100 KLD					

3.4.3 Power

Total power required will be sourced from Himachal Pradesh State Electricity Board (HPSEB). The detailed power requirement and diesel for DG set are given in **Table 3.5**.

Table 3.5: Power requirement

Name		Requirement (kVA)	Total	Remarks
Electricity		250	250	Diesel in litres/hr <ul style="list-style-type: none">Existing – 25Up gradation – 30
DG Set Capacity		250	250	
Note: Upgrading power requirement is calculated based on the existing and proposed plant capacities				

3.4.4 Solid waste

As the existing fruit processing plant proposed for upgradation, the nature of solid waste will be majorly pomace, spoiled fruits, processed fruit packages, etc. Apart from this, office stationery like paper, cardboards, packages, plastic bags etc., are also included.

The sludge from the treatment plant can be used as manure within the premises. The details of the solid waste generated are given in **Table 3.6**. The rejected fruits, peels, rejected cuttings; inner core/seed and separated solids from pulper, crusher from fruit processing unit will be collected and sold for reuse as cattle feed. Alternatively, these solid wastes can be composted (vermicomposting/ organic waste converter) and used as manure to farms. The recyclables will be disposed to local vendors and compostable waste will be converted to compost and used as manure to farms, whereas the non-compostable solid waste will be disposed into local municipal bins.

Table 3.6: Details of solid waste generated

S. No	Details	Solid waste generation	Total (kg/day)	Remarks
1	Domestic	0.2 kg/capita/day	22	Domestic waste shall be sent to OWC and recyclable waste to local vendors
2	Process	220 kg/ton*	6600	
Total			6622	
Note: Production capacity existing 30 TPD * Comprehensive industry document-COINDS/56/1996-97-CPCB				

3.4.5 Roads and street lights

The roads within the project would be minimum 7 m wide for free movement of trucks carrying raw materials and finished products and in emergency for movement of fire engine, ambulance etc. All internal roads will be provided by street lights at every 20m interval.

3.4.6 Storm water drains

The storm water drains would be provided all along the roads. They would be adequately sized to prevent flooding of the site. The storm water drains will also act as recharge trench as the bottom will be stone pitched and side lining, so that maximum amount of rainwater infiltrates into the ground. The excess water will be diverted into the common storm water drain.

3.4.7 Manpower

The work force will be hired locally in order to generate employment to local people. During season of fruit processing professional, skilled and unskilled work force will be more, whereas during non-season the number of work force will vary. Manpower details at different seasons are given in **Table 3.7**.

Table 3.7: Manpower requirement

Phase	Type of employment	Number of workers			Remarks
		Existing	Upgradation	Total	
Construction	Contractual	15		15	In active season, additional manpower will be hired to support the existing manpower
Operation	Permanent	12	1	4	
	Outsourced	9	3	16	
Operation (Season)	Skilled	6	4	10	During peak season
Note: Indirect employment during operations for peak season will be for around 80 persons					

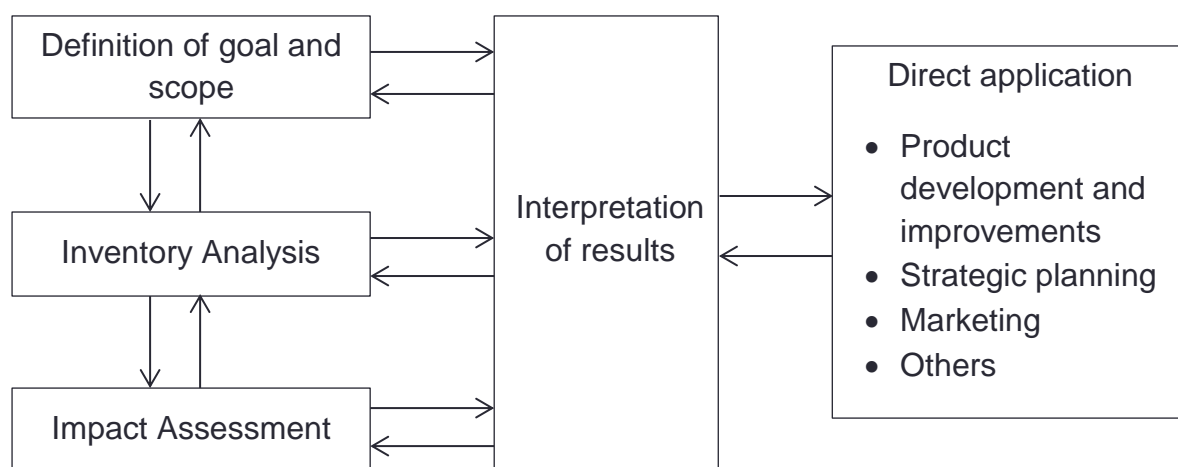
The following data is inadequate / absent and requires additional information:

1. Land ownership details
2. Dimensions of the existing and proposed equipment

3.5 Life cycle analysis for fruit processing facility

The present system of fruit processing production, require larger inputs of resources. As the fruit processing industry activities are very dynamic in nature, it is difficult in conducting Life Cycle Analysis (LCA) of fruit products. The complete study of fruit processing necessarily include agricultural fruit production, industrial fruit processing, grading & packing, storage and distribution, packaging, consumption and finally waste management. All these activities together comprise of a large and a complex system. There are various techniques in quantifying the impacts of fruit processing activities on the ecosystem and one such method used is life cycle analysis, which is the process of evaluating the effects of a production system has on the environment over the entire period of its life cycle. LCA is basically divided into four phases which include goal and scope definition, inventory analysis, impact assessment and interpretation given in **Figure 3.9**.

Figure 3.9: Stages of Life Cycle analysis



The goal of LCA is to identify the reason to carry out the study and the objective is to identify the environmental impacts that occur in the life cycle of fruit processing activities. The energy inputs, chemical inputs and the other utilities provided during the fruit processing operations are considered as resource consumption within the system boundary.

The inventory analysis of the LCA is essentially the collection of data related to input and output of products. For inventory analysis, a summary of the process involved in the fruit processing which include data sources from various stages of process and the allocation of materials applied particularly the site specific inventory data. This information is collected by preparing site specific questionnaires, interviews, environmental and other related data reports.

The life cycle impact assessment mainly examines the fruit process products system from an environmental perspective by identifying the environmental categories and parameters or indicators. The inputs related to emissions to air, waste water generation and solid waste generation during process operations are quantified based on the mass balance of materials and process continuous use. The environmental impacts at production stage, usage stage and disposal stage are identified and the impacts on air, water, land and on ecosystem are addressed in LCA process.

The interpretation component of LCA uses the results from the impact assessment and inventory phases to address the concerns set in the goal and scope of study. The LCA process results will provide the guidelines that are consistent with the assumptions made for the fruit processing activities. The LCA provides the whole life cycle of fruit processing activities which includes the production of apples at agricultural fields to the production of fruit products to the ultimate end use. The Life cycle analysis of Fruit processing facility is given in **Figure 3.10** along with the project time lines for construction, operation, decommissioning and closure phases of the facility at different phases in **Table 3.8**.

Figure 3.10: Life Cycle Analysis for the fruit processing facility

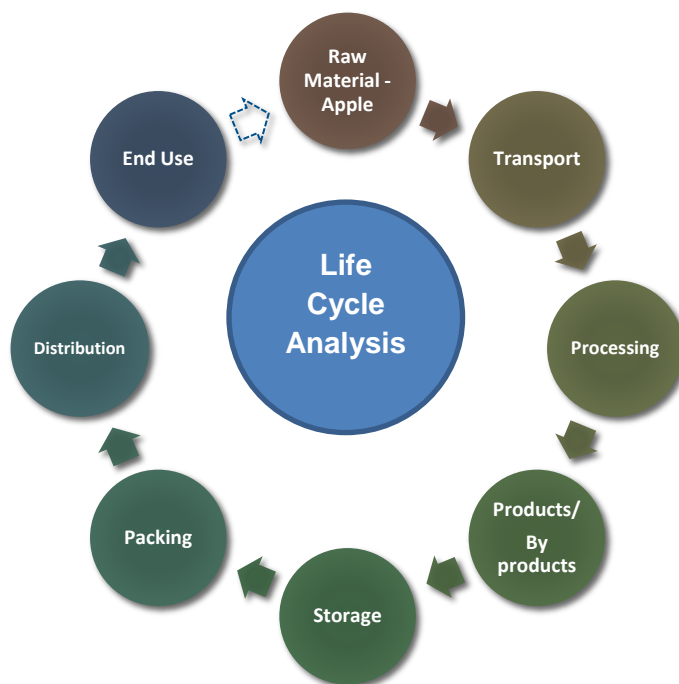


Table 3.8: Project timelines for construction, operation, decommissioning and closure phases

Phase	Period	Remarks
Construction phase	6 to 12 months	After obtaining all necessary statutory approvals and financial sanctions.

Operation phase	1 to 25 years	Depending upon factors like New technology, Competition in the market, Environmental rules and regulations, Demand and supply, etc.
Decommissioning phase/Closure	6 to 12 months	<ul style="list-style-type: none"> • Depending upon the various disposal activities as per statutory norms prevailing at the time of decommissioning. • Due diligence for establishing the end use of the facility.

Chapter 4

Methodology of Environmental & Social study

4.1 Introduction

ESIA is a systematic process that identifies and evaluates the potential impacts (positive and negative) that a developmental project may have on the bio physical and socio-economic environment and thus identifies mitigation measures that need to be implemented in order to avoid, minimize or reduce the negative impacts and also identifies measures to enhance positive impacts.

The scoping phase of the ESIA process involves emphasis on public involvement, stakeholder consultations with reference to the proposed horticulture projects i.e., cold storage activities, marketing yards, grading & packing and fruit & vegetable process plants. The tasks and consultation activities undertaken with experts will decide the project scope and objectives for preparing the ESIA/ESMP documents for all the project interventions. As part of the project initiation, the expert team have carried out an initial site reconnaissance survey of the proposed as well as existing project sites to familiarize the project proposal and affected areas so that to begin the environmental and social screening and scoping process. The methodology of ESIA starts with the scoping and screening of the project and environmental attributes by adopting public participation tasks with mainly people involved in the activities of project processes.

Through planned and carefully structured field visits, the experts gathered data relevant to identifying and assessing environmental impacts that may occur as a result of the project activities. The project team has assessed the potential impacts according to a predefined assessment methodology for the proposed fruit processing unit.

The methodology involved in the final phase of ESIA document is the integration and assessment of impacts anticipated from the project activities. The assessment of impacts proceeded through an iterative process considering the following key elements

- Prediction of the significance of impacts that are the consequences of project operations on the natural and social environment. The prediction step mainly involves establishing the quantitative values to the environmental parameters involved in the project activities.
- Evaluation of the significant impacts which results in changes in nature and surroundings. The evaluation of impacts has to be as much objective as possible.
- Development of mitigation measures to avoid, reduce or manage the impacts.

The involvement of public participation in the initial stages of ESIA process will essentially provide related information regarding the concerns to be considered and recognized from the outcome of project processes. The problems connected to the public opinion on the proposed project can be implemented during the planning and design stages.

The methodology for the detailed impact assessment is as follows:

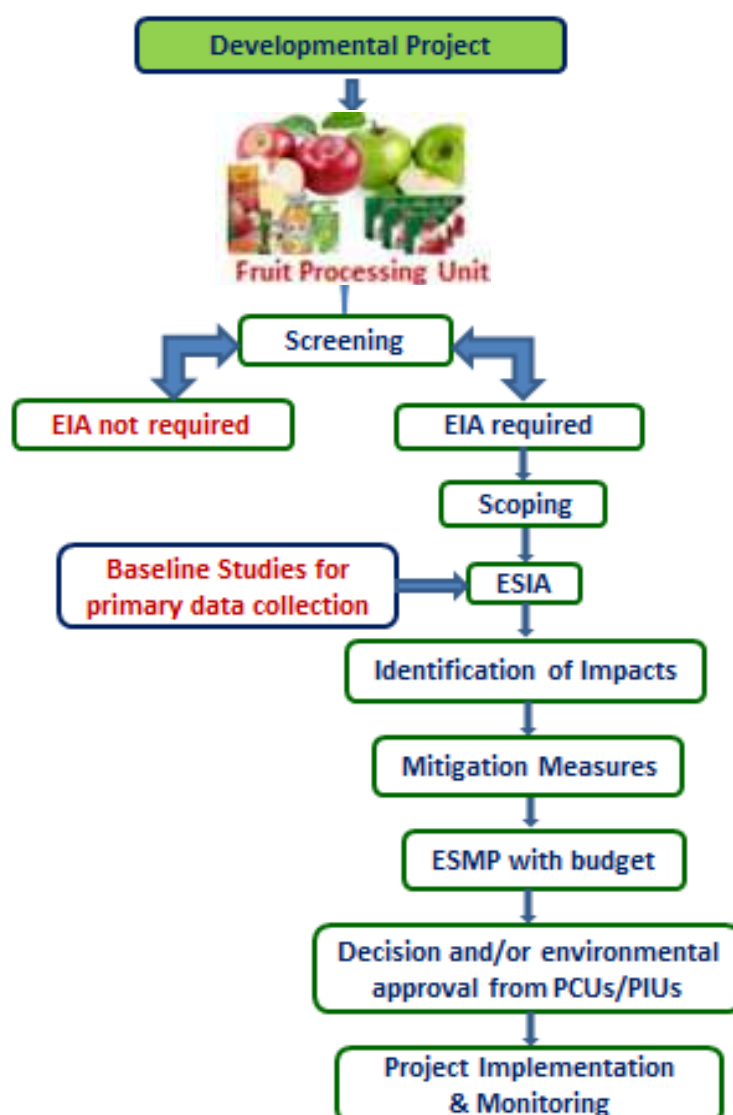
- During the scoping interactions between project activities and environmental and social receptors and identified for further assessment.
- During initial assessment potential interactions are further evaluated against site specific conditions using information gathered through baseline field studies.
- During detailed assessment interactions with potential for impact are assessed in detail to determine the nature and characteristics.
- Mitigation measures are identified to control the residual impacts are re-assessed.

4.2 Process of ESIA study

The flowchart for carrying out ESIA of the project interventions is shown in **Figure 4.1**. The step-wise activities are briefly explained below.

- **Identification and defining the project/activity:** This step defines the project with enough specificity to accurately determine the zone of possible impacts and to include activities that are closely connected with the proposal so that the entire scope of environmental impacts is evaluated.
- **Screening:** Determines whether a particular project requires preparation of an ESIA.
- **Scoping:** A process of determining major issues to be addressed in an ESIA.
- **Identification of impacts:** The process of determining the actual and potential environmental impacts due to the proposed/existing developmental activity.
- **ESIA documentation:** A final impact assessment report that addresses all the issues along with mitigation measures.
- **ESMP:** A plan along with estimated costs to ensure that the environmental quality of the area does not deteriorate due to the operation of the facility under study.
- **Decision/environmental approval from PCUs/PIUs:** Provided all regulatory requirements are met, a project development will/may proceed following the decision of PCUs/PIUs.
- **Project implementation & monitoring:** Monitoring ensures that required mitigation measures are being implemented.

Figure 4.1: General flowchart of ESIA process



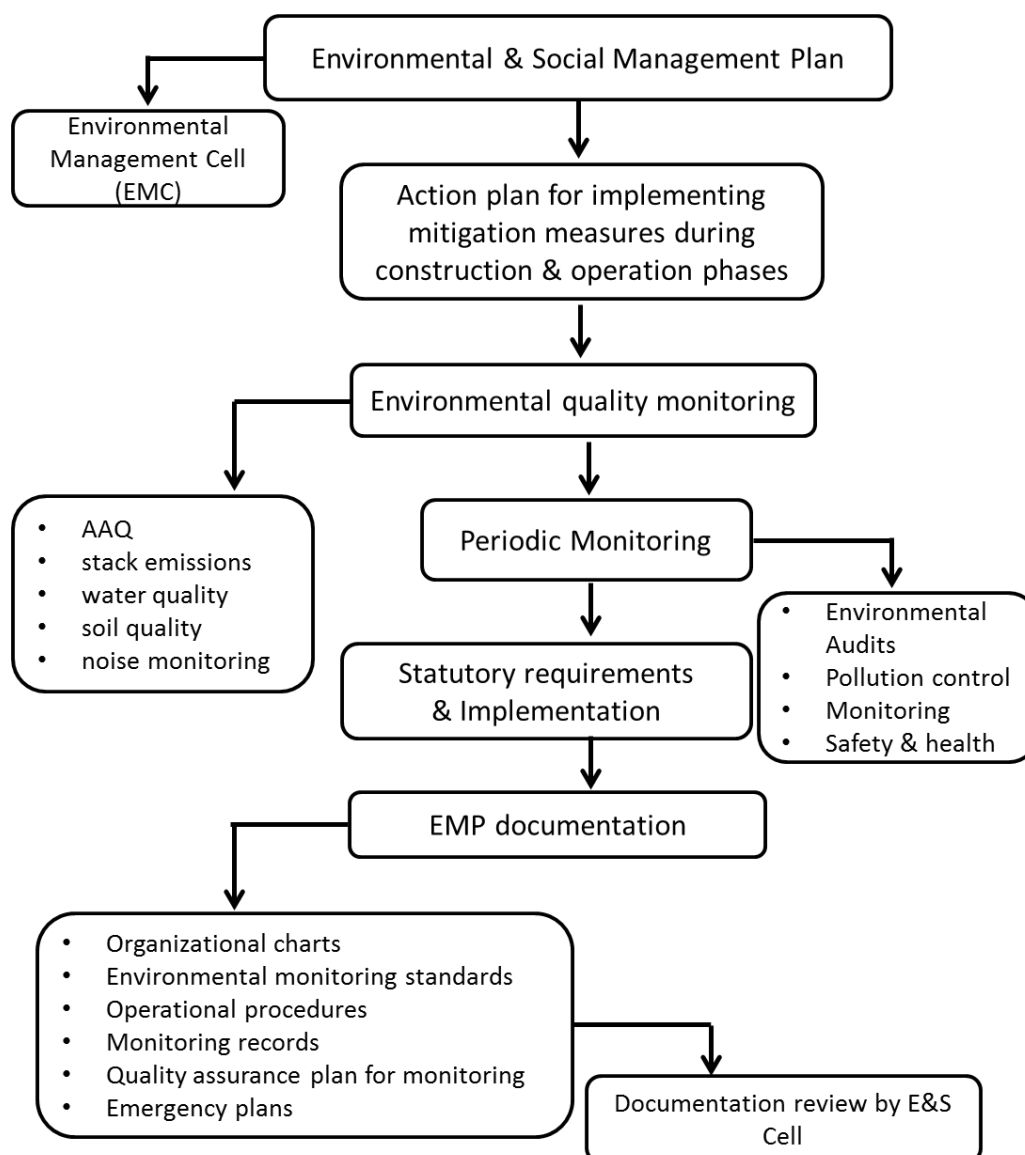
4.3 Process of ESMP

ESMP consists of the following activities and the concerned flowchart is shown in Figure 4.2.

- **Action plan for implementing mitigation measures:** The mitigation plan covers all aspects of the construction and operation phases related to environment.
- **Monitoring of environmental quality:** A detailed monitoring for different environmental parameters like ambient air quality, stack emissions, water quality, soil quality, noise monitoring will be carried out as per the action plan of the project management or as suggested by concerned statutory bodies.
- **Periodic preventive maintenance:** Environmental audits, pollution control, monitoring shall be periodically carried out. Periodic monitoring of the health of the workers will be carried out as required by the concerned legislations.

- **Statutory requirements and Implementation:** These include statutory requirements which a facility needs to meet. EMP will ensure that these requirements are met in time.
- **Documentation:** Consists of technical information, organizational charts, environmental monitoring standards, operational procedures, emergency plans.
- **Environmental & social management cell:** E&SM cell will facilitate selection of activities to be taken up for planning and design and finalizing procedures to ensure compliance with triggered policies.

Figure 4.2: Flowchart of ESMP process



4.4 Description of ESIA methodology

The projects that require statutory clearances shall require ESIA report and ESMP based on guidelines framed by regulatory authorities. In case of multilateral funded projects, the environmental guidelines / framework of the concerned agencies shall be applicable in addition to the guidelines of local pollution control boards. ESIA shall assess the likely impacts on the environment due to existing industry or/and an upcoming project based on which environment management plan is formulated.

ESIA shall identify the potential impacts during design stage of project in order to facilitate decision making process to select the appropriate alternative having minimum environmental impacts. The ESMP shall formulate both mitigation and enhancement measures to trade off the potential adverse impacts with an objective to achieve sustainable development.

4.5 Generation of baseline environmental data

The baseline environmental data (within 2km radius from the proposed site) shall be collected to establish the existing environmental conditions and has two main purposes.

- To assess the existing environmental status of the project area, based on which the potential environmental impacts due to a project is envisaged.
- To provide a means of detecting actual change by monitoring once a project has been initiated.

Baseline data shall consist of collection of primary and secondary data.

Primary sources: Results of the field and laboratory data collected and analysed directly. Primary data shall consist of:

- **Physical:** the project area, soil properties, geological characteristic, topography, agriculture lands etc.
- **Chemicals:** water, air, noise, and soil pollution levels
- **Biological:** the biodiversity of the area, types of flora and fauna, species richness, endangered species
- **Socio-economic:** demography, social structure, economic conditions, developmental capabilities
- **Cultural:** location and state of archaeological and/or religious sites

Secondary sources: Data shall be collected indirectly from published records or documents such as districts gazettes, published data by various government departments such as Indian Meteorological Department, State Forest Department, Survey of India, Census of India, Central Ground Water Board brochures, Economic and Statistics department, etc.

The parameters for baseline environmental data collection shall be as per ESIA guidance manual by MoEF&CC. Site visit shall be conducted for ESIA studies for identification of environmental and social issues at the project area, finalization of monitoring/sampling locations, collection of data, public consultation, etc.

4.5.1 Primary baseline data

Ambient air quality

Air is the one of the basic elements for life on earth and air quality can be defined as the extent to which it can be considered to be clean or safe enough for living organisms to respire and remain healthy. Baseline AAQ provides information on existing air quality levels in the area and helps to predict the likely impacts due to proposed activity.

Identification of Ambient Air Quality (AAQ) monitoring station locations

AAQ monitoring stations were identified within 2km radius from the boundary of proposed site. Out of the identified AAQ monitoring stations, one AAQ monitoring station was set up within the project boundary. The other locations were identified considering meteorological data (like upwind, downwind, cross wind), Land use Land cover details along with information on habitations, sensitive and commercial zones within the study area.

Air monitoring duration, sampling size and testing technique

At each monitoring site AAQ monitoring equipment was installed. The samplers were kept at the height of minimum 3m above ground level for monitoring/collection of samples. AAQ samples were collected for monitoring Particulate Matter (PM < 2.5 µm and PM < 10 µm), Sulfur dioxide (SO₂) and Oxides of nitrogen (NO_x).

Respirable Dust Sampler (RDS) was used to monitor PM₁₀, SO₂ and NO_x whereas PM_{2.5} was monitored using Fine Particulate Sampler.

The air samples collected were properly labeled, sealed and sent to AAQ testing laboratory. The AAQ samples were analyzed as per standard methods specified by Central Pollution Control Board (CPCB), IS: 5182. The air sample results were compared with NAAQ standards 2009. The techniques used for ambient air quality monitoring and minimum detectable level are given in below **Table 4.1**.

Table 4.1 Techniques used for ambient air quality monitoring

Parameters	Test method [as per GSR 826(E), Sch-VII]	Minimum detectable limit (µg/m ³)
Particulate Matter, PM ₁₀	Gravimetric Method	1.0
Particulate Matter, PM _{2.5}	Gravimetric Method	1.0
Sulphur dioxide (SO ₂)	Improved West and Gaeke Method	4.0
Nitrogen dioxide (NO _x)	Modified Jacob and Hochheiser Method	4.0

References:

- i. IS: 5182- sampling and analysis techniques for Ambient Air
- ii. CPCB guidelines for Ambient Air sampling and Analysis
- iii. Instrument working manuals, operating instructions given by manufacture
- iv. American Public Health Association (APHA)

Ambient noise levels

Noise is an unpleasant sound that causes disturbance. Existing noise environment at different zones such as residential, commercial, industrial and silence zones etc., is monitored to predict the changes in noise levels due to proposed activity.

Identification of ambient noise quality monitoring station locations

Noise monitoring stations was identified within 2km radius from the boundary of proposed site. Out of the identified monitoring stations, one monitoring station was set up within the project boundary. The other locations were identified considering Land use Land cover details along with information on habitations, sensitive and commercial zones within the study area.

Noise monitoring duration, sampling size and monitoring technique

At each monitoring site Type 1 Integrating Sound Level Meter with free field microphone which meets the accuracy of noise measurement as per IEC804 Grade I or ANSI Type I was used for noise monitoring.

At each monitoring station 24 hour noise monitoring was carried out. One second sampling frequency was set to record noise level (L_{eq}) (hourly average value). Based on this information L_{max} , L_{min} , L_{day} and L_{night} values were calculated.

Noise levels (L_{eq}) were recorded at monitoring sites using integrated noise meter and equivalent noise levels calculated as per the project requirement.

Water quality

Ambient water quality is an important parameter monitored as part of baseline monitoring. Most of the surface water resources of the state flow from perennial rivers which originate from glaciers. Ground water recharge mainly results from snowfall / rainfall, seepage from the rivers and inflow from upland areas. Baseline water quality provides information on existing water quality of the water resources in the area and helps to predict the likely impacts due to proposed activity. Suitable alternatives and technologies can be evaluated/ suggested to minimize or eliminate the adverse impact.

Identification of water sample collection locations

Water samples were collected from surface water bodies, ground water sources and tap water within 2km radius from the boundary of proposed site. Out of these

samples, one water sample was collected within the site (where ever feasible) and the other sample locations were identified considering Land use land cover details of the study area.

Water sample collection and testing technique

Water samples were collected in plastic / glass containers using grab sampling techniques. At the water sampling site portable meter was used to test pH, EC & TDS values of the samples collated. The collected water samples were properly labeled, sealed and sent to water testing laboratory. The physical, chemical & biological parameters of the water samples were tested as per the Bureau of Indian standards (BIS) & APHA methods. The water sample results were compared with IS 10500-2012 drinking water standards & IS 2296-1992 surface water standards.

Soil quality

Soils are the loose, transformed mineral and organic materials on the surface of earth which have developed specific characteristics over long periods of time through complex interactions among climate, biological processes, parent materials and topographic factors. The present study on soil quality establishes the baseline characteristics in the study area w.r.t. the project site.

Identification of soil sample collection locations

Soil samples were collected within 2km radius from the boundary of proposed site. Out of these samples, one soil sample was collected within the site (where ever feasible) and the other sample locations were identified considering Land use land cover details of the study area.

Soil sample collection and testing technique

Homogenized soil samples were collected using augers and stored in polyethene plastic bags and sealed. The collected soil samples were properly labeled and sent to soil testing laboratory. The physical & chemical parameters of the soil samples were tested as per the Bureau of Indian standards (BIS). The results were compared with standards of Indian Council of Agriculture Research, New Delhi.

Traffic studies

Traffic studies help in quantifying vehicular traffic and passenger volumes on important roads in study area. Based on the passenger volumes and carrying capacity of the existing roads, Level of Service (LOS) of the existing road infrastructure in the study can be evaluated. This will also help in identifying impact on existing roads due to additional traffic volumes expected from project activities.

As part of baseline monitoring, hourly traffic volumes of major roads connecting the project site was manually monitored from 6 AM to 11 PM. The peak hour traffic volumes were converted into passengers volumes to assess the existing LOS of the

important roads connecting the proposed project site. Traffic studies and quantification of information was carried out as per IRC: 106- 1990 guidelines as given in **Table 4.2 & Table 4.3**.

Table 4.2: Recommended design service volumes (PCU / Hour)

S. No.	Type of category	Total design service volumes (PCU/ hour)
1	2-Lane (One-Way)	2400
2	2-Lane (Two-Way)	1500
3	3-Lane (One-Way)	3600
4	4 Lane Undivided (Two-Way)	3000
5	4 Lane Divided (Two-Way)	3600
6	6 Lane Undivided (Two-Way)	4800
7	6 Lane Divided (Two-Way)	5400
8	8 Lane Divided (Two-Way)	7200
Source: IRC 106-1990		

Table 4.3: Level of service indicator (LOS)

Description	Traffic volume/ carrying capacity	Level of Service
Highest driver comfort; free flowing	<0.6	A
High degree of comfort; little delay	0.6 - 0.7	B
Acceptable level of comfort; some delay	0.7 - 0.8	C
Some driver frustration; moderate delay	0.8 - 0.9	D
High level of frustration; high level of delay	0.9 - 1.0	E
Highest level of frustration; excessive delays	> 1.0	F

Land Use Land Cover (LULC) studies

Land use and land cover map of 2km radius from the boundary of proposed site was prepared using high resolution satellite images along with relevant Survey of India (SOI) topo sheets for mapping the land use feature. LULC categories were identified by image interpretation techniques like tone, texture, shape, size, pattern, location, shadow, association and etc. Features like rivers, channels, forests, green areas, water bodies etc., along with man-made features like roads, towers, landmarks etc. were marked on the map using ARC GIS application with help of satellite images and the reference of SOI Topo sheet.

To improve the accuracy of draft LULC and finalize LULC, ground truth or ground investigation was carried out to verify interpreted details and supplement information which cannot be obtained from satellite imagery.

Hydrogeology and Geology

Hydrogeology and geological studies were made within 2km radius from the boundary of proposed site. Topo maps were studied to identify the physiography and geomorphological features like terrain condition, slopes and elevations. Drainage map of the study area was prepared using relevant Topo sheets and observation of surface hydrological features like streams, rivers and water sheds.

During the field visit, information related to geological formations like types of soils, rock formations & stratigraphy, structural features (folds, faults and joints), ground water details like occurrence, depth of water table, specific yield and usage were observed and collated.

Biological/Ecological environment

Ecological studies are largely dependent on the proximity of project location with Eco-sensitive / Protected Areas such as National Parks, Wildlife Sanctuaries, Biosphere Reserves, Forests as well as vegetation and fauna within the study area.

The sensitive maps depicting ecologically and culturally sensitive areas/places/structures were prepared using ground truthing and survey of India maps, satellite imageries, primary observations etc. Ecological studies included identification of common, rare, endangered or endemic flora and fauna of the study area. Flora present in the area was recorded on the basis of field observation. List of species observed and information of flora of the area was also recorded by field observations and community consultation. Information on existing fauna was included based on primary physical observations made at and around the site and through discussion with local people residing in the project area.

The standard methodology was followed during the primary data collection during site visit and recorded the observed biophysical components (flora & fauna). The details of terrestrial & aquatic species available in the core and buffer zone (2km radius) of the project site were tabulated and verified with authenticated sources like BSI, ZSI, FSI, IUCN red data book, forest plan & community consultation etc.

A general ecological survey covering an area of 2km radius from the proposed project boundary was done as follows:

1. Information regarding land use and land cover pattern in the project area as well as the presence of any protected areas such as the Biosphere reserves, National parks, Wildlife sanctuaries, important bird areas etc., is also collected through relevant GIS mapping and literature survey etc.
2. Reconnaissance survey for selection of sampling sites in and around the site on the basis of meteorological conditions.

3. Primary data generated through systematic studies like field observations and community consultation public consultation in and around the project site within study area.

Socio-economic study

Social impacts are due to developmental interventions on human environment. The impacts of development interventions take different forms. While significant benefits flow in from different development actions, there is also a need to identify and evaluate the risks and other not-so-positive externalities associated with them. The following is an attempt to assess the socio economic condition of people within 2km radius from the boundary of the site to identify and measure impacts so as to maximize positive externalities and minimize negative externalities of the proposed project. The impact assessment also helps in facilitating informed decision-making among stakeholders by identifying likely trade-offs and synergies.

Rationale

- To assess social risks and impacts throughout the project life cycle
- To ensure that social impacts and risks of a project are identified, avoided, minimized, reduced or mitigated
- To ensure projects are socially sound and sustainable, and will be used to informed decision making among the different stakeholders
- To identify all relevant direct, indirect and cumulative environmental and social risks and impacts of the project in an integrated way

The project context: Need for social baseline survey and specific tasks involved

The Social baseline assessment aims to incorporate inputs collected from different stakeholders into the project (facility/intervention) designs of the HPHDP. It helps to identify key social issues related to proposed Project activities and propose social management measures in all stages of the project cycle. The Socio-Economic study helps to develop a Social Management Framework (SMF) to ensure that: social considerations are fully mainstreamed in project planning, implementation and monitoring; and potential adverse impacts are adequately mitigated and potential benefits of the project are further enhanced to improve the effectiveness and sustainability of the project. Based on the specific scope of work the following tasks have been identified in conducting intervention specific social baseline survey for the moderate to high risk project interventions:

Preparation of a sampling & survey design

- Input collection from project implementing entities and other institutional stakeholders
- Current state of environment & Social conditions in the project site area

- Undertaking survey through field visits to study project interventions requiring ESIA/ESMP
- Social impact assessment in consultation with affected stakeholders to identify and rank key issues and suggestive measures to address the concerns of all stakeholders
- Data entry & analysis
- Preparation of Intervention specific socio-environment Baseline Survey Report

Approach and methodology

The study also adopts a two-fold methodology for data collection, namely, (i) review of published secondary data and (ii) collection & analysis of primary data. Secondary data will be collected from district census statistics of 2011, which includes: demography, occupational structure, literacy profile and Social structure etc.

Similarly, the primary data will be collected through a range of research techniques and tools as follows:

- Beneficiary assessment: through transect walk, structured questionnaire, stakeholder consultations;
- Participatory Rural Appraisal: through Focus group discussions, Key informant interactions through semi-structured interviewing.

Figure 4.3: Proposed approach for socio-baseline survey



The approach and methodology of the Socio-Economic study would involve five interlinked/incremental steps. These steps will each have specific tasks and each task will further involve specific activity and each such activity aims at delivering an output.

Some of the other activities identified as part of the approach and methodology is detailed below.

Desk review and consultations

This is to familiarize with the concerned and important stakeholders so as to identify and collect the available literature and to scope the activities. This phase also contains consultations with various agencies and enables to verify the issues identified in the literature review and further focus on the issues for investigation. This activity will also help in testing the questionnaires prepared for the base line survey and drafting checklists and interview schedules for the Focus Group Discussions (FGDs) and key stakeholder consultations. Some of the key activities in this phase would include:

- Literature review for the present study;
- Understanding project locations;
- Identification of primary and secondary stakeholders
- Developing a questionnaire for the baseline survey;
- Pre-testing and piloting the questionnaire;
- Overall sampling design for the study;
- Developing consultation checklists for interviews with secondary stakeholders & institutions;
- Review of the organizational structures of the institutions responsible for service delivery; and study the existing schemes of the government for agriculture and horticulture development.

Process of stakeholder consultations and baseline survey

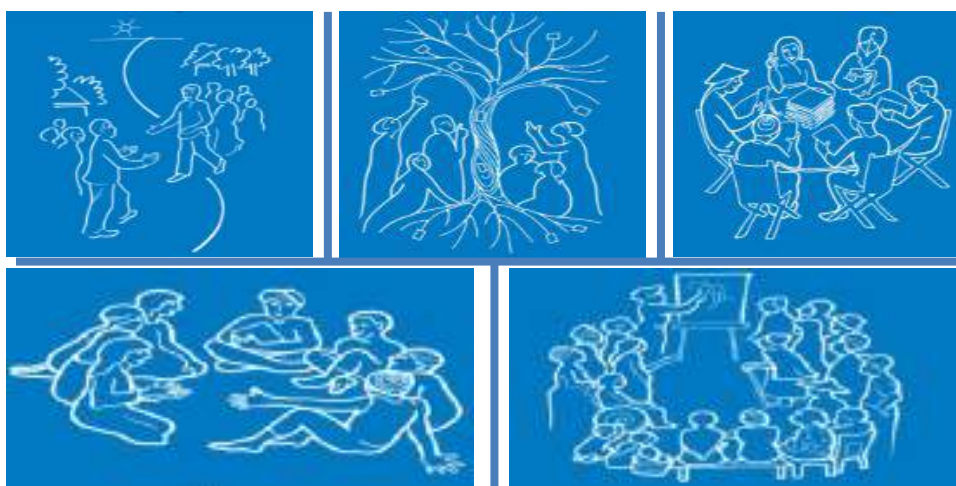
This step contains two parallel but interdependent activities; stakeholder consultations and baseline survey which constitute primary survey component. Arguably, this activity lies at the core of formulation/preparation of baseline report. Primary survey would be done using PRA tools, focus group discussions, structured/semi-structured questionnaire, interview schedules etc. The questionnaires/schedules would be separately designed for each group of respondents. The Stakeholder consultations will be primarily held with local community members, apple growers, Non-Government Organizations (NGOs), women members of Self Help Groups (SHGs), Farmer Interest Groups (FIG), Cooperative societies small farmers. The purpose is to analyze and understand likely social and environmental issues that need to be addressed during preparation of ESMF/ESMP. Baseline information will be gathered from the all project affected stakeholders and consultations would focus on obtaining quantitative and qualitative data/inputs. The survey and consultations would help in identifying and assessing the as-is status of local community in the study area. This questionnaire will be administered to the sampled population. The questionnaire is principally a schedule intended to capture the farmer's perception on the prevailing horticulture scenario and anticipated benefits that can be accrued through the proposed interventions by HPHDP.

The survey would also cover key social and demographic indicators of the beneficiaries in the project area villages and the availability of forward and backward linkages like accessibility to markets, supply chain, credit support, storage, water supply, farm inputs, grading and packaging facilities, advertisement and marketing support etc. The exercise would also engage some of the following stakeholders:

- Farmers
- Market extension officials from the State/Central Government
- Wholesale markets/dealers
- Controlled Atmosphere Stores
- Grading and Processing plants

Consultations with all above listed stakeholders will help in enhancing the baseline study qualitatively and quantitatively. Following **Figure 4.4** shows different methods for stakeholder consultations.

Figure 4.4: Methods for stakeholder consultations



Techniques used for the study

The entire exercise will be proposed carried out through a variety of Social Analysis tools like surveys and structured, semi-structured and In-depth Interviews and Focused Group Discussions (FGDs). The social analysis tools for undertaking baseline survey has been further organized into five main categories (for working purposes)

- Analytical and Consultation tools
- Participatory Methods
- Quantitative Research
- Qualitative Research

Methods of data collection

The following methods would be used for data collection

- Beneficiary Assessment
- Focus Group Discussions
- Household surveys
- Unstructured/semi-structured interviews

For collecting the quantitative data at individual farmers' level, sample survey will be conducted among the target group using structured questionnaire. Questionnaire will include the personal information, Knowledge and awareness on Education, Health, crop specific information, practices, forward and backward linkages etc. Household survey will be undertaken covering the following aspects:

- Key Informant Interview (KII) (Institutional Stakeholders)
- Household survey at Individual level
- Beneficiary Assessment

In addition, 'Participatory Rural Appraisal' (PRA) method will be used as a supplement to the formal questionnaires of sample survey to obtain additional data pertaining to farmers' risks and challenges in the horticulture cultivation, Himachal Pradesh. The PRAs would be focused on horticulture profile of the state, issues/challenges such as production, land usage, irrigation, market linkage; technology usage in the farming, cropping patterns will be reviewed to understand the background of the project.

Data analysis

The information collected through structured interviews and baseline survey questionnaires will be systematically coded, validated, analyzed and tabulated. Wherever required, the observations will also be supported from the information collected through desk research. Content analysis will be used to analyze the information related to Focus Group Discussions. The primary socio-economic baseline study reports will be presented to the department and other identified for obtaining their feedback and suggestions.

Procedure/Steps involved in conducting social baseline survey

The following are indicative list of steps involved in conducting primary social baseline survey

- A review of the project component and activities proposed in the project
- Review of relevant literature including laws, regulations, guidelines; and key policies related to tribal population, farmers, women, Forest and Rehabilitation & Resettlement
- Review of relevant schemes and convergence projects
- Interaction with institutional stakeholders
- Key informants review: Interaction with Community Based Organizations and Joint Liability Groups

- Household data collection through purposive sample survey
- Robust stakeholder consultations through different participatory, ethnographic and community consultation based social analysis tools
- Data entry and verification through statistical packages
- Analysis of social impacts, evaluate alternatives, design appropriate mitigation, management, and monitoring measures
- Preparation of measures to be taken during the implementation & operation of a project to eliminate/offset adverse environmental and social impacts.

Capacity building

Training Need Assessment (TNA) gathers information about organizational overall capacity, potential barriers for capacity development, existing gaps within the personnel, stake holders etc. and accordingly enables the trainer to execute training program to attain desired capacity based on the existing capacity of the trainees/organizations/departments.

