

BEFORE THE NATIONAL GREEN TRIBUNAL

WESTERN ZONE, PUNE

APPEAL NO. 32/2022

SUVARN RAJARAM BANDEKAR ...APPELLANT

VERSUS

STATE OF GOA & OTHERS ...RESPONDENTS

**AFFIDAVIT-IN-REPLY ON BEHALF OF THE**

**RESPONDENT NO. 2 GCZMA**

I, DR. SNEHA S. GITTE (IAS), Member Secretary of the Goa Coastal Zone Management Authority, having my office at Dempo Towers, 4<sup>th</sup> Floor, Patto, Panaji, Goa, do hereby solemnly affirm and state as under:

1. I say that I am the Member Secretary of the Respondent No. 2 GCZMA. I have examined the records available in my office in respect of the above-captioned Appeal, and am, as such capable of affirming the present Affidavit-in-Reply on behalf of the Respondent No. 2 GCZMA. Nothing in the present Affidavit-in-Reply may be deemed to be an admission of the contentions raised in the

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memorandum of the above-captioned Appeal. Nothing in the memorandum of the above-captioned Appeal may be deemed to have been admitted for mere want of traverse seriatim.

2. I say that the Appellant has filed the above-captioned Appeal challenging the Order dated 01.07.2022 bearing No. GCZMA/SAL/SERNA/12-13/01/712 [hereinafter referred to as the *impugned order* for the sake of brevity and convenience] passed by the Respondent No. 2 GCZMA. By the impugned order, the answering Respondent rejected the application/representation filed by the Appellant above-named.
3. The Appellant had filed Original Application No. 23/2013 (subsequently renumbered as O.A. No. 480/2018 before this Hon'ble Tribunal *inter alia* seeking restitution of damaged sand dunes and removal of structures belonging to the Respondents No. 3(a) to 3(h) in property bearing survey no. 16/7 of Village Sernabatim, Taluka Salcete, District South Goa [hereinafter referred to as "*the property*" for the sake of brevity and convenience].

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4. During the pendency of the aforementioned O.A., the answering Respondent issued demolition order dated 05.12.2014 *inter alia* directing the private Respondents to demolish the compound wall on all three sides of the property along with two gates, internal compound wall/partitions, two water wells, three structures consisting of rooms (Sunni Cottages) marked by the Inquiry Committee as C, C1, and C2, storage tank, toilet w.c.m store room, and pump house located in the property, and restore the land to its original condition. The aforesaid demolition order was challenged by the private Respondents before this Hon'ble Tribunal *vide* Appeal No. 39/2013 (subsequently renumbered as Appeal No. 126/2018) and Appeal No. 43/2014 (subsequently renumbered as Appeal No. 128/2018).

5. On 13.12.2018, the Appellant sought to withdraw his aforementioned O.A. This Hon'ble Tribunal by its order dated 13.12.2018 in O.A. No. 23/2013 permitted the Appellant to withdraw the aforementioned O.A. by observing as under:

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*“...after making submission for some time, the learned counsel for the applicant submits that he may be permitted to withdraw this original application with liberty to seek redress before the appropriate forum. Consequently, the original application (480/2018) is dismissed as withdrawn.”*

A true copy of the order dated 13.12.2018 in O.A. No. 23/2013 is annexed and is marked as **ANNEXURE R - 1**



6. On 20.12.2018, this Hon'ble Tribunal allowed the private Respondents' aforementioned Appeals against the order of demolition dated 05.12.2014. This Hon'ble Tribunal remanded the matter back to the answering Respondent to reconsider the same and pass a reasoned order after hearing both the parties. Accordingly, the matter arising out of the aforementioned demolition order stood remanded to the answering Respondent.

