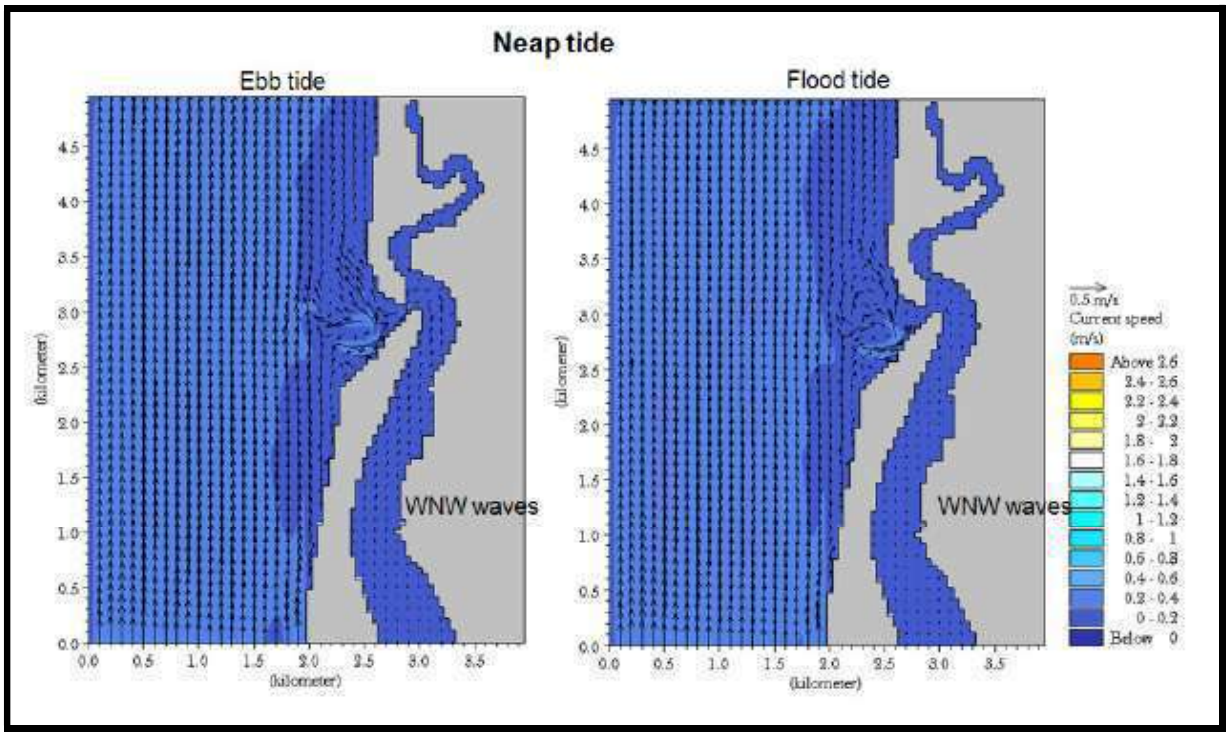


Figure 5-12: Current patterns for dry season during ebb and flood periods (Neap tide)

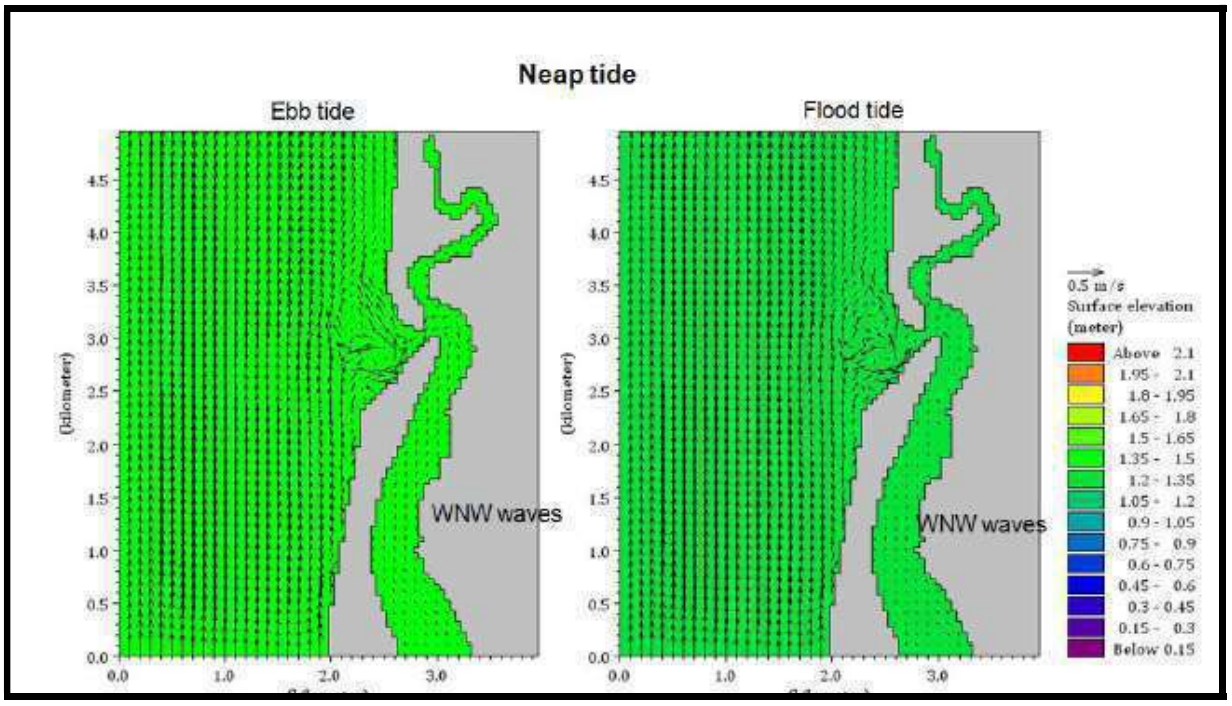


Figure 5-13: Water levels for dry season during ebb and flood periods (Neap tide)

<u>Simulated currents for case-II (with proposed facility):</u>

- Wet season: The currents simulated for wet season at stations T1, T2 and T3 are shown in Figure 5-14. The current patterns for ebb and flood phases of tide during springs and neaps are presented in Figures 5-15 to 5-18

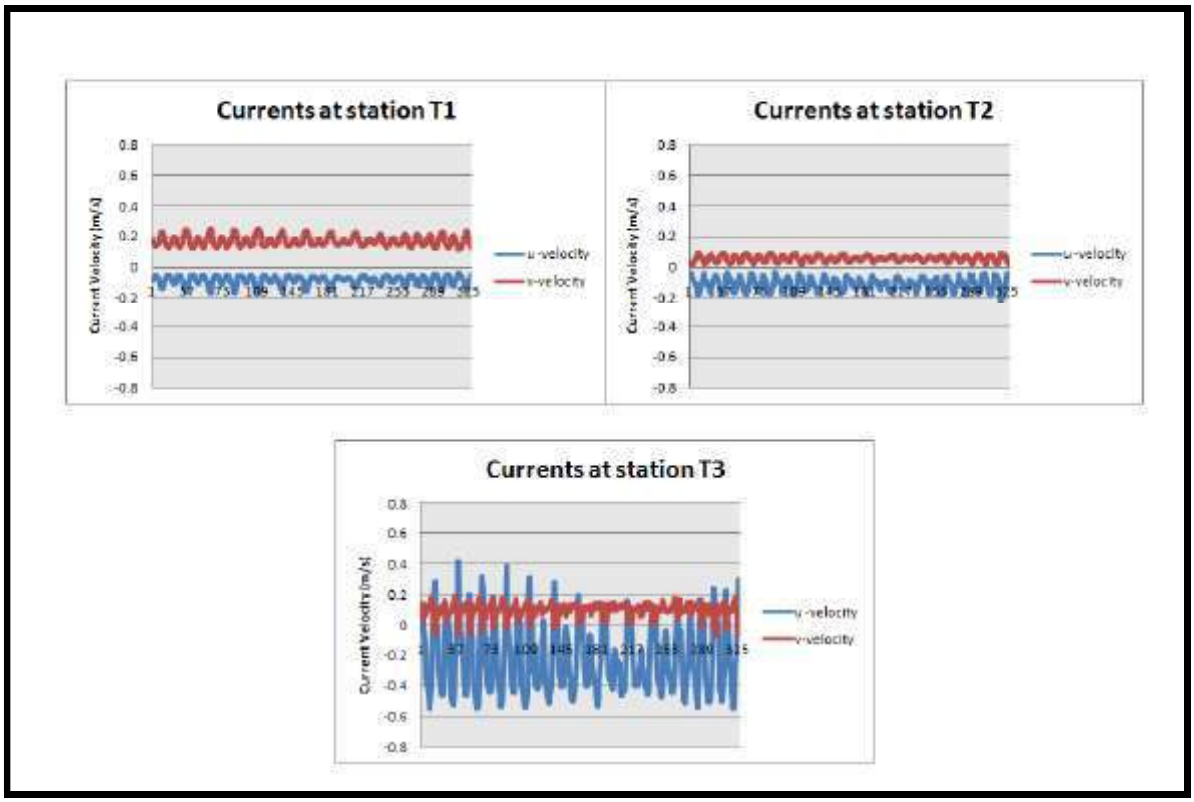


Figure 5-14: Simulated tidal currents during Wet season with proposed facility

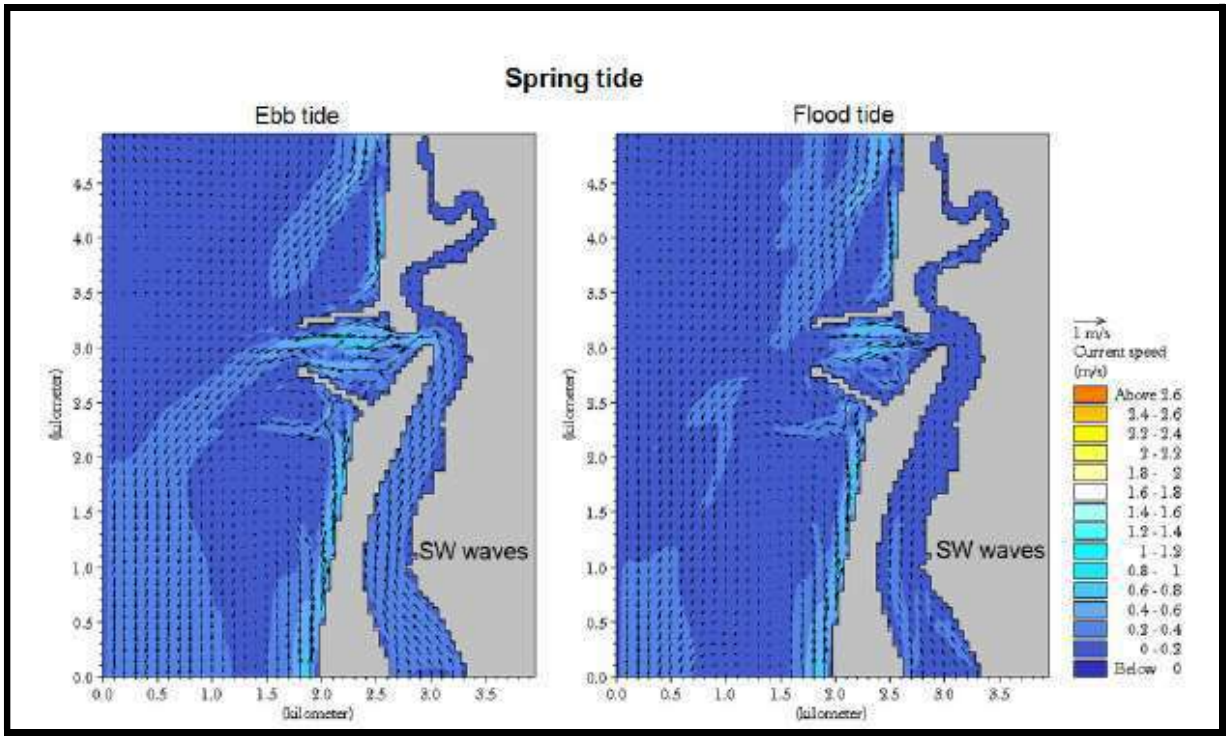


Figure 5-15: Current patterns for wet season during ebb and flood periods (Spring tide) case-2

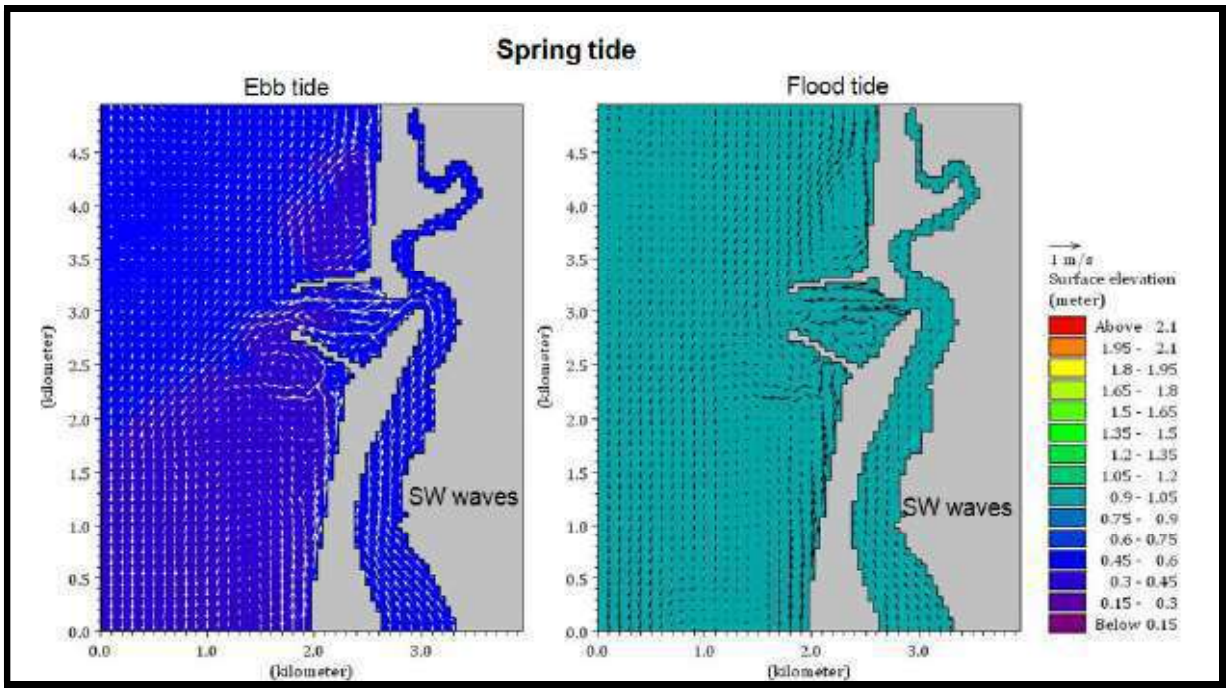


Figure 5-16: Water levels for wet season during ebb and flood periods (Spring tide)

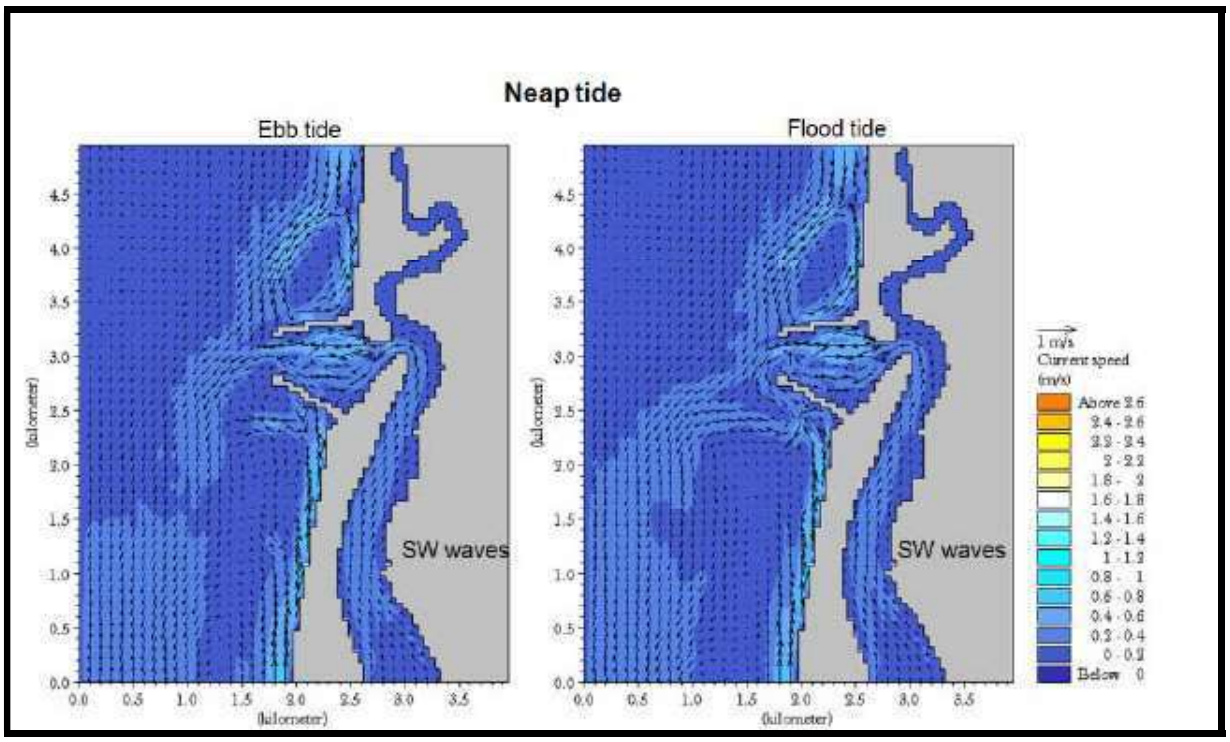


Figure 5-17: Currents for Wet season during ebb and flood periods (Neap tide)

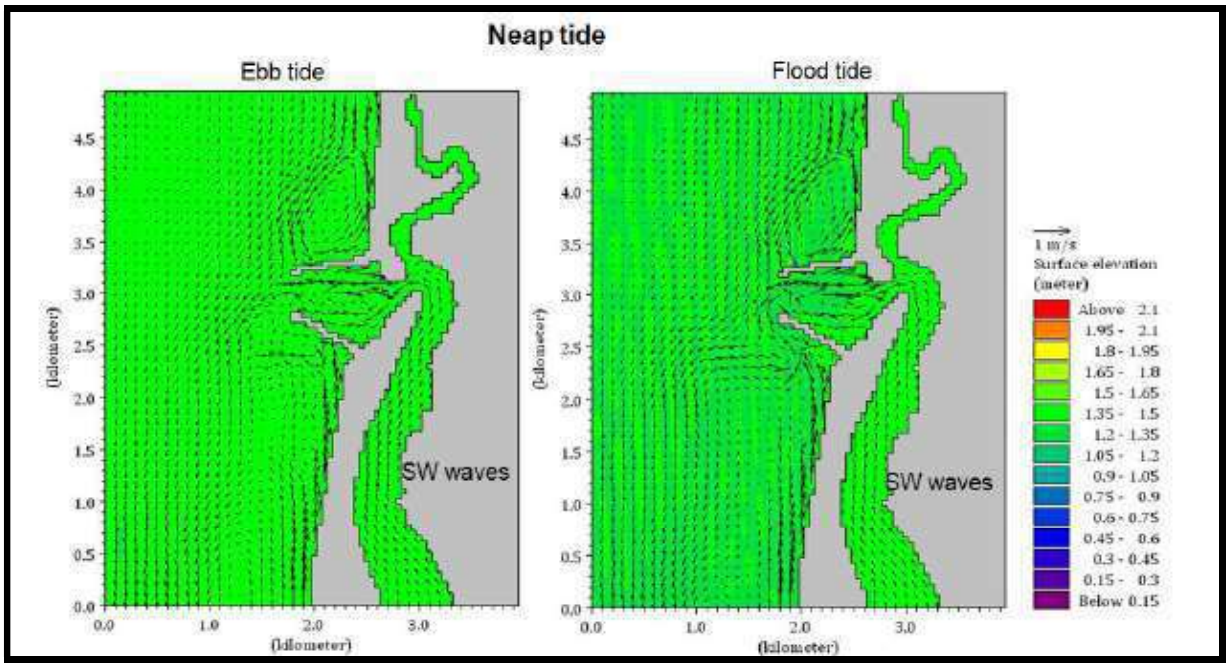


Figure 5-18: Water levels for wet season during ebb and flood periods (Neap tide)

(b) Dry season:

The currents simulated for dry season at stations T1, T2 and T3 are shown in Figure 5-19. The current pattern for different tidal phases (spring and neap) along with flood, ebb and slack periods are presented in Figure 5-20 to 5-23.

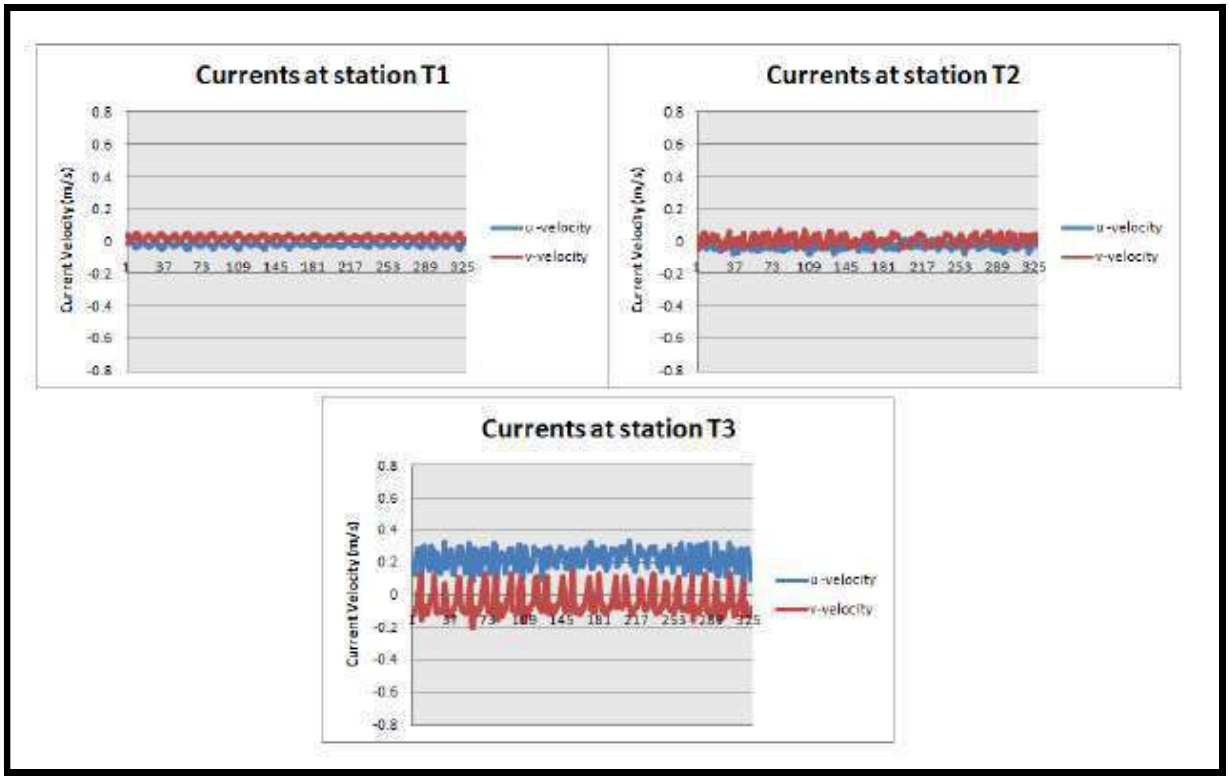


Figure 5-19: Simulated tidal currents during Dry season with proposed facility

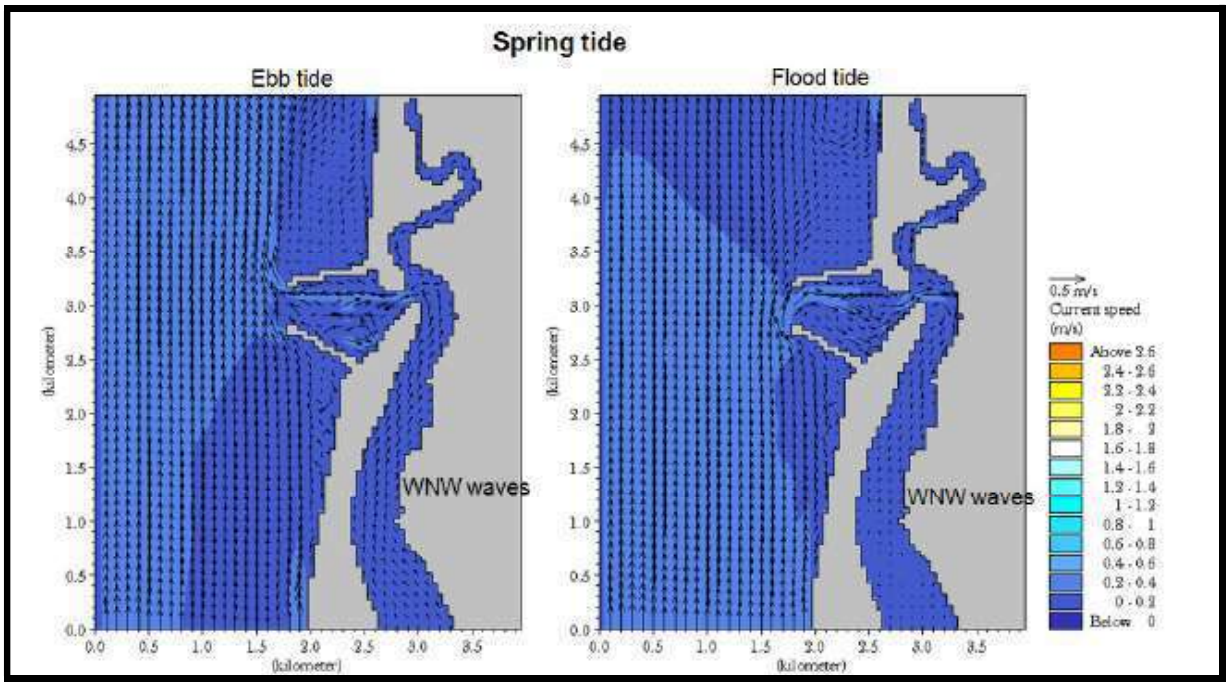


Figure 5-20: Current patterns for dry season during ebb and flood periods (Spring tide)

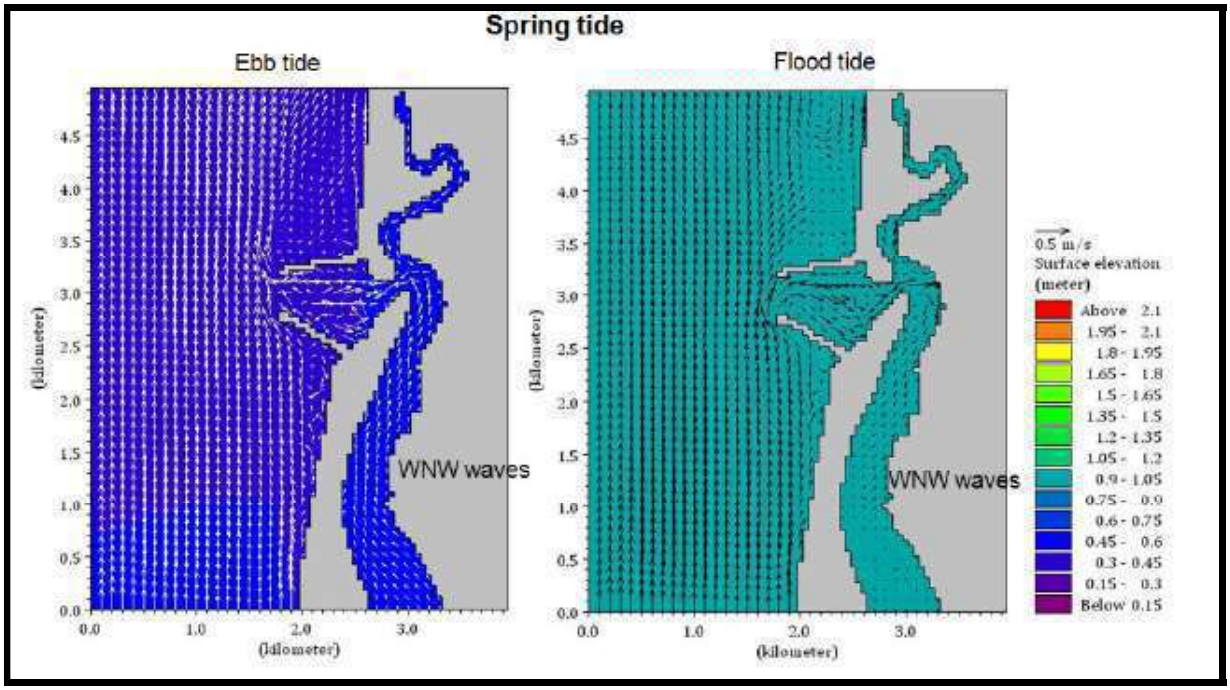


Figure 5-21: Water levels for dry season during ebb and flood periods (Spring tide)

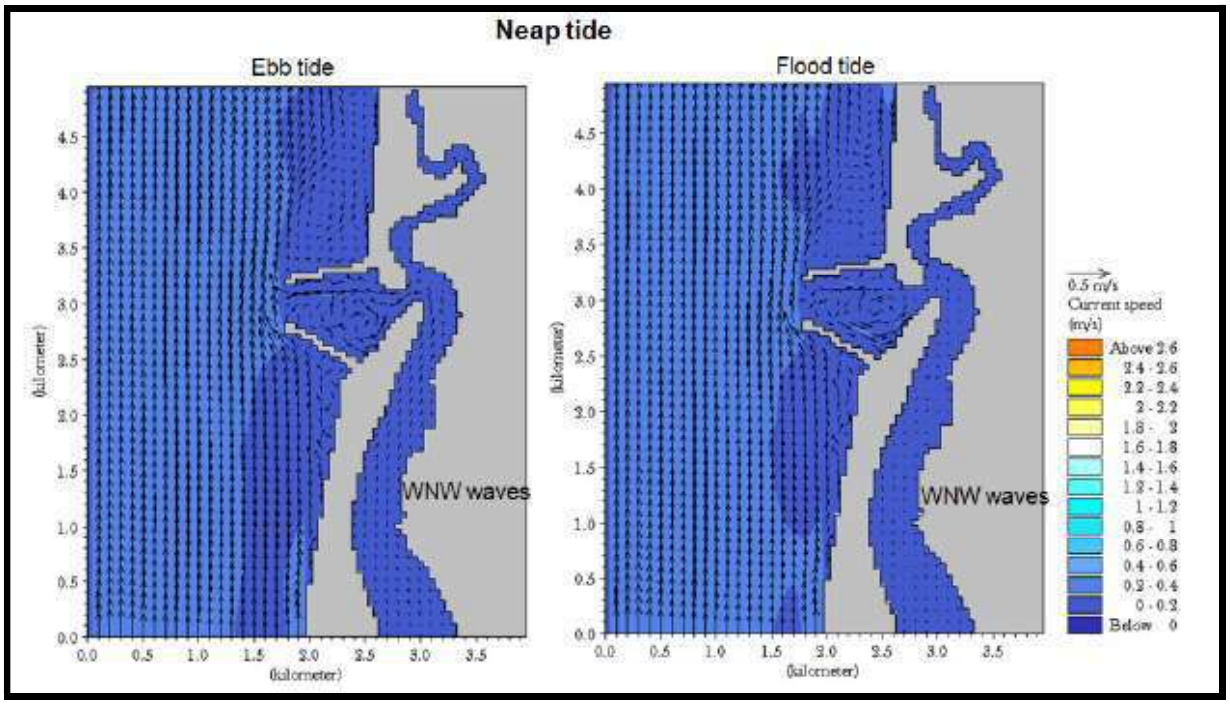


Figure 5-22: Current patterns for dry season during ebb and flood periods (Neap tide)

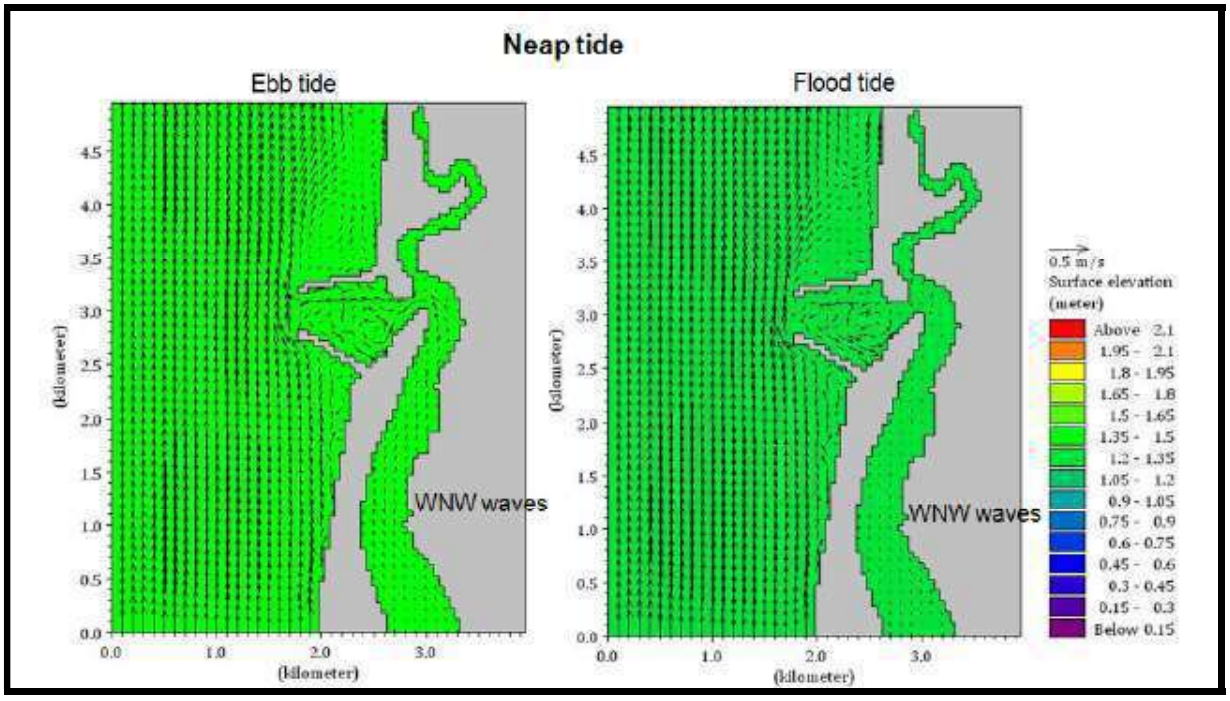


Figure 5-23: Water levels for dry season during ebb and flood periods (Neap tide)

The changes in the current patterns near the inlet - both on the seaside and riverside of the inlet are of interest to us. Similarly, the currents inside the river up to the point of the proposed barge/ vessel loading facilities are also important. The model results show that the ebb currents are strong during wet season when the river discharge is very high. The current strengths increase further during spring tide periods compared to neap tide. For case-I (without breakwaters), during wet season with peak river discharge (300 m^3/s) strong currents of about 1 to 1.2 m/s are noticed inside the channel as well as on the seaward side

of the channel. Inside the river also up to 5 km upstream, the ebb currents are strong (0.4 to 0.6 m/s). During flood period, also the currents continue to be in the ebb direction and no reversal is found. However, there is slight reversal outside the channel to the south. The currents in the river also show no reversal with tide; they continue to be in the ebb direction even during flood period. This is due to the overwhelming effect of the river discharge, which totally controls the circulation. The currents might get reversed with tide at the bottom where sea water could flow up stream; however the model doesn't give the bottom currents. Similar variations of currents are observed during neap tides also.

For case-I during wet season, the impoundment of water within the river and the inlet area is clearly noticed. During ebb period, the water levels in the river are at about 0.6 to 0.75 m while on the seaside, the water levels are around 0.3 to 0.45 m. However, during the flood period the water levels in the river and in the sea remain almost same at around 0.9 m. During dry season the magnitudes of currents have generally decreased to about 0.2 m /s and a clear reversal in tidal currents could be noticed.

For case-II in the wet season strong currents directed seaward are noticed near the inlet during ebb period. The ebb current strength in the river is found to be stronger compared to case-I. With the inclusion of breakwaters, the effective cross sectional area at the entrance has decreased resulting in the increase of current strength. The water levels during the flood period remain almost same as case-I and so it may be inferred that the construction of breakwaters will have negligible effect on the water level changes in the facility.

The increase in current strengths prevents any increase in water levels and no flooding is expected. Since, the currents show higher values only during ebb period, the riverine sediments could be carried offshore by such currents and sedimentation problem within the facility is expected to be lesser. For case-II during dry season reversal of currents in the river are noticed from ebb to flood periods. The water levels also do not show any variations compared to case-I.

COHESIVE SEDIMENT TRANSPORT MODEL STUDIES

Cohesive or mud transport studies are essential for coastal regions where river or tidal inlets are present. Honnavar is such a place where monsoonal rivers discharge significant quantities of sediment into the coastal region. Here, the riverine flow (mud and water) changes rapidly with increase in rainfall and discharge. The cohesive sediment transport model has been simulated for different seasons with different wave approaches, thus including wave-current interactions.

Mud transport (MT) model description:

The MIKE 21 Flow Model, Mud Transport Module (MT) describes erosion, transport and deposition of mud or sand/mud mixtures under the action of currents and waves. MIKE 21 Flow Model, Mud Transport Module, is applicable for:

- Mud fractions alone, and
- Sand/mud mixtures

The following processes can be included in the simulation:

- Forcing by waves
- Sliding

- Salt-flocculation
- Detailed description of the settling process
- Layered description of the bed, and
- Morphological update of the bed

In the MT-module, the settling velocity varies according to the salinity (if included) and the concentration taking into account flocculation in the water column. Waves, as calculated by MIKE 21 NSW for example, may be included.

HD and MT Models setup:

The Flow model (HD and MT) has been simulated for different wave directions obtained from wave radiation stresses output from NSW fine-resolution model simulations. The model setup is divided into two parts one with low discharge conditions (dry monsoon) and the other with high discharge conditions (wet monsoon). For dry monsoon season, the Sharavathi river discharge is very less (50 m^3/s) and for the wet monsoon season, it varies from 200-500 m^3/s during peak discharge periods (KPL river discharge data). We have subjected these values to sensitive analysis and found that the model performed reasonably well for peak discharge of 300 m^3/s. Peak discharge conditions mostly coincide with heavy rainfall events as well as with monsoonal periods. Simulations have been performed for 15 days covering spring and neap tide periods for different cases with open boundary set along the southern part in the riverside. As the riverine discharge in the northern branch of the Pavinkurve is almost negligible, the northern boundary is closed. Eddy viscosity has been considered constant based on velocity formulation to around 0.03 m^2/s. For bed resistance a constant Chezy number of 55 $m^{1/2}/s$ has been used.

For MT model setup, the grain size fraction is taken as 1 and the initial sediment concentration at all the boundaries except at the riverine side are put at 0.01 kg/m^3 (cold start). Dispersion in x and y directions have been taken as constant at a value of 1.5 m^2/s. The outputs obtained from the model results are total net deposition, total bed thickness change, total bed mass change and Total Suspended Sediment concentration (SSC).

Without facility (case-I):

(a) Suspended sediment concentration: The distribution of SSC along Honnavar region has been simulated for predominant wave directions of S, SSW and SW for wet season and with WSW, W and WNE for dry season. The variations at 5 day intervals are shown in below Figure 5-24 to 5-31.

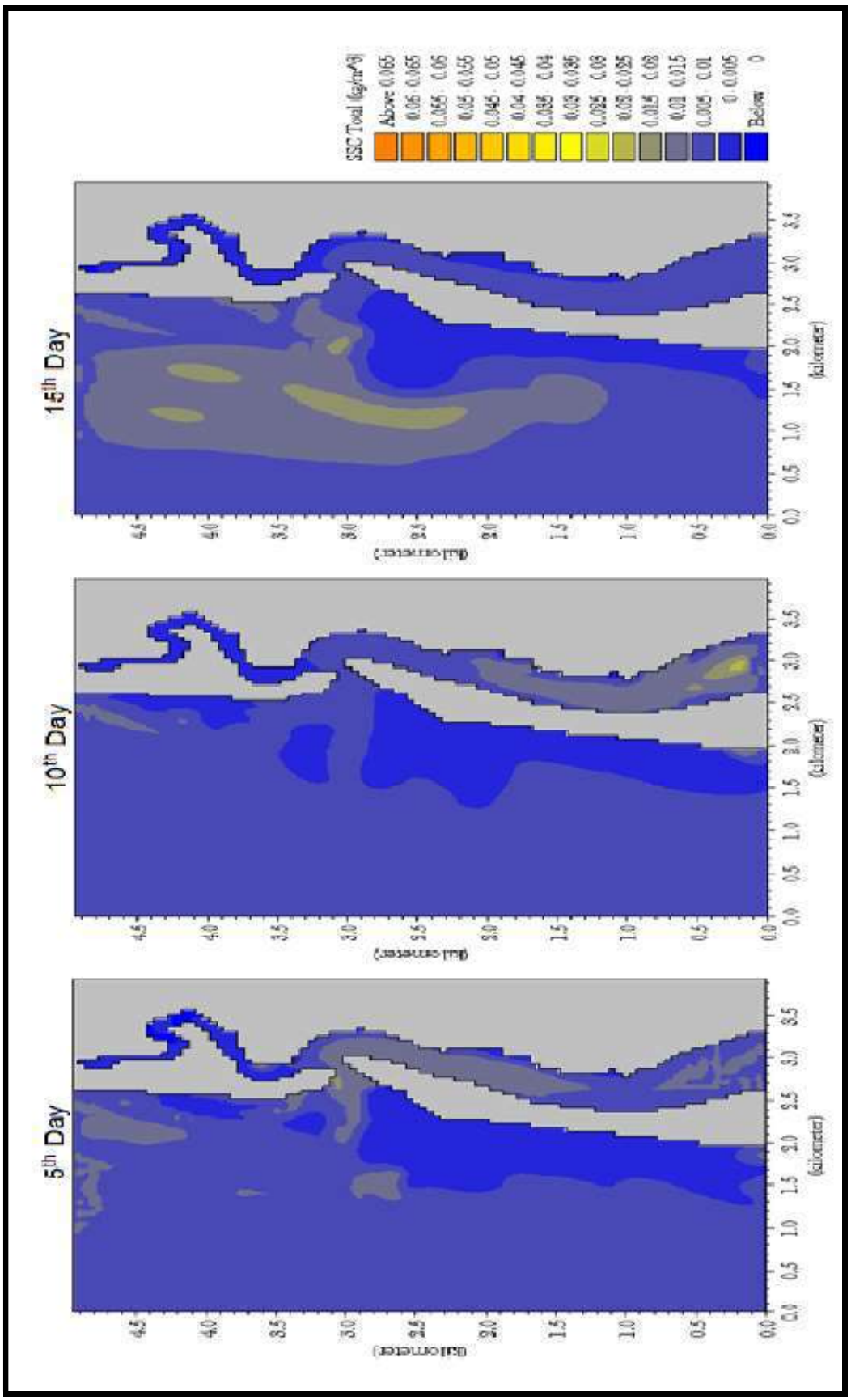


Figure 5-24: Suspended sediment concentration for wet season (SSW waves)

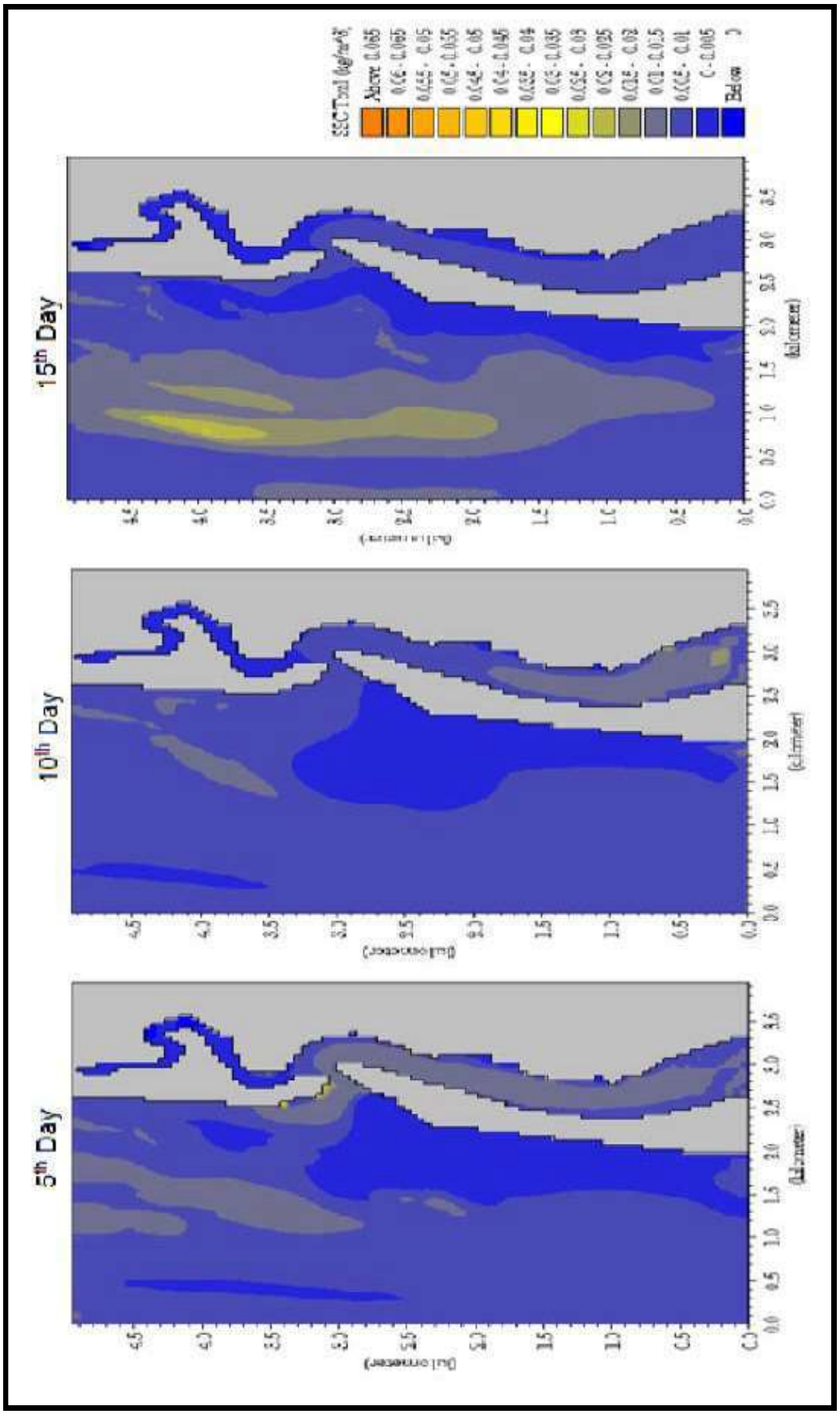


Figure 5-25: Suspended sediment concentration for wet season (SW waves)

