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Environmental Impact Assessment of Kharland Scheme

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ABSTRACT: Environmental impact assessment is the environment management tool. Environment Assessment procedure ensures consideration of environmental implications before making a final decision of assessing the environmental attribute. Process of assessment analyses the effects on environment and is useful for reporting those effects undertaking a public consultation exercise and lastly it reveals decision to public after reviewing the comment of the report. Soil salinity in coastal region is problem due to ingress of tidal water. To protect the land from tidal water embankment is constructed along creeks. These embankment with cross drainage structures called as Kharland scheme. For the purpose of conserving and protecting the coastal areas. mangroves and marine waters, the coastal regulation zones areas are classified by Ministry of environment and forest The Kharland schemes fall under CRZ but these schemes are very important for farmers as area is reclaimed and water is also made available for irrigation purpose. Thus all factors shall be studied thoroughly and environmental impact of Kharland scheme shall be analysed.

KEYWORDS: Environmental Impact analysis, Khar land schemes, saline, mangroves

I. INTRODUCTION

The Maharashtra state has 720 km of coastal length with 54 creeks. It comprises the districts of Palghar, Thane, Raigad, Ratnagiri and Sindhudurg. The coastal saline soils occur in these districts due to periodical inundation of cultivable land by creek/sea water during high tides. Such periodical inundation render the otherwise fertile soils progressively saline and in time make it completely unfit for growing any crop. These coastal saline soils are locally called as khar or khajan soils. As per the master plan of development of coastal saline soils of Maharashtra the total area under saline soils in five districts of Konkan is estimated to be 65,465 ha. A strong embankment is required to construct at least to height greater than the height of maximum tide to stop ingress of sea water. Side slopes of 2:1 with stone pitching towards creek side and 1:1 towards land side with grass cover is found to be optimum. Conservation of mangroves on creek side of the embankment helps in stabilization of embankment and reducing erosion due to waves of sea water. The various projects for construction of Saline Embankments has been undertaken by Kharland Development Circle (KLDC), Water Resource Department, Government of Maharashtra at creek locations across Kokan Region. These schemes are vital since they restrict tidal waters to enter the agricultural lands along the creek or sub creeks. The objective of kharland Scheme is to protect agricultural and grazing land in order to strengthen socio- economic status of nearby villages. The proposed schemes are along Coastal Regulation Zone (CRZ) hence Coastal Regulation Zone (CRZ) clearance as per the CRZ Notification, 2011 and subsequent amendments are applicable. The Projects fall under the CRZ category. Environmental Impact Assessment is required to obtain CRZ clearance. The objective of this project is to carry out Environmental Impact assessment of Kharland Scheme.

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II. LITERATURE REVIEW

In the literature different Environmental impact assessment methods, strategies are there Environmental Impact of water resource project .1st ed CRC Press. Taylor and Francis, New York. 1985. The affected environment was divided into thirteen components, such as Ecology, Surface water, Air quality, etc. Peter Watten (Eds.)² - 'Environmental Impact Assessment Theory and Practice', Unwin Hyman, London (1988). This comprehensive treatment of environmental impact assessment (EIA) provides an authoritative contemporary review of theory and practice over the past ten years. EIA is viewed as both science and art, reflecting the concern both with technical aspects of appraisal and the effects of EIA on the decision-making process. Government of India Coastal Regulation Zone Notification, 2011⁴ the land area from High Tide Line to 500mts on the landward side along the sea front. CRZ shall apply to the land area between HTL to 100 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea The land area falling between the hazard line and 500mts from HTL on the landward side All mangrove areas shall be mapped and notified as protected forest and necessary protection and conservation measures for the identified mangrove areas shall be initiated. Five times the number of mangroves destroyed/cut during the construction process shall be replanted.