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7. The Appellant filed an Application dated 14.01.2019 before the answering Respondent *inter alia* seeking the following prayers:

“(i) *Recover the cost of removal of illegal new road carried out on 14.06.2012 in terms of the orders dated 24.08.2011 and 24.05.2012 of this Hon'ble Authority from the legal heirs of Late Mr. Armando Cardozo as mentioned at Exhibit H.*

(ii) *Issue Directions towards the Execution of the Order dated 24.05.2012 issued by this Hon'ble Authority regarding restoration of land under Survey No. 16/4-A to its original conditions expeditiously considering the fact that it has been pending from the year 2012 i.e. 6 years to avoid further damage/environmental degradation of my clients property as the issue was at large bore the Hon'ble National Green Tribunal as stated herein above.*

*Attor*

(iii) *Recover the cost of restoration of the land to its original condition from the legal heirs of Late Mr. Armando Cardozo.*"(sic)

8. The answering Respondent finally discussed and deliberated upon the aforementioned issue in its 308<sup>th</sup> meeting held on 09.06.2022. It was observed that this Hon'ble Tribunal had only remanded the matters relating to the demolition order dated 05.12.2014 back to the Authority for fresh consideration. As far as the Appellant's O.A. is concerned, it was never specifically remanded by the Hon'ble Principal Bench of this Hon'ble Tribunal for reconsideration of the answering Respondent. Furthermore, the Hon'ble Principal Bench of this Hon'ble Tribunal had made no specific observations in its Order dated 13.12.2018 in O.A. No. 23/2013 about remand of the said matter.

9. Without prejudice to the aforesaid, the answering Respondent had sought reports from time to time from its own Expert Members, and the Goa State Biodiversity

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Board, Saligao [hereinafter referred to as “**GSBB**” for the sake of brevity and convenience]. The first report was prepared by a Team of Expert Members of the GCZMA on 17.02.2014. The Expert Member, GCZMA *vide* his report dated 17.02.2014 concluded as follows:

- “1) *This stretch that was dug up can be restored to its original morphology by simply transferring back the dug up sand.*
- 2) *Planting of ipomoea creepers is expected to restore the profile of the dune strip to its original state within 1-2 years, provided the area is not disturbed further.”*

A true copy of the Report dated 17.12.2014 is annexed and is marked as **ANNEXURE R -2**

10. The answering Respondent again solicited reports from the GSBB along with the Expert Member, GCZMA which are instrumental in matters of sand dune restoration as well as other forms of restoration work allotted by the GCZMA. The Expert Member, GCZMA further inspected the site on

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28.10.2020 along with officials of the GSBB. On the basis of the aforesaid inspection, the Expert Member, GCZMA concluded as under:

(i) *It was observed during the site inspection that the entire stretch of road is fully covered with vegetation including bushes and shrubs except a small portion of it being seen free from natural vegetations.*



(ii) *Over the year, since the area was kept fallow and untouched, sand/mud deposition has taken place over which growth of vegetation is seen.*

(iii) *Restoration of sand dune for the demolished road surface at Sernabatim beach is seen happening by a natural process as evidences are seen on the ground that herbaceous growth is taking place. Keeping the undisturbed and free from human intervention except few scientific coastal dune protocols such as planting native*

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*coastal vegetation may in long run facilitate coastal stabilization process.*

(iv) *Hence, it is recommended that the area may be allowed to reclaim naturally as far as possible and by planting native dune vegetations. Any debris or physical barriers created in the area must be removed and facilitate natural recovery of coastal dunes under the scientific guidance and supervision of Goa State Biodiversity Board (GSBB). The cost towards scientific consultancy of GSBB shall be borne by the project proponent.*

(v) *Ecological restoration aims to recreate, initiate, or accelerate the recovery of an ecosystem that has been disturbed. The practice of ecological restoration includes wide scope of project including: erosion control, reforestation, removal of non-native species and weeds, re-vegetation of*

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*disturbed areas, daylighting streams, reintroduction of native species, as well as habitat and range improvement for targeted species etc. In the present case, natural restoration has occurred over a period time since June 2012.” (sic)*



A true copy of the Report of the GSBB and Expert Member prepared pursuant to the site inspection dated 28.10.2020 is annexed and is marked as **ANNEXURE R – 3**

11. The answering Respondent observed that the report of the GSBB clearly recorded that there was natural restoration which has occurred over time. The area and the road were observed to have had consideration vegetation including bushes, shrubs, and sand dune specific vegetation. Furthermore, sand dune specific eco system features were also seen emerging including butterflies and birds. The GSBB *vide* its report specifically observed that the best strategy would be to allow nature to take over and allow the sand dune to restore itself. The said finding was

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seconded by the Expert Member of the GCZMA who noted that the natural process had started at the property. The answering Respondent found considerable merit in the approach and strategy suggested by the GSBB. Thus, the answering Respondent decided to dismiss the application/representation dated 14.01.2019 filed by the Appellant.