- a) **Verifying client demand:** The Clients' perceptions towards an issue at an organization and his aspiration to address a certain issue form the beginning of TNA. This initial information gathering from the client enunciates his commitment to address existing organizational capacity gap towards potential new change. Various methods like problem tree analysis approach, five whys approach methods can be applied to identify the clients' demand for training. This process complements the client and the trainer thereby facilitating the trainees understands and applies new skills or knowledge gained making the training-related results evident towards capacity building of an organization.
- b) **Identifying the key stakeholders:** Stake holder is an entity either internal or external part of the organization with declared or conceivable stake in an organization. They can be an individual, group of individuals, unorganized groups or an organization and broadly classified into primary or secondary stakeholders contingent to the impacts they sustain due to organizational activities. They form an essential part of training need assessment as they influence the structure and outcome of the training. Four major attributes are imperative while performing stake holder analysis towards training; the stakeholders' position on the training issue, the level of influence (power) they hold, the level of interest they have in the specific program, and the group/coalition to which they belong or can reasonably be associated with. Stake holder analysis typically precedes finalizing the training proposals as it enunciates the sustainability of designed program.
- c) **Identifying desired capacity:** The desired capacity is the set objectives or standards or targets that an organization desires to reach or achieve. To identify the desired capacity of an organization is the foremost requirement based on which the training need assessment can be designed. Also it is

imperative for the trainer to have a clear idea about development objective and desired capacity of the client. This enables the trainer to ensure that all efforts of training needs are comprehended during the training program. This process eliminates any potential misinterpretations between client and the trainer.

- d) **Identifying current capacity:** The capacity of the organization with which it is currently working to reach the set targets or objectives, is called the current capacity. When the current capacity becomes limited, the organization fails to achieve the desired standards, in which case training could facilitate to attain higher set objectives. Accordingly it is important for the trainer to comprehend the current capacity of client, employees, and organization before designing a training program. It specifically helps in exploring the capacity gaps for capacity development of an organization. Capacity analysis elucidates the existing capacities and assesses what the organization already has and does.
- e) **Identifying gaps (from current to desire):** Gap analysis primarily focuses to ascertain the wanting within the system. It focuses on how the organization and employees currently operate against their performance in an ideal condition, if provided. With a detailed definition of the current and the desired capacities, and initial information available the trainer has a clear understanding of if and how the training can contribute to capacity development. This provides provision for the trainer to design a structured training program to strengthen the capacities of the trainees and an organization. Knowledge about the desired capacity also guides for specific areas to be focused and confirm the details to be collected.

4.5.2 Secondary baseline data collection

Prior to initiating the studies, detailed information on the project was obtained from the project proponent and was studied /discussed thoroughly.

Secondary data was collected from reliable sources like local district administration, Government Organizations/Departments such as Survey of India, Department of Geology, Botanical Survey of India, Zoological Survey of India, State Forest department, concerned IMDs, National Information Centre data base, published census documents, MoEF&CC, CPCB, WII/EIA publications and monograms etc. Efforts have been made to collect updated and relevant data.

Secondary data would be restored to environmental parameters like physiography/ terrain and geomorphology, geology & soil, flora, fauna, drainage pattern, water use (surface & ground), air, meteorology, socio-economic etc.

4.5.3 Assumptions and limitations of the study

During the preparation of ESIA reports for the fruit processing units and identifying the environmental impacts arising out of these project activities, some of the need based assumptions were used in the report for fulfilling the guidelines.

Assumptions

- The project study area is identified and confined to 2km radius from the project sites for all the ESIA reports for generating primary as well as secondary data including one season baseline data for ambient air, water, noise, soil and ecological data. Socio economic survey is also carried out from the available habitations within 2km radial distance from project sites due to the existing terrain structure surrounding the project sites. In addition the project workforce and labour approaching to the project sites are mainly from nearby adjacent villages within 2km from the main site.

In view of the above environmental conditions existing surrounding the project site around 2km radial distance is identified and assumed for field studies.

- Boilers used in the processing units have a maximum stack height of 30m. Based on the dispersion pattern guidelines, effect of air pollution due to flue gasses from the stack will be felt at around 10 times the stack height (that is about 300 to 500m).
- All the facilities of proposed project are located in hilly terrain of Himachal Pradesh; the catchment area of each facility is not crossing 2km distance. Hence, environmental impacts on water or soil pollution due to project activities would be confined to less than 2km area from the facility.
- As part of baseline AAQ monitoring 3 to 5 monitoring stations to be set up (minimum 1 upwind & 2 downwind sides / impact zones).
- As per the MoEF&CC guidelines for building, construction and area development projects less than 5 ambient air quality monitoring stations has to be studied for EIA/EMP reports.
- Waste water generated due to the activities of the intervention will be treated and used within the project site to achieve zero discharge from the site.
- The magnitude of impact on soil due to activities of the interventions will be minimal hence 2 to 5 soils samples will be collected within the study area.
- Sufficient greenbelt would be developed in and around the project site, if available.

- CPCB/MoEF&CC regulatory standards were assumed for designing the environmental management plans for all the processing units to meet the emission effluent standards.
- ESMP should be regarded as a live document and should be reviewed as impacts become apparent during the project life.

As per the “Final document on revised classification of industrial sectors under Red, Orange, Green and White Industries” dated 29.02.2016, The FPU would be categorized under “Orange” category under “Food and food processing including fruits and vegetable processing”.

Table 4.4: Categorization of project intervention

1	Food and food processing including fruits and vegetable processing	FPU	Orange
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Requirement for Consent for Establishment (CFE) for FPU

The Himachal Pradesh State Pollution Control Board (HPSPCB) is a statutory authority entrusted to implement environmental laws & rules within the jurisdiction of the State of H.P. The Board ensures proper implementation of the statutory, judicial and legislative pronouncements related to environmental protection within the State. As per the Water (prevention & control of pollution) Act, 1974 and Air (prevention & control of pollution) Act, 1981, since the project involves wastewater generation and air pollution, accordingly, a Consent for Establishment/No Objection Certificate from the State Board maybe required before commencement of the project.

Limitations

- The numbers of AAQ monitoring stations in the site are identified based on terrain of the study area & feasibility to set to the monitoring equipment.
- Treated water after being used for flushing and dust suspension etc., within the site excess will have to be discharged to nearest sewer or water body.
- In case of shortage of land in existing interventions maximum area possible will be developed as green belt, remaining shortfall should be developed nearest open area available to the project site.

Chapter 5

Environmental & Social Baseline Information

5.1 Introduction

Baseline environmental status in and around the proposed project site depicts the existing environmental conditions of air, noise, water, soil, biological and socio-economic environment. Considering the proposed project as the center, a radial distance of 2 km is deemed as 'study area' for baseline data collection and environmental monitoring.

5.2 Baseline environmental studies

The main aim of the impact assessment study is to find out the impact of the project on the environment. This study has to be carried during the project planning stage, so that the proponent can implement the project in a technically, financially and environmentally viable way.

The success of any impact assessment study depends mainly on two factors. One is estimation of impact from proposed project on the environment and the second one is assessment of the environmental condition. Both are key factors to arrive at the post project scenario. The estimated impact due to the proposal can be superimposed over the existing conditions to arrive at the post project scenario. The scope of the baseline studies includes detailed characterization of following environmental components, which are most likely to be influenced by setting up an industry

- Meteorological conditions
- Ambient air quality
- Noise levels
- Water quality
- Soil quality
- Ecological studies
- Socio economic & Health studies
- Land utilization

5.2.1 Monitoring period

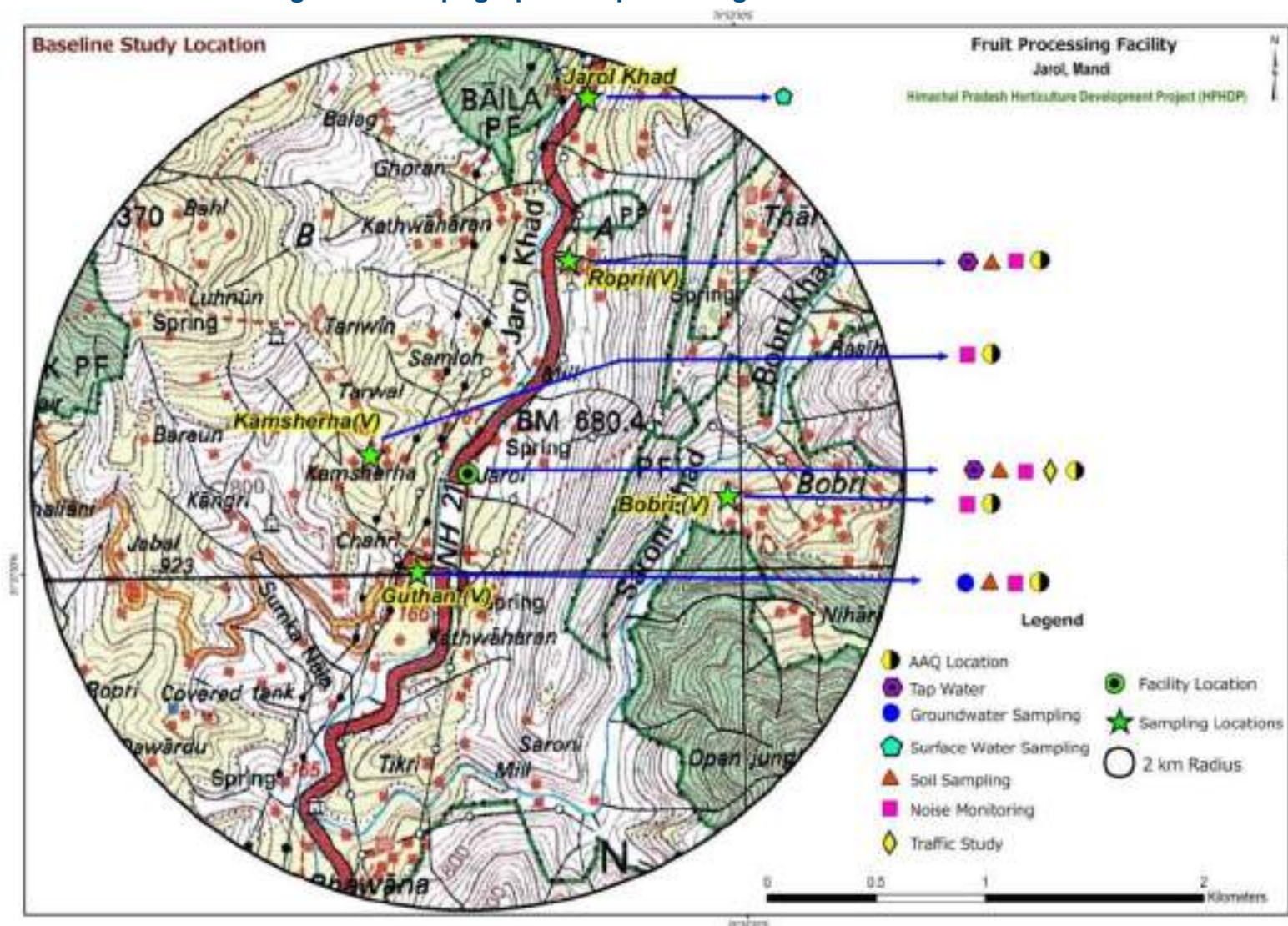
The baseline study was conducted during the months of May and June, 2018 within the study area. Particularly the air quality monitoring was carried out in the month of August, 2018, considering the optimum activity of all the interventions, being the peak season for the apple harvest, processing and marketing. The Jarol FPU facility was visited by the team of key & non-key experts and support team of Ramky during/on 24 – 26th August, 2018, 10th August, 2018 and 23rd November, 2019 for various project related studies and surveys. These visits included collecting preliminary site observations/details, baseline studies for collection of air, water, soil

samples, conducting noise & traffic studies, ecology & biodiversity observations and also for collecting social and environmental surveys details at site and also from nearby villages on project relevant data, which are being presented in the present ESIA and ESMP reports. The location map of the project site is given as **Figure 5.1** and the topographic map showing the baseline locations is given as **Figure 5.2**. Baseline data was collected for various environmental attributes so as to compute the impacts that are likely to arise due to the project activities at the proposed location.

Figure 5.1: Location map of the project site



Figure 5.2: Topographic map showing the baseline locations



5.3 Local meteorological conditions

Regional meteorological scenario helps to understand the trends of the climatic factors. Meteorological scenario exerts a critical influence on air quality as the pollution arises from the interaction of atmospheric contaminants with adverse meteorological conditions such as temperature inversions, atmospheric stability and topographical features like hills, canyons and valleys. The study of meteorological conditions forms an intrinsic part of the Environmental and Social Impact Assessment (ESIA) Study. The meteorological conditions of an area and the industrial process are both intertwined and each has a definite influence over the other. Favorable weather conditions and the surroundings help the successful operation of an industry; while the industrial activity influences the weather in both positive as well as negative ways.

The climate of any place is dependent on various geographical factors. The state of Himachal Pradesh is a hilly region and it experiences a pleasant climate throughout the year. It experiences heavy snow fall during the winter months. The weather of Himachal alters with the change of altitude. The region generally experiences three seasons. The winter season spans from October to February. The summer months are March to June. By July the rainy season starts in the hilly region and it ends in September. The climate in the study area varies from hot and sub-humid tropical. The temperature recorded was in the range of 11°C to 39°C and relative humidity varies from 19% to 79% respectively throughout the year. Summary of the meteorological data of the district is given in **Table 5.1**. The climatological data is given in the **Table 5.2**.

Table 5.1: Meteorological data (October 2017 – September 2018)

Month	Temperature (°C)		Rainfall		Mean wind speed (kmph)	Humidity (%)
	Mean minimum	Mean maximum	Monthly (mm)	No. of rainy days		
Oct-17	19	32	0	0	7.6	29
Nov-17	14	26	0.2	2	6.5	30
Dec-17	13	23	35.7	3	6.1	35
Jan-18	11	21	13.3	1	6.8	33
Feb-18	13	24	28.6	4	7.6	36
Mar-18	17	29	26.6	3	9	28
Apr-18	21	34	32.2	9	9.4	26
May-18	25	39	64.9	13	11.2	19
Jun-18	28	39	161.7	17	8.6	35
Jul-18	27	34	783.6	26	6.1	65
Aug-18	25	30	496.2	30	5.8	79
Sep-18	22	31	273	20	6.1	66

Source: www.worldweatheronline.com

Table 5.2: Climatological data

Sundernagar, Lat: 31° 32' N & Lon: 76° 54' E, MSL 874 m							
Month	Temperature (°C)		Rainfall		Mean wind speed (kmph)	Humidity (%)	Pre-dominant wind direction
	Mean minimum	Mean maximum	Monthly (mm)	No. of rainy days			
Jan	2.8	17.8	61.9	4	1	54	SW
Feb	5.1	19.8	72.4	5.4	1.5	48	SW
Mar	9	24.7	78.1	5.8	1.7	42	SW
Apr	13	30.1	50.5	3.9	1.8	34	SW
May	17.1	33.8	83.1	6.3	2	37	NW
Jun	20	34.1	176.6	9.2	1.8	49	SW
Jul	21.8	30.9	348.8	14.9	1.3	71	SW
Aug	21.5	30.2	314.3	13.8	1.1	76	SW
Sep	18.6	30.3	137.1	7.1	1.1	69	SW
Oct	11.8	28.5	35.7	1.8	0.9	54	SW
Nov	6.3	24.3	13.2	1	0.7	53	SW
Dec	3	19.5	35.5	2.1	0.8	57	SW
Source: GOI, Ministry of Earth Sciences, IMD, Climatological Tables (1981-2010)							

5.3.1 Wind pattern - during August 2018

Dispersion of the different air pollutants released into the atmosphere has significant impacts on neighborhood air environment. The dispersion or dilution of air pollutants over the large area will result in considerable reduction of the concentration of a pollutant. The dispersion in turn depends on the weather conditions like the wind speed, direction, temperature, relative humidity, mixing height, cloud cover and also the rainfall in the area.

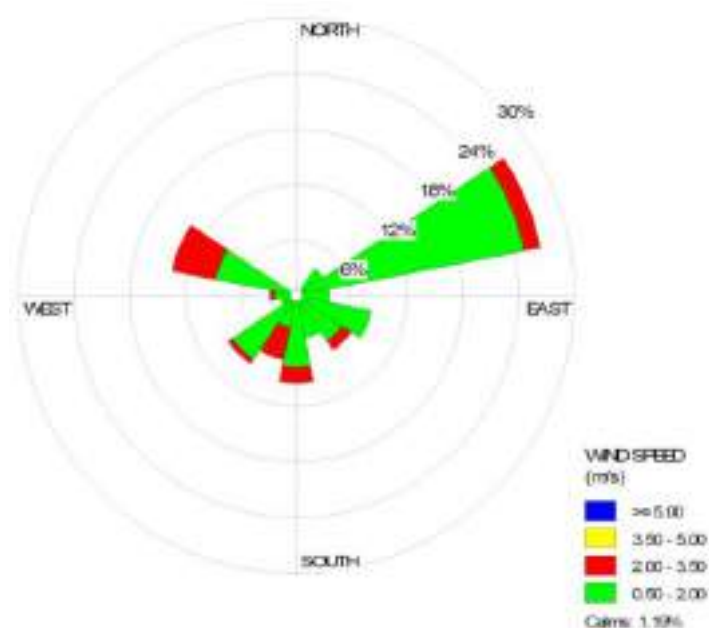
Wind speed and direction data recorded during the study period is useful in identifying the influence of meteorology on the air quality of the area. Based on the meteorological data, wind rose diagrammatic representation of wind speed and wind direction along with their persistence for a fractional period of occurrence at a given location is constructed. Wind rose on sixteen sector basis has been drawn. Wind directions and wind speed frequency observed during study period (month wise) are given in **Table 5.3** wind rose diagram is given in **Figure 5.3**.

The maximum and the minimum temperatures recorded at monitoring station during the study period (August 2018) were 26.4°C and 16.8°C respectively. The maximum and minimum relative humidity recorded at monitoring station during the study period was 84% and 65%.

Table 5.3: Frequency distribution table for August 2018

Wind Directions	Wind Classes (m/s)				Total
	0.50 - 2.00	2.00 - 3.50	3.50 - 5.00	>= 5.00	
N	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00
NE	3.57	0.00	0.00	0.00	3.57
ENE	25.00	1.79	0.00	0.00	26.79
E	3.57	0.00	0.00	0.00	3.57
ESE	8.33	0.00	0.00	0.00	8.33
SE	5.95	1.19	0.00	0.00	7.14
SSE	4.76	0.00	0.00	0.00	4.76
S	7.74	1.79	0.00	0.00	9.52
SSW	3.87	3.87	0.00	0.00	7.74
SW	8.33	0.60	0.00	0.00	8.93
WSW	1.79	0.00	0.00	0.00	1.79
W	2.38	0.60	0.00	0.00	2.98
WNW	8.93	4.76	0.00	0.00	13.69
NW	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00
Sub-Total	84.23	14.59	0.00	0.00	98.81
Calms (< 0.5 m/s)					1.19
Total					100.00
Note: 1. Average wind speed is 1.48 m/sec					
2. All values are in percentage					

Figure 5.3: Wind rose for the month of August 2018



5.4 Environmental baseline data for the components

For collection of environmental data few locations were identified in and around the project site. For collecting air quality samples, locations were identified considering upwind, downwind, nearby villages. Whereas water samples were collected from nearby villages and surface water available in the study area.

5.4.1 Ambient air quality

The ambient air quality status has been assessed with respect to the study zone of within 2 km radius from the center of the project site. The baseline ambient air quality assessed through a scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance program is based on the following considerations

- Meteorological conditions on synoptic scale
- Topography of the study area
- Representation of regional background levels
- Representation of project site
- Influence of the existing sources (if any) are to be kept at minimum
- Inclusion of major distinct villages to collect the baseline status
- Comparison of previous study results to interpret air quality over a period of time

Air pollution in the project area is considerable and is primarily due to process activities. The pollutants of concern are particulate matter (PM_{2.5} & PM₁₀), sulphur dioxide (SO₂), oxides of nitrogen (NO_x). Ambient air quality (AAQ) in the project impact area has been carried out for the pollutants of concern and as per the requirements of an ESIA and is presented in this section.

Ambient air quality in the study area has been assessed through a network of AAQ monitoring locations fixed using screening models within 2km radius keeping in view the topographical and meteorological conditions. The air samplers were fixed on top of building at a height of about 3m above the ground level ensuring there are no obstructions to the free flow of winds in all air quality monitoring locations. The locations were selected to assess the dispersion of the pollutants considering the prevalent meteorological conditions.

The prime objective of the baseline air quality study was to assess the existing ambient air quality of the area. The monitoring has been performed for one season. The locations of the AAQ are described in **Table 5.4** & **Figure 5.2**.

5.4.1.1 Air quality scenario in the study area

The concentration levels of air pollutants of concern, as mentioned above, are presented in **Table 5.5**. Statistical parameters like minimum, maximum and 98th percentiles have been computed from the observed raw data for all sampling locations. The observed values were compared with the standards as prescribed by MoEF&CC for industrial, residential and rural zone.

Table 5.4: Ambient air quality monitoring locations

Location	W.R.T Site		Latitude	Longitude
	Distance (km)	Direction		
Site	-	-	31°27'44.188"N	76°51'42.893"E
Kamsherha	0.5	W	31°27'46.398"N	76°51'25.059"E
Guthan	0.62	SW	31°27'29.28"N	76°51'33.497"E
Ropri	1.06	NE	31°28'14.849"N	76°52'1.053"E
Bobri	1.2	E	31°27'40.47"N	76°52'27.673"E

Table 5.5: Ambient air quality PM₁₀, PM_{2.5}, SO₂ & NO_x levels in the study area (µg/m³)

Location	PM ₁₀			PM _{2.5}		
	Min	Max	98 th Percentile	Min	Max	98 th Percentile
Site	36.5	42.3	42.3	21.8	24.4	24.4
Kamsherha	31.2	33.2	33.2	19.2	21.2	21.2
Guthan	28.9	32.1	32.1	19.4	20.9	20.9
Ropri	34.4	36.8	36.8	21.1	22.5	22.5
Bobri	30.2	32.5	32.5	18.4	20.1	20.1
98th Percentile	32.1 to 42.3			20.1 to 24.4		
NAAQ Standards 2009 (24 hours)	100			60		

Location	SO ₂			NO _x		
	Min	Max	98 th Percentile	Min	Max	98 th Percentile
Site	8.5	9.5	9.5	15.4	16.5	16.5
Kamsherha	5.4	6.9	6.9	13.8	14.6	14.6
Guthan	4.8	5.8	5.8	12.8	14.3	14.3
Ropri	7.3	8.6	8.6	14.8	15.6	15.6
Bobri	6.6	7.6	7.6	13.2	14.8	14.8
98th Percentile	5.8 to 9.5			14.3 to 16.5		
NAAQ Standards 2009 (24 hours)	80			80		

The 24 hourly average values of PM_{2.5}, PM₁₀, SO₂ and NO_x were recorded.

- 98th percentile of Particulate Matter <10µm recorded within the study area were in the range of **32.1 – 42.3 µg/m³**
- 98th percentile of Particulate Matter <2.5µm recorded within the study area were in the range of **20.1 – 24.4 µg/m³**
- 98th percentile of SO₂ recorded within the study area was in the range of **5.8 – 9.5 µg/m³**
- 98th percentile of NO_x recorded within the study area was in the range of **14.3 – 16.5 µg/m³**

The results were compared with the national ambient air quality standards (NAAQS) and found that the PM_{2.5} and PM₁₀, SO₂ and NO_x values for all the samples in the study area were within the limits prescribed for residential and rural areas.

5.4.2 Water environment

Water samples were collected from surface water, ground water and taps used by villagers for their daily use and some important physical and chemical parameters were considered for depicting baseline status of the study area. The details of ground water sampling locations are given in **Table 5.6**.

Table 5.6: Water sampling locations

Location	W.R.T. site		Latitude	Longitude	Remarks
	Distance (km)	Direction			
Site	-	-	31°27'44.188"N	76°51'42.893"E	Tap water
Guthan	0.61	SW	31°27'29.28"N	76°51'33.497"E	Ground water
Ropri	0.98	NE	31°28'14.849"N	76°52'1.053"E	Tap water
Jarol Khad	1.88	NE	31°28'39.586"N	76°52'5.12"E	Surface water

The water samples were analyzed and the analytical results were compared with IS: 10500-2012 drinking water standards, IS 2296:1992 Inland surface water standards and the results are shown in **Table 5.7**.

The ground and tap water samples results are well within the acceptable limits as per the drinking water standards IS 10500:2012. Whereas surface water is falling under class A as per IS 2296:1992 standard.

Table 5.7: Water analysis results

S. No.	Parameter	Unit	Analysis Results				IS -10500:2012 ground water standards		IS 2296-1992 Inland surface water standards				
			Site	Guthan	Ropri	Jarol Khad	Acceptable limit	Permissible limit	A	B	C	D	E
1	pH Value	--	7.3	7.3	7.1	7.6	6.5-8.5	No Relaxation	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.5-8.5
2	Elec. Cond	µS/cm	495	590	645	620	--	--	-	-	-	-	2250
3	Dissolved Solids	mg/l	351	410	424	412	500	2000	500	-	1500	-	2100
4	Alkalinity	mg/l	112	155	22	112	200	600	-	-	-	-	-
5	Chloride (as Cl)	mg/l	54	25	30	101	250	1000	250	-	600	-	600
6	Sulphate (as SO ₄)	mg/l	22	35	69	65	200	400	400	-	400	-	1000
7	Nitrate (as NO ₃)	mg/l	4	12	44	1.8	45	No Relaxation	20	-	50	-	-
8	Hardness (as CaCO ₃)	mg/l	153	153	168	196	200	600	200	-	-	-	-
9	Calcium (as Ca)	mg/l	43	28	54	45	75	200	-	-	-	-	-
10	Magnesium (as Mg)	mg/l	11	20	8	20	30	100	-	-	-	-	-
11	Sodium (as Na)	mg/l	26	42	45	55	--	--	-	-	-	-	-
12	Potassium (as K)	mg/l	9	16	22	<5	--	--	-	-	-	-	-
13	Phosphate as (PO ₄)	mg/l	1.7	1.2	3.1	2.4	-	-	-	-	-	-	-
14	Fluoride (as F)	mg/l	<0.5	0.85	<0.5	0.24	1	1.5	1.5	1.5	1.5	-	-
15	Iron (as Fe)	mg/l	<0.2	<0.2	<0.2	<0.2	0.3	No Relaxation	0.3	-	0.5	-	-
16	Lead (as Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	0.01		0.1	-	0.1	-	-
17	Chromium (as Cr)	mg/l	<0.05	<0.05	<0.05	<0.05	0.05		0.05	-	0.05	-	-
18	Copper (as Cu)	mg/l	<0.05	<0.05	<0.05	<0.05	0.05	1.5	1.5	-	1.5	-	-
19	Arsenic (as As)	mg/l	<0.01	<0.01	<0.01	<0.2	0.01	0.05	0.05	0.2	0.2	-	-
20	Zinc (as Zn)	mg/l	<1	<1	<1	<1	5	15	15	-	15	-	-
21	Boron (as B)	mg/l	<0.1	<0.1	<0.1	<0.1	0.5	1	-	-	-	-	2
22	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	0.001	No Relaxation	0.001	-	-	-	-
23	COD	mg/l	-	-	-	8	-	-	-	-	-	-	-
24	BOD	mg/l	-	-	-	2	-	-	2	3	3	-	-

Note: TW- Tap water, GW- Groundwater, SW - Surface water

Class A-Drinking water source without conventional treatment but after disinfection; Class B-Outdoor bathing; Class C-Drinking water source with conventional treatment followed by disinfection; Class D-Fish culture and wild life propagation; Class E-Irrigation, industrial cooling or controlled waste disposal

5.4.3 Soil environment

For studying the soil types and soil characteristics, sampling locations were selected near to the site to assess the existing soil conditions representing various land use conditions and geological features.

The homogenized soil samples collected in 2km radius from the project site at different locations were packed in a polyethylene plastic bag and sealed. The sealed samples were sent to laboratory for analysis. The important physical, chemical parameters were determined from all samples. The soils in the region can be categorized within low hill soil to mid hill zone. Soil depth is shallow to moderate in the region.

The soil sampling locations and the analysis results are given in **Table 5.8 & Figure 5.2**. Soil analysis results are given in **Table 5.9** and the results are compared with ICAR standards.

Table 5.8: Soil sampling locations

Location	W.R.T. Site		Latitude (N)	Longitude (E)	Remarks
	Direction	Distance km			
Site	-	-	31°27'44.188"N	76°51'42.893"E	Open land
Guthan	0.67	SW	31°27'29.28"N	76°51'33.497"E	Farm land
Ropri	1.06	NE	31°28'14.849"N	76°52'1.053"E	

Table 5.9: Soil analysis results

Parameter	Unit	Site	Guthan	Ropri	Standard soil classification – Indian Council of Agricultural Research, New Delhi
Texture	-	Sandy loam	Sandy loam	Sandy loam	----
Colour	-	Blackish brown	Reddish brown	Dark brown	----
pH (1:5 extract)	--	8.3	8.2	8.4	<ul style="list-style-type: none"> • Acidic <6.0 • Normal to saline 6.0 – 8.5 • Tending to be alkaline 8.6-9.0 • Alkaline > 9.0
Bulk Density	g/cc	1.18	1.30	1.32	----
Total organic Carbon	%	3.07	1.98	1.59	Low <0.5%, Medium 0.5-0.75%, High >0.75%
Calcium as Ca	mg/Kg	2654	1732	2134	----
Magnesium as Mg	mg/Kg	336	166	192	----
Available Potassium as K	Kg/ha	158	266	270	Low below 110; Medium 110 to 280; High above 280
Available Nitrogen as N	Kg/ha	179	474	428	Low below 280; Medium 280 to 560; High above 560
Available Phosphorus as P	Kg/ha	14	22	27	Low below 10; Medium 10 to 25; High above 25
Lead as Pb	mg/Kg	2.9	1.5	1.8	----
Copper as Cu	mg/Kg	8.56	4.61	6.81	----

Boron as B	mg/Kg	<0.1	<0.1	<0.1	----
Zinc as Zn	mg/Kg	102.0	43.6	54.9	----
Arsenic as As	mg/Kg	<0.2	<0.2	<0.2	----
Chromium as Cr	mg/Kg	1.1	1.3	0.8	----

The analytical results of the soil samples collected during the study period are summarized in above **Table 5.9**.

- pH values varying from **8.2 to 8.4** indicates the samples are falling in normal to saline class.
- Total organic carbon percentage is varying **1.59 to 3.07%** indicating that all the samples are falling in high range.
- Available potassium, nitrogen and phosphorus values varying between **158 to 270 kg/ha, 179 to 474 kg/ha & 14 to 27 kg/ha** respectively. This indicates that values of all the samples are falling in medium range except nitrogen value at the site is falling under low range and phosphorous value at Ropri is falling under high range.

5.4.3.1 Land Use and Land Cover

Land use is influenced by economic, cultural, political, and historical and land-tenure factors at multiple scales. Land cover, on the other hand, is one of the many biophysical attributes of the land that affect how ecosystems function. Land use referred to as man's activities and the various uses which are carried on land and land cover is referred to as natural vegetation, water bodies, rock/soil, artificial cover and others resulting due to land transformation. Since both land use/land cover are closely related and are not mutually exclusive they are interchangeable as the former is inferred based on the land cover and on the contextual evidence.

a) Importance of LULC

A modern nation, as a modern business, must have adequate information on many complex interrelated aspects of its activities in order to make decisions. Land use is only one such aspect, but knowledge about land use and land cover has become increasingly important as the Nation plans to overcome the problems of haphazard, uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, destruction of important wetlands, and loss of fish and wildlife habitat. So it is needed to monitoring and managing systematically to maintain food security, to minimize deforestation, conservation of biological diversity and protection of natural resources. It is necessary to enhance human occupation to the changing social, economic and natural environmental conditions. Rapid increase in population demands for more food, fodder and fuel wood have led to large scale environment degradation and ecological imbalance. In order to use land optimally, it is necessary to have first-hand information about the existing land use/land cover (ELULC)

patterns, which help to analysis of environmental processes and problems in living conditions as well as to maintain the standards at current levels.

b) Description of existing Land Use & Land Cover

Land use/land cover (LULC) map was extracted within 2km radius of the project site, considered as the study area as well as impact area due to project intervention. The preparation of LULC map involved by using Geographical Information Systems (GIS) and remote sensing technology along with utilization of Survey of India topographic map as secondary reference. The LULC map was classified as per NRSC standard Level-II classification format and represented the map in 1: 50000 scale. LULC map with 2 km radius is given in **Figure 5.4** and LULC classification details are given in **Table 5.10**.

Table: 5.10: Land use / Land cover class types and area statistics

Level-I	Level-II	Area (ha)	Percentage
Built Up	Rural	11.112	0.9
Agricultural Land	Cropland	13.89	1.1
Forest	Evergreen/ Semi-evergreen	78.71	6.3
Water bodies	River/ Stream	14.06	1.1
Waste lands	Scrubland	81.488	6.5
Grasslands/ Grazing Lands	Grasslands/ Grazing Lands	1057.38	84.1
	Total	1256.64	100.0

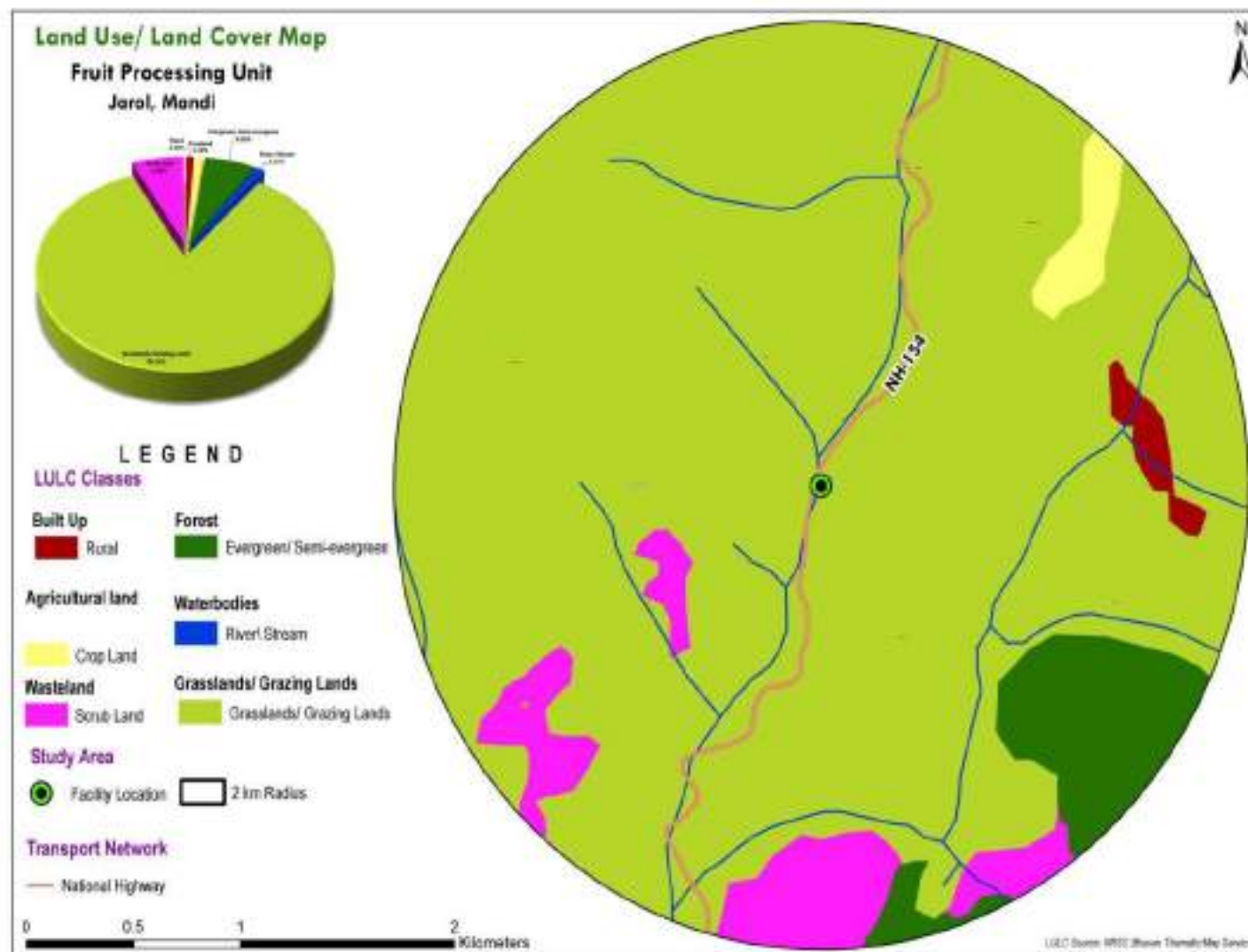
In present study 6 classes have been found in Level-II category as well as 6 classes for Level-I classification standard. According to the level-1 classification it is noted that around 84% of the study area is covered by Grass land/ Grazing land whereas Scrub land is near about 6% and Forest area is 6% of the study area. Other classes like built-up area, agricultural land and water bodies are covering remaining 3% of the study area.

As LULC is represented in 1:50k scale so majority in area of the surroundings land use and land cover will be visible in LULC thematic map of the study area. Few classes may missed out\ ignored due to not full filling the criteria of minimum mapping unit as well as not representable in 1:50K scale standard.

The major area of the study and its surroundings are represented in LULC thematic map on 1:50000 scale.

According to land use map it is noted that, study area is mostly dominated by grass land/ grazing land. So surrounding land use/ land cover will not be affected much by project intervention due to non-existence of environmental sensitive features around the site. Also, no major water bodies were found within 2km radius from the project site, it is only covered with few water streams.

Figure 5.4: Land use/land cover map



5.4.4 Noise environment and traffic study

5.4.4.1 Noise environment

Noise can be defined as unwanted sound or sound in the wrong place at the wrong time. It can also be defined as any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing or is otherwise annoying. The definition noise as unwanted sound implies that it has an adverse effect on human beings and their environment, including land, structures, and domestic animals. Noise can also disturb natural wildlife and ecological systems.

Sound can be transmitted through gases, liquids, and solids. Noise impacts can be of concern during the construction and the operational phases of projects. Noise should also be considered in relation to present and future land use zoning and policies.

Construction noise can be a significant source of community noise. Of concern are impacts on people near the construction site, who are totally unrelated to construction activities (e.g. area residents, office workers, school children, staff, etc.). Factors which are important in determining noise levels that will potentially impact such populations include distance from the noise source, natural or man-made barriers between the source and the impacted population, weather conditions which could potentially absorb, reflect, or focus sound (such as wind speed, direction, temperature inversions), and the scale and intensity of the particular construction phase (excavation, erection, or finishing). The environment/health impacts of noise can vary from noise induced hearing loss (NIHL) to annoyance depending on loudness of noise levels and tolerance levels of individual.

a) Sources of noise

The main sources of noise in the study area are domestic activities, industrial activities and vehicular traffic. The main occupation of the villagers in the study area is agriculture and business.

Baseline noise levels have been monitored at 5 locations within the study area, using Noise Level Meter. Keeping in view the land use pattern, residential areas, commercial areas & bus stands etc., were identified for assessment of existing noise level status. The day levels of noise have been monitored during 6 AM to 10 PM and the night levels during 10 PM to 6 AM. The details of noise monitoring locations are given in **Table 5.11 & Figure 5.2**. The results are presented in **Table 5.12**.

Table 5.11: Noise monitoring locations

Location	W.R.T. Site		Latitude (N)	Longitude (E)	Remarks
	Distance (km)	Direction			
Site	-	-	31°27'44.188"N	76°51'42.893"E	Site Office
Kamsherha	0.5	W	31°27'46.398"N	76°51'25.059"E	Village entrance
Guthan	0.62	SW	31°27'29.28"N	76°51'33.497"E	Near school
Ropri	1.06	NE	31°28'14.849"N	76°52'1.053"E	Near temple
Bobri	1.2	E	31°27'40.47"N	76°52'27.673"E	Near houses

Table 5.12: Results of noise quality monitoring dB(A)

Hours	Site	Guthan	Ropri	Kamsherah	Bobri	Standards dB(A)		
	Commercial area	Silence area	Residential areas					
1	42.1	40.3	41.2	41.2	40.6	AAQ Standards in respect of Noise SO 123 (E) dt 14th Feb 2000 – Silence Area	AAQ Standards in respect of Noise SO 123 (E) dt 14th Feb 2000 – Residential Area	AAQ Standards in respect of Noise SO 123 (E) dt 14th Feb 2000 – Commercial Area
2	43.4	40.6	42.5	42.3	42.3			
3	44.6	41.2	43.8	43.4	43.7			
4	46.5	42.4	44.8	44.5	44.2			
5	46.8	44.3	45.8	45.3	44.8			
6	47.6	46.5	48.7	45.9	45.7			
7	50.4	48.7	53.2	48.9	50.4			
8	53.3	50.7	55.4	52.3	53.2			
9	54.4	52.3	54.4	54.3	54.6			
10	55.4	53.4	56.5	55.6	55.1			
11	56.5	52.3	57.5	54.7	56.4			
12	55.4	50.4	54.4	53.4	54.3			
13	54.4	49.5	53.4	54.6	55.6			
14	55.6	52.3	54.6	52.2	54.5			
15	54.3	50.7	52.4	53.5	53.4			
16	57.5	52.3	55.4	52.8	52.3			
17	56.5	51.2	54.5	53.2	48.6			
18	55.4	50.6	53.3	51.3	47.6			
19	54.4	49.6	50.5	50.6	51.1			
20	51.2	48.7	49.5	48.7	49.6			
21	50.3	46.5	46.7	47.6	47.6			
22	45.3	43.3	45.4	44.5	44.7			
23	44.4	41.2	42.3	42.5	43.6			
24	43.3	40.5	41.2	40.5	41.2			
Min	42.1	40.3	41.2	40.5	40.6			
Max	57.5	53.4	57.5	55.6	56.4			
L _{day}	54.6	50.8	53.9	52.6	52.9	50	55	65
L _{night}	43.9	40.9	42.7	42.3	42.5	40	45	55

The values of noise observed are primarily owing to vehicular traffic and other anthropogenic activities. The day and night equivalents during the study period for commercial area were 54.6 dB (A) and 43.9 dB (A), silence area were 50.8 dB (A) and 40.9 dB (A). Whereas day and night equivalents in residential area were in the range of 52.6 dB (A) to 53.9 dB (A) and 42.3 to 42.7 dB(A) respectively. The results are compared with AAQ standards in respect of Noise SO 123 (E) dt 14th Feb 2000 for Residential and Commercial area. From the results it can be seen that the day equivalents and night equivalents were within the specified standards, whereas in silent area the day and night equivalent of the noise are slightly higher than the standards.