III. EXPERIMENTAL SECTION

Sea water rises above the normal level up to 4 to 5 m during high tides and recedes to the same extent during low tides. The effect is manifested in the rise and fall of water level of the estuarine channels and creeks. High tides and low tides occur twice a day. Period between these two tides is generally 24 hours and 50 minutes, which is counted between these two ditches. It would be seen that the period between two consecutive high tides is about 15 days. Similarly, the period between two consecutive low tides is also about 15 days. The salinity of surface water is important for growth of the paddy crops. Khar Land means such tidal land as is made cultivable or otherwise beneficial in any manner whatsoever by protecting it, by means of an embankment, from the sea or tidal river, and includes all such land in whatever manner described, whether as Khar, Kajan, Kharepat, Gazni or otherwise. Reference: Maharashtra Kharland Act, 1981 Purpose of Construction of Kharland Bunds Agricultural lands in the coastal area in Konkan become saline due to ingress of tidal waters. Tidal waters are restricted to enter into the agricultural lands by constructing saline embankment along the banks of the creek. The flood water is allowed to go into the sea through the cross drainage works constructed in the embankments. One-way gates are provided to the Cross-Drainage Works in order to restrict the saline water from the sea to enter into the agricultural lands.

Project description

Moracotta is an island it is surrounded by Dadar Creek on all sides. Site is of directly accessible by road available after crossing 200 meters of water stretch.; which is near to The Morakotha Khar Land Scheme Situated near village Morakotha & Rave Taluka Pen, District Raigad. Current embankment was in very poor state and needs to be rebuilt in order to protect agricultural land as well as protect villagers during floods.

Brief details about Saline embankment-The Total length of bund is 2490 meters and the total estimated cost of construction is approximately 535.65 lakh.

Description of Activities -The natural resources required for construction of project are water, power supply and raw materials like cement, stone, sand, murrum. Cement shall be procured from Pen city, stone and murrum shall be obtained from quarry at Khaisarwadi village. Sand will be obtained by Rawe. The present project necessitates the supply of 300 litres /day of water whose source will be tanker supply. Electricity required for the project will be supplied by MSEB.

Manpower Requirement For construction of saline embankment a total of 30 people will be employed out of which 10 will be skilled workers and 20 will be semiskilled workers.

Project Implementation Schedule The duration of proposed project will be 1.5 to 2.5 years.

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Vol. 8, Issue 7, July 2019

Figure 1. Design of kharland scheme

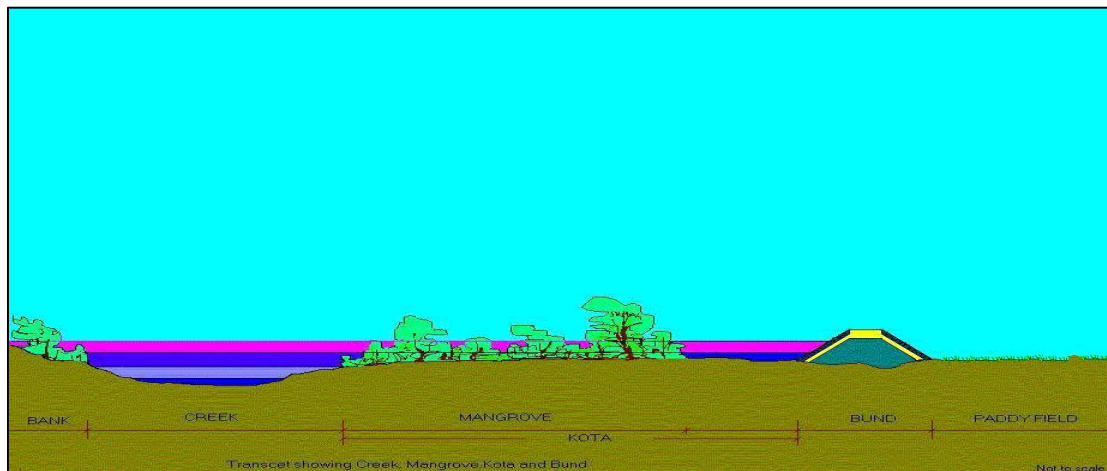
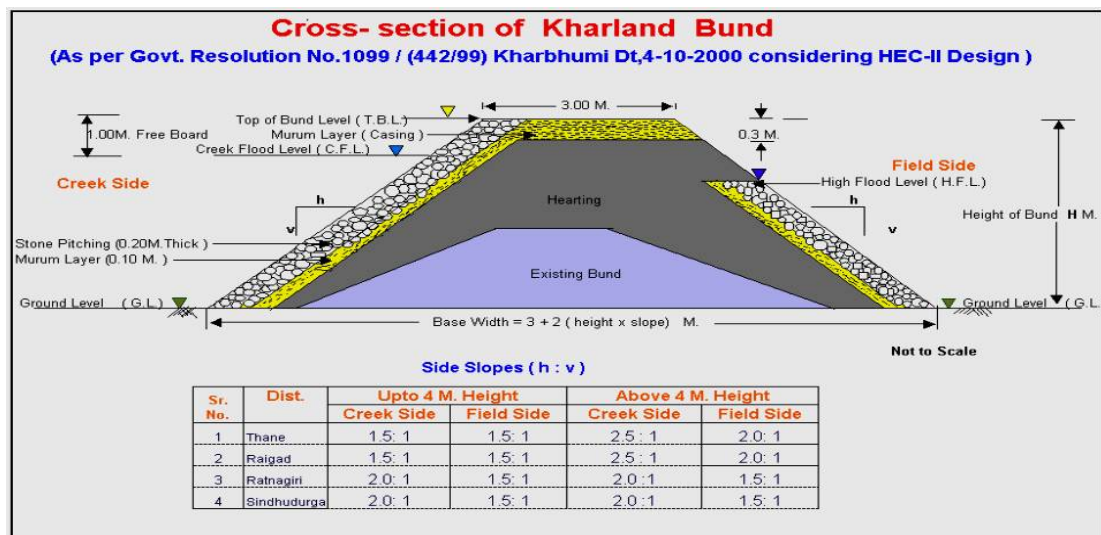