12. The answering Respondent submits that the GSBB is established and constituted under the provisions of the Biological Diversity Act, 2002. In terms of Section 22 of the aforesaid Act, the GSBB *inter alia* consists of experts in matter relating to conservation of biological diversity, sustainable use of biological resources, and equitable sharing of benefits arising out of the use of biological resources. *Vide* Section 23 of the Act, one of the functions of the GSBB is to advise on matters relating to conservation of biodiversity, sustainable use of its components, and equitable sharing of the benefits arising out of utilization of biological resources. On many occasions, the answering Respondent has sought assistance



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from the GSBB in respect of matters relating to sand dune restoration. The reports submitted by the GSBB have been accepted by this Hon'ble Tribunal as well. Thus, even in the present case, there is no reason whatsoever to question the aforementioned reports of the GSBB.

13. This Hon'ble Tribunal *vide* its order dated 29.08.2022 was pleased to constitute a Committee consisting of one member of the National Center for Sustainable Coastal Management, Chennai (NCSCM), and one member of the answering Respondent i.e. the GCZMA to visit the site and submit a factual and action taken report. In terms of the directions of this Hon'ble Tribunal, the Committee conducted a site inspection on 19.10.2022 and submitted its report to this Hon'ble Tribunal. The relevant portion of the Report of the Committee constituted by this Hon'ble Tribunal is as under:

*“Natural restitution is not possible due to the presence of the existing unmetalled/mud road very adjacent to the area under restitution because of the lack of sediment supply from*



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*beach face naturally by wind.*

*To recover the natural sand dune associated environment, and morphology which were present earlier, the following steps need to be taken which may be a long-term process.*

- 1) *Removal of existing remnants of debris and refilling with sand*
- 2) *Planting of sand dune stabilization plants such as Spinifex sericeus, Saccharum spontaneu, Ipomoea Pes-caprae, Physalis minima, etc.*
- 3) *Protecting the area from anthropogenic activity.*

*The above procedure only substantiates the sand dune environment. A map showing the site along with existing mud road in front of the area of restitution with field photographs is enclosed for reference as Fig. 2."*

14. The answering Respondent submits that in view of the reports submitted to it by GSBB it is clear that the natural

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process of restoration has already begun and the same may be allowed to be completed with minimum interference. Notwithstanding the aforesaid, if this Hon'ble Tribunal is inclined to direct the answering respondent to undertake the work of restitution/restoration of the damaged sand dunes on the property in a scientific manner, directions may be issued to the Respondents No. 3 (a) to (h) to deposit and pay the answering Respondent the cost of undertaking the work for restitution/restoration of damaged properties.

15. At this stage the answering Respondent refrains from filing a paragraph wise response to the memorandum of appeal filed by the Appellant above-named. Nothing in the present Affidavit-in-Reply may be deemed to be an admission of the contents of the memorandum of Appeal, unless the same is specifically admitted herein. Nothing in the memorandum of Appeal may be deemed to have been admitted for mere want of traverse seriatim.

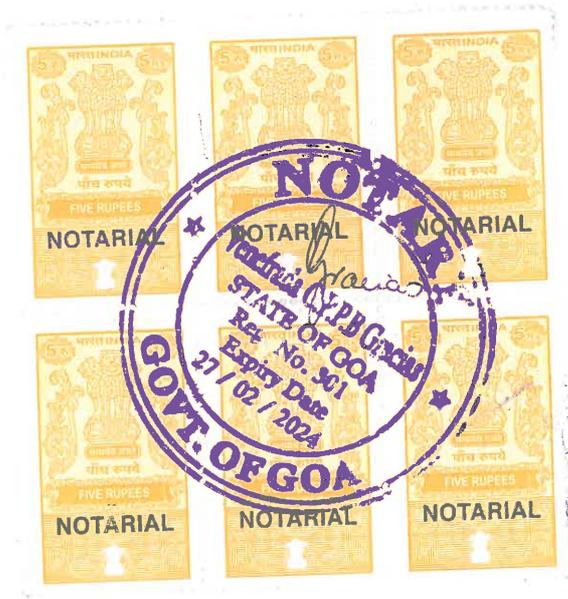
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16. In view of the aforesaid, the answering Respondent submits that above-captioned Appeal be dismissed.