5.4.4.2 Traffic study

The objective of traffic study and emission quantification is to assess the magnitude of the emissions resulting from two-wheelers, three wheelers and four wheelers that are extensively used as a means of common transport within the urban areas. The employees use the public or personal transport and the heavy/bulk loading vehicles will be used for transportation of raw materials into the facility.

A detailed traffic survey was conducted on nearby NH-154 in the study area and also to evaluate the impacts of the increased traffic due to the proposed activity. Vehicular emissions are the major source of air quality impacts in the study area. The principal cause of air pollution during the construction phase is the diesel-powered vehicles used in haulage of aggregates, earth and other construction material. Air quality could be affected by dust & particulate matter arising due to site clearing, vehicular emissions etc. Gaseous emissions like NO_x, CO and HC might be released from the vehicular movement, which has a direct impact on the environment. Increase in the traffic in the study area has a direct impact on the resources as a heavy release of automobile exhaust is envisaged which has a direct impact on the air quality and the ambient noise levels in the study area.

The automobile source is currently the major source of air pollutant emission in many air quality impact analyses. The traffic survey was carried out on the approach road (NH-154) which is 16 m (W) away from the project site which is 2 way 4 lane roads, details of which are given in [Table 5.13](#).

Table 5.13: Traffic survey details on NH-154

Road Name		Distance (km)		Direction		Lat (DMS)		Long (DMS)	
NH-154		0.16		W		31°27'48.092"N		76°51'42.645"E	

Hours	Two wheeler		Light Commercial Vehicles (LCV)		Heavy commercial Vehicles (HCV)		Total vehicles	
	v/hr	PCU/hr	v/hr	PCU/hr	v/hr	PCU/hr	v/hr	PCU/hr
06-07 am	104	78	317	317	63	233	484	628
07-08 am	164	123	473	473	83	307	720	903
08-09 am	204	153	547	547	104	385	855	1085
09-10 am	243	182	663	663	130	481	1036	1326
10-11 am	272	204	712	712	159	588	1143	1504
11-12 pm	240	180	696	696	144	533	1080	1409
12-01 pm	223	167	564	564	123	455	910	1186
01-02 pm	204	153	432	432	80	296	716	881
02-03 pm	183	137	403	403	88	326	674	866
03-04 pm	218	164	446	446	111	411	775	1020
04-05 pm	236	177	578	578	120	444	934	1199
05-06 pm	251	188	660	660	135	500	1046	1348
06-07 pm	223	167	593	593	126	466	942	1226
07-08 pm	189	142	517	517	119	440	825	1099
08-09pm	153	115	452	452	93	344	698	911
09-10pm	119	89	371	371	71	263	561	723
10-11pm	86	65	286	286	62	229	434	580

The highest peak observed is 1504 PCU/hr during 10 to 11 am

Total width of the road in meters (with divider)	~ 20
Carrying capacity of the road (the road is 2 way 4 lane road) As per IRC:106-1990 (PCU's per hour)	3000
Existing V/C ratio	0.5
LOS=Level of Service (Existing)	C

Indicators for LOS		
V/C	LOS	Performance
0.0 - 0.2	A	Excellent
0.2 - 0.4	B	Very good
0.4 - 0.6	C	Good
0.6 - 0.8	D	Fair/Average
0.8 - 1.0	E	Poor
1.0 & above	F	Very poor

Table 5.14: Existing and Proposed Level of Service of NH - 154

Description	Carrying capacity of the road As per IRC:106-1990 (PCU's per hour)	NH – 154 (Kalka to Shimla)			Remarks
		Total No of Vehicles (Peak Time)	Total PCUs (Peak Time)	Existing V/C Ratio	
Existing	3000	1456	2665	0.88	Peak time 10 – 11 am
Proposed Upgradation		1462	2676	0.89	1 HCV + 1 LCV +2 Car + 2 wheeler = 6

From the studies, it was observed that the highest peak traffic was 1504 PCU/hr during 10 to 11 AM. It was observed that the existing Level of Service (LOS) of the road during peak hours is falling under “C” (Acceptable level of comfort; some delay). However, there is widening activity for the road is being carried out. With the expansion activity and increase in the number of vehicles that visit the site, the traffic is not going to increase drastically and the level of services remains same. This implies that traffic will not have a major impact due to the proposed expansion.

5.4.5 Ecological environment

The land area of the existing project going for upgradation is referred hereafter as the core area while its surroundings extending up to 2km radius is referred to as the buffer zone. The study area includes both the core area and the buffer zone.

5.4.5.1 Terrestrial vegetation and flora of the core

The core area is plain land comprises of sparse vegetation like Mango tree (*Mangifera indica*), Bamboo tree (*Bambusa vulgaris*), Neem tree (*Azadirachta indica*), Pongamia pinnata (*Millettia pinnata*), and widely spread weed species like Congress weed (*Parthenium hysterophorus*), Coat buttons plant (*Tridax procumbens*), Indian Lantana (*Lantana camara*), Mountain knotgrass (*Aerva lanata*), White weed (*Ageratum conyzoides*), Green amaranth (*Amaranthus viridis*) and others etc.

5.4.5.2 Vegetation and flora of the buffer zone

Satellite imagery of the land use and land cover and topographical map of the buffer zone reveals the absence of Biosphere Reserves or Important Bird Areas (IBAs) or Protected Wetlands within 2km radius of the project site.

According to satellite imagery of Land use and Land cover map most of the area is urbanized and other land covered by evergreen/semi-evergreen forests, scrub and plantation.

Buffer zone vegetation observed namely Indian gooseberry (*Phyllanthus emblica*), Golden shower tree (*Cassia fistula*), Java Plum (*Syzygium cumini*), Mango (*Mangifera indica*), Malabar Nut (*Justicia adhatoda*), Bahera (*Terminalia bellirica*), Chir pine (*Pinus roxburghii*), Peepal (*Ficus religiosa*), Deodar cedar (*Cedrus deodara*) and others plant species etc., List of plants found in the core and buffer area are given in **Table 5.15**.

Table 5.15: List of flora in study area

S. No	Scientific name	Family name	Common/Local name
1	<i>Mangifera indica</i>	Anacardiaceae	Mango
2	<i>Bambusa vulgaris</i>	Poaceae	Bamboo tree
3	<i>Senegalia catechu</i>	Fabaceae	Cutch tree
4	<i>Eucalyptus globulus</i>	Myrtaceae Juss	Eucalyptus
5	<i>Acacia catechu</i>	Mimosaceae	Arabic Gum
6	<i>Tridax procumbens</i>	Asteraceae	Coatbuttons
7	<i>Polyalthia longifolia</i>	Annonaceae	False ashoka
8	<i>Azadirachta indica</i>	Meliaceae	Neem Tree
9	<i>Ficus religiosa</i>	Moraceae	Peepal tree
10	<i>Psidium guajava</i>	Myrtaceae	Common guava
11	<i>Canna Indica</i>	Cannaceae	Edible canna
12	<i>Ficus benghalensis</i>	Moraceae	Banyan tree
13	<i>Pinus roxburghii</i>	Pinaceae	Chir Pine
14	<i>Millettia pinnata</i>	Fabaceae	Pongamia pinnata
15	<i>Musa</i>	Musaceae	Banana tree
16	<i>Lantana camara</i>	Verbenaceae	Indian Lantana
17	<i>Opuntia stricta</i>	Cactaceae	Prickly pear
18	<i>Acalypha indica</i>	Euphorbiaceae	Indian Acalypha
19	<i>Aerva lanata</i>	Amaranthaceae	Mountain knotgrass
20	<i>Ageratum conyzoides</i>	Asteraceae	White weed
21	<i>Amaranthus viridis</i>	Amaranthaceae	Green amaranth
22	<i>Argemone Mexicana</i>	Papaveraceae	Mexican Prickly Poppy
23	<i>Phyllanthus emblica</i>	Phyllanthaceae	Indian gooseberry
24	<i>Terminalia bellirica</i>	Combretaceae	Bahera
25	<i>Syzygium cumini</i>	Myrtaceae	Black plum
26	<i>Phoenix</i>	Arecaceae	Palm tree
27	<i>Cassia fistula</i>	Fabaceae	Golden shower tree
Source:- Information relating to the flora is based on Primary survey and secondary data (forest department, literature survey etc.)			

5.4.5.3 Terrestrial fauna of the core and buffer zone

There are no wetlands or IBAs in the core and buffer zone within 2km radius except the forests like PF (Near Saroni khad) - 700m (E), Bandli Wildlife Sanctuary - 1000m (E), Saroni Khad - 1000m (E), Bandli PF - 1050m (E), Baila PF - 1350m (N), Bhawana PF - 1490m (S), Dartak PF - 1650m (W) falling in the buffer zone. Eco-sensitive map of the site is shown in **Figure 5.5** and eco sensitive map on google map is shown in **Figure 5.6**.

Species observed during the survey among the mammals were Common langur, Monkeys, squirrels and Wild pig. Among the reptiles, garden lizards were observed. Amphibians were seen frequently in the water bodies. Among the birds were Red-wattled Lapwing, Common Koel, Pigeon, Parrot, Myna etc., were observed.

5.4.5.4 Key information of Bandli wildlife sanctuary

The area is located between 31° 5' 13" to 31° 28' 41" N latitude and 76° 52' 17" to 76° 56' 47" E longitude, spreading over an area of 32.11sq.km. The flora and fauna represent the rich biological significance of this sanctuary. The main species of flora in the area are *Phyllanthus emblica*, *Acacia catechu*, *Cassia fistula*, *Dalbergiasissoo*, *Terminalia bellirica*, *Syzygium cumini*, *Cinnamomum Tamala*, *Phoenix* and *Pinus roxburghii*. The key species of fauna found in areas are Leopard, Leopard cat, Jungle cat, Goral, Himalayan Civet, Himalayan yellow throated marten, Black Bear, Porcupine, Flying squirrel, Monkey, Langur, Barking deer, Indian hare.

Common lists are prepared based on available secondary data and on the basis of direct observation, indirect or circumstantial evidence such as foot prints, feathers, skin, hair, hooves etc. The list of fauna observed during primary survey and based on secondary sources is given in **Table 5.16**.

Table 5.16: List of fauna in the study area

S. No	Scientific name	Common name	WPA Schedule	IUCN Red List
Mammals				
1	<i>Semnopithecus entellus</i>	Common langur	II Part-I	Least Concern
2	<i>Felis silvestris Schreber</i>	Jungle Cat	II Part-II	Least Concern
3	<i>Muntiacus muntjak</i>	Barking Deer	III	Least Concern
4	<i>Martes flavigula</i>	Yellow-throated marten	II (Part I)	Least Concern
5	<i>Naemorhedus goral</i>	Goral	III	Near Threatened
6	<i>Macaca mulatta</i>	Rhesus Monkey	II	Least Concern
7	<i>Ursus thibetanus</i>	Himalayan Black Bear	II (Part I)	Vulnerable
8	<i>Hystrix indica</i>	Indian Crested Porcupine	IV	Least Concern
9	<i>Semnopithecus entellus</i>	Hanuman langur	II (Part I)	Least Concern
10	<i>Himalayan Masked Palm Civet</i>	Paguma larvata	II (Part I)	Least Concern

S. No	Scientific name	Common name	WPA Schedule	IUCN Red List
11	<i>Sus scrofa</i>	Wild Pig	III	Least Concern
12	<i>Funambulus palmarum</i>	Indian palm squirrel	IV	Least Concern
13	<i>Herpestes edwardsii</i>	Common mongoose	II	Least Concern
14	<i>Lepus nigricollis</i>	India hare	IV	Least Concern
Reptiles				
1	<i>Chamaeleo zeylanicus</i>	Asian chameleon	IV	Least Concern
2	<i>Calotes versicolor</i>	Garden Lizard	IV	Least Concern
3	<i>Vipera russeli</i>	Viper (*P)	II	Least Concern
4	<i>Bungarus caeruleus</i>	Common krait (*P)	II	Least Concern
* Poisonous				
Amphibians				
1	<i>Bufo melanostictus</i>	Indian Toad	IV	Least Concern
2	<i>Rhacophorus maculatus</i>	Indian Tree frog	IV	Least Concern
Avian Species				
1	<i>Acridotheres tristis</i>	Common Myna	IV	Least Concern
2	<i>Emberiza cia</i>	Rock bunting	IV	Least Concern
3	<i>Eudynamis scolopacea</i>	Common Koel	IV	Least Concern
4	<i>Pycnonotus cafer</i>	Red vented bulbul	IV	Least Concern
5	<i>Turdoides striata</i>	Jungle babbler	IV	Least Concern
6	<i>Dicrurus leucophaeus</i>	Ashy drongo	IV	Least Concern
7	<i>Vanellus indicus</i>	Red-wattled Lapwing	IV	Least Concern
8	<i>Parakeet</i>	Parrot	IV	Least Concern
9	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	IV	Least Concern
10	<i>Gallus gallus</i>	Red Junglefowl	IV	Least Concern
11	<i>Phoenicurus leucocephalus</i>	White-capped Water-redstart	IV	Least Concern
Source: Information is based both on direct observations during field survey, information gathered from surrounding villagers and secondary data (forest department, literature survey etc)				

5.4.5.5 Aquatic flora and fauna of the study area

According to topographical map, Jarol Khad – 30 m (W), Saroni Khad- 1000m (E), Bobri khad- 1500m (NE) from the project site but during primary survey, so only semi-aquatic macrophytes observed are given in the below **Table 5.17**. There is no reservoir, protected wetlands or other ecologically sensitive wetlands within the 2km radius of the study area.

Table 5.17: List of semi aquatic macrophytes found in the surface water bodies

S. No	Latin name	Local / Common name	Family
1	<i>Cyperus triceps</i>	Guinea Rush	Cyperaceae
2	<i>Cyprus longus</i>	Umbrella sedge	Cyperaceae
3	<i>Echinochloa crus-galli</i>	Cock spur	Poaceae
4	<i>Eichhornia crassipes</i>	Water hyacinth	Pontederiaceae
5	<i>Malachra capitata</i>	Yellow leaf bract	Malvaceae
6	<i>Cyperus digitatus</i>	Finger flat sedge	Cyperaceae
7	<i>Typha angustata</i>	Lesser Cattail	Typhaceae

5.4.5.6 Conclusion

Bandli Wildlife Sanctuary located at a distance of 930m towards East of the project site is a home for the following REET species.

Table 5.18: List of semi aquatic macrophytes found in the surface water bodies

Scientific name	Common name	WPA Schedule	IUCN Status
<i>Ursus thibetanus</i>	Himalayan Black Bear	II (Part I)	Vulnerable
<i>Naemorhedus goral</i>	Goral	III	Near Threatened
<i>Uncia uncia</i>	Snow Leopard	I (Part I)	Vulnerable

Based on the survey, primary and secondary data collected and on the basis of surroundings and circumstances, it may be stated that the area under consideration is not ecologically sensitive except for a very small and narrow strip of Bandli Wildlife Sanctuary beyond 930m from the core area. There are no REET species or species belonging to Schedule I of the Indian Wildlife (Protection) Act 1972, other than those in the Bandli Wildlife Sanctuary. The flora and fauna of the study area is very common and fairly widespread in large areas.

As the proposed project is an expansion/upgradation of the existing fruit processing unit, operates in sustainable manner with feasible techniques, in ecological point of view negligible impact on flora and fauna of the study area and it is not going to create any kind of additional environmental stress to the surrounding biodiversity and even under the worst cases will not leave any lasting and unmanageable adverse impacts on the ecosystems, flora and fauna of the area under the project impacts.

The anticipated impacts of noise & dust pollution can be controlled by the effective traffic management in & around the project facility. Water can be sprinkled on the roads for reducing the dust pollution due to the motorised vehicles biodiversity.

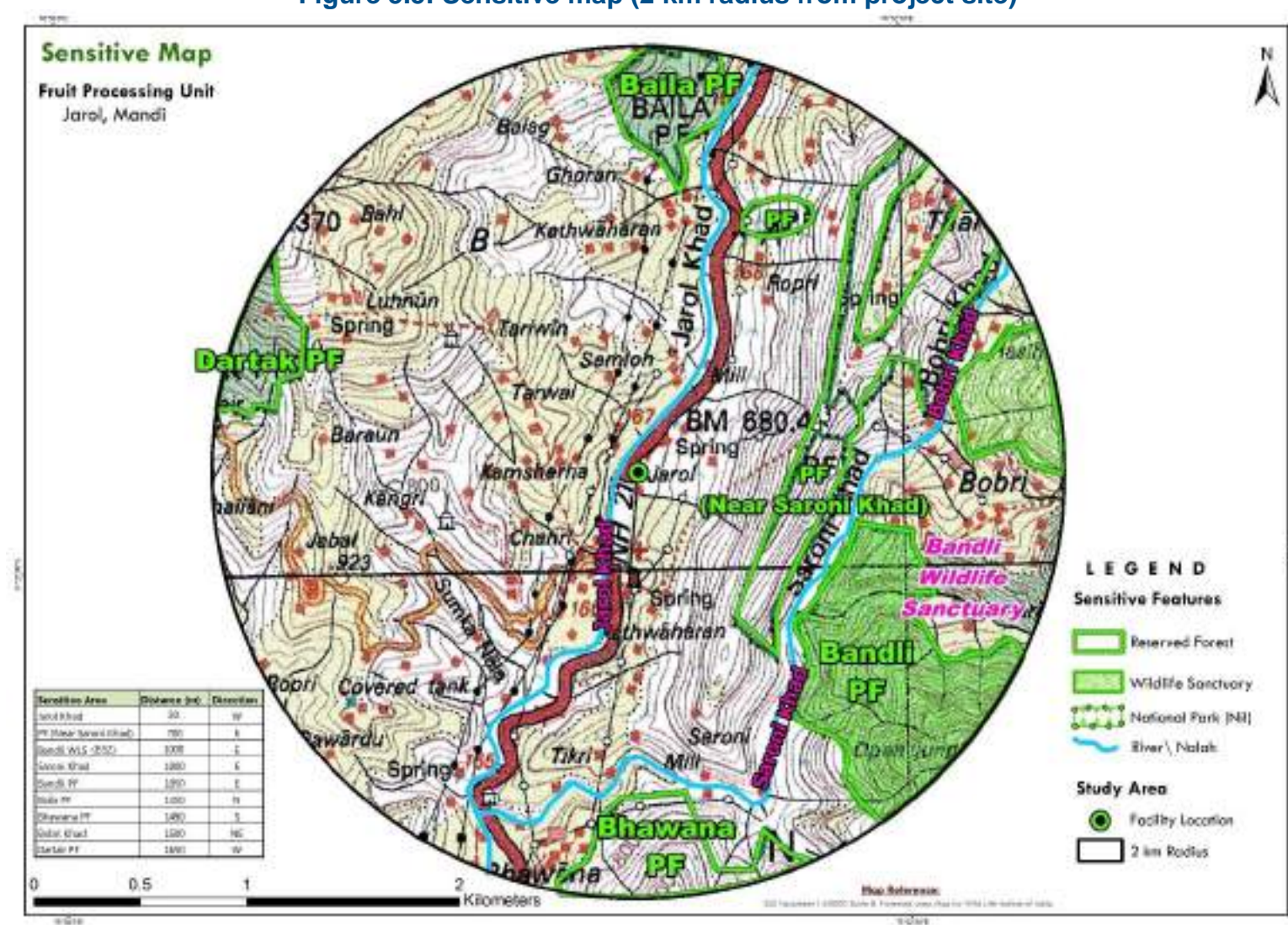
The anticipated air emissions from the processing unit can be controlled by the adopting the Air Pollution Controlling Devices (APCD) as prescribed by the standards EPA act 1986.

The impacts identified are of very minor to moderate and it is for short duration only as it can be controlled by the effective implementation of Environment Management Plan (EMP). Hence and it is not going to create any kind of additional environmental stress to the surrounding biodiversity.

Greenbelt development plan

As per the layout plan, there is no open space available for greenbelt development and hence, no species have been recommended for greenbelt development.

Figure 5.5: Sensitive map (2 km radius from project site)



5.4.6 Hydrogeology

5.4.6.1 Physiography and topography

The project site is located in the south part of the district. It is in the outer Himalayan zone of West Himalayan region; and falls in submontane and low hills, and sub-tropical agro-climatic zone. The site surroundings comprises of high heightened hills, uplands, terraces, plains and valleys. There are hills in the east, southeast and northwest sides and the high hill which is located in the east side from project area with a height of ranging to 1100m above MSL (Mean Sea Level). The topographic elevation, in the study area of 2km radius, is ranging from 650 to 1300m above MSL. The slope varies from very steep to gentle slope. . In the project area, Contour values are ranging from 700 to 750m above MSL at the project site. Topographically, the project site has undulating plain land and altitude of the site is 700m above MSL. Contour Map of the study area of 2 km radius from the boundary of the project site has been presented by **Figure 5.6**.

Surface hydrology

The natural drainage is consisting of streams and rivers. The drainage system is showing parallel and sub-dendritic drainage pattern. The streams are flowing through the study area and, some are originating at the hills in the study area, and are finally flowing towards the major stream then to the river. There are no major rivers and lakes. The streams flowing in this area are mostly ephemeral in nature that is, flowing during the rainy season. The water basin area falls in the ghaggar sub-basin of Sutlej basin. Drainage Map of the study area of 2 km radius from the boundary of the project site has been presented by **Figure 5.7**. Near the project area, towards northwest, a stream (3rd order) is flowing from northeast to southwest, and the project area is located on an elevated portion with respect to the stream. There are no major rivers and lakes with in the 2km radius study area.

5.4.6.2 Geology

The rock formations belong to recent to sub-recent alluvium. This consists of unconsolidated sand, silt, clay etc. The thickness of this formation is varying from place to place. It is spread and covered in the minor river portions also in the main streams. Below the top soil layer lies beneath the hard rock formation consisting of sandstones, shales, gravel and conglomerates which belong siwalik group of tertiary (neogene to paleogene) age.

Age	Group/formation	Lithology
Quaternary	Newer alluvium	Alluvium unconsolidated sand, silt, clay; topsoil.
Tertiary	Siwalik group	Sandstone, shales, gravel and conglomerates.

The area is mainly covered with structural hills and valleys, geomorphologically. The hills are highly dissected. The valley portions are covered with younger alluvium

which are occupied adjoining the major streams and minor rivers of limited and narrow aerial extent only and they are of low to moderate depth

Figure 5.6: Contour map of study area

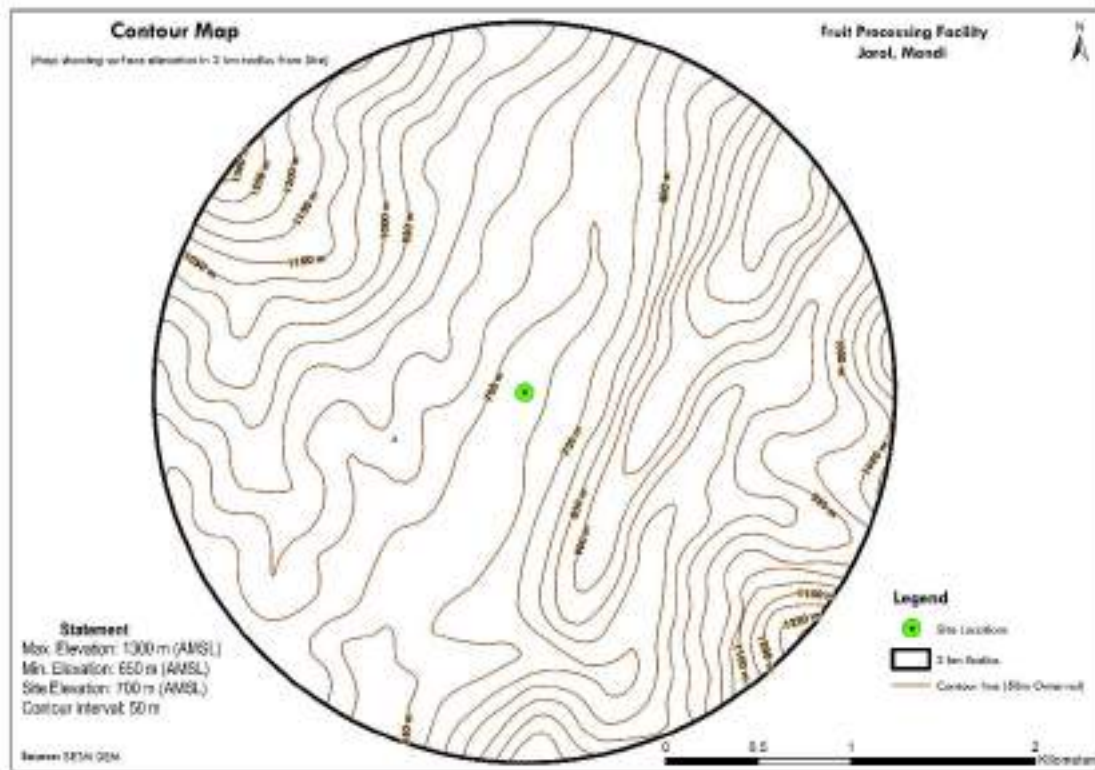
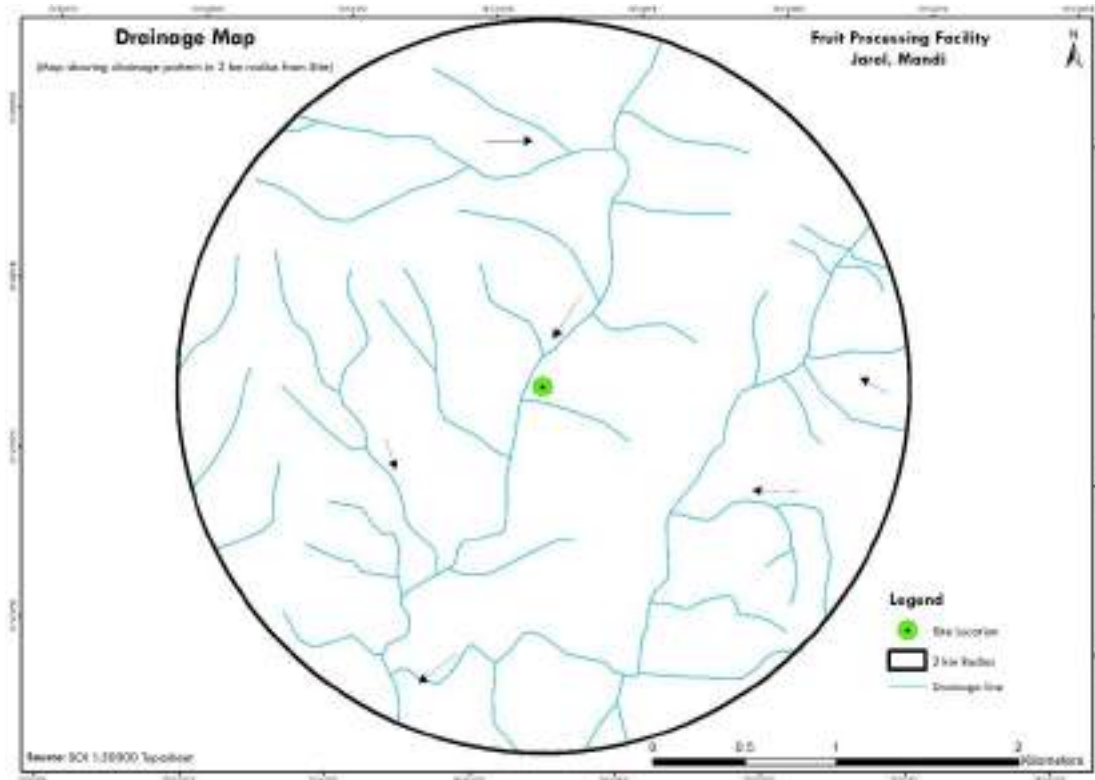


Figure 5.7: Drainage map of the study area



5.4.6.2.1. Soils

Soil is generally sandy loam in valley areas and in rest of the hilly and mountainous areas, soil is skeletal. Soil depth is generally shallow, except in areas having good vegetative cover. It is generally dry, shallow. Landslides are the common features in mountainous terrain. Soils are rich in nutrients and thus are fertile.

5.4.6.3 Ground water

The major part of Himachal Pradesh is hilly and mountainous with few small intermontane valleys covering about 15% of the area. These valleys comprise of alluvial deposits, which form extensive aquifers and thus represent porous formations. Major valleys in the state are Indora-Nurpur and Kangra-Palampur valleys in district Kangra, Una valley in district Una, Balh valley in district Mandi, Nalagarh valley in district Solan and Paonta valley in district Sirmaur. The Siwalik and Sirmaur group represent the Tertiary formation in the area. The Siwalik comprises of boulder, conglomerate, sandstone and clay while, Sirmaur group comprises of shale, sandstone and clay. The primary porosity and permeability in the Tertiary formation is low to moderate and hence, these aquifers do not form high yielding aquifers. The older rock formations of Proterozoic to Mesozoic eras constitute of igneous and metamorphic rocks like granite, gneiss, slate, schist, phyllite, quartzite etc. Because of their consolidated nature, these rock formations serve as poor aquifers. However, due to tectonic movements, they have been traversed by faults, thrust and joints, which have enhanced their ground water potential.

The quality of ground water in hard rocks and alluvial areas is by and large good and suitable for domestic and irrigational use. The yield potential of the hydrogeological formations discussed above is presented below in **Table 5.19**.

Table 5.19: Hydrogeological formations and their yield potential

Age	Rock Formation	Hydrogeological Characteristics
Recent to Sub Recent	Boulder, Cobble, Pebble, Sand, Silt & Clay	High Yield 30 – 75 m ³ /hr.
Tertiary	Boulder Conglomerate, Sandstone, Clay	Moderate to Low Yield <30 m ³ /hr
Proterozoic to Mesozoic	Shale, Slate, Phyllite, Limestone, Dolomite, Sandstone, Quartzite, Granite and Schist	Moderate to Low Yield <5 to 30 m ³ /hr

The artificial recharge is a means by which ground water is augmented at much higher rate than natural percolating conditions to replenish the aquifer. In the facility, during the rains all the storm water needs to be collected, pre-treated, stored also recharged and excess sent to outside natural drains. This improves local ground

water levels there by enhancing yields also reduction in cost of lifting it, control the land subsidence, improved water quality, utilizable in future; and at the site, it facilitates to minimize inundation due to excess runoff from the surface area if any during times, also on-site re-use of stored rain water for landscape and green belt development.

5.4.6.4 Rooftop rain water harvesting, surface runoff calculation and water conservation within the project premises

The average annual rainfall in Mandi District of Himachal Pradesh is about 1413 mm. Average number of rainy days per year is about 43 days. Rain water harvesting and water conservation are mainly based on the rainfall intensity at the project area. Rainwater will be captured by using the rainwater harvesting system. It will be done by direct collection and aquifer recharge of rooftop rainwater and by direct collection and surface storage of surface runoff from roads, green belt area and open spaces. Total quantity of rooftop rainwater to be harvested and recharged to shallow aquifers and total quantity of storm water surface runoff from roads, green belt area and open spaces to be harvested and stored as surface storage for future use are for this project site have been estimated presented below in **Table 5.20**.

Table 5.20: Rain water harvesting and surface runoff calculation

Catchment surface type	Area in m ²	Rainfall (m ³ /day)	Runoff coefficient	Volume (m ³ /day)
Built-up area	2045.3	0.01787	0.90	33
Roads	1847	0.01787	0.80	27
Open spaces	159.55	0.01787	0.70	20
Total				80
Source: www.worldweatheronline.com, highest rainfall in Sundarnagar town is 536.1 mm in 30 days of August-2020.				

5.4.6.4.1 Rooftop rainwater harvesting and shallow aquifer recharge within the project premises

Total quantity of harvested rooftop rainwater will be 6,640 m³ / year i.e., 80 m³/day. This harvested quantity of rooftop rainwater will be recharged to shallow aquifers.

Depth to water table shows wide variation in this area. During pre-monsoon period (May) it ranges between 5.01 and 28.76 m bgl, while during the post-monsoon period (November) depth to water level ranges from 3.02 to 27.57 m bgl. Deeper water levels are observed mainly in hilly areas and along the foothills. In major parts of the valley, the depth to water level is less than 15.00 m bgl. There is a need of Water Conservation and Artificial Recharge Measures in this area.

Rainfall is the major source of recharge to the groundwater body, apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas. The hilly areas receive fair amount of rainfall and ample scope exists for implementing roof top rain water harvesting by constructing appropriate harvesting structures.

5.5 Socio-economic baseline

This section illustrates the prevailing socio-economic aspects of people inhabiting villages in the core and buffer zone of the proposed project facility. It also attempts to comprehend the social phenomenon so as to represent the demographic, occupational, gender and diversity among the surrounding villages, thereby postulate impactful developmental interventions.

5.5.1 Demographic aspects, social & occupational structure

This section illustrates the prevailing socio-economic aspects of villages in the 0-2km radius of processing facility at Jarol in Mandi District. The following pages attempt to comprehend the social phenomenon so as to represent the demographic, occupational, gender and diversity among the project area villages, thereby postulate appropriate mitigation.

5.5.1.1 Distribution of population

As per 2011 census the study area consists of 5590 people and the distribution of population in the study area is given in **Table 5.21**.

Table 5.21: Distribution of population in the study area

S. No	Particulars	0-2km
1	Number of households	1106
2	Male population	2844
3	Female population	2746
4	Total population	5590
5	SC population	1070
6	ST population	0
7	Total population (0-6 years)	618
8	Average household size	5.1
9	% of males to the total population	50.9
10	% of females to the total population	49.1
11	Sex ratio (number of females per 1000 males)	965.5
Source: District Primary Census statistics of Himachal Pradesh -2011		

As illustrated in the above table, the gender diversity, as percentage of men and women constitute about 50.9% and 49.1% in the study area respectively.

5.5.1.2 Average household size

According to the Census data of 2011, study area had an average family size of 5 persons per household. This represents nuclear family type which is also prevalent in other parts of the district

5.5.1.3 Population density and projections

It is estimated that the average density of population of the study area is 157 persons per km².

5.5.1.4 Sex ratio

To reiterate; the male and female constitute 50.9% and 49.1% respectively and number of females per 1000 males are 965.

5.5.1.5 Social structure

The socio-economic study observed that 19% of people belong to scheduled category, which comprises of Scheduled Castes comprises only. The data revealed the absence of Scheduled Tribes (ST) households in the project area. The distribution of population in the study area by social structure is illustrated in **Table 5.24**.

Table 5.22: Distribution of population by social structure

S. No	Particulars	0-2 km
1	SC population	1070
2	ST population	0
3	% of SC to the total population	19.1
4	% of ST to the total population	0.0
5	Total SC & ST Population	1070
6	percentage to the total population	19.1
7	Total population	5590
Source: District Primary Census statistics of Himachal Pradesh - 2011		

5.5.1.6 Literacy levels

The analysis of the literacy levels in selected villages of study area, reveals that an average literacy rate of 65.8% as per 2011 census data. However, the male literacy of the study area is 57%, whereas literacy rate among women, which is an important indicator for social change, is low as 43%. The distribution of literates and literacy rates in the study area is illustrated in **Table 5.23**.

Table 5.23: Distribution of literates and literacy rates

S. No	Particulars	0-2 km
1	Male population	2844
2	Female population	2746
3	Total population	5590
4	Male literates	2099
5	Female literates	1582
6	Total literates	3681
7	Male literacy rate (%)	57.0
8	Female literacy rate (%)	43.0
9	% of Male literates to the male population	73.8
10	% of Female literates to the female population	57.6
11	Total literacy rate (%)	65.8
Source: District Primary Census statistics of Himachal Pradesh -2011		

5.5.1.7 Occupational structure

The data revealed that as low as 19.6% people are engaged in main works such as, cultivators, agricultural laborers, manufacturing, processing and repairs in household industry; construction, trade & commerce and other services in the study area. The main workers, marginal workers and non-workers constitute to 19.6%, 35.1% and 45.3% of the total population respectively. The occupational structure of the study area is given in Table 5.24.

Table 5.24: Occupational structure

S. No.	Particulars	0-2 km
1	Total population	5590
2	Total workers	3056
3	Work participation rate (%) (Total workers/Total population)*100	54.7
4	Main workers	1095
5	Percentage of main workers to total population	19.6
6	Marginal workers	1961
7	Percentage of marginal workers to total population	35.1
8	Non-workers	2534
9	Percentage of non-workers to total population	45.3
10	Dependency ratio	4:5
Source: District Primary Census statistics of Himachal Pradesh -2011		

5.5.1.8 Dependency ratio

Based on the occupational structure of the study area the dependency rate of non-workers on the workers category has been estimated at as high as 4:5. The study also noted that overall work participation rate is as low as 54.7% in the project area. It is observed that some of the educated youth is part of the non-working population. Therefore there is a need for income generation activities to strengthen the livelihoods of local population.

5.5.1.9 Employment pattern

The study noted that 41% of working population in the project area is currently engaged in agriculture, horticulture and other allied activities as cultivators and agricultural labour. The proportion of dependency on non-agricultural livelihoods is observed to be as high 57% of total employment pattern in the project area. The employment pattern in project area is given in **Table 5.25**.

Table 5.25: Employment pattern in project area

S. No	Particulars	0-2 km	Percentage
1	Population in main cultivators	450	41.10
2	Agricultural labour population	11	1.00
3	Main household workers	30	2.74
4	Main other working population	604	55.16
Total main working population		1095	100

5.5.2 Social Infrastructure

The following paragraphs illustrates the current social Infrastructural details in project area which includes, presence of educational institutions, Community facilities and services, Amenities and Settlement patterns. The data has been collected through interactions with key informants and Focus Group Discussions (FGDs) with primary stakeholders in the project area – Jarol in Sundernagar Tahsil in Mandi District.

It is observed that project area at the fruit processing facility at Jarol reflects primarily a rural composition in terms of availability of resources and lifestyle choices. Majority of the population has access to infrastructural facilities in terms of education, medical aid and electricity and employment opportunities.

The main occupation of the people in this area is on non-agriculture activities. Many working individuals depend on secondary and tertiary sector for their livelihoods. When the team visited the local area to conduct focus group discussions, many important facts have emerged.

It has been observed that the surrounding villages in the project area are dependent on Jarol, Bobar and Gamohu for their basic necessities. In the local villages basic facilities like education, medical, transportation, roads and infrastructure are developed to considerable extent.

5.5.2.1 Accessibility to educational institutions

The educational infrastructure has been observed to be good in the Project area. All the villages have Anganwadis, Primary Schools followed by Middle Schools. The study observed that 37.2% of the villages have secondary Schools and educational facilities up to senior secondary level. Similarly, the villages also have access to Degree collages, ITI collages and vocational training institutes in Sunder nagar which is 30km and Mandi town which is 52km from Jarol. Educational facilities details are provided in **Table 5.26**.

Table 5.26: Details of educational facilities

S. No	Type	Percentage
1	Anganwadi	98.1
2	Primary	80
3	Middle School	55
4	Secondary	20.1
5	Senior-Secondary	18.6
6	Degree	-
7	ITI collages	-

5.5.2.2 Healthcare facilities

The baseline study observed that Health care facilities are well developed in the study area. It has been observed that all the 10 villages in the project area along with Jarol are connected with Private or Government hospitals and Dispensaries. The study reveals no prevalence of major chronic diseases in the project area. The stakeholder responses reveal that some common health problems like malaria, Diarrhea, cardio vascular disorders, respiratory illness, typhoid, and seasonal fever prevalent in the study area. The details of Healthcare facilities are given in **Table 5.27**.