Figure 2. Cross section of kharland scheme



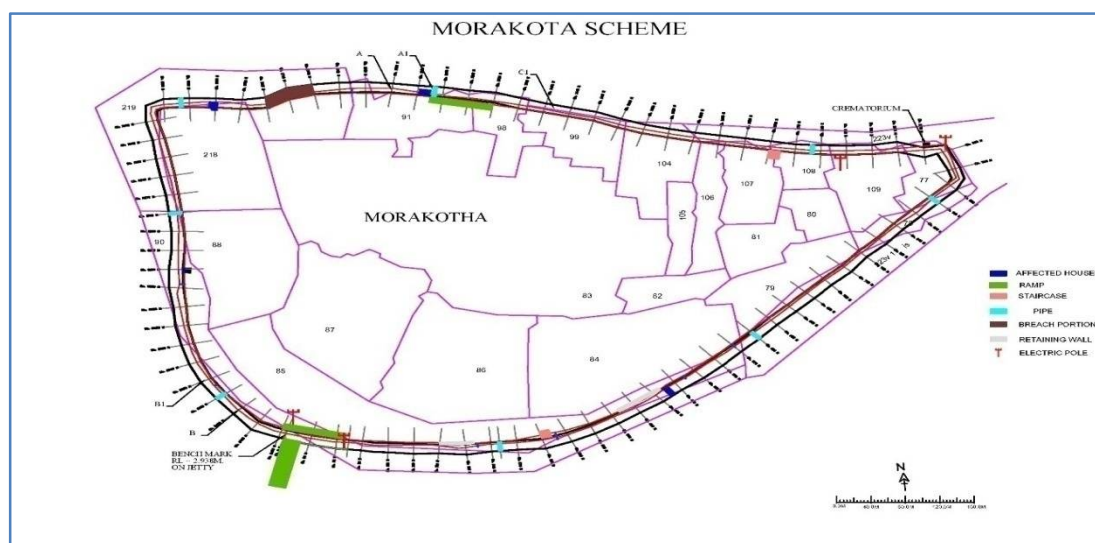
International Journal of Innovative Research in Science, Engineering and Technology

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Visit: www.ijirset.com

Vol. 8, Issue 7, July 2019

Figure 3. Morakota kharland scheme



Baseline Environmental Status-

Baseline environmental study was carried out in premonsoon season (23rd December 2018 – 23rd March 2018). The environmental baseline data for Soil quality, Ambient air quality, Water quality, Marine ecology, Noise level monitoring, flora and fauna studies and demography was collected for an area of 10 km radius from proposed project sites.

Land use-The total land use area is 29030 ha. The major share of the land in the study is vegetation, comprising of about 13616 ha followed by build-up area comprising of 5577.45 ha and Agricultural land of 4997.7 ha.