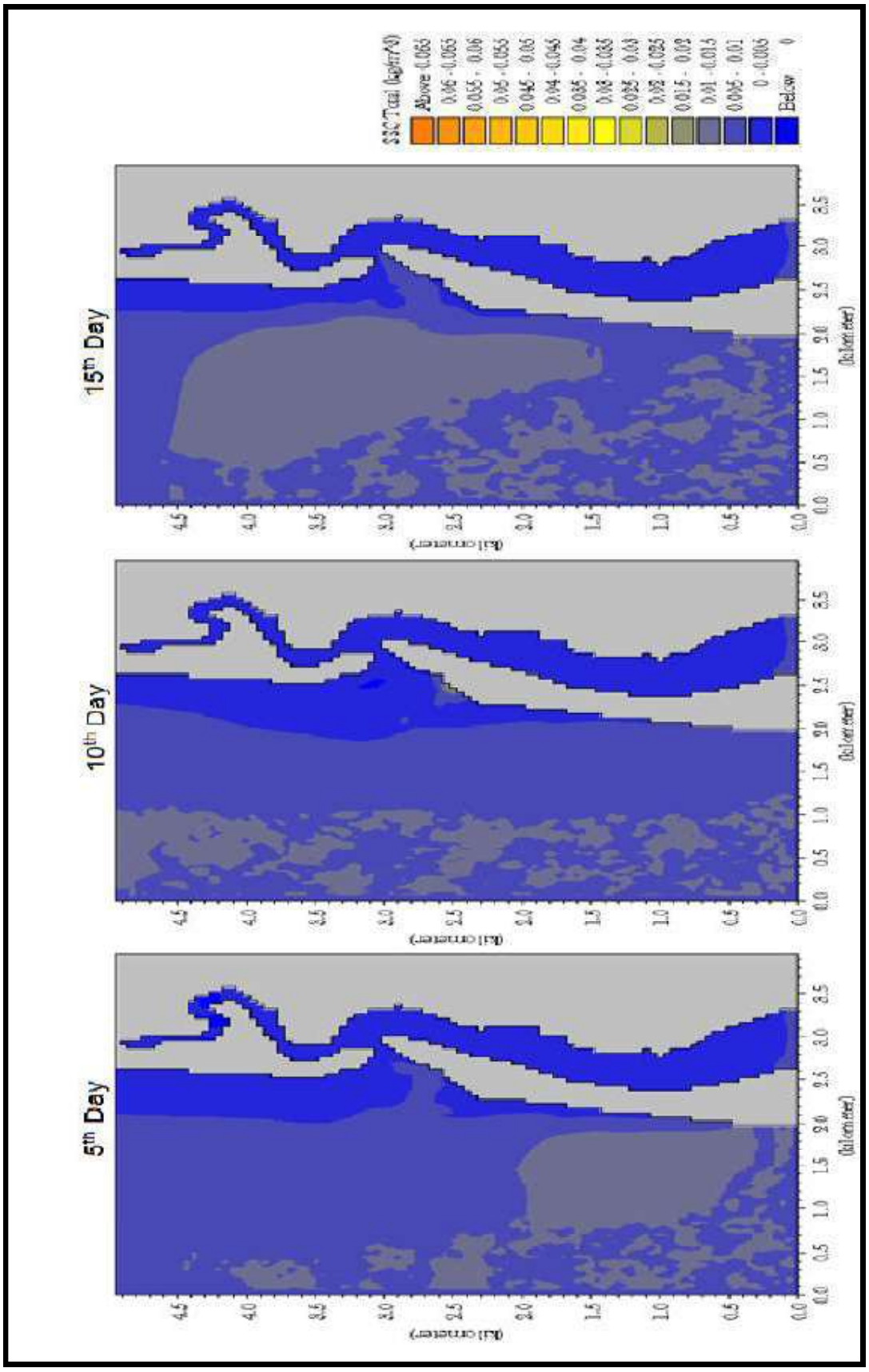


Figure 5-26: Suspended sediment concentration for dry season (WNW waves)

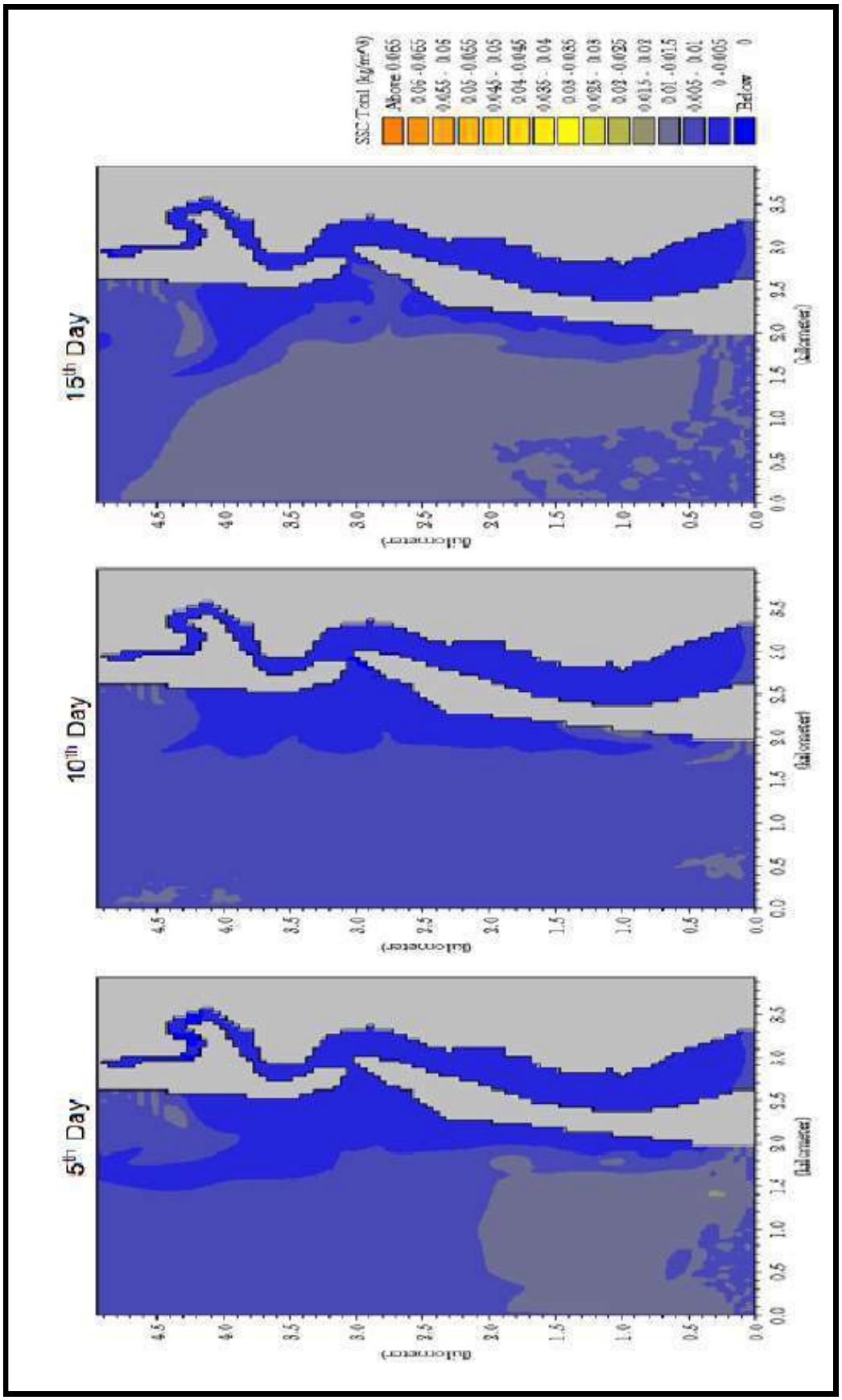


Figure 5-27: Suspended sediment concentration for dry season (W waves)

(b) Total bed thickness change: The total bed thickness change computed for 5 day interval with different directions of wave approach are shown in below figures

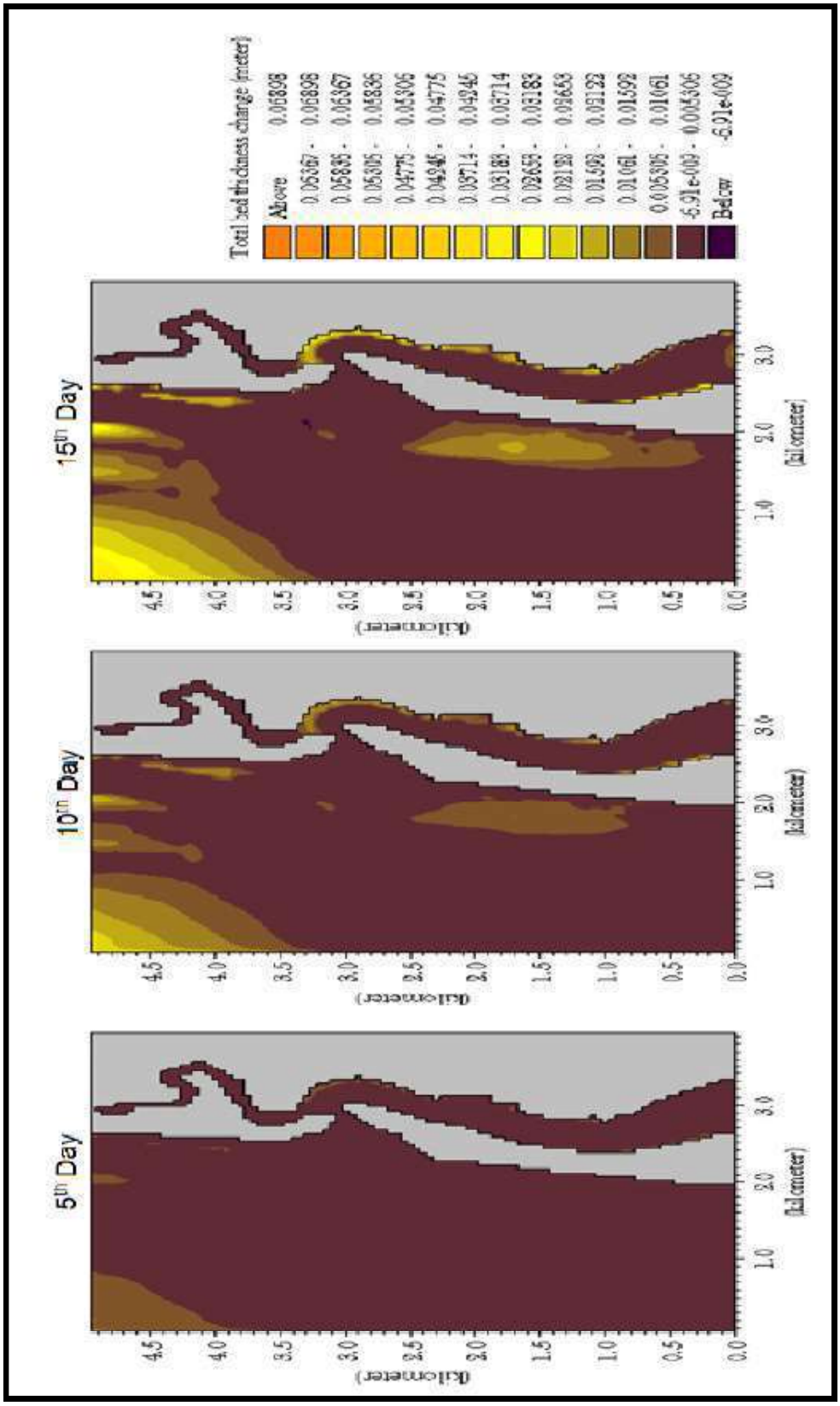


Figure 5-28: Total bed thickness change (m) for wet season (SSW waves)

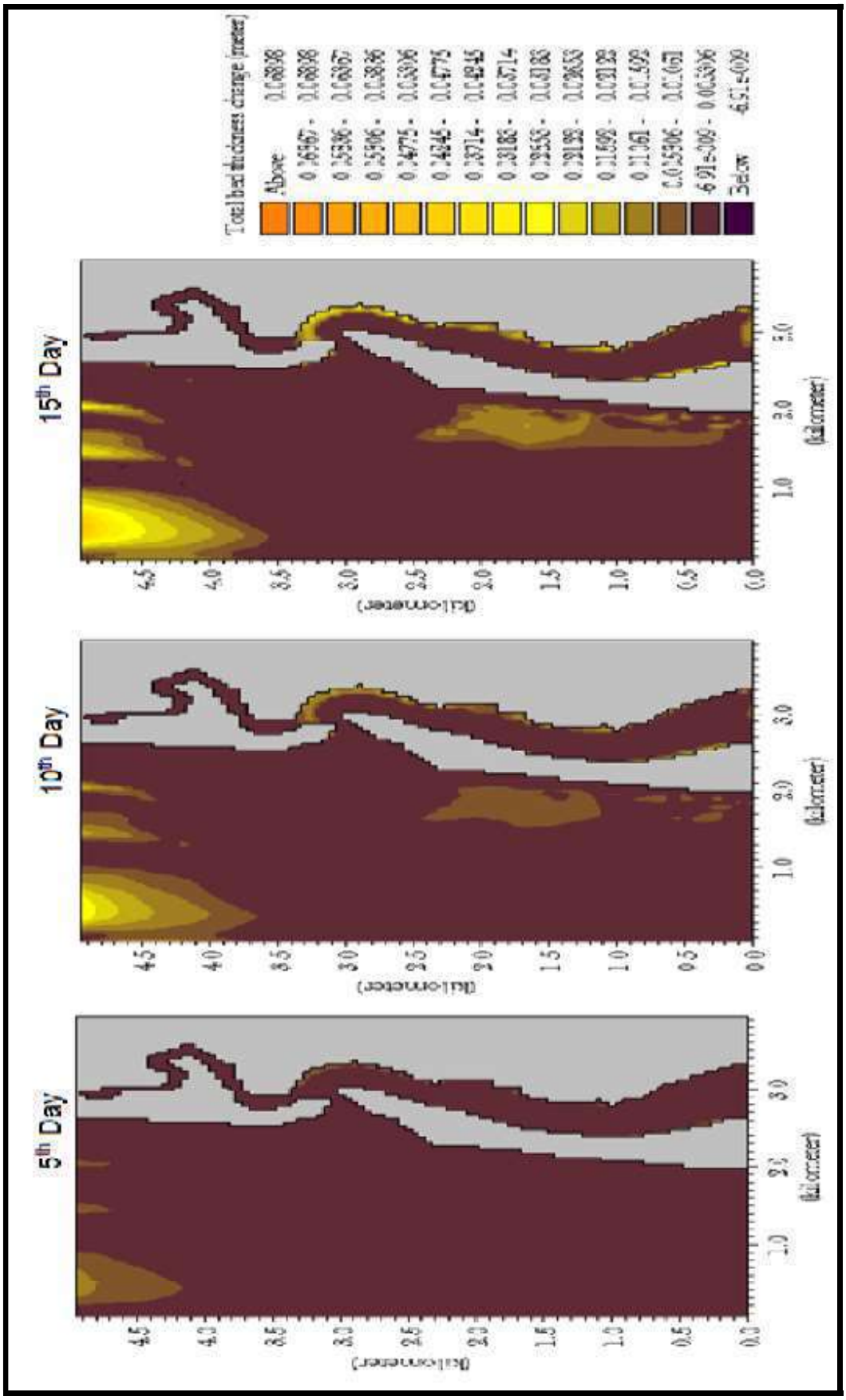


Figure 5-29: Total bed thickness change (m) for wet season (SW waves)

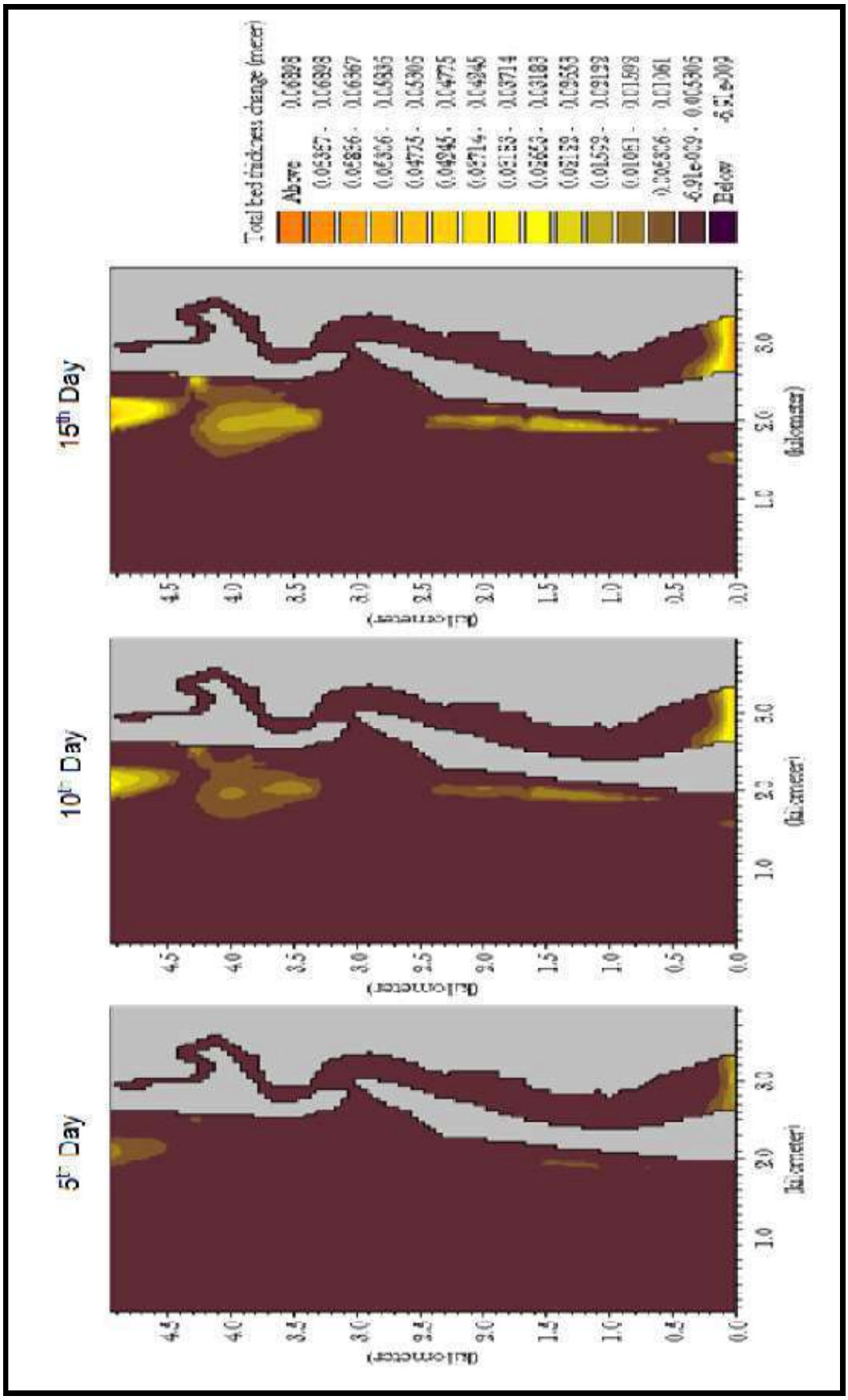


Figure 5-30: Total bed thickness change (m) for dry season (W waves)

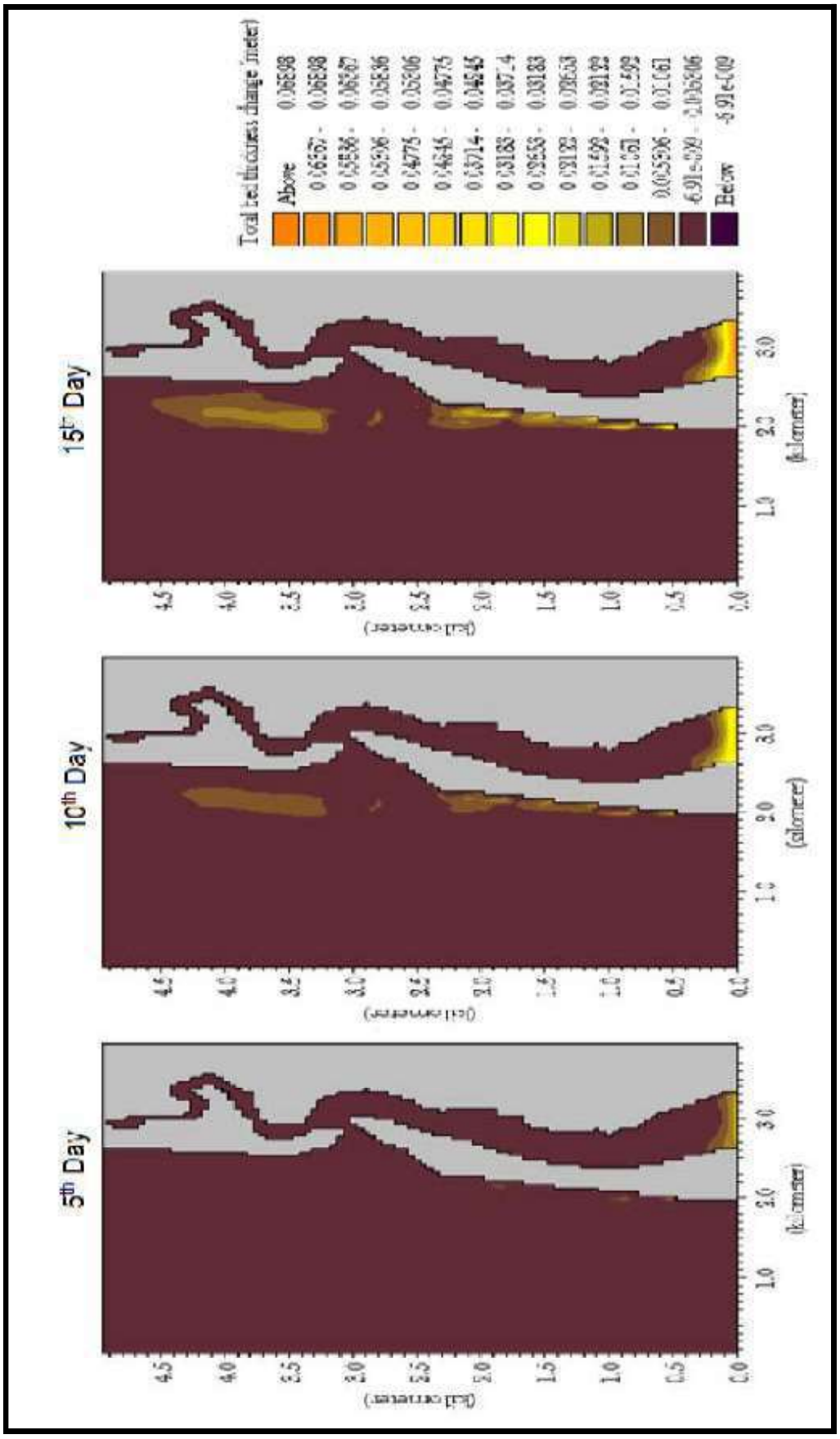


Figure 5-31: Total bed thickness change (m) for dry season (W NW waves)

With Proposed construction (case-II):

Suspended sediment concentration: The distribution of SSC along Honnavar region have been simulated for wet season with predominant directions of approach SSW and SW and for dry season W and WNE. The variations at 5 day intervals are shown in below Figures 5-32 to 5-39.

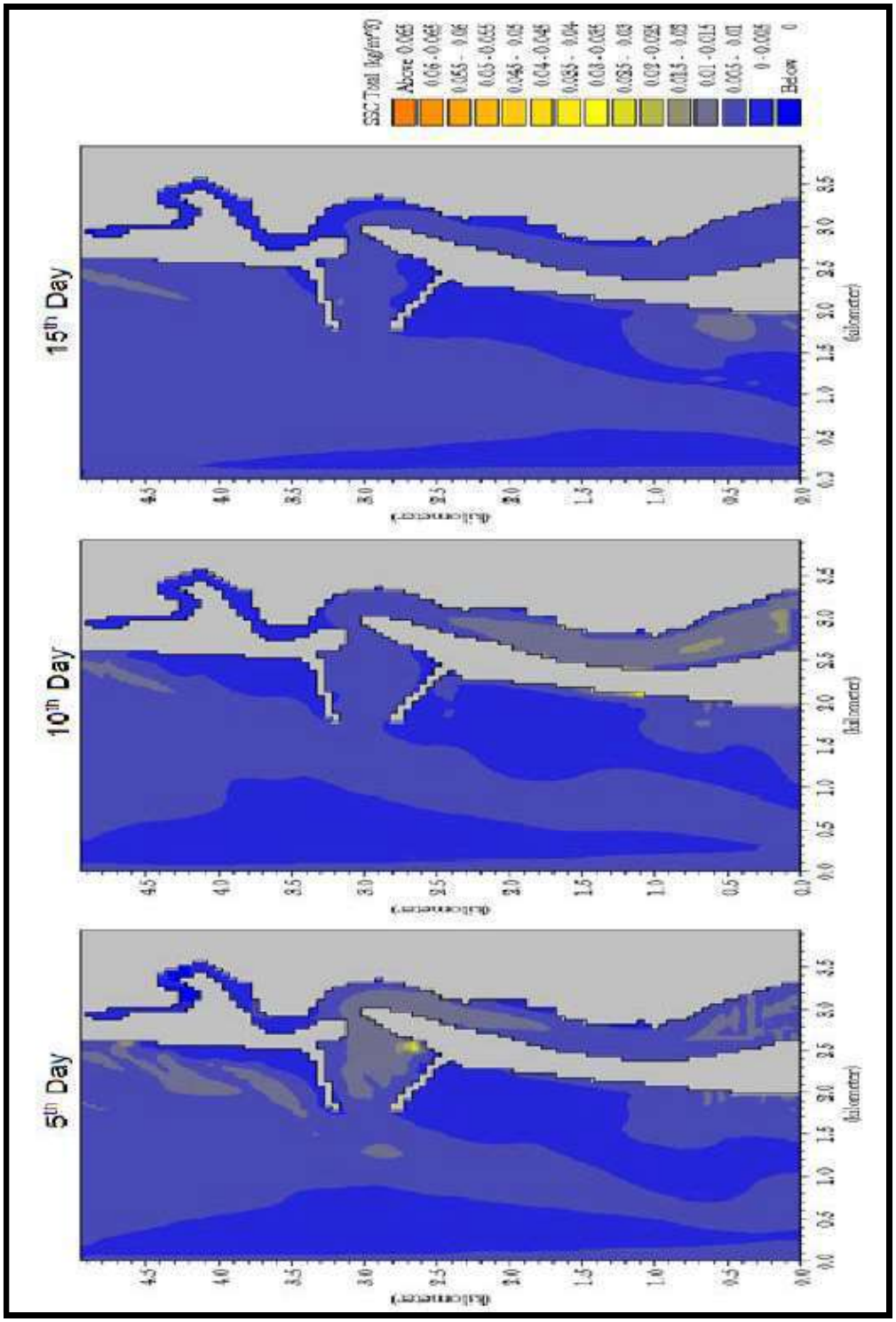


Figure 5-32: Suspended sediment concentration for wet season (SSW waves) with Barge/vessel Loading Facility

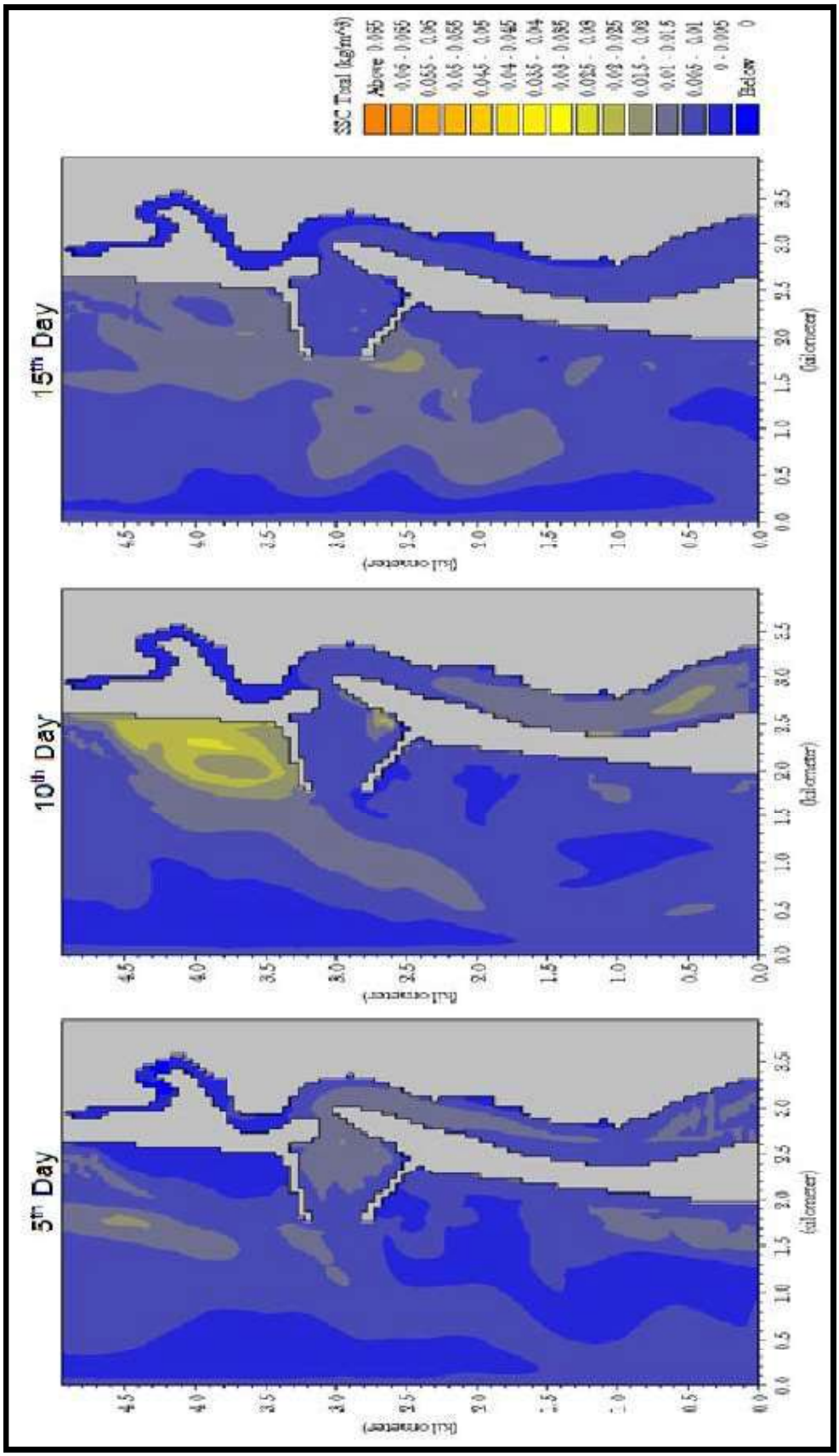


Figure 5-33: Suspended sediment concentration for wet season (SW waves) with Barge/vessel Loading Facility

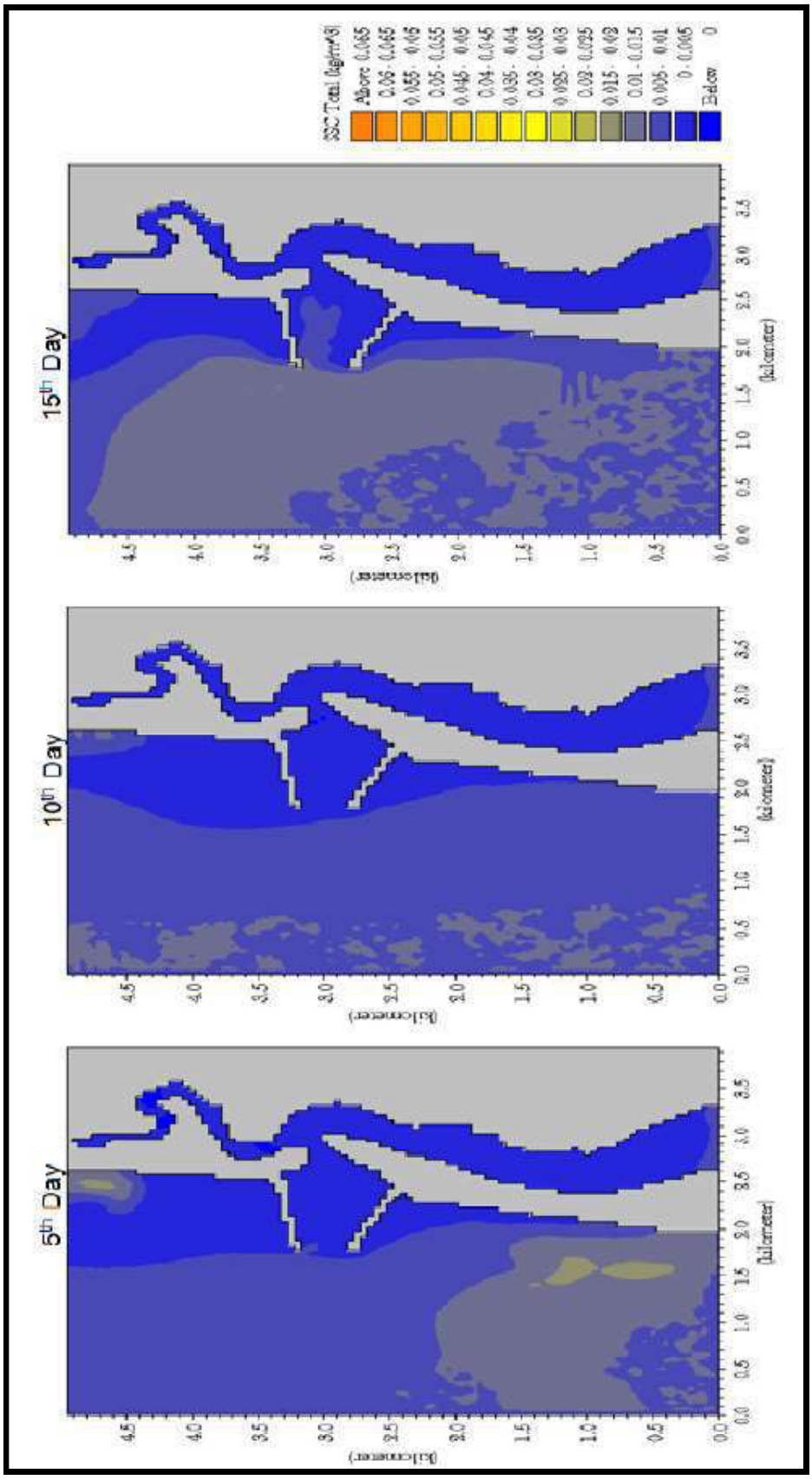


Figure 5-34: Suspended sediment concentration for dry season (W waves) with Barge/vessel Loading Facility

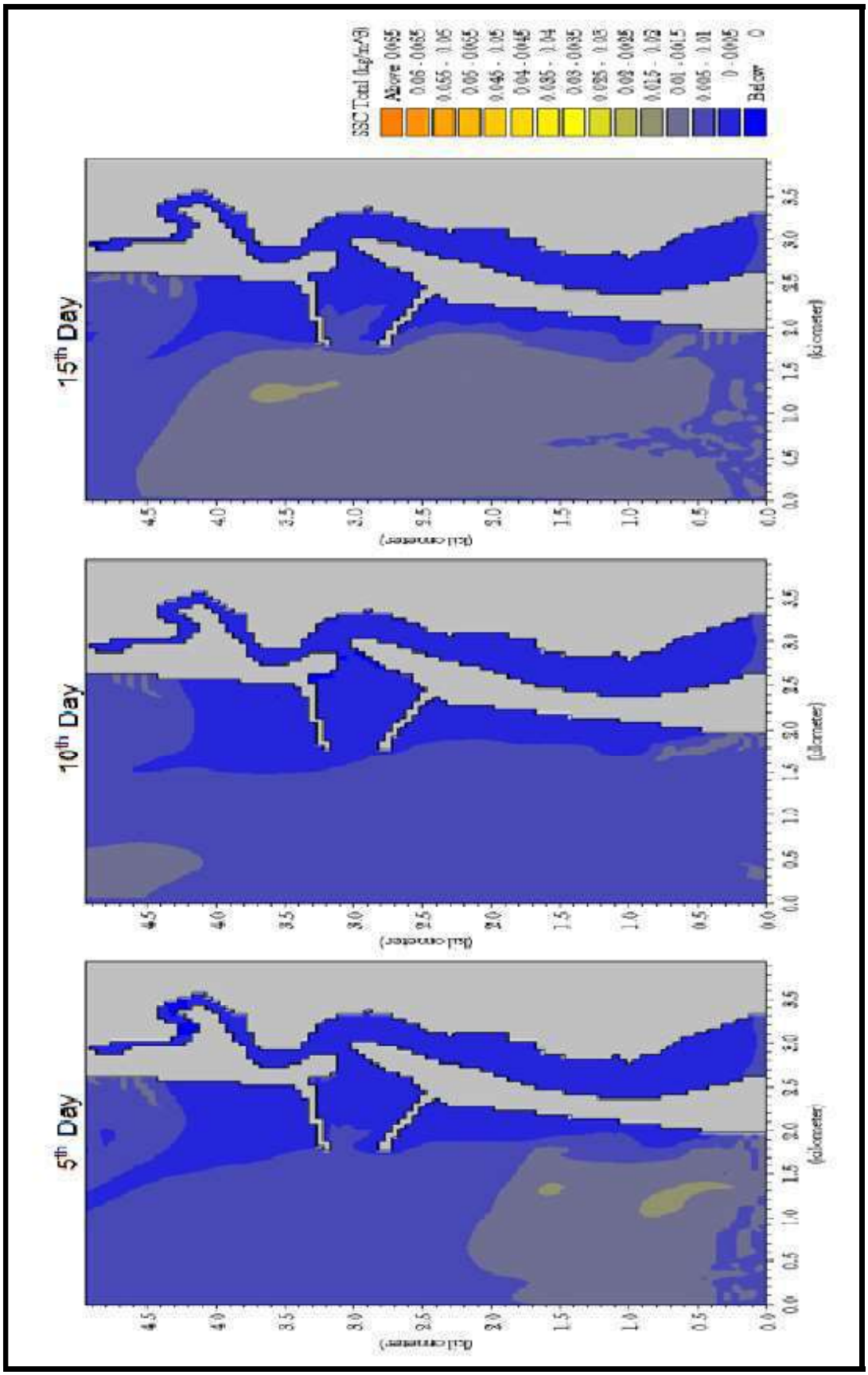


Figure 5-35: Suspended sediment concentration for dry season (WNW waves) with proposed facility

Total bed thickness change: The total bed thickness change computed for 5 day interval with different directions of wave approach is shown in below figures.

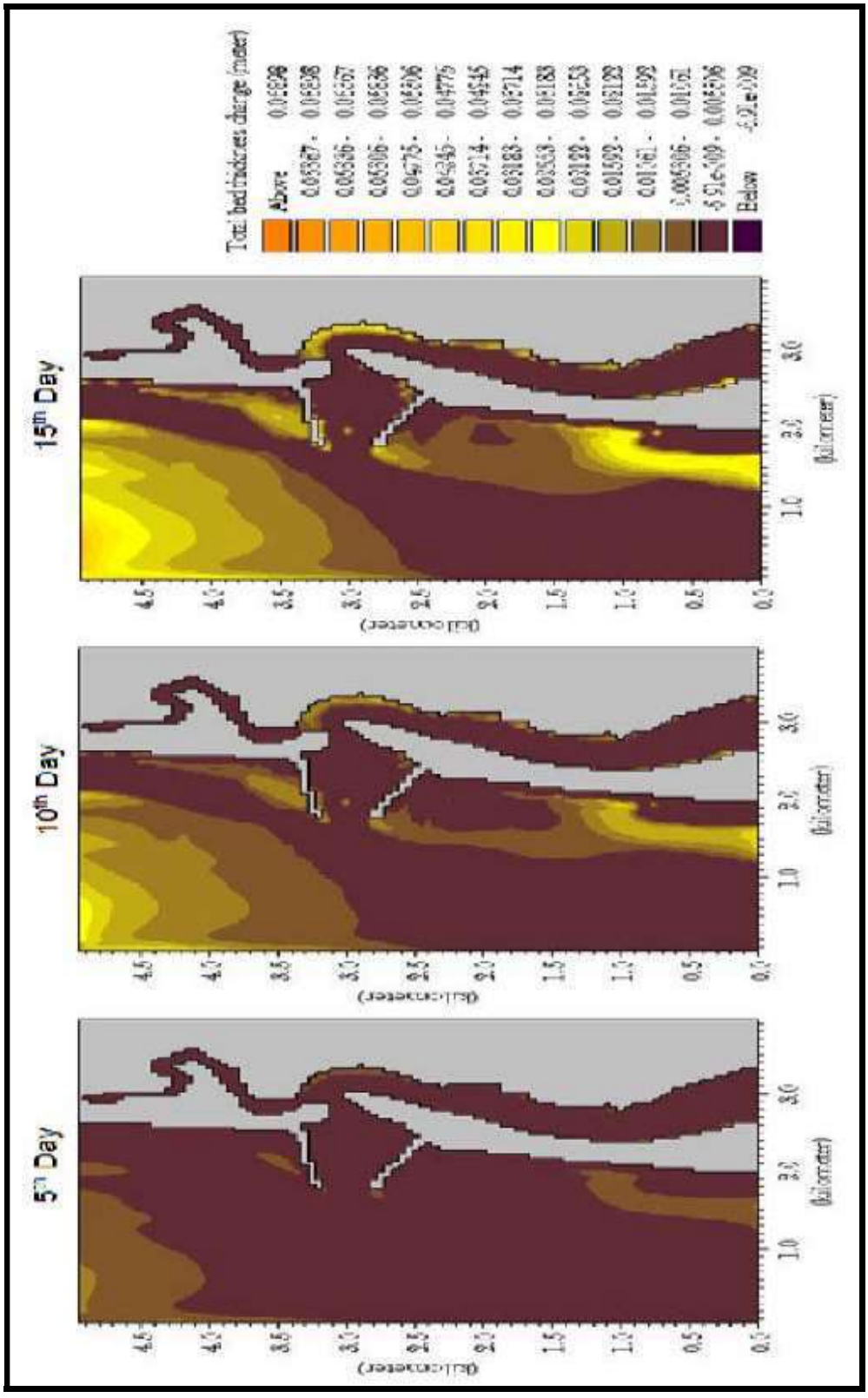


Figure 5-36: Total bed thickness change (m) for wet season (SSW waves) with proposed facility

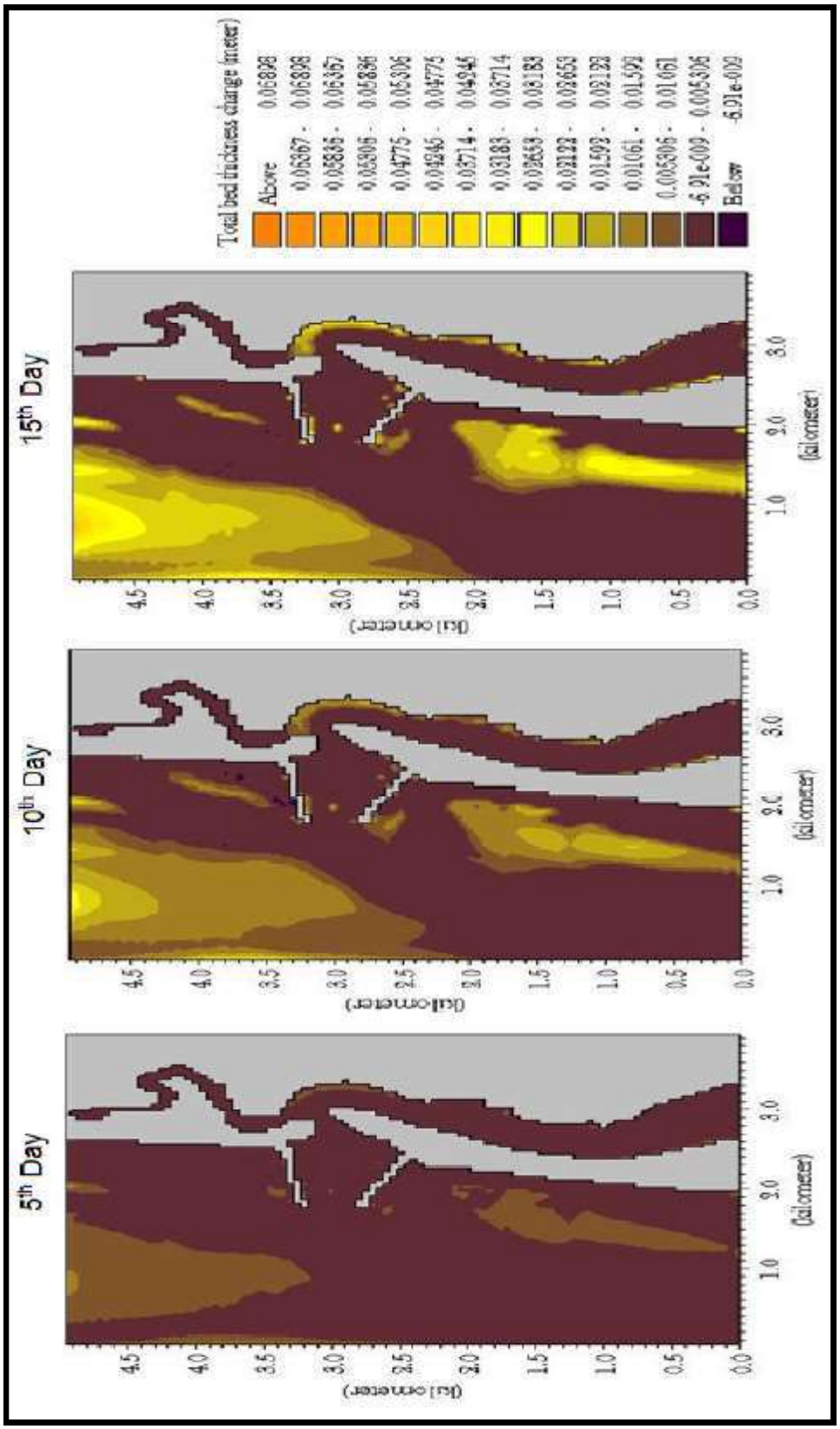


Figure 5-37: Total bed thickness change (m) for wet season (SSW waves) with proposed facility

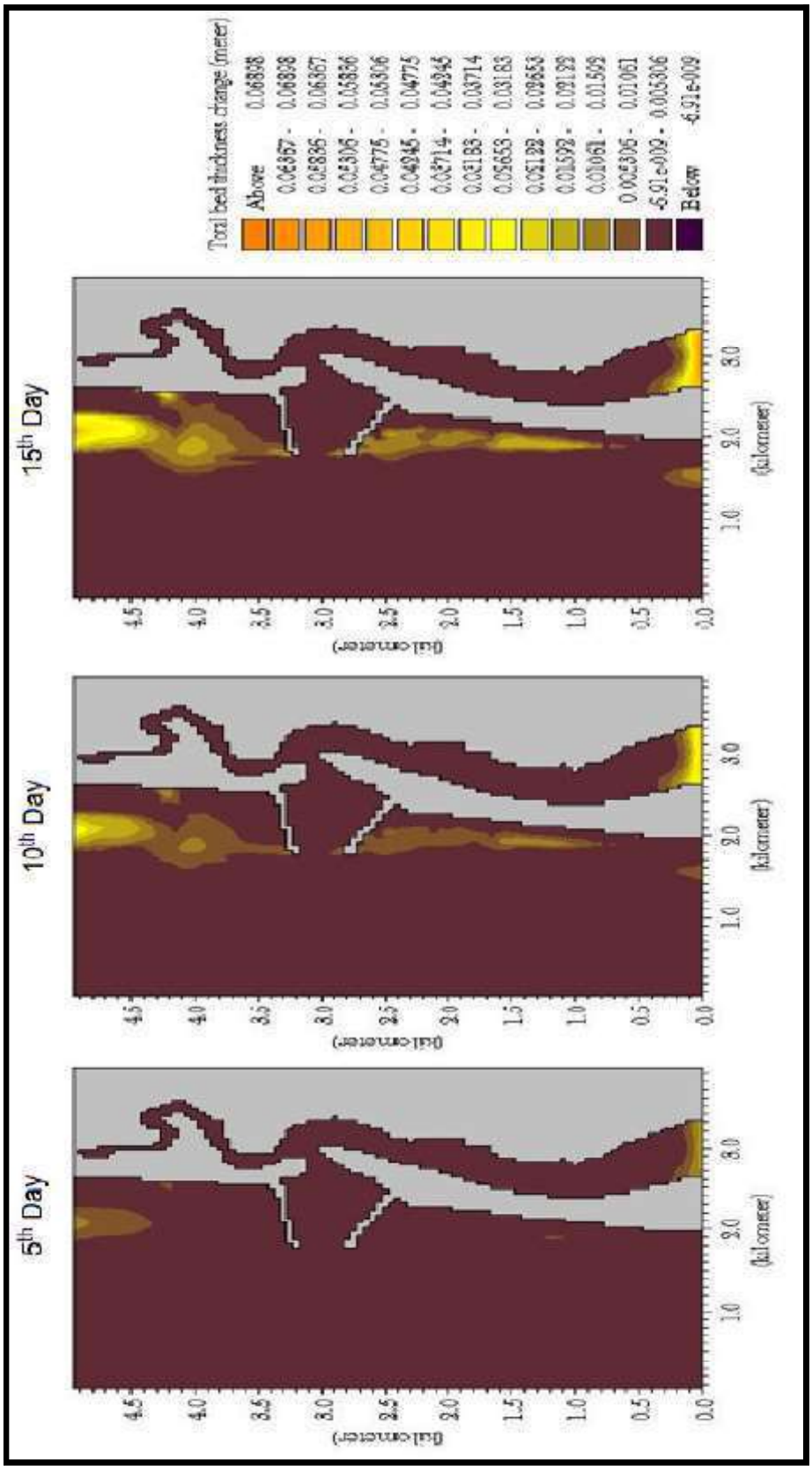


Figure 5-38: Total bed thickness change (m) for dry season (W waves) with proposed facility

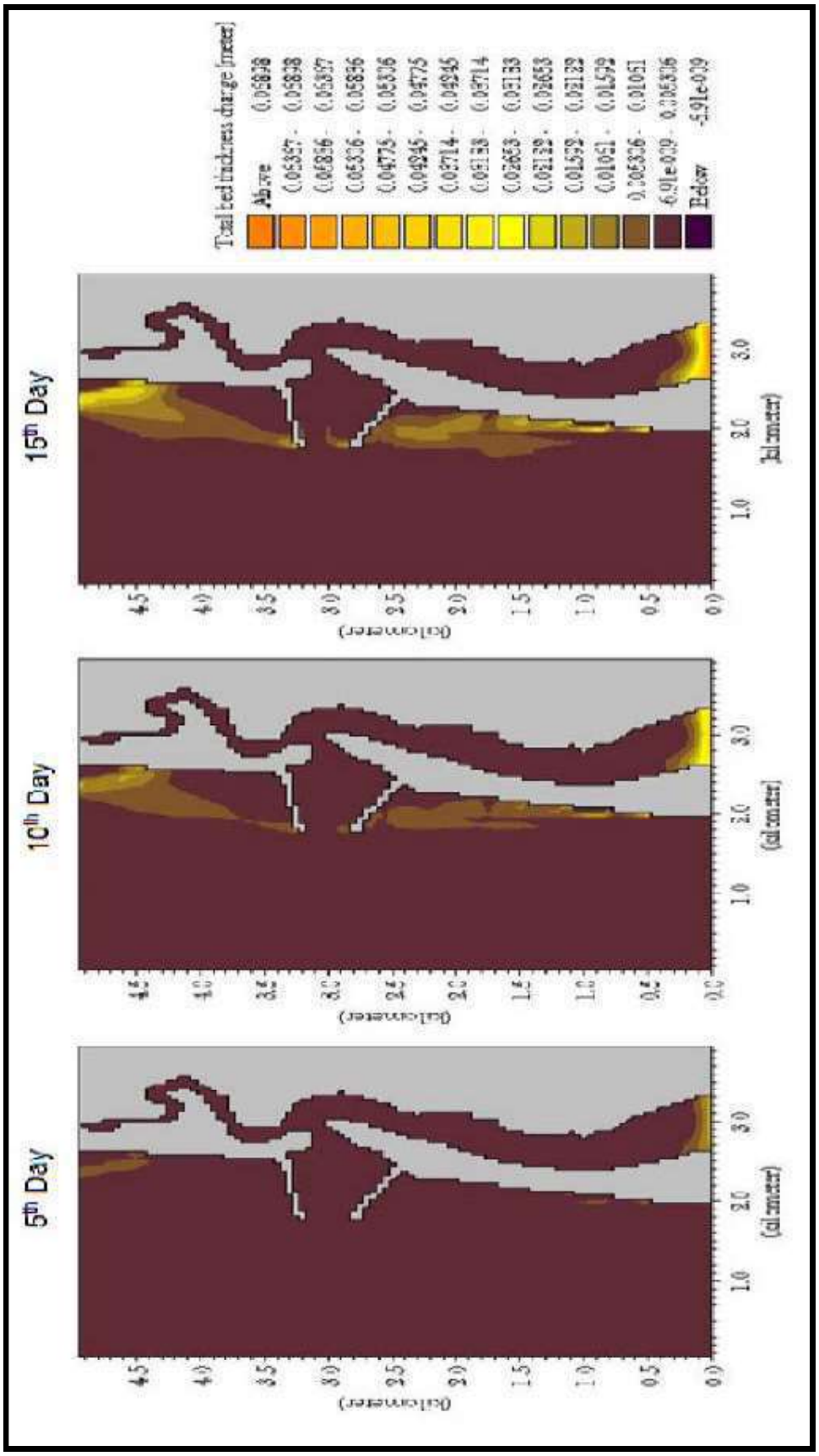


Figure 5-39; Total bed thickness change (m) for dry season (W NW waves) with proposed facility

Conclusion:

For case-I (without breakwaters) in the wet season, on the 5th day of the model run higher SSC values are noticed both inside the river and near the inlet entrance, which gradually decreased and by 10th day became negligible except on the southern end of the river. By 15th day the SSC is completely flushed out and higher SSC values are noticed only far away on the sea side of the channel. For dry season the SSC values continue to be less throughout the model run up to 15 days. The model run for bed level changes shows negligible bed level changes up to 5th day throughout the entire area; but by 10th day slight deposition is noticed on the right bank of the river to the north of the channel entrance and by 15th day the deposition seems to have increased further. For dry season however the bed level changes are negligible for the entire area.