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DR. SNEHA S. GITTE (IAS),  
MEMBER SECRETARY (GCZMA)  
DEPONENT



Solemnly affirmed before me  
Dr Sneha S. Gitte (IAS)  
Who is identified before me by

\_\_\_\_\_ At Panjim - Goa

Sr No. 288/05/2023/P

Date. 06/05/2023

*Gracias*  
Venefrada C.P.P.B Gracias  
Advocate & Notary Goa State

Item No. 06 (Through VC)

Court No. 2

BEFORE THE NATIONAL GREEN TRIBUNAL  
PRINCIPAL BENCH, NEW DELHI

Original Application No. 480 of 2018  
(Earlier O.A. No. 23/2013(WZ))

Suvarn Rajaram Bandekar

Applicant(s)

Versus

State of Goa & Ors.

Respondent(s)

Date of hearing: 13.12.2018

**CORAM :**

**HON'BLE MR. JUSTICE RAGHUVENDRA S. RATHORE, JUDICIAL MEMBER**  
**HON'BLE MR. JUSTICE K. RAMAKRISHNAN, JUDICIAL MEMBER**  
**HON'BLE DR. SATYAWAN SINGH GARBYAL, EXPERT MEMBER**

For Applicant(s)

Mr. N. Caze, Mr. Shailesh with  
Ms. M. Joshi, Advocates

For Respondent(s)

Ms. Fawia Mesquita and Ms.  
Prachi Sawant, Advocates for  
R-1 & 2

**ORDER**

After making submission for some time, the Learned Counsel for the applicant submits that he may be permitted to withdraw this original application with liberty to seek redress before the appropriate forum.

Consequently, the original application (480/2018) is dismissed as withdrawn.

Raghuvendra S. Rathore, JM

K. Ramakrishnan, JM

Dr. Satyawan Singh Garbyal, EM

December 13, 2018.(JG)

Inspection Report on site visit at Sernabatim at 16.30 Hrs  
on 17/2/2014.

Expert Members: Mr. Raghunath Dhume

(GCZMA) Dr. Antonio Mascarenhas

Present inspection is being conducted in terms of direction of the Hon'ble National Green Tribunal(WZ) as contained in order dated 15/1/2014 passed in application no.23/2013,wherein the GCZMA has been directed to examine the issue regarding existence of "Sand dune" as alleged in the application and if so , may also place on record relevant material pertaining to the same, in order to fix the liability for restoration, compensation etc.

The application no: 23/2013 has been perused and in this regard an inspection of property bearing survey no.16/4 and 16/4A

Whether the site has dunes: **Yes, the site is a dune field.**

Observations

1. The coastal strip consists of around 40 m wide beach (17/02/2014, 16.30 hrs), backed by sand dunes.
2. Sand dunes are around 2.5 m high from the beach level and vegetated with luxuriant ipomoea creepers all along the frontal dune face.
3. The upper part of the dune is thickly populated by low bushes; further inland the dune field is undulating in nature and with sparse vegetation. At several places, coconut trees (1-2 year old) are planted.

*Raghunath Dhume*  
17/2/2014 17/2/2014

4. As seen from the beach, the frontal dune is damaged at three places; vegetation is uprooted.
5. A tarred access road to Sernabatim beach ends at this site, perpendicular to the frontal dune
6. A 2.5 mts wide mud road exists parallel to the dune line; the road is about 5 mts from the frontal dune. The excavation is of 0.50 mts deep and 21 long and 5 mts
7. It appears some digging/excavation has taken place about 8 mts parallel to the above 2.5 mts wide road.
8. This human activity has resulted in remobilisation of sand; the impact is however negligible.

#### Conclusions

1. This stretch that was dug up can be restored to its original morphology by simply transferring back the dug up sand.
2. Planting of ipomoea creepers is expected to restore the profile of the dune strip to its original state within 1-2 years, provided the area is not disturbed further.