Soil Environment-The soil samples collected from two locations showed the soil texture to be sandy loam. The pH at two sites was found to be neutral. Salinity of the soil is on a higher side which may be due to severe accumulation of salts that may restrict growth of plants. Nitrates, as NO₃ was found near Morakota village 5.98 and near Kharland scheme was 1.28 mg/kg. Potassium, (as K) was more at Morakota village 322 mg/kg and Rave was 96 mg/lit. Permeability near Kharland Scheme was found to be 0.355 cm/sec and that of near Morakota village was 0.298 cm/sec. Electric conductivity near Morakota village was 0.526 mS/cm and near Kharland Scheme was 0.256 mS/cm.

Water Environment Two surface water and one ground water samples were collected, analysed and compared to standards IS 2296 and IS 10500:2012 for physicochemical, heavy metals and bacteriological parameters in order to assess the impact of the project.

Ground water: Ground water sampling was done at one location near from Morakota village. All parameters analysed were within standard limits (IS 10500:2012) except for coliform bacteria which indicates that the water sample analysed maybe unfit for drinking purpose.

Surface water: The analysis reports of sampled surface water shows pH to be slightly alkaline, increase in C.O.D. and B.O.D. values may be due to domestic runoff intrusion and decrease in D.O. values indicates that the ponds are in detrimental condition.

Marine Environment Creek water and sediment samples were collected and analyzed for various physio-chemicals and heavy metal parameters in order to assess the impact of the project.

International Journal of Innovative Research in Science, Engineering and Technology

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Visit: www.ijirset.com

Vol. 8, Issue 7, July 2019

Creek water: Creek water pH was found to be neutral. The phosphates and nitrates are within limits and the chlorides and Sulphates are indicative of the salt water characteristic to the sampled water. Major and minor nutrients like phosphates, nitrates, nitrates signifies good productivity of the water in the study area.

Creek Sediment: Creek sediment samples had sandy loam texture. pH of the sediment was found to be neutral. Oil content was found to be slightly higher along with major and minor nutrients such as phosphorus and sulphide which are detrimental to the aquatic fauna. Heavy metals such as iron, zinc, lead, cobalt copper are all found to be on a higher side. This would indicate presence of industrial source of pollution. Air Environment Metrological Data The meteorological data was procured from Indian Meteorological Department (IMD Raigad) for the period of 10 year from 2004 to 2013.

Temperature: The temperature varies from 29°C to 34°C throughout the year. In past 10 years lowest temperature recorded was 15°C for the month of January and the highest was 37°C for the months of May and June. Mean minimum temperature varies from 18°C to 27°C.

Relative Humidity: On an average a RH of 80% was observed in the morning and a RH of 70% was observed in the evenings. The lowest Relative Humidity recorded was 57% in January, 2005 and the highest Relative Humidity recorded was 93% in March, 2008

Rainfall: Average annual rainfall recorded 2335.7 mm as per date for year 2004- 2013. • **Wind Direction:** The wind parameters like the wind speed and wind direction were recorded twice in a day at morning 8:30 am and evening 5:30 pm.

Ambient Air Quality Monitoring (AAQM) Ambient Air Quality Monitoring was carried out for three locations. As per NAAQS specifications of CPCB for the parameters PM10, PM2.5, SO₂, NO_x and samples were collected on 24 hours basis for all parameters and one-hour sampling for CO as per standard method. The results obtained were as follows: • PM10 ranged from 76.30µg/m³ (Morakotavillage) to 51.30µg/m³ (Rave village). • PM2.5 ranged from 39.90µg/m³ (Nr. Kelvane village) to 18.20µg/m³ (Rave village). • SO₂ ranged from 21.98µg/m³ (Nr. Kelvane village) to 9.42µg/m³ (Morakotavillage) • NO₂ is recorded to range between 39.89µg/m³ (Nr. Kelvane village) to 24.89µg/m³ (Nr. Kelvane village) • CO is ranged between 0.85 mg/m³ (Rave village) to 0.29 mg/m³ (Nr. Kelvane village). All components are observed to be within standard limit given by CPCB and MoEF.