For case-II (with breakwaters) during wet season slightly higher values of SSC are noticed inside the region of breakwaters and also inside the river. But by 10th day the SSC is flushed out and by 15th day the entire area is free of any SSC. During dry season the SSC is negligible throughout the study area. The bed level changes during wet season indicate the sedimentation is negligible up to 10th day; but by 15th day slight deposition appears on the right bank of the river facing the channel inlet. But this siltation is not severe and it can be concluded that the construction of breakwaters will not have any significant effect on siltation in the proposed facility area.

NON- COHESIVE SEDIMENT TRANSPORT MODEL STUDIES:

Honnavar coast is affected mainly by wind waves during all seasons. During wet season swells from south-west predominantly hit the coast and the sediment (sand) is lifted into suspension all along the coast. Since the inlet at Honnavar is very shallow, the waves break frequently on the shoals and cause varying degrees of sedimentation transport. This phenomenon can be examined using MIKE 21 Non-cohesive sediment transport model.

Non-cohesive Sediment transport (ST) model description:

MIKE 21 ST is a module in the MIKE 21 application suite for calculating non-cohesive sediment (sand) transport rates. We can calculate sand transport based on pure current information or with only wave impact. In addition to sand transport rates, a simulation will give the initial rates of bed level changes as well. This is sufficient to identify potential areas of erosion or deposition, but cannot take the place of a full morphological model. MIKE 21 ST can simulate sand transport rates in a wide array of settings, including natural environments like tidal inlets, estuaries and coastlines, and man-made constructions like harbours and bridges. Tide, wind, wave and current can all be taken into consideration for optimum precision in the simulations.

ST model Setup:

For ST model setup, we considered both currents and wave simulations as the coast is exposed to open sea where combined action of waves and currents are important. The HD simulation output for different wave conditions are given separately for executing the ST model. Bjiker's method has been adopted for performing sediment transport calculations with constant relative sediment density taken as 2.65 and water temperature to be 28°C. Bed load transport coefficient has been considered spatially constant. For bed resistance, the Chezy

number with value 55 has been used. Sediment porosity is considered as 0.4 with size 0.2 mm, gradation factor of 1.1.

Results:

Without proposed facility (case-I):

The seasonal distribution of sediment transport (wet and dry seasons) for six predominant deep-water wave directions are presented in below Figures 5-40 to Figure 5-51.

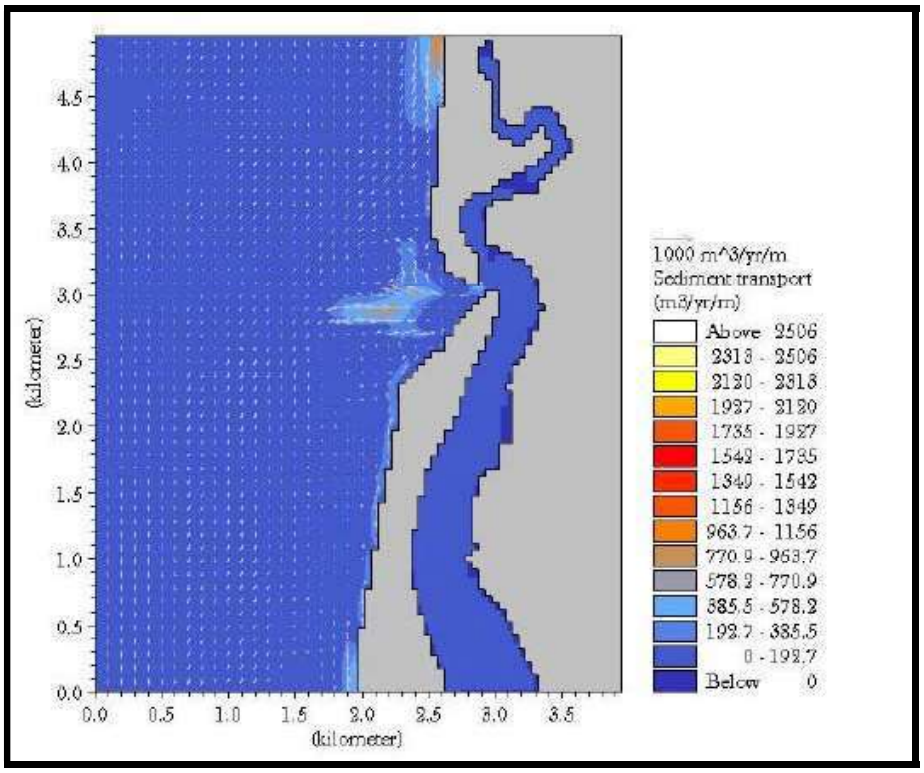


Figure 5-40: Rate of non-cohesive sediment transport during Wet season for S waves

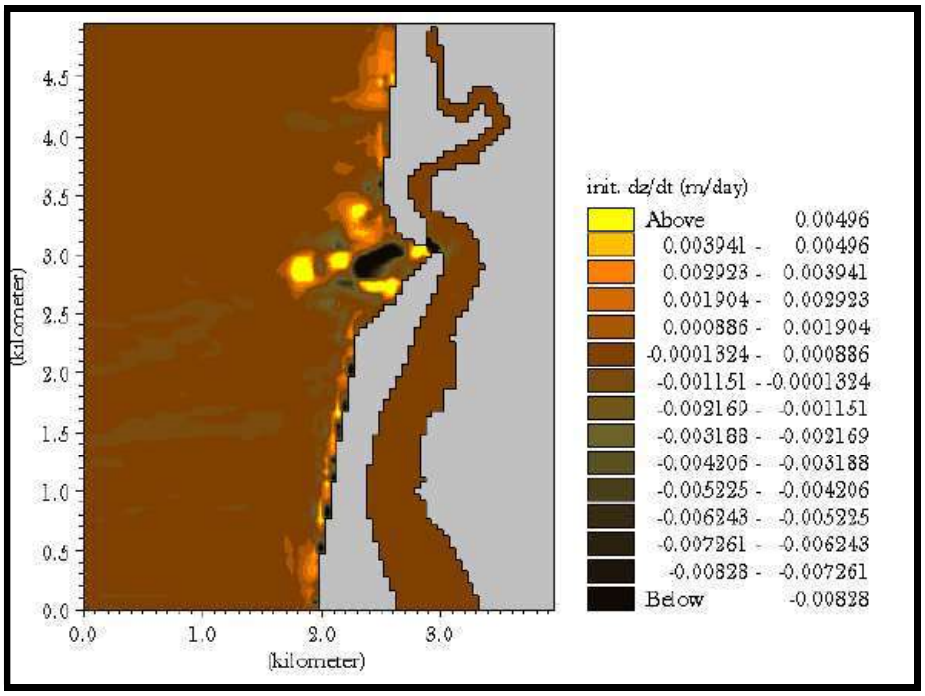


Figure 5-41: Bed level changes (Non-cohesive) from initial condition during wet season (S waves)

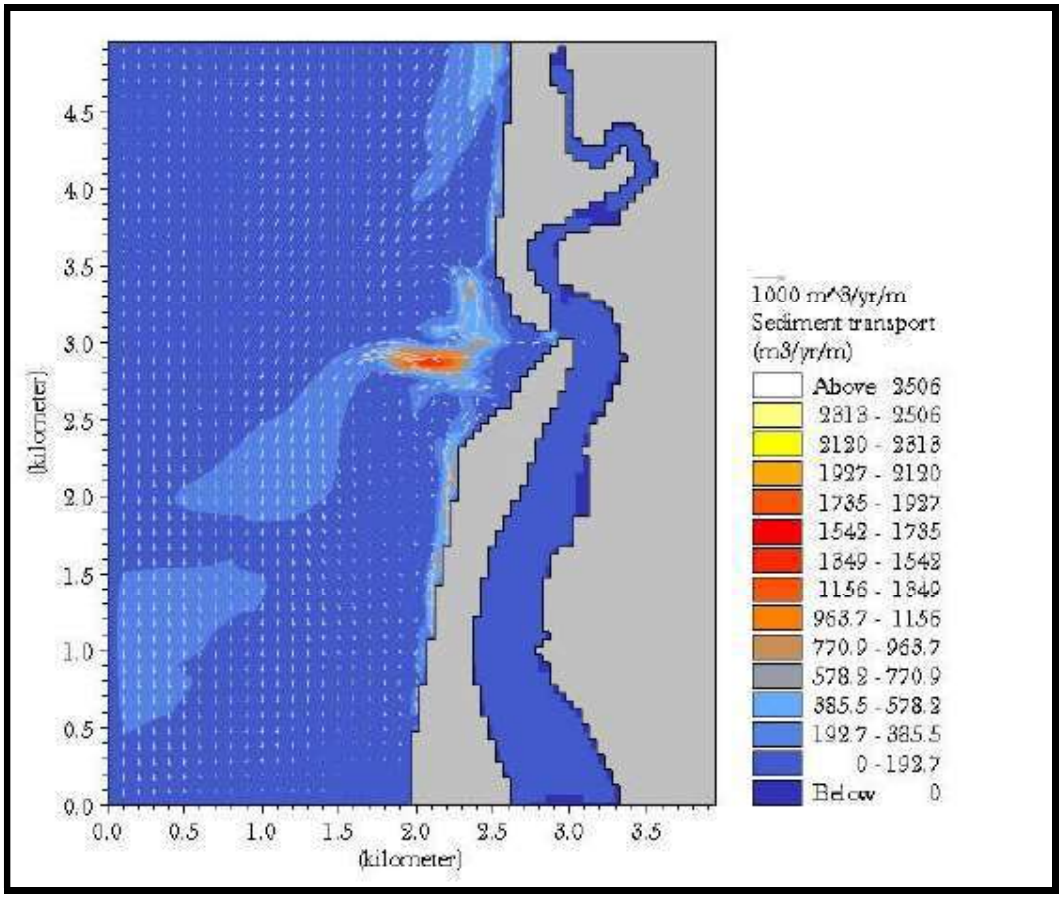


Figure 5-42: Rate of non-cohesive sediment transport during wet season for SSW waves

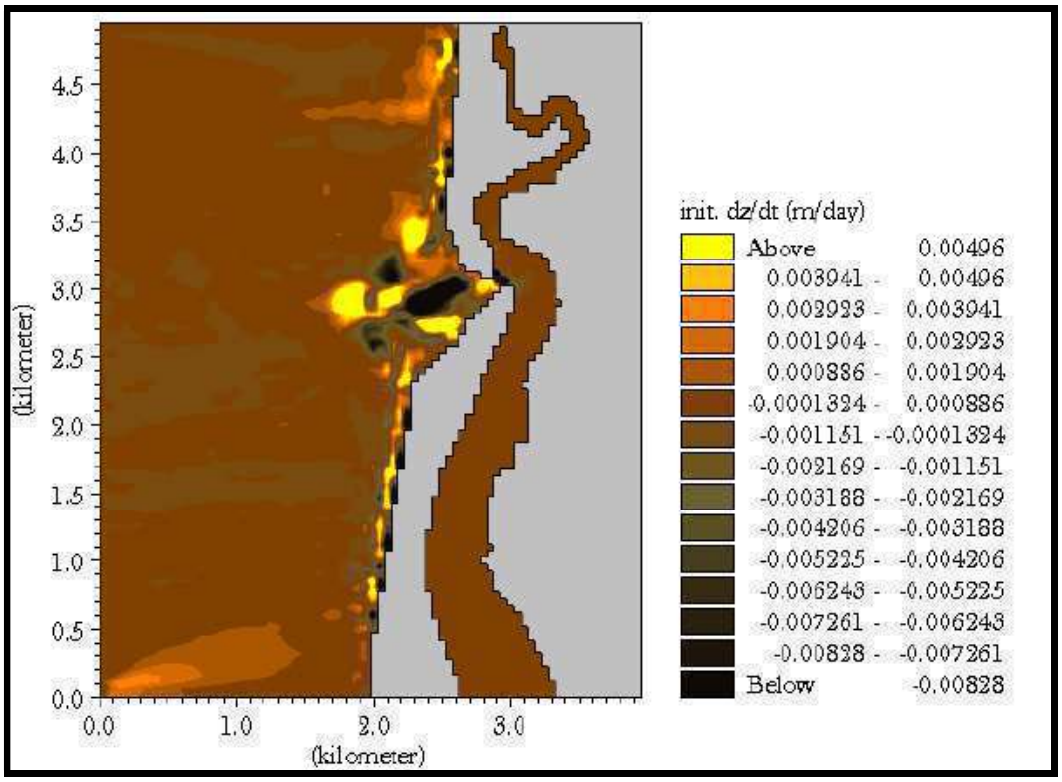


Figure 5-43: Bed level changes (Non-cohesive) during wet season (SSW waves)

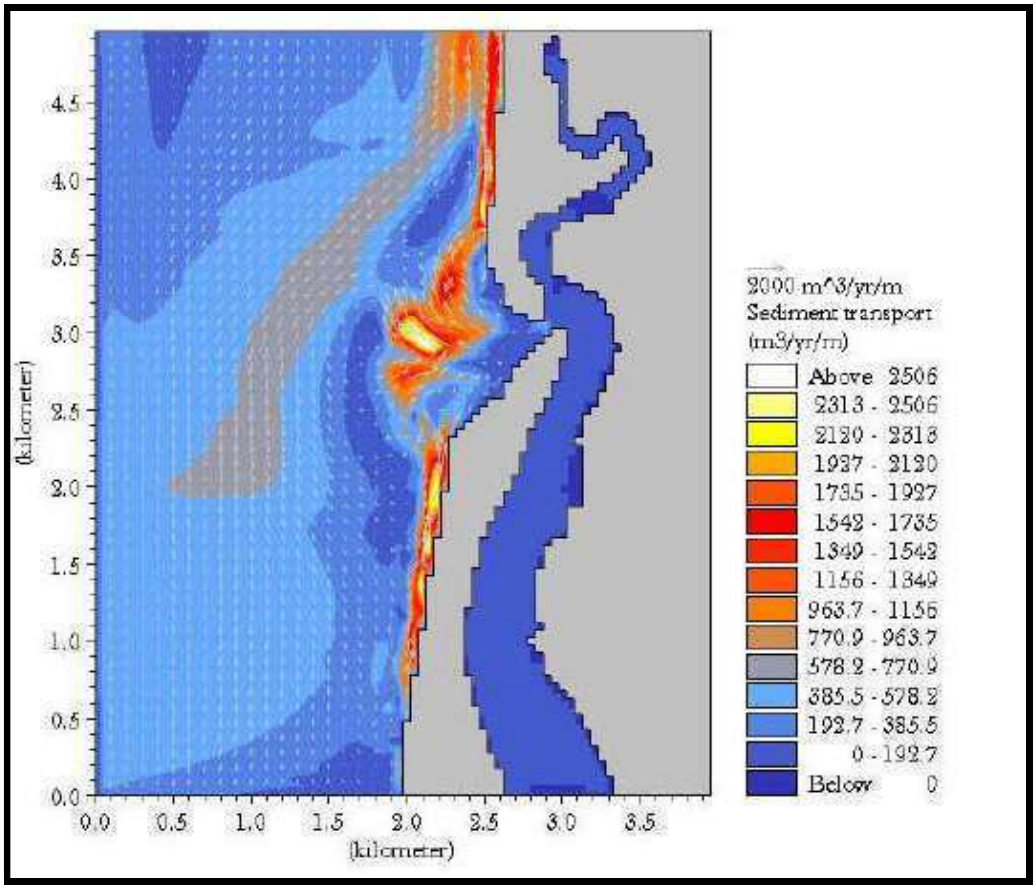


Figure 5-44: Rate of non-cohesive sediment transport during wet season for SW waves

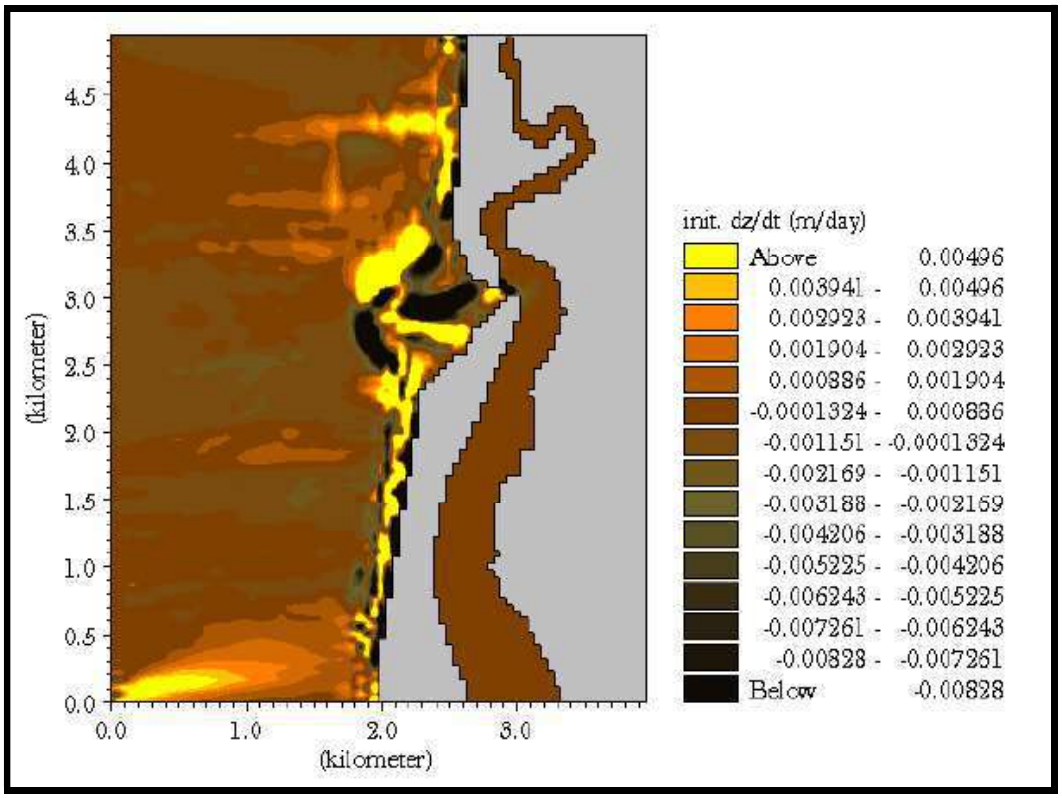


Figure 5-45: Bed level changes (Non-cohesive) from initial condition during wet season (SW waves)

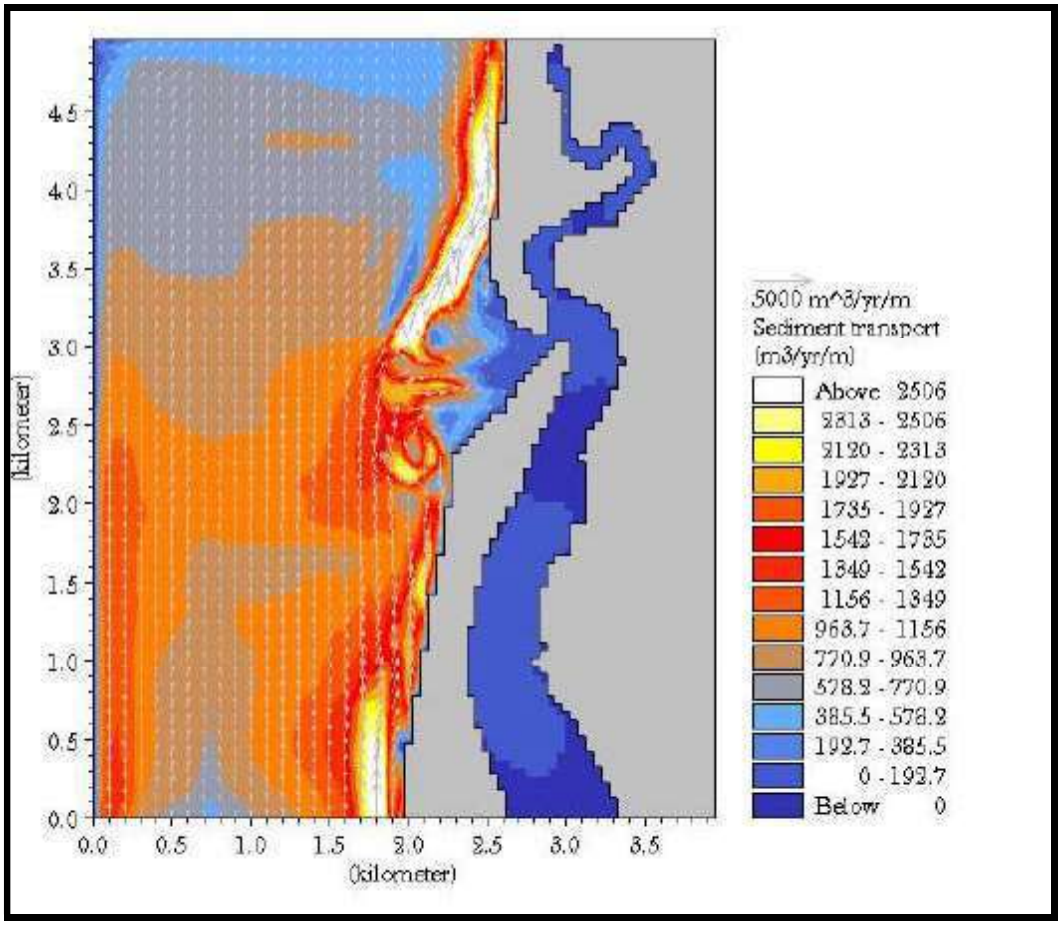


Figure 5-46: Rate of non-cohesive sediment transport during dry season for WSW waves

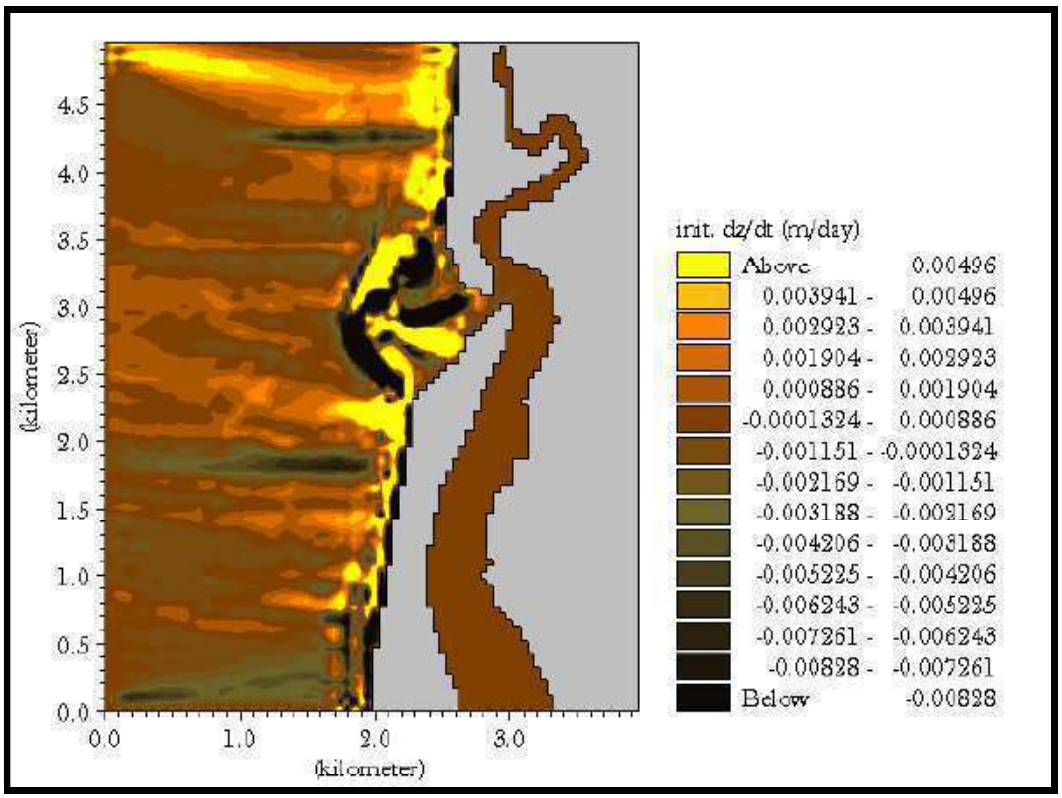


Figure 5-47: Bed level changes (Non-cohesive) during dry season (WSW waves)

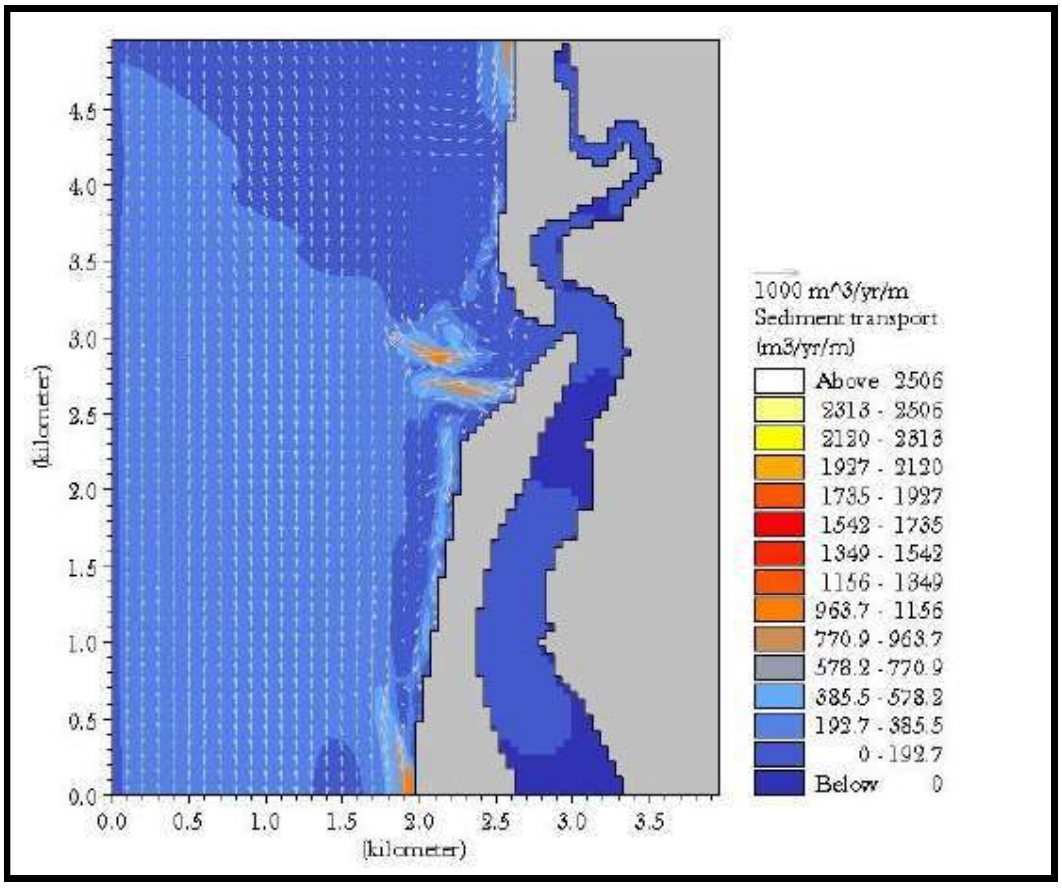


Figure 5-48: Rate of non-cohesive sediment transport during dry season for W waves

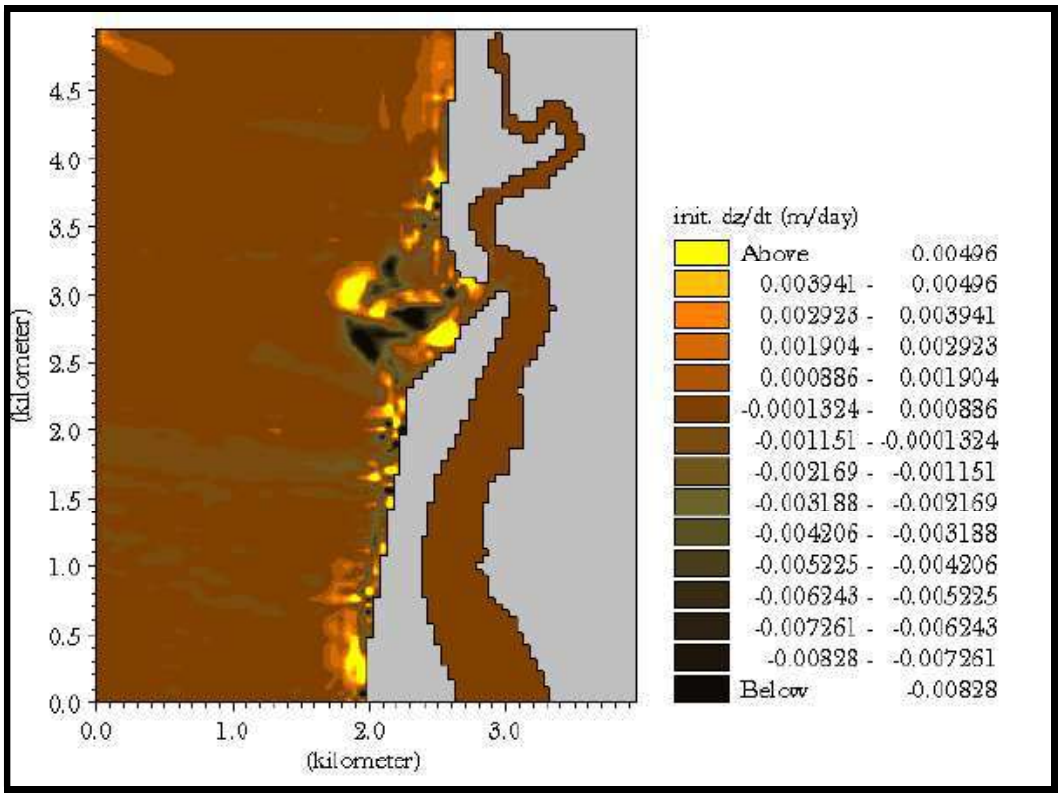


Figure 5-49: Bed level changes (Non-cohesive) from initial condition during dry season (W waves)

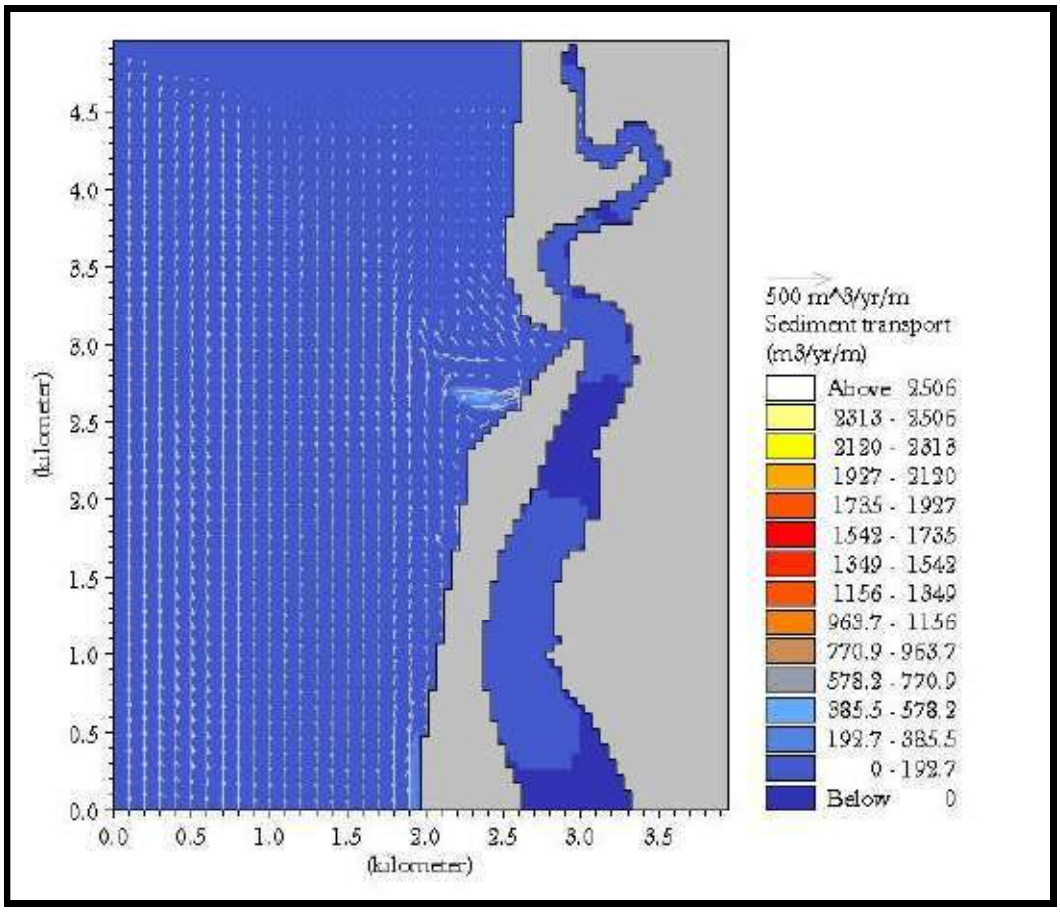


Figure 5-50: Rate of non-cohesive sediment transport during dry season for WNW waves

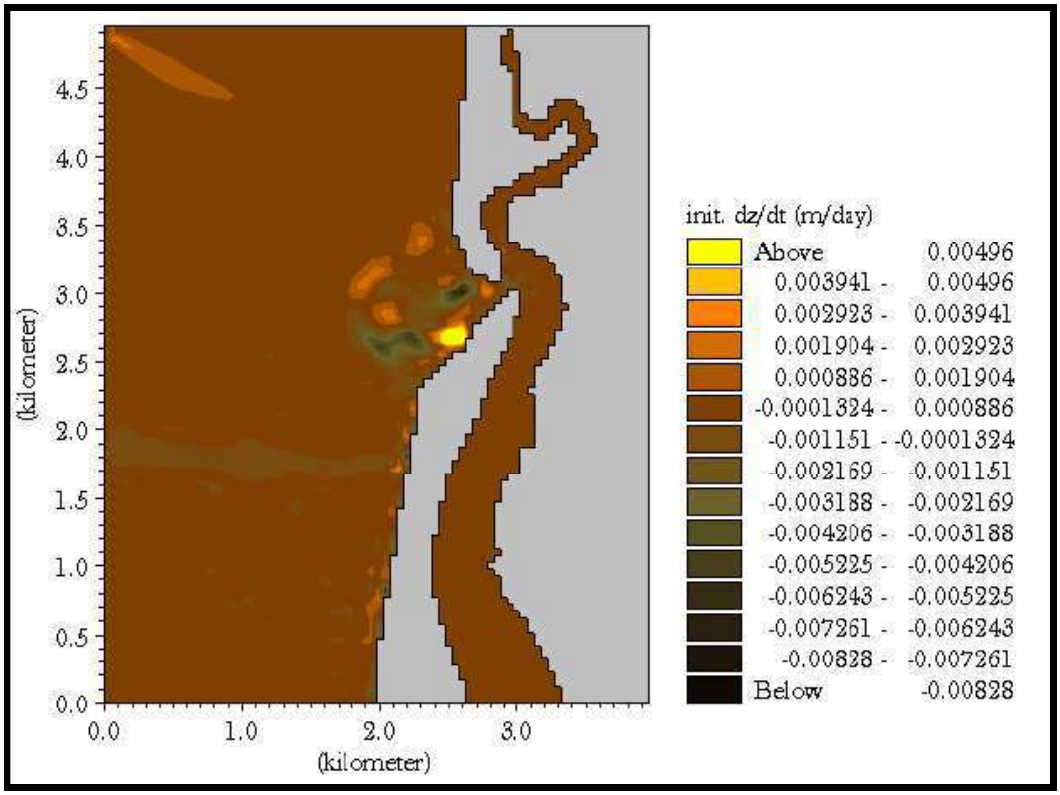


Figure 5-51: Bed level changes (Non-cohesive) during dry season (WNW waves)

With proposed Facility (Case-II):

The seasonal distribution of sediment transport (wet and dry seasons) for six predominant wave directions have been presented in below Figure 5-52 to 5-63

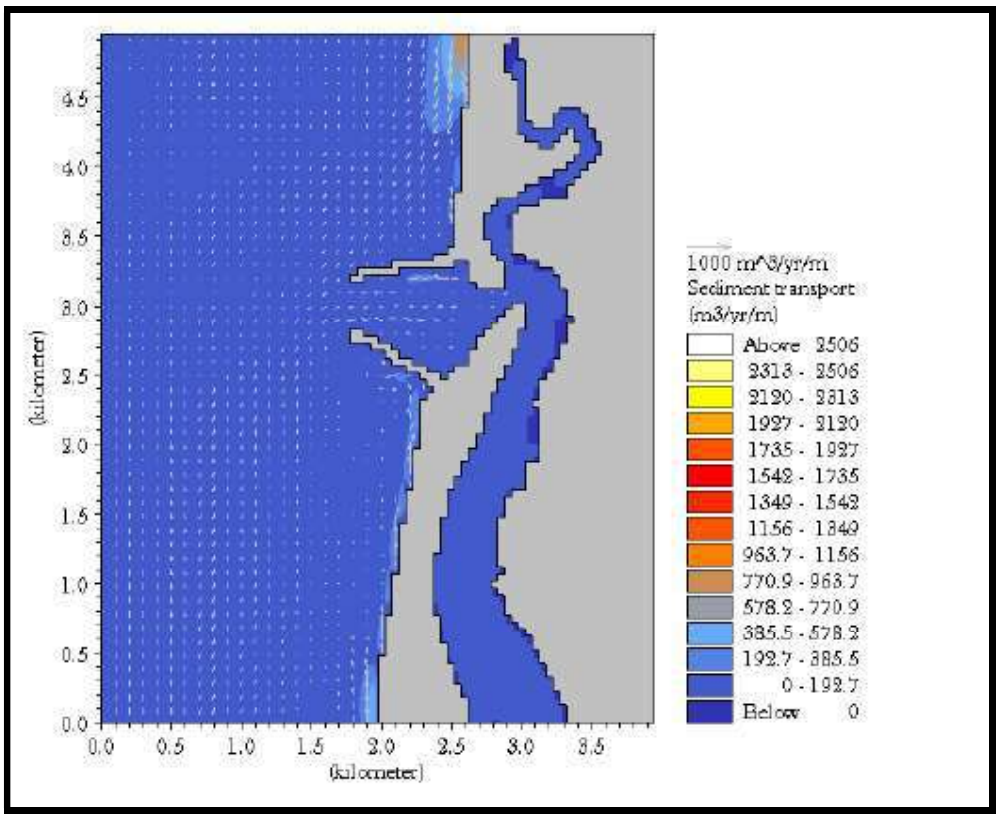


Figure 5-52: Rate of non-cohesive sediment transport during wet season for S waves (with proposed facility)

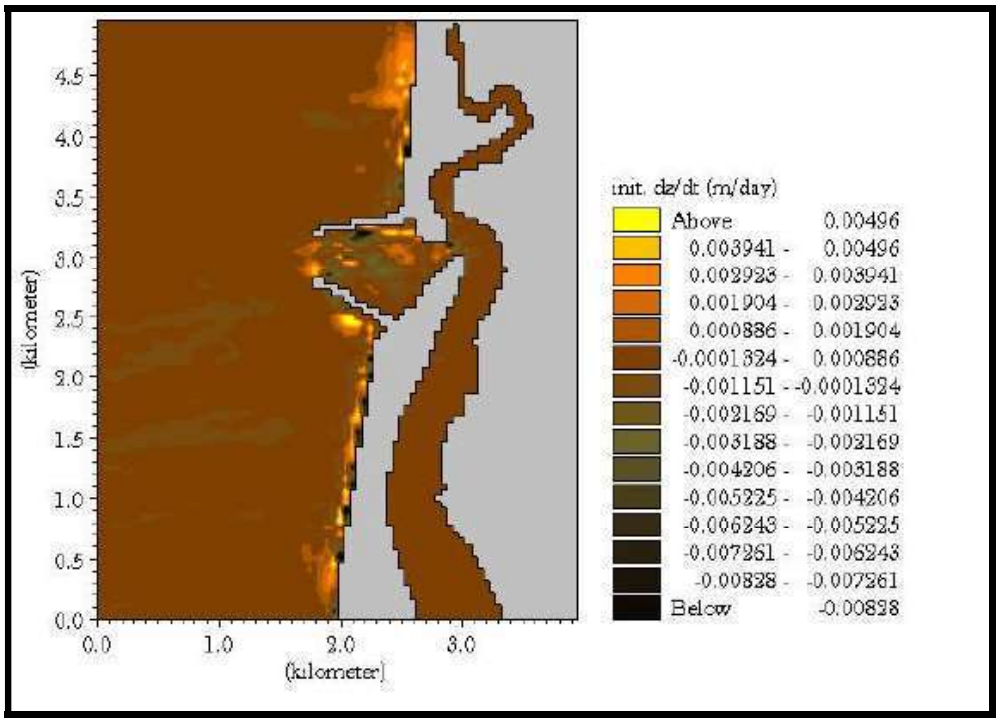


Figure 5-53: Bed level changes (Non-cohesive) during wet season (S waves) with proposed facility

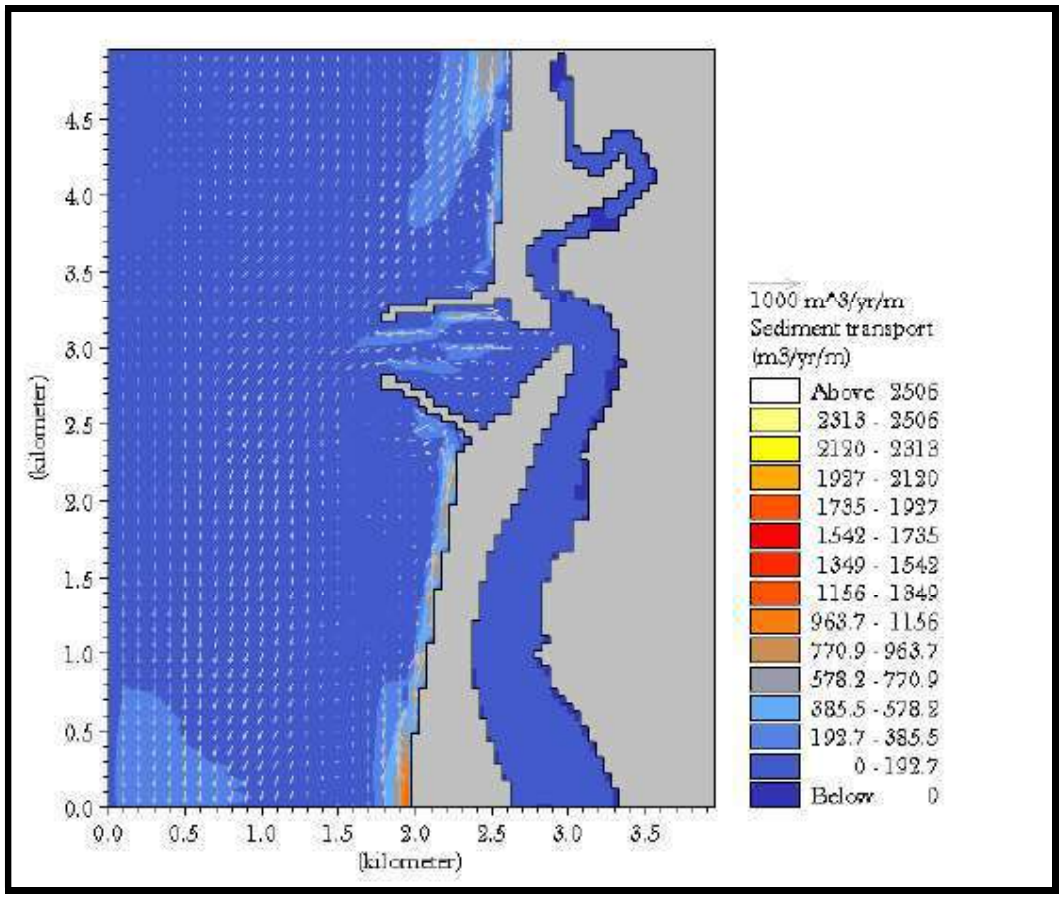


Figure 5-54: Rate of non-cohesive sediment transport during wet season for SSW waves