Table 5.27: Healthcare facilities details

S. No	Type	Percentage
1	Primary Health Centre	80
2	Primary Health Sub Centre	15
3	Mother and Child welfare Centre	20
4	Dispensary	40
5	Veterinary Hospitals	80
6	Medical Practitioners	29.6

6	Pvt./Govt. Hospitals	28
8	Traditional Medicine Practitioners	10
9	ASHA Workers	94

The data revealed that 30% villages have Medical Practitioners without formal degree and 10% of villages also have Traditional medicine healers who are frequently approached by the villagers in case of illness. However, all villages have Accredited Social Health Activists or ASHA workers to address the community healthcare needs.

5.5.2.3 Water and sanitation facilities

Regarding water facility in the studied villages the main source of drinking water through public taps, Bore wells Hand pumps, tank and Ponds. The water is also sourced from open wells, tubewells, infiltration galleries and wells.

Similarly, the study area also presents a fair picture when it comes to sanitation. The project area has community toilets, and even the percentage of households with access to private toilets is very high in the project area. Water and sanitation facilities are given in **Table 5.28**.

Table 5.28: Water and Sanitation facilities

S. No	Type	Percentage
1	Public taps	78.7
2	Borewell/Tube well/streams	76.2
4	Tanks/Pond	53.1
5	Public/Community toilets	70
6	Individual toilets	84.8

5.5.3 Other facilities in the project area

The primary data and village level focus group discussions revealed that, 85% of people in the project area have accessibility to postal communication and 34% of villages have community centers. However, all the villages have power Supply both for Domestic and Agricultural purposes. Similarly as many as 50% population have access to play grounds/shed for sports and recreation purposes and 35.2% villagers have reading room/Library with regular supply of newspaper. It is also noted that all these villages have access to mobile networks/coverage.

Table 5.29: Infrastructure facilities

S. No	Type	Percentage
1	Post office/Sub post office	85
2	Library/reading room	35.2

3	Power Supply	100.0
4	Banks/Finance sources	70
5	Playground/Sports	50
5	Community centers	34

5.5.3.1 Transport facilities

The project area has good road connectivity. A large majority of the project villages have access to bus service with Pucca roads connecting to major towns and state highways. Almost all villages have all weather road connectivity.

Table 5.30: Transportation facilities

S. No	Type	Percentage
1	Bus service	82
2	Road connectivity	91
3	Pucca roads	88.4
4	Kachha roads	11.6

5.5.3.2 Other village level institutions

The primary data illustrated that project area have Self Help Groups organizing women into income generating and micro finance based thrift societies. These SHGs work as cohesive entities and organize themselves around an income generating activity. However, the study didn't observe any specific mechanisms/support services to strengthen these SHGs in the project area.

Table 5.31: Village level institutions

S. No	Type	Percentage
1	Self Help Groups	66.6
2	Public Distribution System	72
3	Agriculture Credit Society	19.4
4	Mandi / Weekly Markets	33.2
5	Agriculture Marketing Society	18

Similarly these villages are based on non-agrarian economy and depend on tertiary sector for major employment and economic activity. A variety of agricultural and horticultural products are grown in the district. There is also much of support or agriculture market extension services are provided to these farmers. It is observed that 18% of villages have agriculture marketing societies, 33.2% of villages have accessibility to Mandis or Weekly markets.

5.5.4 Settlement pattern

A settlement pattern refers to the way that buildings and houses are distributed in a rural/urban settlement. The study observed a dispersed settlement pattern in the project area is where the buildings are spread out.

Similarly, Linier settlement pattern has been observed in Jarol village, where in group of buildings are formed in a long line. These buildings were following the road to sunder nagar and mandi.

To understand the settlement pattern in terms of functionality the facilities and services of the settlements within project area are divided into following three functionalities:

1. Physical facilities like Roads, Water supply, Sewer Network, Drainage Network, Solid Waste Management and Power supply.
2. Social facilities like Medical, Education
3. Communicational facilities namely: Mobile Phone Coverage, Private Courier Facility, Internet Cafes etc.

The study observed permanency in settlement in the project area. Many of the households live in pucca, semi-pucca houses.

5.5.5 Description of aesthetics

The project area falls in the core zone of Jarol Village, which is connected to major cities in the through State Highway namely, Punjab and Haryana and Chandigarh. Jarol – situated in chandigarh to Manali highway helps in cross boarder ties, marketing linkages and networks. The project area primarily reflects an rural subsistence agrarian economy where in majority of people are dependent on Agriculture and Horticulture along with business and household level entrepreneurial activities.

The baseline study observed that the project area is in the shivalik hill ranges (Lower) of Himalayas and reflects a scenic rural environment. The visual setting, and air quality is has been examined and found moderately well for the human settlement in the project area. Similarly the noise levels have been observed lo be moderately fair in the project area.

Similarly, the baseline study observed an affective bond between people and place (project area). There has been great amount of sense of place perceived by the local residents. The people in the project area are also observed to be satisfied with life: including everything from physical health, family, education, employment, wealth, safety, and security to freedom, religious beliefs, and the environment

However, the local population in the project area did not complain any odour / foul smell from the plant.

5.5.6 Status of women in the society

The status of women is a vital instrument to expand women's ability to have resources and to make strategic life choices. It is observed that Women constitute 49.28% of the Himachal Pradesh total population and directly or indirectly they are contributing towards the economic development of the state. Government had also taken various initiatives for the development of the women & encourages people to accept girl child and this also improves the sex ratio of the state.

The status of the women in Himachal Pradesh is comparatively higher than its neighboring states. Many studies revealed that because of the government schemes women in Himachal are more empowered than other states in terms of education, employability and income. Some studies have concluded that it was primarily because of high literacy rate; 31% of women is employed in the state in comparison to other adjoining states. Likewise, data collected from census survey 2011 it has been observed that sex ratio is highest in Himachal Pradesh.

5.5.6.1 Gender based work force participation in the project area

The study observed that men workers are predominant among the total workforce in the project area. The majority of them are engaged in works other than agriculture and horticulture etc. Gender based work force participation is given in **Table 5.32**.

Table 5.32: Gender based work force participation

S. No	Gender based work participation	Total	Percentage
1	Women workers	1440	47.12
2	Men workers	1616	52.88
Total		3056	100.00

Similarly, the proportion of women as non-workers is considerably high when compared with their counterparts in the project area. Thus percentage of non-working women is observed to be 51% of total non-working population. Gender based non worker participation is given in **Table 5.33**.

Table 5.33: Non-workers

S. No	Non-worker participation	Total	Percentage
1	Women non-workers	1306	51.54
2	Men non-workers	1228	48.46
Total		2534	100.00

5.5.7 Stakeholder consultations, interactions, community meetings

The stakeholder consultations, interactions and community meetings have been conducted during the baseline survey. These stakeholder consultations primarily conducted through PRA tools, such as, focus group discussions, structured/semi-structured questionnaire, interview schedules etc. The Stakeholder consultations was held with major institutional stakeholders, say, employees, individual households, Non-Government Organizations (NGOs), women members of Self Help Groups (SHGs), Tribal Farmers, leaders, Farmer Interest Groups (FIG), Cooperative societies etc. The stakeholder consultations enabled to analyze and understand likely social and environmental issues that need to be addressed during preparation of ESMP.

In case of present ESIA study, the baseline information was gathered from the all stakeholders through 12 group level and individual face-to-face consultations at the processing plant at Jarol. These consultations helped in identifying and assessing the as-is status of socio-environmental scenario in the study area. The process of our Stakeholder consultations is context-specific and based on following principles.

- Intervention specific and Targeted at those most likely to be affected - Workers
- Two-way so as provide an opportunity to exchange views and information, to listen, and to have their issues recorded
- Gender-inclusive
- Localized to reflect appropriate context, and social issues embedded therein
- Free from manipulation
- Documented to keep track of who has been consulted and the key issues raised

The FGDs and Stakeholder consultations with Women and men workers at Jarol Fruit processing plant has revealed that around 40 to 45 numbers of women workers were currently working at present in the facility. The male to female ratio was estimated as 20:40. This indicates the labour market participation of women has increased significantly in the industrialized sector in recent years. The baseline study also observed that direct or indirect relationship between workgroup gender composition and workers job satisfaction.

These women workers reside in the villages neighboring to the facility. The distance between the facility and their residence is observed to vary from 2 to 10Km. The mode of transfer is either Auto riksha, public transport or by walk. The nature of employment for the worker in the facility is on contract basis and their wages ranges from Rs 200- 250 /- per day. They work in a general day shift with 8 hours of working from 9am to 5pm keeping Sunday as a Holiday. During seasons (Feb- May) and (Aug-Oct) their workload increases and the working hours shifts to 8 -12 hours. Under Section 66 of the Factories Act, 1948 imposes restriction on employment of

women to work between 7.00 pm to 6.00 am. And while interviewing, information noted all women workers leave the premise by 5.00 – 5.30 pm.

The workforce engagement is a key variable observed during the study, wherein the workers/ participants of the workforce feel engaged when they find personal meaning and motivation in their work and when they receive positive interpersonal and workplace support. An engaged workforce benefits from trusting relationships, a safe and cooperative environment, good communication and information flow, empowerment, and performance accountability. It was observed among the women workers, that though they are hired on temporary basis but the bond among them displays fair treatment and family friendliness. During the interaction, the workers informed that no migrants are working in the facility. It was also mentioned during FGDs that they have a workers union inside the facility.

During the visit it was observed that both male and female workers were busy in doing packaging and labeling of pickle and concentrate to their respective bottles. They were having head covers, maxi, gloves and face masks while working. The education qualifications of the workers are below SSC levels. There is no canteen facility for the workers and they bring their food from home.

During the discussion, it also brought to notice that situation of sanitation inside the facility for women workers is not in good, still the growing role of women in informal and formal work environments; one can extrapolate the potential impacts of inadequate workplace sanitation on their productivity and overall health and well-being.

Similarly, a basic medical kit was available in the facility. The workers were provided with Face masks, gloves and aprons. It was also observed that many of them are not wearing gloves and other safety kits while working. Therefore proper awareness should be generated among themselves for the safety cause. The observer felt that workers previous health records should be maintained which may help in assessing the work relatedness of any illnesses. Thus appropriate and reasonable safeguards must be established to ensure security and confidentiality of the records. Useful summary and trend information should be provided to health and safety committees in order to assist in making recommendations.

The child labour problem is multidimensional and needs matching approach and solutions. Employment of child is a cognizable offence and there should be more deterrent and stringent penalties. During the site visit no child labour was observed.

No fire exit was observed inside the facility. A danger sign board was noted nearby Sipraflow heat exchanger, inside the facility. No proper leveling of floor.

Thus these consultations enabled to capture the views and perceptions of women workers who may be affected or have an interest in project. Their views thus have

been taken as inputs to improved project design, thereby avoiding it was observed that, around or reducing adverse impacts, and enhancing benefits.

5.5.8 Health scenario (HIV/AIDS)

Similarly, the data collected from the project area revealed that people has good access to healthcare facilities. It is noticed that 30% of the villages surveyed have access to Govt. and private hospitals. These villages have PHC, SHCs and village level dispensaries. Similarly, the data revealed that majority of the people have generic health problems in the project area.

The study observed that very few cases of HIV/AIDS or other STDs registered in the local health centers or ICTCs (Integrated Counseling and Testing Centre) operated by local TI partners. It was reflected in the data collected from NACO and HPSACS that the project area is in the low risk zone of HIV/AIDS with prevalence levels observed to be less than 0.8% in the cases registered in the local medical offices.

5.5.9 Crime and community safety

The socio-Economic study revealed that crime rate has been very low in the project area. The project villages attract migrant during the specific time in every year. However, it was never perceived as a problem by the local residents and migrants too are assimilated in the local setting to a great extent.

Similarly, the study noted that youth in the project area are devoid of employment opportunities. They can be a potential source of workers with minimum handholding and vocational education. The youth have expressed their willingness to setting up of industries in the area as it provides them gainful employment opportunities.

5.5.10 Sites of cultural significance

The Jarol fruit processing facility is not in the vicinity of any cultural heritage sites, and do not require excavation, construction near any historical, archaeological or cultural heritage site.

The project doesn't have any impact on the cultural components people living in the project area. As mentioned above, there are no sites of spiritual and/or religious significance, sites of cultural significance, sites of historical and archaeological significance is prevalent within the pre-defined boundary/scope of the intervention or facility area.

5.5.11 Land use and involuntary settlement

The expansion of Jarol fruit processing facility will not reduce people's access to their economic resources, such as land, pasture, water, public services, sites of common public use or other resources that they currently depend on.

Similarly, the project would not result in resettlement of individuals or families for its development. It will also not result in the temporary or permanent loss of crops, fruit trees and household infrastructure.

Likewise, the project will not have any adverse impact on the livelihoods of traditional local communities or Historically Underserved Traditional Local Communities.

5.5.12 Economic scenario

The economic scenario is analyzed based on three kinds of indicators:

- Leading indicators (such as new orders for consumer durables, net business formation, and share prices) that attempt to predict the economy's direction,
- Coincident indicators (such as gross domestic product, employment levels, retail sales) that show up together with the occurrence of associated economic activity, and
- Lagging indicators (such as gross national product, consumer price index, interest rates) that become apparent only after the occurrence of associated economic activity.

The following are the key indicators at National, regional and district levels for the perusal of current socio-environmental baseline study.

National Economic Indicators

- GDP growth rate
- Unemployment rate
- Import and Export Potential
- Employment rate
- Labour Force participation rate
- Production
- Interest rate/Loans
- Personal Savings and Spending

Regional Economic Indicators

- GDP
- Unemployment rate
- Import/Export Potential
- Production
- Interest rates
- Personal Savings/Spending
- Women work participation rate

Local Economic Indicators

- Employment rate
- Production
- Increase in Income/savings/spending
- Women Work participation

The project area is in the highway connecting to Mandi town, which is connected to major cities in Himachal Pradesh, Punjab and Chandigarh. The data revealed that as low as 19.6% people are engaged in main works such as, cultivators, agricultural laborers, manufacturing, processing and repairs in household industry; construction, trade & commerce, and other services in the study area. The marginal workers and non-workers constitute to 35.1% and 64.9% of the total population respectively. Therefore, non-workers are predominant in that of workers by occupation.

The study noted that as 42% of the working population in the project area is currently engaged in Agriculture, horticulture and other allied activities as cultivators and agricultural labour. The proportion of dependency on non-agricultural livelihoods is observed to be as high as 57% of total employment pattern in the project area.

Evidently, the state of Himachal Pradesh is most prosperous and fastest growing economy in the country. The economy of the State is expected to achieve a growth rate 6.3 percent in the current financial year.

The data revealed that as low as 43% people are engaged in main works such as, cultivators, agricultural laborers, manufacturing, processing and repairs in household industry; construction, trade & commerce, and other services in the study area. The marginal workers and non-workers constitute to 2.1% and 54.2% of the total population respectively. Therefore, non-workers are predominant in that of workers by occupation.

The study noted that only 2% of working population in the project area is currently engaged in Agriculture, horticulture and other allied activities as cultivators and agricultural labour. The proportion of dependency on non-agricultural livelihoods is observed to be as high as 98% reflecting an urban employment pattern in the project area.

5.5.12.1 Sectoral strengthening

The study revealed that expansion of processing facility at Jarol, Mandi district would trigger many direct and indirect benefits for economic advancement and social development of project area. Various stakeholders expressed that it would strengthen the horticulture sector and accelerate import and export potential, productivity and local employment rate and savings. They also positively noted that forward and backward linkages in terms of credit and market extension services would be strengthened through this intervention.

The sectoral improvement would improve the productivity of Land, generating employment, improving economic conditions of the farmers and entrepreneurs, enhancing exports and providing nutritional security to the people is widely acknowledged.

5.5.12.2 Import and export potential

Similarly, many also expressed that with an increase in exports and marketability of produce there would be proportionate increase in household level spending on goods and services. Thus the study postulate the rising incomes would lead to new demand, thereby creates a multiplier effect. This is because an injection of extra income leads to more spending, which creates more income, and so on. However, the size of the multiplier depends upon household's final spending and their marginal propensity to consume (mpc), or marginal propensity to save (mps).

In addition to that, Himachal Pradesh is only state in the country whose 89.96 percent of population (Census 2011) lives in rural areas. Therefore Agriculture/Horticulture is dominant as it provides direct employment to about 62 percent of total workers of the state. Agriculture happens to be the premier source of State Income (GSDP). About 10.4 percent of the total GSDP comes from the agriculture and its allied sectors.

Thus with the increase of area of apple fruit cultivation at an average growth of 1.5 percent every year, the project would further provide impetus to boost horticulture sector in the state and livelihoods of diverse stakeholders who are part of the entire value chain.

5.5.12.3 Multiplier effect

Similarly, the Stakeholder consultations have revealed that the project would create a long term multiplier effect for the farmers and local, national economy given change in marketing linkages, government spending which would cause a larger change in an output, gross domestic product of horticultural sector in Himachal Pradesh and India.

It would also results in agricultural multiplier effect, where in investing in farming leads to larger-reaching benefits for the apple growers as an entire community. By connecting growers to better markets, the project would increases income levels of apple growing households, to afford good education for children, healthcare for elderly, create jobs, and keeps their environment healthy. Arguably, all of this would enable to uplift grower community from poverty for the long term.

5.5.13 On-going schemes at state and national level

The state of Himachal Pradesh has many schemes for the welfare and upliftment of women, farmer groups, marginalized and deprived sections of society. The following are some of the centrally/State sponsored schemes which have larger developmental outreach and impact.

a) Self-Employment schemes for women

Under this scheme Rs.2,500 provided to the women whose annual income is less than Rs.7,500 for carrying income generating activities.

b) Vishesh Mahila Uthan Yojna

There is a provision to provide stipend @ Rs.3,000 per month per trainee and test fee of Rs.800 per trainee through the department of Women and Child Development. Further, for those women who intend to start their own self-employment projects, a back ended subsidy is provided @ 20% of the project cost subject to maximum of Rs.10,000 per beneficiary, on loan arranged through HP Mahila Vikas Nigam.

c) Self Help Groups

These SHGs are doing income generating activities. So far, 66,106 SHGs have been formed out of which 64,451 SHGs have been linked with banks.

d) Kishori Shakti Yojna

This scheme is implemented to improve the nutritional and health status of girls in the age group of 11-18 years, to provide the required literacy and numeracy skills through non-formal education to train and equip the adolescent girls to improve/upgrade home-based and vocational skills and to promote awareness of health, hygiene, nutrition and family welfare, home management/ child care and to take all measure as to facilitate their marrying only after attaining the age of 18 years and if possible, even later; The scheme is being implemented in 8 Districts (46 projects). viz. Shimla, Sirmaur, Kinnaur, Mandi, Hamirpur, Bilaspur, Una and Lahaul & Spiti.

e) Rajiv Gandhi Scheme for Empowerment of Adolescent Girls

This scheme has been started in 4 districts viz., Solan, Kullu, Chamba, and Kangra in place of Kishori Shakti Yojna and also Nutritional Programme for Adolescent Girls (NPAG) in Kangra district.

f) HP Crop Diversification Promotion Project (JICA Oda Loan Project)

To encourage crop diversification in Himachal Pradesh a project in collaboration with Japan International Cooperative Agency (JICA) has been started since June, 2011. The project area comprises 5 districts Kangra, Mandi, Hamirpur, Bilaspur and Una. The project period is 7 years i.e. 2011 to March 2018 and the total project cost is

Rs.321 Crores (Loan Rs.266 Crores and State share Rs.55 Crores). The following are major activities funded under the scheme:

- Organization of farmers groups
- Promotion of organic farming
- Vegetable promotion training
- Food grain productivity enhancement
- Post-Harvest / Marketing
- Collection centers (23 Nos.)

g) Soil & water conservation

Due to topographical factors, the soil is subject to splash, sheet and gully erosion resulting into degradation of the soil.

Besides this, there is biotic pressure on the lands and to curb this menace particularly on the agricultural lands, the Department of Agriculture, H.P. is executing two Soil and Water Conservation schemes under State Sector Scheme. The schemes are:

- Soil Conservation Works
- Water conservation and development

h) Mukhya Mantri Kisaan Evam Khetihar Mazdoor Jeevan Suraksha Yojna

With a view to provide Insurance cover to the Farmers and Agricultural Labourers in the event of sustaining injury or death due to operation of farm machinery, the State Government has launched a Scheme called; 'Mukhyamantra Kisaan evam Khetihar MazdoorJeevan Surakhsha Yojna in 2015-16. In case of the death and permanent disability, a compensation of Rs.1.5 Lakh and in case of partial disabilities, compensation up to Rs.50,000 will be provided to the affected. A provision of Rs. 40.00 lakhs has been kept for 2017-18.

i) Promotion of organic farming

The State has diverse agro-climate conditions and due to its favorable positioning in the Himalayan region, has great scope for promotion of Organic farming. The use of chemical fertilizers and pesticides in the State is very low and 80% of the area is rain fed. The State Government formulated a Policy on Organic Farming in 2010 and has covered 39,440 farmers with an area of 21,603 ha under Organic farming. During current financial year 2,000 hectare additional area is being covered under organic farming. During current financial year 20,000 Vermi-Compost Units with 50 per cent assistance will be set up. This year Government will develop 200 bio-villages. To promote organic farming in the State, the Government has started Mukhya Mantri Jaivik Kheti Puraskar Yojna from this year.

j) Mukhya Mantri Green House Renovation Scheme:

Farmers of the state have demanded that there should be a scheme to replace the Poly sheets. Therefore, the Government of Himachal Pradesh has introduced a new scheme Mukhya Mantri Green House Renovation Scheme. Under this scheme, 50 % subsidy will be provided to the farmers for the replacement of poly sheet after 5 years of setting up of polyhouse or damage due to natural calamities. A budget provision of 3.0 crore has been kept for the year 2017-18.

Chapter 6

Social and Environmental Impacts of Project

6.1 Environmental impacts - Impact prediction and evaluation

The environmental impacts associated with the proposed project are identified, characterized and evaluated systematically. The extent of impact on air, water, soil, flora, and fauna has been evaluated in relation to the environmental pollution. The impacts may be distinctly direct and indirect, positive and negative, reversible and irreversible. The prediction of impacts on various environmental parameters during construction and occupation of the proposed project assists in effective identification of mitigation measures to minimize the adverse impacts on environmental quality. The prediction of impacts on different areas has been studied using scientific tools and the results are estimated. Such predictions are superimposed over the baseline (pre-project) status of environmental quality to develop the ultimate (post-project) scenario of the environmental conditions.

The successful environmental impact assessment process requires proper identification, prediction, assessment and also communication of the significant environmental impacts to the public. The details on impact of the project activity on each of the disciplines mentioned above are discussed below.

The environmental impacts associated due to proposed project are classified into construction, operation and post operation phases and the possible impacts are assessed.

1) Construction phase impacts

Construction activity is temporary activity till construction and establishment of new machinery takes place in the proposed project. To minimize the impacts during construction period necessary control measures will be adopted, so that the environmental damage is minimized. The positive and negative impacts due to this activity are given below.

Negative impacts

- Dust generation during leveling of earth, movement of vehicles on unpaved roads, Unloading of raw materials and removal of waste material from site
- Emission of pollutants from vehicular exhaust
- Site formation may produce large quantities of run-off with high suspended solids; this potential problem will be of higher magnitude during rainy season.
- Construction of various civil structures generates site runoff which results in significant pollution in the receiving water bodies during the rainy season.

- Washing of the construction equipment will also result in water pollution.
- Domestic wastewater from labor and staff present onsite
- Noise pollution due to foundation works, concreting works, piling, steel cutting and fabrication of structures, etc.,
- Noise generated from running of pumps, motors, construction equipment, etc., and movement of trucks carrying construction materials
- Construction & demolition waste consists of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets, plastic material, paper, etc.
- Municipal waste generation from construction workers
- Compaction of soils by earth moving equipment, vehicles used for construction purpose
- Erosion (wind and water) and modification of surface
- Disturbing natural drainage contours, slopes
- During construction phase, dust and noise pollution will be affecting nearby flora and fauna of the facility but necessary control measures will be taken up.

Positive impacts

- Improvement of local infrastructure (approach roads, street lights, etc.)
- Demand for housing, hotels, etc., will increase the earning of the local persons
- Temporary employment to local labour
- Improved business to local vendors
- More revenue to governing departments in form of taxes, fees, etc.

2) Operation phase impacts

During operation period the fruits handling capacity of the project will be increased, so the local farmers will be able to utilize the services of the upgradation of the industrial unit. The positive and negative impacts due to this activity are given below.

Negative impacts

- Emissions (PM, SO₂ and NO_x) from stacks attached to boiler and DG sets.
- Emissions from vehicles carrying raw materials and finished products.
- Emissions arising from processing and handling of raw materials, finished products, intermediates products, etc.
- Emission of pollutants from solid waste handling and wastewater treatment plant area.
- Odour generation from thermal processing steps such as steam peeling, blanching and dehydrating and microbial action in stored solid waste areas
- Fruit processing activities typically generated large volumes of effluents containing organic loads, cleaning agents, salt and suspended solids. They may also contain pesticide residues washed from raw materials.

- Major waste water generation is from fruits washing, floor/equipment washings, boiler blow down, etc.
- Domestic wastewater from eating areas and sanitary facilities
- Noise generation from bottling machines, conveyors and blanching applications
- Running of pumps, motors for pumping and transferring liquids etc.,
- Generation of Solid wastes such as organic materials, including spoiled and rotten fruits
- Solid waste in the form of inedible materials and rejected products from sorting, grading and other production process
- Sludge from wastewater treatment facilities
- Not maintaining proper storm water drains, rain water harvesting pits, etc.
- Increase in traffic problems due to increased movement of heavy vehicles
- Increase in accidents due to the speed of the vehicles

Positive impacts

- Additional employment due to proposed modernization
- Additional business for local traders
- Reduction in pollution due to improved pollution control measures
- Developments of new projects are aimed at providing goods and services to improve community's living standards.
- Projects therefore present an opportunity for the community to achieve economic and social development for the ultimate well-being of a community or nation.
- The proposed activities will be environmental friendly due to adopting of new technology meeting national standards
- Industrialization leads to urbanization by creating economic growth and job opportunities that draw people to cities.
- Changes can be felt in social and living conditions of the surroundings areas.
- Industries will increase in wealth, the production of goods, and the standard of living. People had access to healthier diets, better housing, and cheaper goods

3) Post-operation phase impacts

During post operation period the impacts can be due to decommissioning of the industry and making use of the site for any other new activity, the industrial activity proposed modernization is planned as long term activity with life of the project 30 years. The negative and positive impacts envisaged are given below.

Negative impacts

- Dust generation due to de-commissioning of the industry on the neighboring areas
- Emissions from vehicles carrying construction and demolition waste for disposing at designated area

- Increase of traffic on the roads due to movement of trucks
- Generation of scrap material (hazardous waste, electronic and electrical waste, e-waste, etc.,) which needs to be disposed as per the existing standards at the time of de-commissioning
- Loss of the employment to workers employed in the industry

Positive impacts

- Availability of developed land area having all required infrastructure
- Development of new activity suitable for the current period following all modern manufacturing environmentally friendly process
- Use of industrial land for new establishment of new facility with environmental friendly technologies may simplify regulatory and legal procedures
- Reuse of site may compensate for the negative socio-economic impact of the old facility with outdated technology
- Some systems and utilities of the old facility may be used in a new one
- Less man power more production having edge in the market for marketing the finished product at cheaper price than the competitor

6.1.1 Air environment

During construction period the possible dust sources associated with the construction activities include site clearance, site formation, building works, loading and unloading of the raw materials (viz., bricks, cement, sand, etc.), top soil removal, vehicular movement over unpaved roads, wind erosion etc. The potential source of air quality arising from the existing / proposed fruit processing unit is fugitive dust generation. The major pollutant dust, measurable as Particulate Matter (PM) would be generated as a result of these activities. The possible activities that contribute to the environmental impacts are broadly given below:

- Dust Generation during leveling of earth
- Dust generation due to the movement of vehicles on unpaved roads
- Emission of pollutants from vehicular exhaust
- Unloading of raw materials and removal of waste material from site

During operation period in fruit processing industry there are no major air emissions envisaged from the production activities and only source of air pollution are combustion products from boilers and D.G. sets. The possible activities that contribute to the environmental impacts are broadly given below:

- Emissions (PM, SO₂ and NO_x) from stacks attached to boiler and DG sets.
- Emissions from vehicles carrying raw materials and finished products
- Emissions may arise from solids handling, solid reduction, drying.
- Emission of pollutants from solid waste handling and wastewater treatment plant

- Odour generation from thermal processing steps such as steam peeling, blanching and dehydrating and microbial action in stored solid waste areas.

6.1.1.1 Impact on air quality

Prediction of impacts on air environment

For study the impacts on air quality from point source emissions and vehicular traffic in the project area American Meteorological Society / Environmental Protection Agency Regulatory Mode - AERMOD model version: 7.0.3 was used, which is a steady-state dispersion model designed for short-range (up to 50 km) dispersion of air pollutant emissions from different sources. It is used to predict the ground level concentrations (GLCs) of pollutants due to the existing/proposed upgradation project. The GLCs were predicted on 24 hourly average basis and the line source concentrations are shown in the form of isopleths. The main sources of air pollution are as follows:

1. Point source emissions from boiler and DG sets.
2. Line source emissions from Vehicular movement

The main point source emissions in the project are from boiler and DG sets. The DG set is used during power break down.

Atmospheric dispersion of stack emissions

The model considers the sources and receptors in undulated terrain as well as plain terrain and the combination of both. The basis of the model is the straight line steady state Gaussian Plume Equation.

$$C(x, y, z) = \frac{Q}{2\pi u \sigma_y \sigma_z} e^{-\frac{y^2}{2\sigma_y^2}} \left(e^{-\frac{(z+H)^2}{2\sigma_z^2}} + e^{-\frac{(z-H)^2}{2\sigma_z^2}} \right)$$

Where C = Plume contaminant concentration ($\mu\text{g}/\text{m}^3$)

Q = Pollutant emission rate (g/s)

u = Average wind speed (m/s)

σ_y = y direction plume standard deviation (m)

σ_z = z direction plume standard deviation (m)

y = y position (m)

z = z position (m)

H = Effective stack height (m)

AERMOD dispersion model with the following options has been used to predict the cumulative ground level concentrations due to the emissions. Area being rural, rural dispersion parameters is considered

- Predictions have been carried out to estimate concentration values over radial distance of 2km around the sources.
- A combination of Cartesian and Polar receptor network has been considered.
- Emission rates from the sources were considered as constant during the entire period.
- The ground level concentrations computed were as is basis without any consideration of decay coefficient.
- Calm winds recorded during the study period were also taken into consideration.
- 24-hour mean meteorological data extracted from the meteorological data collected during the study period as per guidelines of IMD/CPCB has been used to compute the mean ground level concentrations to study the impact on study area.

The details of the boilers and DG sets used in the project are given in **Table 6.1 & Table 6.2.**

Table 6.1: Stack emissions details – Existing

Details	Boilers (2 x 3 Tons)		DG set
Capacity	3 Tons	3 Tons	100 kVA
Type of fuel	Furnace oil	Biomass	HSD
Height of the stack (m)	30	30	7
Temp of flue gas (°C)	140	120	420
Internal dia. of the stack (m)	0.85	0.85	0.2
Velocity of flue gas (m/s)	14	14	12
Volumetric flow rate (m ³ /s)	7.94	7.94	0.38
PM Emissions (g/s)	0.05	0.02	0.004
SO ₂ Emissions (g/s)	3.9	0.84	0.004
*NO _x Emissions (g/s)	0.29	0.29	0.09
Emission Standards considered			
DG Set: Sulphur content in diesel - 10 mg/kg As per BS-VI Standards PM & NO _x limit are 0.2 & 4 g/kW-h as per Gazette of India - G.S.R .771(E) Environmental (Protection) third amended rules dated 11 th December 2013. Boiler: Furnace oil Ash 0.1 %, Sulphur max 4% : *NO _x Considered as 130 g/GJ from pollution prevention and abatement handbook (World Bank group-industry sector guidelines) Boiler: Biomass Ash 5.5 %, Sulphur 0.7%: Efficiency of Boiler (control measures) 99.5%.			

Table 6.2: Stack emissions details – Proposed

Details	DG Set
Capacity	250 kVA
Type of fuel	HSD
Height of the stack (m)	3.5
Temp of flue gas (°C)	420
Internal Dia. of the stack (m)	0.2
Velocity of flue gas (m/s)	16
Volumetric flow rate (m ³ /s)	0.65
PM emissions (g/s)	0.011
SO ₂ emissions (g/s)	0.012
*NO _x emissions (g/s)	0.22
Emission standards considered	
<p>DG set: Sulphur content in diesel - 10 mg/kg As per BS-VI Standards</p> <p>PM & NO_x limit are 0.2 & 4 g/kW-h as per Gazette of India - G.S.R .771(E) Environmental (Protection) third amended rules dated 11th December 2013.</p> <p>Boiler: Biomass Ash 5.5 %, Sulphur 0.7%: Efficiency of boiler (control measures) 99.5%. *NO_x Considered as 130 g/GJ from pollution prevention and abatement handbook (World Bank group-industry sector guidelines)</p>	

The major emissions from the line sources are from movement of vehicles carrying raw materials and finished products, line source modeling is done considering worst traffic volume expected to the project site. The inputs used for using the model are vehicle details, emission details, and a twenty-four hour mean meteorological data during study period.

The meteorological data vehicle details, emission factors (existing & upgradation) used for modeling are given in **Table 6.4** and **Table 6.5** respectively.

The predicted maximum ground level concentrations obtained from the modeling are added to maximum baseline values monitored for getting post project scenario and the same are presented in **Table 6.6** for point and line source emissions. The isopleths obtained for point source emissions (upgradation) are shown in **Figure 6.1** to **Table 6.3** and isopleths obtained for line source emissions (upgradation) are given in **Figure 6.4** to **Table 6.6**.

Table 6.3: Mean meteorological data - August 2018

Hour	Temperature (°C)	Relative humidity (%)	Wind direction (Degree)	Wind speed (m/s)	Stability class
1	18.7	81	270	0.87	6
2	18.4	82	270	1.01	6
3	17.8	83	240	1.02	6
4	16.9	84	270	1.13	6
5	16.8	84	270	1.23	6
6	18.7	83	225	1.12	6
7	19.1	81	270	1.46	5
8	20.1	79	270	1.67	5
9	21.4	77	290	1.48	4
10	22.4	73	290	2.13	3
11	23.7	68	270	2.33	2
12	25.8	66	270	2.56	1
13	26.4	65	270	2.67	1
14	25.7	68	270	2.45	1
15	23.5	70	290	2.23	2
16	22.5	72	240	2.12	3
17	22.7	74	60	2.04	4
18	21.1	75	270	1.87	4
19	21.6	76	225	1.45	5
20	20.2	78	270	1.68	5
21	20.4	79	270	1.45	6
22	20.8	80	290	1.37	6
23	19.9	80	270	1.06	6
24	19.7	81	60	1.04	6

Table 6.4: Inputs and emission factors for line source emissions (Existing)

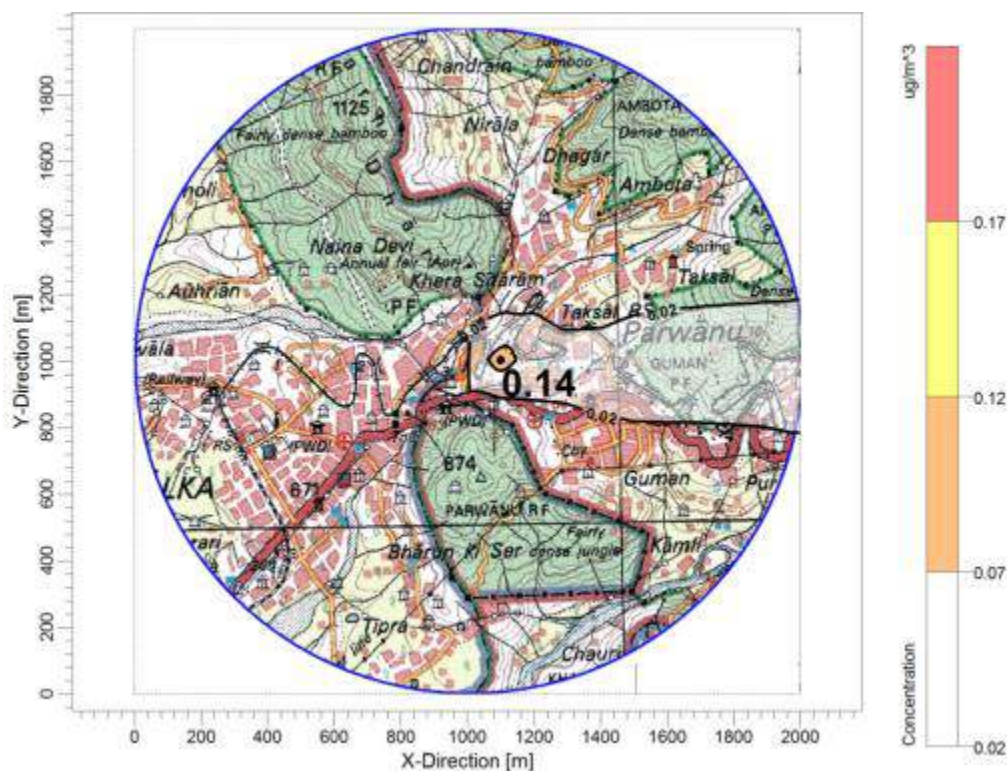
As per Automotive Research Association of India (ARAI) – Emission Factor (g/Km)/Vehicle								
Vehicle type	No. of vehicles/day	Vehicles /hr	PM		NOx		CO	
			Factors (g/Km)	Emission (g/s)	Factors (g/Km)	Emission (g/s)	Factors (g/Km)	Emission (g/s)
Heavy Vehicles (HCV)	3	1	0.30*	0.0008	6.50	0.018	3.92	0.011
Light Vehicle (LCV)	5	2	0.47	0.0026	2.12	0.012	3.66	0.020
Car	2	2	0.015	0.0001	0.28	0.002	0.06	0.0003
Two wheeler	2	2	NA	-	0.54	0.003	1.48	0.008
Input values in modeling (g/s)			--	0.0035	-	0.035	-	0.0393
Emissions= Emission factor x No. of Vehicles x Velocity (Vehicle speed 10 km/hr near site area) Consider only peak hours, LCV=Medium trucks, Small trucks & Vans *Sample calculation = 0.30 g/Km x 1 x 10 Km/hr = 3 g/hr = 0.0008 g/s								

To assess the impact on Air quality based on traffic from the fruits transportation PM, CO and NO_x are the important pollutants emitting from the traffic and transportation.