Biological environment - Creek ecology: Among Phytoplankton Nitzschiaspp was predominant, ShannonWiener Index (SWI) was found to be low indicating less diversity among species. Copepod constitutes one of the most common zooplankton; ShanonWeaver Index (SWI) indicated good diversity of zooplankton. Polychaeta was the most abundant group in the sediment. Other groups included Brachyura and Gastropoda. Diversity index was lower indicating poor diversity among macrobenthic species

Terrestrial ecology -Fauna Total 59 bird species, 7 reptiles, 11 mammals and 9 butterfly species were documented during the field survey. Black tailed godwit and Malabar hornbill were the threatened species observed. Indian white rumped vulture, Oriental darter were the critically endangered and near threatened species documented.

Flora- A total of 61 trees, 17 shrubs 27 herbs and 8 climbers were recorded in the entire project area during the survey. No scheduled or nationally protected species were observed in the project area. The most common tree species was found to be Coconut (Coconusnucifera), Supari (Areca catechu), Arjun (Terminaliaarjuna), Mango (Mangiferaindica), etc. In shrubs, the most commonly occurring species was Ixora, Hibiscus, Lantana camara. Karkonda (Blumealacera), Nilchardi (Triumfettapentandra) and Kantachaulai (Amaranthusspinosus) were the most common herb species in the project area.

Mangrove species found in the study area were Avicennia marina, Avicenniaofficinalis, Rhizophoraapiculata, Excoecariaagallocha and mangrove associate found were Derris scandens, Sesuviumportulacastrum, Acanthus ilicifolius, and Salvadorapersica.

Socio Economic The socioeconomic profile of the 10 km radius of the project location includes 104 towns and villages. Raigad district is having area of 7,152 sq. km. with a population of 26.3 lakhs. The study of the socio economic aspects was done within 10 km radius from the site and in person survey of people within 1 km around the site. The survey

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Vol. 8, Issue 7, July 2019

shows that people will greatly benefit from the project as it will protect their agricultural lands, livestock and will reduce their water scarcity problems.

IV. RESULTS AND ANALYSIS

Anticipated impacts and mitigations

Mitigation measures are proposed in order to minimize and control environmental impact to acceptable levels. The magnitude of the identified impacts from the project activities will be reduced with the help of suggested mitigation measures.

Land Use No major change in land use will take place as change in land use is limited only during construction phase; impact will be temporary. Site clearance, excavation work and levelling of ground such Construction activities will effect on land use pattern.

Soil Quality Construction of saline embankments will restrict the flow of creek/sub creek water into the agriculture field; hence soil fertility will be improved. As frequent ingress of saline water is restricted, soil will slowly reclaim and would be capable for cultivation increasing soil fertility. **Water Quality** Surface water bodies are away from construction site, hence no impact is expected from construction of saline embankment. During construction phase, there will be negligible negative impact on the groundwater level or quality of the area.

Creek Water Quality The liquid waste which generate in the normal day to day operations may pollute and deteriorate the creek water quality. The creek flow has altered due to damage of the bund and will be restored once the bund is rebuilt which will also help improve soil quality and fertility of agricultural land/reclaimed area. The construction of the saline embankment is a onetime process so it is not expected to show any significant impact on water body. Consequently after short period of time construction turbidity will dissipate and settle.

Creek Sediment Quality During construction of saline embankment sediment quality may be impacted minimally due to incidental turbidity and mixing of cementing material in creek water. The potential impact on sediment could be due to mixing of cementing material with the sediments. To overcome this issue, implementation of appropriate measures such as solid waste management at site and carrying out cementing or stone pitching activities skillfully may help mitigate this temporary impact.

Air Quality During construction phase, activities like site excavation, levelling, loading-unloading, stone pitching will affect surrounding air quality. Vehicular emissions while transportation will also lead to increment in air quality pollution. (Particulate matter, SO₂, NO₂, CO). However, this impact is limited. To minimize the effect, use of water sprinkling, tarpaulin cover should be done. Vehicles and equipment used in the construction of saline embankment must be subjected to routine servicing and maintenance checks and must have a valid Pollution under Control (PUC) certificate.

Noise Quality During construction phase, noise would be generated due use of equipment and vehicles. To reduce impact, construction work such as crushing, operation of DG sets and any high noise construction equipment shall be stopped during night time between 10.00 p.m. and 6.00 a.m. Also, regular servicing of all construction vehicles and machinery shall be done.

Solid Waste Management This project does involve negligible quantity of solid waste generation in form of inert waste which will occur during construction activities. To encounter this impact, inert waste will be used for site levelling and other type of waste will be given to authorized vendor which is undoubtedly the best for the correct disposal of this segment of the waste.