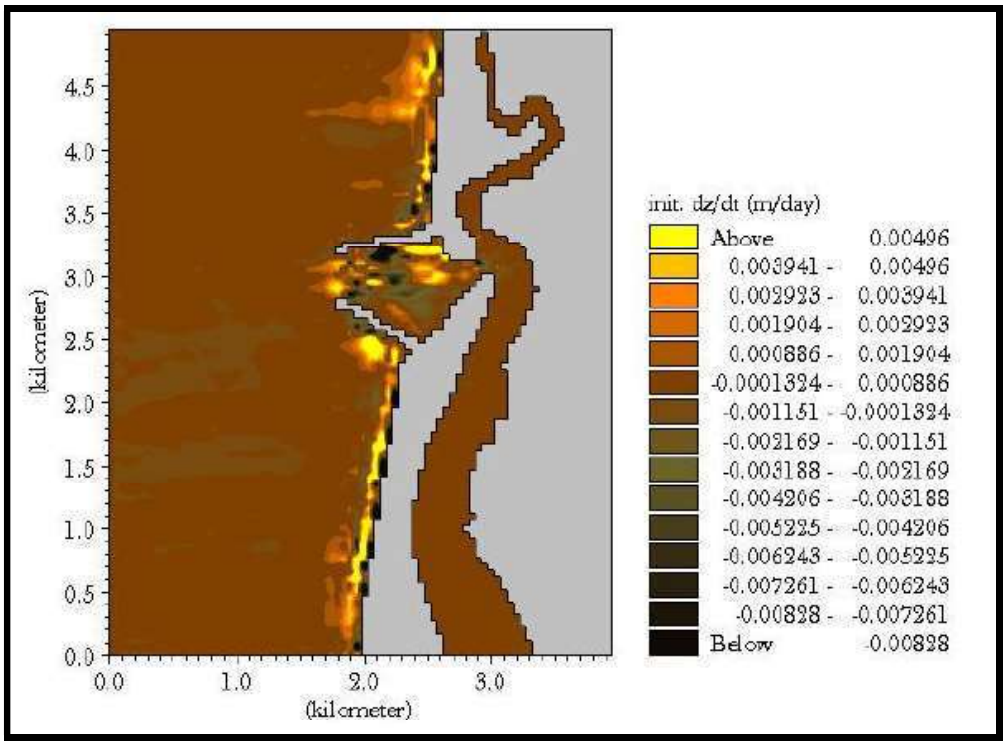


Figure 5-55: Bed level changes (Non-cohesive) during wet season (SSW waves)

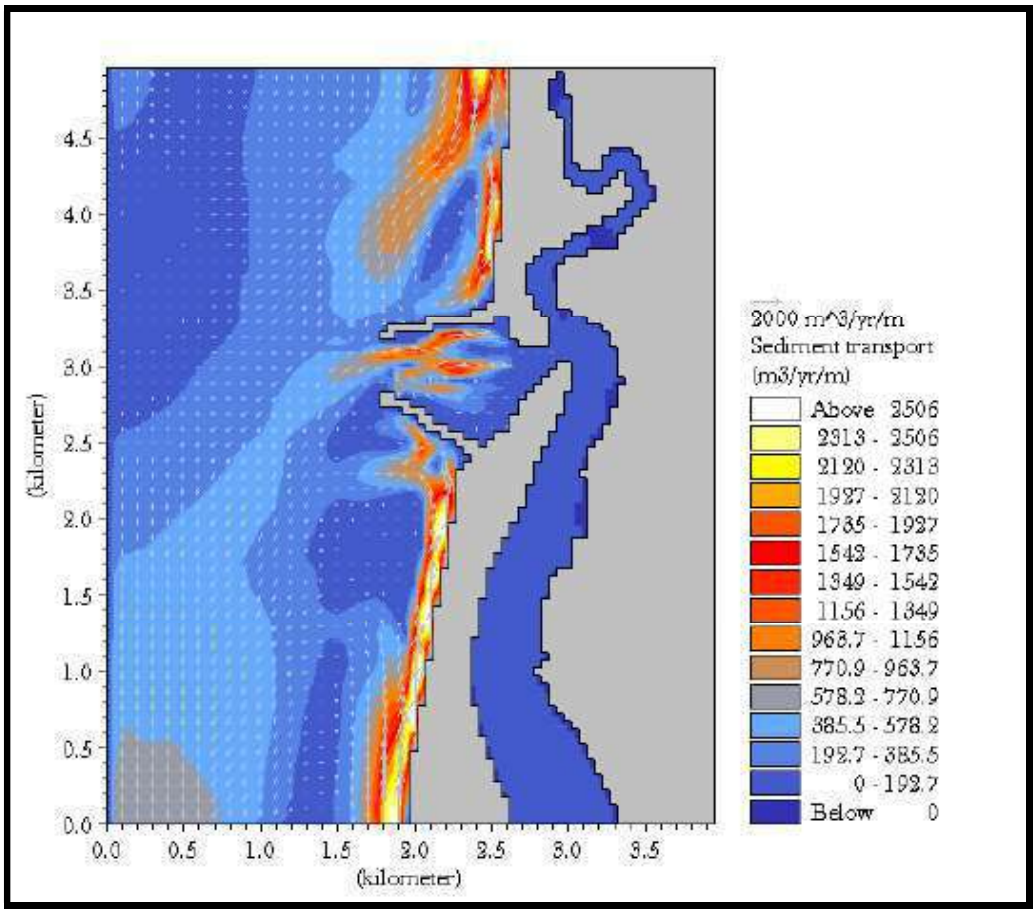


Figure 5-56: Rate of non-cohesive sediment transport during wet season for SW waves

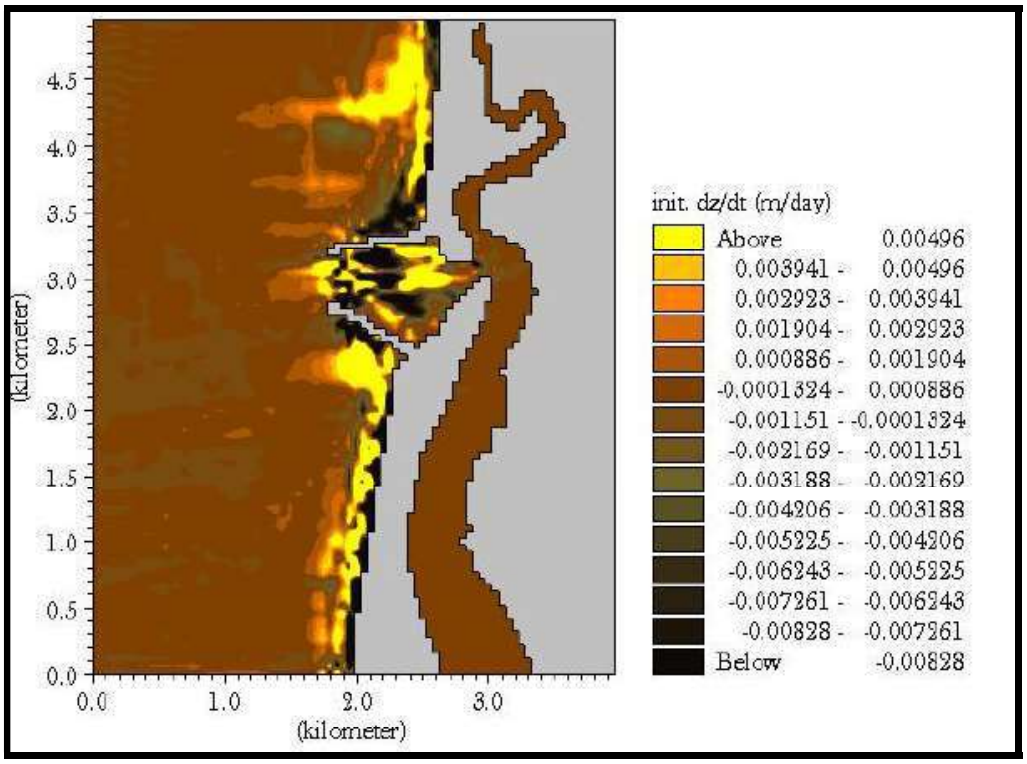


Figure 5-57: Bed level changes (Non-cohesive) during wet season (SW waves)

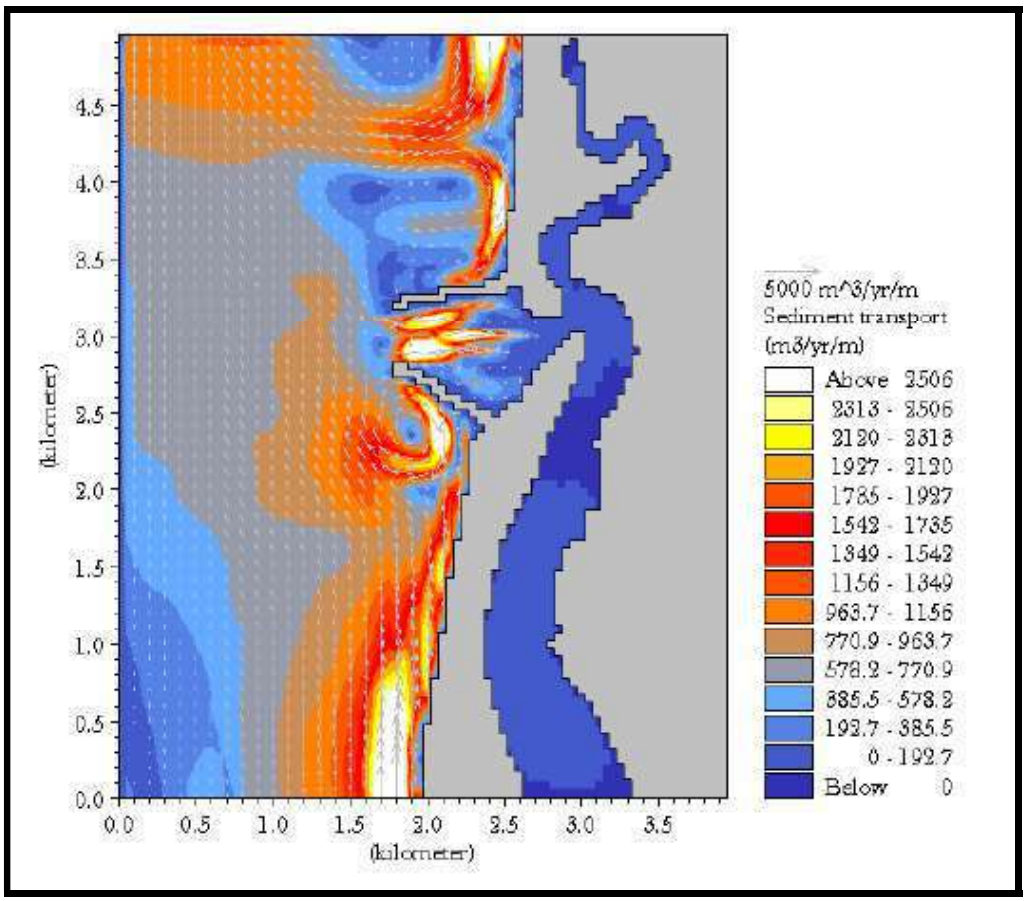


Figure 5-58: Rate of non-cohesive sediment transport during dry season for WSW waves

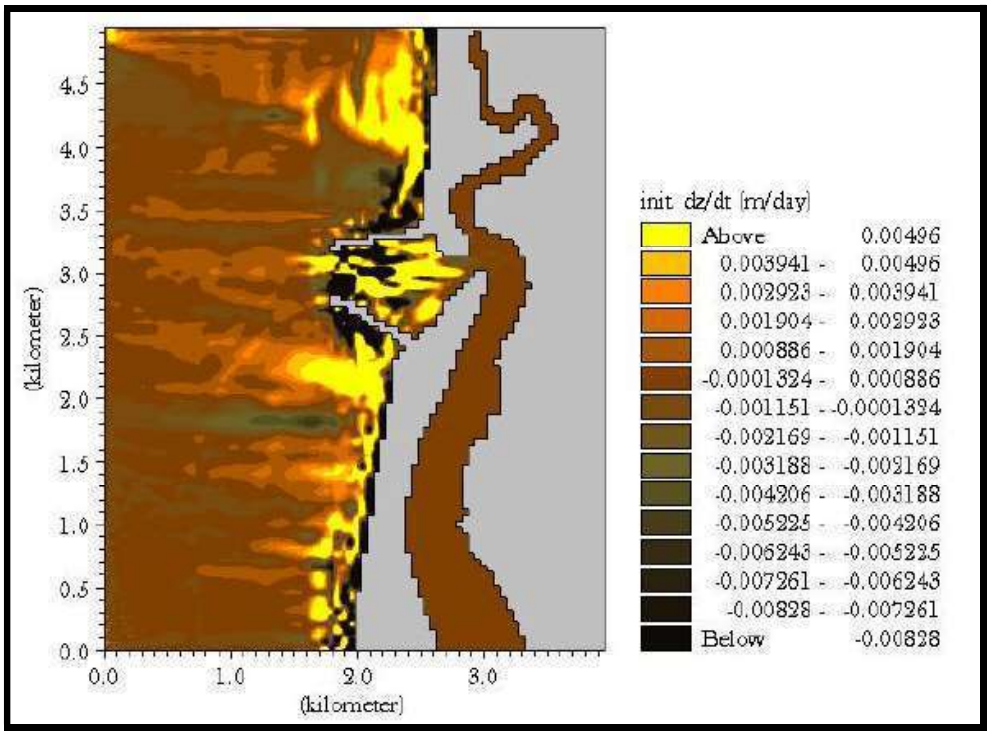


Figure 5-59: Bed level changes (Non-cohesive) during dry season (WSW waves)

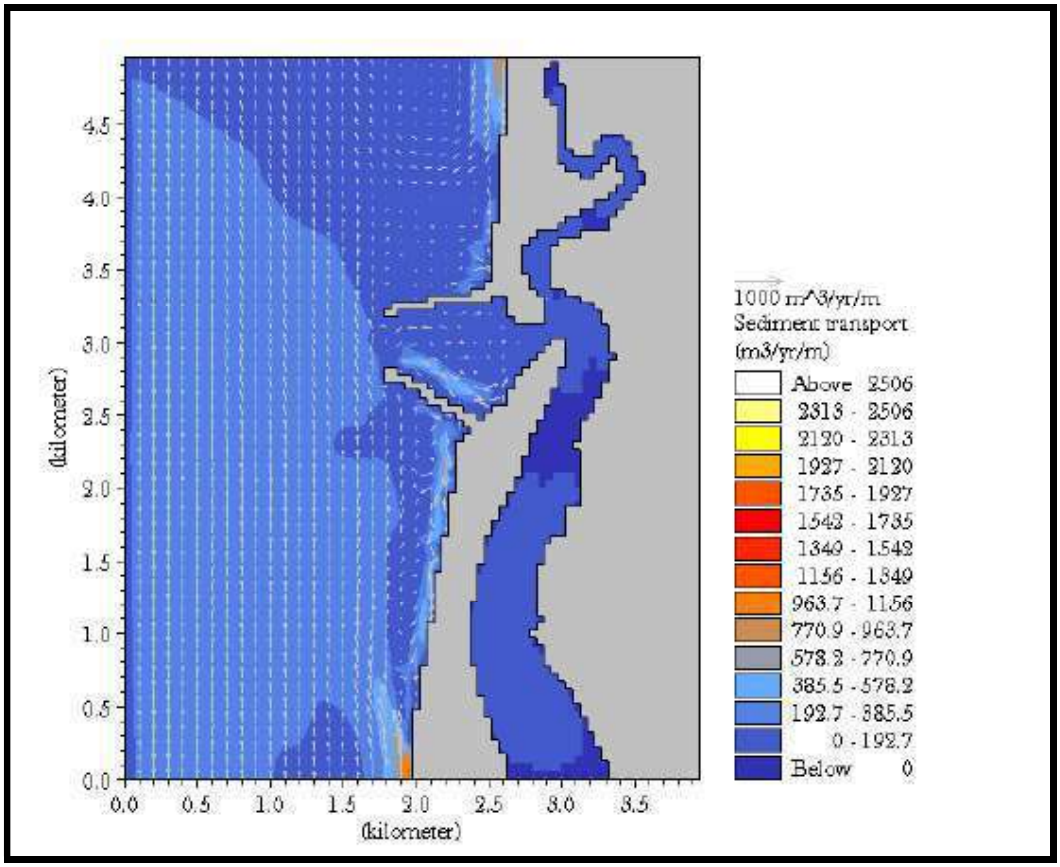


Figure 5-60: Rate of non-cohesive sediment transport during dry season for W waves

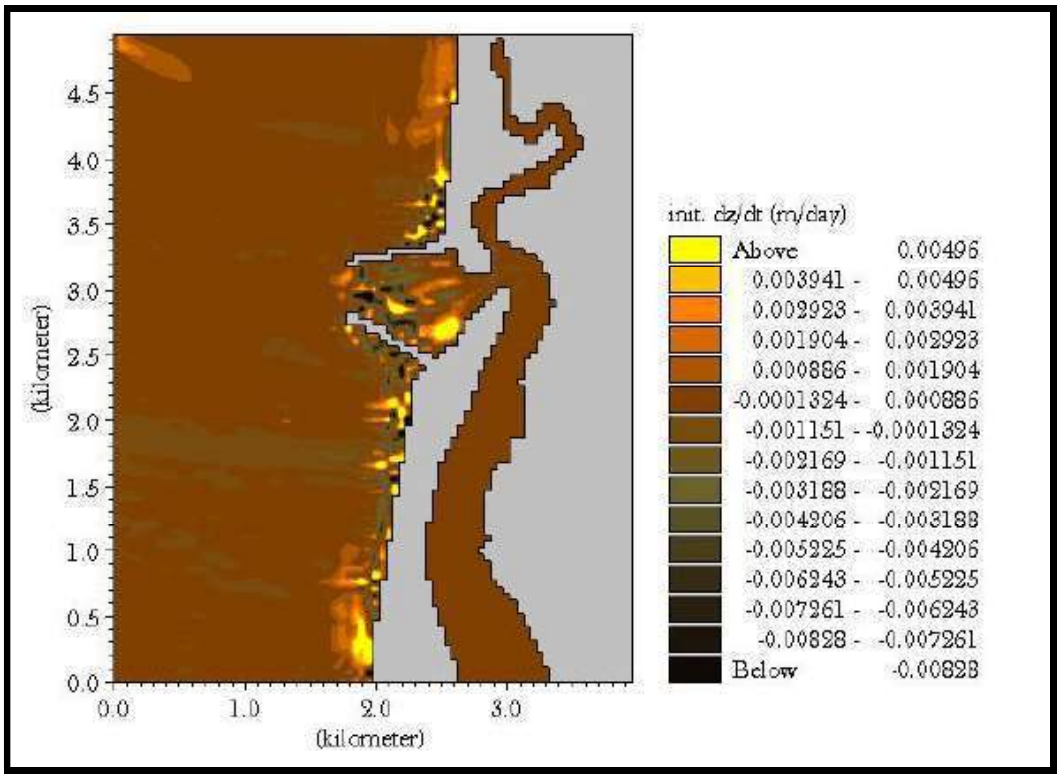


Figure 5-61: Bed level changes (Non-cohesive) from initial condition during dry season (W waves)

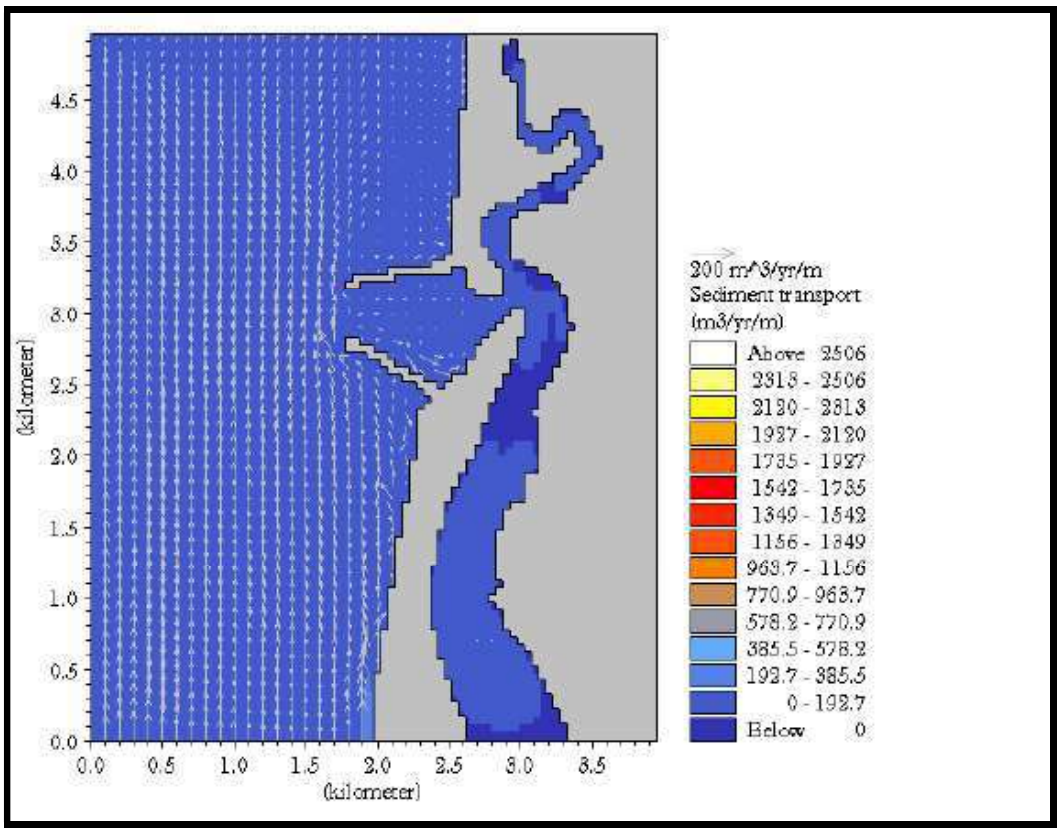


Figure 5-62: Rate of non-cohesive sediment transport during dry season for WNW waves

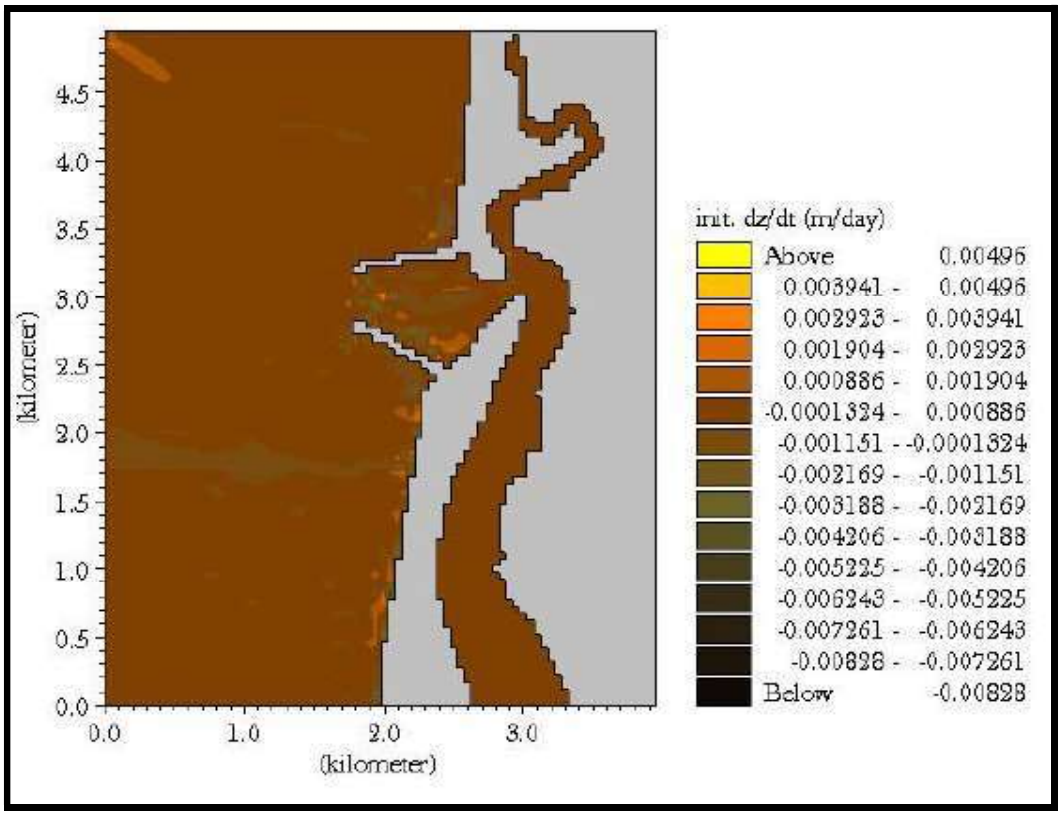


Figure 5-63: Bed level changes (Non-cohesive) during dry season (WNW waves)

Conclusion:

For case-I the rates of sediment transport for deep water waves from S and SSW are much less (< 200 m^3/yr/m) along the entire coastal stretch. However slightly higher values (about 400) are noticed on the seaward side of the entrance where shoals are present. The bed level changes indicate deposition at the mouth and to the south of the inlet. For SW and SSW waves during monsoon season high values of sand transport (>2000 m^3/yr/m) are noticed along the entire coastal stretch due to high and steep waves during this season. The bed level changes indicate significant deposition (0.005 m/day) both to the south and north of the entrance channel. During non-monsoon season, when W and WNW waves prevail the sediment transport as well as the bed level changes are not significant.

For case-II (with breakwaters) during monsoon season when SW and WSW waves prevail the sediment transport is significant (>2000 m^3/yr/m) to the north as well as to the south of breakwaters. Bed level changes indicate deposition to the northern and southern coastline in general; but there is also erosion just to the north of northern breakwater, some deposition is noticed inside the breakwaters zone just at the mouth of the entrance channel, which must be cleared periodically in maintenance dredging. Model studies indicate an annual deposition of about 10,300 m^3/yr in the dredged channel. Again, during non monsoon months there is no significant deposition. On the whole, the sand transport model studies indicate depositional trend near the mouth of the channel as well as to the north of the channel for case I. But for case II, the depositional trend in the channel has somewhat decreased due to breakwaters while some erosional trend is noticed towards the northern shores.

5.3.1.2 Wave Induced Littoral Drift

The littoral currents are mainly responsible for transport of sediments in the surf-zone causing erosion or deposition along a beach. Therefore, wave induced littoral drift (with no interaction of coastal currents) has been modeled in ST model for different wave approaches and are presented in below Figures for case-I and case-II.

Littoral drift without Proposed Facility (case-I):

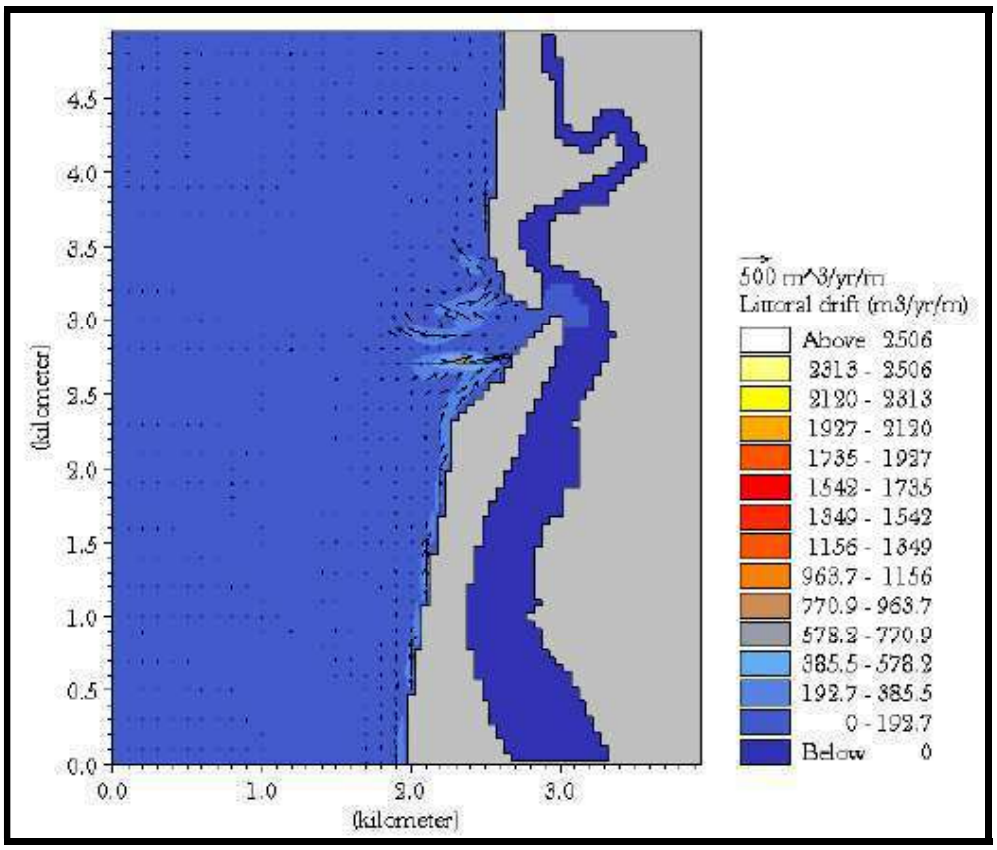


Figure 5-64: Wave induced littoral drift for S waves

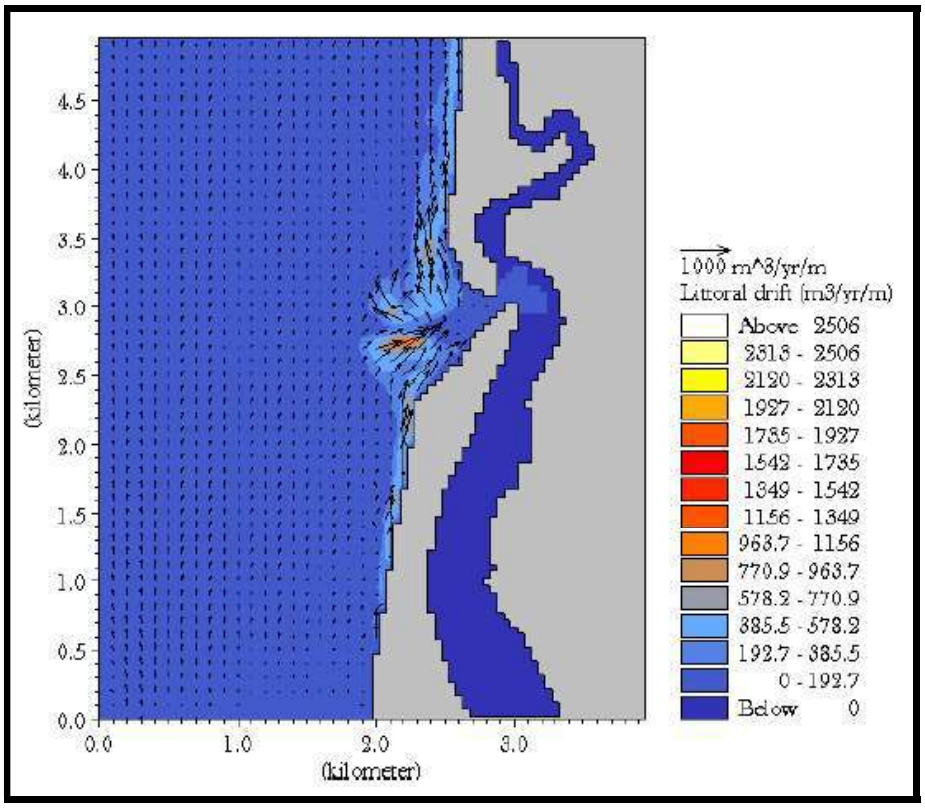


Figure 5-65: Wave induced littoral drift for SSW waves

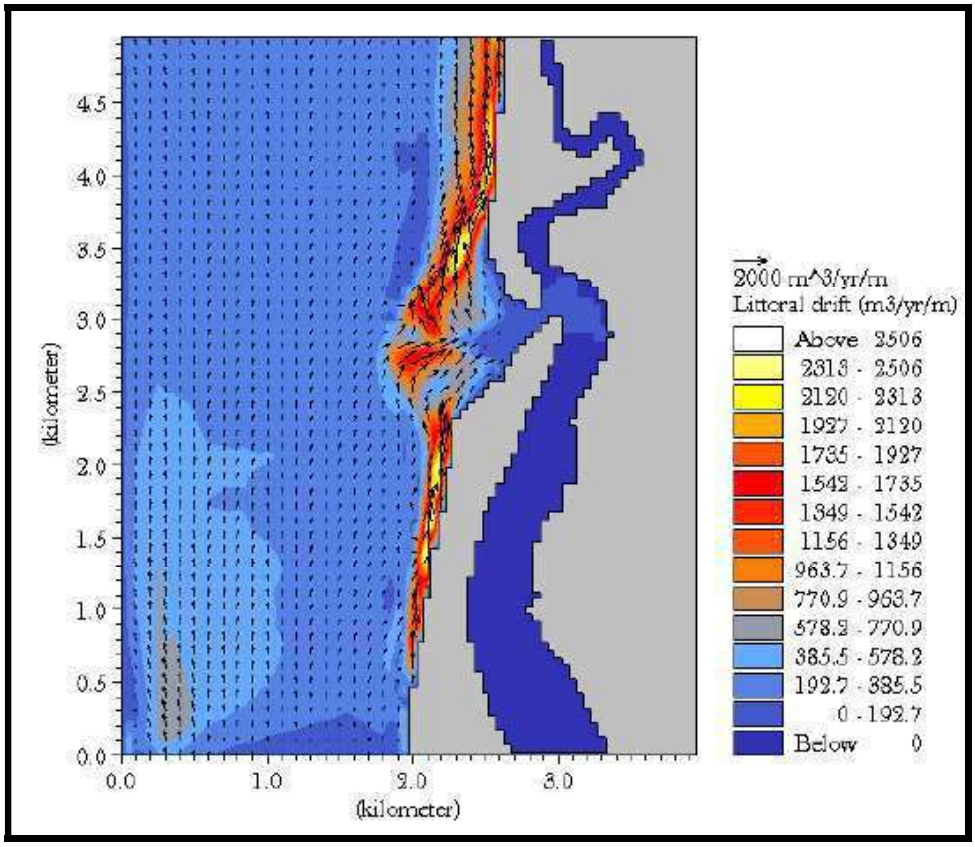


Figure 5-66: Wave induced littoral drift for SW waves

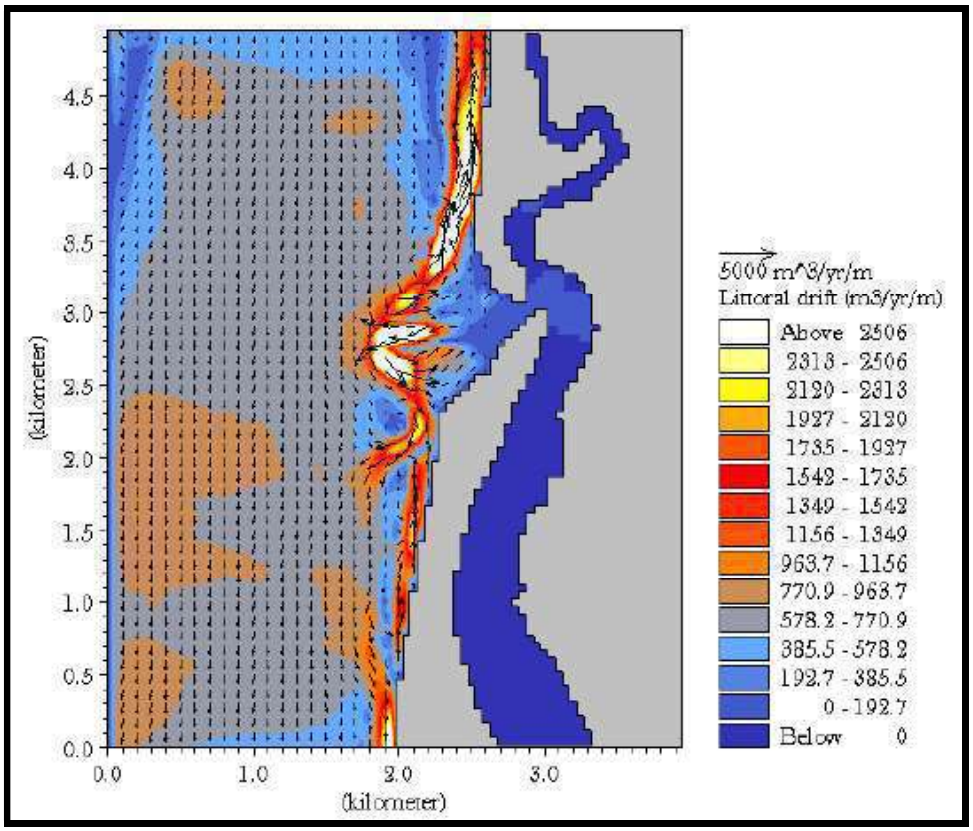


Figure 5-67: Wave induced littoral drift for WSW waves

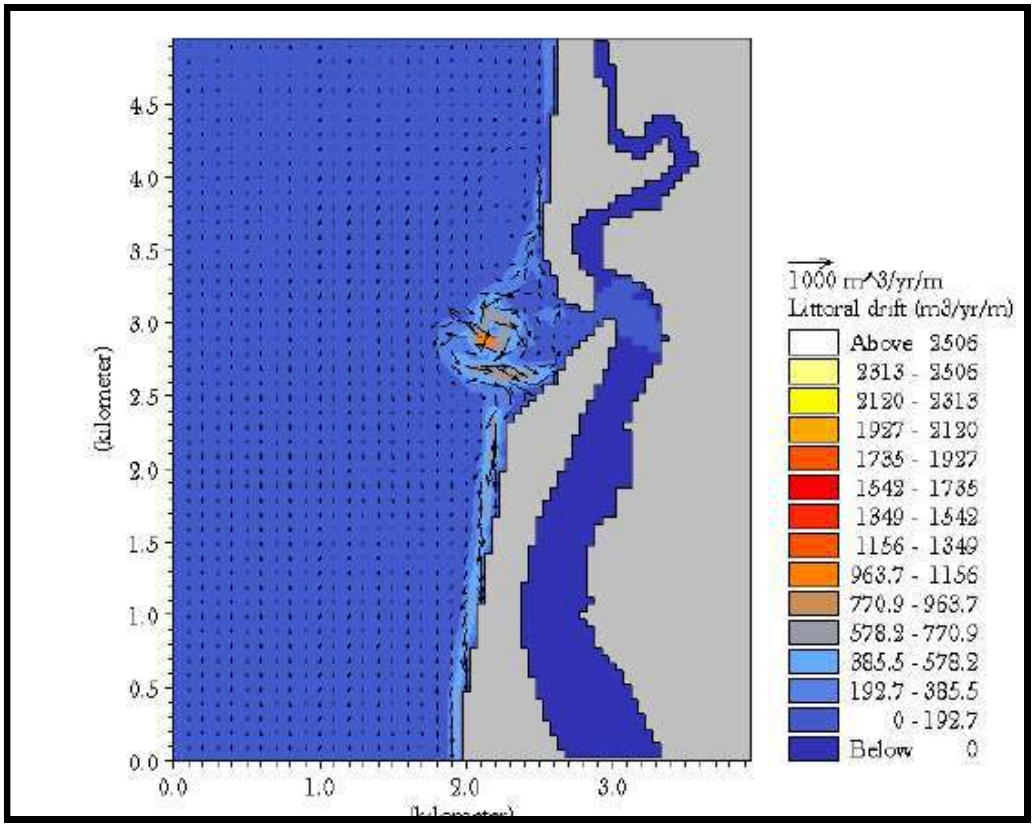


Figure 5-68: Wave induced littoral drift for W waves

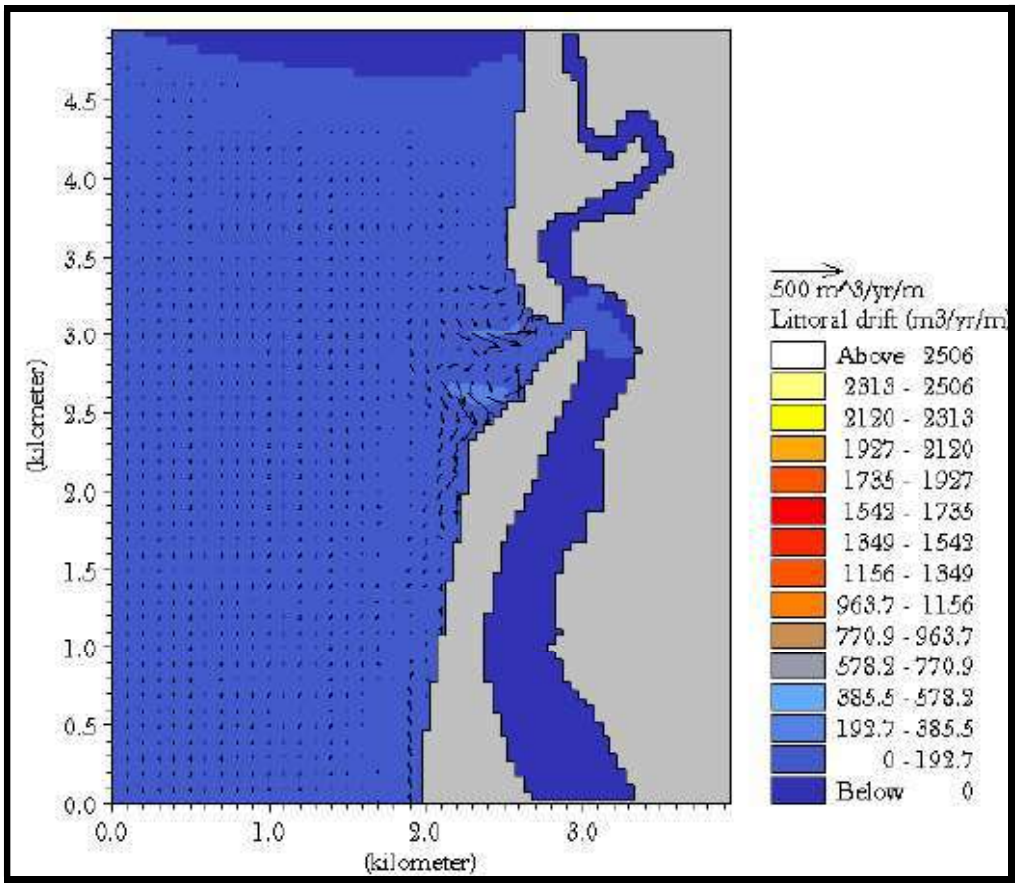


Figure 5-69: Wave induced littoral drift for WNW waves

Littoral drift with proposed facility (case-II):