Table 6.5: Inputs and emission factors for line source emissions (Proposed)

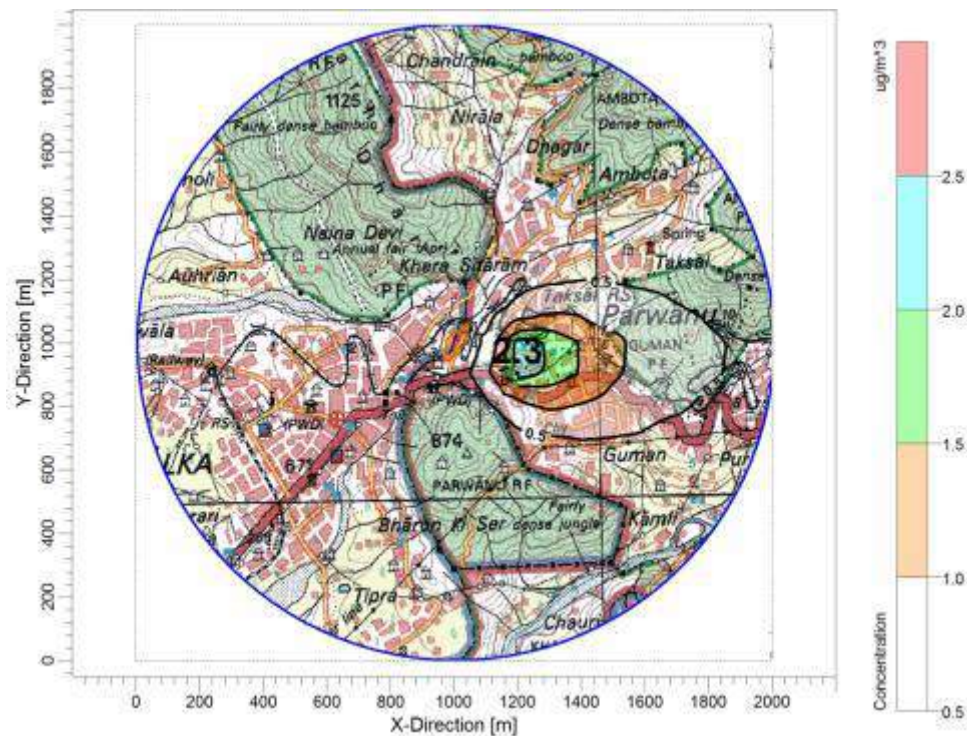
As per Automotive Research Association of India (ARAI) – Emission factor (g/Km)/vehicle								
Vehicle Type	No. of Vehicles/day	Vehicles /hr	PM		NOx		CO	
			Factors (g/Km)	Emission (g/s)	Factors (g/Km)	Emission (g/s)	Factors (g/Km)	Emission (g/s)
Heavy Vehicles (HCV)	1	1	0.30*	0.0008	6.50	0.018	3.92	0.011
Light Vehicle (LCV)	1	1	0.47	0.0013	2.12	0.006	3.66	0.010
Car	2	2	0.015	0.0001	0.28	0.002	0.06	0.0003
Two wheeler	2	2	NA	-	0.54	0.003	1.48	0.008
Input values in modeling (g/s)			--	0.0022	-	0.029	-	0.0293
Emissions= Emission factor x No. of Vehicles x Velocity (Vehicle speed 10 km/hr near site area)								
Consider only peak hours, LCV=Medium trucks, Small trucks & Vans								
*Sample calculation = 0.30 g/Km x 1 x 10 Km/hr = 3 g/hr = 0.0008 g/s								

Figure 6.1: Predicted 24 hourly average GLCs of PM – Point source (Proposed)



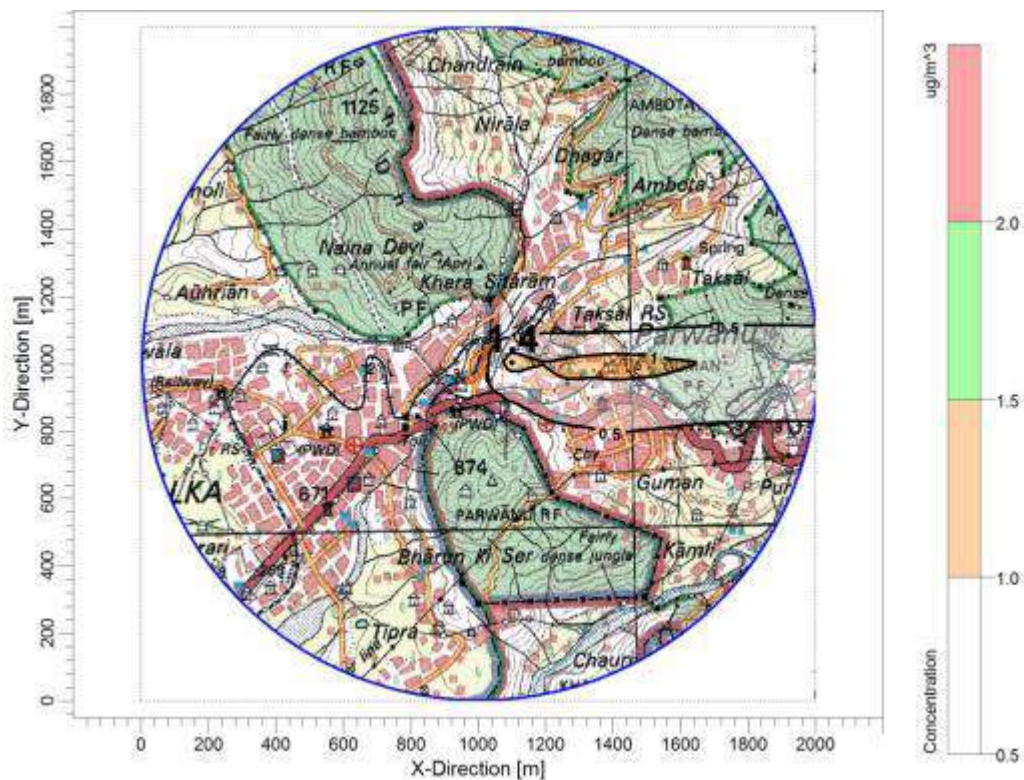
Max. Concentration of PM: 0.14 $\mu\text{g}/\text{m}^3$ @0.10 km in E direction

Figure 6.2: Predicted 24 hourly average GLCs of SO₂ - Point source (Proposed)



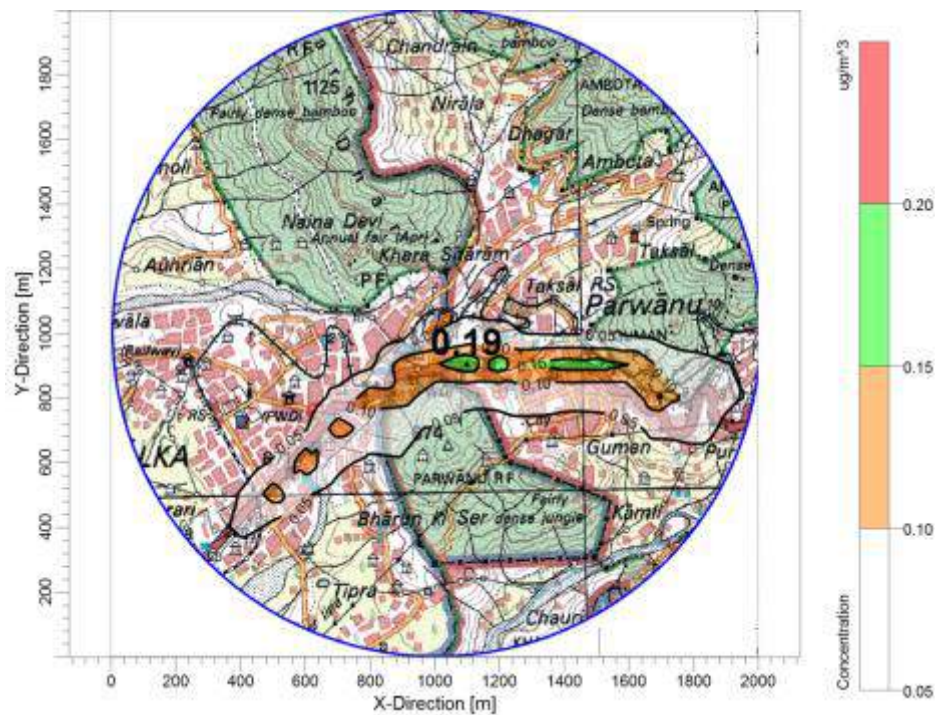
Max. Concentration of SO₂: 2.3 $\mu\text{g}/\text{m}^3$ @0.20 km in E direction

Figure 6.3: Predicted 24 hourly average GLCs of NO_x - Point source (Proposed)



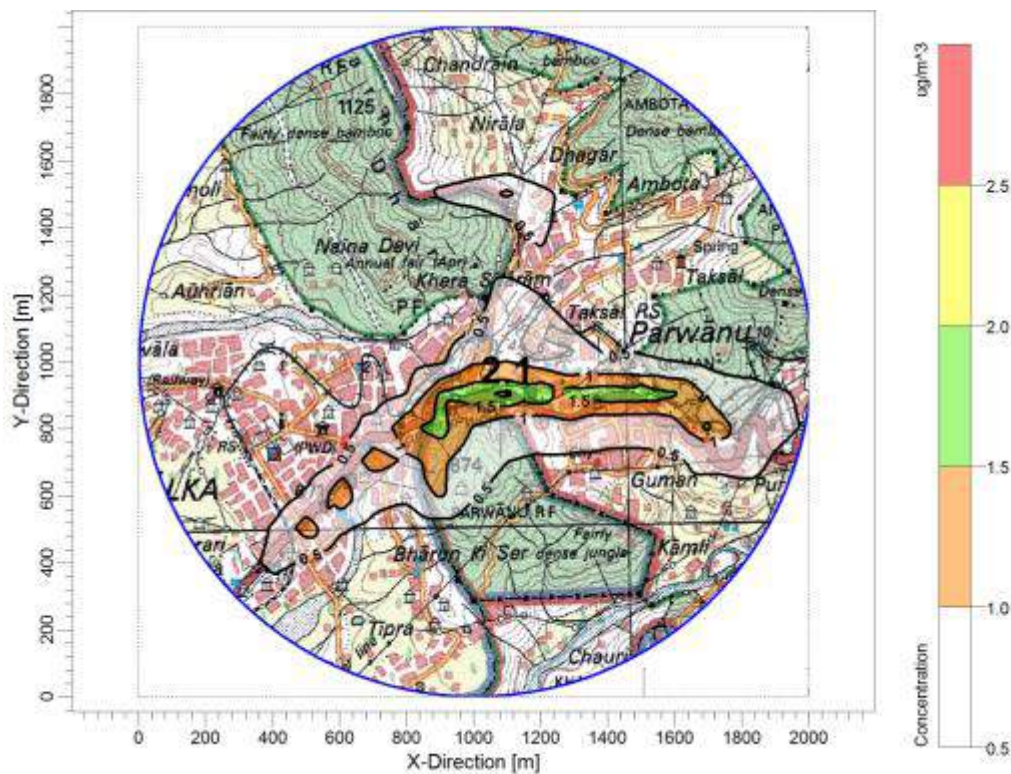
Max. Concentration of NO_x: 1.4 $\mu\text{g}/\text{m}^3$ @0.20 km in E direction

Figure 6.4: Predicted 24 hourly average GLCs of PM - Line source (Proposed)



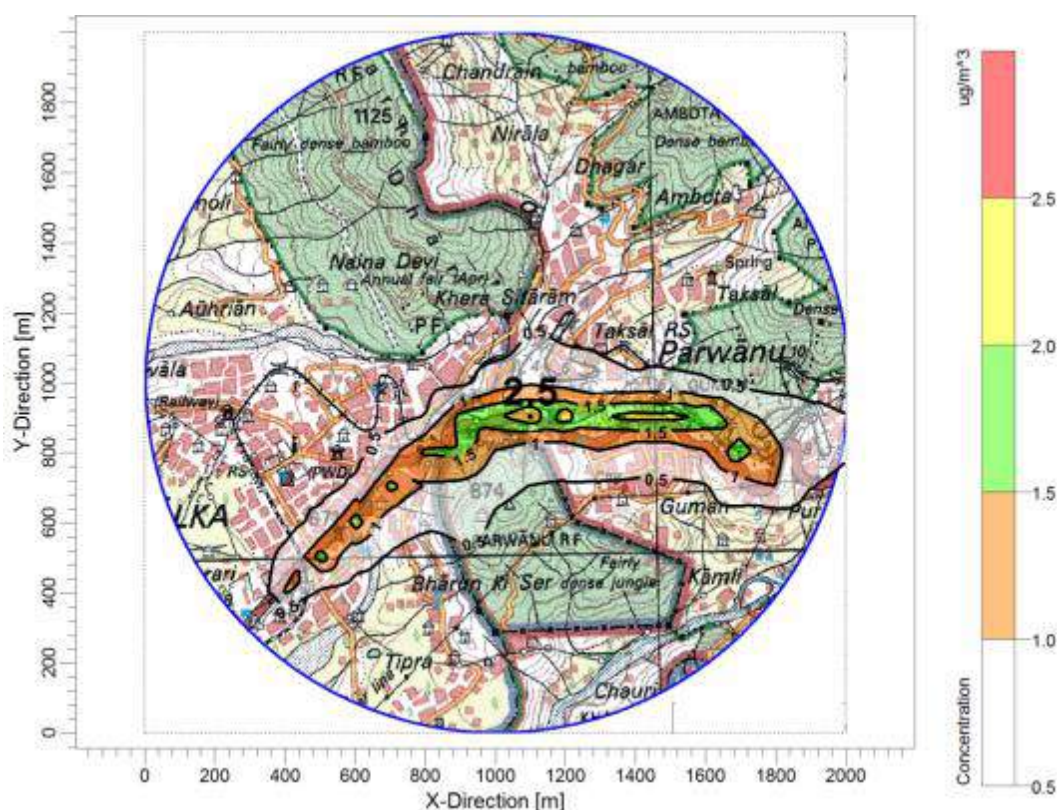
Max. Concentration of PM: 0.19 $\mu\text{g}/\text{m}^3$ @10 m from the road

Figure 6.5: Predicted 24 hourly average GLCs of NO_x - Line source (Proposed)



Max. Concentration of NO_x: 2.1 $\mu\text{g}/\text{m}^3$ @10m from the road

Figure 6.6: Predicted 24 hourly average GLCs of CO - Line source (Proposed)



Max. Concentration of CO: 2.5 $\mu\text{g}/\text{m}^3$ @10 m from the road

Table 6.6: Post project scenario – Point & Line source emissions ($\mu\text{g}/\text{m}^3$)

Particulars	Existing & Proposed			
	Particulate Matter (PM ₁₀)	Sulphur dioxide (SO ₂)	Oxides of Nitrogen (NO _x)	Carbon monoxide (CO)
Contribution from existing plant to baseline(Point source)	0.61	22.7	4.8	--
Contribution from existing plant to baseline(Line source)	0.30	--	2.5	3.4
Baseline Scenario (Max)	52.1	13.9	23.2	--
Predicted GLCs from proposed expansion plant (Point source)	0.14	2.3	1.4	-
Predicted GLCs from proposed expansion plant (Line source)	0.19	--	2.1	2.5
Future predicted GLC	52.43	16.2	26.7	2.5
MoEF&CC/CPCB Standards – 24 hourly	100	80	80	--

The air emission released from the operations of DG sets and boiler are quantified for PM, SO₂ and NO_x with 0.02g/s, 0.84g/s and 0.29g/s respectively based on the quantity of fuel used and the composition of fuel burned. The dispersion modeling carried out for predicting the incremental rise in the pollutant concentration levels uses the local meteorological conditions along with the stack characteristics and type of fuel burned. The level of uncertainty expected in the results of the predicted values is negligible as all the model inputs are very much quantified with information of stack details. The predicted concentration levels for PM, SO₂ and NO_x are 0.14µg/m³, 2.3µg/m³ and 1.4µg/m³ as per the output results from AERMOD software.

6.1.2 Water environment

The construction phase would involve water for site preparation, leveling for infrastructure development, removal of vegetation, roads formation, etc. Water is required for dust suppression, consolidation, compaction and curing. Construction of building infrastructure involves water for construction activities and domestic activities which include water requirements for labour and staff onsite. The possible impacts from these activities are as follows.

- Site formation may produce large quantities of run-off with high suspended solids, this potential problem will be of higher magnitude during rainy season.
- Construction of various civil structures generates site runoff which results in significant pollution in the receiving water bodies during the rainy season.
- Washing of the construction equipment will also result in water pollution.
- Domestic wastewater from labor and staff present onsite

During operation period fruit processing activities typically results in generation of large volumes of solid wastes and process wastewaters containing organic matter and suspended solids. Process wastewaters are generated from contact of water with fruits during washing, blanching, cooling and other processing steps. The majority of horticultural crops are irrigated; hence the industry contributes to water scarcity problems and carries a responsibility to reduce water use and causes of contamination. Wastewater will be generated from eating areas and the sewage will be generated from sanitary facilities. Significant impact on water quality is envisaged if the sewage is discharged directly into the receiving waters without any prior treatment. Over-exploitation of the water resources by the labor for domestic purposes and processing units will create water scarcity. The possible major impacts envisaged on water environment are as follows.

- Fruit processing activities typically generated large volumes of effluents containing organic loads, cleaning agents, salt and suspended solids. They may also contain pesticide residues washed from raw materials.

- Major streams are from fruits washing, floor/equipment washings, boiler blow down, etc.
- Domestic wastewater from eating areas and sanitary facilities

6.1.2.1 Effluent conveyance system & disposal

The main sources of wastewater generation from the unit are industrial wastewater and domestic wastewater, the project being fruit processing industry, the main pollutants in the wastewater are Suspended solids, BOD and COD, initial fruit washings may contain trace amounts of pesticides. The details of wastewater generation are given in **Table 6.7** and wastewater characteristics before and after treatment are given in **Table 6.8**.

Table 6.7: Wastewater generation

Details	Quantity KLD	Remarks
Domestic	5	Treated in ETP (50 KLD) and partly reused and excess discharged into streams
Industrial	25	
Total	30	

Table 6.8: Wastewater characteristics

Parameter	Units	Effluent ^{##}	Max. permissible values ^{\$\$}	
			Into inland surface water	On land for irrigation
pH	-	6 to 9	6-9	6-9
BOD ₃ , 27°C	mg/l	900 to 1000	30	100
COD	mg/l	1600 to 1700	250	250
TSS	mg/l	200 to 250	100	100
Oil & Grease	mg/l	15 to 20	10	10
Source : ^{##} Comprehensive industry document-COINDS/56/1996-97-CPCB ^{\$\$} MoEF&CC Notification SO 4 (E) January 1st, 2016				

The domestic wastewater and industrial wastewater generated is collected and treated in an effluent treatment plant. The treated wastewater is partly used for industrial uses floor washing, gardening, etc., and excesses treated wastewater meeting discharge standards will be disposed into nearby stream.

Hence the uncertainty of the impact results is negligible. Similarly the water related quantities withdrawn from the source and subsequent utilization in certain unit operations are as per the design basis and as per the product requirements. Thus the uncertainty of these consumptions of water is also negligible.

6.1.3 Noise environment and transportation

During the construction phase of the site the following sources of noise pollution is expected

- Foundation works
- Concreting works
- Piling, steel cutting and fabrication of structures, etc.,
- Running of pumps, motors, construction equipment, etc.,
- Movement of trucks carrying construction materials

A variety of operations in fruit processing units generate substantial noise levels, some of the major activities of the same are given below.

- Noise generation from bottling machines, conveyors and blanching applications
- Running of pumps, motors for pumping and transferring liquids etc.,
- Movement of trucks carrying fruits and subsequent traffic of vehicles
- Use of boiler, DG set and other mechanical equipment's

6.1.3.1 Impacts on noise

Impacts on the ambient noise due to the proposed industrial activities were studied using Custic version 3.2 (Noise pollution modeling software). The Custic software estimates the dispersion of noise in air. The numeric algorithms that Custic uses give the possibility to study the noise pollution that we find in our environment. The numerical method uses an equation that estimates the dispersion of the noise in air. The software admits meteorological data to establish the form of the noise pollution and calculates the sound emission that is produced by each one of the sources and it considers the estates of the sources and state of atmosphere.

The main sources of the noise generating equipment in the project and there noise levels are given in **Table 6.9**, the figure showing isolines generated is given as **Figure 6.7** and the noise isolines values observed near the boundary of the plant and future predicted noise is given in **Table 6.10**. The ambient air quality standards in respect of noise are given in **Table 6.11**.

Table 6.9: Details of noise generating equipment - dB(A)

S.No	Equipmnet	Nos.	Noise	Remarks
1	Water pump	1	100	Used as and when required for pumping water
2	Boilers	2	95	Boiler is used during working hours for steam generation
3	DG sets	2	90	Used during power failure

Table 6.10: Noise values observed at boundary of the project – dB(A)

S.No	Boundary of the project	Noise Predicted	Ambient Noise	Noise Future Predicted	Remarks
1	North	61	57	62	The noise values are within the industrial zone standards
2	South East	71	65	72	
3	South	66	60	67	
4	West	61	59	63	

Table 6.11: Ambient air quality standards with respect to noise - dB(A)

S.No	Category Area/Zone	Limits in dB(A) Leq		Remarks
		Day time	Night time	
1	Industrial	75	70	The noise pollution (regulation & control) rules, 2000 Day time – 6.00am to 10.00pm Night time – 10.00pm to 6.00am
2	Commercial	65	55	
3	Residential	55	45	
4	Silence	50	40	

Figure 6.7: Noise Isopleths



Note: Contour interval is 3.98 dB(A), Grid distance 70.0m

6.1.3.2 Impacts on transportation

Transport is the basic infrastructure, which is usually a pre-requisite for day to day travel. Loading and unloading areas of raw material are closed/ covered in order to decrease the air pollution in the nearby areas and hazards that it might cause due to the dust. Maximum amount of air pollution is generated in handling, loading and unloading of raw materials. The lack of lighting on the roads leads to accidents while transportation. Improper parking of vehicles may result in traffic congestion.

6.1.4 Solid waste

The construction phase solid waste will comprise of excavated and demolition waste, broken bricks, tiles, and construction rejects. Some of the major sources of the solid waste generation are given below.

- Construction waste consists of sand, gravel, concrete, stone, bricks, wood, metal, glass, polythene sheets, plastic material, paper, etc.
- Segregation has to be done at the site for maximum reuse and recycle
- Municipal waste generation from workers

During operation period in the fruit processing units, solid waste is one of the main issues which need to be addressed properly to avoid occupation of major land area. Some of the major sources of solid waste generation envisaged are given below.

- The main solid wastes are organic materials, including spoiled and rotten fruits
- Solid waste in the form of inedible materials and rejected products from sorting, grading and other production process
- Sludge from wastewater treatment facilities

6.1.4.1 Solid waste collection & disposal

As the existing fruit processing plant proposed for upgradation, the nature of solid waste will be majorly pomace, spoiled fruits, processed fruit packages, etc. Apart from this, office stationery like paper, cardboards, packages, plastic bags etc., are also included.

The sludge from the treatment plant can be used as manure within the premises. The details of the solid waste generated are given in **Table 6.12**. The rejected fruits, peels, rejected cuttings; inner core/seed and separated solids from pulper, crusher from fruit processing unit will be collected and sold for reuse as cattle feed. Alternatively, these solid wastes can be composted (vermicomposting) and used as manure to farms. The recyclables will be disposed to local vendors and compostable waste will be converted to compost and used as manure to farms, whereas the non-compostable solid waste will be disposed into local municipal bins.

Table 6.12: Details of solid waste generated

S. No	Details	Solid waste generation	Total (kg/day)	Remarks
1	Domestic	0.2 kg/capita/day	22	Domestic waste shall be sent to OWC and recyclable waste to local vendors
2	Process	220 kg/ton*	6600	
Total			6622	
Note: Production capacity existing 30 TPD * Comprehensive industry document-COINDS/56/1996-97-CPCB				

6.1.5 Soils, Hydrogeology and Land use

The impacts due to construction activity can be envisaged on soils, hydrogeology and land use of the project site. Some of the major impacts that are caused are given below.

- Compaction of soils by earth moving equipment, vehicles used for construction purpose
- Erosion (wind and water) and modification of surface
- Indiscriminate disposal of solid waste generated on land
- Disturbing natural drainage contours, slopes

During operation period the impacts on soil and hydrogeology is not much envisaged when compared to construction period. Some of the impacts envisaged are given below.

- Discharge of wastewater not meeting standards on land
- Not maintaining proper storm water drains, rain water harvesting pits, etc.

Land use

The industries considered in this study do have both positive and negative impacts on the environment. The positive impacts are more in the nature of social services to their host communities. Of greater significance to this study are the negative impacts of fruit processing on land use and land capability, noise and vibration, environmentally sensitive areas and visual quality. Pollution of environmental elements resulting from unrestrained activities of the food processing industries has impacted negatively on land use and land capability for man, aquatic life, flora and fauna.

Displacement of agricultural production, loss of forestry and pasture lands; cracks on buildings near or adjacent to the industries due to vibrations from heavy machines; noise pollution from processing machines leading to hearing loss/impairment;

reduced shell-fish yield; increased commercial and social activities; and distortion of visual content and coherence.

The processing industries are a part of our environment and are often major generators of wastes.

Industrial waste is a major source of environmental pollution which effects of pollution on geology, soil and ecology include depletion of natural reserves, endangered terrestrial habitats leading to migration of arboreal animals to safer places and loss of them in the host communities, increased compaction due to increased vehicular and human traffic and reduction in yield of lands within the vicinity of the industries. The reduced soil fertility could be attributed to leachate from chemical wastes from the processing facility.

6.1.6 Flora and Fauna

Since the facility is going only for upgradation of capacity, so no major impacts would be anticipated. During construction phase, dust and noise pollution will be affecting nearby flora and fauna of the facility but necessary control measures will be taken up.

During operation phase (such as increase in movement of vehicles) may cause increase in fuel and noise emissions which will be controlled by noise acoustics and other measures to minimal the effect on surrounding environment of the project site. The envisaged impacts and its mitigation plan are discussed in the Environmental Management Plan (EMP) during construction phase & operation phase with cost implication plan.

6.2 Socio-economic impacts

Development projects are aimed at providing goods and services to improve community's living standards. Such projects therefore present an opportunity for the community to achieve economic and social development for the ultimate well-being of a community or nation.

6.2.1 Impact on lifestyle

Horticultural projects are labor intensive and tend to encourage population densities to increase because the increased prosperity of the area attracts incomers. The increase of the labor raises local demand for food, housing and other social amenities. Large and new horticultural projects attract temporary populations during construction and operation period. Large scale horticultural farms employ a large number of female workers who were previously not earning money. This may change perception at family level and change of roles previously held by men. Some of the impacts which are felt are given below.

- Deterioration of health of nearby residents
- Increase in traffic problems due to increased movement of heavy vehicles
- Increase in accidents due to the speed of the vehicles

6.2.2 Infrastructure development

The proposed project will boost the local economy through payment of royalties, taxes, levies and other charges to the County and central governments. The project will also open up the area for similar and other varied investments. The net effect will be improved infrastructure in the area and better living standards. Some of the positive and negative impacts from the project are given below.

- The pressure on the existing infrastructure will be observed
- Upgradation of existing roads, intersection to be done or new roads have to be laid
- The demand of housing, hotels, shops will be generate additional revenue for locals
- Ancillary industries will be coming up in the nearby areas

6.2.3 Employment potential and safety concepts

The proposed project will create employment opportunities for both skilled and unskilled labor and preferences will be given to women empowerment by providing them equal employment opportunities with men. Unemployment is rampant in rural areas and especially in areas that have low agricultural potential. The project is expected to generate both direct and indirect employment during construction and operation period. Much of the work will be manual and will not require any specialized training. This will thus open opportunities for the rural women and youth who comprise the largest proportion of the rural population. Priority will be given to persons from the local community to ensure that the project uplifts their living standards.

Movement of new comers into the area will expose the local culture to integration with cultures of other people leading to gradual cultural change as has happened in other areas. The loss of culture not only eliminates the harmful practices in a community but may also interfere with the norms and value systems that helps sustain peace and harmony within a community. There may be changes in traditional livelihood strategies, conflict resolution mechanisms e.g. that may have a significant impact on development of the community (either negative of positive). Safety concepts considered in the project are given in **Table 6.13**.

Table 6.13: Safety concepts

S. No.	Details	Remarks
1	Personal Protective Equipment (PPE)	Appropriate PPE (dust masks, gloves, safety goggles, etc.) will be given to workers as per the requirement.
2	Occupational Health Safety (OHS)	All employees will be informed about various Occupational health safety during recruitment and at regular intervals Regular health and safety audits will be carried out
3	First aid and medical needs	In every department some of the employee will be trained in first aid. First aid kits will be kept at security office and important locations Periodical health checks up will be organized as per the rules
4	Sanitation and drinking water	Sufficient number of toilets will be provided for males and females as per the requirement Safe drinking water will be provided to all the workers Regular cleaning of toilets will be done to keep it clean and hygiene

6.2.4 Occupational health & safety and public involvement

Occupational health is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their job. Establishing a safety and health program at the workplace is one of the most effective ways of protecting the workers. Workers in this industry are exposed to a wide range of hazards as described below:

6.2.4.1 Physical hazards (collision, lifting and repetitive work)

Physical hazards include exposure to same-level fall hazards due to slippery conditions, the use of machines and tools, and collisions with internal transport equipment.

- Maintain walkways and working surfaces to be clean and dry by preventing spillages water/liquids during operation
- Risk assessment should consider which other work area specific hazards may be present (e.g. rolling barrels or kegs)
- When hand knives are in regular used, knife resistant protective clothing should be worn as determined by the risk assessment (e.g. an apron and forearm guard/glove for the hands)
- Hand tools should be maintained in good condition so that undue force is not required to use them.

- Ensure likely injury-producing tasks are not given to known sufferers and injury-aggravating tasks not given to past sufferers and employee rotation for repetitive tasks
- Give careful consideration to methods of stacking, handling and movement of goods to prevent articles falling
- Workers must be trained in proper lifting techniques and workstations should be designed to ensure that the worker has enough workspace.

6.2.4.2 Exposure to noise

Some operations such as bottling and use of conveyors cause workers to be exposed to excessive noise levels. Engineering control measures should be used to reduce the noise levels, and personal protection should be emphasized.

6.2.4.3 Confined spaces

To avoid dangers for workers working in confined spaces the following precautions has to be taken.

- Proper ventilation to be there at the working place inside the facility
- All access points must be secured against entry or signs must be used to identify confined spaces
- Install exhaust ventilation at the source to reduce dust

6.2.4.4 Burns due to steam

Exposure to hot water or steam may cause scalding and/or first, second or third degree burns. A burn or scald is generally very painful. They appear red, blistered, and may be swollen or look wet, shiny and may be white or discoloured. The extent of the injury depends on the temperature of the water and the duration of the exposure. The treatment required depends on the severity of the burn. Control measures to reduce the risks to the lowest possible level includes

- Identifying and implementing control measures that reduce the risks to the lowest possible levels
- Reporting, investigating and implementing control measures in regard to any incidents to the authority to ensure they don't happen again
- Documenting this process so that there is evidence of everything that has been done in the workplace to reduce the risks to the lowest possible levels

6.2.4.5 Control of health hazards

There should be adequate medical supervision for personnel comprising pre-hiring clinical screening, periodic medical examination and rehabilitative care for any affected workers. A comprehensive risk assessment should be carried out on

commencement of operations so that specific measures for control and mitigation of workplace hazards and risks are put in place.

6.2.4.6 Ergonomics

All personnel should be trained on the basic ergonomics principles. This should cover the correct lifting, carrying and setting down techniques to prevent incidences of hernias, sprains, strains, back injuries and other muscular-skeletal disorders due to improper handling of objects.

6.2.4.7 Employees' pro-active safety attitudes

Regular training on pro-active safety attitudes for employees would instill a sense of responsibility upon the employees, and in this way, increase employee's efforts towards avoiding occurrence of accidents due to negligence, ignorance or carelessness.

6.3 Environmental risks

6.3.1 Evaluation of potential adverse onsite risks

The principal objective of the risk assessment study is to identify and quantify the major hazards and the risk associated with various operations of the proposed project, which may lead to emergency consequences (disasters) affecting the public safety and health.

The unpredictable nature of natural hazards occurring in the area leads to the vulnerability of people at the site. Based on this information, an emergency preparedness plan is to be prepared to mitigate the consequences. The approach involves hazards identification, hazards assessment and evaluation, developing Disaster Management Plan (DMP).

6.3.1.1 Scope of study

The risk analysis/assessment study covers the following:

- Identification of potential hazard areas and representative failure cases
- Assess the overall damage potential of the identified hazardous events and impact zones from the accident scenarios
- Furnish specific recommendations on the minimization of the worst accident possibilities

6.3.2 Hazard identification

Identification of hazards is the primary task for planning for risk assessment in the analysis, quantification and cost-effective control of accidents involving chemicals and processes. A classical definition of hazard states that it is the characteristic of system/process that presents a potential for an accident. Hence, all the components

of a system/process need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. The methods employed for hazard identification in this study are:

- Identification of major hazards based on Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) amendment rules, 2000 and
- Occupational health and safety of workers

The type, quantity, location and conditions of release of toxic or flammable substances have to be identified in order to estimate its damaging effects, the area involved and possible precautionary measures required to be taken. Based on vulnerability involved, various hazards due to nature and in the areas of unit operations are identified and given in **Table 6.14 & 6.15**.

Table 6.14: Vulnerability due to natural hazards

S. No	Hazard type		Intensity
1	Geophysical	Earthquake	Very high (Zone V)
		Landslide	Moderate to low
		Forest fire	Low
2	Hydrological	Flash flood	Low
		Lightening	Low

Table 6.15: Potential risk areas within the facility

S. No	Blocks/areas	Hazards identified
1	Control room	Fire in cable galleries and switchgear/control room
2	Transformer blast/fire	Fire, personnel injury
3	Boilers	Steam explosions, fire
4	Feed materials storage	Fire, dust explosion
5	LDO/HSD tanks	Fire/ explosions
6	Equipment failure	Personnel injury

6.3.2.1 Earthquake

As per the BIS seismic zoning map entire region falls under Zone V [High Damage Risk Zone (MSK<VIII)], on the buffer zone of thrust and fault lines which makes the facility liable to the severest design intensity of earthquake as shown in **Figure 6.8**. The precautions to be taken during after earthquake are given in **Table 6.16**.

Preparedness measures

The NDMA (National Disaster Management Authority) guideline “management of earthquakes” highlights the necessary details for achieving safety against earthquakes.

- Construction of earthquake resistant building as per codes IS: 1893 (Part 1):2002 and IS 1893: Part 4: 2002
- Retrofitting of the existing building and structures to code specified level
- Place large and heavy objects at ground level and provide strong support to gas and power appliances
- Educate workers about the basic first-aid instructions which may be useful after a severe earthquake and conduct safety training and drills informing necessary authorities

Figure 6.8: Earthquake hazard map



Table 6.16: Precautions to be taken for earthquake

During an earthquake	After an earthquake
<ul style="list-style-type: none"> • Remain calm and try to reassure others • Stay away from glass windows, mirrors, chimneys and other projecting parts of the building • Try to get under a table, desk or stand in the inner corner away from the windows • If possible, move to an open area way from the falling hazards 	<ul style="list-style-type: none"> • Check for injuries, do not attempt to move seriously injured persons unless they are in immediate danger of further injury • Be prepared for additional earthquake shocks called 'aftershocks' after a major earthquake • Inform and request for help from the civil defense, fire services, police, home guards and other public safety officials • Do not crowd the damage areas unless help has been requested

6.3.2.2 Landslide

The landslide vulnerability for the site falls in the moderate to low risk zone as per the **Figure 6.9**. The site is situated at valley point with terrain being moderately sloppy, experiencing major slope from east direction as per the contour map given in **Figure 6.10**. Due to the proposed infrastructural activities chances of occurring of landslides is very low. However, the precautionary measures which can be taken to reduce the damage if caused are:

- The site construction should be in line with the following codes and guidelines, finalized and published by the BIS
 - i) IS 14496 (Part 2): 1998 Guidelines for the preparation of LHZ maps in mountainous terrain: Part 2: Macro Zonation
 - ii) IS 14458: Guidelines for Retaining Walls for Hilly Areas
 - iii) IS 14680:1999: Guidelines for Landslide Control
- Have an emergency kit ready and necessary communications facility in working condition
- Protect the property by planting ground cover on slopes and build retaining walls

Figure 6.9: Landslide hazard map

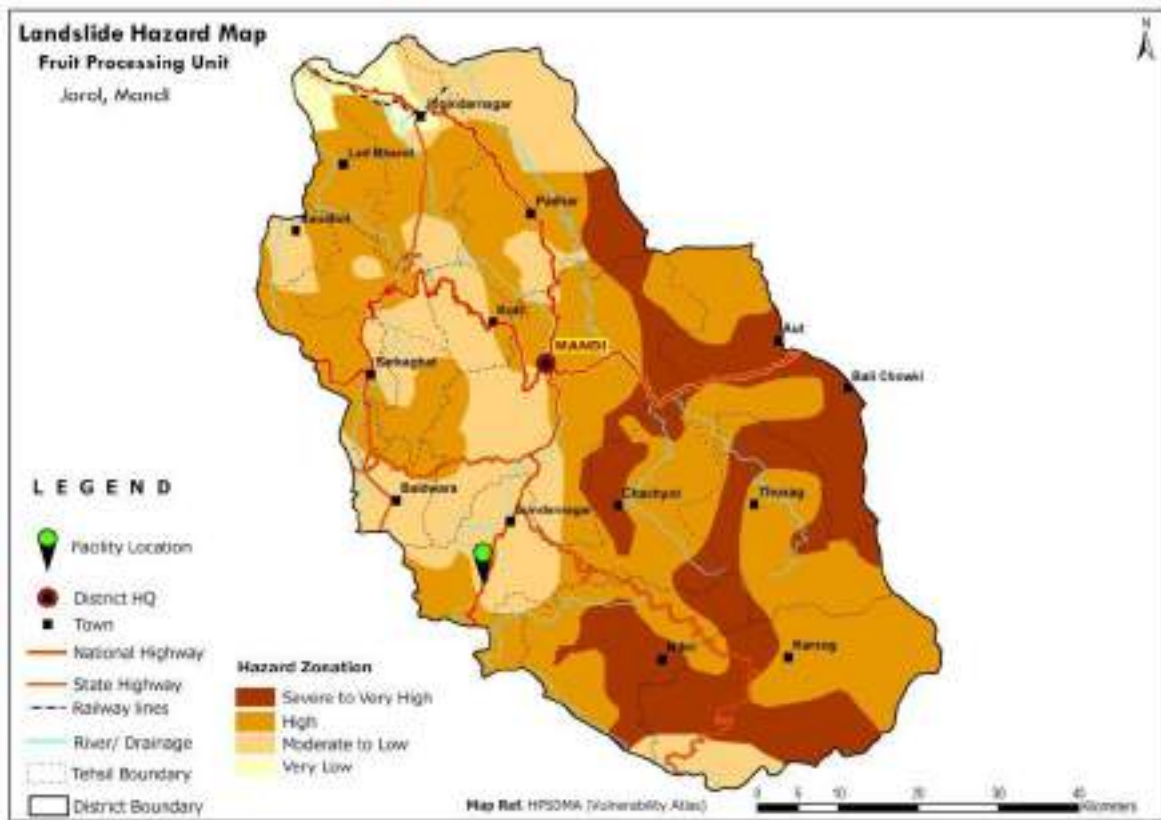
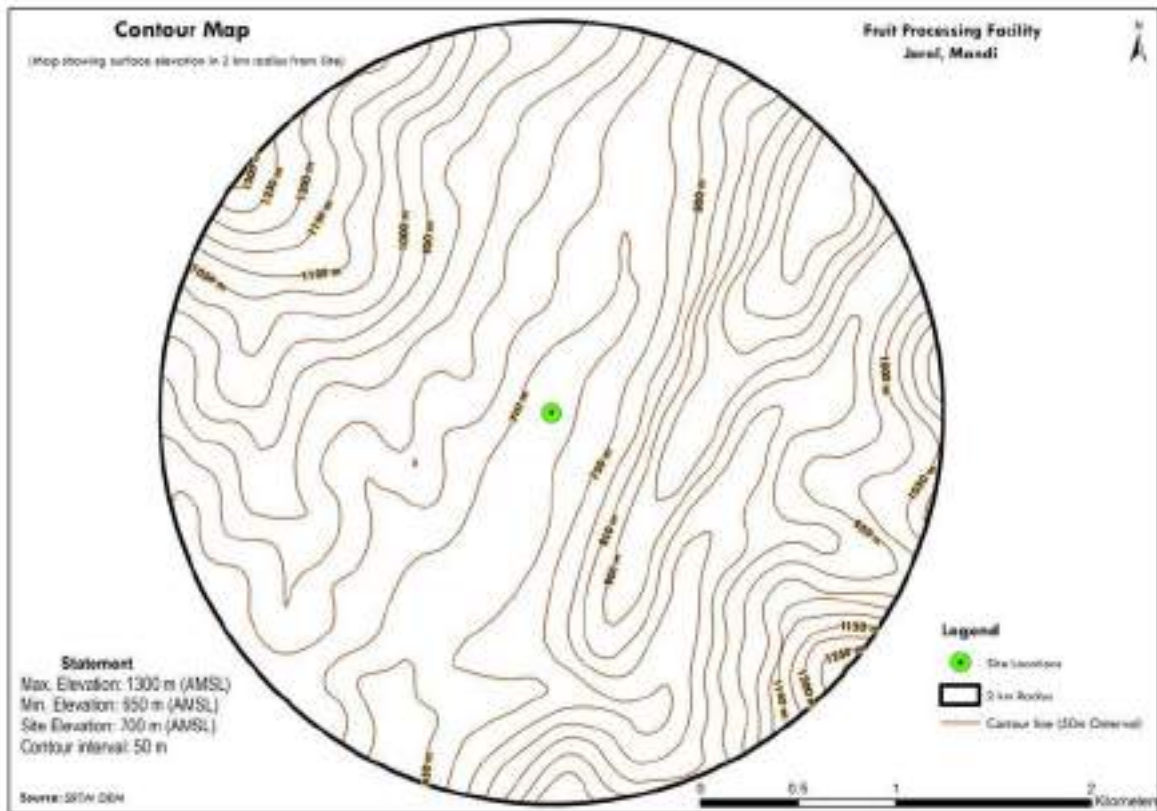


Figure 6.10: Contour map



6.3.2.3 Flash floods

The project is closer to Jarol Khad, which is a seasonal drain and at a lower elevation w.r.t site. As per the flood history, no such incidents have been reported and elevation is decreasing westward from site hence accumulation of water within the premises would not be of much concern. However certain measures can be taken in rise of any major emergency. The flood hazard map for the site is given in **Figure 6.11**.

- Sewerage and storm water systems to be provided
- Provision to be made to harvest most of the rain water at the site. This will reduce the water shortage as well as runoff water on the site
- Turn off electricity to reduce the risk of electrocution

Figure 6.11: Flood hazard map



6.3.2.4 Lightning

The area experiences incidents of lightning strike, but no significant casualty has never been reported. To decrease the impact of such on the facility lightening arrester (Copper rod) can be placed at top of the building.

6.3.3 Major accidents and hazards from storage / operations

6.3.3.1 Maximum credible accident analysis

Hazardous substances may be released as a result of failures or catastrophes, causing possible damage to the surrounding area. Identification of causes and types of hazards is the primary task for assessing risk. Hazards can happen because of the nature of chemicals handled and also the nature of processes involved. A pre-requisite for risk analysis is to identify and study the hazardous chemicals associated with risk.