*R. M. Dhume*  
Mr. Raghunath Dhume 17/2/20

*Antonio Mascarenhas*  
17/2/2014  
Dr. Antonio Mascarenhas

Dated 17/2/2014

**STATUS REPORT PREPARED IN COMPLIANCE OF ORDER DATED 29/08/2022 PASSED BY HON'BLE NGT, WESTERN ZONE BENCH, PUNE IN APPEAL BEARING NO.32/2022(WZ) AND TO ASCERTAIN THE POSITION OF THE SPOT AS TO WHETHER RESTITUTION HAS ALREADY TAKEN PLACE NATURALLY OR NOT - APPELLANT MR. SUVARN RAJARAM BANDEKAR**

## 1.0 Background

In the appeal No. 32/2022, the order dated 01.07.2022 has been challenged whereby application/representation made by the Appellant, seeking restoration of the Survey Nos. 16/4 and 16/4A of Village Sernabatim, district South Goa has been rejected, where earlier a road had been constructed on sand dune which is said to have been demolished by order dated 24.08.2011 passed by the Goa Coastal Zone Management Authority (GCZMA) and the same remained upheld upto the level of Hon'ble High Court.

The Learned Counsel for the Appellant had moved an application before the Hon'ble National Green Tribunal (WZ) being Original Application No. 480/2018, seeking restoration wherein the Hon'ble NGT had passed order dated 13.12.2018 permitting the Appellant to withdraw the original application with liberty to seek redressal before the appropriate forum.

The Learned Counsel for the Appellant has not annexed the Original Application No. 480/2018 but it has been apprised to the Hon'ble National Green Tribunal (WZ) that in that application it was prayed that the GCZMA be directed to ensure restoration and damages be realized from the Project Proponent of the above-mentioned survey numbers.

Pursuant to the order of the Hon'ble NGT dated 13.12.2018, the Learned Counsel for the Appellant has filed the present Appeal seeking quashing of the impugned order dated 01.07.2022 and direction to Respondent No.3 (a to h) to jointly and severally carry out restitution/restoration of the damaged property of the Appellant and reverse the damage to the environment by reconstructing the damaged sand dune in the above-mentioned survey numbers.

The Hon'ble NGT had made the following observations on the impugned order wherein the representation of the Appellant dated 14.01.2019 has been rejected:-

*"The First such report was prepared by Team of Expert Members of GCZMA which is dated 17.02.2014. The Expert Members GCZMA in the said report dated 17.12.2014 concluded as follows: -*

- 1) *This stretch that was dug up can be restored to its original morphology by simply transferring back the dug-up sand.*
- 2) *Planting of ipomoea creepers is expected to restore the profile of the dune strip to its original state within 1-2 years, provided the area is not disturbed further.*



Dr. Badarees KO (NCSCM)



Shri. Flaviano Jose Miranda



Shri. Devendra Gankar

The order dated 29/08/2022 of the Hon'ble NGT states that GCZMA again solicited reports from the Goa State Biodiversity Board (GSBB), Saligao along with Expert Member GCZMA, which are instrumental in matter of sand dune restoration as well as other forms of restoration work allotted by this Authority. The Expert Member GCZMA further inspected the site on 28.10.2020 along with officials of GSBB. On the basis of report, the Expert Member GCZMA concluded as follows:-

- (i) *It was observation during the site inspection that the entire stretch of road is fully covered with vegetation including bushes and shrubs except a small portion of it being seen free from natural vegetation is seen.*
- (ii) *Over the year, since the area was kept fallow and untouched, sand/mud deposition has taken place over which growth of vegetation is seen.*
- (iii) *Restoration of sand dune for the demolished road surface Sernabatim beach is seen happening by a natural process evidences are seen on the ground that herbaceous growth is taking place. Keeping the undisturbed and free from human intervention except few scientific coastal dune protocols such as platting native coastal vegetation may in long run facilitate coastal stabilization process.*
- (iv) *Hence, it is recommended that the area may be allowed to reclaim naturally as far as possible and by planting native dune vegetations. Any debris or physical barriers created in the area must be removed and facilitate natural recovery of coastal dunes under the scientific guidance and supervision of Goa State Biodiversity Board (GSBB). The cost towards scientific consultancy of GSBB shall be borne by the project proponent.*
- (v) *Ecological restoration aims recreate, initiate, or accelerate the recovery of an ecosystem that has been disturbed. The practice of ecological restoration includes wide scope of projects including: erosion control, reforestation, removal of non-native species and weeds, re-vegetation of disturbed areas, day lighting streams, reintroduction of native species, as well as habitat and range improvement for targeted species etc. in the present case, natural restoration has occurred over a period of time since June, 2012.*

The order dated 29/08/2022 of the Hon'ble NGT states that the Authority observed that in the report of the Goa State Biodiversity Board (GSBB), Saligao it has been clearly observed that there was natural restoration which has occurred over time. It is recorded that the said area and road was seen to have considerable vegetation including bushes, shrubs & sand dune specific vegetation and eco system features were also seen emerging including butterflies and birds and that the Expert Member GCZMA in his report has concurred with above findings of Goa State Biodiversity Board (GSBB), Saligao.