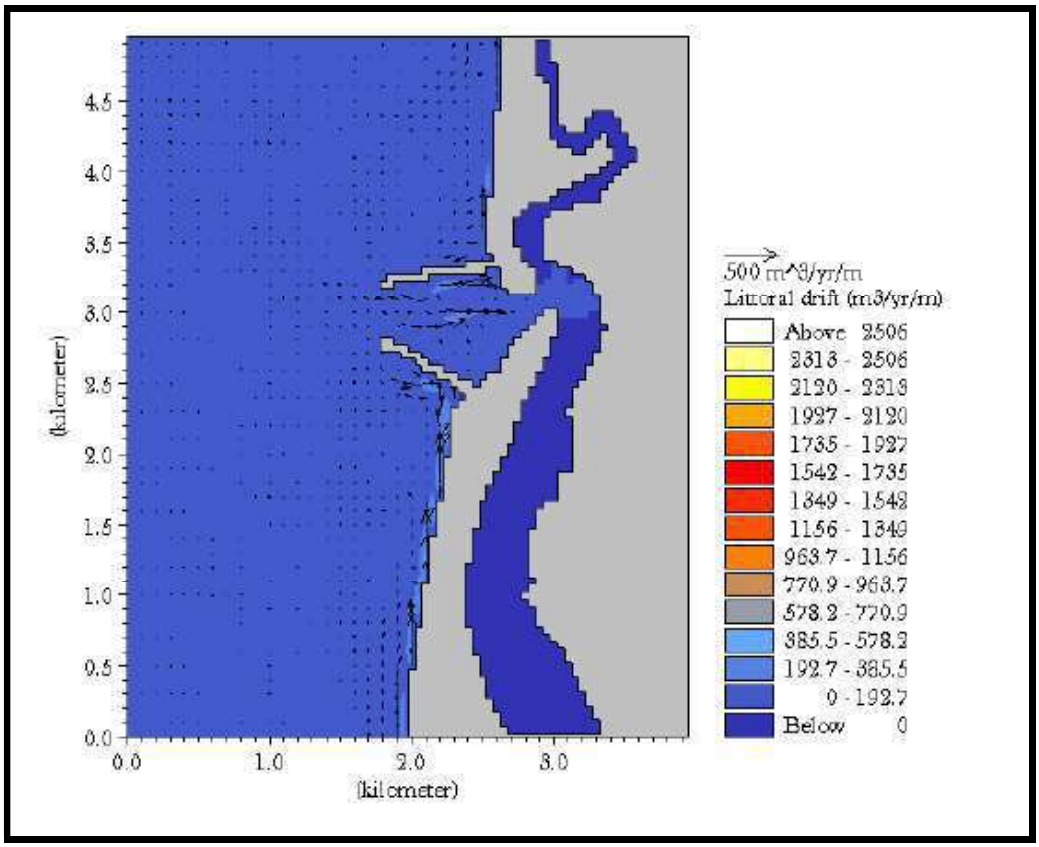


Figure 5-70: Wave induced littoral drift for S waves with proposed facility

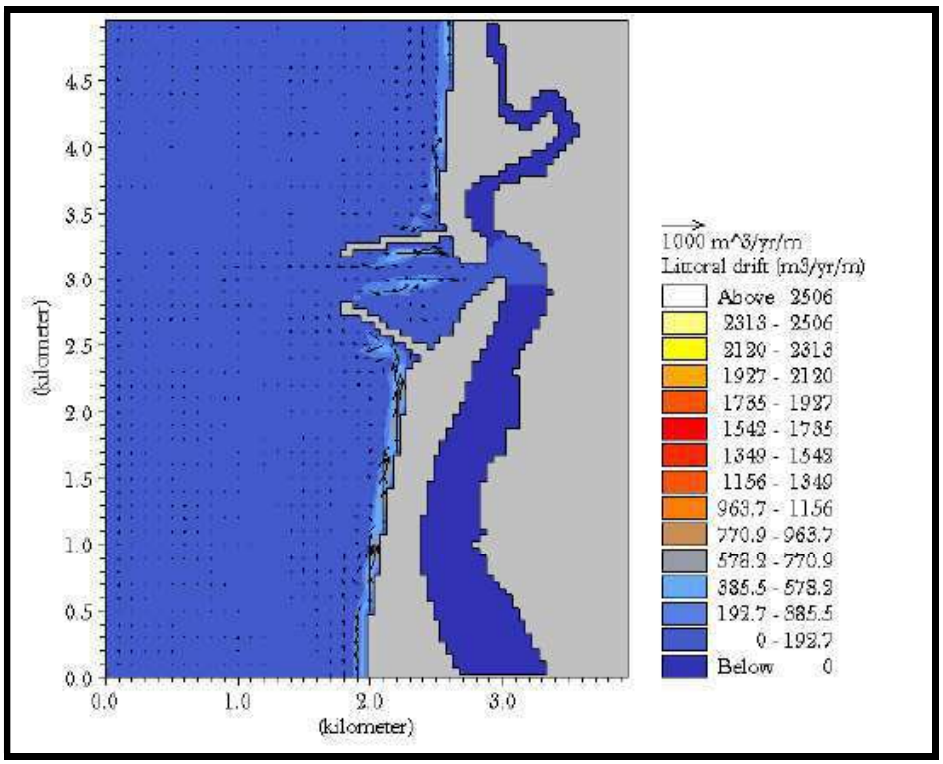


Figure 5-71: Wave induced littoral drift for SSW waves with proposed facility

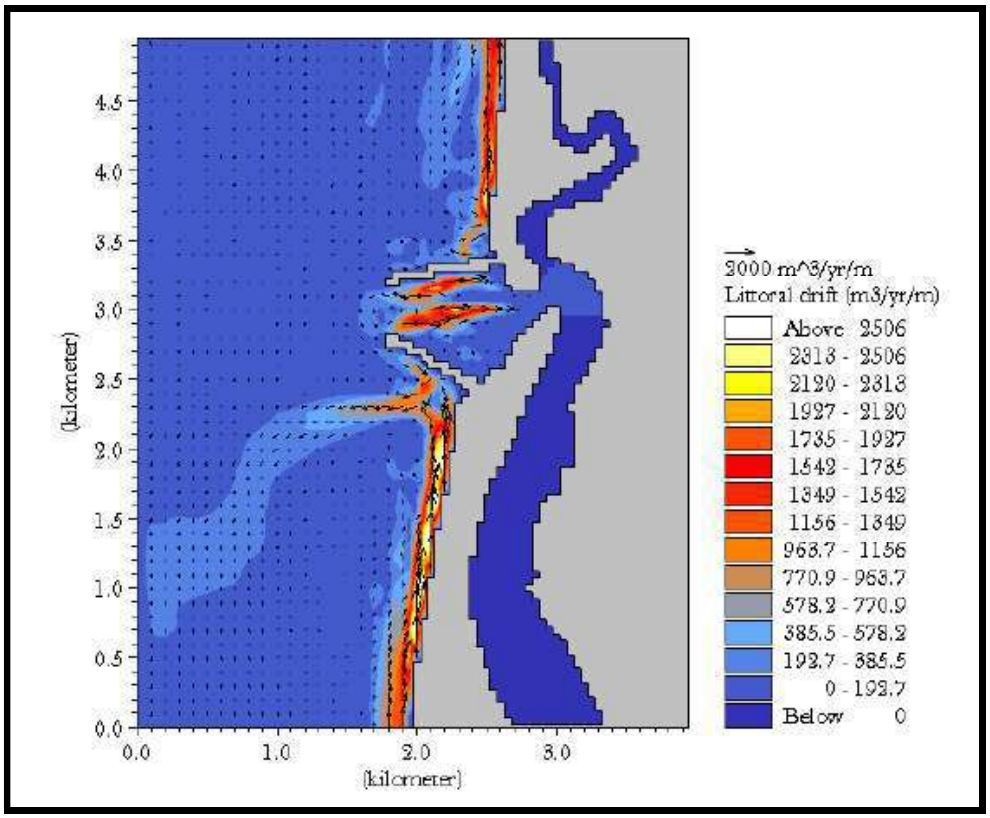


Figure 5-72: Wave induced littoral drift for SW waves with proposed facility

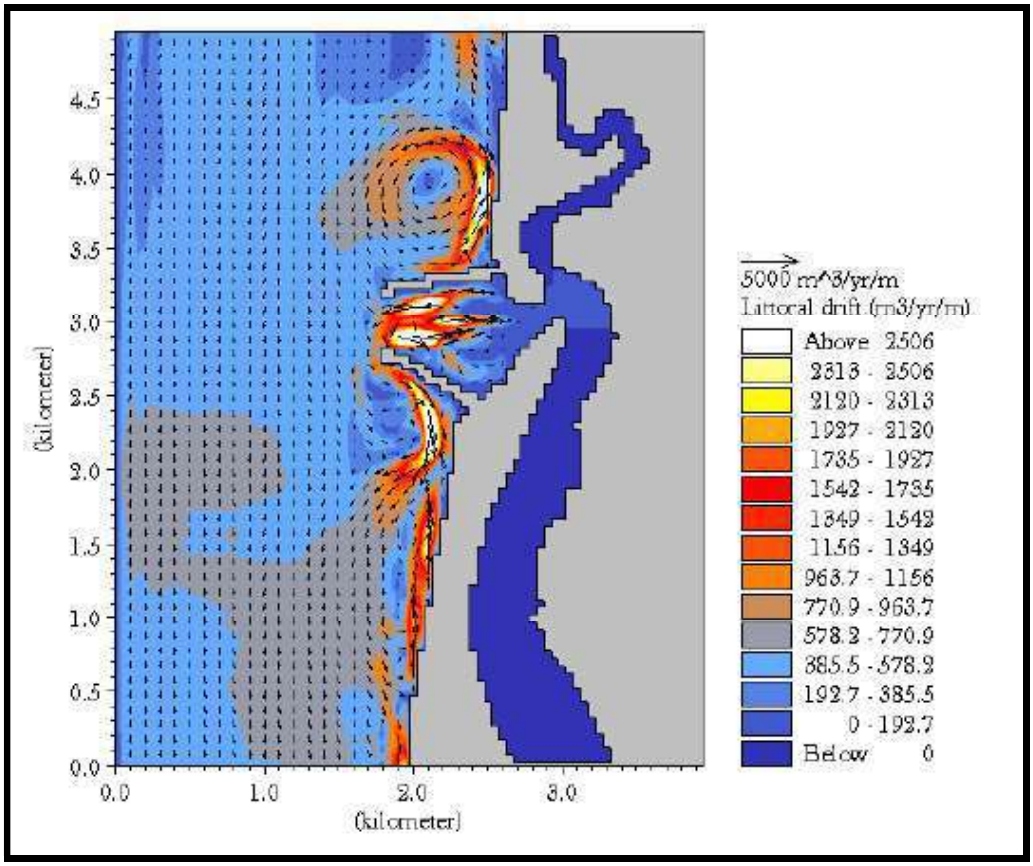


Figure 5-73: Wave induced littoral drift for WSW waves with proposed facility

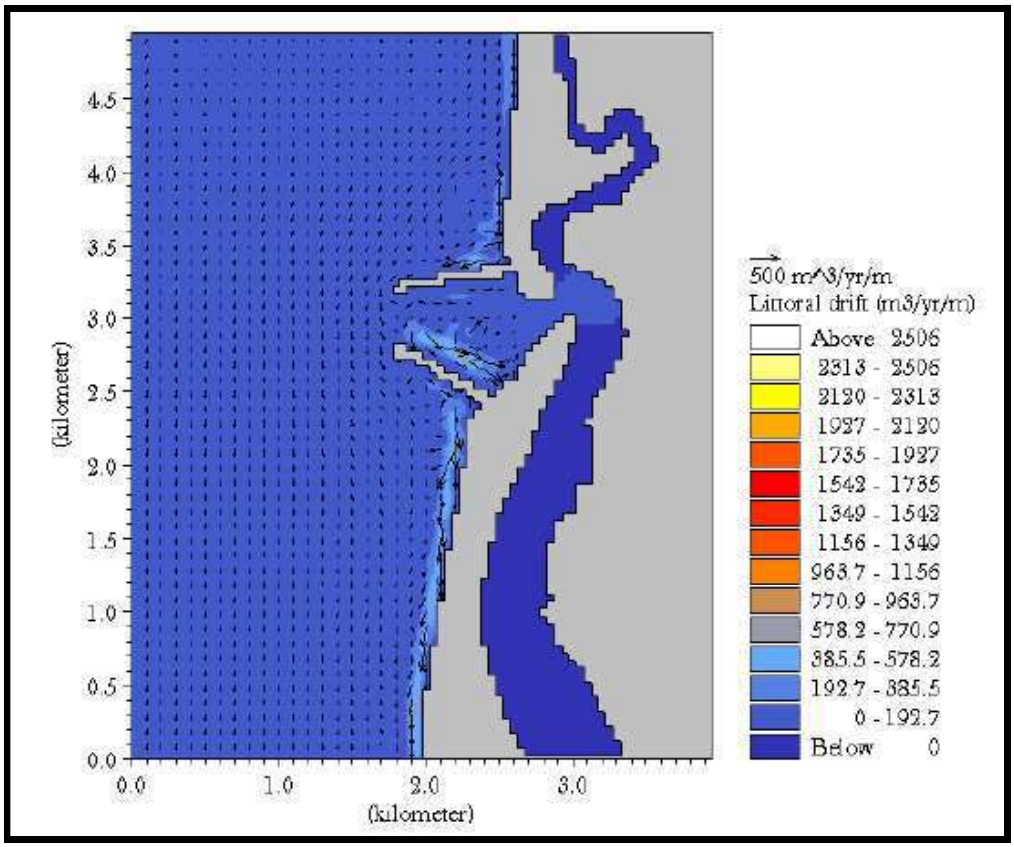


Figure 5-74: Wave induced littoral drift for W waves with proposed facility

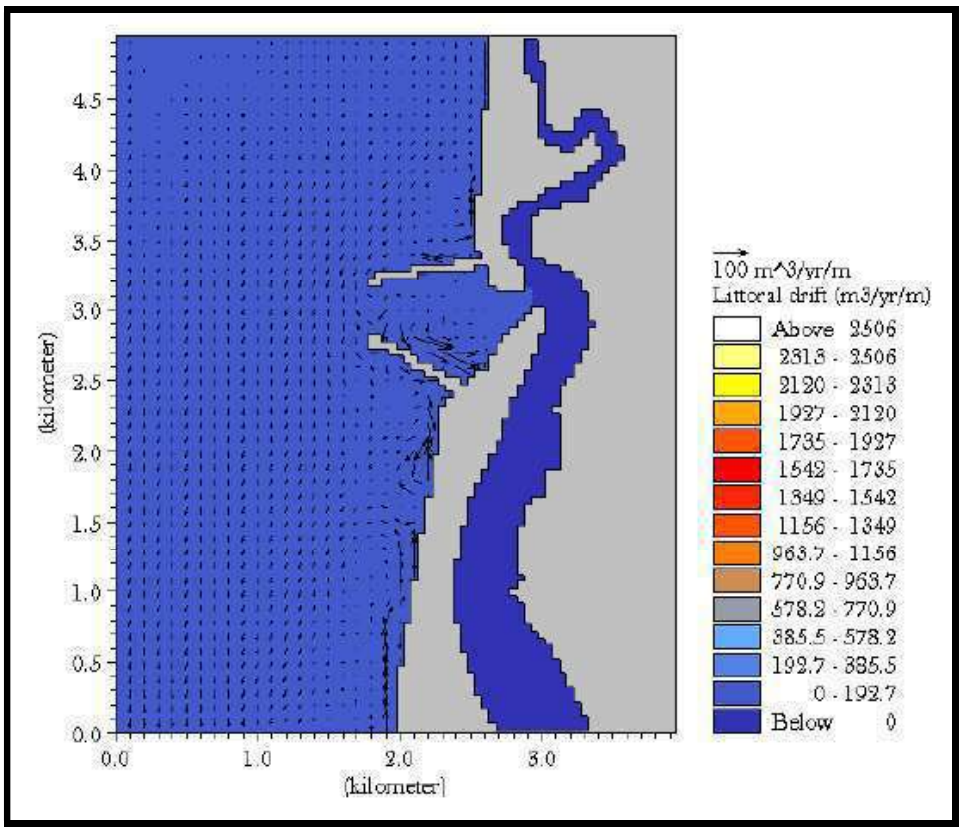


Figure 5-75: Wave induced littoral drift for WNW waves with proposed facility

The drifts computed for different directions of wave approach are shown in Figure 5-76 and Table 5-1. The figure shows that the predominant direction of alongshore sediment transport is towards north due to S, SSW and SW waves and the net transport of sediment is around $0.6x10^6$ m^3 directed towards north. Directional distribution of sediment transport rates is shown in Figure 5-76.

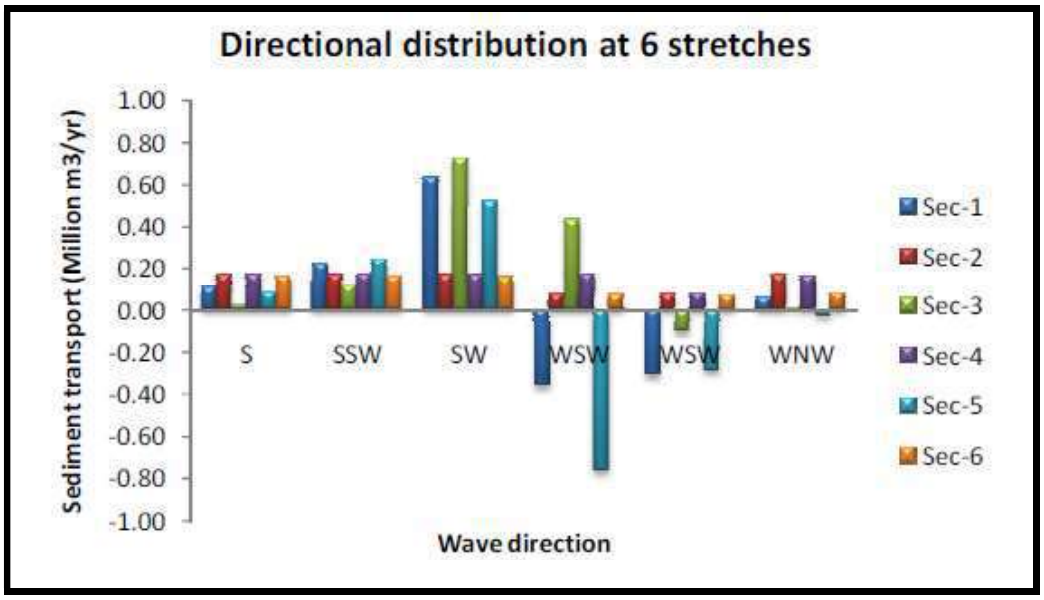


Figure 5-76: Sediment transport rates at 6 coastal stretches along Honnavar coast

Table 5-1: Sediment transport along the Honnavar coast derived from ST model

Station/ Stretch	Southerly transport (Million m3/yr)	Northerly transport (Million m3/yr)	Net transport (Million m3/yr)	Gross transport (Million m3/yr)
1	-0.677	1.023	0.347	1.700
2	0.000	0.822	0.822	0.822
3	-0.106	1.306	1.200	1.412
4	0.000	0.932	0.932	0.932
5	-1.088	0.849	-0.239	1.938
6	0.000	0.709	0.709	0.709
Net	-0.312	0.940	0.629	1.252

Note: (+ve) values indicate northerly drift and (-ve) values indicate southerly drift. Net drift is 0.6 $x10^6$ cubic meters towards north.

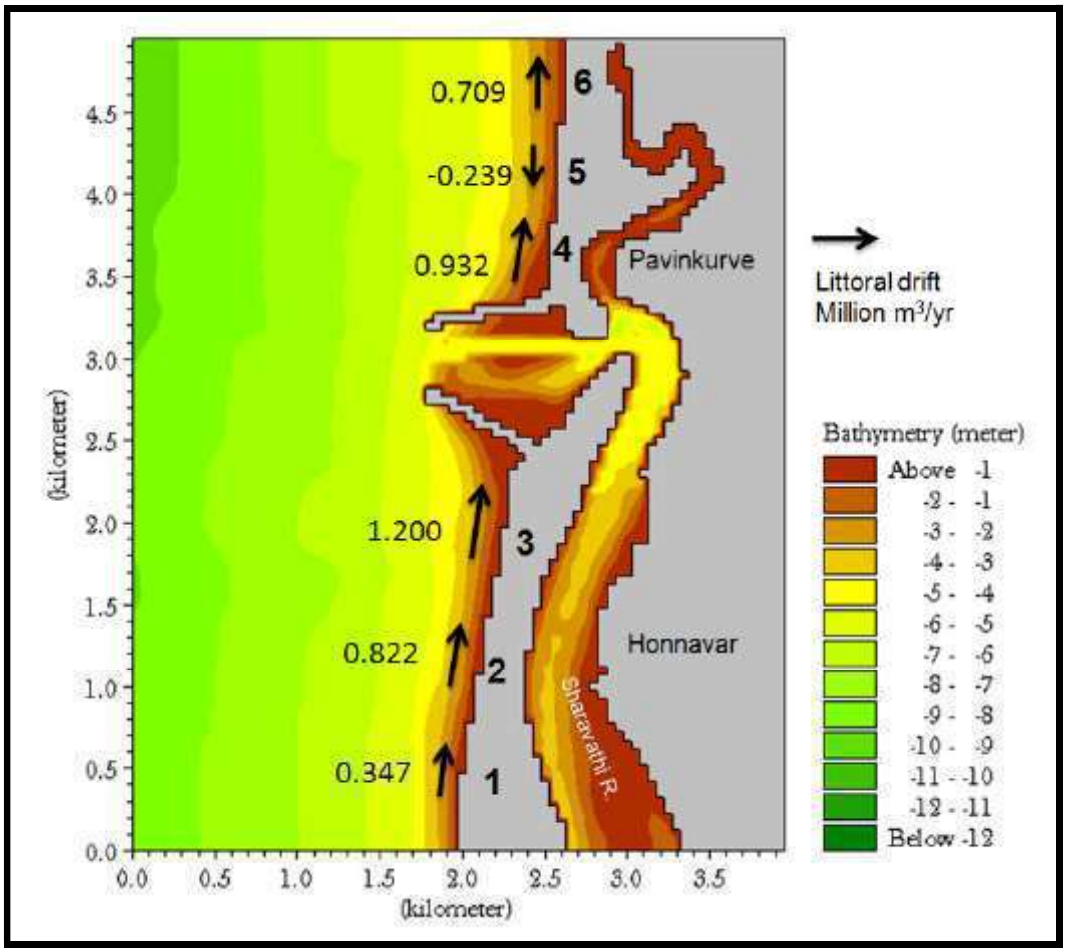


Figure 5-77: The Net sediment transport rates (million m^3/yr) along Honnavar coast

5.3.2 Potential Impact due to Construction

Developmental activities such as capital dredging, dredged material disposal and construction of approach channel and cargo berths will result in disturbance to marine environment. During these activities, particularly dredging, localised and short term impacts on marine water quality are likely to occur due to increased turbidity from suspended sediment. Further, marine sediment quality indicates that it is free from any significant pollution.

5.3.2.1 Capital Dredging and Disposal of Dredged Material

Capital dredging is required to create inner navigation channel, outer navigation channel, turning circle and berthing areas. During the construction stage and operation stage the dredging volume is estimated about 3.9 MCM. About 1.0 MCM of the dredged material will be used for reclamation. Remaining quantity of 2.9 MCM dredged material will be disposed off at the designated offshore area.

The choice of dredging equipment depends primarily on dredge material, disposal methodology and distance of disposal location. The dredgers are mainly classified as Mechanical (Grab, Dipper and Bucket), Hydraulic (Plain suction, Cutter Suction, Wheel, Barge/ Vessel unloading and Trailer suction) and Pneumatic dredgers. The selection of equipment mainly depends on Size of the Project (quantity in cum), Nature of the material

(hard rock, sandy or clay), Volume of the material, Topography of the area with reference to accessibility etc., Distance of disposal ground from the dredging area, Environmental factors at the site and also other environmental aspects and Accuracy of the work required.

Besides the contract conditions, the available time and the equipment available in the market play an important role in selecting the dredging equipment.

Based on the soil conditions appropriate suction dredger will be used for the development of Honnavar Barge/vessel loading facility.

The selection of a disposal site in sea depends on several factors, which can be broadly classified into environmental and economical considerations. The major economic factors are volume of dredged material and distance of the disposal site. The environmental considerations are the characteristics of the material, short-term fate of the dredged material and the initial deposition pattern of the material in the bottom. These factors in turn determine the long-term movement of the disposed material from the disposal site. Generally, coarse material quickly settles to the bottom, while fine material is removed during its descendent to the bottom and transported by currents to adjoining areas.

The disposed material will settle down depending on its own bulk size and grain size with different settling velocity. Hence, the environmental conditions at the location of the disposal site should be such that it is not subjected to high near-bottom current velocities which would cause the disposed material to return to areas of interest like the approach channel. Moreover, the shuttle distance between the disposal site and the areas of dredging should not be too large, as this would increase cost of disposal and consequently the dredging cost. Hence, the selection of the disposal site has to be the result of a balance between the environmental factors and economy of cost.

The dredge spoils will be disposed through a hopper or suitable dredger at the disposal site. The impacts due to disposal of dredged material such as the spreading of turbidity at disposal location, suspension & re-suspension of sediment in the bulk of water column.

Numerical modelling studies for Dredge disposal

The dredging schedule will be covering both the wet season and the dry season. Numerical modelling studies have been conducted with a view to determine the ideal site for the dredge disposal. The studies have been carried out for the predominant waves in the respective seasons; SW waves for wet season and WNW waves for dry season. The peak river discharge values corresponding to wet and dry seasons are set to 300 m^3/s and 50 m^3/s respectively. Boundary conditions and other required parameters (bed resistance, eddy viscosity etc) are set in a way similar to the simulations described in Sediment transport study sections.

As the sediment transport and littoral drift studies revealed that the net transport along this coast is towards north, an appropriate disposal site towards north of the northern breakwater is chosen such that the disposed material does not come back towards the port entrance and at the same time it could be helpful in nourishing the eroding beaches in the area. After examining several locations along the northern coast, the most suitable site for dredge disposal is recommended at a distance of about 2.0 km to the north of port entrance channel located at latitude 14.308°N and longitude 74.415°E as shown in Figure 5-78:

Figure 5-78: Location of the proposed disposal site (Image courtesy: Google Earth)

MIKE 21 hydrodynamic model (with mud transport) has been used to simulate the suspended sediment concentration (SSC) and bed level changes when the dredged material is discharged at a rate of 150 m^3/s with a velocity of 5 m/s in the outlet direction of 10^o relative to true North. The results of the modelling studies are shown in Figure 5-79 to Figure 5-82.

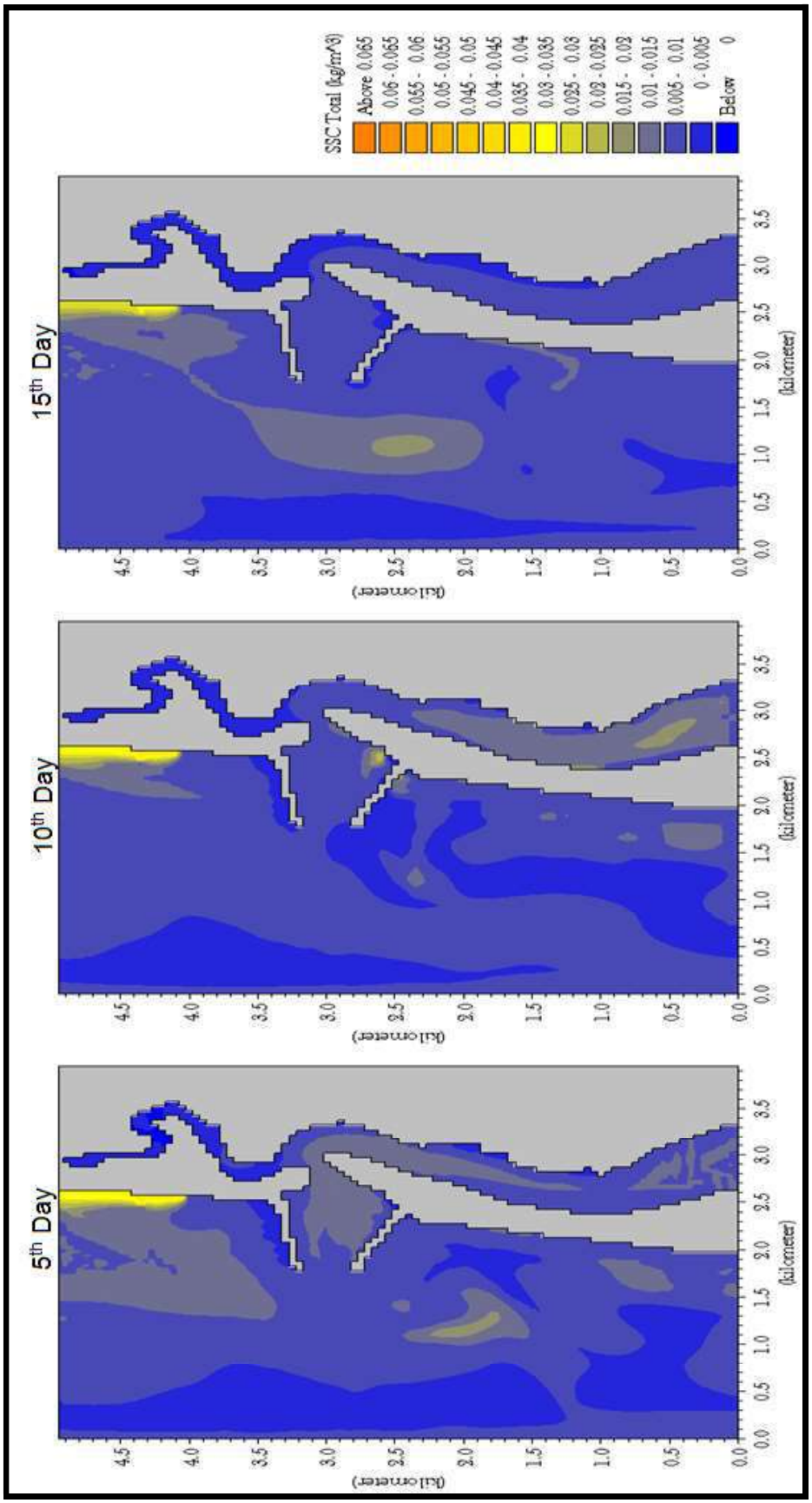


Figure 5-79: Suspended sediment concentration for wet season (SW waves) at disposal site

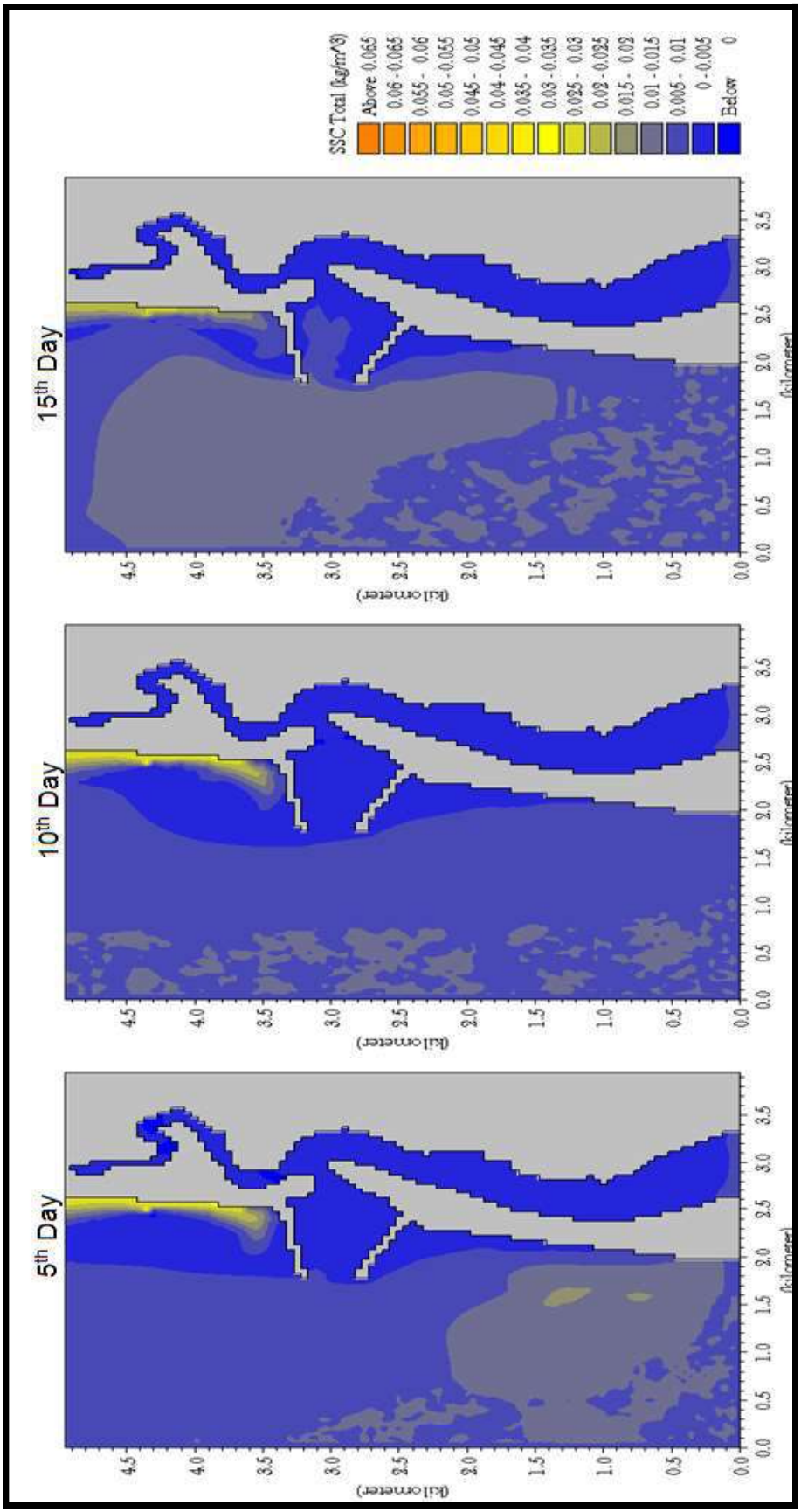


Figure 5-80: Suspended sediment concentration for dry season (WNW waves) at disposal site

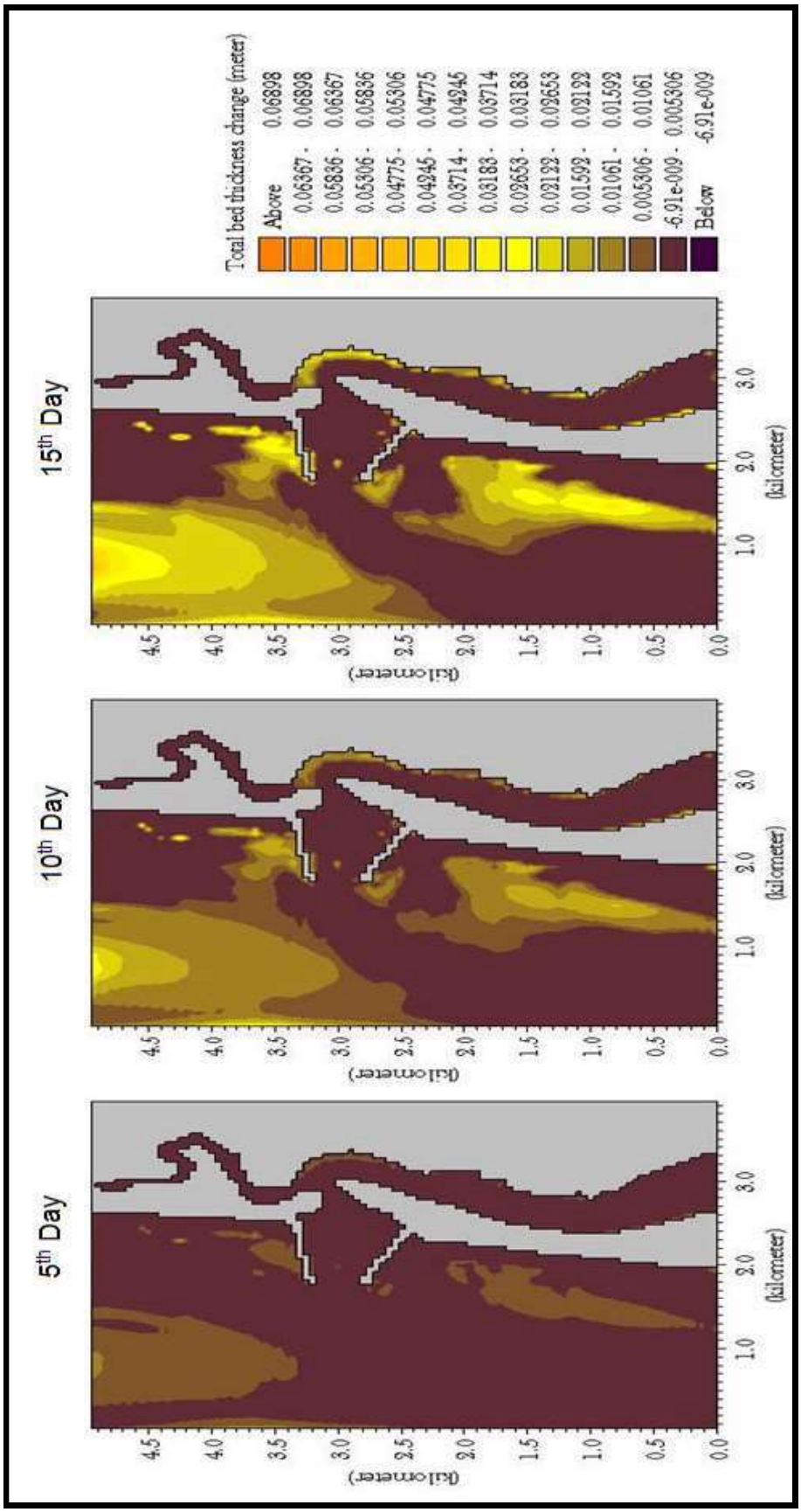


Figure 5-81: Total bed thickness change (m) for wet season (SW Waves) with disposal site

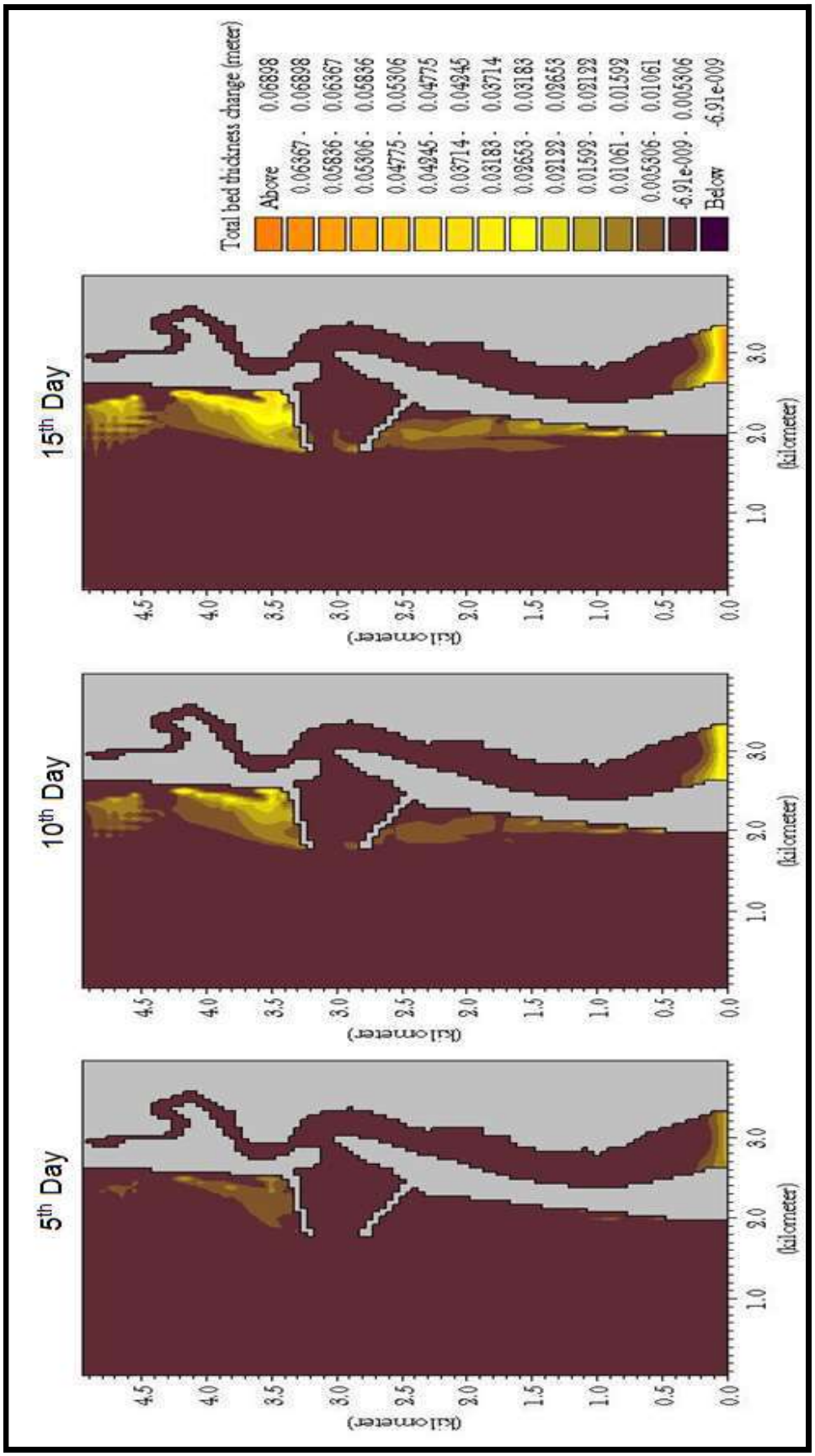


Figure 5-82: Total bed thickness change (m) for dry season (WNW Waves) with disposal site

Dredge Spoil Disposal Study – Results and Discussions:

It is observed that during wet season, the suspended sediment concentration (SSC) is relatively high for a few days after dredge disposal but later it spreads along the coast towards north without any impact to the port entrance area and the nearby environment. However, during dry season with WNW waves, the discharged sediment (SSC) spreads along the coast towards south, but it does not extend up to the entrance channel.

It is evident from the rate of bed level change during wet season; there is very little increase in bed level in the near shore regions at the disposal site. During dry season, the supplied sediment is carried towards south supplying sediment to the northern part of the north breakwater. This positive feedback from the natural near shore current system is quite helpful for nourishing the northern beaches.

During periods of strong near shore currents (during peak wet season), it is suggested to dispose the sediment offshore at greater depths (>30 m). Based on the studies it is concluded that the dredge disposal at the recommended site will not cause any natural imbalance to the nearby shoreline and will not affect the coastal eco-system in any way.

5.3.2.2 Impact on Marine Water Quality

Marine water quality will be impacted due to dredging and disposal, construction of breakwaters, and cargo berths during construction phase. Direct impact of these activities on marine water quality would be increased turbidity due to suspended sediment and will be predominant during dredging.

Turbidity due to dredging operation varies with depth and lateral distance from dredger location. During dredging, transport of sediment depends on velocity and fine material concentration. Very fine cohesive material will remain in suspension for a long time and is independent of hydrodynamic conditions. Due to above factors, there will be an increase in turbidity due to suspended sediment in water column. Thus, it can be inferred that dredging would cause a short-term and localised impact on marine water quality.

Apart from turbidity, the marine water quality may be affected due to aqueous discharge (oily wastes, sanitary wastes, etc.) from the dredgers, barges and workboats involved in the activities. No discharge from the dredgers or work boats shall be allowed into marine waters. The dredging activity will be confined within the project site and the impact due to dredging will cease upon completion. The impact due to dredging can be minimised with the implementation of a dredge management programme.

5.3.2.3 Impact on Marine Ecology

Capital dredging and construction of approach channel, breakwaters and cargo berths will result in disturbance to marine ecology.

Turbulence – Changes in Dissolved Oxygen (DO) Levels: During dredging, oxygen-demanding compounds, nutrients and sediments from the sea bed enter into water column. Since concentrations of oxygen-demanding compounds are normally much higher in pore water than in water column, it will cause a drop in oxygen concentration. Nutrients may stimulate primary production when light and temperatures are sufficient; and may cause eutrophication problems when released in favourable conditions. DO levels in bottom

sediments, which are usually low would increase during dredging period. Changes in DO levels and noise are likely to result in localised and short-term impacts on marine ecology.

Removal of Benthic Communities associated with Bottom Sediments: Dredging would result in removal of benthic communities associated with bottom sediments. During dredging, sessile forms are removed along with sediments and mobile species tend to move away and are likely to increase species diversity in areas adjoining dredging site. Further, it is observed that due to movement of mobile species and transfer of nutrients during dredging, there will be an increase in species diversity and density in areas adjoining dredging site.

To mitigate impacts on marine ecology, measures such as selection of equipment and dredgers, environmental monitoring and regulating activities based on monitoring results will be adopted.

Smothering Effect Due to Settling of Sediment: Settlement of the suspended sediments can result in the smothering or blanketing of sub-tidal communities and/or adjacent inter-tidal communities. Presently, the marine biota in the Indian Coast of India is already subjected to considerable changes in turbidity due to large-scale littoral movement, which is a recurring regular natural phenomenon. Therefore, it would be able to withstand localised turbidity induced during the dredging.

5.3.2.4 Changes in Seabed Profile

Changes in sea bed are envisaged due to the proposed project.

The morphodynamics (study of the seabed changes over long period of time) a coastal sea is studied by using ST model sub-module of CAMS. ST is used for assessing the probable zones of erosion/accretion and the initial bed level changes due to wave action in the proposed harbour vicinity. The results are discussed in Section 5.3.1.1.

5.3.2.5 Mitigation Measures

Prior to commencement of dredging, a Dredging Management Programme will be prepared and implemented, which will include the following details.

- A schedule for dredging shall be prepared and list of DO (s) and DO NOT (s) shall be circulated among the people involved in the construction activities
- Currently, there are no standards in India to regulate turbidity levels during dredging. It is proposed to check turbidity levels during construction phase with baseline turbidity levels as a reference during dredging.
- It will be ensured that suitable dredging equipment is deployed to minimise the suspension of fine sediments at the dredge site.
- Dredging activity will be regulated during rough sea conditions.
- Additional Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of dredging and will be carried out throughout dredging period.
- It will be ensured that barges/workboats have slop tanks for collection of liquid/solid waste generated on board. Discharge of wastes into sea will be prohibited.
- Spill control measures will be adopted while fuelling dredgers, barges, workboats, etc.

- Post dredging monitoring program will carried out to assess effect of dredging and disposal on marine ecology.
- Dredging and dredged material disposal will be monitored for compliance with proposed mitigation measures.

5.3.3 Potential Impact during Operation

5.3.3.1 Impact on Marine Water Quality and Ecology in Harbour Basin

Due to Aqueous Discharges: During the operation phase there will be continuous movement of cargo Barges and port crafts round the clock. There is a possibility of aqueous discharges from the cargo Barges such as dumping of Barges wastes (sullage)/sewage, bilge water, solid wastes, etc. if not regulated.

Barges/vessels calling at Honnavar Barge/vessel loading facility will not be permitted dump the wastes during the berthing period. In addition, land-based sources of pollution such as runoff from the cargo berths, waste water, sewage and effluents from the Barge loading operations would also affect the marine water and sediment qualities in the harbour basin, if disposed without proper treatment. To avoid impacts on the marine water quality, it is proposed to prevent discharges from certain areas and regulate the discharges from other areas. Accordingly, storm water runoff will be directed into open concrete lined channels. The runoff from uncontaminated areas will be discharged directly into the sea. The runoff from berths and other areas liable for pollution will be intercepted and directed to septic tank followed by soak pit.

Due to Maintenance Dredging: During the operational phase, maintenance dredging of the approach channel and the harbour basin will be carried out in order to maintain the required draft in the channel for the free movement of the vessels. The maintenance dredge quantity is estimated at 10,300 cubic meter/year. The maintenance dredge spoil will be dumped at recommended at a distance of about 2.0 km to the north of port entrance channel or beyond 30 m depth contour..

Localised and short term impacts on marine water quality are anticipated from increased turbidity during maintenance dredging. The magnitude of impact due to the maintenance dredging and disposal is dependent on the quality of the dredged material.

As Dredge Management Programme proposed to be adopted, no significant impact are anticipated from maintenance dredging on water quality except locally due to suspension of bottom sediment resulting in increased turbidity levels. Further, during the disposal of the dredge spoil at the identified disposal ground, the dredger hopper will be shifted to minimize the increase in turbidity/suspended solids concentration and built up of the bed material.

Due to Cargo Spills during Handling: Spills do not occur during normal operations, as the cargo will be handled by specialised barge-loaders. In the event of accidental spills of cargo during transfer from/to the ships, the marine water quality, sediment quality and ecology in the harbour basin will be impacted.

Due to Oil Spills during Fuelling: Oil spills do not occur during normal fuelling operations. In the event of accidental oil spills during fuelling of the ships / port crafts, the marine water quality in the harbour basin will be impacted. To minimise the impacts on marine water quality, the spills will be recovered.

5.3.3.2 Mitigation Measures

- Barges/Vessel visiting the facility will comply with MARPOL convention and avoid the discharges.
- Settling Tanks will be provided for containment/treatment of runoff from cargo storage areas and other areas liable for pollution. Lime will be added in the settling ponds to neutralise the heavy metals if any in the runoff from the stockyards and the settled waste will be disposed of complying with the norms stipulated by statutory authorities.
- It will be ensured that the dumping of the maintenance dredge spoil would be uniform.
- Along with the operational phase environmental monitoring, an additional Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of maintenance dredging and will be carried out during the dredging period.
- In case of any cargo spillage during transfer from/to ships, it will be attempted to recover the spills.
- Oil spill control equipment such as booms/barriers will be provided for containment.
- As the accidental spills will be in harboured waters, it would not spread spatially and the response time for shutting down the fuelling, containment and recovery will be quicker.

5.4 Biological Environment (Coastal and Marine Ecology)

5.4.1 Potential Impact due to proposed Facility Location

5.4.1.1 Impact on Mangrove Areas

The land identified for the development of Honnavar Barge/Vessel loading facility does not entail mangroves, however dense mangroves and their associated species are observed towards eastern side of the Sharavati River, but is it is approximately located 2.7 km South East from the proposed barge/vessel loading facility.

As per the Google imagery and satellite imagery the area of the mangrove are in the Figure 5-83.

Figure 5-83: Mangroves located towards East of Sharavati River

5.4.1.2 Mitigation/Mangrove Conservation Measures

- Awareness will be given to workers in the Barge/vessel loading facility about the importance of mangroves and their conservation
- Discharge of handling materials during the construction and operation would not be allowed
- During dredging the water quality near the mangrove area will be ensured by adopting suitable mitigation measures.

5.4.1.3 Impact on River Confluence Point/River Mouth

Breakwater construction will lead to accretion/erosion on coast adjacent to that. These will change the morphodynamics of the river mouth/inlet which leads to reduction in tidal water flow in the water body. Reduction in tidal exchange will affect the biodiversity. Studies with MIKE 21 mud transport (MT) model give the details of sedimentation and siltation due to the riverine flow. The model results show that by and large there is a negligible siltation due to riverine flow. Although slight siltation is noticed during wet season at the northern end of the river facing the river mouth, this is not significant.

The model studies show that the tranquillity conditions have improved on the riverside where barge/ vessel loading facilities is proposed, when the breakwaters are incorporated in the model. During wet season slightly higher values of SSC are noticed inside the region of

breakwaters and also inside the river. But by 10th day the SSC is flushed out and by 15th day the entire area including river side is free of any SSC. During dry season the SSC is negligible throughout the study area. The bed level changes during wet season indicate the sedimentation is negligible up to 10th day; but by 15th day slight deposition appears on the right bank of the river facing the channel inlet. But this siltation is not severe and it can be concluded that the construction of breakwaters will not have any significant effect on siltation.

Hydrodynamic Model Studies and other model studies ensures that changes the morphodynamic of the river mouth is not significant. This will ensure the tidal water exchange and thereby maintain the bio diversity.

As a part of EMP, both water quality monitoring and shoreline monitoring is proposed.

5.4.2 Potential Impact due to Construction

5.4.2.1 Impact due to Capital Dredging and Disposal

Capital dredging is required to create inner navigation channel, outer navigation channel, turning circle and berthing areas which may cause temporary disturbance to biological environment. Dredging removes bottom biota and dumping of dredged material covers bottom habitat. Piles, rubble mounds and concrete surfaces will form new habitat. The likely impacts on marine ecology are discussed in Section 5.3.2.1.

5.4.2.2 Mitigation Measures during Dredging and Disposal

In addition to the mitigation measures followed in Section 5.3.2.5, the following will be adopted:

- Appropriate selection of equipment for pile driving and dredging
- Uniform disposal of dredged material at identified disposal location

5.4.2.3 Impact on Ecology due to Reclamation

The Barge/Vessel loading facility areas proposed to be reclaimed is mostly Coastal sand and intertidal zone which is devoid of vegetation. These areas are going to be reclaimed with 1.0 MCM of dredged material.

5.4.2.4 Mitigation Measures during Reclamation

While reclaiming the existing area, bunds will be provided with a suitable overflow facilities so that only clean water will be returned to the sea..

5.4.3 Potential Impact due to Operation

5.4.3.1 Impact due to Aqueous Discharges and Mitigation Measures

During the operation phase there will be continuous movement of cargo Barges and Barge/Vessel loading facility crafts round the clock. There is a possibility of aqueous discharges from the cargo vessels such as dumping of Barges wastes (sullage)/sewage, bilge water, solid wastes, etc. if not regulated. The likely impacts and corresponding

mitigation measures to be followed are discussed in section 5.3.3.2 of Chapter 5 respectively.

5.4.3.2 Potential Impact due to Cargo Operations

Due to Cargo Spills during Handling: Spills do not occur during normal operations, as the cargo will be handled by specialised mechanised Barge/ Vessel -loaders/un-loaders. In the event of accidental spills of cargo during transfer from/to the Barges/ Vessel, the marine water quality, sediment quality and ecology in the harbour basin will be impacted.

5.4.3.3 Mitigation Measures

- Spill contingency plan as a part of Disaster Management Plan will be prepared in accordance to the cargo will be handled.
- Spill recovery/immediate response measures will be displayed at cargo handling areas.
- Material Safety data Sheet (MSDS) of cargo being handled will be displayed.
- Mock drills will be conducted at periodic intervals.

5.5 Air Environment

5.5.1 Potential Impact during Construction

5.5.1.1 Impact due to Transportation of Construction and Cargo Material

As the quarry material will be sourced from approved/licensed quarries, the environmental management at the quarry site will be taken care by the quarry agencies. Hence, no significant impact is anticipated. During material transportation, there is a possibility of impact on air quality along the route due to exhaust emissions, fugitive dust suspension and traffic congestion. The windblown dust during the material movement could impact the road users and also habitations enroute. Fugitive dust could arise during material unloading. This can contribute towards slight build-up of pollutant concentration over the baseline levels. It is proposed to use the dedicated road as well as rail corridor for the transportation of construction material by which the likely impacts due to traffic movement on roads will be minimised.

5.5.1.2 Emissions during Construction

During the construction activities, the sources of potential impacts on the air quality at the construction site can be categorised as:

- Exhaust emissions from diesel run engines, construction machinery and vehicles
- Dust suspension during site preparation, construction, trenching and material transport

Grading and soil compaction will be involved as a part of site preparation before undertaking construction work. Area development will involve developing the internal road, utilities, services and ancillary buildings etc. Fugitive dust is expected particularly during dry weather conditions due to the site preparation and movement of transport vehicles for materials and personnel. Emissions from power generators, construction equipment and transport vehicles will affect the air quality within the work areas, if not adequately managed. Movement of

materials such as cement, steel, sand, etc. will cause disturbance to the adjoining communities.