Identification of hazardous chemicals is done in accordance with “Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Amendment Rules, 2000”. Schedule 1, of the Rule, provides a list of toxic and hazardous chemicals and the flammable chemicals. The threshold quantity of chemicals that can be stored as per MSIHC rules are given in **Table 6.17** and physical properties of the chemicals are given in **Table 6.18**.

Table 6.17: Details of chemicals and applicability of GoI rules

Solvent	Storage type	Listed in scheduled	Threshold quantity (Tons) for Application of Rules	
			4,5,7-9,13-15	10-12
High speed diesel (HSD)	Tank	Schedule 1 (part I)	5000	50000

From the above table, it can be inferred that there would be no major hazardous chemicals stored at the proposed plant which would attract the GoI rules 4, 5, 7-9 and 13-15. Further, as the quantities likely to be stored at site lie below the stipulated threshold quantities major hazards are not anticipated. The quantity of chemicals stored at site is given in **Table 6.19**.

Table 6.18: Physical properties of chemicals at site

Chemical	Codes/ Label	TLV	BP	FP	LEL	UEL
			(°C)			%
HSD	Flammable	800 ppm	215 - 376	32	0.6	6.0
Note: TLV - Threshold Limit Value; BP - Boiling Point; MP - Melting Point; FP - Flash Point; UEL - Upper Explosive Limit; LEL - Lower Explosive Limit						

Table 6.19: Hazardous chemicals at the project site

Chemical	Use	Nature of chemical	Type of storage & Nos.	Storage quantity
HSD	Fuel for D.G sets	Flammable	Tank - Vertical & 1No.	2 kl

6.3.3.2 Fire Explosive Toxicity Index (FETI) for HSD

The computations of FETI (Fire and Explosion, Toxicity Index) for HSD at proposed site are shown in **Table 6.20** and the subsequent F&EI categories are given in **Table 6.21**. The capacity of the HSD storage tank mentioned in the table above was considered for these studies. The Health (N_h), Flammability (N_f), Reactivity (N_r), and MF (Material Factor) under consideration was derived from the NFPA (National Fire Protection Association) codes. The GPH (General Process Hazard Factor) and SPH (Specific Process Hazard Factor) was calculated accordingly. Based on F&EI (Fire and Explosion Index), HSD and other solvents comes under “Low” category and ranges from nil to moderate toxicity.

Table 6.20: F&EI of fuel and solvents for the proposed project

Chemical/Fuel	NFPA Classification				GPH	SPH	*F&EI	Toxicity Category	F&E Category
	N_h	N_f	N_r	MF					
HSD	1	2	0	10	1.8	2.8	50.4	Nil	Low
Note: *F&EI = MF *(GPH) * (SPH)									

The F&EI values are ranked into the following categories

Table 6.21: F&EI category

S. No	F&EI	Category
1	1-60	Low
2	60-90	Medium
3	90 and above	Severe

Hazard from fuel storage

Diesel is a flammable liquid having a flash point of 32°C. Major hazards from oil storage can be fire and maximum credible accidents like

- a) Tank fire and
- b) Pool / dyke fire

a. Tank fire

Oil is stored in a floating roof tank; any leak in rim seal or spillage leads to accumulation of vapor which can be a source of ignition and can cause tank fire.

b. Pool / dyke fire

If there is outflow from the tank due to any leakage from tank or any failure of connecting pipes or valves, oil will flow outside and form a pool. If an ignition source is present, the pool can catch fire and can cause pool or dyke fire. The level of damage caused by heat radiation due to fire is a function of duration of exposure as well as heat flux and is true for effect on building, plant equipment and also for the effect on personnel. The effect of heat radiation with damage intensity is given in **Table 6.22**.

Table 6.22: Effect of heat radiation

Thermal radiation (kW/m ²)	Damage intensity due to thermal radiation
37.5	100% lethality in 1 minute. 1% lethality in 10 seconds
25.0	50% lethality in 1 minute. Significant injury in 10 seconds
12.5	1% lethality in 1 minute
8.0	1% lethality in 50 seconds
4.5	Causes pain if duration is longer than 20 sec, however blistering is unlikely
1.6	Causes no discomfort on long exposure

Tank rupture is considered as one of the major accidental scenarios. It is assumed that complete liquid leaks due to tank failure or ruptures and develops into a pool and gets ignited. Hazard distances have been arrived due to effect of pool fires. For computing the damage distances, Areal Locations of Hazardous Atmospheres (ALOHA) software is used. Full tank storage capacity of 2 kl has been considered for the calculations for HSD. The effect of heat radiation and subsequent damage distances for HSD are given in **Table 6.23**. The risk contour on site layout and thermal radiation threat zone for HSD are given in **Figures 6.12 & 6.13**.

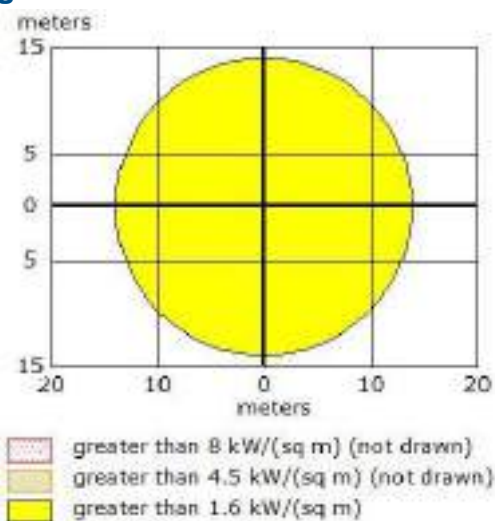
Table 6.23: Effect of heat radiation due to HSD storage tank (Pool fire)

Input data		Results of computation	
Spilled quantity	2 kl	Max. flame length	8 m
Circular opening diameter	2.5 cm	Max burn rate	21.4 kg/min
Wind speed	1.6 m/s	Total amount burned	1273 kg
Heat radiation at ground level kW/m ²		Damage distances (m)	
8		<10	
4.5		<10	
1.6		14	

Figure 6.12: Risk contour on site layout for HSD



Figure 6.13: Aloha threat zone for HSD



6.3.3.3 Major accidents and hazards from process operations

Some of the possible mechanical hazards in the unit are listed below and presented in **Table 6.24**.

- Machinery and equipment with moving parts like centrifuge, conveyor, booms or mechanical appendages (arms) that can be reached by people should be handled with care.
- Machinery and equipment like fruit mill, mash tank, filter press and hydraulic press that can eject objects (apple juice, filtered product and waste products) may strike a person with sufficient force to cause harm.
- Improper handling of boiler equipment involving high pressure gas may lead to major accidents, as high velocity and high heat steam and water are released. Failure of such equipment will lead to hazards at the work site.
- Fuel is stored for the operation of D.G. sets and other equipment. Any failure, damage or leakage in them would lead to hazardous atmospheres, harmful emissions for the personnel in their vicinity.

Table 6.24: Probable risks and hazards

Hazard	Risk
Hard surfaces moving together	Crushing
Scissor or shear action	Severing
Sharp edge – moving or stationary	Cutting or puncturing
Cable or hose connections	Slips, trips and falls

6.3.3.4 Boiler hazards

Irrespective of the type of fuel being fired, boiler explosion causes long outage and loss of generation resulting in loss of life and property. Evaluating the cause, documenting it for corrective and preventive action is essential. Various failures in the boiler are caused by the following:

- Operation of burners with insufficient air for perfect combustion
- Boiler fouling - increases the deposits in the tubes and risk of corrosion

Precautionary measures

- Major exposed portions of the boiler unit to be thermally insulated
- Regular inspection of safety valves for proper functioning
- Optimization of convective exchanger arrangement to prevent corrosion
- Avoid flue-gas preferential path, leading to temperature stratification and ineffective heat exchange
- Necessary measures and training to be given to the personnel operating near the boiler

6.3.3.5 Fire hazards

To increase the level of safety at the facility, installation of smoke alarms or automatic fire detection/alarm systems will be proposed at strategic locations as an early warning of fire to the occupants. To prevent fire mishaps and manage the emergency situation during a fire in the proposed project the following activities and precautions are proposed.

- An emergency evacuation plan to be prepared
- It will be advised to keep oxygen cylinders, medical kits and masks to prevent smoke inhalation.
- The plant manager is advised to ensure that the fire-fighting equipment is in good working conditions in sufficient numbers as there were no such equipment present
- Regular mock drills to create awareness on procedures to be followed in times of emergency situation/evacuation.

The management needs to take into consideration fire prevention measures at the project planning and during plant operation stage to avoid any outbreak of fire. Hence, following fire-fighting equipment to be employed:

1. ABC type fire extinguisher
2. CO₂ type fire extinguisher
3. Hose reel
4. Sand buckets

Safety precautions for the storage of fuel

- Separately stored with proper enclosures and marked within premises in a closed shed
- Proper ventilation to be provided
- Sufficient fire extinguishers and PPE to be provided
- Flameproof fittings to be provided
- Smoking to be prohibited

6.3.3.6 Electrical accidents

Electrical hazards can cause burns, shocks, and electrocution which can lead to serious injury and even death.

Prevention measures

- Flexible cords connected to appliance should be wired to confirm to the international colour code

- The appliance should preferably be tested and certified by a national or reputed standards testing authority
- All electrical wiring, rewiring or extension work must be carried out by licensed electrical contractors. On completion, the contractors should test before electricity supply is connected.
- To ensure electrical safety in the facility, a current-operated earth leakage circuit breaker (ELCB) or residual current circuit breaker (RCCB) set to operate at a very small leakage current is recommended. In case of dangerous electrical leakage to earth, it should automatically cut-off the supply of electricity.

The probability and risk assessment – Consequence Matrix is given in **Table 6.25** and the control measures of the associated risks are given in **Table 6.26**.

Table 6.25: Probability and risk assessment - Consequence Matrix

Consequences	Likelihood	Risk																																													
<ul style="list-style-type: none">• Type of harm could occur• Proximity to hazard/ task• People exposed	<ul style="list-style-type: none">• Often task done?• Exposure duration• Control measures, environment effect (temp., rains etc.), people's behavior (stress, panic, deadlines etc.)	<ul style="list-style-type: none">• Risk rating by consequence and likelihood <p>VH – Very High, H – High, M – Medium, L - Low</p>																																													
<p>5. Severe: Death or Permanent disability to one or more persons</p> <p>4. Major: Hospital Admission required</p> <p>3. Moderate: Medical treatment required</p> <p>2. Minor: first aid required</p> <p>1. Insignificant: Injuries not requiring first-aid</p>	<p>A. Almost certain: Expected to occur in most circumstances</p> <p>B. Likely: will probably occur in most circumstances</p> <p>C. Possible: might occur occasionally</p> <p>D. Unlikely: could happen at some time</p> <p>E. Rare: may happen only in exceptional circumstances</p>	<p>Resultant Table</p> <table><tr><th colspan="2"></th><th colspan="5">CONSEQUENCES</th></tr><tr><th colspan="2"></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><th rowspan="5">LIKELIHOOD</th><th>A</th><td>M</td><td>H</td><td>H</td><td>VH</td><td>VH</td></tr><tr><th>B</th><td>M</td><td>M</td><td>H</td><td>H</td><td>VH</td></tr><tr><th>C</th><td>L</td><td>M</td><td>H</td><td>H</td><td>VH</td></tr><tr><th>D</th><td>L</td><td>L</td><td>M</td><td>M</td><td>H</td></tr><tr><th>E</th><td>L</td><td>L</td><td>M</td><td>M</td><td>M</td></tr></table>			CONSEQUENCES							1	2	3	4	5	LIKELIHOOD	A	M	H	H	VH	VH	B	M	M	H	H	VH	C	L	M	H	H	VH	D	L	L	M	M	H	E	L	L	M	M	M
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Table 6.26: Control measures of the associated risks

Hazard	Task/Scenario	Associated harm	Control measures proposed	Risk rating		
				C	L	R
Earthquake	<ul style="list-style-type: none"> • Construction phase • Operation phase 	<ul style="list-style-type: none"> • Human life • Infrastructure collapse 	<ul style="list-style-type: none"> • Construction of earthquake resistant building • Educate workers on do's and don'ts during and after earthquake 	5	C	VH

Hazard	Task/Scenario	Associated harm	Control measures proposed	Risk rating		
				C	L	R
			<ul style="list-style-type: none"> Safety measures like first-aid, emergency contacts, other dept. etc., to be maintained 			
Landslide	<ul style="list-style-type: none"> Construction phase Operation phase 	<ul style="list-style-type: none"> Human life Infrastructure collapse 	<ul style="list-style-type: none"> The site construction should be in line with the following codes and guidelines Have an emergency kit ready and necessary communications facility in working condition Protect the property by planting ground cover on slopes and build retaining walls 	3	D	M
Flood	<ul style="list-style-type: none"> Water clogging Power shutdown 	<ul style="list-style-type: none"> Economic loss 	<ul style="list-style-type: none"> Sewerage and storm water systems to be provided Rain water harvesting measures Electricity cut-off to prevent electrocution 	1	E	L
Lightening	<ul style="list-style-type: none"> Rainy season 	<ul style="list-style-type: none"> Fire Infrastructure damage 	<ul style="list-style-type: none"> Installation of Cooper rods 	1	E	L
Fire	<ul style="list-style-type: none"> Short-circuits Combustible materials Fuel storage LPG cylinder blast 	<ul style="list-style-type: none"> Economic loss Human life Infrastructure damage 	<ul style="list-style-type: none"> Fire-fighting equipment of sufficient numbers to be kept Safety measures like smoke alarms, hose pumps, sand 	4	E	M

Hazard	Task/Scenario	Associated harm	Control measures proposed	Risk rating		
				C	L	R
			buckets, fire blankets etc. to be kept at prominent places • Staff training and mock drills to be conducted • Emergency fire exits to be maintained			
Electrical	• Economic loss • Electrocution	• Human life	• Electrical cables and lighting works to be done at a specified place/area • Proper grounding works to avoid static electricity build up • Certified appliances to be tried and tested before use • Use of intrinsically safe electrical installations and non-sparking tools	3	E	M
Physical/ Occupational Safety and Health	• Steam burns • Collision • Lifting • Repetitive work • Noise • Work at height • Material handling	• Human life	• Regular inspection of boiler unit • Personnel training • Implement strict use of PPE • Rotation of workers, use of better hand tools, equipment use for stacking and movement of goods • Proper ventilation and entry/exit signs to be placed	2	E	L

6.4 Social risks

The development projects would also trigger several risks which need to be addressed with well thought-out action plan and mitigation measures. The following are some of the key risks which are identified in case of the proposed project.

- The project might result in Influx of labour, especially migrant population to find a gainful employment.
- The project would result in increase of floating population specially, truck drivers, intermediaries, middlemen etc.
- The raise of floating population, influx of labour may adversely spread certain communicable diseases, if not checked.
- The frequent movement of vehicles would create air and noise pollution in the local dwellings.
- There may be an impact on indigenous population and their livelihoods; however no such risk is envisaged in case of this project.
- Third party contractors needs to be educated about rights and duties towards direct workers and contract workers
- Employment opportunities to the local people based on priority, educational qualification and skills
- Provision of infrastructural facilities for Workers' recreation, sanitation, health and Hygiene

Training programs for workers on efficient handling of waste, safety at work, gender mainstreaming, child labour and employment of indigenous people.

6.4.1 Market and occupational analysis

In order to develop the agricultural marketing in the state, the basic criteria to be followed are classified as below:

a) Governance

- The Agricultural Produce Marketing Corporation (APMC), which has been identified for taking up new markets or for upgradation, should have possessed clear title of the land available with them.
- They must have appreciable cash surplus for last preceding 3 years.
- They must have effective audit scheme in place and must not have any serious audit objections for last 3 years.
- They should have not been declared as defaulter by the Bank or board / institution.

b) Economic and technical

- The volume of trade conducted for last 3 years and throughout.
- Potential and catchment area of production and marketable surplus to be covered and benefited.
- Access to road, power supply and water supply etc.

SWOT Analysis:

- **Strengths:** The major strengths of the proposed project will be brand perception & advertising, Strong leading team & staff capabilities, focus on quality and reliability, reputation and credibility. Other strengths need for a center focusing on breeding and evaluation of new varieties, multidisciplinary research programs, effectiveness and resources for developing/breeding new varieties, effectiveness of screening and gradation.
- **Weaknesses:** Price of the apple products, Initial lack of power equipment.
- **Opportunities:** Constant market growth, loyal customer base, new alliances with stakeholder associations, flavor and quality, technology innovation to enhance products, health benefits of the fruits, positive publicity, sustainability and organics,
- **Threats:** Intense competition, water availability, lack of knowledge/appreciation for agriculture, climate and weather impacts, food safety, water quality, easily copied ideas from competitors.

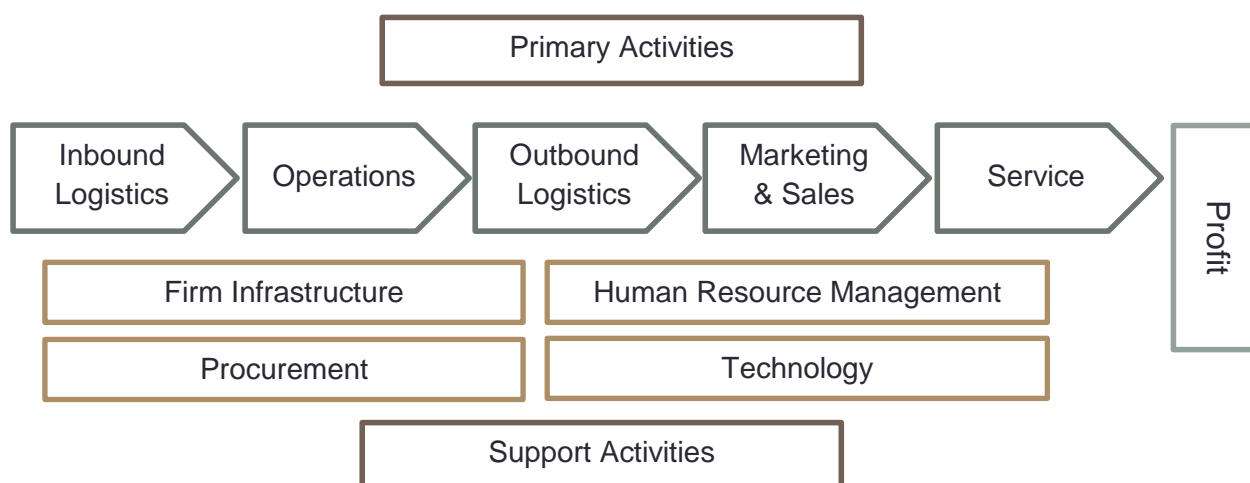
6.4.2 Value chain analysis

Value chain analysis (VCA) is a process where a firm identified its primary and support activities that add value to its final product and then analyze these activities to reduce costs or increase differentiation.

VCA is a strategy tool used to analyze internal firm activities. Its goal is to recognize, which activities are the most valuable (i.e., are the source of cost or differentiation advantage) to the firm and which ones could be improved to provide competitive advantage. In other words, by looking into internal activities, the analysis reveals where a firm's competitive advantages or disadvantages are. The firm that competes through differentiation advantage will try to perform its activities better than competitors would do. If it competes through cost advantage, it will try to perform internal activities at lower costs than competitors would do. When a company is capable of producing goods at lower costs than the market price or to provide superior products, it earns profits.

Value chain represents all the internal activities a firm engages in to produce goods and services. VC is formed of primary activities that add value to the final product directly and support activities that add value indirectly.

Figure 6.14: Value chain model



Although, primary activities add value directly to the production process, they are not necessarily more important than support activities. Nowadays, competitive advantage mainly derives from technological improvements or innovations in business models or processes. Therefore, such support activities as 'information systems', 'R&D' or 'general management' are usually the most important source of differentiation advantage. On the other hand, primary activities are usually the source of cost advantage, where costs can be easily identified for each activity and properly managed.

Management of the unit will regularly accesses the primary activities and support activities using modern techniques to reduce the expenses, cost of production by implementing regular audits, inspections and plug the waste expenses, increase the production output, reduce operation costs of manufacturing to improve the profits.

6.5 Magnitude of impacts

The time scale effects of the environmental impacts arising out of the proposed processing activities are of different types with the magnitude of project operations. The project construction activities to be undertaken are mainly of short term based on the design basis and available resources like manpower, raw materials, power and water etc., the impacts arising out of the project construction activities can be reversible with provision of environmental management plans in term of soil leveling and replantation of damage trees etc. The impacts of construction are also of temporary in nature. The time scale effects of the impacts during processing/operational phases are predicted to establish the incremental rise in the pollution levels due to various project operations. The usage of DG sets for project operations and the emission expected to be released and quantified to compare with the existing air pollutant levels. The incremental rise of particulate matter, SO₂ and NO_x are predicted by using AERMOD software to draw contours of concentration levels at each grid point of 2km X 2km scale covering a distance of 2km from the

project location. The impacts during the project operations are very minimal and there may not be any permanent changes expected from the project. The quantity of water used for the project will not lead to any medium or long term impacts due to sufficient availability of water supply from the regulatory departments.

Chapter 7

Analysis of Alternate Sites and Technologies

7.1 Site selection criteria concepts

In order to help the concerned authorities and the entrepreneurs, Ministry of Environment Forests & Climate Change (MoEF&CC), Government of India has framed certain broad guidelines for siting of projects to ensure optimum use of natural and man-made resources in sustainable manner with minimal depletion; degradation and or destruction of environment are given in **Table 7.1**.

Table 7.1: Site selection criteria – areas to be avoided

Land Procurement	Sufficient land to meet the demand of greenbelt development, reuse of treated water, storing of solid waste before final disposal
Coastal areas	At least 500 m from high tide line
Estuaries	At least 200 m away from the estuary boundaries
Flood plains of the Riverine system	At least 500 m from flood plain or modified flood plain, or by flood control systems
Transport / communications system	At least 500 m from highway and railway
Major settlements	At least 25 km from the project growth boundary of the settlement (3 lakh Population)
Ecologically and or otherwise sensitive area	At least 25 km (Archaeological monuments, National parks & Sanctuaries, Biosphere reserves, Hill resorts, Scenic areas, etc.,
Ecologically and/or otherwise sensitive areas include: 1) Religious & historic places, 2) Archaeological monuments, 3) scenic areas, 4) Hills resorts, 5) Beach resorts 6) Health resorts 7) Coastal areas rich in coral, mangroves, breeding grounds of specific species, 8) Estuaries rich in mangroves, breeding ground of specific species, 9) Gulf areas, 10) Biosphere reserves, 11) National parks and sanctuaries, 12) Natural lakes, swamps, 13) seismic zones, 14) Tribal settlements, 15) Areas of scientific and geological interest, 16) Defense installations, specifically those of security importance and sensitive to pollution, 17) Border areas (International), 18) Airports, 19) Tiger reserves/elephant reserves/turtle nestling grounds, 20) Habitat for migratory birds, 21) Lakes/reservoirs/dams	

7.2 Alternative sites- justification for selecting site

No alternate sites were considered for the proposed upgradation project as the existing site is having sufficient space for proposed upgradation and expansion and it is also meeting the broad guidelines suggested by MoEF&CC. The site is well

connected to road and rail transport, having experience staff, nearer to raw material availability, etc.

Table 7.2: Details of the site with respect to siting guidelines

Description: Site of existing fruit processing facility at Jarol village, Sunder Nagar tehsil, Mandi district, Himachal Pradesh state. (geo-coordinates: latitude & longitude – in DMS (degree minutes seconds): 31°27'44.35"N, 76°51'42.72"E; in DD (decimal degrees): 31° 27.739'N, 76° 51.712'E [tentative site centre location])

S.no	Criteria	Sub-criteria	Evaluation (with relative classes)	Site characters, environmental conditions, resources and others, evaluation class & justification
1	Topography	Elevation	Class-A: More than 3000 m amsl Class-B: Between 1000 to 3000 m Class-C: Less than 1000 m	Class- C (Good) Elevation: 700m (amsl)
		Slope	Class-A: More than 45° angle Class-B: Between 25 to 45° Class-C: Less than 25°	Class- C (Good) Slope: 7°
2	Land use/land cover	--	Class-A: Residential, industrial, prime agriculture land area, forest (reserved forest or protected forest), gullied or ravenous land, waterlogged area. Class-B: Earlier developed area or containing suitable civil structures. Class-C: Agriculture fallow land, open land, wasteland.	Class- B (Fair) Present land use: developed land plot
3	Hydrology	River/lake	Aerial distance: Class-A: Less than 200 m distance Class-B: Between 200 to 300 m Class-C: More than 300 m	Class- C (Good) There are no major rivers/lakes within 300 m of the project site. A minor seasonal stream, Jarol Khad is at a distance of 30 m (W). It is 5 m elevated above ground and a wide road – NH-154 is present between the site and stream.
4	Geology	Seismic	Class-A: Earthquake zone – IV & V	Class-A (poor)

		area	Class-B: Earthquake zone – III Class-C: Earthquake zone – II	Earthquake zone: IV *Although in hazard area, all the civil structures will be designed as per earthquake resistant design of features of new structures and/or strengthen existing structures.
5	Ecological and/or sensitive areas	--	Class-A: Within protected area and ecological sensitive zone (ESZ). Class-B: Away from ESZ. Class-C: Not within 10 km.	Class-B (Fair) Bandli WLS (ESZ) is about 1000 m (E) away from the site with a hill and a stream as barriers in between
6	Transport system	Roadway	Class-A: National highway (NH), state highway (SH), HPPWDs scheduled road and bye-pass road <15 m; District road < 10 m; Non-schedule and municipal roads < 3 m distance. Class-B: National highway (NH), State highway (SH), HPPWDs (Himachal Pradesh Public Works Department) scheduled and bye-pass road =15 m; District road = 10 m; Non-schedule and Municipal roads = 3 m distance. Class-C: National highway (NH), state highway (SH), HPPWDs scheduled and bye-pass road >15 m; District road >10 m; Non-schedule and municipal roads >3 m. Distance is from center line of road.	Class- C (Good) Highway: NH-154 (Pathankot–Sundernagar–Nauni road) is 16 m (W).
7	Habitation	Town/village/hamlet	Class-A: Less than 500 m distance Class-B: Between 500 to 600 m Class-C: More than 600 m	Class- B (Fair) Habitation: Jarol village is 500 m (S).

Note: -

- (i) Relative classes and grades for evaluation: Class-A (Poor), Class-B (Fair), Class-C (Good).
- (ii) Used acronyms of units/abbreviations: m=metre, km=kilometre, amsl= above mean sea level; direction: N for North, E for East, S for South, W for West, NE for Northeast, NW for Northwest, SE for Southeast and SW for Southwest; HPPWD = Himachal Pradesh Public Works Department of Government of Himachal Pradesh, India

Evaluation:	Class score:	Class-A	Class-B	Class-C
		1	3	4
Comments:	Overall rank	Good		
		As per the analysis of detailed screening criteria, the proposed project site can be accepted for Upgradation/expansion of proposed Fruit Processing Unit in the identified location from both social & environmental perspectives		

Used references:

(i) Topography, slope angle limit, as per document of Himachal Pradesh Town and Country Planning Rules-2014 amended 2016, Department of Town and Country Planning, Shimla, Government of Himachal Pradesh state, India. http://ud-hp.in/pdf/tcp_plans_2014.pdf

(ii) Land cover, as per environmental guidelines for industries of Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. http://moef.gov.in/wp-content/uploads/2017/06/moef_gov_in_citizen_specinfo_enguin_html.pdf

(iii) Hydrology: (a) setback distance to flood plain extent, flood plain of riverine systems, environmental guidelines for industries of Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. http://moef.gov.in/wp-content/uploads/2017/06/moef_gov_in_citizen_specinfo_enguin_html.pdf

(iv) Seismic area, earthquake hazard map of Himachal Pradesh, Himachal Pradesh State Disaster Management Authority of Government of Himachal Pradesh, India. <https://hpsdma.nic.in//admnis/admin/showimg.aspx?ID=1225>

(v) Ecological and/or sensitive areas, siting guidelines for industries, Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. http://moef.gov.in/wp-content/uploads/2017/06/moef_gov_in_citizen_specinfo_enguin_html.pdf

(vi) Transport system – roadway: (a) setback distance of structures from road, Himachal Pradesh Town and Country Planning Rules-2014 amended 2016, Department of Town and Country Planning, Government of Himachal Pradesh state, India. http://ud-hp.in/pdf/tcp_plans_2014.pdf

(b) Setback distance of structures from road, for city roads is 7 metres and non-schedule roads and municipal roads is 3 metres for apartments regulations, draft development plan of Shimla city of Shimla district in Himachal Pradesh state, Department of Town and Country Planning, Government of Himachal Pradesh state, India. http://tcp.hp.gov.in/Application//uploadDocuments/devlopmentPlan/PlanDoc020150127_173301.pdf

(vii) Habitation, distance to habitation, Manual of Swachh Bharat Mission, National Institute of Urban Affairs, Ministry of Urban Development, Government of India. <https://smartnet.niua.org/sites/default/files/resources/Book2.pdf>

7.3 Alternative technologies

7.3.1 Fruit processing industry

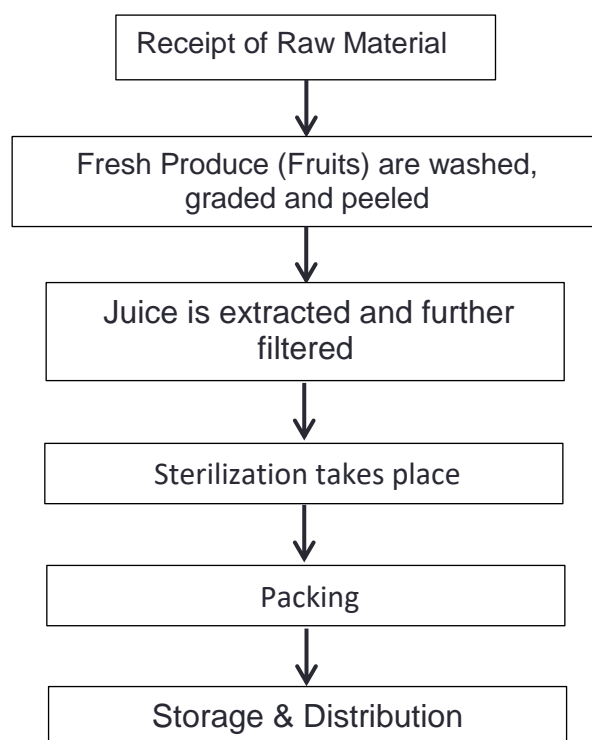
Fruits comprise vitamins, proteins, minerals and dietary fibres. Fruits are perishable in nature and there is a need to process fruits in order to increase their storage or

shelf-life significantly. Fruit processing is done to add value to the fresh fruits produce in a number of ways viz. canning, drying, freezing and new ingredient creation. There are various forms of processed fruits:

- **Pre- prepared fresh** (includes fruit salads, having a shorter storage life as they include added ingredients, such as sauces and flavourings)
- **Canned** (includes canned pineapple, peaches, apricots, pears and mixed fruits) Frozen (includes Frozen mangoes, berries and pineapple having a longer shelf life, convenience, easy storage)
- **Dried** (includes dried apricots, apples and prunes with shorter life cycles than fresh fruits)
- **Juiced** (includes fresh fruit juices)

The most common fruit processing process follows consists of four steps. In the first step, washing, cleaning, grading and peeling of matured and fully ripe fruits is done. Thereafter, juice is extracted from fruits and then it is filtered to remove seeds, fibres, etc. This juice is then processed, sterilized and bottled after adding preservatives. In case of squash, syrup of sugar along with preservatives is added to juice and this mixture is stirred till a uniform solution is formed and then it is bottled. The process flowchart is as in **Figure 7.1**.

Figure 7.1: Flowchart of fruit processing



(Source: Central Food Technological Research Institute, Mysore)

Processing in the fruit industry consists of three steps:

Minimal Processing: It helps in increasing the functionality of fruits without changing its fresh like appearance, texture and colour by cleaning, sorting, grading and cutting.

Primary Processing: It helps in retaining freshness, flavour, and texture. It can be done through efficient storage of the product e.g.: slices, pulps, paste, preserved & flavoured.

Secondary Processing: It involves heat preservation, refrigerated “ready to eat”, dehydration, and fermentation, e.g.: ketchups, jam, juices, pickles, preserves, candies, chips etc.

7.3.2 Types of fruit processing technologies

Traditional processing technology: Basically, processing technologies which are traditional in nature are implemented in the conservation of horticultural produce. Major categories of processed products produced by these technologies are fruit preserves, fruit juices. Freezing, thermal processing, dehydration, and drying technologies come under this processing type only.

Modern processing technology: Modern Processing Technology is applied in the processing of trimmed and packed produce, prepared fruits. Minimal Processing and Non- Thermal Processing Technologies are used.

7.3.2.1 Supply chain of fruit processing industry

Supply chain process of fruit processing industry from the farm to the fork is complex and fruits are required to be handled carefully not to be deteriorating before they reach the end consumers. Fruit processing industry involves use of various processing tools & techniques, packaging, storage & transportation (of processed fruits too) that reduce spoilage and enhance the shelf life of fruits by cleaning, sorting, and packaging.

7.3.2.2 Post-harvest management

Post-harvest management is about maintaining quality of production in the paddock of the fruits being placed on a plate for consumption. It includes activities like cooling, fresh produce storage and handling, processing, packing, transportation of the produce from one place to another. The ultimate aim of post- harvest management is to postpone the death and decay of the fresh produce for as long as possible and increase the availability of food from existing production. Post- harvest management practices help in reducing product (fresh produce) spoilage and wastages due to unavailability of proper and adequate resources at the farm level. Estimates suggest that after leaving the farm boundaries nearly 30-40% of fruits are damaged or lost which further results in diminished returns for producers.

In the complete supply chain, the intensity of post-harvest wastages are high because of harvesting the fresh produce (fruits) at early and inadequate maturity, physical damage and decay. Therefore, damage and decay can be prevented by educating and training, labor to handle the produce effectively; harvesting the produce (fruits) at adequate maturity; handling fruits, no more than necessary (if feasible, by doing field packs); installing padding inside bulk bins; and avoiding overstuffing or under stuffing of the containers of produce. The main objective of post-harvest management and treatments is to extend shelf and storage life of the produce by creating suitable conditions and thereby retaining the quality attributes and nutritional composition of the product. Severe efforts like infrastructure modernizing and strengthening of policy/institutional settings are needed to be made so that the intensity of post-harvest wastages can be lessened. Post-harvest handling includes cleaning the produce, sorting, packing & processing refrigerated storage, transportation and distribution.

Cleaning the product makes the produce looks fresh and also cleans the produce with negligible risk of microbial contamination. At the same time, it also helps in the reduction of potential microbial contamination.

Sorting the product is helpful in getting rid of a product or portions of a product that may detract or pose a threat of shortened product shelf life and/or contamination by a microbial organism.

Packaging the product helps in protecting the quality attribute of the produce. Packaging of the produce should be designed in such a way so that there should not be any kind of mechanical and physical damage and the product is easy to store and handle.

Storage of the product lengthens the product's shelf life and also reduces the peril of microbial growth. Generally, it is refrigerated storage wherein the storage temperature is dependent upon the type of fruits. The lowest temperature that does not cause chilling injury is the ideal storage temperature for fresh produce (fruits).

Transportation of the product is basically done by road, from the farmer to the ultimate end consumer. So, the focus on vehicles, equipment for storage, handling and transportation should be more. Fresh produce (fruits) is transported by vehicles which are refrigerated or non-refrigerated vehicles. Improper handling during loading and unloading, rough roads, overloading and lack of ventilation add to transportation cost.

7.3.2.3 Causes of postharvest losses

Post-harvest wastages are caused by both external and internal factors as given in **Table 7.3**.

Table 7.3: Causes of postharvest wastages

External factors	Internal factors
<p>Mechanical injury: Improper packaging and handling during transportation are the cause of sap burning, breaking and bruising.</p> <p>Parasitic diseases: Parasitic diseases are caused by the attack on fruits by fungi, bacteria, and insects which is a major reason behind post-harvest decay and wastage in fruits.</p>	<p>Physiological deterioration: Even after the harvesting process, fruits and vegetables have life in them, and continue their physiological activity. Deterioration takes place due to fluctuations in temperature and deficiency of minerals</p>

No matter how effective post-harvest operations are, returns cannot be good if the productive poor. Linking production to post-harvest operations is essential to optimizing results. Pre harvest parameters like the selection of proper planting material, crop management, and pest control must be geared toward producing high quality products.

7.3.2.4 Cold storage facility

Cold storage facility is a temperature-controlled facility network along with storage, and distribution operations carried out in order to maintain the temperature of a product (fresh produce, fruits) in a specified temperature range, to keep the produce suitable for eating for a much longer span of time. In order to extend the shelf life of the fresh produce (fruits) & period of marketing and transportation hurdles, cold storage facilities are required. This system facilitates long distance transport of various products as well as makes seasonal products available over the entire year.

Components of a cold storage facility comprise post-harvest handling of produce, refrigerated storage & transport, controlled atmosphere storage (CA), chilled or frozen processing, distribution and retail refrigeration. A robust cold chain industry has a critical role to play as it ensures better availability of fruits as well as preventing spoilage of the same.

Surface storage and refrigerated transportation are the major components of the cold chain logistics network:

- **Surface storage:** Involves refrigerating warehouse for storage of the perishable product in consideration
- **Refrigerated transportation:** Reefer trucks, containers, ships, trains, specifically for transport of perishable products

Perishable items like fruits and vegetables have a shorter product life cycle. Therefore, cold chain facility has been considered as the best and suitable to handle

such perishable items in order to get rid of mechanical damage, decay, aging and wastage of fresh produce. Because of this, it has become mandatory for the producing & consuming centres to establish a cold to take good care of the fresh produce (fruits). Also, there is a dire need to create an understanding in the minds of the traders, farmers and the ultimate end consumers regarding the advantages of establishing cold chain facilities in preserving and storing the fresh produce.

7.4 Crop improvement technologies

The main problems plaguing the apple industry of Himachal Pradesh include plantation on marginal lands, erratic production and low productivity. The productivity of Indian apple is markedly lower than the major apple producing countries of the world. Furthermore, the productivity of Himachal Pradesh apples is higher than Uttarakhand, but lower than Jammu and Kashmir although the areas under apple in the two states are comparable. The much documented scientific and systematic farm management, better utilization of technology and mechanization and a better support and infrastructure seem to contribute a great deal for better crop yield in developed countries. Healthy growth of crop plants and the crop productivity can be intensified by modifying either agronomic inputs or biotechnological approaches. Agronomic techniques include modifying used seed types, high density planting and land management practices while biotechnological approaches refer to manipulating photosynthetic rate, biological N fixation, etc. Furthermore the lesser known but significantly influential latest practice include managing crop pollination using friendly insects. The possible practices that can be exercised to significantly improve the apple yield and thereby the profits, have been discussed here under.

Table 7.4: Apple orchard best management practices

Technique	Features
Orchard lay out	
Cultivar mix	<ul style="list-style-type: none"> • Cultivar Gale Gala on EMLA 111 is reported to produce greater vegetative growth and yield, large fruit tree height (499.66 cm), along with large plant diameter (32.20 mm) and shoot extension growth (60 cm). • Initial research reports following research at UHF suggest that Red cultivar Red Velox that is imported from Italy has great maximum shoot growth compared to other varieties such as Super Chief, Edlum, Gala and Jeromine. • The chilling apple cultivar Anna and Scarlet Gala were observed to have greater trunk girth, tree height, and greater tree spread in east west and north south directions following a research studies
High density plantation	<ul style="list-style-type: none"> • Planting trees at closer spaces using special techniques to increase productivity without compromising with the quality. • The density of plantation is generally around 250 trees/Ha in Traditional plantation around 250 – 500 trees/Ha, in Moderate plantation, around 500 – 1250 trees/Ha in High Density while it is around 1250 trees/Ha in Ultra High

	<p>Density plantation.</p> <ul style="list-style-type: none"> • In established farms, the varieties chosen dictate the density of plantation and for new plantations decisions about the desired density of plantation precede the choice of cultivars • Recently super high density plantation within apple orchards has been proposed with plantation of more than 20,000 trees/Ha.
Canopy management	<ul style="list-style-type: none"> • Canopy configuration is a combination of variety, rootstock, spacing, plant training etc. • Fruiting potential is significantly affected by canopy management since it impacts aeration, penetration of sunlight to inner parts of canopy, subsequently effects photosynthetic activity and productivity • It is managed through cultural practices as training and pruning of trees • Pruning of selective branches and changing their orientation through training opens the canopy for leaf penetration, yield improvement and fruit quality • Raising Apples in open field can produce larger and heavy fruits with less spherical in shape and with grater shelf life compared to apples that are raised in polyhouses
Intercropping	<ul style="list-style-type: none"> • Inter cropping reduces soil wastage space in an apple orchard system. • Intercropping during the first 4 year offsets investment expenses • A careful balance has to be maintained while selecting intercropping varieties.
Variety mix	
Variety management	<ul style="list-style-type: none"> • Enhanced fruit yield can be achieved in apple orchards by placing more than one type of pollinizer varieties • The variety of mix with 67% with main delicious varieties and 33% of other pollinizer varieties combination can result in enhanced fruit yield.
Nutrition management	
Nutrient management	<ul style="list-style-type: none"> • Ascertaining the exact crop nutrient requirement is significant in enhancing the productivity and crop yield, and both soil and plant nutrient analysis has to be conducted in the process • Nutrient use efficiency can be enhanced through split fertilizer application at peak periods of requirement, foliar application of nutrients and application of slow release fertilizers • The most suitable alternative source of nitrogen for apple trees as a substitute of CAN was observed to be calcium nitrate + urea (50% recommended dose of nitrogen through each source) or through calcium nitrate + urea + liming • The foliar application of 1-2% of hydrogen cyanamide has been found effective in dealing with issue of delayed and non-uniform bud burst and prolonged flowering period in apple under growing conditions interrupted with warm climate during winters • Soil application of YaraMila Complex (2000g) and YaraLiva Nitrabor (1500 g) was observed to significantly increase the fruit set, fruit yield and fruit weight, fruit quality of apple.