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Vol. 8, Issue 7, July 2019

Biological Environment Marine biology During construction of saline embankment solid waste and wastewater discharges in creek environment may impact on creek biology. Oil spillage from construction machinery may contaminate the creek water and sediment as a result creek biology will be disturb. Consequently, contractors will ensure that there is no misuse of the creek area and water body by workforce employed during construction phase. Impact on creek ecology would be minor, temporary and reversible so situation will be recovered very shortly. Thus construction activity does not show major effect on fisheries.

Terrestrial Biology During the construction phase, no direct impacts of the activities will be observed on the terrestrial flora and fauna diversity. Supporting activities like transportation of the raw materials to the construction area will have a minimal and reversible impact on the floral diversity. The impacts observed during the construction phase will be easily reversible and no major intervention would be required. Some precautionary measures needs to be taken like to minimize the impact on fauna the construction should not be carried out in early morning and late evenings.

Coastal or Mangrove Biology Onset of mangrove encroachment started in year 2012 covering around 1918m² in embankment line and 6484m² in agricultural lands, permanent loss of mangrove is anticipated. Compensatory Mangrove plantation shall be carried out, as per the norms, along the creek side.

Socio Economics Positive impact on Socio economy is envisaged as saline embankment will protect agricultural lands from saline water ingress. However, there can be inconvenience caused to the village during construction period in terms of the form of high noise levels, traffic, or having to reroute their current path. Inconvenience caused to people during construction phase should be kept at a minimal level. Use of silencer in noise producing equipment's and proper maintenance of vehicles will be done wherever possible.

Analysis of alternatives

Existing saline embankment is in poor condition, incapable to protect saline water ingress and wrath of tidal surges. By constructing saline embankment, agricultural land as well as grazing land will be protected which will be of great help to local farmers, resulting in strengthening socioeconomy. Therefore, the need of saline embankment is very much essential at proposed location itself.

Environmental monitoring programme

A detailed Environmental monitoring program has been envisaged with the following objectives to ensure proper and effective implementation of the proposed mitigation measures.

- To evaluate the performance of mitigation measures proposed.
- To evaluate the adequacy of Environmental Impact Assessment.
- To suggest improvements in environmental management plan, if required.
- To enhance environmental quality.
- To implement and manage the mitigation measures defined in EMP.

Environmental aspects like Meteorological data, solid/hazardous wastes generation/utilization, Ambient Air Quality, Ambient Noise, Marine ecology, Ground water quality etc. will be monitored as per the details worked out in the Environmental Monitoring Program. The Monitoring plan specifies the parameters to be monitored, location of the monitoring sites, Frequency and duration of monitoring, applicable standards and institutional responsibilities for implementation & supervision. Suggested monitoring parameters and programs are described as follows as per CPCB and MoEF guideline given for individual components:

Marine Quality The characteristics of marine water quality should be sampled and analyzed once a season except monsoon close to the major construction sites. The physico-chemical and biological parameters shall be monitored for marine as well as sediment quality.

International Journal of Innovative Research in Science, Engineering and Technology

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Visit: www.ijirset.com

Vol. 8, Issue 7, July 2019

Ambient Air Quality

Ambient air quality monitoring should be conducted for once every season except monsoon. The monitoring will be carried out at four stations close to the construction sites. The parameters monitored are PM10, PM2.5, SO₂, CO and NO_x.

Noise Pollution The noise monitoring would be carried out at 3 locations representing different receptors/land use. Noise monitoring will be carried out once a season except for monsoon with a 24 hour reading with per second frequency.

Water Quality -The Ground and Surface Water quality should be monitored for the following parameters:

Ground water: EC, pH, TDS, Chlorides, Salinity, DO, BOD, COD, Total coliform, E. coli.

Surface Water: Colour, Temperature, Turbidity, pH, EC, TDS, TSS, Total Hardness, Total alkalinity, Sulphates, Phosphates, Chlorides, Salinity, Nitrates, Fluorides, DO, Ca.

Soil Quality Physico-chemical characteristics of the soil at the project location should be monitored at one location. Monitoring will be carried out once a season except for monsoon.