The baseline concentrations of Particulate Matter (PM_{10} and $PM_{2.5}$), SO_2, NO_X and CO are within the limits of NAAQS stipulated by MoEF/CPCB. With the present background concentrations of air quality parameters, it is expected that there will only be a mild build-up of air pollutants. Further, because of the prevailing strong winds along the coastal region and the resulting dispersion the impact on air quality from pollutants would be reduced.

The impacts during construction are short-term in nature and will cease on completion of the construction. Further, adoption of suitable mitigation measures will ensure that these impacts are rendered insignificant.

5.5.1.3 Mitigation Measures

Construction Yard

- During planning, it will be attempted to prevent/minimise disturbance to adjacent properties/habitations. If unavoidable, same will be restored with consent from affected persons.
- Adequately sized construction yard will be provided at the site for storage of construction materials, equipment tools, earthmoving equipment, etc. In addition, temporary field offices and worker amenities will be provided at site. Appropriate spill control measures and labelling/handling procedures will be maintained.
- Construction sites will be provided with enclosures on all sides to prevent dispersion of dust and transmission of noise.
- Drainage system will be provided at construction yard. Measures will be taken to prevent silting of natural drainage due to runoff from construction areas.
- Proper area will be demarcated for storage of construction material. This will enable proper management of the materials including control of seepage and spillage thereby preventing contamination of the project area.

Movement of Machinery and Equipment

- Movement of material will be mostly during non-peak hours and regulated during peak hours. Mobile equipment such as intermittently used machines and transport vehicles will be either switched off or throttled down to a minimum.
- On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic.
- Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt.

Dust suppression

- Water sprinkling will be carried out to suppress fugitive dust during earthworks and along unpaved sections of access roads.

Environmental Awareness

- Environmental awareness program/training will be organised to the personnel involved in developmental works.

5.5.2 Potential Impact due to Operation

5.5.2.1 Impact due to Emission from Barges/vessels

During the operational phase, there will be an increase in the movement of traffic and hence, emissions from the moving vehicles will also increase. The exhaust from the DG set at the site, the tugs, launches, diesel operated small boats, dredgers etc will enhance a pollution load during operational phase. With the increase in the number of barges and boats, their operation and movement of cargo to and fro will also increase. These activities will increase the pollution load in the atmosphere. The machine generated pollutants (viz. suspended particles and smoke) from repair and maintenance area, storage area and service area will also add up to a considerable amount of pollution load. The stacking of coal if not covered and sprinkled with water would generate dust, however, as described herein, all stacking areas will employ adequate dust suppression measures.

5.5.2.2 Impact due to Cargo Handling and Storage

Cargo proposed to be handled at Honnavar Barge/vessel loading facility is as follows:

Handling Capacity: 4.9 MTPA

Dry and Bulk Cargo

- Coal - 2.7 MTPA
- Iron Ore – 1.0 MTPA

General cargo – 1.2 MTPA

- Granite – 0.16MTPA
- Fertilizer – 0.2 MTPA
- Molasses with Agro Products – 0.15 MTPA
- Steel Products – 0.4 MTPA
- Sugar – 0.29 MTPA

Cargo Handling:

The installation of mechanised cargo handling equipment on berths and in storage/stockyard areas for unloading/loading has been proposed to match the traffic demand. Dry bulk cargo (Iron Ore, Thermal Coal) and general cargo which is non hazardous in nature will be handled using mechanical cargo handling equipment such as Mobile harbour Cranes and pay loaders etc., on berths and in storage/stackyard areas for unloading/loading operations.

In the proposed Barge/Vessel loading facility, cargo handling operations involve the following.

- Barge to-Shore and vice-versa transfer of cargo by Mobile harbour Cranes and loaders.
- Movement of cargo from berth to stockyard and vice-versa by Trucks/Tractor Trailers.
- Appropriate Fork-Lifts and Front-end loaders can be used at General Cargo storage yards.

Cargo Storage:

The cargo storage proposed in the Barge/Vessel loading facility is as follows:

- Open storage for dry bulk cargo
- Open storage and transit sheds for general cargo

There will be impact on air quality due to fugitive emissions during cargo handling and storage. The build up of pollutants would result in impact of air quality.

The impact of air quality due to fugitive emissions from dry bulk cargo has been studied using the Industrial Source Complex, Short Term (ISCST3) dispersion model based on Steady State Gaussian Plume Dispersion, developed by US Environmental Protection Agency (US EPA). The model simulations have been carried out for dispersion of particulate matter from the handling of cargo and cargo storage areas/stockyards.

Modelling Options/Assumptions

- Calm's processing routine is used by default
- Wind profile exponents is used by default, 'Irwin'
- Flat terrain is used for computations
- It is assumed that the pollutants do not undergo any physico-chemical transformation and that there is no pollutant removal by dry deposition
- Meteorological inputs required are hourly wind speed and direction, ambient temperature, stability class, and mixing height
- Washout by rain is not considered

Input Data: The following technical details of Honnavar barge/vessel loading facility are considered for air quality modelling studies:

Source		Details
a)	Cargo details	In chapter 2, section 2.3.4
b)	Cargo Handling Rates	In chapter 2 , section 2.6.1
c)	Silt content in % of coal Silt content in % of iron ore	
d)	Moisture content in % of coal Moisture content in % of iron ore	
f)	VKT = No. of km travelled by each vehicle in case of transport	A total of 4 km to and fro from the berth upto the gate.
g)	Size of Loader / Unloader (cu.m.)	40 cum per lift
h)	Frequency of loading / unloading (No./Hour)	Frequency of unloading – 35 cycles per hour
i)	Capacity of Dumper / Unloader in tons	Capacity of unloader – 30 tons per lift
j)	Drop height	0 to 5 m
k)	Vehicular Information	Coal : 770 truck movements per day Iron ore : 250 truck movements per day General cargo : 300 truck movements per day
l)	Direction and distance of the open sea from the cargo handling and other elevated pollution sources	Direction : West , adjacent to the proposed development
m)	Berth (Unloading from Ship)	Inside the river
n	Storage Area	Coal stack yard Width=120 m Length =450 m Height=10m Iron Ore Stack yard Width=60 m Length =450 m Height=10m
o)	Operating cycles (hrs/day) & days/annum	16 hrs/ day & 260 days/annum

Meteorological Data: Project site specific meteorological data was generated during the study period by installing an automatic weather monitoring station. The parameters like wind speed, wind direction and temperature have been taken based on the primary data generated.

Extrapolation of Wind Speed: Wind speed at stack level is calculated by power law as given below.

$U_{stack} = U_{10}(\text{Stack height}/10)^{p}$

Where U_{10} is the wind speed at 10 m level and p is the power law coefficient (0.07, 0.07, 0.10, 0.15, 0.35 and 0.55 for stability classes A,B,C,D,E and F respectively) as per Irwin for rural areas (USEPA, 1987).

Stability Classification: Stability class can be estimated from wind speed and radiation. Stability classes are classified in to A: Extremely unstable, B: Moderately unstable, C: Slightly unstable, D: Neutral, E: Slightly stable, F: Moderately stable. Hourly stability is determined by wind direction fluctuation method as recommended by CPCB (PROBES/70/1997-1998).

$$\sigma a = W_{dr}/6$$

σ_a, is standard deviation of wind direction fluctuation, W_{dr} is the overall wind direction fluctuation or width of the wind direction in degrees. The table for stability classes is given as under.

Stability Class	σ_a (degree)
A	> 22.5
B	22.4 – 17.5
C	17.4 – 12.5
D	12.4 – 7.5
E	7.4 – 3.5
F	< 3.5

Dispersion Parameters:

Atmospheric dispersion coefficients vary with downwind distance (x) from emission sources for different atmospheric stability conditions (CPCB – PROBES/70/1997-98). Dispersion parameters σ_y and σ_z for open country conditions (Briggs, 1974) are used as the project is located on a flat terrain in a rural area.

Table 5-2: Rural Conditions

Stability Class	σ_y	σ_{az}
A	$0.22x(1+0.0001x)^{-.5}$	0.20x
B	$0.16x(1+0.0001x)^{-.5}$	0.12x
C	$0.11x(1+0.0001x)^{-.5}$	$0.08x(1+0.0002x)^{.5}$
D	$0.08x(1+0.0001x)^{-.5}$	$0.06(1+0.0015x)^{.5}$
E	$0.06x(1+0.0001x)^{-.5}$	$0.03x(1+0.0003x)^{-1}$
F	$0.04x(1+0.0001x)^{-.5}$	$0.16x(1+0.0003x)^{-1}$

Mixing Height:

As site specific mixing heights are not available, mixing heights based on CPCB publication, “SPATIAL DISTRIBUTION OF HOURLY MIXING DEPTH OVER INDIAN REGION”, PROBES/88/2002-03 has been considered for Industrial Source Complex model to establish the worst case scenario

Table 5-3: Mixing Height

Hour of The day	Mixing Height Winter Season
7	50
8	100
9	200
10	575
11	700
12	840

Hour of The day	Mixing Height Winter Season
13	1000
14	1050
15	1200
16	1100
17	900
18	500
19	400

Emission Calculation:

For the modelling purpose, Particulate Matter from barge/vessel loading facility is considered. The Barge/ vessel loading facility emissions mainly are from handling and storage of dry bulk cargo such as coal and iron ore. The calculated emissions from Honnavar Barge/ vessel loading facility are given in Table 5-8 below

Table 5-4: Particulate Matter Emission Details

S.No	Emission Source	Unit	Coal	Iron Ore
1	Wind Erosion From Stock yard	g/s	2.383373741	1.265704689
2	Emission due to Handling at berth activities	g/s	1.10554E-05	3.21466E-05
3	Emission due to Vehicular Traffic	(g/s/m travelled)	0.04041799	0.028869993
4	Emission due to loading at Stockpile	g/s	0.721153846	0.267094017
5	Emission due to Unloading at Stockpile	g/s	5.408653846	2.003205128
6	Total Emissions withoutcontrol	g/s	8.553610479	3.564905974
7	Total Emissions withoutcontrol	g/s-m2	0.000122194	0.00019805
8	Emissions after Incorporating Controll measures (50% of total Emissions) (Water Sprinklers)	g/s-m2	6.10972E-05	9.90252E-05
9	PM10(at 60% of controlled Emissions)	g/s-m2	3.66583E-05	5.94151E-05
10	PM2.5(at 40% of PM10)	g/s-m2	1.46633E-05	2.3766E-05

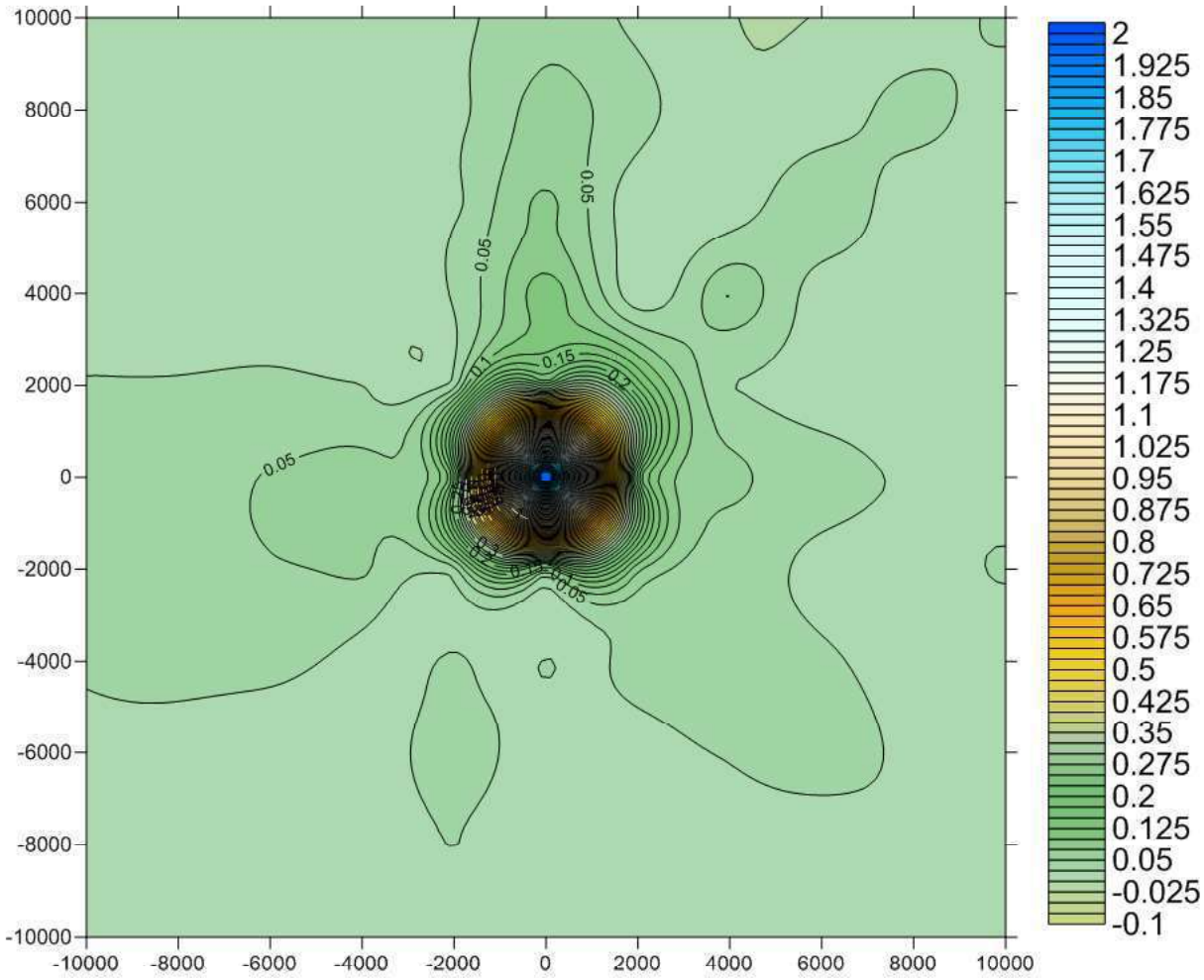
Model Results:

Model simulations have been carried using the hourly Triple Joint Frequency data viz., stability, wind speed, mixing height and temperature. Short-term simulations have been carried to estimate concentrations at the receptors to obtain an optimum description of variations in concentrations over the site covering 16 directions. The maximum incremental Ground Level Concentrations (GLCs) of Particulate Matter due to fugitive emissions from barge/vessel loading operation activities are superimposed on the maximum baseline concentrations of respective air quality parameters recorded during study period to arrive at the likely resultant concentrations during the operational phase of the barge/vessel loading facility.

The incremental and the resultant concentrations of PM_{10} are given in Table 5-5 below and the isopleth corresponding to the incremental concentration is shown in Figure 5-84.

Table 5-5: Resultant 24 Hourly Concentrations of PM_{10} due to Operation of Project

S. No.	Name of the Location	Baseline Data* ($\mu g/m^3$)	Incremental Conc. ($\mu g/m^3$)	Resultant Conc. ($\mu g/m^3$)	NAAQ Standards (Industrial, Residential, Rural, Ecologically Sensitive Area and Other Area) ($\mu g/m^3$)
1.	Honnavar-A1	55.9	0.1175	56.0175	100
2.	Kasarkod-A2	46.0	0.0514	46.0514	100
3.	Karki-A3	24.0	0.1295	24.1295	100
4.	Ramtirth-A4	21.7	0.0638	21.7638	100
5.	Kulkod-A5	21.2	0.049	21.249	100
6.	Hosad-A6	25.6	0.01126	25.61126	100



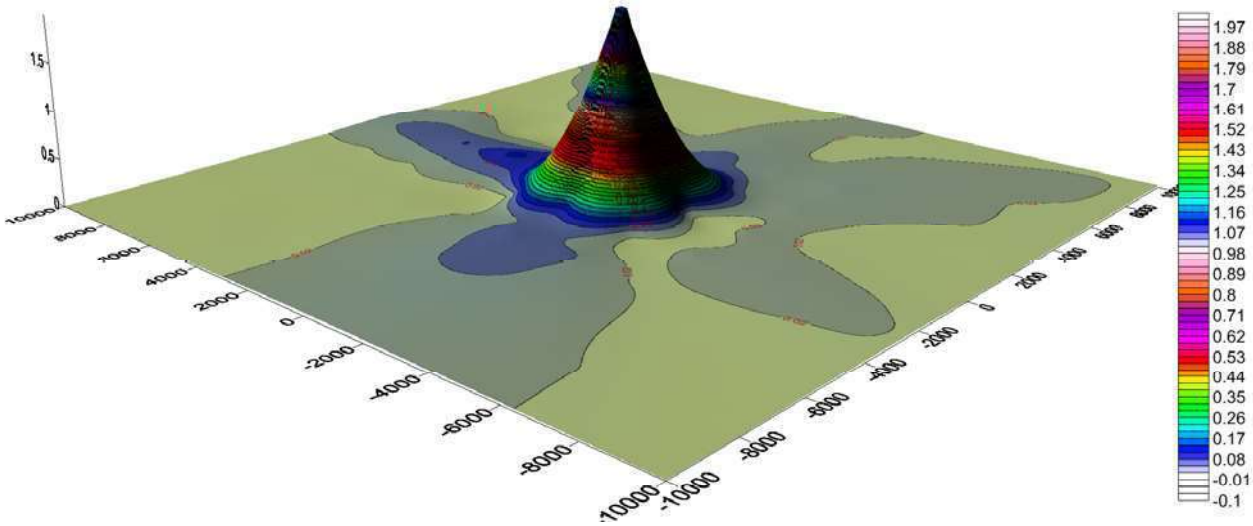


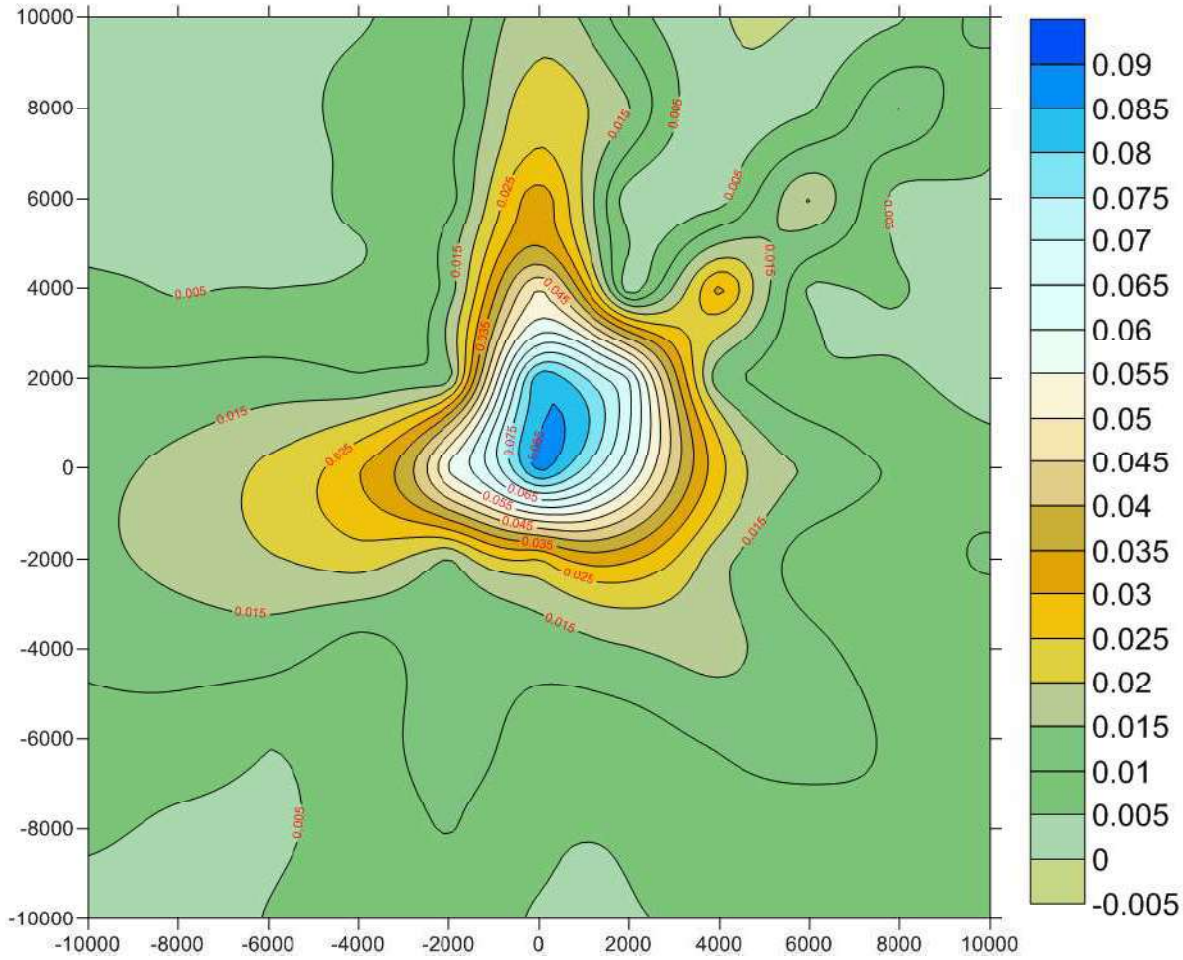
Figure 5-84: Isopleths PM_{10}[3] for control emission (2D & 3D) views

The incremental and the resultant concentrations of $PM_{2.5}$ are given in Table 5-6 below and the isopleth corresponding to the incremental concentration is shown in Figure 5-85.

Table 5-6: Resultant 24 Hourly Concentrations of $PM_{2.5}$ due to Operation of Project

S. No.	Name of the Location	Baseline Data* ($\mu g/m^3$)	Incremental Conc. ($\mu g/m^3$)	Resultant Conc. ($\mu g/m^3$)	NAAQ Standards (Industrial, Residential, Rural, Ecologically Sensitive Area and Other Area) ($\mu g/m^3$)
1.	Honnavar-A1	27.7	0.0477	27.7477	60
2.	Kasarkod-A2	22.9	0.02078	22.92078	60
3.	Karki-A3	12.6	0.0526	12.6526	60
4.	Ramtirth-A4	10.6	0.02592	10.62592	60
5.	Kulkod-A5	10.4	0.01994	10.41994	60
6.	Hosad-A6	14.1	0.0046	14.1046	60

[3] Coordinate (0,0) denotes the centre of the Barge/ Vessel loading facility Honnavar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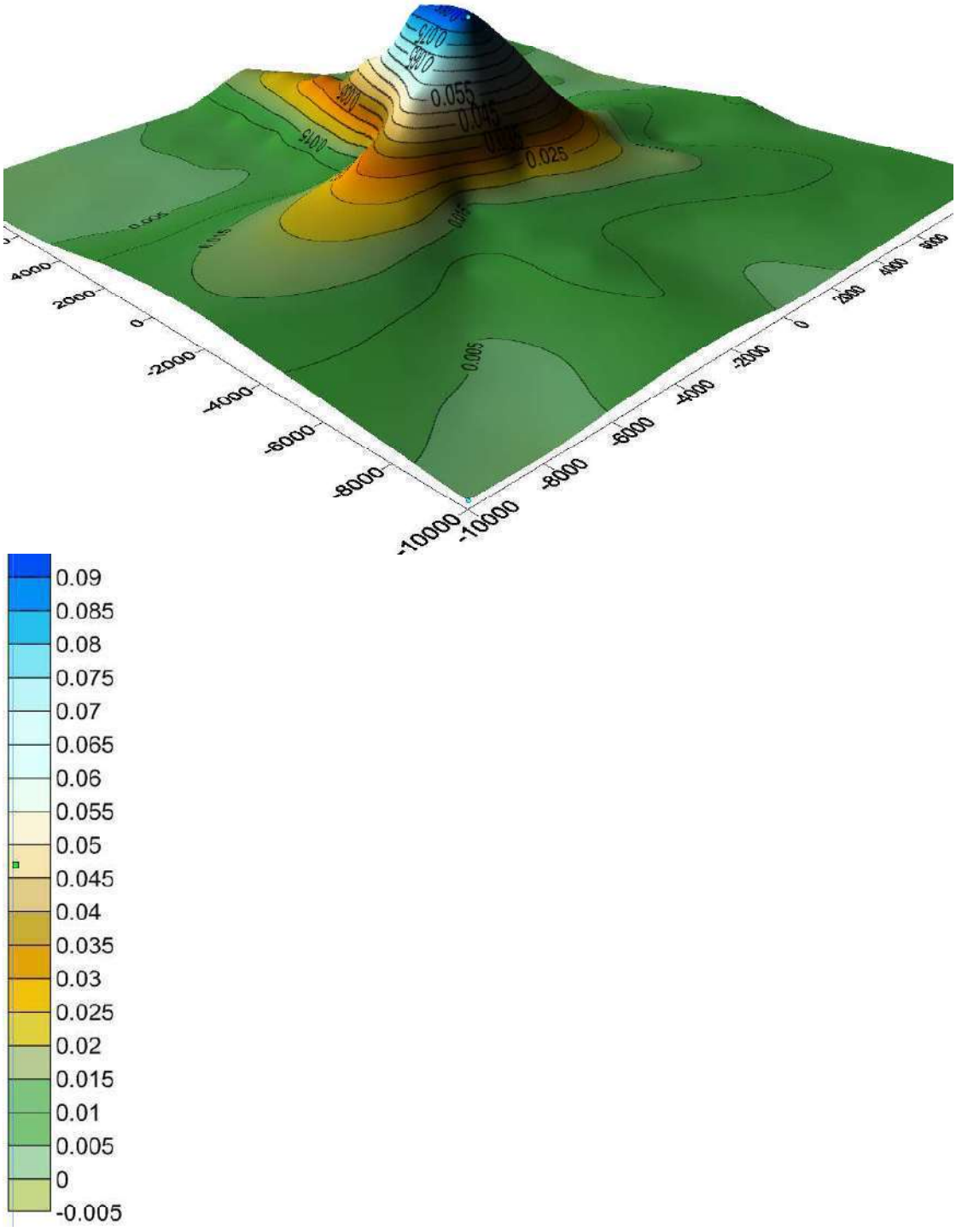


Figure 5-85: Isopleths $PM_{2.5}$(2D & 3D) views

Observations:

The resultant concentrations of PM_{10} and $PM_{2.5}$ at all monitoring stations are found to be well within the National Ambient Air Quality Standards (NAAQS). From the predicted GLCs and the corresponding resultant concentrations, it can be concluded that there is no significant increase over the baseline levels. It must be noted that since the Honnavar barge/ vessel loading facility site is area source and barriers is not considered for computations in practice, the actual concentrations are likely to be lower than indicated.

5.5.2.3 Mitigation Measures

- Water sprinkling will be carried out at cargo storage areas.
- Greenbelt of adequate width will be developed around the cargo storage areas in particular and long the boundary of Barge/vessel loading facility area to minimise the likely impacts due to air pollution.
- Usage of Vehicles with pollution under control certificate
- Ambient air quality monitoring will be carried out regularly at selected locations in the predicted maximum impact zone in order to check and compare the predicted concentrations with the measured concentrations.

5.6 Noise Pollution

5.6.1 Potential Impact during Construction

Construction activities increase ambient noise levels. There would be impact on noise levels due to the following:

- Vehicles transporting construction and Cargo material
- Diesel run engines of construction machinery and dredgers
- Pile driving activities during construction of cargo berths.

Noise is an inherent part of construction activity and response of species / communities would be either attracted or diverted away from the region. Noise generated from diesel engines of dredgers, workboats, etc. could result in movement of mobile faunal species away from area of operation.

There would be a degree of avoidance behaviour exhibited by marine species initially and they would eventually be expected to return once they become accustomed to increased noise levels or once the noise source has moved or ceased. Noise generating sources are mobile and hence, the impact will be localised and short-term in nature.

Marine species in the vicinity of project site are accustomed to noise generated from movement of fishing vessels and are likely to tolerate increased noise generated from workboats and construction activities.

Noise generated from construction activities will be predominantly confined within project site and will impact construction workers at site. Impacts due to these activities would be short-term in nature and localised.

5.6.1.1 Mitigation Measures

The following mitigation measures will be followed to minimise the noise generation and the associated impacts:

- During construction, noise levels will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures. Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).
- Only well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used. Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors.

- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained throughout the construction period.
- High noise generating activities such as piling and drilling will be scheduled to minimise noise impacts.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during construction phase of the project.
- All haul roads (for truck transport and other vehicles) within the boundary and outside will be sealed and maintained properly to avoid excessive noise levels from Engine acceleration and deceleration

5.6.2 Potential Impact during Operation

During the operational phase, noise will be generated due to the operation of the generators, pumps, engines of boats and barges, cranes for handling of goods, cargo and shipment vehicles. Noise will also be generated considerably from the warehouse, repair and maintenance block, service area, goods loading and unloading.

Workers exposed to excessive noise will use appropriate Personal Protecting Equipment (PPE) including ear plugs, muffs, or both when engineering or administrative controls are not feasible to reduce exposure. Hence, it is anticipated that there would not be significant impact of noise on the work personnel.

Impact on noise environment

For the proposed Barge / vessel loading facility the following are the principal source of noise considered for this study

- Diesel Generates
- Barge Loaders
- Pay loaders
- Harbour Crane

The stationary sources are considered for the present noise modelling study. The noise emission standard for individual unit / equipments as prescribed by central pollution control board is 85dB (A).

$L_s = L_w - 8 - 20\log(S) - D1 + K_o + \delta L$.....(2)

L_S= Expected sound pressure level from the measuring point (receptor)

L_W= Cumulative sound pressure level at the source

S=Distance between the surface noise source and receptor

D1= surface directivity factor due to different radiation angle

K_0= reflection effect from the surrounding environment / building

∂L= Correction factor for other effects (wind , temperature, relative humidity)

Addition of different are based on the following thump rule

L_1 - L_2, dB	Add to L_1
0 or 1	3 dB
2 or 3	2 dB
4 - 8	1 dB
9 or more	0 dB

Basic Assumption

- Reflection factor of the surrounding environment / buildings= 3db(A) to 4 db(A)
- surface directivity factor due to different radiation angle =3db(A)
- Correction factor for the other factors such as Wind, Temperature and Relative humidity etc=5 db (A) to 7 db (A).
- $\beta^0=65^0$ Horizontal angle for hemisphere propagation
- $\gamma^0= 10^0$ vertical angle for hemisphere propagation
- $S_=$ = assuming 20 M height

Calculation

- Cumulative sound pressure level from the proposed facility = 112.1 db (A) calculated from the equation (1).
- From the equation (2) the expected sound pressure level at the receptors are presented in the below table
- Predicted sound pressure level at receptors

Sl.no	Name of the village	Distance from the facility (M)	Expected sound pressure level db(A)	Baseline Noise level $L_d$db(A)	Cumulative Noise level L_{day}db (A)	Standards for residential zone($L_d$db(A))
Noise level during day time						
1	Honnavar	2300	45.8	48.9	50.9	55
2	kasarkod	2400	45.4	47.3	49.3	55
3	Karki	2800	44.1	46.3	48.3	55
4	Ramthirth	2900	43.8	44.4	46.4	55
5	Kolkod	4200	40.5	44.6	46.6	55
6	Hosad	7300	35.7	42.4	44.4	55
Noise level during night time						
1	Honnavar	2300	45.8	38.8	47.8	45
2	kasarkod	2400	45.4	37.1	47.4	45
3	Karki	2800	44.1	36.2	46.1	45
4	Ramthirth	2900	43.8	36.0	45.8	45
5	Kolkod	4200	40.5	36.0	42.5	45
6	Hosad	7300	35.7	35.7	37.7	45

Observations

- The resultant noise levels at all monitoring stations are found to be well within the Central pollution control board(CPCB). From the predicted Noise level and the corresponding resultant noise level, it can be concluded that there is no significant increase over the baseline levels. It must be noted that since the Honnavar barge/ vessel loading facility site is area source and Noise barriers/ other natural noise attenuations are not considered for computations in practice, the actual noise levels are likely to be lower than indicated or equal to the measured baseline value at respective locations

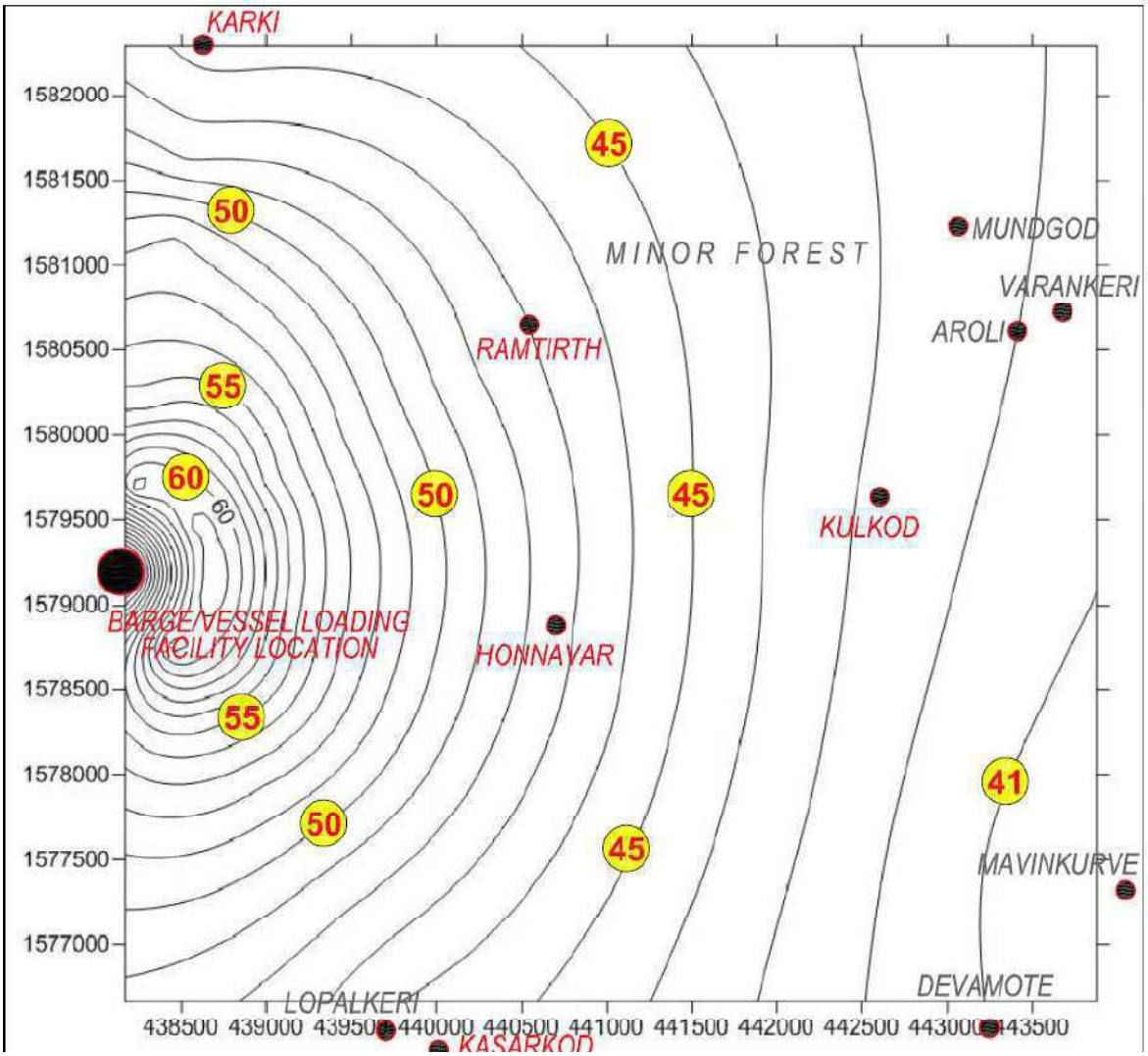


Figure 5-86: Isopleths for noise level-day (L_D) & night (L_N)

5.6.2.1 Mitigation Measures

- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained throughout the construction period.

- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during operational phase of the project.

5.7 Solid Waste Management

5.7.1 Potential Impact during Construction

5.7.1.1 Construction and Other Wastes

Construction waste will be re-used within project site for filling of low lying areas. Composted bio-degradable waste will be used as manure in greenbelt. Other wastes which can be re-cycled will be sold. Hazardous wastes will be disposed through approved KSPCB vendors. Hence, significant impacts are not envisaged.

5.7.1.2 Mitigation Measures/Solid Waste Management

- The various types of solid wastes generated during the construction phase will be segregated into two main categories, viz., non-hazardous and hazardous. All non-hazardous waste will be covered under solid waste management.
- Construction waste will be used within project site for filling of low lying areas. Composted bio-degradable waste will be used as manure in greenbelt. Other wastes which can be re-cycled will be sold.
- Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water.
- General refuse generated on-site will be collected in waste skips and separated from construction waste.
- A local authorised waste handler will be employed to remove general refuse from the site, separately from construction waste and hazardous wastes, on regular basis to minimise odour, pest and litter impacts.
- The burning of refuse at construction sites will be prohibited.

5.7.1.3 Hazardous Materials Management

- Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms.
- The construction site will be secured by fencing with controlled/limited entry points.
- Hazardous wastes will be disposed through approved KSPCB vendors. Hazardous materials will be stored as per prescribed safety norms in locations with restricted entry and with fire-fighting facilities.
- Medical facilities including first aid will be available for attending to injured workers Occupational Health Construction Equipment and waste.

5.7.2 Potential Impact during Operation

Waste generated from cargo operations such as remains of bulk cargo storage, rubbish from unpacking, and canteen wastes from daily activities. Solid waste will be generated from the

canteen and administrative area during the operation stage. Wastes will generate odour and health impacts if not managed properly.

5.7.2.1 Mitigation Measures

- Proper collection and disposal of solid waste from office establishment based on the Central Public Health and Environmental Engineering Organization (CPHEEO) manual on "Municipal Solid Waste Management, 2000.
- The solid waste from the utilities like canteen shall be segregated as biodegradable and non-biodegradable waste and collected separately by providing bins at respective places.
- The collected biodegradable waste shall be subjected to composting and the compost will be used as manure for the development of green belt within the Barge/vessel loading facility
- The non-biodegradable waste like plastic shall be disposed off to approved vendors of KSPCB/CPCB in a scientific manner.
- Anticipated Potential impacts due to the proposed Rail/Road alignment

5.7.2.2 Environmental Aspects

The proposed Road /Rail alignments are completely a new link connecting the proposed Barge/Vessel loading facility with exiting NH 17/ Konkan railway line.

5.7.2.3 Ambient Air quality

The proposed alignment is a new link connecting Barge/vessel loading facility with NH17/ Manki Railway station. The baseline ambient air quality is well within the prescribed NAAQ standards due to the less human activity and low industrial activity. During the construction phase ambient air quality along the adjacent villages will get disturbed due to the various construction related activities such as:

- Site Clearance and use of heavy vehicles and Machinery
- Transport of Raw materials, borrow and quarry material to construction site
- Earthworks
- Handling and Storage of aggregates
- Asphalt mixing plant operations

These activities mainly generate dust and emissions such as CO, SO_2, NO_X from construction machineries and also due to other vehicular movements during construction.

During the operation phase the anticipated impacts to the Air quality is due to the movement of vehicles used for transportation of Cargo and transport of other materials.

Mitigation Measures:

- The asphalt plants, crushers will be sited at least 1 km in the down wind direction of human settlement along the Rail/Road corridor.
- During and after compaction of the sub grade, water will be sprayed at regular interval in order to avoid fugitive dust generation
- Vehicles carrying fine and coarse aggregate shall be covered with tarpaulin in order to avoid the spills.
- Pollution Under Control (PUC) certified construction machinery and equipments will be used and checked at regular intervals.

- During the operation stage dust generation will be minimum, because most of surface will be covered by paved shoulder.
- Tree plantation along the Right of way also will act as a major sink of pollutant due to the plying vehicle through corridor
- Regular maintenance of the road, during the operation phase will reduce any negative impacts to an absolute minimum.
- Adequate vehicle maintenance and not to use adulterated fuels shall be confirmed with the contractors.
- Ambient air quality will be monitored at regular intervals during construction and operations phase of the rail/road corridor.

5.7.2.4 Ambient Noise Level

The baseline ambient Noise levels are well within the prescribed CPCB standards. During construction phase, there will be significant increase in the Ambient Noise Level due to the various construction activities and use of the large number of heavy machineries. However, these construction phase impacts are short term in nature, realised in the immediate vicinity and will cease upon completion of construction. This will be occurred along the construction corridor as well as in the secondary site includes construction camps, asphalt mixing plant etc. During the operation stage, incremental noise level is due to the increased traffic volume and Cargo movements.

Mitigation Measures

- During construction, noise levels will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures.
- Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).
- Only well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used.
- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation etc.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc.
- During operation phase noise levels will be significantly less because of smooth paved shoulders and presence of trees along the Right of way.
- Ambient noise levels will be monitored at regular intervals during construction and operations phases of the rail/road corridor

5.7.2.5 Inland water quality

During construction phase, anticipated impacts are due to spillage of construction materials such as cement, POL and Bitumen etc., falling in to the water bodies and drainage channels from workshops, construction camps etc. During construction phase the natural drainage system will get disturbed and reduction in the capacity of the natural stream. Extraction of the water for the construction activities and labour camp will disturb the local water supply in the contiguous village. Runoff from the construction sites and labour camp will increase the risk of pollution in the natural watercourse. During operation phase there will not be a chance of degradation of water quality during normal operations and spillages will impact the water quality during the accidents if any. Also the entry of vehicles to streams/nallah/rivers for

cleaning could be an impact during operation phase. Surface runoff will be expected due to paved surface.

Mitigation Measures:

- Construction along the water courses will be carried out in the lean flow periods.
- Water will not be extracted from the local resources. Requirement of the water will be met from the ample resource.
- Construction site will not be sited nearer to the surface water or ground water resources.
- Control of the access of Vehicles to the water bodies will be ensured
- Road Safety will be strictly ensured to keep the accident quite low.
- Water Quality will be monitored at regular intervals during construction and operation phase of the project

5.7.2.6 Land

The proposed Road/Rail alignment will traverse across the coastal sand and barren land. During the construction stage accidental spills of fossil fuel and other Hazardous material will increase the risk of soil pollution. Contamination of soil may takes place due to solid waste generated from labour camps. Soil compaction will take place due to the movement of Heavy vehicles and Other Vehicles. During operation phase there will not be degradation of soil quality during normal operations and spillages will impact the soil quality during the accidents if any.

Mitigation Measures

- All the top soil up to 150 mm shall be blended with other barren land to convert in to arable land and will be utilized for land scaping along the corridor,
- Restriction of the plant moving vehicle and machineries in the Agricultural land
- During operational phase, the impacts expected will be minimum due to the proposed green belt
- Soil Quality will be monitored during construction and operation phase of rail/road corridor.

Flora and Fauna

There is no protected Reserve Forest, Wild life sanctuaries and National Parks located in the land proposed for rail/road corridor. The impact on the Flora and Fauna due to this development is insignificant.

Green Belt Development along Road/Rail Corridor

Proposed plantation pattern along the rail/ road corridor will be as follows

- The first row will be of small to medium sized ornamental trees.
- Subsequent rows will comprise of shade bearing species of more height than those in the first row.
- Planting of dwarf shrubs in the median, provide glare free travel to the road user during night time
- Planting of herbaceous species as ground cover in the median, special landscape and the embankment slopes

- Turfing with grass in the median, special landscape and embankments

Following are the recommended species for roadside plantation

Table 5-7: Species recommended for first row

S. No	Botanical name	Importance
1	*Acacia auriculiformis*	Tall Evergreen drought resistant Avenue tree
2	*Ailanthus excelsa*	Tall branched semievergreen tree.
3	*Albizia lebbeck*	Branced evergreen leguminous tree
4	*Alstonia scholaris*	Beautiful medicinal tree.
5	*Neolamarckia cadamba*	Beautiful tree with large leaves.
6	*Azadirachta indica*	Neem oil & neem products
7	*Bauhinia racemosa*	Ornamental tree
8	*Cassia fistula*	Ornamental and bark is a source of tannin
9	*Cassia siamea*	Ornamental avenue tree
10	*Cocos nucifera*	Coconut palm
11	*Dalbergia sissoo*	Avnue and timber tree
12	*Dendrocalamus strictus*	Bamboo products
13	*Casuarina equisetifolia*	Pulp and construction material
14	*Delonix regia*	Ornamental avenue tree
15	*Eucalyptus sp*	Grown in high density along the boundary
16	*Ficus benghalensis*	Shade and a source of food for birds
17	*Ficus racemosa*	Edible fruits
18	*Ficus religiosa*	Shade and a source of food for birds
19	*Gmelina arborea*	Timber
20	*Grewilia robusta*	Avenue tree
21	*Holoptelia integrifolia*	Fibre and timber
22	*Leucaena leucocephala*	Fodder and pulp wood
23	*Mangifera indica*	Edible fruit
24	*Michelia champaca*	Scented flowers
25	*Mimosops elengi*	Shade and edible fruit
26	*Muntingia calabura*	Shade and edible fruit
27	*Phoenix sylvestris*	Palm and the grown up palms can be easily transplanted. Good soil binder.
28	*Pongamia pinnata*	Source of biodiesel
29	*Polyalthia pendula*	Majestic tree with drooping branches
30	*Polyalthia longifolia*	Avenue tree
31	*Samania saman*	Shade, timber and fruits are a good live stock feed.
32	*Shorea robusta*	Tall and locally adapted Timber tree.
33	*Spathodea companulata*	Ornamental avenue tree
34	*Terminalia bellerica*	A common local tree of timber vlue.
35	*Syzygium cumini*	Edible fruits
36	*Tamarindus indica*	Tamarind fruit and leaf
37	*Tectona grandis*	Timber
38	*Terminalia arjuna*	Timber and shade tree
39	*Terminalia catappa*	Edible almond nuts

Table 5-8: Shrubs recommended for Median and Embankments

S.No	Botanical name
1	Bougainvellia
2	Bauhinia alba
3	Bauhinia acuminata
4	calliandra
5	crosandra
6	Gardenia floria
7	Hibiscus SPS
8	Hamelia

9	Musanda
10	Mangnolia SPS
11	Nerium oleander
12	Tecoma stans
13	Tecoma Capensis
14	TMS single and double
15	Thevetia nerifolia

5.8 Vehicular traffic

5.8.1 Potential impact during construction stage

During the construction stage average truck movement is calculated about 150 trucks/day. Potential impacts due to the truck movements are as follows

- Fugitive dust generation during loading and un loading of the construction material
- Vehicular emissions
- Traffic congestion in the existing road
- Increase in noise level due to the movement of vehicles

Mitigation measures

- Trucks will be covered with tarpaulin to avoid fugitive dust generation
- All the vehicle should be warranted with Pollution under control (PUC) certificate
- Usage of appropriate fuels and proper maintenance of vehicles.
- Prohibition of sound horn will significantly reduce the noise level.
- All the vehicles are allowed to use the existing road in the non peak hours.
- Care should be taken by the contractor during the hauling of the construction materials in the project site .

5.8.2 Potential impact during operation stage

During the operation stage average truck movements are given below

Sl.no	Cargo	Truck/day
1	Coal	770
2	Iron ore	250
3	General	300

Potential impacts due to the truck movements are as follows

- Fugitive dust generation during loading and un loading of the construction material
- Vehicular emissions
- Traffic congestion in the existing road
- Increase in noise level due to the movement of vehicles

Mitigation measures

- Trucks will be covered with tarpaulin to avoid fugitive dust generation
- All the vehicle should be warranted with Pollution under control (PUC) certificate
- Usage of appropriate fuels and proper maintenance of vehicles.
- Prohibition of sound horn will significantly reduce the noise level.
- All the vehicles are allowed to use the existing road in the non peak hours.
- Care should be taken by the operator during the hauling of the cargoes in the stock yard.

5.9 Socio-Cultural Impact

5.9.1 Potential Impact due to proposed Facility Location

5.9.1.1 Relocation of Local People

Due to the proposed project, there is no relocation of the local people as the project area is completely on coastal sand.

5.9.2 Potential Impact during proposed Facility Operation

5.9.2.1 Impacts due to Inland Cargo Movement

Proposed Barge/ Vessel loading facility at Honnavar will handle 4.9 MTPA. Proposed road / rail corridor will be used to transport the cargo from/to barge/ vessel loading facility. Hence there will be no congestion of traffic and disturbance to level of service to the existing infrastructure facility

5.9.2.2 Vessel Movement and Impact on Beaches

Barge traffic may disturb fishing activities like fishing nets getting entangled with the moving vessels in outer harbour areas which may cause financial losses to fishing communities. The possibility of accidents in the barge/vessel traffic may affect local people.

Barge/ Vessel loading facility activities may result in the hiring of local labour and procurement of various commodities from a local market. The local economy will be boosted by Barge/ Vessel loading -related activities and be greatly involved in urbanization and industrialization.