	<ul style="list-style-type: none"> • Preharvest spray of calcium chloride at 0.25, and 0.50 %, concentrations after 60 days from full bloom over Golden Delicious fruits was found to result in greater fruit size (diameter) • The dose and frequency of application of BOLT @ 1.5 gms (Three applications of BOLT SP @ 1.5 TM g/l) was observed to be optimum dose and significantly enhance fruit set, fruit retention, yield and fruit quality
Plant bio regulators	<ul style="list-style-type: none"> • Plant bio regulators include cytokinins and gibberellins • Can be applied either alone or in combination to enhance both quantitative and qualitative aspects of fruit growth • Photosynthetic stimulants such as mixatol can enhance crop photosynthetic activity generating greater yields, flesh firmness, total soluble solids and sugars in apple • Bio-efficacy application of Gibberellic acid 0.45% at 2.5 ml/L in Red Delicious was observed to perform greater fruit length, fruit breadth, fruit weight and yield.
Fertigation	<ul style="list-style-type: none"> • This involves key nutrient delivery to main rooting zone such that nitrogen, phosphorus, and potassium match the crop demand accurately and maximize the nutrient uptake and avoid vigor and poor fruit quality • The recommended numbers and discharge of drippers / micro jets / micro sprinklers with respect to plant to plant and space to space varies with soil types.
Bio-fertilization	
Vesicular Arbuscular Mycorrhizae	<ul style="list-style-type: none"> • It establishes mutualistic symbiosis with the plant roots resulting in enhanced nutrient uptake, resistance to plant pathogens etc. • Apple plantations can have strong association with Mycorrhizae and to form naturally occurring vesicular-arbuscular mycorrhizal flora • This resulted in enhanced P nutrition and other immobile nutrient absorption leading to better plant growth, fruit yield and alleviated several abiotic stresses
Compost	<ul style="list-style-type: none"> • Compost is stable decomposed organic matter and formed due to decomposition due to microbial activity • Compost application increases soil biodiversity, soil organic carbon levels and soil health • Increased blooming and growth of newly added apple plants was observed following compost application • Also compost application in apple orchards was reported to be more financial friendly compared to conventional practices
Manure	<ul style="list-style-type: none"> • Humus content was observed to increase greatly following manure application in soils there by increasing soil organic carbon stocks • Manure application was also observed to abate N₂O emission peaks and maintain efficient applied N use • Moisture availability, pH, organic carbon, and soil nutrient status were reported to have bettered significantly following organic manure application
Irrigation	<ul style="list-style-type: none"> • While Subsurface drip irrigation @ 60% ET+ fertigation of 100%

	recommended dose (RD) was observed to result in maximum plant girth (18.81 mm) compared to surface irrigation + conventional fertilizers that resulted in lower plant girth (4.02 mm), maximum plant height (126.24 cm) was observed under drip irrigation @ 100% ET + 100 % RD (SS&WM, Nauni)
Pollination resource and technology	
Pollination management	<ul style="list-style-type: none"> • Since apple plants display extreme heterozygosis, require cross pollination and managed honey bee colonies serve as significant commercial pollinators. • Bees with traits such as cleptoparasitic life style should be excepted from managed honey bees • Bee keeping management methodologies such as long distance, migratory beekeeping high parasite and pathogen levels have to be eliminated to prevent colony collapse disorder
Soil management practices	
Mulching	<ul style="list-style-type: none"> • The moisture requirement for an apple orchard of 1 ha is 114 cm of water during the whole year to be supplied through 19 irrigations • Mulching process to orchard floor was observed to conserve moisture, nutrition, soil organic matter, temperature to an extent and suppress weeds • Polyethylene mulch retain soil moisture to increase plant height, diameter, leaf number, and leaf area as well control the weeds and was reported the best for soil moisture conservation in apple basin • Hay and black plastic mulch is known to increase trunk girth, total shoot length, nutrient release and soil temperature • Grass mulch was observed to increase extension and radial growth in apple tree • Organic and synthetic mulches were also reported to increase growth of apple tress
Weather management	
Hail protection	<ul style="list-style-type: none"> • Hails affects the size and yields of the apple crop negatively and produce scars and disfigured fruits • Antihail guns can be used to reduce the negative impacts following hail storms, however limited success has been reported • Anti-hail nets are expected to prevent damage by hail and sleet. • Once applied anitihail nets can be used for many years

Chapter 8

Environmental Mitigation Measures

8.1 Approach to Environmental mitigation measures

The Environmental mitigation measures is to prevent, reduce or control adverse environmental effects of a project, and include restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means. The proposed mitigation measures provide the basis for the development of environmental management plans and monitoring programs for the project. The following mitigation measures are proposed in order to synchronize the economic development of the study area with the environmental protection of the region.

8.1.1 Mitigation measures during construction

The project is an existing processing unit going for upgrading and expansion of the capacities of the existing infrastructure and addition of new facilities. The impacts during the pre-construction and construction on the environment would be basically of temporary nature and are expected to reduce gradually on completion of the construction activities.

8.1.1.1 Air quality mitigation measure

For the proposed project site leveling and grading will be carried out if required, wherever possible to maintain the natural elevations they will not be disturbed, only leveling activity will be carried out for providing roads, sewage network, storm water system. According to the engineering assessment; most of the excavated mud generated for providing basement shall be reused within the project boundary for leveling during road formation, the excess if any will be given to local contractors for disposal in low lying areas, road constructions, etc., as per the local existing rules.

Most of the construction dust will be generated from the movement of construction vehicles on unpaved roads. Unloading and removal of soil material shall also act as a potential source for dust nuisance. The control measures proposed to be taken up are given below

- 1 Water sprinkling on main haul roads in the project area will be done, this activity will be carried out at least twice a day, if need arises frequency will be increased on windy days, in this way around 50% reduction on the dust contribution from the exposed surface will be achieved.
- 2 The duration of stockpiling of excavated mud will be as short as possible as most of the material will be used as backfill material for the open cut trenches for road development.

- 3 Temporary thin sheets of sufficient height (3m) will be erected around the site of dust generation or all around the project site as barrier for dust control.
- 4 Tree plantations around the project boundary will be initiated (where ever required) at the early stages by plantation of 2 to 3 years old saplings using drip irrigation or by regular watering so that the area will be moist for most part of the day.
- 5 All vehicles carrying raw materials will be instructed to cover with tarpaulin/ plastic sheet, unloading and loading activity will be stopped during windy period.
- 6 To reduce the dust movement from civil construction site to the neighborhood the external part of the building will be covered by plastic sheets

8.1.1.2 Water quality mitigation measure

During site development necessary precautions will be taken, so that the runoff water from the site gets collected to working pit and if any over flow is, will be diverted.

During construction activity all the equipment's washed water will be diverted to working pit to arrest the suspended solids if any and the settled water will be reused for construction purposes, and for sprinkling on roads to control the dust emission, etc. The construction workers will be using the toilets of the existing facility.

8.1.1.3 Noise and transportation mitigation measures

Noise generating equipment will be used during day time for brief period of its requirement. Proper enclosures will be used for reduction in noise levels, where ever possible the noise generating equipment will be kept away from the human habitation. Temporary thin sheets of sufficient height (3m) will be erected around the noise generating activity or all around the project site as barrier for minimizing the noise travel to surrounding areas. Therefore, impact on noise environment due to proposed project would be insignificant.

All vehicles entering into the project will be informed to maintain speed limits, and not blow horns unless it is required.

Personal protective equipment like earmuffs, helmets covering ears would be provided to the workers working near noise generating equipment and would see that workers use the protective gadgets regularly.

To avoid any impact due to transport all the trucks will be environment emission standard complied and the raw material will be fully covered and ensured that no spillage will be there during transport. The roads within the project site are properly maintained by the company. The following specific actions will be ensured to minimize the impact due to transport.

- Use all the trucks with environment compliance emission and emission level will be checked half yearly or as per prevailing laws of the land
- There will not be any spillage from the trucks as the vehicles carrying raw materials will be covered properly with tarpaulin / plastic sheet.
- The surface of the roads will be regularly repaired to avoid any ditches, pits etc.
- The traffic speed will be maintained within the limits

8.1.1.4 Solid waste mitigation measure

The solid waste generated during construction period being predominantly inert in nature, construction and demolition waste does not create chemical or biochemical pollution. However maximum effort would be made to reuse and recycle them. Most of the solid waste material will be used for filling/ leveling of low-lying areas, as road construction material, if any excess given to local contractors for lifting and dumping in low lying areas. All attempts would be made to stick to the following measures.

1. All construction waste shall be stored within the site itself. A proper screen will be provided so that the waste does not get scattered.
2. Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.
3. Materials, which can be reused for purpose of construction, leveling, making roads/ pavement will also be kept in separate heaps from those which are to be sold or land filled.
4. Construction waste generated will be deposited at collection center made by local body or handed over it to the authorized processing facilities of construction and demolition waste

8.1.1.5 Land use mitigation measure

The food industries should be aware of the contents of the wastes they generate with the view to making them environment friendly. In order to protect the environment from the adverse effects of fruit processing industries, a number of mitigation measures and management options that should be implemented are hereby recommended. For all of the identified negative environmental impacts, it is recommended that utilization of the best available technology; payment of optimal liability compensation to local communities and institutionalization of adequate abatement measures to be adopted. The manufacturing processes should be designed to maximize recycling potential and minimize the generation of wastes. For example, new low and non-waste technologies which can reduce environmental impacts should be adopted.

8.1.1.6 Ecological aspects

During pre-construction period, there could be clearing of vegetation in order to prepare the site for construction, the top soil from the construction area will be collected, stored separately.

8.1.1.7 Site security

Adequate security arrangement would be made to ensure that the local inhabitants and the stray cattle are not exposed to the potential hazards of construction activities. Round the clock security personnel will be appointed to restrict entry of unwanted people to the site.

8.1.2 Mitigation measures during operation

Necessary control measures will be undertaken at the operation stage to meet the statutory requirements and towards minimizing environmental impacts. During operation period special emphasis will be made on measures to minimize effluent generation and dust control at source. The specific control measures related to air emissions, liquid effluent discharges, noise generation, solid waste disposal etc. are described below.

8.1.2.1 Air quality mitigation measure

The main activities from the proposed project which cause air pollution are as follows:

1. Sulphur dioxide and nitrogen oxide from DG set
2. PM, SO₂ and NO_x emissions from boilers.
3. Dust particulates due to movement of vehicles and road sweepings.

The following methods of abatement will be employed for the air pollution control.

1. DG set & boilers are to be provided with a stack height meeting MoEF&CC guidelines or 1m above the tallest structure in the project area for proper dispersion of sulphur dioxide and oxides of nitrogen.
2. Internal roads will be concreted / asphalted to reduce dust emissions.
3. Vehicles coming into the plant will be instructed to have PUC certificates
4. Speed restriction will be followed within the project and speed breakers will be provided at entry and exit points.

8.1.2.2 Water quality mitigation measure

The source of water for the proposed project is natural stream from nearby mountain. The waste water generated will be collected and diverted to proposed Effluent Treatment Plant (ETP) of capacity 50 KLD; the treated water from ETP will be used for gardening, floor washing, etc. The domestic sewage from canteen, washrooms and other locations were pre-treated and if needed can also be treated along with ETP as organic matter (COD, BOD) removal requires nutrients supply which can be augmented by adding domestic sewage.

8.1.2.3 Noise and transportation mitigation measures

The specifications for procuring major noise generating machines/equipment would include built in design requirements of 85dB(A) to have minimum noise levels meeting Occupational Safety and Health Assessment (OSHA) requirement.

The major sources of noise pollution are as follows:

- DG set
- Boiler
- Water pumps

Acoustic enclosures, noise barriers or shields will be provided for DG set, boiler and water pumps respectively and where ever possible they will be mounted on anti-vibration pads to minimize the noise. Regular maintenance will be carried out as per the schedule prescribed by the manufacturer for smooth functioning.

The mitigation measures for transportation of raw materials, personnel and visitors to the project site are given below:

- Bulk load carrying capacity trucks will be used to maximum extent possible and will be sent one after the other to reduce congestion of traffic.
- Hydraulic loading and unloading facility will be practiced as much as possible
- The roads will be swept at regular intervals to keep premises clean and to minimize the dust generation
- Sign boards will be kept so as to avoid any accident/damage within the site on anti-vibration pads to minimize the noise.
- Vehicles of visitors/personnel will be parked properly in parking slots to avoid traffic congestion.

8.1.2.4 Solid waste mitigation measures

The waste generated by processing units can be classified as:

- Sorting section- rejected fruits,
- Hydraulic press- separated solids after juice extraction.

- Waste from utilities such as canteen waste, boiler ash, paper, plastic bottles and other packing waste
- Pollution control facilities- ETP sludge etc.

The solid waste generated will be collected from processing area and brought to one place, and it will be segregated into recyclable, compostable and non-compostable. The peeled and cored fruit waste will be sold (or given) as animal feed. The recyclables will be disposed to local vendors and compostable (other than peeled/cored fruit waste) will be converted to the compost (Vermi composting / Organic waste converter), whereas the non-compostable solid waste will be disposed into local municipal bins.

8.1.2.4.1 Fruit waste management

The agri-processing industry generates greater amount of fruit and vegetable wastes (FVW), following improper handling of produce, compromised infrastructure facilities and un-fulfillment of retailer quality standards. Such waste represents unconsumed or unused fruit or vegetable following its morphological characters else simply discarded for diverse reasons. This waste generation is discernible during all post-harvest stages of supply-chain logistics including harvesting, market yards or grading and packing unit transportation of harvest; processing and storage unit operations. Such wastes pose serious environmental concerns since these are prone to easy microbial decomposition resulting in unpleasant odours, infestation by pests and birds, generation of disease producing pathogens etc., demanding proper maintenance. On the other hand, their components like seed, skin, rind and pomace comprise of valuable bioactive compounds as carotenoids, polyphenols, dietary fibers, sugar derivatives, vitamins, enzymes and other oils, which can be sourced for extraction of valuable biomolecules within discarded Fruit and Vegetable Waste (FVW) which have been proved to harbor highly beneficial health traits such as; anti-tumor, anti-bacterial, antiviral, anti-mutagenic, and cardio protective activities. As well, FVW extracts find their way into textile, cosmetic and food industries. The valorization of FVW also complements continually growing ecological distress through bio active compound resource extraction.

8.1.2.4.2 Bioactive compound extraction technologies

Diverse extraction technologies as solid liquid, soxhelt, pressurized fluid, super critical fluid extraction, enzyme assisted extraction etc. have been applied towards extraction of value added biomolecules from FVW. Application of the referred technique depends upon the processing scale, biomolecule matrix type, and cost-benefit analysis of exercising the extraction technology. The general process flow chart for extraction of valuable biomolecules from fruit and vegetable waste has been given in **Figure 8.1** and the comparative advantage and limitations of various techniques is presented in the following **Table 8.1**.

Figurer 8.1: Process for extraction of valuable biomolecules from FVW

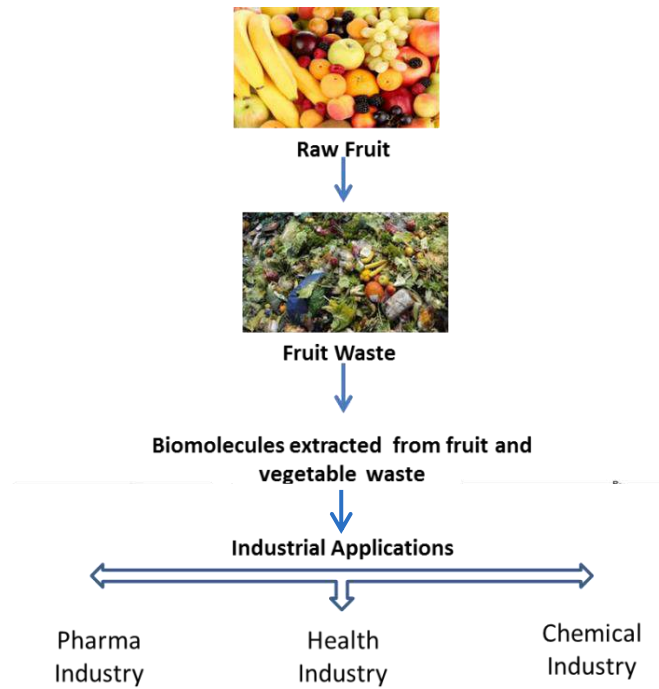


Table 8.1: Technologies for extraction of useful compounds from fruit waste

Extraction technique	Extracted Useful biomolecules/component	Source of FVW	Advantages of technology	Limitations of technology
Soxhelt extraction	Phenolic compounds, Ascorbic acid and triterpenes, lipids and fat	Avocado fruit pulp, guava, apple pomace	Widely used, classical technique, basic model technique, inexpensive, wider industrial application, greater productivity & efficient and extract manipulation.	Time consuming, requiring large solvent quantity, Not very environmental friendly, limited application in food processing, risk of degradation for heat labile compounds
Liquid-liquid extraction	Phenolic compounds		Suitable for liquid compounds, can be applied at room temperature	Require hazardous and expensive compounds, high labor, Time consuming process
Solid liquid extraction	Flavonoids, Pectin, Dietary fibers, Phenolic compounds	Apple pomace, peach pomace, grape skins and seeds citrus peels and seeds fruit wastes (peels and pomace) industrial onion waste	Have a wider industrial application	Expensive process, partly toxic and require hazardous, organic solvents
Supercritical fluid extraction	Phenolic compounds, Anthocyanins Caffeine, β Carotene and lycopene	Grape skins, peels, seeds, apple pomace, hazelnut, peach pomace, green tea leaves, tomato waste and tomato peels	Gives better mass transfer, time saving, environment friendly, minimum wastage, Performed at room temperature.	High solute diffusivities, expensive system
Hydro distillation	Oil and bio active compounds	Olives, almonds, nuts	Simplest technique for extracting oil from plant parts, Best technology for small scale industries.	Risk of degradation for heat-labile compounds, slow process and time consuming
Pressurized liquid extraction	Anthocyanins, phyto chemicals	Apples, grape skins, peels, cherry seeds	Suited for solid samples, less time consuming and less solvent required	Expensive equipment is required, suitable for samples with very high level of targeted analytes only

Extraction technique	Extracted Useful biomolecules/component	Source of FVW	Advantages of technology	Limitations of technology
Pulsed electric field extraction	Anthocyanins, phytosterols, polyphenols	Grape skins, peels, cactus fruit, tomato juice	Greater extraction yield with smaller solvent composition, less extraction time, selective recovery of valuable compounds without disturbing the treated matrix	Requires regular maintenance of process parameters and sophisticated instruments
Enzyme assisted extraction	Polysaccharides, anti-oxidants, natural pigments, flavors, phytochemicals, oils	Tomato juice, apple pomace	Uses water as solvent rather than organic chemicals, greater extraction rates, environment friendly method.	Expensive process, requires more research
Microwave assisted	Pectin, phenolic compounds, caffeine, β carotene and lycopene	Apple pomace, peach pomace, grape skins and seeds, citrus peels and seeds Fruit wastes, Green tea leaves, tomato paste waste and tomato peels	Reduced extraction time and increased yields, better quality of extracts, low cost technology	Uses organic solvents, not compatible for heat sensitive compounds, application at industrial level is still limited
Ultra sound assisted	Anthocyanins, Phenolic compounds	Apple pomace, Grape skin, grape peels, Grape fruit, Peach pomace, Chicory	Less chemical usage and greater yield and kinetics, less power and energy usage and low investment required, shorter extraction time	Requires proper optimization, still in developing stage

8.1.2.4.3 Sustainable fruit waste management technologies

Ancillary to the bio compound extraction from FVW, waste management techniques should consider altering fruit waste to value added products, as means of sustainable waste management strategy wherein, composting can be an attractive option. Composting could be a panacea towards fruit waste management, since it limits waste stream, mitigates GHG emissions alternatively produce attractive product - compost.

Composting process

Compost is a simple process where nature takes its natural course through compost operator. Precisely it is a highly valued organic waste recycling strategy that involves natural conversion of organic waste under thermophilic conditions into stable, sanitized humus like material with rich nutrient composition called compost. Composting process continues under two phases, mineralization and humification. While organic matter degradation due to microbial action represents mineralization, transformation of the C and N is characterized by humification, which finally produces the fine compost. Compost application propels back the nutrients observed from soil through harvested produce back to soil closing a cycle. As applied on farm, compost enhances soil fertility, soil organic carbon, soil water holding capacity along with boosting soil tilt, combat soil erosion and complement fertilizer efficiency by optimizing plant nutrient availability. Compost application forms an important practice towards resilient agri systems as the process reduces the ecological risk and supports better environment. The process is mainly performed by microorganisms under controlled conditions and can be performed either as large or small scale practice where differentiation being made through infrastructure, technique and financials exercised. Feed stock and nutrient balance, particle size, moisture content, oxygen flow and temperature control the process. Compositing techniques can be differentiated into two types following its decomposition principle applied, aerobic and anaerobic composting.

Aerobic composting

The decomposition process necessitates oxygen and the products of aerobic composting include CO₂, NH₃, water heat and humus. Organic acids produced during the process are decomposed further due to presence of oxygen. Any type of organic waste can be composted under these conditions, however it requires optimal conditions (moisture) and blend (C:N ratio) for greater efficiency. Any significant variation negatively affects the degradation process. To ensure an adequate supply of oxygen throughout, the compost is turned weekly or at regular intervals. The advantages of aerobic compositing includes quick process completion time as well, the process kills any pathogens and weeds due to high temperatures during the process operations. The compost generated has little phytotoxic effect owing to highly unstable organic matter.

Anaerobic composting

Anaerobic composting employs fermentation technique and this method was traditionally used to decompose animal manure and human sewage sludge; however it finds its reach into organic waste composting as well lately. The products produced following anaerobic composting include methane, (CH_4), CO_2 , NH_3 and trace amounts of other gases and organic acids. Under anaerobic conditions these compounds get accumulated and are not metabolized further. Some of these compounds can exhibit phytotoxicity, as well this technique holds the limitation since it requires longer time and may at times spread pathogens and weeds.

Composting methods

Various composting methods have been developed over time. The choice of preferred composting method depends on the quantity (production scale) and quality of the input materials, the geographical and climatic situation and on preferences of the compost producer, etc. Important aspects also include the degree of mechanization and the labor intensity of the system. Most existing systems are capable of producing good quality compost, but it is also possible to produce poor quality compost with all the existing methods. The process flowchart for composting is presented in the following **Figure 8.2** and a quick comparison of various composting methods is presented in the **Table 8.2** below.

Figure 8.2: Composting process flowchart

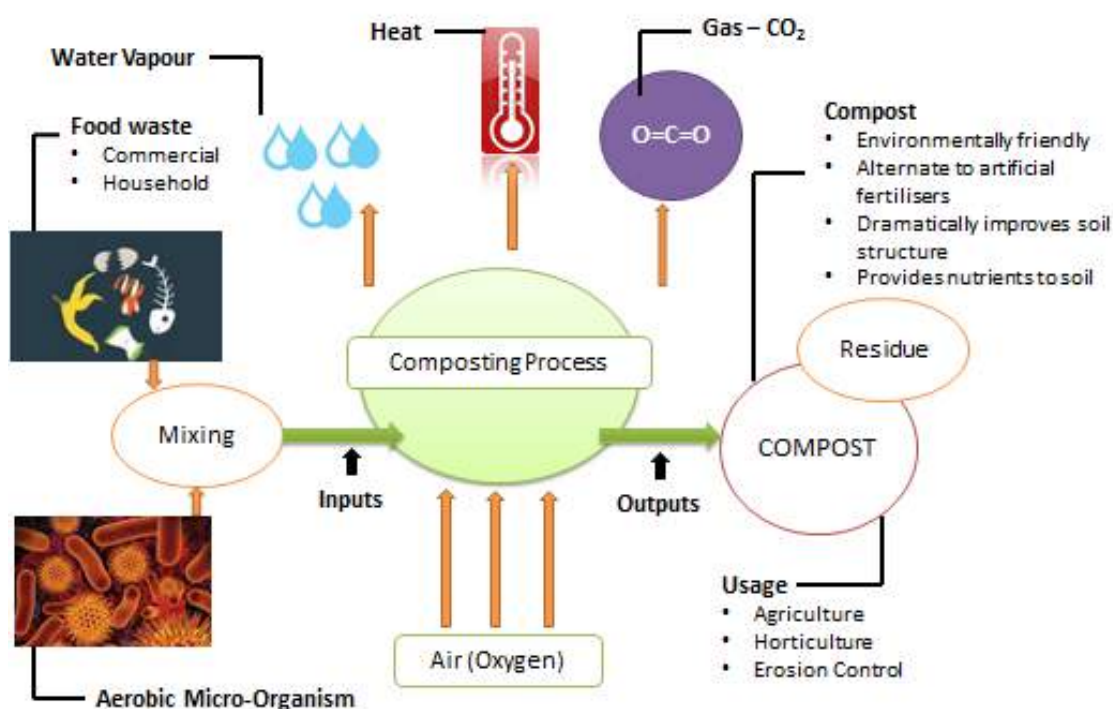


Table 8.2: Composting methods

Compositing type	Advantages	Limitations	Capital and maintenance cost
Aerated windrow compositing	<ul style="list-style-type: none"> • Diverse and large quantity waste can be composted • Can be operated in cold environments too • Significant quantity of compost is generated • Compost quality is medium to good 	<ul style="list-style-type: none"> • Requires careful and continual monitoring • Bad odours and leachate release is a common factor • High GHG emissions can occur during the turning process • Requires large quantity of land, and continual labor to operate and maintain the facility • The site has to be away from populated area there by incur extra cost for transportation • Long composting period 	<ul style="list-style-type: none"> • Low capital cost is required towards site construction and setting up the facilities • Medium management expenses for diesel for tractor and turner • High number of labor accordingly the cost is required towards compost turning and site management
Aerated static pile compositing	<ul style="list-style-type: none"> • Can be placed indoor in presence of proper ventilation • Lower GHG emissions • Compost quality is medium to good 	<ul style="list-style-type: none"> • Suitable with homogenous and consistent mix of waste only and doesn't work well if animal byproducts or food processing waste (Grease, fats) are included. • Bulking agent is required • Aeration might be difficult in cold climate since it involve passive air flow process • Require proper system to control bad odour and leachate generated during the process • The site has to be away from populated area there by incur extra cost for 	<ul style="list-style-type: none"> • Medium capital cost is required towards site construction and setting up the facilities • Low management cost incur towards power and diesel consumption during operations • Medium cost implies for system maintenance and monitoring

Compositing type	Advantages	Limitations	Capital and maintenance cost
		transportation • Long composting period	
In vessel composting	<ul style="list-style-type: none"> • All types of organic wastes can be managed • Requires less space and labor • Can be operated year around and in any temperature conditions since environment is controlled through electronic means • Produce very little leachate / odour • The compost generated is of good quality 	<ul style="list-style-type: none"> • Composters are moderately expensive and require technical assistance or staff with technical knowledge to operate • Require additional time for microbial activity to stabilize and pit to cool 	<ul style="list-style-type: none"> • The initial investment is high to set up the infrastructure required such as composter, conveyance facilities and baggers etc. • High maintenance cost due to high power consumption and composter maintenance • Low number of staff required for maintenance
Back yard or On site composting	<ul style="list-style-type: none"> • Requires very little space and equipment • Climatic variations does not pose a serious challenge since it pose a smaller quantity of waste 	<ul style="list-style-type: none"> • Not suitable with animal products or large food scrap • Suitable for only very small waste • Improper maintenance can result in odour as well attract insects • Takes longer period for compost generation and compost might contains weeds grass seeds 	<ul style="list-style-type: none"> • Low capital and maintenance costs
Vermi composting	<ul style="list-style-type: none"> • Can be used with any type of waste • Requires very basic 	<ul style="list-style-type: none"> • The worms in the process are highly sensitive to climatic variations • Staff with technical knowledge are 	<ul style="list-style-type: none"> • Smaller initial investment is required for shed development and land

Compositing type	Advantages	Limitations	Capital and maintenance cost
	<p>infrastructure</p> <ul style="list-style-type: none"> • Worm bins are easy to construct and can be accommodated as per the quantity of waste generated • Can be practiced in indoor environment 	<p>require during maintenance /operations of the process</p>	<ul style="list-style-type: none"> • Medium maintenance cost is required towards worm, worm bedding, and buckets as required
Bokashi compositing	<ul style="list-style-type: none"> • Can be operated either internally or outside • C:N ratio is less significant providing flexibility with feed stock • Technology retains larger organic matter and greater energy • No potential leachate generated • Low organic matter loss is involved resulting in lower CO₂ foot print 	<ul style="list-style-type: none"> • Bad odour generation potential is quite high • High maintenance cost is involved • Requires extra inoculations for consistency • Potential for GHG release of the product application needs to be verified • The compost or the product is highly acidic and requires careful handling 	<ul style="list-style-type: none"> • Low maintenance cost as the vessels used are low tech.

Organic Waste Converter (OWC)

In addition to the composting through aerobic or anaerobic process, an effective organic waste management towards the Centralized Waste Management is offered through organic waste converters. The Organic Waste Converter (OWC) works on the principle of microbial decomposition of solid waste. The typical section of the organic waste converter is given in **Figure 8.3**.

Figure 8.3: Organic Waste Converter



Typical treatment cycle in the system is initiated through waste material load, where end is a valorized material posing beneficial characteristic that the input material did not. The conversion process holds various sequential phases. During the process, initially fed waste is first ground and pulverized to an unrecognizable mixture by a combination of fixed and actuated hardened steel blades. The mixture is then heated through the injection of steam and also by the heat generated by frictional forces of the grinding phase. The exact temperature required for pasteurizing, and in the subsequent phase to sterilize the waste, is maintained. In order to eliminate the required amount of microorganisms, a complete saturation of waste matter with superheated steam is required for a minimum amount of time. Various models are available and are designed to meet the physiological requirements of the bacterial growth. The cycle ends in a cooling phase, during which product continues to be dehydrated. Upon reaching temperature at which product is safe to handle, near ambient temperature, the cycle automatically shuts down. The end product is expelled into a tray that can then be hauled off for storage. The entire process and statistics are recorded and stored in computer memory for record keeping. An overview of process in OWC and the equipment model is presented below.

8.1.2.5 Ecology and bio diversity mitigation measures

The greenbelt development is one of the most effective environmental pollution control measure. Trees play a vital role in the environment in preventing the horizontal dispersion of the pollutants to the surrounding areas. They are very effective in trapping the pollution causing agents viz. dust and gaseous pollutants. They are also considered to be excellent indicators of excessive ground level concentrations. The placement of the plants would be designed as follows:

- Trees growing up to 10m or more in height with thick canopy cover and perennial foliage would be planted along the boundary.
- Planting of trees would be done in rows with minimum three rows encircling perimeter of the project (where ever there is place for planting in three rows). While planting the trees care would be taken that the buildings would be difficult to see through foliage when seen from a point outside the green envelope.
- The sensitive species which work as an indicator of pollution potential would be planted along the entire green belt.

8.1.3 Mitigation measures during decommissioning and closure

The proposed project is long term activity no decommissioning and closure of the unit is envisaged. The major activity will be seasonal, in non-season period the required staff will be available for carrying out day to day maintenance activities and juice packing unit will be in operation.

8.1.4 Environmental impacts of mitigation measures

The mitigation measures are to eliminate, reduce or control the adverse environmental impacts of the project. The impacts of these measures are quantifiable as the measurable parameters of air, water and soil should be meeting the standards fixed by the regulatory bodies time to time.

8.2 Best Available Techniques Not Entailing Excessive Cost (BATNEEC) Systems

The fruit processing industry identifies five key areas that can ensure day to day processing safety i.e.

- Improved fruit processing safety systems
- Robust traceability systems
- Crisis management system
- Risk identification and communication

Food processing safety and hygienic requirements may affect the requirement of water used to clean the process equipment and installation, making it necessary to use hot water. Likewise wastewater is also contaminated by substances used for hygiene purposes for cleaning and sterilization e.g. during the production and packaging of long life of food products. Heat treatment is a key tool to manage microbiological contamination of food and is even mandatory as per the existing legislation.

Best Available Techniques Not Entailing Excessive Cost (BATNEEC) is an approach implemented for sustainable environmental process operations with best environmental management systems. BATNEEC is implemented to various fruit

processing plants for preventing the release of pollutants, substances to any environmental medium and if not possible to totally prevent releases, in such cases for reducing the pollutant release to a minimum and for rendering harmless air pollutants that are released during process operations.

The basic principle in application of BATNEEC to fruit processing industries is the use of the most efficient pollution control techniques having regard to a balance between the economic costs and environmental costs. The main gaseous pollutant expected from food processing industries is volatile organic compounds from various process unit operations. By applying BATNEEC technique, it is possible to prevent the VOC emissions from process by ceasing the use of organic solvents. However in most cases the option of process change is limited by the process technologies and therefore end-of-pipe pollution abatement equipment is utilized to minimize emissions.

Particulate matter emissions from food processing

There are many potential sources for the emission of particulate matter from fruit processing operations. These include size reduction, raw material handling and transport of raw material and products. The emissions arising out of these processing and operation are generally dry in nature and the principle effect is possible nuisance due to deposition and soiling of buildings, equipment and other property. Many processing operations generate particulate matter and require the installation of abatement equipment to control particulate emissions.

Chemical emissions from fruit processing

There are potential acidic emissions from processing unit operations due to utilization of acids in the processes. These acidic emissions lead to acidification of rain, soil, building material damage and leaf collapse in plants. Other processes may involve the use of sulphides and similar chemicals and these produce primarily odour generation. The application of BATNEEC systems for the control of these pollutants is by installing control equipment. The principle equipment used for the control of acid gas emissions is based upon the absorption (scrubbing) technology. Scrubbers work on the principle of absorption of the acidic gases into a liquid (usually water). The wastewater can then be treated to remove the acids simply by pH adjustment.

There are mainly two types of scrubbing systems,

- 1) Spray towers where the liquid is sprayed counter current to the pollutant gas flow and
- 2) Packed towers where the liquid is sprayed into a packing material which effectively increases the surface area of contact between contaminated gaseous and the liquid. In general packed towers are more efficient technique used for food processing industries.

Emissions of volatile organic compounds

The potential sources of emissions of volatile organic compounds (VOCs) include heating and cooking operations where organic material present in the fruit may be volatilized resulting into odour as main concern. All the fruit processing operations use organic solvents in the process operations (mainly for extraction processes) and may emit VOCs as a by-product of reactions. The major problems caused by the emission of VOCs are

- 1) Photo chemical oxidation in the presence of sunlight and nitrogen oxides to produce ground level ozone and
- 2) The risk of perceptible odour at ground level.

Key environmental issues in fruit processing industries

Being a diverse industrial sector, the fruit processing industry has a different environmental issues and challenges in terms of relevant process emissions (direct, indirect and diffuse), outputs and subsequently BATNEEC applications.

Water consumption is one of the key environmental issues in fruit processing industries. Water which is not used as an ingredient, ultimately released as waste water stream with very high COD & BOD concentrations due to organic nature of raw materials. The waste water from these industries is mainly bio degradable and can be treated along with domestic effluents to meet the regulatory requirements. The main air pollutants from fruit processes are dust, VOCs and odour. Refrigerants containing ammonia and halogens are also expected to release accidentally from CA stores.

Noise can be observed as a local problem at project operations and site only. The noise is mainly from vehicles movement, grinding and refrigeration and compressor systems. The main sources of solid waste from food processing industry are inherent losses besides spillages, leakages, overflow, defects/returned products, retained material that cannot be freely drained to the next stage in the process.

Environmental management related to cooling/ freezing in fruit processing industry

The cooling and freezing processes during fruit processing operations and selection of cooling agents and refrigerants are the main criteria in controlling the environmental concerns. The typical cooling processes adopted in the processing operations are mainly cooling with air, water and combination of air and water. Batch cooling is mainly used in dedicated chilling rooms or cabinets with packed products. Spiral cooling is used for dedicated equipment with airflow of around 6m/s. Water spray directly on the product of unpacked or packed products is also used for product safety and hygiene. The major savings in energy, during food processing operations are possible by correct adjustments of working parameters such as

evaporator's temperature, conveyor belt speed and blower power in the freezing mechanism. Heat can be recovered from cooling equipment and compressors used for food processing operations by providing heat exchanges and storage tanks for warm water which can further be used for fruit cleaning. BATNEEC also applied for process compressor systems where the drier inlet air temperature should not exceed 35°C and maintaining the dryer room temperature within 5°C of the outside ambient temperature.

Water consumption in fruit process industries

Good quality of water is essential in food processing industry for maintaining food safety standards. A minimum raw water treatment concept involves water filtering, disinfecting and proper storage. The water can also be further treated by softening, de-alkalizing, demineralizing or chlorinating as required specifically for process operations or for utilities within the plant.

Water is mainly used in fruit processing operations for

- Process operations
- Equipment and installation cleaning
- Washing of fruits and raw materials
- Water does not come into contact with product, example boilers, cooling circuits refrigeration, chillers, air conditioning and heating
- Cleaning of packaging materials.
- Firefighting.

Waste water treatment

BATNEEC systems can be applied in fruit processing industries by reducing volume and pollutant load of the wastewater generated by

- Process integrated techniques such as eliminating or decreasing the concentration of certain critical pollutants, reducing water consumption, recycling/reducing raw materials and by products, recycling or reusing treated water.
- End-of-pipe techniques i.e., waste water treatment.

The sources of waste water generation from fruit process industries include

- Washing of the raw materials particularly fruits
- Steeping of raw material
- Water used for transporting fruits or fluming raw material
- Cleaning of installations, process lives, equipment and process areas
- Cleaning of product containers, washing of packaging materials
- Blow down from steam boilers

- Bleed from closed-circuit cooling water system
- Freezer defrosts waste water

The combined waste water will be treated in a well designated waste water treatment plant within the plant. The treatment plant mainly comprises of units such as screening, fat trap for removal of oil grease, flow equalization, neutralization, followed by sedimentation. The activated sludge process which is mainly to remove the organic pollutants like BOD & COD is basically an aerobic treatment process where air or oxygen is supplemented to the system for aeration for uniform mixing. The sludge removal and thickening systems will be provided to separate the sludge generated during the waste water treatment process. The fruit processing waste water mainly consists of

- Solids (gross or finely dispersed/suspended)
- Low & high pH levels
- Free edible fat/fiber
- Emulsified material
- Soluble biodegradable organic material (BOD)
- Volatile substances (ammonia and organics)
- Plant nutrients (phosphorous and nitrogen)
- Pathogens from sanitary water
- Dissolved non-biodegradable organics.

The primary treatment provided for food processing wastewater mainly reduces the BOD of incoming wastewater by 20-30% and the total suspended solids by 50-60%. Secondary treatment is principally towards the removal of biodegradable organics and suspended solids by biological methods. Organic nitrogen and phosphorous are also partially removed during secondary treatment. The process parameters for waste water treatment to be adopted are:

- pH should be in the range of 6.5 to 7.5
- The micro nutrients required in terms of BOD: N: P should be 100: 5: 1
- The optimum temperature to be maintained in the range of 35°C-37°C
- The original hydraulic loading rates and organic loading design rates should not exceed the manufacturer's recommendations.

Air emissions from fruit processing operations

The BATNEEC systems can provide techniques for the prevention and reduction of VOC, emissions during process operations. The emissions are mainly from:

- Process emissions from vent pipes, equipment, frying, boiling, cooking operation
- Waste gases from purge vents of process reactors
- Emissions from storage and handling operations e.g. transfer, loading and unloading of raw materials & products

- Flue gases from steam boilers, stacks
- Vapour losses during storage, filling and emptying of bulk solvent tanks and drums.
- Leakages from flanges, pumps, seals and value glands.

The main treatment systems adopted to control the air pollutants are mainly bag filters, cyclones followed by wet scrubbing systems to remove particulates as well as gaseous pollutants including VOCs. Bio-scrubbers and bio-filters are used for odour control from process operations.