Ecology Monitoring of flora and fauna will be carried out once a season except monsoon

Additional Studies Emergency situations/ Probable hazards and on-site accidents can be avoided by giving necessary training to the workforce. Saline embankment in turn will minimize risk of degradation of the soil quality and natural disasters to certain extent. Risk assessment study will be done

Environmental management plan (EMP)

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation & function. The EMP envisages the plans for the proper implementation of management measures to reduce the adverse impacts arising out of the project activities.

Land Environment The proposed construction of embankment will not have any major impact on the existing land environment. Moreover it will positively impact the land environment by preventing sea water ingress on agricultural land.

Soil Quality The proposed construction of saline embankment does not envisage any major impact on soil quality. Regular maintenance of the structure will be carried out to ensure there is no impact on the soil quality due to damage in the structure. Construction phase Impacts can be reduce by proper Waste management plan.

Water Quality No discharge of waste or wastewater would be directly discharged into water body during construction activities. No existing resources/water sources (surface/ groundwater) which are currently being used by the neighboring population for the purpose of obtaining drinking water and/or water for irrigation or other purposes will be tapped into.

Marine Quality-Marine water No major impact on marine water quality is envisaged after completion of construction work. Post construction maintenance of the embankment structure will be carried out; it will be replenished periodically to avoid further impact on the structure and resulting environment. During construction activity, waste generated during excavation and construction work will be collected, segregated and duly disposed off in accordance with the Solid Waste Management norms. Mobile toilets will be provided for the laborers at the construction site to keep the coastal area clean and hygienic.

Sediment -Temporary impact on the sediment quality may be observed due to the excavation and placement of rocks, sand bags etc. There may be alteration and deepening of shore and movement of sediments due to seepage of water through voids in the stone placement, which results in erosion of the finer underlying core layer, thereby being detrimental to the turbidity of the water as a result of increased siltation.

Air Quality - During construction phase, generation of dust and vehicular emission is expected from activities like raw material transportation, loading and unloading of raw material and construction activity. Generic measures will be

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 8, Issue 7, July 2019

taken to reduce fugitive emissions like sprinkling of water in and around site. Vehicles delivering construction materials to the site will be enclosed and covered to prevent escape of dust. DG set will be at adequate height. Noise Quality - Rise in noise levels are expected during construction phase of the project due to operation of construction equipment, movement of raw material carrying vehicles and allied activities. However, appropriate measures will be taken to reduce noise levels to the possible extent. Training will be given to all the workers for the proper handling of equipment's with Personal Protective Equipment (PPE). Proper maintenance of the equipment's will be done.

Biological Environment The Impact of the construction of Saline Embankments on the Biological Environment is minimal and easily reversible. In accordance with the indirect impacts caused due to the transportation, transportation during early morning, late evening and night time should be prohibited.

SocioEconomic Environment Socioeconomic environment will be impacted positively due to construction of saline embankment. Local people will obtain indirect employment. Protection of agricultural land from salt water ingress will help improve soil quality hence; increase in agricultural yield is the major benefit to the villages.

Health and Safety During construction stage of the project health and safety of the onsite personnel will be ensured. Construction site will be provided with a readily available first aid kit including an adequate supply of sterilized dressing materials and appliances. All machines to be used in the construction will conform to the relevant Indian Standard Codes, free from patent defect, kept in good working order, regularly inspected and properly maintained.

Environmental Management Cost Environmental management cost during construction phase will be 4.85 lakhs; after erection of saline embankment post management cost shall be 3.70 lakhs.

Project Benefits

- The primary purpose of saline embankment is to prevent creek water entering agricultural land.
- Saline embankment can be useful at the time of cyclones and floods in order to minimize loss to socioeconomic aspects of the area.
- Saline embankment would help restoring fertility of the agricultural land over certain time period thereby increasing yield.
- The construction of saline embankment is economically feasible as it requires minimal maintenance.
- The proposed project will also provide indirect employment to local people.

V. CONCLUSIONS

From the Environmental Impact Assessment (EIA) study, it is concluded that proposed saline embankment project will have greater positive impacts over local surrounding comparing with temporary negative impact during construction phase. The minor impacts arising out during construction phases can be mitigated with the help of the proposed Environment Management Plan (EMP). Construction of embankment will help to intensify socio economy of nearby local villagers.

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