Mitigation Measures

- In case of any accident spills, spill recovery will be attempted. A contingency plan will be developed and followed.
- Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalised in consultation of fishing harbour authorities and fishing communities.

Chapter 6
Environmental Monitoring Programme

6 Environmental Monitoring Programme

In this chapter, environmental monitoring programme for the proposed Honnavar Barge/ vessel loading facility is formulated. Environmental Monitoring Programme is an important component during environmental management of the project. The institutional mechanism to implement the planned mitigation and monitoring measures during all stages of the project is discussed in **Chapter 10**. The project management especially the Environmental Management Cell (EMC) (described in **Chapter 10**) should always go for a rational approach with regards to environmental monitoring. This includes judicious decision making in consultation with responsible agencies (e.g. Karnataka State Pollution Control Board (KSPCB)) or reputed environmental consultants for appropriate changes in the monitoring strategy, changes in the monitoring frequency, and any new requirements. The efficacy of the mitigation measures being followed during construction and operational phases can be assessed and can be revised, made more stringent and reinforced based on the monitoring results. The environmental attributes to be monitored during construction and operational phases of the project, specific description details of environmental monitoring including the monitoring parameters, methodology, sampling locations and frequency of monitoring are presented in Section 6.2 of this chapter.

6.1 Budgetary Estimates for Environmental Management

The budgetary estimate for Environmental Management during construction phase is INR ***16.2 Million (***INR***1.62 Crores)*** and the annual budgetary estimate during operational phase is INR ***6.00 Million (***INR ***0.60 Crores)***. The breakup of cost is given in Tables 6-1 and 6-2.

Table 6-1: Environmental Management - Capital Cost

S. No.	Purpose	Cost items	Cost in `	Cost ` in Million
1.	Green Belt Development	Tree (Greenbelt/green areas) Plantation • Total Area – 3.1 ha (Approx) • Spacing – 2.5 m X 2.5 m	874260.00	0.88
2.	Solid Waste Management	Dustbins for waste collection	29652.00	0.03
3.	Capacity Building	Training Workshop	100000.00	0.1
4.	Marine Life Protection out of Oil Spill	Dust exhausting equipment	200000.00	0.2
5.	Dust Sweeper		4500000.00	4.5
6.	Air Pollution Control	Installation of dust suppression systems	7500000.00	7.5
7.	Environmental Monitoring Construction Phase (Additional Facilities)	Marine & Terrestrial Environment	1500000.00	1.5
8.	Oil Water Separator	--	1250000.00	1.25
9.	Soak Pit (2 Nos.)	--	200000.00	0.2
	Total		16153912.00	**16.15**

S. No.	Purpose	Cost items	Cost in `	Cost ` in Million
	Total Capital Cost Rounded off INR 1.62 Crores: (INR 16.2 Million)			

Table 6-2: Environmental Management - Annual Recurring Cost

S. No.	Purpose	Cost items	Cost in `	Cost ` in Million
1.	EMC Recurring Expenditure	• EMC Expenditure	900000.00	0.9
		• Waste Disposal & House Keeping	1200000.00	1.2
2.	Greenbelt Maintenance		383646	0.38
3.	Maintenance of Dust bins		30000	0.03
4.	Awareness campaigns-Training		200000.00	0.2
5	Maintenance of Dust sweepers		1200000.00	1.2
6.	Maintenance of Sprinkler system		1200000.00	1.2
7.	Wetting of Roads		600000	0.60
8.	Oil Water Separator Maintenance		125000	0.13
9.	Soak pit Maintenance		20000	0.02
10.	Statutory compliance for environmental protection	Environmental Monitoring (marine & terrestrial)	100000 (approx)	0.1
	Total		**5958646**	**6.0**
	Total Recurring Cost Rounded off: INR 0.60 Crores (INR 6.0 Million)			

6.2 Environmental Monitoring Programme

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
Construction Phase					
Air Quality	PM_{10}, $PM_{2.5}$, SO_2,NO_x CO, HC	Five (5) • Project site • Kasarkod • Honnavar • Kulkod • Ramthirth	Once in 2 weeks during entire construction period	Respirable Dust Sampler Fine Particulate Samplers Single Gas Detector Organic Vapour Sampler	National Ambient Air Quality Standards released during November, 2009
Noise Levels	Day and night noise levels	Five (5) • Project site • Kasarkod • Honnavar • Kulkod • Ramthirth	Once in a fortnight during entire construction period	Portable hand-held integrated noise level meter.	National Ambient Noise Standards, GSR 1063 (E), 1989
Water Quality	Physical, Chemical and Bacteriological	Groundwater (2) • Honnavar • Kasarkod Surface water (2) • Sharavati river • Badgani River	Once in a month during entire construction period	Grab sampling and analysis by using standard methods.	IS10500, 1991 drinking water standards for Groundwater and Designated Best Use (Outdoor bathing – Organised) Classification of Inland Surface Water of National Rivers Conservation Directorate, MoEF for Surface Water
Soil	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.	Three (3) • Port Site • Honnavar • Kasarkod	Once in a year during construction period	Collection and analysis of samples as per IS:2720	Baseline data
Marine Water Quality	Physical, Chemical and	Six (6) • Dredge Spoil Disposal	Monthly basis both for low tide and	Bottom sampler (Nishkin Sampler) and analysis by	Primary water quality standards for coastal

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
	Biological	Areas • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	high tide periods during entire construction period	using standard methods.	water (SW–IV) Given as **Appendix H**
Plankton and Benthic Communities	Phytoplankton, Zooplankton and Benthic Communities	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area Saravathi/Badagani river Mouth (near confluence point)	Monthly basis during entire construction period	Plankton net of diameter of 0.35 m, No.25 mesh size 63 μ and analysis by using standard methods.	Baseline data
Sediment Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater	Monthly basis during entire construction period	Peterson's Grab Sampler and analysis by using standard methods	Baseline data

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
		• Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)			
Operation Phase					
Air Quality	PM_{10}, $PM_{2.5}$, SO_2,NO_x CO, HC	Five (5) • Project site • Kasarkod • HonnavarKulkod • Ramthirth	Once in a month	Respirable Dust Sampler Fine Particulate Samplers Single Gas Detector Organic Vapour Sampler	National Ambient Air Quality Standards released during November, 2009.
Noise Levels	Day and night noise levels	Five (5) • Project site • Kasarkod • Honnavar • Kulkod • Ramthirth	Once in a month	Portable hand-held noise level meter.	National Ambient Noise Standards, GSR 1063 (E), 1989
Water Quality	Physical, Chemical and Biological	Groundwater (2) • Honnavar • Kasarkod Surface water (2) • Sharavati river • Badgani River	Once in a quarter of the year	Grab sampling and analysis by using standard methods.	IS10500, 1991 drinking water standards for Groundwater and Designated Best Use (Outdoor bathing – Organised) Classification of Inland Surface Water of National Rivers Conservation Directorate, MoEF for Surface Water
Soil	Soil texture, type,	Three (3)	Once in a year	Collection and analysis of	Baseline data

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
	electrical conductivity, pH, infiltration, porosity, etc.,	• Port Site • Honnavar • Kasarkod		samples as per IS 2720	
Marine Water Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	Once in a quarter of the year	Bottom sampler (Nishkin Sampler) and analysis by using standard methods.	Primary water quality standards for harbour waters (SW –IV) Given as **Appendix H**
Plankton and Benthic Communities	Phytoplankton, Zooplankton and Benthic Communities	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near	Once in a quarter of the year	Plankton net of diameter of 0.35 m, No.25 mesh size 63 μ and analysis by using standard methods.	Baseline data

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
		confluence point)			
Sediment Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	Once in a quarter of the year	Peterson's Grab Sampler and analysis by using standard methods	Baseline data

6.3 Compliance Reports

- As a part of environmental monitoring programme, following compliance reports shall be submitted to KSPCB.
- Half yearly compliance report on 1st June and 1st December of every calendar year
- Environmental statement for the financial year ending 31st March to KSPCB on or before 30th September every year
- Format for maintaining records of hazardous waste if any in Form 3 as per Hazardous Waste (Management, Handling and Transboundary movement) Rules, 2008
- Format for maintaining hazardous waste imported and exported in Form 10 as per Hazardous Waste (Management, Handling and Transboundary movement) Rules, 2008
- Safety data sheet for hazardous chemicals shall be maintained as per schedule 9 of MSIHC rules, 1989 (amended 2000)
- Format for maintaining notification of major accident in schedule 6 as per MISHC rules, 1989 (amended 2000)
- Water Cess returns in Form 1 as per Rule 4 (1) of Water (Prevention & Control of Pollution) Cess Rules 1978 on or before the 5th of every calendar month

6.4 Plantation Monitoring Programme

Environmental Management team will monitor the following activities of greenbelt development:

- Watering
- Fencing and Nursery shed
- Transport of seedlings/Weeding and soil working
- Application of insecticides
- Pruning (trimming of plant)
- Replacement/ Inter planting

During Operation phase periodic monitoring of application of insecticides, pruning, and replacement will be performed in order to properly maintain vegetation, greenbelt and green cover.

6.5 On-site Mock Drills Requirements

On-site mock drills are very important as employees should know how to react during the time of crisis. Conducting mock drills at regular intervals enhances preparedness and checks the viability of environmental/ disaster management plan. Mock drills are essential for the following reasons:

- Helps in revising/ improving the environmental/ disaster management plan
- Helps to evaluate whether the responsible officials are trained efficiently for the unforeseen event
- Helps in evaluating whether HPPL maintains all the emergency equipment

To ensure efficient environmental/ disaster management, HPPL shall conduct periodic on-site mock drills in case of occurrence of the following activities:

- Fire
- Natural calamities (cyclones, floods, tsunami, earthquakes)
- Collision of vessels calling at barge/vessel loading facility

- Power break down
- Oil spill
- Bomb threats
- War alerts/ terrorist attacks

Mock drills should also involve fire department, police, municipal authorities, hospitals and other department/ agencies that are mandated to provide emergency support to Honnavar Barge/ vessel loading facility. Documenting the outcome of mock drills is an important aspect as this helps in revising the existing plan more efficiently.

Chapter 7
Additional Studies

7 Additional Studies

7.1 Public Hearing

In line with the requirements of EIA Notification, 2006 (as amended) for Category B1 projects, Public Hearing was conducted at Project Site, kasarkod-tonka, honnavar taluk, uttara kannada district for the proposed Barge/Vessel Loading Facility development. For conducting Public Hearing, the Draft EIA Report was prepared in accordance to SEAC approved ToR and Executive summaries in English and Local (Kannada) languages were submitted to Karnataka State Pollution Control Board (KSPCB). The Public Hearing was conducted on January 27, 2012 by KSPCB in the presence of Dy. Commissioner & District Magistrate, Uttar Kannada District. Karwar. Regional State Pollution Control Board Officer, Karwar and Public. The advertisements, Minutes of Meeting (MoM) of Public Hearing are given in **Appendix J**

7.1.1 Responses of HPPL on Views Expressed by Public

Responses provided by HPPL on the each aspects discussed during Public Hearing are given Table 7-1

Table 7-1: Responses of HPPL on Views Expressed by Public

Name of the speaker &Place	Issues Raised	Response of HPPL
1. Smt. Laxmi Algod:	She stated that, • 90% of the local populations are fishermen. They are practicing traditional fishing and depend on it for their livelihood. She stated that, the project proponents have not given clear information about the project.	• The details of the project and its components were well described in Chapter 2 of Draft EIA report as well as in Executive Summaries both in English and Kannada Languages were legally displayed as per the law of the country During Public Hearing also the project development details were spelt in vernacular language out clearly and presented. • The details of the Fishing villages, Fish landing centres, number of families, Fishermen population etc., in the study area and fish catch details were provided in the DEIA report. The details have been collected from the Department of Fisheries and National Information Centre.
	• She expressed concern about adverse effect on public health in case of accidents occurring due to loading of cargo from barges to ship, dust pollution and other problems due to handling of different cargo.	• Proposed facility is barge/vessel loading facility and planned to handle coal, Iron Ore and General Cargo. The loading/ unloading of Barges to ship will not be carried out at the Harbour and will be done at deep waters where the mother ship used to be anchored by taking necessary well accepted pre cautionary measures and adopting best available Technologies and when concerned with the Berth/Vessel loading of cargos, technologically advanced mobile loader cranes will be used which suppress the dust to a maximum extent/captures the dust. • In the event of accidental spills of cargo during transfer from/to the ships, the Spill contingency plan provided in the EIA will be adopted to contain and recover the same at the earliest possible. If the accidental spills will be in harboured waters, since the harbour will be protected by Breakwaters, it would not spread spatially and the response time, containment and recovery (ie remedial measures) will be quicker. • If the accidental spills due to liquid cargo such as Edible oil and fules for barges/vessel, the oil spill contingency plan provided in the EIA

Name of the speaker &Place	Issues Raised	Response of HPPL
		report will be adopted. Depends on the quantities of spill, necessary assistance will be sought from the nearby ports/ coast guard. • • The necessary mitigation measures such as Green Belt development and Water Sprinkling etc., to suppress the dust while handling and storage will be followed as a part Environmental Management Plan. Proper dust suppression will be ensured in the port premises.
	• She also expressed that, the study on the said project has been carried out by outside agencies instead of local agencies and University.	• As per MoEF Requirment, QCI, NABET Accredited and Experienced consultant in Port EIA studies is engaged to carry out EIA Study for Proposed Barge/Vessel Loading facility.
	• She expressed doubts on whether the study has been carried out properly or not.	• The study has been carried out as per the ToR prescribed by KSEIAA and the Guidance Manual for Ports and Harbours published by MoEF.
	• She also stated that, there was no clear information in the presentation regarding road, railway track etc. made by the project proponent. • She also expressed that, they were already put into a lot of inconveniences due to the Sharavati project and felt that they are again being made a	Proposed Dedicated Rail/Road Corridor details are provided in the EIA report, Executive Summaries disclosed for public scrutiny before Public Hearing as per the EIA Notification, 2006. Proposed Rail corridor connecting project site to Manki railway station of 15.0 km and proposed road connecting project site to NH-17 of 4.0 km will be constructed as a part development. The proposed facility will be developed strictly adhering the Environmental Management Plan suggested in the EIA to ensure the development as a sustainable one.

Name of the speaker &Place	Issues Raised	Response of HPPL
	scape goat and felt it was not justifiable.	
	• She further expressed is it was justified to give good health facilities as assured by the project proponent after spoiling the health of the local community by establishing this kind of project.	As a part of Corporate Social Responsibility (CSR), to improve the medical facilities and Health Environment conditions, HPPL is proposed to provide better health services such as Strengthening area Government hospitals by assisting them in procurement of essential medical equipments and Providing quality health care through regular medical camps. The impacts due to the proposed development and necessary mitigation measures to render these impact as insignificant was addressed in the EIA report and the respective budgetary provision to implement the mitigation measures is made as a part of EMP.
	• She expressed that, the project proponent has mentioned that, the main cargo handled in the project is coal, but at present situation, there is already scarcity of coal to the industries that use it as raw material, in this situation the coal handling as main activity is false and they have hidden plans to handle Iron Ore.	The proposed barge/vessel loading facility is planned to handle coal, Iron Ore and Other General cargo and the same was mentioned in the EIA report, Executive Summaries and During Public Hearing Presentation also. The developer is committed to the national regulations and therefore Iron ore will be handled as and when the handling is legally permitted. As true to the report submitted we are handling coal as our major cargo and which is imported to fulfil the requirement of the hinterland coal dependent industries. This will cater to the scarcity of the coal in the hinterland.

Name of the speaker &Place	Issues Raised	Response of HPPL
	• She further expressed the project cost ` 450 Crores will be collected from local community and fishermen in the form of taxes.	The project will be developed by HPPL and the company is registered under the laws of the country. HPPL is committed to follow all the regulatory requirements of the country only. Entire investment of Rs.450 Crores is made by HPPL only. The government is not investing anything therefore the question of imposing taxes does not arise
	• She also informed that, they have seen fishing activity suffered due to discharge of waste water by fish processing unit in the areas during earlier days.	As per our EIA/EMP commitments ,no discharge of wastewater/waste from the Barges/vessel calling at Honnavar Barge loading facility will be permitted into the area. There will not be any discharge in to the sea from the proposed barge/vessel loading facility.
	• Further, she also expressed that, public hearing notification is given like tender notification & failed to attract attention of the public.	Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006.
	She expressed that, the project proponents have planned to establish the project without giving information to public. Hence, she on behalf of public and women organizations is opposing the said project.	

Name of the speaker &Place	Issues Raised	Response of HPPL
2. Smt. Laxmi Naik, Snehakunja, Honnavar	She expressed that, it is not right to organize public hearing without giving proper report of the project to the public.	Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006. The necessary Document such as Executive Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same was displayed in Deputy commissioners office, Karwar Chief Executive officer - Karwar District Industries Center,Karwar hasildhar's office - Karwar. Thasildhar's Office - Honnavar. Taluk/Town Panchayat - Honnavar. Gram Panchayat - Kasarkod. Zilla panchayat - Karwar. Library - Karwar. Library - Honnavar. KSPCB - Karwar. KSPCB - Bangalore. CRZ office - Karwar. Asst Commissioner - Bhatkal. Asst Commissioner - Kumta. (Acknowledgement for the same is also obtained by KSPCB)by KSPCB.
	Further she expressed that, this project will create local employment only during the construction phase and is doubtful whether locals will be employed once the project is operational.	It is estimated that during construction stage & operation stage the employment generation will be about 500 & 50 people respectively. Based on the skill set of the people such as skilled, semi skilled and unskilled, the preference will be given to the local people during the operation stage.

Name of the speaker &Place	Issues Raised	Response of HPPL
	Further she mentioned that the project proponent is misleading the public by stating this project will help local fishing boats in their activity because once the project is completed and is in full operation, this area will become prohibited area and local fishing boats will not have access to the area.	Fishing Vessel movements and access will not be prohibited even during the operation phase. This is one of the commitments to the state and we are bound to follow these and more over we need all support and well wishes of all sections of the local communities There is a capsizing of fishing vessels near the river mouth due to insufficient depth. Creation of approach channel and provision breakwater as a part of the development which will rule out the capsizing incidence. Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalized in consultation of fishing harbour authorities and fishing communities. Awareness will be given to fisherman about the barge/vessel movement's time schedule and clearances required for safe manoeuvring etc., During berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.
	She informed that, the proposed project proponent have not given clear picture of survey number of the 109 acres of land to be acquired by the project.	As this being a reclaimed land it does not have any survey numbers at the moment. Thashildhar is in the process of carrying out the survey of the existing land and provide new survey numbers to them.

Name of the speaker &Place	Issues Raised	Response of HPPL
	She also shared her experiences during the health survey conducted by their organization in the Kaiga area and stated that, the local people of the Kaiga area were not provided medical facilities by Kaiga authorities, though there is a very good hospital in Kaiga established by Kaiga authorities. She expressed fear that the same will be repeated in the present project.	We are not aware of the Kaiga situation but we are committed to provide the promised services to the local communities. As a part of Corporate Social Responsibility (CSR), to improve the medical facilities and Health Environment conditions, HPPL is proposed to provide better health services such as Strengthening area Government hospitals by assisting them in procurement of essential medical equipments and Providing quality health care through regular medical camps.
	She objected to the acquisition of land for development of railway line and road for the project as land holdings of local people are very less.	A new independent access road is being developed for the traffic to and from the facility, without disturbing the existing roads by the facility traffic The alignment is planned in such a way that it has minimum disturbance to the local communities. More over the road is not an access controlled therefore the local public also can use the road for their needs.
	She insisted to give detail project report of the said project to the local fishermen community.	Before Public Hearing, the necessary Documents such as Executive Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same was displayed in Thashildhar's office, Honnavar, Town Panchayat Honnavar, Gram panchayat, Kasarkod (Acknowledgement for the same is also obtained by KSPCB) by KSPCB for Public.
3. Shri. K. Ramesh, Snehakunja, from Ankola	He stated that, project proponents are misleading the locals by stating that, the proposed project is only for barge and vessel loading facility, instead they are trying to handle hazardous cargo like Iron ore,	The proposed facility is a Barge/Vessel Loading facility only and planned to handle 4.9 MTPA of cargo. This facility will handle coal, Iron Ore and Other General cargo and the same was mentioned in the EIA report, Executive Summaries and During Public Hearing Presentation also.

Name of the speaker &Place	Issues Raised	Response of HPPL
	Oil, Coal etc	
	and trying to conduct public hearing under heavy police protection creating fear among local people to express their factual opinions. He complained that, the activities viz. handling of iron ore, coal, oil are not mentioned in the paper notification published.	Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006. The Public Hearing was conducted by KSPCB as per the procedures and the proceedings of the same were forwarded to respective authorities.
	He explained that, while he was residing at Ankola he has experienced the adverse effect on the environment and safety problems faced during handling of iron ore at Belekeri. He explained details of environmental pollution and nuisance to public during handling of iron ore iron ore at Belekeri Port which has caused financial loss to Govt and other problems faced by common public is well known to the entire nation. He complained that the	The proposed facility will be developed strictly adhering the Environmental Management Plan suggested in the EIA to ensure the development as a sustainable one. Fishing Vessel movements and access will not be prohibited even during the operation phase. Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalized in consultation of fishing harbour authorities and fishing communities. Awareness will be given to fisherman about the barge/vessel movement's time schedule and clearances required for safe manoeuvring etc., During berthing of barges/vessels, necessary clearances shall be made available to ensure the

Name of the speaker &Place	Issues Raised	Response of HPPL
	local people who handed over their land to project like Kaiga, Sea bird did not get benefit from the project and also are not made a part of the decision making process in the said project and expressed fear that, same will be repeated in the said project also. He stated that he is totally opposed to the proposed project, which is proposed to handle commodities like iron ore and coal because this activities will create environmental damage in the area and also health problems to the local people besides traffic congestion in the area and affect traditional fishing activity of local fishermen on which they depend for their livelihood.	fishing vessels movements.

<table>
<tr><th>Name of the speaker &Place</th><th>Issues Raised</th><th>Response of HPPL</th></tr>
<tr><td rowspan="2">4. Shri Abdul Hussain, Masjid Secretary, Honnavar</td><td>He stated that, project proponents have not given detailed report regarding the requirement and usability of land for the proposed project.</td><td>The land required for the development of Barge/ Loading Facility is 44 Ha. The layout Showing the same is presented in the DEIA report. The proposed land use Pattern is given below.
<table>
<tr><th>S.No</th><th>Description</th><th>Area (Ha)</th></tr>
<tr><td>1.</td><td>Coal Stockyard</td><td>7.00</td></tr>
<tr><td>2.</td><td>Iron Ore Stockyard</td><td>1.80</td></tr>
<tr><td>3.</td><td>General Cargo Storage (Open)</td><td>4.00</td></tr>
<tr><td>4.</td><td>General Cargo Storage (Closed)</td><td>2.00</td></tr>
<tr><td>5.</td><td>Liquid cargo storage</td><td>0.10</td></tr>
<tr><td>6.</td><td>Roads and Circulation Area</td><td>8.15</td></tr>
<tr><td>7.</td><td>Operation Building</td><td>0.05</td></tr>
<tr><td>8.</td><td>Canteen</td><td>0.02</td></tr>
<tr><td>9.</td><td>Vehicle Parking</td><td>0.09</td></tr>
<tr><td>10.</td><td>Substation</td><td>0.02</td></tr>
<tr><td>11.</td><td>Gate House/Security/Weigh Bridge</td><td>1.50</td></tr>
<tr><td>12.</td><td>Truck Parking</td><td>5.40</td></tr>
<tr><td>13.</td><td>Fuel Station</td><td>0.02</td></tr>
<tr><td>14.</td><td>Control Tower</td><td>0.01</td></tr>
<tr><td>15.</td><td>Green Belt</td><td>3.10</td></tr>
<tr><td></td><td>Sub total</td><td>33.26</td></tr>
<tr><td>16.</td><td>Area available for other Operations and area earmarked for future expansion</td><td>6.72</td></tr>
<tr><td>17</td><td>Rock armour area(approx)</td><td>4.00</td></tr>
<tr><td></td><td>Total</td><td>44.00</td></tr>
</table></td></tr>
<tr><td>He added that, the project proponents have not included mitigation measures for oil spillages problem due to operation of project in the area.</td><td>Mitigation measures for oil spillages were addressed in the EIA report. The barge/vessel loading facility will be equipped with minimum equipment to contain and recover oil spills. Oil spill control equipment such as booms / barriers will be provided for containment and skimmers will be provided for recovery. In case of any cargo spillage during transfer from/to mother ships, Barges/ Vessels, it will be attempted to recover the spills. If the accidental spills</td></tr>
</table>

Name of the speaker &Place	Issues Raised	Response of HPPL
		will be in harbor waters, it would not spread spatially and the Response time for shutting down the fuelling, containment and recovery will be quicker.
	He expressed concern that the sea eco system in vicinity of the project would be disturbed due to operation of said project and there may lead to extinction of certain species of fishes which are observed only in this area.	The impact on Biological Environment (Coastal and Marine Ecology) due to the proposed barge/vessel loading facility and respective mitigation measures is addressed in the EIA report. The proposed port will be developed strictly adhering the Environmental Management Plan suggested in the EIA to ensure the development as a sustainable one. The post project monitoring covering marine environment monitoring will also be carried out.
	He complained that, the project proponents have not informed the local Panchayat, so as to prevent public from attending the public hearing and expressed strong objection to the proposed project in the area.	Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006. Before Public Hearing, the necessary Documents such as Executive Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same was displayed in Deputy commissioners office,Karwar Chief Executive officer – Karwar District Industries Center,Karwar Thasildhar's Office - Karwar. Thasildhar's Office - Honnavar. Taluk/Town Panchayat - Honnavar. Gram Panchayat - Kasarkod. Zilla panchayat - Karwar. Library - karwar. Library - Honnavar. KSPCB - Karwar. KSPCB - Bangalore. CRZ office - Karwar. Asst Commissioner - Bhatkal. Asst Commissioner - Kumta.

Name of the speaker &Place	Issues Raised	Response of HPPL
		(Acknowledgement for the same is also obtained by KSPCB) by KSPCB for Public. English & Kannada Executive Summary, DEIA report were placed in the respective office on 22nd December 2011. Pamphlet distribution and Auto announcement was conducted in the local region (specifically giving more priority to Kasarkod area) on 25th January 2012.
5. Shri M. N. Subramanya, Advocate, Honnavar	He stated that the location is ecologically sensitive as it is an estuary point of Sharavati river joining the Arabian Sea and that the location is critically sensitive for marine ecology as big fish and particular species of fishes depend on this area for their breeding activity. He expressed fear that there would be ecological imbalance of marine ecology due to development and operation activities of the project and requested presiding officer not to allow such project in the area in the larger interest of sustaining ecological balance of marine life in the region.	Impact on River Confluence Point/River Mouth due to the proposed barge/vessel loading facility is studied by appropriate mathematical modeling and other marine biological studies and addressed in the EIA report. Breakwater construction will lead to accretion/erosion on coast adjacent to that. These will change the morpho dynamics of the river mouth/inlet which leads to reduction in tidal water flow in the water body. Reduction in tidal exchange will affect the biodiversity. Hydrodynamic Model Studies and other model studies ensures that changes the morphodynamic of the river mouth is not significant. This will ensure the tidal water exchange and thereby maintain the bio diversity. However, as a part of EMP, both water quality monitoring and shoreline monitoring will be carried out during construction as well as operation phases of the project.
	He also expressed that the project proponent have not mentioned about the applicability	Coastal Regulation Zone compatibility of the proposed barge/vessel loading facility is discussed in Chapter 2 of EIA report.

Name of the speaker &Place	Issues Raised	Response of HPPL
	of CRZ Notification, 2011 for the said project at the said area. He questioned that the CRZ notification was applied to construction of houses for fishermen and not done in the case of big projects like this.	Physical demarcation of HTL, LTL and delineation of CRZ setbacks for the project site were carried out by Centre for Earth Science Studies (CESS). Based on the perusal of the CRZ Notification, 2011 and the HTL/LTL survey outcome, following are the inferences arrived: • Proposed site falls on the sandy beach near the river mouth. • CRZ Setback lines indicate that the proposed barge/ vessel loading site mostly falls within the CRZ I (B) (i.e. Area between LTL and HTL) ,CRZ (III) undeveloped rural area and CRZ IV (near shore waters and back waters). • Proposed location does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs. It also does not include breeding and spawning grounds of fish and other marine life, area of outstanding natural beauty / historically / heritage area, area rich in genetic diversity. Based on perusal of Coastal Regulation Zone (CRZ) Notification, 2011 and Karnataka Coastal Zone Management Plan (CZMP), Proposed Honnavar barge/vessel loading is a permissible activity in CRZ as it requires waterfront and foreshore facilities. The project layout superimposed on HTL, LTL and CRZ setbacks is given the EIA Report.
	He expressed fear that, the operation of such project would create shortage of electricity in the entire Honnavar Taluk.	Power requirement during construction phase is expected to be around 1 MVA. The power demand is estimated at 1 MVA during operation. Construction phase power requirement will be met from DG sets and operation phase power will be drawn from Substation located at Honnavar (~2 km) after obtaining the necessary permissions from respective Electricity department. Hence, no competitiveness with the local people is envisaged.

Name of the speaker &Place	Issues Raised	Response of HPPL
	He expressed his dissatisfaction over absence of information on rehabilitation, alternative business to affected fisherman community due to the proposed project. He also expressed dis-satisfaction over the information given with regard to employment generation to local people and expressed strong objection to proposed project in the area.	HPPL has been allotted to use the government land of 44 hectares by Government of Karnataka near Sharavati river mouth in Kasarkod Tonka village to develop a barge/vessel loading facility. There are no land acquisition and encroachers involved. It is estimated that during construction stage & operation stage the employment generation will be about 500 & 50 people respectively. Based on the skill set of the people such as skilled, semi skilled and unskilled, the preference will be given to the local people during the operation stage.
6. Shri. Nivel Fernadis, Secretary Pershian Boat owners association, Honnavar	He expressed pollution of the sea and surrounding area due to operation of said project, which would directly affect the fishing activity in the area. He opined that, project will create water scarcity in the area.	No discharge of wastewater/waste from the Barges/vessel calling at Honnavar Barge loading facility will be permitted into the area. There will not be any discharge in to the sea from the proposed barge/vessel loading facility. Water requirement during the construction is expected to be around **15m^3/day.** Water demand during operational phase of barge/ vessel loading facility is estimated as **7m^3/day**. The water requirement will be met from Karnataka Rural water supply and sanitation agency which includes supply to Barge/vessels, staff and users. In addition to that water required for dust suppression system and fire fighting will be sourced from Sharavati River. Hence, no competitiveness with the local people is envisaged.
	He expressed doubt of controlling generation of dust by proposed tarpaulin cover on ore storage heaps as wind velocity in the area is very high and expressed fear of dust nuisance to the surrounding areas	Dust suppression equipment will be provided for efficient control of dust pollution on environment during storage and handling of Coal and Iron ore at berth and stockyard. An efficient dust suppression system will contain dust particles before it is airborne. A common system consisting of suitable pump, storage tank, nozzles have been proposed for efficient dust control system. Dust control is envisaged at following locations: 1) barge/ vessel loading /unloading area 2) Stockyards

Name of the speaker &Place	Issues Raised	Response of HPPL
		Water sprinkling system at high pressure with swivelling type nozzles will be installed to cover entire stockpile. Nozzles will be installed on pipes at different levels from ground. Nozzles will be installed along stockpile at regular intervals to cover stockpile height and width.
	He requested to construct break water in the alive area (River joining Sea) area which would facilitate the fishermen.	As a part of development, construction of Southern and Northern Breakwater are envisaged and navigational channel was planned in between the breakwater as well as in the said alive area (river joining sea). Hence this arrangement of breakwater as well as navigation channel will help the fisher folk to navigate their fishing vessels very safely.
	He pointed out that, project proponent have not given a clear picture of vehicular movement and proposed route for the project area and proposed mitigation methods to avoid nuisance created due to movement of heavy vehicles during development and operational phase He objected to the said project in order to avoid environmental damage and to avoid problems that would be created due to vehicular movement of the project.	Proposed road connectivity starts from NH 17 at Kasarkod. This road will then run south east for some distance and then aligns parallel to the shoreline till it reaches the proposed project site. This will be parallel to the existing single lane road at an offset distance of 100 m. The total length of this road from NH 17 to the proposed site is 4.0 km. This road connectivity will have a width of 25 m. Proposed railway line will take off from the existing railway station at Manki. The new railway line will have to be laid for a distance of 14.6 km from Manki railway station to the proposed project site. Proposed railway line will run parallel to existing railway line for a length of about 8 km and then will take a turn towards sea coast which will then run parallel to the sea coast till the proposed project site for the remaining 6.6 km. Anticipated Potential impacts due to the proposed Rail/Road alignment and respective mitigation measures are provided in the EIA report.

Name of the speaker &Place	Issues Raised	Response of HPPL
7. **Shri. Abdul Khadar, local resident, Honnavar:**	He stated that, maximum fisherman living in this area have migrated from Mallukurva area which was destroyed due to flood and till date have not obtained their land rights from the Govt. He informed that, most of the fishermen in the area are holding small lands and expressed fear that, their land may be acquired for the said project and they may be evacuated from the area without suitable rehabilitation as they do not have land records in their names.	As there is no land acquisition , so there is no rehabilitation is envisaged.
	He expressed his dis-satisfaction on preparation of project report by the people who have no knowledge of local geology.	QCI, NABET Accredited and Experienced consultant in Port EIA studies is engaged to carry out EIA Study for Proposed Barge/Vessel Loading facility.
	Further, he questioned the permission given for the project since the same is denied for local poor people since 1974.	Directorate of Ports and Inland Water Transport Department, Government of Karnataka signed a lease agreement with HPPL to develop Honnavar Port. Based on perusal of Coastal Regulation Zone (CRZ) Notification, 2011 and Karnataka Coastal Zone Management Plan (CZMP), Proposed Honnavar barge/vessel loading is a permissible activity in CRZ as it requires waterfront and foreshore facilities.
8. Shri. Basha Ahmed Patel, Gram	He informed that, he came to know about the proposed project very recently as a result of which he could not understand the	Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006. Before Public Hearing, the necessary Documents such as Executive

Name of the speaker &Place	Issues Raised	Response of HPPL
Panchayat Member, Honnavar	project as there was lack of publicity given about the proposed project.	Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same was displayed in Deputy commissioners office,Karwar Chief Executive officer – Karwar District Industries Center,Karwar Thasildhar's office - Karwar. Thasildhar's Office - Honnavar. Taluk/Town Panchayat - Honnavar. Gram Panchayat - Kasarkod. Zilla panchayat - Karwar. Library - karwar. Library - Honnavar. KSPCB - Karwar. KSPCB - Bangalore. CRZ office - Karwar. Asst Commissioner - Bhatkal. Asst Commissioner - Kumta

Name of the speaker &Place	Issues Raised	Response of HPPL
	He also informed that school, masjid, temples and residential area are situated on the way to the proposed project as well as the proposed road and railway track. He also informed that the school, religious places and residential areas will be affected if the project is allowed to come up. He objected to the development of road and railway track as it will affect local ecosystem.	Proposed road connectivity starts from NH 17 at Kasarkod. This road will then run south east for some distance and then aligns parallel to the shoreline till it reaches the proposed project site. This will be parallel to the existing single lane road at an offset distance of 100 m. The total length of this road from NH 17 to the proposed site is 4 km. This road connectivity will have a width of 25 m. Proposed railway line will take off from the existing railway station at Manki. The new railway line will have to be laid for a distance of 14.6 km from Manki railway station to the proposed project site. Proposed railway line will run parallel to existing railway line for a length of about 8 km and then will take a turn towards sea coast which will then run parallel to the sea coast till the proposed project site for the remaining 6.6 km. Proposed road/rail alignment will traverse across the coastal sand and barren land. The alignment is selected such a way that there will not be any disturbance to the existing structures. The proposed road connectivity is not an access controlled private facility and hence local people will be allowed to use as required. Anticipated Potential impacts due to the proposed Rail/Road alignment and respective mitigation measures are provided in the EIA report.
	He expressed surprise over Govt. officers attending the public hearing when they failed to visit the area during the recent floods. He welcomed the Deputy Commissioner for her first visit to the area and requested for basic infrastructure for the fishing activities and also strongly objected to the proposed project.	--

Name of the speaker &Place	Issues Raised	Response of HPPL
9. Shri. Umesh Mesta, Society Chairman, Honnavar	He stated that, project proponent have not obtained clearance from CRZ as CRZ notification is applicable to the project. He also expressed that the proponents have failed to present clear picture of the proposed project. He also objected for the project on behalf of the Society.	Final EIA report is prepared based on the proceedings of the public hearing with necessary responses for the clarifications raised by the public. The same will be submitted to the respective CZMA authorities to obtain CRZ Clearance. The proponent is legally bound to obtain all clearances as per the regulatory frame work of the country. This public hearing is also part of the legal process to obtain all clearances required for the project. • The details of the project and its components were well described in Chapter 2 of Draft EIA report as well as in Executive Summaries both in English and Kannada Languages. During Public Hearing also the project development details were spelt out clearly and presented.
10. Shri. J.D.Naik, MLA, Honnavar	He informed that, he was attending the public hearing as a public representative. He expressed that he was in support of the project if it fulfills long pending demand for development works such as construction of break water, Dredging, harbor development which will facilitate the local fishermen community in their fishing activity.	As a part of proposed development, construction of Breakwater, Dredging etc., will be carried out.

Name of the speaker &Place	Issues Raised	Response of HPPL
	However he was opposed to the project if the life of the local community, their profession & business are likely to be affected. He also informed that the final say on the proposed project was entirely dependent on the will of the local community and that he would stand by their decision.	Construction activities involve dredging, construction of cargo berths which may likely to disturb the fishing activity at nearyby villages. However, necessary marker buoys shall be installed and interactions shall be initiated with the fishing communities about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period. During operation phase, barges/vessels movements may hinder the fishing vessels approach to the fish landing wharf and to the sea. Awareness will be given to the fishermen about the barges/vessels movement's time schedules and clearances required for safe maneuvering etc., During berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.

7.2 Preliminary Risk Analysis

7.2.1 Hazard Identification

A classical definition of hazard states "hazard is in fact the characteristic of a system/plant/process that presents potential for an accident." Hence, all the components of a system such as process, storage of chemicals, etc., 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.

Hazards in the proposed facility were identified in this section in terms of:

- Hazards during Construction Phase
  - Mechanical Hazards
  - Transportation Hazards
  - Physical Hazards
  - Storage and Handling of Hazardous Materials
- Hazards during Operation Phase
  - Material Hazards
  - Handling Hazards
- Hazards due to Natural Calamities
  - Earthquake
  - Tsunami
  - Cyclone

The summary of potential hazards and the probable impacts are given in the Table 7-2.

Table 7-2: Summary of Potential Hazards

S. No	Potential Hazard	Probable Impacts
Man Made		
1	Berthing Accidents	Impact on jetty (mooring, structure)
2	Carrier Running Aground	Oil Spills, Wreckage
3	Fuel/ Oil Spills, Leaks	Impact on aquatic (marine) environment
4	Break/leak in	Asphyxiation/ breathing problems due to fine dust in the air, shutting down of operation
5	Cargo loading/Unloading	Failure of loaders/unloaders may result in cargo deposition in sea and settling on seabed
Natural		
1	Tropical Storms, Cyclones, Heavy Rain	Rough seas during particular seasons during which carrier berthing is not possible; accidents due to collision with jetty
2	Earth Quake/Tsunami	Damage buildings and equipment, inundation of jetty
Others		
1	Fire	Fire outbreaks can vary in size and location can cause extensive damage
2	Accident	Can occur at any time especially due to falling debris during construction; operation procedure

7.2.2 Hazards during Construction Phase

Potential hazards during the construction phase of the project could be due to the mechanical hazards, navigation/ transportation hazards, physical hazards and storage and handling of hazardous materials.

Mechanical Hazards: Mechanical hazards during the construction phase arise due to the moving parts in the machinery, especially the belts and bolts of the construction equipment, which are heavy and pose a threat to the work personnel. Other hazards include falling (during working at heights), falling objects like hand held tools, etc; failure of slips and traps created for scaffolding; and due to faulting of electrical equipment.

Navigation/ transportation Hazards: The planning of access/egress to the construction site also plays a significant role in minimizing the associated hazards such as vehicles collision.

Physical Hazards: The noise and vibrations generated during the construction phase may affect the workers health, hinder effective communication and may jeopardise sensitive organs. In addition to noise and vibration, hot works also pose a considerable hazard to the workers.

Storage and handling of hazardous materials: During the construction period, storage of hazardous materials like fuel for the engines, lubricants, paints and other flammable materials is likely to pose a fire and explosion risk. Due care shall be taken in locating these materials away from the work place, free of any influence of temperature or sparks or fire. Proper wiring of the electrical appliances like lights, exhausts, etc., would be made to ensure that there are no live wires causing short circuits to ignite these materials.

7.2.3 Hazards during Operational Phase

Material Hazards: The proposed Barge/ vessel loading facility handles coal, iron ore, edible oil, fertilizer and other general cargo which can be classified as non-hazardous.

Hazard Intensity Classification

The hazard ratings of various cargos proposed to be stored in the barge/vessel loading facility w.r.t National Fire Protection Agency (NFPA) rating is provided in Table 7-3.

Table 7-3: NFPA Ratings of Various Materials

S. No.	Material	Properties	NFPA Hazard Intensity			Hazards due to Human Exposure
			H	F	R	
1	Coal	• Melting Point: 750°F • Flash Point: >260°F • Auto Ignition Temperature: 260-365°F	1	1	0	• The chronic stage involves massive pulmonary fibrosis that does impair pulmonary function and shorten life. • Chronic Bronchitis (lung inflammation, coughing attacks, difficult breathing,

S. No.	Material	Properties	NFPA Hazard Intensity			Hazards due to Human Exposure
			H	F	R	
						etc.) and emphysema can result from excessive coal dust inhalation. • Rheumatoid arthritis can be exacerbated by pneumonias leading to rapidly developing lung damage (Caplan's Syndrome).
2	Iron Ore	-	1	0	0	• Inhalation may cause irritation to mucous membranes • Skin & eye contact may cause irritation

H: Health

- 0: Material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.
- 1: Material that on exposure would cause irritation but only minor residual injury.
- 2: Material that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury.
- 3: Material that on short exposure could cause serious temporary or residual injury.
- 4: Material that on very short exposure could cause death or major residual injury.

F: Flammability (Susceptibility of material to burning)

- 0: Will not burn.
- 1: Must be preheated before ignition can occur.
- 2: Must be moderately heated or exposed to relatively high temperature environment before ignition can occur.
- 3: Can be ignited at almost all temperatures.
- 4: Will rapidly or completely vaporize at atmospheric pressure and normal temperature or will rapidly disperse in air and burn easily.

R: Reactivity (Susceptibility of Material to release Energy either by themselves or in combination with other materials)

- 0: Normally stable; even under fire exposure conditions.
- 1: Normally stable except in combination with certain other materials or at elevated temperatures and pressures.
- 2: Normally unstable; readily undergoes violent chemical change at elevated temperature and pressures.
- 3: Can detonate or explode under a strong initiating force or after heating under confinement.
- 4: Readily detonates or explodes at normal temperatures and pressure.

Coal

Fire hazard: Coal is susceptible to spontaneous combustion, most commonly due to oxidation of pyrite or other sulphidic contaminants in coal.

Coal reacts with atmospheric oxygen even at ambient temperatures and this reaction is exothermic. If the heat liberated during the process is allowed to accumulate, the rate of the above reaction increases exponentially and there is a further rise in temperature. When this temperature reaches the ignition temperature of coal, the coal starts to burn and the phenomena is described as spontaneous combustion.

Initiation of spontaneous combustion is through development of hot spots in the coal stockpiles. The significant factors to be considered for prevention of this development are as follows:

- Ventilation
- Coal Quality: low carbon content and large amounts of volatile components support combustion
- Particle Size: the smaller the particles, the larger the surface, the higher the risk
- Stockpile Design
- Humidity

Dust explosion: Coal dust is prone to ignition depending on its concentration in air and presence of ignition sources. Coal dust therefore represents a significant explosion hazard in coal storage and handling facilities where coal dust clouds may be generated in enclosed spaces. The significant factors which contribute to the dust explosion are:

- Concentration of dust in suspension
- Sufficient oxygen to enable combustion
- Source of energy for ignition
- A certain degree of confinement of the suspended dust mixed with oxygen

This hazard is associated with empty Barge/ vessels, unloaders and hoppers.

Health hazards: Coal dust poses a possibility of reduced lung function. Workers exposed to coal dust may develop lung damage and pulmonary fibrosis. The occupational exposure standard (OES) for coal dust is 2 mg/m^3 of respirable dust (Exposure limit eight-hour TWA). OES is the level of dust at which there is no evidence of injury to people exposed day after day.

7.2.3.1 Handling Hazards

Cargo handling:. The major components of proposed Barge/ vessel cargo handling system are Barge loaders, Mobile Harbour Cranes and pay loaders etc.,

Barge/ vessel movements: The possible hazards during Barge/ vessel movements at the barge/ vessel loading facility are collision, grounding, etc.

Barge/ vessel unloading: During Barge/ vessel unloading operations, the possible hazard may arise due to collision by other Barge/ vessels and others.

Transfer operation: The transfer operation involves transfer of cargo from mother ship to Barge/ vessel and Barge/ vessels to stock yard or others. During this operation there is a possibility of mal-operation/non-synchronisation/misalignment leading to cargo spillage.

7.2.3.2 Hazards due to Natural Calamities

Earth Quake: As per Seismic Zoning Map of India, the project area falls under Zone-III (moderate to low risk zone) as per the IS: 1893, Part-I, 2002. The design of the facilities should incorporate this factor which would give the required structural integrity.

Cyclone/Tsunami: Karnataka is one of the cyclone prone areas in west coast of India. In general west coast experienced less inundation during December 2004 Tsunami. However, necessary mitigation steps shall be taken during cyclone as per Cyclone Contingency Plan and during Tsunami as per "Ship Action Policy against Tsunami".

7.2.4 Enumeration of Potential Accidents

The possible accidents from the proposed barge/vessel loading facility are envisaged from the spontaneous ignition of coal.

Fire due to spontaneous combustion of coal dust: Coal dust when dispersed in air and ignited would explode. Stock yards are most susceptible to this hazard. To be explosive, the dust mixture should have:

- Particles dispersed in the air with minimum size
- Dust concentrations must be reasonably uniform
- Minimum explosive concentration for coal dust (33% volatile) is 50 g/m^3.

Failure of dust extraction and suppression systems may lead to abnormal conditions and increasing the concentration of coal dust to the explosive limits. Sources of ignition present are incandescent bulbs with the glasses of bulkhead fittings missing, electric equipment and cables, friction, spontaneous combustion in accumulated dust.

Dust explosions may occur without any warnings with maximum explosion pressure up to 6.4 bar. Another dangerous characteristic of dust explosion is that it sets off secondary explosions after the occurrence of the initial dust explosion. Many a time, the secondary explosions are more damaging than primary ones.

The dust explosions are powerful enough to destroy structures, kill or injure people and set dangerous fires likely to damage a large portion of the Coal Handling Plant.

7.2.5 Safety Features

The built in safety features in the proposed facility are given in this section.

Fire fighting facilities shall be provided with fire hydrant systems and jockey pump. Based upon the type of fire, additional combustible material onsite fire extinguishers of Class A, B, and C will be planted to suppress/prevent the spreading of the fire. The fire fighting facilities (hydrant system etc.) to be provided in the barge/vessel loading facility are discussed below:

The fire fighting in the port shall consist of the following:

- Fire protection
- Fire alarms
- Fire-fighting equipment
- Means of escape in case of fire

- All sources of ignition (especially in the warehouses) shall be highly controlled. Appropriate use of fire fighting equipment shall be provided throughout the barge/vessel loading facility area.
- All portable fire-fighting equipment shall be grouped at clearly marked fire points, which are marked with conspicuous signs and markings. The choice of fire fighting equipment depends on the nature of the cargo stored.
- The entire barge/vessel loading facility area shall be provided with fire fighting system, which must include portable first-aid fire extinguishers and fixed system (Hoses and hydrant) and the same shall be tested at regular intervals and renewed periodically.
- In accordance with the International & National guidelines and codal requirement, the type, location and number of fire fighting equipment shall be determined
- Fire points shall not be more than 80 m apart and they shall be marked clearly with signs and shall be visible at all times, it shall be located in such a way that fire fighting system is brought into action quickly (Hydrants at warehouses shall be close to doors)
- Depending upon the type of fire, which may likely to occur and nature of material involved, the fire fighting agents shall be selected. Catastrophe may occur if an improper fire-fighting agent will be selected.
- Commonly used fire-fighting agents are water, foam, carbon dioxide and powder. In most of the cases when water shall be used as the fire-fighting agent, the intake mains should be below water at any point of time and protected from damages.