8.3 Application of BATNEEC and Best Environmental Operations (BEO)

Widely accepted definition of BATNEEC for preventing the release of substances to environmental medium or, where it is not practicable by such means for reducing the release of such substances to a minimum and for rendering harmless any substance that are released is that

- “BEST” should mean the most effective in preventing, minimizing and rendering harmless pollution emissions. There may be more than one set of techniques which can be termed ‘best’.
- “AVAILABLE” should mean procurable by any operator of the class of process in question. It should not imply that the technique is in general use but it does require general accessibility.

Following technologies are being proposed in line with BATNEEC requirements

Installation of Solar Panels (including Roof top) for power generation & solar street lights within fruit processing facility

To reduce power consumption from Himachal Pradesh State Electricity Board (HPSEB) & use of DG set, it is proposed to set up roof top solar panels and solar street lights within the processing facility. This initiative will help in

- reducing power consumption of electricity generated by non-renewable resources (fossil fuels) by utilizing large land parcels and huge quantity of water
- reduce air, water, noise, solid wastes emissions from the thermal power plant
- as most of the power consumption at processing facility is during day time, solar power can be utilized during power failures there by reducing the need to utilize the DG set. This will help in reducing the diesel consumption, air emissions and noise levels in the surrounding area.

Power requirement and solar panel availability at fruit processing facility

The power requirement of fruit processing activities after expansion is about 250 kVA. About 10 sq. m of area is required to generate 1kW of solar energy (source: Bureau of Energy Efficiency - BEE, India). The current fruit processing

facility built up area is 2045.3 sq. m which can be utilized to setup the solar roof top panels for generating the electricity. The required solar panels can be procured from authorized dealers from the facility.

Sensor-fitted underground waste bins

To avoid and eliminate the current open dumping discreetly and provide a clean and litter free fruit processing facility, it is proposed to install sensor-fitted underground waste bins within the facility. This initiative will help in

- Eliminating vulnerable garbage points, open dumping spots, problem of over following garbage and sensitize users to be more careful while depositing their waste.
- Keeping garbage out of sight and providing a clean, tidy and pleasant aesthetics and better environment
- Put an end to bad odour (VOC's) from dirty smelly spill over garbage, bins and stray animals feeding on waste. Helping improve hygiene within the facility and reducing health impact on employees and visitors.
- The automatic bin lifting, emptying and washing of underground dustbins ensures that no garbage is spills out while transferring the waste and the bins can be reused

As there is minimal/ reduced human intervention involved, the workers don't come in contact with the garbage thus giving them a clean working environment.

Underground waste bin availability at fruit processing facility

On an average 1 cubic meter bin hold up to 0.5 tons of garbage. With about 15.24 tons/day of solid waste generated, number of bins with total capacity of about 15 cubic meters can be instated with in the fruit processing facility. The undergrounds bins has already being instated other projects in India and can be procured from authorized dealers from the market.

Silent diesel generator sets

It is proposed to install 250 kVA silent DG set at fruit processing facility. Silent power DG set shall be installed to reduce the noise pollution during operation of the DG set. The various companies providing silent DG sets include Mahindra, Reliance, Jakson. This initiative will help in reducing the noise generated from the DG set.

Automation of loading, unloading and transport of material within the fruit processing facility

At present loading, unloading and transfer of fruits and vegetables at fruit processing facility is handled by labor manually which will be strenuous and expensive. The chances of damage due to staking, accidental falling and mishandling are high due to manual intervention. Manual carrying of heavy loads by labor may also be

injurious to health. It is proposed to automate the loading, unloading from trucks and transfer of raw material within the facility by using appropriate lifting equipment like fork lifts, conveyor system and electrical/ battery transport vehicles.

Automation process will increase efficiency of handling material, minimize manual intervention thereby reduce losses and risk associated with manual handling of heavy consignments.

The various advanced technological aspects available for efficient conveyor systems are listed below

- The conveyor systems lately have a motor and controller built into a single module. These can offer control communications that work with specific yard communication systems. Servo stepper motors are used in a variety of indexing and positioning applications. These have become smaller and more streamlined there by increasing their functionality and capacity
- Conveyor systems with drive drum motors are more feasible in the space constrained areas since these contain the motor internal to the conveyor's drive pulley
- The modern conveyor systems that can be easily fitted on site using fast joint system and require few minutes and no adhesives
- Horizontal conveyor systems can be more feasible for fruit processing facility and these can come with either one or two pulleys at the end

Odour control technologies

Odour control technologies abate airborne odour problems significantly.

- Ecosorb is a deposited formulation of various natural oils and is used as an alternative to the many applications of the traditional form of odour control. It is most commonly applied via nebulisation, which attracts everything that is in the air - whether it's a pleasant smell or a real stench.
- Bio scrubber consists of a gas scrubber and a biological reactor. In the gas scrubber, to-be-removed components are absorbed from the gas stream by the wash water. In the biological reactor, the pollutants that have been absorbed by the wash water are biologically degraded. The purified scrubbing liquid is circulated to the scrubber, where it is able to reabsorb pollutants.
- BiOWiSH® technology accelerates decomposition of organic waste. There by the technology reduces odours and a wide range of volatile organic compounds (VOCs), including ammonia and hydrogen sulphide. The technology can be applied even at the low dosage of the waste available.

Comparative study of existing technology of processing plant and proposed alternative technology

S. No	Existing techniques	Proposed techniques
1	The total power required for the existing facility will be sourced from Himachal Pradesh State Electricity Board (HPSEB).	To reduce power consumption from Himachal Pradesh State Electricity Board (HPSEB) & use of DG set, it is proposed to set up roof top solar panels and solar street lights within the facility
2	The solid waste from the facility is being dumped openly.	To avoid and eliminate the current open dumping discreetly and provide a clean and litter free facility, it is proposed to install sensor-fitted underground waste bins within the site
3	DG sets are used as an emergency backup and are closed with acoustic enclosures	Silent DG sets shall be installed to reduce the noise pollution during operation of the DG set.
4	At present loading, unloading and transfer of fruits and vegetables at the facility is handled by labor manually which will be strenuous and expensive.	Automation process will increase efficiency of handling material, minimize manual intervention thereby reduce loses and risk associated with manual handling of heavy consignments.
5	No odour control measures were adopted	Odour control technologies such as BiOWiSH, Bio scrubbers are proposed to abate air borne odour problems.

8.4 Planning year wise implementation schedule

Mitigation plan is the key to ensure that the environmental qualities of the area will not deteriorate due to the construction and operation of the proposed project. The mitigation plan covers all aspects of the construction and operation phases related to environment. The mitigation plan needs to be implemented right from the conception phase and should continue till the end of operations at the project site. The plan can be divided into two phases viz., construction phase and operation phase.

During both phases air, water, wastewater, soil, noise, etc., has to be monitored and the reports should be kept at secured place and should be submitted to all concerned departments as and when they ask or as per the conditions mentioned in the statutory norms.

Documentation is an important step in implementing EMP, all statutory clearance obtained should be kept at one place for quick reference. All monitoring results should be kept at selected folders for quick references and access. The results

obtained over the period should be tabulated and converted into graphs and diagrams to see the trend in environmental quality changes. Documents which need to be kept in secured place are given below.

- Major technical information in operation
- Organizational charts
- Environmental monitoring standards to achieve
- Environmental and related legislations to be followed
- Operation procedures
- Monitoring records
- Quality assurance plans
- Emergency plants (onsite and off-site disaster management plan)
- MSDS of the various chemicals used in the project

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation. Records should be maintained for regulatory, monitoring and operational issues. Typical record keeping requirements for the unit is summarized in **Table 8.3** below:

Table 8.3: Record keeping particulars

Parameter	Particulars
Solid Waste Handling and Disposal	<ul style="list-style-type: none"> • Daily quantity of waste generated • Daily quantity of waste sent for Composting / Vermi-composting
Waste water	<ul style="list-style-type: none"> • Daily quantities of waste water & treated effluent • Point of generation & usage of treated wastewater • Treated wastewater quality
Regulatory Licenses (Environmental)	<ul style="list-style-type: none"> • Environmental Permits / consents from SPCB – renewals
Monitoring and Survey	<ul style="list-style-type: none"> • Records of all monitoring carried out as per the finalized monitoring protocol
Accident reporting	<ul style="list-style-type: none"> • Date and time of the accident • Sequence of events leading to accident & history of accidents • Investigation reports of previous accidents • Chemical datasheet assessing effect of accident on health and environment • Emergency measures taken • Corrective measures and steps taken to prevent recurrence of such events
Other	<ul style="list-style-type: none"> • Log book of compliance • Employee environmental, health and safety records • Equipment inspection and calibration records • Vehicle maintenance and inspection records

The detailed implementation schedule is given in **Table 8.4**.

Table 8.4: Implementation schedule

Phase	Period	Remarks
Construction phase	Before starting construction activities at site	<ul style="list-style-type: none"> Necessary arrangement will be made in identifying third party labs in carrying monitoring Necessary funds will earmarked in the budget
Operation phase	Monthly, quarterly, six monthly, yearly	<ul style="list-style-type: none"> In house monitoring for regular day to day needs. Third party monitoring for additional studies if required as per statutory norms EMP capital cost will be allotted during initial stages and recurring cost will be provided for regular operation and maintenance, chemicals, etc.

8.5 Institutional arrangements and capacity development for implementation of EMP

For implementation of Environmental Management Plan, an E&SM cell has to be formed. The Environmental and Social Management Cell (E&SM) will be headed by the Project Manager followed by other officers and technicians. The departments are the nodal agency to co-ordinate and provide necessary services on environmental issues during operation of the project. This environmental group is responsible for implementation of environmental management plan, interaction with the environmental regulatory agencies, reviewing draft policy and planning. This department interacts with State Pollution Control Board and other environment regulatory agencies. The department also interacts with local people to understand their problems and to formulate appropriate community development plan. The major duties and responsibilities of Environmental Management Cell shall be as given below:

- To implement the environmental management plan.
- To assure regulatory compliance with all relevant rules and regulations.
- To ensure regular operation and maintenance of pollution control devices.
- To minimize environmental impacts of operations as by strict adherence to the EMP.
- To initiate environmental monitoring as per approved schedule.
- To review and interpret monitored results and corrective measures in case monitored results are above the specified limit.
- To maintain documentation of good environmental practices and applicable environmental laws as ready reference and ensure that they are followed and maintain environmental records.
- Coordination with regulatory agencies, external consultants

The typical structure of E&SM cell is given in **Figure 8.4** and educational qualifications and experience details of the E&SM cell are given in **Table 8.5**.

Figure 8.4: Organizational setup of E&SM cell

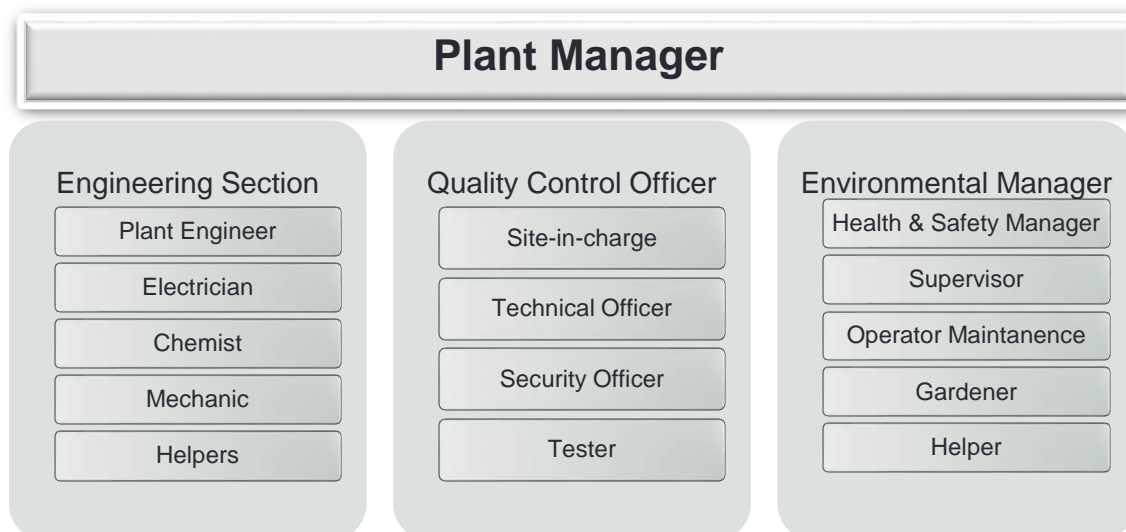


Table 8.5: Manpower for E&SM cell

S. No	Designation	Minimum qualification	Experience	Minimum no. of persons
1	EHS Manager	Graduate /Post Graduate	5	1
2	Site In-charge	Graduate	3	1
3	Supervisor	Graduate/ITI/Diploma	3	2
4	Operator	ITI/Diploma	3	2
5	Electrician	ITI/Diploma	1	1
6	Mechanic	ITI/Diploma	1	1
7	Chemist	B.Sc (Science)	2	1
8	Gardener	-	1	1
9	Helpers/Collectors	10 th / Intermediate	2	5

Note: Mechanic/electrician – can be part time employees on call will attend

8.5.1 Identification and assessment of training needs

Capacity building is a long-term, deliberate process of increasing the ability of an organization/group to identify and solve its own problems and risks, and to maximize its opportunities. This involves the mobilization of human, institutional and other resources and their subsequent strengthening and development.

In the present assignment, capacity building in the form of training and awareness programs will be conducted to ensure the sustainability of the project. Training will be

provided to the target groups (PCU/PIUs) to make them understand possible environmental and social issues associated with the moderate to high risk interventions of project and strategy to mitigate these issues.

The training sessions shall majorly emphasize on environmental issues related to the project interventions such as air, water, soil, noise pollution prevention and control, integrated solid waste management and the importance of waste separation, recycling and reuse, environmental monitoring, health and safety measures etc. An exposure about these issues to the participants will help identify the problems and enhance capacity to solve problems on their own. Following the training sessions, IE&C material will be provided to all the participants

8.5.2 Assessment of training needs

The processing units were visited by the team experts for conducting primary survey. The existing capacities were analyzed through obtaining primary information from the facility in charges, the working personnel, and nearby habitants with the help of well framed questionnaires.

The following training needs were identified and grouped into two groups viz., common for four interventions given in **Tables 8.6** and specific for processing unit and given in **Table 8.7** below.

Table 8.6: Identified gaps and training needs common for all four interventions

S. No	Anticipated Risks / Identified needs	Personnel to be trained	Proposed training topics
1	Material handling and operational posture related risks & hazards	Individuals Managers / Supervisors	Best ergonomic postures on-site and their significance in long run. Significance of PPE Signifying counseling sessions on proper shift change logistics, sitting or standing facilities, conducting health checkups
2	Fire & Safety related risks a. Electricity supply b. Fire safety	Individuals Managers/ supervisors	Importance of taking proper safety measures, wearing safety and personal protective equipment. Signifying importance of workplace safety and hygiene, installation of proper sign boards at appropriate places, maintenance of sufficient first aid safety equipment.
3	Improper housekeeping	Individuals	Maintain work place etiquette, good housekeeping practices bring to the notice

S. No	Anticipated Risks / Identified needs	Personnel to be trained	Proposed training topics
	facilities a) Drinking water facilities. b) Sanitation facilities. c) Maintenance of workplace hygiene	Managers	of higher authorities regarding observed any improper housekeeping operations Maintenance and supervising for availability of proper and safe drinking water, common and other logistic supply, taking action if and as required
4	Emergency response as required	Individuals Managers	Work to avoid any potential risk / hazard and immediately intimate to the higher levels regarding any observed emergency situations Training on handling emergency situations and take necessary responsive and corrective actions
5	Waste management and pollution control d) Solid waste generation e) Waste water generation f) Air and noise pollution	Individuals Managers	Best practices for waste minimization, importance of 3 R's and waste segregation. Alternative technologies, waste and pollution mitigation measures
6	Collectivization and Quality of life for Women workers	Women workers	To educate and motivate the women workforce through dialogic process, thereby find solutions to their problems through collective action
7	Issues of Migrant labor, child labor	Managers/ Supervisors	Sensitization against child labor, issues of migrant labor, rights of unorganized workers
8	Learning attitude and Development	Managers/ supervisors & workers	Education and skill development, Health and personal hygiene, Developing positive work place attitude
9	Stakeholder Engagement (Enterprise/Corporate Social responsibility)	Managers/ Supervisors	Rules and guidelines of CSR, social responsibility, stakeholder engagement and community development
10	Workers' Management	Managers/ Supervisors	An overview of Labour Law in terms of all applicable labour laws, like contract labour act, minimum wages act, workmen compensation act etc., will be covered.
11	Gender at work	Managers/ supervisors individual workers	Gender Sensitization, Equality of Work and Inclusive Development.

Table 8.7: Fruit processing units – identified gaps and training needs

Anticipated risks	Responsible personnel	Training proposed
Slippery surface	Individuals	PPE and its usage (Non slippery shoes, non-slippery flooring, Rubber mats)
	Managers	Coordinating with facilities for immediate cleaning following any spillage
Sharp objects	Individuals	Metal mesh gloves, Wrist guards
Noise	Individuals	PPE and its usage (Ear plugs)
Repetitive tasks associated stress	Managers	Counseling / Shift change management
Electricity related risks	Individuals	Importance of safety foot wear during operations
Fire related risks	Managers / Supervisors	Fire triangle, fire types and fire extinguishers usage training
Contamination sources	Managers	Training on importance of such sources away from working area with safe storage measures
Microbial contaminations	Individuals	PPE (Hand gloves, masks) and safe hand wash protocols post work
	Managers / Supervisors	Maintaining contamination free conditions
Chemical exposure	Individuals	PPE and its usage (Goggles, Respirators, chemical proof glass, Masks, Head covers)
Eating on the site	Individuals	Counseling over work place eat
	Managers / Supervisors	Providing designated eat place and time
Emergency response as required	Individuals	First aid training
Any near miss	Individuals	Train on significance of reporting it to higher authorities or concerned personnel
	Managers / Supervisors	Take immediate and necessary action
Improper housekeeping facilities	Managers	Train about importance of good housekeeping to eliminate incidents
Work place safety monitoring	Managers	Signifying importance of work place hygiene and safety

References

- 1 Project Implementation Plan 2016-17 to 2022-23
- 2 Wild life (Protection) Act, 1972 and its amendments
- 3 The Water (Prevention and Control of Pollution) Act, 1974 and its amendments
- 4 The Forest (Conservation) Act, 1980 and its amendments
- 5 The Air (Prevention and Control of Pollution) Act, 1981 and its amendments
- 6 The Environmental (Protection) Act, 1986 and its amendments
- 7 Central Motor Vehicle Act /Rules 1989
- 8 The Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, 2000 and its amendments
- 9 The Batteries (Management and Handling) Rules, 2000 and its amendments
- 10 The Noise Pollution (Regulation and Control) Rules, 2000 and its amendments
- 11 Ozone Depleting Substances (Regulation and Control) Rules, 2000
- 12 Food Safety & Standards Act (Integrated food law), 2000
- 13 Environmental Impact Assessment Notification, 2006 and its amendments
- 14 Guidelines/Criteria for evaluation of proposals/requests for ground water abstraction (with effect from 16.11.2015) and its amendments
- 15 Solid Waste Management Rules, 2016 and its amendments
- 16 Construction and Demolition Waste Management Rules, 2016 and its amendments
- 17 Bio-Medical Waste Management Rules, 2016 and its subsequent amendments
- 18 Plastic Waste Management Rules, 2016 and its subsequent amendments
- 19 Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendments
- 20 E-Waste (Management) Rules, 2016 and its amendments
- 21 Comprehensive industry document-COINDS/56/1996-97-CPCB
- 22 IS: 5182- sampling and analysis techniques for Ambient Air
- 23 CPCB guidelines for Ambient Air sampling and Analysis
- 24 Instrument working manuals, operating instructions given by manufacture
- 25 American Public Health Association (APHA) Standards
- 26 Bureau of Indian standards (BIS) & APHA methods
- 27 IS 10500-2012 drinking water standards
- 28 IS 2296-1992 inland surface water standards
- 29 Standard soil classification – Indian Council of Agricultural Research, New Delhi
- 30 IRC: 106- 1990 guidelines
- 31 <http://www.surveyofindia.gov.in/> (Survey of India)
- 32 Department of Geology
- 33 <http://www.bsi.gov.in/> (Botanical Survey of India)
- 34 <http://zsi.gov.in/App/index.aspx> (Zoological Survey of India)
- 35 <https://hpforest.nic.in/> (State Forest department)
- 36 GOI, Ministry of Earth Sciences, IMD, Climatological Tables (1981-2010)
- 37 <https://www.nic.in/> (National Information Centre data base)
- 38 <https://data.gov.in/catalog/villagetown-wise-primary-census-abstract-2011->

- [himachal-pradesh](#) (District Primary Census statistics of Himachal Pradesh - 2011)
- 39 WII/EIA publications and monograms
- 40 CPCB/ MoEF&CC regulatory standards
- 41 www.worldweatheronline.com
- 42 <https://www.nrsc.gov.in/> (NRSC standard)
- 43 AAQ Standards in respect of Noise SO 123 (E) dt 14th Feb 2000 – Silence Area, Residential Area, Commercial Area
- 44 Weather Statistics for Mandi, Himachal Pradesh
- 45 MoEF&CC Notification SO 4 (E) January 1st, 2016
- 46 <https://www.araiindia.com/home> (Automotive Research Association of India (ARAI))
- 47 <https://www.cftri.com/> (Central Food Technological Research Institute, Mysore)

Annexure 1 - Site photographs

Fruit processing facility Jarol - Site photos



Key experts team visit to the site and interaction with site officials

Observation of the site infrastructure



Baseline survey around 2km radius of the facility





Quality Council of India

National Accreditation Board for Education & Training



CERTIFICATE OF ACCREDITATION

Ramky Enviro Services Private Limited

- Ramky Grandiose, Ramky Towers Complex,
Gachibowli, Hyderabad – 500032, Telangana

Accredited as **Category - A** organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including Open cast/ Underground mining	1	1 (a) (i)	A
2	Onshore Oil and gas exploration, development & production	2	1 (b)	A
3	Thermal power plants	4	1 (d)	A
4	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	20	5 (e)	A
5	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
6	Industrial estates/ parks/ complexes/ Areas, export processing zones (EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
7	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	32	7 (d)	A
8	Bio-medical waste treatment facilities	32A	7 (da)	B
9	Common effluent treatment plants (CETPs)	36	7 (h)	B
10	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
11	Building and construction projects	38	8 (a)	B
12	Townships and Area Development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RA AC minutes dated July 26, 2019 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/19/1045 dated August 28, 2019. The accreditation needs to be renewed before the expiry date by Ramky Enviro Services Private Limited, Hyderabad, following due process of assessment.

Sr. Director, NABET
Dated: August 28, 2019

Certificate No.
NABET/ EIA/1922/ RA 0140

Valid till
21.05.2022

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.



**National Accreditation Board for
Testing and Calibration Laboratories**

(A Constituent Board of Quality Council of India)



CERTIFICATE OF ACCREDITATION

HYDERABAD WASTE MANAGEMENT PROJECT LABORATORY

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

TSDF AT 684/1, Dundigal Village,
Dundigal Gandimaisamma Mandal, Medchal District, Telangana

in the field of

TESTING

Certificate Number TC-5067

Issue Date 27/02/2019

Valid Until 26/02/2021

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Signed for and on behalf of NABL



89076970100030002480

N. Venkateswaran
Chief Executive Officer

JAROL

(Existed)
PerfectTNA Questioner on

Intervention activities, environment and social infrastructure facilities available

Name of the project/Intervention	HPMC, Fruit Processing unit, Jarol
Facility Type	Existing facility / Green field site
Type of activity carried out / proposed	Products such as Apple Juice, Concentrate, Sausage, drinks, Pickle, etc.
Intervention location details	
Village	Jarol
District	Mandi
State	Himachal Pradesh
Latitude	31°27'44.01"N
Longitude	76°51'42.58"E
Contact person details	
Contact Person Name	Mr. Vineet Kaushik
Designation of contact person	Add. General Manager
Telephone / contact no	9816033580.
Email ID	hpmcjarol@gmail.com
Land area details (Acres) (collect available information)	
Total land area	1.01 Acres.
Private/Government	Government
Others (specify)	
Man power details	
Permanent staff	16 (Total = 30, vacant = 6)
Contract staff/ Labours	8
Visitors	
Others (Please specify)	
Power requirement	
Source of electricity	State electricity board
Electricity requirement (kVA)	141 kW
Capacity & type of power back up	DG set - 100 kVA
Energy conservation methods and best practices being followed	Nil

Water requirement	
Source of water	Ground water (nearby mountain, natural)
Total water consumption (KLD)	70 - 150 KLD (100 KL-Tank)
Air pollution control measures	
Boiler/ DG set Stack details	DG set Capacity (100 KVA)
Existing control equipment details and best practices followed at intervention	Pollution Control equipment is installed
Waste water handling measures	
Operation of waste water collection, treatment and disposal system details. (ETP/Any other method)	operations of waste water treatment carried out in ETP.
Sewage collection, treatment and disposal system details. (STP/Septic tank/Soak pit)	Sewage Collection is collected in SoakPite.
Rainwater harvesting	
Rain water harvesting method followed with details. (Yes/No)	No, Rain water harvesting pit flows to natural drains.
Noise pollution control measures	
Existing control equipment details and best practices followed at intervention (Yes/No) If yes details	No noise Control equipments are used at intervention.
Solid waste handling measures	
Segregation, collection, treatment and disposal system	Solid waste Collected and disposed by municipalities
Sanitation facilities & House keeping	
Availability of separate Toilets for men & women (Yes/No)	Yes (male-1, female-1)
Hygiene and proper maintenance of toilets for use condition	Good

Housekeeping / cleaning activities within the facility and best practices followed	Activities followed once in daily.
Safety	
Safety equipment details like PPE, Fire extinguishers, Sand buckets are used at intervention	No Safety equipment usage
Health care facilities	
Availability of First aid kit at intervention	Available of first aid kit
Availability of Ambulance at intervention	No Available of Ambulance
Availability of health centre/ medical facilities at inventory	No health Centre at Intervention
Availability of doctor at intervention	No doctor available
Other facilities	
Availability of Creche for workers children within the site	No Creche for workers children
Availability of temporary sheds for Labour	Available but not for Accommodation
Availability of drinking water	Available of drinking water
Availability of transportation and road connectivity for current workers	Good road Connectivity and use Public & Private transport
Observations by investigator	
<p>1) No drainage for waste water, it is openly drained</p> <p>2) Animals are Present in the Premises of site</p> <p>3) No green belt Present in site</p> <p>4) No safety equipment available/use in site</p>	


Information provided by:

Name:

Signature:

Questionnaire filled by:

Name: Subash Koduri

Signature: 

TNA Questioner on

Gap analysis: Environment & Social needs of the project & Stakeholders

Name of the intervention	HMC / Jarol / FPU	
Type of intervention	G&P / CA / MY / FPU	
Facility Type	Existing facility / Green field site	
Name of the stakeholder	Group of workers (manufacturing Process)	
Individual / Group If group: number of people	42 No. of People	
Stakeholder Type	Official/ Labourer / Migrant labourer/ Visitor/ Truck driver / villager/ others:	
Other information		
Stakeholder Signature		Mobile No:

Awareness related to	Observations
Awareness/ knowledge on existing manufacturing process / produce handling process at intervention (CA/ G&P/ MY/ FPU)	Aware of manufacturing Process at intervention
Awareness/ knowledge on existing equipment functioning procedures	Aware of equipment function procedure
Availability / awareness on manuals / User guide of Equipment	Aware of user manual
Environmental attributes	
Awareness/ knowledge on existing pollution generating sources / process (air, odour, noise, water, sludge, solid waste)	Aware of pollution generating sources
Awareness / knowledge of applicable standards / regulation to the inventory	Partially aware of regulation
Awareness / knowledge of type of waste generated at the inventory	Aware of waste like fruit waste, dust, broken glass (Pomona)

Awareness related to	Observations
Awareness / knowledge of existing / likely waste collection & storage procedures	Aware of waste Collection at Intervention
Awareness / knowledge of present disposal methods followed	Aware of disposal method and carried out by Contract
Awareness / knowledge of existing resource conservation measures (rainwater harvesting, power etc.)	Not aware of Conservation methods
Risk & Safety measures	
Awareness / knowledge of existing hazards of manufacturing stages/ activities	Aware of hazards taken place in manufacturing stages.
Awareness / knowledge of work place safety measures to be followed	Aware of safety measures followed
Awareness / knowledge on best practices on material handling and operational postures	Aware of operational method.
Availability & usage of personal safety equipment	Not aware because no available of safety equipment
Awareness / knowledge of emergency response systems at intervention	Aware of emergency response system
Social attributes	
Awareness / Knowledge on women's safety and prevention of sexual abuse, harassment and violence	Aware of Prevention of violence, etc
Awareness / knowledge on children's safety, protection & prevention of child labor	Aware of Prevention of child labour
Awareness on applicable Labour laws like Contract labour, minimum wages, workmen compensation Act etc.	Partially aware of minimum wages, Acts, etc

Awareness related to	Observations
Awareness / knowledge on temporary accommodation & sanitary facilities provided for migrant workers and labours	Partially aware of Dormitories, etc
Awareness on up-gradation of skills & livelihoods. On-the-Job Trainings for workers	Aware of trainings for workers.
Awareness on Grievance Redressal Mechanism (GRM) (like : registration, resolution and tracking)	Not Aware

Housekeeping & sanitation

Importance of maintaining clean and hygienic work place	Aware of maintaining clean at work place
Availability of portable water for drinking purpose	Aware of drinking water available
Availability and usage of hygienic toilets to avoid open defecation	Aware of avoiding open defecation
Awareness against indiscriminate disposal of waste generated on land near collection bins	Aware of disposal of waste at collection bins.

Health attributes

Awareness about health issues due to unhygienic work place and odour nuisance	Aware of health issues due to unhygienic work place
Awareness on First aid and medical facilities available and worker compensation for on minor injuries sustained at site	Aware of first aid kit at intervention

Observation by investigator on environment considerations

<p>1) No drainage for waste water - it is openly drained</p> <p>2) Animals are Present within Site Premises</p> <p>3) No green belt Present within site.</p>
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Awareness related to	Observations
Observation by investigator on Social considerations	
1) Poor sanitation facility & management 2) No safety equipment available at site 3) Dormitory available for truck drivers.	


Filled By

Name: Subash Kaduri

Signature: 

Approved By

Name: B. Chakrabarti

Signature: 

Tanul
Villager

HPHDP Questionnaire

Environmental Impact Assessment of New/Existing project

7/28/2018

Ramky Enviro Services Pvt. Ltd

Hyderabad

1. Questionnaire Details	
Reference No	
Date	✓
Survey Team	
1. Dr. Haish	Signature: ✓
2. Souleat	Signature: ✓
3. Shahid	Signature: ✓

2. Site/Facility / Project Information	
Name of the Unit / project	HPMC, fruit processing unit, Jauhal
Name of the Chief Executive & Postal address:	
Contact particulars (Tel/Fax/E-mail):	
GPS Coordinates (Latitude/Longitude)	31°27'44.01" N 76°51'42.58" E
Nature of the Unit / Project	Fruit Processing Unit
Funding of the project	World bank
Name of the agency proposing the new project:	HPMC/HPSAMB/HP Horticulture Department
Any Encroachments / settlements in the project area	No
Distances from the nearest State / National Highway:	NH-154, Adjacent (W)
Railway station :	✓
Bus stand:	
Estimated cost of the project	✓
Land cost :	
Land owned by:	HPMC
Estimated construction cost: (including plant & machinery)	

3. General Topography		
3.1	Type of Terrain	Hilly
3.2	Slope	Gentle to steep slope
3.3	Run off characteristics of the project	
3.4	Specify general features of land	Denudation hills, traces, valleys
3.5	Soil characteristics	Blackish brown, sandy loam
3.6	Natural drainage pattern	ephemeral
3.7	Flood prone areas if any, specify	✓

4. Ecology and Bio-Diversity		
4.1	Tree cover – prominent species (If any)	Bamboo tree, Eucalyptus, Neem
4.2	Fauna – wildlife/domesticated	Langur, black bear, wild pig
4.3	Avifauna	Myba, Kori, Rock bunting
4.4	Environmental sensitive locations near the project area if any	Banoli wildlife sanct.

5. Geological Features		
5.1	Existing land use: area & percentages	
5.2	agricultural & non-agricultural uses:	
5.3	commercial and industrial	Urban
5.4	dense/open forests, fallow land	
5.5	Total Number of human settlements	
5.6	Water bodies	
5.7	National/State Highways and Transport system	Yes
5.8	Predominant activities in the project area: Residential -1 institutional -2 commercial -3 Any other -4	1 and 3 very little
5.8	Special features in the project area Tourist spots -1 Monument/archaeological sites -2 places of worship-3 Heritage areas -4 Places of other interest -5	None

6. General Meteorological data		
6.1	What is the direction of Wind	
6.2	What is Speed	
6.3	What is the average annual rainfall	
6.4	What is average annual temperature	

7. Socio-Economic Data		
7.1	Population of study area (10 km radius)	
	a) Total Number of Households	1106
	b) Total Population	5590
	c) Male	2844

	d) Female	2746
	e) Scheduled Caste	1070
	f) Schedule Tribes	15
	g) Others	
7.2	Decadal growth rate	11.3
7.3	Literates	3681
7.4	Settlement pattern	Linear scattered
7.5	Total Number of Hospitals, PHCs and Dispensaries	7
7.6	Prevalence of Endemic disease and epidemics	None
7.7	Occupational Pattern	
	a) Main Workers	1015
	b) Marginal Workers	1961
	c) Non-Workers	2534
7.8	Educational infrastructure	
	a) Anganwadi	9
	b) Schools - Primary, Secondary, Senior secondary, Higher	6
	c) Collages -Intermediate, Graduation, PG and Above	-
7.9	Villager level Institutions	
	a) Post offices	yes
	b) Banks	yes
	c) Cooperative Banks	yes
	d) Credit Societies	NA
	e) Market committees/societies	yes
	f) Self-Help Groups	yes
	g) Farmer Producer Groups	NA
	h) Other use groups if any	NA
7.10	Source of Drinking water:	
	a) Own-1,	1, 2
	b) Govt.-2,	
	c) Private-3,	
	d) Others-4	
7.11	Post-harvest facility:	
	a) Cold Storage -1,	2
	b) Proceession Plant -2,	
	c) Grading and Packaging -3,	
	d) Wholesale Mandi / Market yard - 4,	
	e) Any others- 5	
7.12	Distance Travelled to reach facility	
	a) 0-2 km -1,	a)

	b) 2-5 km -2, c) 5-10 - 3, d) 10 and above - 4	
7.13	Presence of indigenous people, migratory tribes in the project area Yes -1, No - 2	2
7.13.1	If yes, indicate season, livelihood and settlement pattern	N/A
7.14	Toilet facility: a) Inhouse-1, b) Community-2, c) Open defecation-3	1, 3
7.15	Domestic Sewage, Collection, Treatment & Disposal a) Mode of collection b) Surface drains - Underground c) System and capacity d) Any treatment e) Septic tank and filters (capacity) f) Biological treatment capacity & other details	yes open drains NA NO NA
7.16	Solid Wastes a) Estimated quantity of each types of solid waste b) Mode of collection and disposal c) Recycling to be instituted, if any	NA public NA

8. Natural resources		
8.1	Water: a) Availability of ground water table, b) rate of recharge present restrictions on drawl c) Available yield d) Quality of water (physical, chemical, biological) e) Source of water supply and quantities to be drawn f) Type of treatment, if any g) Continuous/intermittent supply h) Storage capacity in kiloliters	Public source yes NA NA NA NA NA NA NA
8.2	Electricity: a) Sources of power and supply capacity BSES b) Connected load	+113513 yes

	c) Distribution system through onsite ESS d) Alternate supply for essential services for power back-up e) Type of fuel used and capacity	NA NA
8.3	Indicate Ambient air quality levels (standard parameters including noise)	PM ₁₀ 30.1 - 42.3 $\mu\text{g}/\text{m}^3$ PM _{2.5} 20.1 - 24.1 $\mu\text{g}/\text{m}^3$
8.4	Mineral: a) Type b) Location c) Quantum (estimated)	— — —
8.5	Energy Consumption pattern for hydrocarbons, gas, electricity and any other nonconventional energy source	—

9. Details of new construction		
9.1	Plot coverage	—
9.2	Height, FSI (permissible/proposed)	NA
9.3	Building materials for construction a) Quantities b) Source c) Processes involved d) Special attributes, if any (life cycle costs, efforts towards greening the supply chain)	— — NA
9.4	Details of public utilities required for the project during construction Phase	Canteen, Toilets, emergency medical aid
9.5	Details of public utilities required for the project during operational Phase	Recreation hall, rest room, emergency medical aid

10. Possible Impacts on the surrounding areas (reflections from local community)		
10.1	Awareness about existing facility / proposed intervention Yes-1, No - 2, Partially Known -3, Others-4	1
10.2	Your willingness about the proposed/ existing facility Yes-1, No - 2, Not Known -3, Others-4	2
10.3	Do you think the project will bring benefits to the area. Yes-1, No - 2, cannot say -3, Others-4	1
10.3.1	If yes, which benefits: a) Employment -1, b) Improvement of Social Status -2, c) Industrial Development -3, d) Other, if any -4	1 3 4

	Do you think your family will be benefitted? a) Yes-1, b) No-2, c) cannot say -3, d) Others-4	2, 3
10.4	Did you face any following scenario in the recent times a) Influx of migrant labour -1, b) instance of communicable diseases -3, c) crime rate & theft -4, d) others if any -5	1 - - 5
10.5	Did you experienced any problems due to migrant workers, floating population in this area Yes - 1, No -2	2
10.5.1	If, yes, please elaborate:	NA
10.6	Have you experienced any increase in Traffic recently	Yes
10.7	Did you face any problem during peak hours? Yes - 1, No -2	1
10.8	Do you suggest for provision of service roads for entry/exist of the project site Yes -1, No -2	1
10.9	Do you see any other impacts due to activities likely to come up in the surrounding areas from the project during construction & operation phases Yes-1, No-2	1
10.9.1	If Yes, Please describe the nature of problems (indicate list) a) Environmental Pollution -1, b) River/ water contamination -2, c) Land degradation -3, d) Loss of Agricultural Productivity -4, e) Hike in Living cost/land rates -5, f) Issues of migrant labour -6, g) Threat to cultural values-7, h) Increase in crime rate - 8, i) Threat to indigenous population - 9, j) Impact on Places of Worship - 10, k) Any other -11 l) Unplanned developments like slums, shops - 12	1 2 - 5 6 - - - -
10.10	State briefly impacts predicted on: a) quality and quantity of natural resources b) Air quality	yes yes

	c) Vegetation d) Animal/Aquatic life e) Surface/ground water	NA NA
10.11	State briefly impacts predicted on the quality and quantity of manmade features, like: a) Transport linkages: 1. Road, 2. Bus, 3. Water, 4. Air, 5. Others b) Heritage areas/ecologically sensitive areas	1, 2 and 5 NA
10.12	Do you perceive any Specific Problem to your Family Yes-1, No - 2, cannot say -3, Others-4	3
10.12.1	If yes, Please elaborate: Loss of Land -1, Loss of employment -2, Any other -3	NA
10.13	Any Project Affected Population (directly) in the village Yes-1, No - 2, Others-3	2
10.14	Any specific R&R problem due to proposed intervention Yes-1, No - 2, Others-3	2
10.14.1	If Yes, please elaborate a) Issue in Land Acquisition -1, b) In adequate Compensation - 2, c) No proper R&R -3, d) cultural issues- 4, e) Impact on places of worship - 5, f) Others-6	NA - - - - -
10.15	Any other issues:	NA

11. Any other relevant information of environmental significance:		
11.1	a) Disabled friendly design,	yes
	b) fly ash utilization	yes
	c) Greening of supply chain	NA
	d) Timber-free construction	NA
	e) Green rating,	NA
	f) Energy efficiency for lighting & ventilation	yes
	g) Design impacts on human health	yes
	h) Occupational health and safety	yes

12. Checklist of Enclosures

1. Land purchase agreement:
2. Building approvals from local authority:
3. Land use/Zoning particulars-relevant portions from the prevailing local Regulations
4. Landscape plans with proposed tree plantation
5. Rainwater harvesting plan
6. Sewage treatment plant-details with a write up
7. Water balance statement:
8. Cost estimates inclusive of land cost
9. Fire protection measures & approvals obtained
10. Public hearing report
11. Incorporation of points raised in public hearing
12. Approval of competent authorities in case of conversion of agricultural land, change of land use,
13. Construction schedule (CPM/PERT chart)
14. Statement on the machinery & manpower during construction
15. Approval from special bodies (such as Urban Art Commission or heritage areas
16. Approvals if applicable from ASI, Civil Aviation, ecologically sensitive areas, development regulations
17. Solid waste collection /disposal plan
18. Vehicle parking and management:
19. Storm water drainage Plan shall be submitted to competent authority for approval.
20. Comprehensive listing of building materials for construction
21. Energy balance studies, if carried out
22. Executive summary of EIA:

13. Observations by Investigators