7.2.5.1 Fire Hydrant System

The system comprises of a main working pump set, a stand-by main pump set, Jockey Pump Set and a network of hydrant main's with Single Headed Hydrants, double heated hydrants, Fire Escape Hydrants for staircases & all accessories.

- Jockey pump set, min. 1 no. shall be provided to:
- Maintain the water pressure in the Hydrant line.
- Provide a means of pumping pressurised water to the system in case of small system demands.
- Jockey pump shall start automatically upon receipt of a signal from pressure switches installed at the downstream of NRV provided for the Jockey Pump.

The main pumping system comprises of two nos. Centrifugal pumps with end suction and top discharge nozzle pumps one working and one standby. Working Pump shall be of Electric motor driven and Standby Pump Diesel Engine driven. These pump sets shall satisfy Tariff Advisory Committee (TAC) conditions of performance as a minimum.

The main pump set shall start at lower pressure level sensed by pressure switch installed downstream of the non-return valve for the main pump.

A master panel shall be provided in the pump house. This panel shall receive all the signals from the various pressure switches etc. and then relay the signals onwards to the respective local panels to initiate action to start/stop, etc. the respective pump. The selector switch housing for the selection of main working or stand-by pump set shall be in this master control panel.

- Accessories

The fire and Jockey pumps shall be complete with the following accessories:

- Suction and discharge eccentric reducers.

- Pump coupling guard.
- Common base frame
- Suction & Discharge Piping with all necessary piping & valves.
- Each pump shall have independent set of pressure switches.

- Master Control Panel

The composite power cum control panel is proposed to be located in the Firewater Pump House. Incoming power supply for the control panel shall be 415V, 3 phase, 50 Hz.

The motor starters shall consist of electrically actuated contactors. The starter shall be complete with ON - OFF push buttons, timers & auxiliary contacts & shall be fully automatic. There shall be an indicating lamp with each of the pumps & an ammeter & selector switch with the fire pumps. In addition provision shall be made for starting the motor manually to check the performance after maintenance.

The Master Control panel must be fulfilling the requirement of TAC and Visual alarm would be in the form of annunciation with the following inscriptions:

- Fire water pump(s) fail to start.
- Jockey pump fail to start.
- Low header pressure.

One hooter shall be provided to alert in fire condition & the event of any of the above fault conditions. Fire pump starting shall be annunciated through an electric siren.

One common alarm contact shall be provided to indicate a fire alarm in any of the areas. This signal shall be brought up to a terminal block in vendor's panel for further cabling to clients control system (overall).

The Fire Hydrant System installation shall conform to and meet with the requirements set out by the latest editions of:

IS:1648 : 1961	Code of Practice for Fire Safety of Buildings (General) Fire Fighting Equipment and its maintenance.
IS : 3844 : 1998	Code of Practice for Installation of Internal Fire Hydrants in Multi-Storied Buildings.
TAC : 1998	Fire Hydrant System, sprinkler system & spray system
IS : 778 : 1984	Gun metal gate, globe and check valves
IS : 1239 / 3589 : 1991	Mild Steel Pipes
IS :12469 :1988	Specification of pumps
IS :5290 : 1983	Specification for Landing Valves
IS : 10001 : 1981 & 10002 : 1981	Specification of Diesel Engine
IS : 5312 :1984	Specification for Non-Return Valve
BS : 5150 (Latest Edition)	Specification for Sluice Valve (Rising stem), PN 16.
IS : 10221 : 1982	Specification for Wrapping and Coating materials.
IS : 636 : 1988	Non-Percolating Flexible Fire Fighting Delivery Hose
IS : 903 : 1984	Specification for Hose Coupling

7.2.5.2 Fire Hydrant Posts

The height of the hydrant post shall be minimum 1200 mm overall from the ground level at readily accessible and visible locations.

7.2.5.3 Hydrant Valves

Design manufacture and construction of hydrant valves shall be conforming to IS: 5290 - 1983. Requirements regarding material, types, and dimensions, construction, finish painting shall conform to IS: 5290 - 1983 type A in general.

The following tests shall be carried out by the contractor strictly as per IS: 5290 – 1983:-

- Hydrostatic pressure test
- Flow test
- Water tightness test for valves
- Marking on the Hydrant valves shall be done as per IS: 5290 - 1983

7.2.6 Risk Reducing Measures

7.2.6.1 General

- Monitoring System for process parameters including manual checking should be established.
- Automation of the preliminary fire fighting/system cooling initiation based on temperature and smoke detectors should be ensured to prevent a small incident from escalating. This would also give adequate time for effective personnel response and intervention.
- All sources of ignition should be removed from the storage and process areas. De-matching and removal of spark generating electronic equipment such as cellular phones should be strictly followed.
- Procedures for ensuring use of relevant Personal Protective Equipments (PPE) should be delineated and strictly enforced to prevent exposure to personnel.
- Periodic Inspection/Corrosion Monitoring
- Periodic Training to Personnel

Above all, consistent and total quality assurance for engineering design, hardware selection, through construction to commissioning and subsequent operation and maintenance has to be adopted.

7.2.6.2 Coal Handling – Prevention of Coal Dust Generation

Recommendations to prevent and control fugitive coal emissions and generation of coal dust include the following:

- Design of the facility layout to facilitate emissions management
- Use of loading and unloading equipment to minimize the height of coal drop to the stockpile
- Providing access for fire fighting
- Eliminating the presence of potential sources of ignition, providing appropriate equipment grounding to minimize static electricity hazards
- Installing dust collector systems to capture fugitive emissions from coal handling equipment or machinery

7.2.6.3 Control of Exposure of Coal Dust

- Keeping away people who do not need to be in dusty areas
- Using totally enclosed, continuous handling systems - these usually provide the best control and should be used whenever reasonably practicable
- Suppressing dusts with sprays of water or other binding agents
- Use appropriate PPEs.

7.2.6.4 Navigation and Barge/ vessel/ Ship Movements

Construction Phase: Good communications and exchange of information when planning work boats/Barge/ vessel movements are essential. The master and pilot should exchange information and agree on a berthing plan which should include the above information taking into account the position of obstructions such as the cranes, piles, dredgers etc. The master should inform the Barge/ vessel operator, the characteristics such as the bow flare, cranes etc.

The authorities should ensure that the construction area is well lit and that the Barge/ vessel operators and Barge/ vessel are fully informed of the berthing requirements and position of obstructions. All obstructions such as cranes should be moved out of the way.

If necessary, movement of boats/ Barge/ vessels/ berthing should be delayed until the cranes had been moved to a less vulnerable position.

Operational Phase: Charts, tidal information and other information about the prevailing conditions at the Barge/ vessel loading facility should be checked prior to berthing and cargo operations. If there is any doubt about the conditions at the berth, including the available depth of water, clarification should be obtained before berthing or cargo operations start.

Even apparently minor contacts with piers and jetties should be taken very seriously and experts called in immediately to assess the extent of damage.

7.2.6.5 Safety

Construction Phase: All workers, technicians and supervisors should make use of all safety equipment such as masks, goggles, helmets, safety belts, ear muffs safety shoes, etc., as required, during the construction phase. Danger areas will be marked in order to restrict unauthorized entry into the Project area. Proper security arrangements will be made during nights to avoid any accidents due to unauthorised entry of workers or civilians. Adequate and proper fire-fighting facilities will be provided by the management in all areas so as to take care of all unexpected fire accidents.

Operational Phase: The following safety measures in addition to those outlined in previous subsections are recommended:

- Preparation of detailed operational procedures including instructions for emergency situations
- Preparation of strict working procedures in connection with repair and maintenance of the various equipment and systems.

7.2.6.6 Hazardous Material Storage

The hazardous materials anticipated to be stored at the site during construction are gas for welding, fuel for operating construction equipment, paint, etc. All these and other materials of a dangerous or hazardous nature will be stored as per the norms of industrial safety.

7.3 Disaster Management Plan

The disaster management plan mainly deals with:

- Prevention of loss of life
- Damage limitation
- Preparedness to deal with any disaster
- Return of normal working after the crisis
- The plan also delegates specific assignments to available manpower with a view to avoid over-lapping of activities between various groups.

7.3.1 Causes of Disaster

- Natural: Flood, Earth Quakes, cyclones, Tsunami and Lightning
- System failure, design deficiency, bad operating practice, sabotage resulting in
  - Fire
  - Explosion
  - Release of toxic/ inflammable gases

7.3.2 Categorisation of Emergency

Any emergency situation has to be first categorised as an onsite emergency or an offsite emergency, the difference being that the effects of the onsite emergency are confined within the premises while those of an offsite emergency spill over beyond the Barge/ vessel loading facility premises or even beyond the project site premises. Thus, the onsite and offsite emergency plans are detailed below:

7.3.2.1 Onsite Emergency Plan

The plan would have the following components:

- Formulation of Disaster Management Plan and Emergency Services
- Organisation Structure
- Roles and Responsibilities of Emergency Teams
- Communication
- Emergency Control Centre
- Alarm Systems & Assembly Points
- Mutual Aid Scheme
- Onsite Emergency Plan and Rehearsals
- Spillage & Contingency Plan
- Formulation of Disaster Management Plan for Cyclones

7.3.2.2 Offsite Emergency Plan

The components of an offsite emergency plan would include:

- Identification of locations of hazardous or dangerous substances, personnel and emergency control rooms.

- Technical information such as chemical and physical properties, dangers, etc. Background information, past accidents, control techniques and effects of hazardous materials of relevance.
- Identification of facilities and transport routes for toxic materials.
- Contact for further advice such as meteorological information, transport, temporary food and accommodation, first aid and hospital services, water etc.
- Establishing communication links including fire fighting materials, damage control and repair items.
- Detailing emergency response procedures.
- Notification to public at large.
- Evacuation arrangements.
- Press/media handling.
- Addressing longer term environmental cleanup.

7.3.3 Onsite Emergency Plan

7.3.3.1 Formulation of Disaster Management Plan and Emergency Services

The assessment of the risks and hazards leads either to improvements being made at the installation in the form, for example, of additional safeguards or better procedures, or the decision being taken that the risk is sufficiently small to be accepted.

The Disaster Management Plan must be related to the final assessment and it is the responsibility of the HPPL management to formulate it. The plan will include the following elements.

- Assessment of the magnitude and nature of the events foreseen and the probability of their occurrence
- Formulation of the plan and liaison with outside authorities, including the emergency services
- Procedures for raising the alarm and communication both within and outside the barge/vessel loading facility
- Appointment of key personnel and their duties and responsibilities (organizational structure)
- Emergency Control Centre and Action on site/Action off site

7.3.3.2 Organization Structure

The first few minutes after the incident/accident are invariably the most critical period in prevention of escalation. Therefore, the personnel available at or near the incident site (and often responsible for or carrying out that particular activity) and on a round the clock basis play a vital role in an emergency. This concept is made use of in nominating the KEY PERSONS.

In each hazardous location it is necessary to nominate a functionary as the *"Incident Controller"* who is invariably a shift-in-charge of the facility. The Incident Controller tackling the emergency in real terms requires support from various other services e.g. fire & safety, medical services, security, engineering, administration, technical services covering communication, transport and personnel functions, etc. A KEY PERSON for each one of these services, therefore, should be nominated.

The "SITE MAIN CONTROLLER" (SMC) will be the Unit In-charge. The various controllers selected to carry out the work will co-ordinate with the SMC through the functional KEY

PERSONS at the incident site. The KEY PERSONS will generally be at the site of incident and the CONTROLLERS will report at the EMERGENCY CONTROL CENTRE.

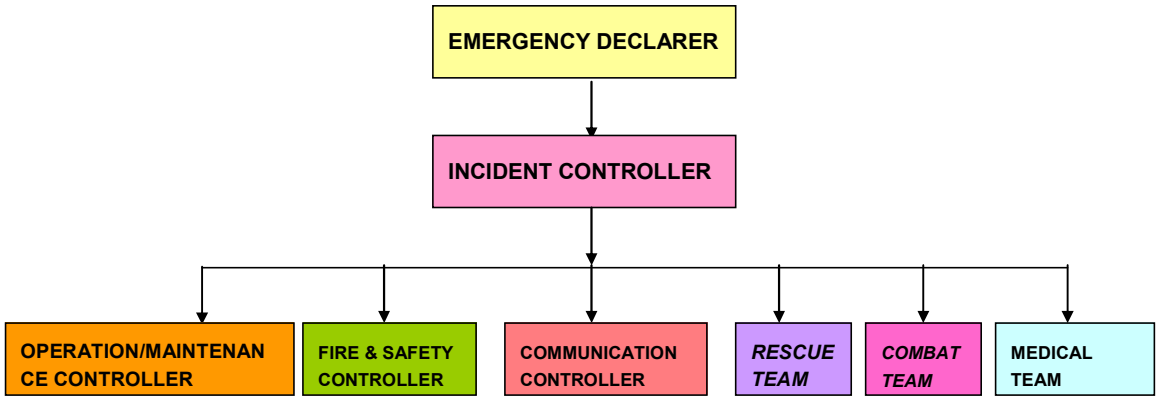
The duties and responsibilities of various KEY PERSONS AND CONTROLLERS will be written down ensuring no grey areas or overlapping responsibilities.

Various Controllers will be drawn from the organisation and clear-cut responsibilities will be spelt out for the following controllers:

- Operation Controller
- Maintenance Controller
- Fire and Safety Controller
- Communication Controller
- Environment Controller

A Succession chart will be developed as above nominating second-line controller who would act as controller in the absence of any of the above officials.

An emergency organisation chart is as follows:



7.3.3.3 Roles and Responsibilities of Emergency Team

i) Site Main Controller (In-charge)

- To access the extent and magnitude of the damage and by maintaining communication with the Site Incident Controller (SIC).
- To determine how far the emergency control plan can be extended
- Prepare action for monitoring and controlling the emergencies
- To decide whether any section/process/area to be shut down/isolated in the event of any accident
- To finalise the means of evaluation and explore the possibilities of taking help from offsite sources
- Review the fire fighting operations in consultation with Safety Coordinator
- Co-ordination with the safety officer regarding evacuation and shelter rehabilitation aspects
- Arrange for restoration and normalcy in consultation with Incident Controller
- Announcement of conclusion of emergency
- Issuance of authorised statements and ensures that all evidences of the incident are preserved.

(ii) Site Incident Controller (Shift in-charge)

- Establish Emergency Control Centre and inform SMC
- Ensure availability of Controllers/Team members
- Priority decisions for strategy for development of resources for incident control
- Periodic assessment of actual disaster zone and resource deployment (own / external)
- Periodic status report of SMC
- Seek help for:
  - Fire Fighting
  - Medical Aid
  - Rescue
  - Transport
  - Traffic Arrangement
  - Law and Order
- Inform the following authorities about the incident through zonal/sector authorities:
  - District Collector
  - Superintendent of Police
  - District Environmental Engineer
  - District Health Officer
  - Inspector of Factories
  - Neighbouring Installations
- Establish contacts with the following, through controllers:
  - Superintendents of nearby hospitals
  - Chief Fire Officer of nearby fire services
  - Insurance Company
  - Establish First Aid Centre through Safety Coordinator
- Establish Information Centres

7.3.3.4 Emergency Co-ordinators

Logistics Coordinator: The duties and responsibilities in the event of any emergency include:

- Report at the affected area to the SMC & SIC
- Arrange to attend all maintenance jobs as instructed by SIC
- Ensure that all essential services like power, water etc are maintained without interruption
- Ensure adequate manpower availability at the affected area
- Reporting all the incidents to SIC
- Arrange for all the tools, materials at the site of emergency

Communication Coordinator: Responsibilities include:

- Report to SMC & SIC
- Removal of non essential personnel from the emergency area in consultation with SIC
- Contact with SIC and arrange for necessary facilities
- Control over entry and maintain law & order and arrange for police help in consultation with SMC
- Liaison with external agencies in consultation with SMC
- Co-ordination of transportation requirements for moving personnel for first aid, evacuation, rehabilitation etc.
- Maintenance of inventory systems in the Emergency Control Centre

Safety Coordinator: Responsibilities include:

- Immediate Reporting to SIC
- Co-ordination with Security officer and security personnel

- Ensure availability of all safety equipments at site
- Co-ordination of all rescue operations
- Co-ordination of availability of first aid to all injured personnel
- Advice to SIC on fire fighting operations
- Ensure availability of necessary antidotes/medicines in case of toxic release

7.3.3.5 Communication

An essential component of any emergency preparedness programme is the communication links for gathering information needed for overall co-ordination e.g. emergency control centre with in-house as well as outside emergency services. Too much reliance on the telephone system Fixed lines/Mobile phones is risky as it can soon be overloaded in an emergency situation. A computer with internet and printer facility and photocopying machine, wireless networks, fax, intercom units are recommended for higher reliability.

- Help line numbers will be setup for emergency related queries

The description of the tasks and responsibilities, reporting place, etc. for each key functionary will be, as far as possible, so drafted as to reduce the communication needs between the interacting groups and permit good mutual understanding and well co-ordinated independent actions to tackle emergency situations.

7.3.3.6 Emergency Control Centre

The emergency control centre should be established separately for Barge/ vessel loading facility and should be equipped with the following:

- An adequate number of external telephones. If possible, one should accept outgoing calls only, in order to bypass jammed switchboards during an emergency.
- An adequate number of internal telephones, Radio equipment/pager system.
- A layout plan of the facility showing.
- Location of possible spillage/fire points.
- Sources of safety equipment and other fire-fighting system elements.
- Escape Routes.
- A nominal roll of employees at the facility.
- A list of KEY PERSONNEL with addresses, telephone numbers, etc.
- An adequate number of personnel protective/safety equipment available on site/back up in warehouse or with other member groups of mutual aid programme.
- Locations of various fire fighting arrangements at the facility.

7.3.3.7 Alarm Systems

The emergency (due to fires or spillages) should be initiated by the first person noticing it by activating the fire alarm from the nearest call-point or by contacting the fire control room immediately on the internal telephone in case of any emergency.

If in the opinion of the shift in-charge in consultation with the fire safety officer, the severity of the emergency is such that it can primarily be coped with by HPPL's own resources (aided by fire fighting appliances from the fire brigade, if required) the siren code for ONSITE CRISIS will be sounded through the hooter. The siren codes for distinguishing between an ONSITE & OFFSITE CRISIS will be clearly established.

The onsite/offsite siren codes should be informed to the neighbouring population of the facility.

7.3.3.8 Mutual Aid Scheme

Assistance in terms of equipment and manpower will be taken from the neighbouring installations under a Mutual Aid Scheme/Zonal Disaster Management Plan.

7.3.3.9 Assembly Points

Shifting or evacuating facility personnel during an onsite crisis will be done to a predetermined assembly point in a safe part of the facility. The assembly point will be identified at safe locations (Barge/ vessel loading facility administrative building).

7.3.3.10 Onsite Emergency Plan and Rehearsals

Once the emergency programme is finalised, it should be made known to all personnel so that each one knows his or her role in the event of an emergency. The plan will be regularly tested through the rehearsals, at a regular frequency and updated accordingly.

7.3.3.11 Spillage and Contingency Plan

The purpose of this plan is to identify, prevent and control all probable spillages in Barge/ vessel loading facility for safe and healthy working of facility personnel and machinery.

Probable materials for spillage:

- Electrical equipment area (Transformer oil and cable filling compounds)
- Liquid and solid wastes
- Cargo (coal and Iron Ore) spills
- Oil during bunkering, from Ships, Barge/ vessels, tugs and other facility crafts

Spillages in the Barge/ vessel loading facility can lead to:

- Causing loss of property
- Interfaces with safe moving of personnel
- Damage to equipment when left unattended
- Health hazard i.e., toxic when released in air or mixes with the main Barge/ vessel loading facility drain system and further to sea.
- Fire hazard

Prevention of spillage:

Routine checks of the system have to be made to ensure that no leak or spill starts. Any minor leakage has to be reported to the concerned person (Shift In-charge, Operation & Maintenance team member). Leakage has to be arrested in the shortest possible time. Necessary arrangements have to be made to collect the leakage and to store in proper place.

In case of spillage the following measures would be adopted:

- Oil spill on the land should be properly cleaned using absorbents, cotton waste, sand, saw dust, etc.
- The collected oil is disposed to SPCB/CPCB authorized agency.

- Oil spill on the barge/vessel loading facility premises should be properly cleaned using absorbents, cotton waste, sand, saw dust, etc., and the materials used for cleaning should be incinerated.
- Major oil spills can be taken to oil separator and the same to be reused depending on the quality.

7.3.3.12Oil Spill Contingency Plan

The barge/vessel loading facility will be equipped with minimum equipment to contain and recover oil spills. In addition, HPPL will develop a customised Oil Spill Contingency Plan to cope with any accidental oil spill during bunkering if any. The contingency plan will be prepared by HPPL in consultation with the Department of Ports, GoK.

In case of an oil spill, immediate steps would be taken to contain and control the spill. An Oil Spill Contingency Plan will outline the steps to be taken before, during and after a spill. In the present case, an Oil Spill Contingency Plan covering the following will be prepared:

- Hazard Identification
- Vulnerability Analysis
- Risk Assessment
- Response Actions.

Hazard Identification: All conditions which can lead to an oil spill will be identified and necessary information to react to a spill under different conditions will be studied.

Vulnerability Analysis: Vulnerability analysis will help to identify the resources and communities which could be affected due a spill and accordingly they can be informed or quick measures can be taken so that it results in minimum damage. Information on the following will be collected as a part of vulnerability analysis:

- Public safety officials
- Schools, nursing homes, hospitals and prisons in the area
- Recreational areas
- Special events such as festivals and when they occur
- Ecologically sensitive areas specially areas susceptible to oil or water pollution

Risk Assessment: Based on hazard identification and vulnerability analysis, the extent of risks involved will be assessed.

Response Actions: Response actions will provide information on all the immediate actions that will be taken in the event of a spill. It will have information on the following:

- Measures to prevent further flow of oil
- Measures to prevent ignition
- Agencies responsible for clean-up effort
- Information on the extent of spill
- Measures to contain spill to a limited area
- Measures to remove oil
- Measures to dispose the spilled oil

Mock drills will be carried out to test the effectiveness of the contingency plan.

7.3.3.13Coal Dust Suppression System

The stack height of the coal stack yard would be limited to 10-12 m from the point of view of safety against fires. During coal handling and storage activities there may be fugitive dust

emission which might cause occupational health hazards. Hence, dust suppression will be provided.

Dust control equipment system consisting of suitable pump, storage tank for water and sprinklers & nozzles for dust suppression will be provided. In addition to the above, suitable spray system shall also be provided at ship unloader & coal stockyard.

The water sprinkling system with nozzles shall be installed to cover the entire stockpile. The nozzles shall be installed on pipes at about 2 to 3 meters elevation from ground. The nozzles shall be installed along the stockpile which can cover the stockpile height and proposed width.

7.3.3.14 District Disaster Management Committee

The District Level Disaster Management Committee is set up for major off-site emergencies along with Port Officers for Uttara Kanada. This committee would comprise of the following members:

District Collector	Chair Person
ADM, Uttara Kanada	Member
Sub Collector, Uttara Kanada	Member
RTO, Uttara Kanada	Member
EE (R&B), Uttara Kanada	Member
EE, Irrigation Division, Uttara Kanada	Member
Deputy Director (Agriculture), Uttara Kanada	Member
District Development Officer, Uttara Kanada	Member
District Emergency Officer	Member, Convener

7.3.3.15 Disaster Management Plan for Cyclones/Floods

In line with the Disaster Management Plan of Uttara Kannada District, HPPL will develop a customised DMP to cope during disasters from natural calamities such as rough weather conditions, cyclones, Tsunami and floods, etc. Proper planning can reduce the potential damage from disasters in terms of losses to human lives, port assets, and environmental damage and rehabilitation costs. The DMP for Cyclones and Tsunami will be prepared by HPPL in consultation with the Department of Ports, Government of Karnataka.

The rough weather operations will be controlled in three stages:

- Green Status – The operations of loading/unloading will be carried out as planned.
- Yellow Status – This is an alert stage indicating possibility of rough weather. Still operations can be continued with all emergency precautions
- Red Status – Emergency situations or rough weather; operation will be suspended.

Activities controlled by in-charge of emergency operations. The vessel/tanker is to be moved to safe anchorage or will be advised to proceed to sea.

The main components of the DMP for cyclones will include the following:

- Pre-Disaster (or Pre-Cyclone/Flood) Plan
- On (or During Cyclone/Flood) Disaster Plan
- Post (or After Cyclone/Flood) Disaster Plan

Pre-Cyclone/Flood Plan

Pre-Cyclone Measures: Barge/ vessel loading facility will maintain and exchange information continuously with the local IMD authorities at Honnavar, Uttar Kanada district for continuous updates of meteorological conditions in general and emerging/predicted weather phenomenon such as cyclones and prolonged or intensive rainfall in particular. Upon issue of a cyclone/flood warning by the IMD, the management would immediately initiate the Pre-Cyclone/flood Measures. The Department of Ports and District Collector of Uttar Kanada would be informed of the imminent cyclone. All barge/vessel loading facility officials dealing with operations and disaster management will be informed.

Pre-Cyclone/flood Exercise: On signalling of a cyclone alert, the Control Room will be manned 24 hours a day for disaster management. The 'Weather Signals' depending on the data available about the cyclone/intensive rainfall and flow details Sharavati/Badgani and its threat perception will be informed to all personnel. The marine side operations will be regulated as per the rough-weather classification and will be continued with all emergency precautions. The different personnel of Barge/ vessel loading facility would assume their roles and responsibilities as previously identified for disaster management. The standby arrangement for power supply will be checked. Pre-identified 'Rescue Centres' will be kept ready. A pre-alert will be issued regarding suspension of all operations in case of emergency and to await instructions regarding the same. All Port Crafts and barges/vessels will be fully secured inside the harbour area. Communication system including standby arrangement will be tested for working condition. Vehicles involved in rescue operations will be checked for working condition. Port crafts to be engaged in rescue will be kept in readiness. The safety in the project area will be ensured.

The following Flood warning messages will also be given:

- Flood Alert – Flooding is possible
- Flood Warning – Flooding of homes, businesses and main roads is expected
- Severe Flood Warning – Severe flooding may cause Imminent danger
- All Clear – No Flood Alerts or Warnings are in force

When a flood warning message is received, an Emergency team In-charge shall alert relevant agencies. The following advice shall be given to the Public:

- Flood warning: 'GO IN, STAY IN, TUNE IN'
- Stay calm
- Ensure that neighbours know of the warning, and be prepared to help them
- Monitor local radio
- Make a flood kit: medications, warm clothing, sealed food, blankets, matches, candles, flashlights, portable radio, spare batteries, rubber gloves, personal documents

During Cyclone/Flood Plan: The emergency alarm siren will be raised as per the 'Alarm System'. All personnel will be evacuated except essential operational personnel and personnel dealing with disaster management. The cargo handling operations will be suspended. The vessel will be moved to safe anchorage or will be advised to proceed to sea. Power supply will be disconnected and alternative power supply will be restored in essential operational areas. Port Crafts and Tugs will continue to be in readiness for rescue.

Depending upon the scale of potential flooding, the following steps shall be taken:

- Care of evacuated, hurt or homeless people
- Protecting of utilities
- Availability of transport
- Flood alleviation e.g. clearing blocked culverts and drains
- Providing emergency health advice
- Providing road barriers and signs
- Coordinating emergency support

Post Cyclone/Flood Plan: This would be the rescue and rehabilitation stage after passing of the cyclone/flood. The damages would be assessed and rehabilitation work initiated to restore operations at the earliest. The records of the events during the cyclone/flood will be maintained and reviewed for possible enhancements to the DMP.

7.3.4 Recommendations for Implementation of Off-site Emergency Plan

- Emergency control centre will be the focal point to co-ordinate emergency activities. Emergency control centre would be equipped with adequate number of equipment mentioned under heading “Emergency Control Centre”.
- Succession or second-line controllers would be named for assuming responsibilities in case disaster occurs in absence of principal co-ordinators.
- Hot line would be provided between Barge/ vessel loading facility and Fire Brigade at Honnavar/karwar
- HPPL would make arrangement for coded siren system or through some other suitable means to alert people in surrounding areas in case of off-site crisis.

A summarised version of action procedures detailing the “Role of Essential Staff in Major Emergency” would be issued in a flip chart like booklet form to all concerned persons (officers and supervisors) at work places and also to senior officers of the civic administration.

7.3.5 Conclusion

The broad Disaster Management Plan is prepared in conjunction with and taking into consideration all technical reviews and suggestions as per acceptable norms. These details shall be considered as guidelines to Disaster Management Plan based on detailed risk analysis which will be prepared by project proponent.

7.4 Dredge Material Utilization & Disposal Plan

The capital dredging quantity will be 3.9 MCM during the construction stage. Reclamation will be carried out in the back up area 1.0 MCM of dredged spoil material is proposed to utilise for reclamation and remaining will be dumped back in to the sea at designated dumping location. The total maintenance dredging quantity is estimated to be around 10,300 m^3/hr, which will be disposed at the designated disposal site.

7.5 Social Impact Assessment

7.5.1 Social Impacts during Construction Phase

7.5.1.1 Land Acquisition

HPPL has been allotted to use the government land of 44 hectares by Government of Karnataka near Sharavati river mouth in Kasarkod Tonka village to develop a barge/vessel loading facility. There are no land acquisition and encroachers involved.

7.5.1.2 Impact on Nearby Settlements

The impact on nearby settlements during construction phase will be due to air pollution and the noise generating activities. However, the activities are limited to the construction phase and will cease upon completion of the construction. Hence, this impact is considered to be negligible and therefore can be classified as insignificant.

The dust suppression measures such as sprinkling of water and suitable enclosures around the high noise generating areas within construction area will be provided.

The noise generating equipment will be provided with suitable enclosures such that cumulative noise will be within permissible limits.

7.5.1.3 Fishing Activity

The construction activities involve dredging, construction of cargo berths which may likely impact the fishing activity at nearby fishing villages. There are no major fishing zones in the study area. The fish landing centres and fishing settlements in the study area are at Honnavar, 1.0 km SE and Manki, 11 km S.

However, necessary marker buoys shall be installed and interactions shall be initiated with the fishing community about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period. Hence, minimal hindrance to fishing activity is anticipated during construction phase of the proposed barge/vessel loading facility.

7.5.1.4 Employment Potential

The employment potential from the construction phase of the proposed port is estimated as 500 persons.

7.5.2 Social Impacts during Operational Phase

7.5.2.1 Fishing Activity

During operation phase, barges/vessels movement may hinder the fishing vessels approach to the fish landing wharf and to the sea. Awareness will be given to fisherman about the barge/vessel movement's time schedule and clearances required for safe manoeuvring etc., during berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.

Necessary marker buoys shall be installed and interactions shall be initiated with the fishing community about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period.

7.5.2.2 Employment Potential

The expected direct employment will be 50 persons. The proposed project is likely to have positive impact on socio-economic condition of the region overall.

7.5.2.3 Public Health and Safety

The proposed Barge/ Vessel loading facility handles coal and other cargos which can be classified as non-hazardous. However exposure to coal dust is likely to have minimum impacts on public health and safety. However suitable safety procedures will be followed by HPPL during handling and transportation of cargo.

An effective Disaster Management Plan (DMP) which includes Onsite and Offsite emergency plan will be prepared and followed to minimize the probability of occurrence of emergency situations and mitigate the impacts.

7.6 Corporate Social Responsibility

As a part of Corporate Social Responsibility (CSR), HPPL proposed to take up following activities for improving the way of living of people of Kasarkod Tonka, Apsarkonda and other nearby villages.

- Providing better health services
- Providing better educational facilities for children of employees
- Creating job opportunities
- Facilitate self-employment through training and credit linkage
- Outsourcing opportunities to Self Help Groups (SHG)
- Providing protected water supply system to Kasarkod Tonka and Apsarkonda villages.
- Strengthening area Government hospitals by assisting them in procurement of essential medical equipments.
- Providing quality health care through regular medical camps.

7.6.1 Education Facilities

Basic education facilities for the children of the employees will be provided.

7.6.2 Budgetary Allocation for CSR Activities

7.6.2.1 Treated Drinking Water

Kasarkod Tonka and Apsarkonda are the villages identified for regular treated drinking water provision. The cost for implementing the same is estimated as below.

S. No.	Particulars	Amount (` Lakhs)
1	Reverse Osmosis plant (2 units)	40
	Total	**40**

7.6.2.2 Budgetary Provision for Educational Facilities

There are two (2) Schools nearby barge/ vessel loading facility area.

S. No.	Particulars	Amount (` Lakhs)
1	Adoption of two Schools	12
2	Building & Furniture	6
3	Library Facility	5
4	Science Library Facility (2 Schools)	5
5	Sanitary & Water Supply	2
6	Electricity Facility	2
7	Sports Equipment Facility	2
8	Miscellaneous & Contingency	1
	Total	**35**

Chapter 8
Project Benefits

8 Project Benefits

8.1 Introduction

Liberalization of the Indian economy has led to significant growth and India is fast emerging as one of the largest economies of the world. This growth will provide a major thrust to trade. About 95% by volume and 70% by value of Indian exports are channelled through maritime Route. Foreign Trade Policy envisages doubling of Indian share in the global market. Hence, there is an immediate necessity to augment the Indian infrastructure by expanding or creating new Ports. Since, existing ports are saturated or congested and have limited scope for expansion there is a great need for development of green-field ports along East and West coasts. Based on the growing demand/export potential in the state, the Government of Karnataka also has estimated that Karnataka coast would need more seaports/barge/vessel loading facility along Coast. Bellary district in Karnataka is blessed with many industrial projects that makes it second fastest growing city in the state .Out of the ports of the state, NMPT, the major port currently caters to the cargo requirements in the southern districts of the state and is operating at 89% capacity (in 2008 – 2009). Cargos such as granite, fertilizer, molasses, iron ore, wood logs, coal with other agro products and steel products also has the potential to grow in demand and supply which will increase the traffic. The capacity at the port is not adequate to cater to the demand of this region. This will increase the traffic across the proposed Barge/ Vessel loading facility.

About 27% of the power demand of Karnataka is met by that generated from coal based power plants. JSW Energy Limited (JSWEL) has commissioned coal based thermal power plant in Karnataka. JSWEL is also proposing to develop another unit of 600 MW in Bellary. Two coastal coal based thermal power plants are also proposed to be set up with capacities of 1015 MW and 4000 MW in Tadri and Mangalore respectively. The demand supply gap of coal is expected to increase in the coming years. The development of Barge/ Vessel loading facility will meet the capacity requirements of the region and Karnataka State and in turn is expected to boost the economy of State

8.2 Infrastructure Facilities

The following infrastructure facilities will be developed; Good road and rail connectivity is an essential requirement for the efficient functioning of any port. As far as Honnavar Barge/ Vessel facility is concerned, the main commodities being handled are coal, iron ore, fertilizer, and edible oil. Hence good road and rail connectivity plays a vital role in the successful functioning of Honnavar Barge/ Vessel loading facility.

8.2.1 Rail Connectivity

The nearest railway station is Honnavar Railway station which is on the Konkan stretch connecting Kerala to Mumbai. The railway station is at about 5 km from the present Honnavar barge/vessel loading facility.

The proposed railway line will take off from the existing railway station at Manki. The new railway line will have to be laid for a distance of 14.6 km from Manki railway station to the proposed port. The new railway line will run parallel to existing railway line for a length of

about 8 km and then will take a turn towards sea coast which will then run parallel to the sea coast till the proposed barge/vessel loading facility for the remaining 6.6 km.

8.2.2 Road Connectivity

The site has good road connectivity. The Honnavar fishing harbour is about 1 km off NH 17. The site is connected to Bellary through NH 63 and NH 17. NH 17 meets NH 63 at Ankola at about 45 km from the site. There are also alternate routes through Kumta which is about 30 km from the site.

The proposed road starts from NH 17 at Kasarkod. This road will then run south east for some distance and then aligns parallel to the shoreline till it reaches the proposed port. This option will lie parallel to the existing single lane road at an offset distance of 100 m. The total length of this road from NH17 to the proposed berth is 4 km. This road connectivity will have a width of 25 m.

8.3 Induced development

Apart from the surrounding region, the adjoining states would also benefit a lot because of the proposed development of Honnavar Barge/ Vessel loading facility. The benefits may be realised with the upcoming of industries such as steel plants, thermal power plants and their allied ancillary units. Other benefits would be generation/providing of either direct or indirect employment to the local people. With the new connectivity through rail and road, there will be a facility to improve the trading, marketing and as well as value addition of local products. The proposed connectivity will also serve to the tourist places nearby thereby improving employment to the local people. The development of Honnavar Barge/ Vessel loading facility will be a boon for the development of the region.

8.4 Improved Socio-economic Conditions

The proposed project is likely to have a positive impact on the socio economic conditions of the region. The social infrastructure in the region is likely to change due to the creation of more job opportunities and avenues for income generation. People will have higher income due to direct employment as well as indirect employment and will have higher earning and buying capacities.

8.4.1 Quality of Life

The quality of life in the region is likely to improve due to the creation of jobs for the local people so that the dependency changes and there will be more than one earning member in the family, which will provide economic freedom.

8.4.2 Health

As part of the CSR, it will also be proposed to conduct periodic health camps and carryout health campaigns which will lead to better health conditions of the local people. As a part of CSR, procurement of essential medical equipment.

8.4.3 Educational Facilities

HPPL is planning to undertake the following activities in the project region as part of Corporate Social Responsibility (CSR):

- Basic education facilities for the children of the employees will be provided
- Strengthen the primary schools with teaching aids and student education material
- Strengthen the upper primary and high schools with teaching aids, mobile laboratory and computer education
- Initiatives for reducing school dropouts Funds for setting up of Libraries

8.5 Corporate Social Responsibility (CSR)

HPPL is planning the following in the project region as part of Corporate Social Responsibility (CSR):

- Providing better health services
- Providing better educational facilities for children of employees
- Creating job opportunities
- Facilitate self-employment through training and credit linkage
- Outsourcing opportunities to Self Help Groups (SHG)
- Providing protected water supply system to Kasarkod Tonka and Apsarkonda villages.
- Strengthening area Government hospitals by assisting them in procurement of essential medical equipments.
- Providing quality health care through regular medical camps.

8.6 Employment Opportunities

The proposed project will provide direct as well as indirect employment to the locals.

There will be a huge demand for skilled, semi skilled and unskilled work force during the construction and operational phase of the port and it is imperative that mostly local people would be employed based on their skills and educational qualifications. The employment potential from the construction phase of the proposed Barge/ Vessel loading facility is estimated as 500 persons (approximately). The expected direct employment during operation phase will be 50 people. The proposed project is likely to have positive impact on socio-economic condition of the region overall. Indirect employment will be generated due to overall improvement of socio-economic growth of the project region.

Chapter 9
Environmental Cost Benefit Analysis

9 Environmental Cost Benefit Analysis

As per "***EIA Guidance Manual for Ports and Harbours***" released by MoEF in February 2010, Environmental Cost Benefit Analysis of the project needs to be included as a part of EIA Study if recommended by Expert Appraisal Committee at the scoping stage.

Honnavar Port Private Limited (HPPL) submitted the Form-1, Draft ToR and Prefeasibility Report for consideration by the Karnataka State level expert appraisal committee (KSEAC) meeting held on August 20, 2011 at Bangalore to determine the Terms of Reference (ToR) for undertaking detailed EIA study for obtaining environmental clearance in accordance with the provisions of the EIA Notification, 2006 (as amended) and CRZ notification, 2011 has not mentioned on an Environmental Cost Benefit Analysis.

Therefore, KSE EAC approved the ToR vide letter No: SEIAA 22 IND 2011 of September 13, 2011and Environmental Cost Benefit Analysis of the project is not recommended by the State appraisal committee. A copy of the letter is enclosed as **Appendix A** for reference.

Chapter 10
Environmental Management Plan

10 Environmental Management Plan

A generic Environmental Management plan (EMP) is provided in this Chapter. This gives the project proponent the broad general guide lines (Framework) for managing the Environmental aspects of the project during pre construction, construction and operational stages of the project.

The main objectives of Environmental Management are to:

- Ensure the mitigation measures are implemented
- Establish systems and procedures for implementing mitigation measures
- Monitor the effectiveness of mitigation measures
- Take necessary prompt action when unforeseen impacts occur

10.1 Components of EMP

The environmental impact mitigation and avoidance measures for each likely impact on the prevailing environment have been discussed in detail at the respective sections in **Chapter 5**. The Environmental Monitoring Programme has been discussed in **Chapter 6**.Various project activities, associated impacts and mitigation measures are summarised in Table 10-1.

Table 10-1: Project Activities, Associated Impacts and Mitigation Measures

S. No.	Activity	Relevant Environmental components likely to impacted	Proposed Mitigation Measures
Construction Phase			
1.	Capital dredging and reclamation	Marine water quality	– Check turbidity levels with baseline levels as reference during entire monitoring programme – Dredge Management Programme will be prepared and implemented, – Ensure that slop tanks will be provided to barges/ Vessel / workboats for collection of liquid/ solid waste – Discharge of waste into sea will be prohibited – Oil Spill control measures will be adopted – Marine environmental monitoring as per environmental monitoring programme – Dredge Spoil Disposal at the identified disposal site
		Marine ecology	
		Changes in Sea Bed Profile	– Provision of rip-rap structures, side screens while laying piles – Post construction/ implementation survey of pile positioning is suggested
		Mangrove area	– Mangroves are located at 2.7 km (approx) inside the river Sharavati River towards South East of the proposed barge/vessel loading facility port and no significant impacts are expected.
2	Material transport and construction activities	Air Quality	– To reduce impacts from exhausts, emission control norms will be enforced / adhered. – All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards – Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt – Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc – Provide enclosures on all sides of construction site – Movement of material will be mostly during non-peak hours. – On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic – Water sprinkling will be carried out to suppress fugitive dust – Environmental awareness program will be provided to the personnel involved in developmental works
		Noise	– Noise levels will be maintained below threshold levels stipulated by Central/State Pollution Control Board (CPCB)/KSPCB

S. No.	Activity	Relevant Environmental components likely to impacted	Proposed Mitigation Measures
			– Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A) – Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used – Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors – Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers – High noise generating activities such as piling and drilling will be scheduled to daytime to minimise noise impacts – Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. – Ambient noise levels will be monitored at regular intervals
		Disturbance to Natural Drainage pattern	– Adequate storm water drainage system will be provided. if natural drainage disturbed, it will be reinstated
		Vegetation and Strain on existing infrastructure	– Adequate greenbelt will be developed – Temporary workers camp with self sufficient infrastructure.
		Existing Traffic	– New road link will be developed to connect the NH 17 with proposed barge/vessel loading facility site – New rail way link will be developed to connect the Konkan rail way link at Manki station with the barge / vessel loading facility site.
3.	Land Reclamation	Existing Water Resources like Groundwater and surface	– Protective bunds will prevent inundation of sea water to the adjoining land. – Return sea water will be flown back to sea through appropriate channels.

S. No.	Activity	Relevant Environmental components likely to impacted	Proposed Mitigation Measures
		water	
4.	Solid Waste Management	Soil quality	– Construction waste will be used within site for filling of low lying areas. – Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. – Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. – General refuse generated on-site will be collected in waste skips and separated from construction waste. – Burning of refuse at construction sites will be prohibited.
5.	Handling of hazardous wastes	Human safety and property loss	– Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms. – Construction site will be secured by fencing with controlled/limited entry points. – Hazardous wastes will be disposed through approved KSPCB/CPCB vendors. – Medical facilities including first aid will be available for attending to injured workers Occupational Health Construction Equipment and waste. – Handling and storage as per MoEF guidelines Fire protection system.
6.	Fishing	Fishermen and fishing villages	– Signboards will be placed at the construction activities in order to make fishermen aware of the ongoing activities – Necessary marker buoys will be installed – Interactions will be initiated with the fishing community before commencement of construction works
Operation Phase			
1.	Cargo handling and Inland Cargo movement and storage areas	Air Quality	– Use of specialised ship loaders/ Barge /Vessel loaders and Unloaders – Dust suppression measures such as water sprinkling – Scientific and regulated stacking of cargo piles – Cargo unloading through underground wagon tipplers – Regularization of truck movement – Periodic cleaning of cargo spills, – Use of tarpaulin covers and speed regulations for vehicles engaged in transportation – Greenbelt Development
		Noise	– Acoustic Barriers and Enclosures – Personal Protecting Equipment (PPE) – Greenbelt Development – Counselling and traffic regulation

S. No.	Activity	Relevant Environmental components likely to impacted	Proposed Mitigation Measures
2.	Aqueous discharges in harbour basin	Marine water quality and ecology	– Barges / Vessels are prohibited from discharging wastewater, bilge, oil wastes, etc. into the near-shore as well as harbour waters. – Barges/ Vessels would also comply with the MARPOL convention. – As a mitigation measure for spillages an Oil spill contingency plan will be prepared and implemented.
3.	Cargo and Oil spills	Marine water quality and ecology	– In case of any cargo spillage during transfer from/to mother ships, Barges/ Vessels, it will be attempted to recover the spills. – Oil spill control equipment such as booms / barriers will be provided for containment and skimmers will be provided for recovery. – Response time for shutting down the fuelling, containment and recovery will be quicker.
4.	Maintenance dredging	Marine water quality Marine Ecology	– It will be ensured that the dumping of the maintenance dredge spoil would be uniform. – Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of dredging and will be carried out during the dredging period.
5.	Water Supply	Water resources	– The water requirement will be met from Karnataka Rural water supply and sanitation agency which includes supply to Barge/vessels, staff and users. In addition to that water required for dust suppression system and fire fighting will be sourced from Sharavati River.
6.	Wastewater Discharge	Water Quality	– Collection of runoff from stock piles and directing into settling ponds – Neutralization using lime to ensure settlement of heavy metals, if any
7.	Solid Waste Management	Groundwater and Soil quality	– Composted bio-degradable waste will be used as manure in greenbelt. – Other recyclable wastes will be sold.

S. No.	Activity	Relevant Environmental components likely to impacted	Proposed Mitigation Measures
8.	Handling of hazardous wastes	Fire accidents due to products handling	– Hazardous materials will be stored as per the prescribed/approved safety norms. – Construction site will be secured by fencing with controlled/limited entry points. – Hazardous wastes (used oil & used battery) will be sent to KSPCB/CPCB approved recyclers. – Medical facilities including first aid will be available for attending to injured workers – Emergency alarms, provision of fire hydrant system and fire station. – Effective Disaster Management Plan (DMP) which covers onsite and offsite emergency plans. – Recovery of spills to the extent possible.
9.	Fishing activity	Fishermen livelihood	– Educating the fishermen about the orientation of approach channel – Regular Interactions will be initiated with the fishing community – Conflicts if any with fishing community will be amicably resolved in all cases
10.	Operation of Barge/Vessel loading facility	Socio-economic conditions of the region	During construction phase, the employment potential is estimated at about 500 persons. During operational phase, the Barge/ Vessel loading facility is likely to generate employment for 500 persons. Local people will be given preference based on their qualification and skill set. Together with this employment potential, project will help to enhance the socio economic conditions of the area with better schooling, communication and transport facilities that will be developed/ triggered as a part of overall economic development of the region.
		Natural Hazards	Disaster Management Plan (DMP) will be prepared; Manager (EHS) will act as the overall in-charge of the control of educative, protective and rehabilitation activities to ensure least damage to life and property.
		Induced Development	Offers an efficient and cost effective supply chain/ value proposition to the local importers and exporters in states of Karnataka, Goa and Andhra Pradesh.

10.1.1 Administrative and Technical Setup for Environmental Management

A Highly qualified and experienced person in the field of Environmental Management of barge/vessel loading facility shall be considered for the position of Senior Manager for Environmental management along with adequate supervisory staff.

10.1.2 Institutional Framework of EMP

The proposed organization of all personnel involved in the EMP process is depicted in Figure 10-1. The roles and responsibilities of the various parties involved in the EMP process are summarized below.

Project Proponent: Honnavar Port Private Limited, Environmental Management Cell.

Project Design, Construct and Operate: Contractor employed by the Project Proponent to carry out design, construction and operate the Barge/ vessel loading facility.

Environmental Management Team (EMT): The EMT will be responsible for implementing all environmental measures and EMP requirements recommended in the EIA Report throughout the construction, operation, restoration, aftercare of the barge/vessel loading facility and report to the barge/vessel loading facility Contractor on all environmental aspects of the Project. The EMT can be a separate consultant employed by the barge/vessel loading facility Contractor or the Contractor's in house environmental specialists.

Independent Consultant (IC): The IC will be appointed by the Project Proponent to provide an independent review and certification of the design, construction, operation, restoration and aftercare of the port.

Independent Environmental Checker (IEC): The IEC will be appointed by the Project Proponent as part of the IC to provide independent monitoring and audit to verify the overall environmental performance of the project and to assess the effectiveness of the ET in their duties. An IEC will be responsible to certify all environmental submissions to the Environmental Protection Division (EPD).

Environmental Protection Division (EPD): The Project EPD will be the authority to approve all submissions under The Environmental Impact Assessment Ordinance (EIAO) Authority.