Dr. Badarees KO (NCSCM)



Shri. Flaviano Jose Miranda



Shri. Devendra Gankar

The order dated 29/08/2022 of the Hon'ble NGT further states that Goa State Biodiversity Board (GSBB), Saligao in its report has clearly observed that best strategy would be to allow nature to take over and allow the sand dune to restore itself. The said finding further was seconded by the Expert Member GCZMA who noted that natural process has started at the said site.

The Authority found considerable merit in the approach/strategy of Goa State Biodiversity Board (GSBB), Saligao along with the Expert Member GCZMA, as in the preset matter natural restoration of the sand dune has occurred over time."

The order dated 29/08/2022 of the Hon'ble NGT further states that from the above observation in the impugned order, it is apparent that according to the GCZMA the land stands restored already as it has happened naturally.

The order dated 29/08/2022 of the Hon'ble NGT further states that in view of the above, a committee consisting of the following institution/authority is formed to ascertain the position of the spot as to whether restitution has already taken place naturally.

- (i) One member of National Center for Sustainable Coastal Management, Chennai (NCSCM);
- (ii) One Member of Goa Coastal Zone Management Authority(GCZMA)

Accordingly, a Joint Committee was formed with the following members from NCSCM and GCZMA. Where GCZMA as a nodal agency for coordination.

1. Dr. Badarees KO (Scientist, NCSCM)
2. Shri. Flaviano Jose Miranda (E.M GCZMA)
3. Sri. Devendra Gaonkar (F.S. GCZMA)

The committee conducted the site inspection in the presence of the Appellant and the Respondents/Private Respondents/Complainant, on 29/08/2022 at 11 AM. The details of members present during field visit is given as **Annexure I**.

Dr. Badarees KO (NCSCM)

Shri. Flaviano Jose Miranda

Shri. Devendra Gaonkar

## ANNEXURE I

## GOA COASTAL ZONE MANAGEMENT AUTHORITY

C/o Department of Environment, (Govt. of Goa)  
4<sup>th</sup> Floor, Dempo Tower, Pato Plaza,  
Panaji-Goa 403001

PROCEEDINGS OF SITE INSPECTION

FILE NO:- GCZMA/SHAL/SERNA/12-13/01

DATE: 19/10/2022

SUB: Site Inspection in terms of order dated 29/08/2022  
Passed by Hon'ble National Green Tribunal in Appeal  
No. 32/2022 filed by Mr. Suvarna Bandekar

REF:

Village: Sernabatem Taluka: Salcete Survey: 16 Sub.Div.No. 4 & 4A

Parties/Officers Present:-

- ① Shri. Flaviano Jose Miranda (E.M GCZMA) *[Signature]*
- ② Dr. Badarees K.O. (Scientist NCSCM) *[Signature]* 19/10/2022
- ③ Shri. Devendra Gaonkar (F.S GCZMA) *[Signature]*
- ④ Prof. M.R. Barhan on behalf of appellant
- ⑤ Ad. S. Henriquez on behalf of appellant *[Signature]*
- ⑥ Mr. Jovell Candozo (Respondent) *[Signature]*
- ⑦ Ad. T. Kerkar (Advocate for Suvarna Bandekar) *[Signature]*

Brief description of proceedings:-

Site inspection is commenced at 11:00 am in the presence of above parties/officials. The inspection was carried out as per order in appeal No. 32/2022 (W-2) of Hon'ble National Green Tribunal Bench Zone 1 Pune date of hearing on 29/08/2022. The site inspection is concluded at 12:15 P.M.

*[Signatures]* 19/10/22 *[Signature]* 19/10/22 *[Signature]* 19/10/2022

*[Signature]*

Dr. Badarees KO (NCSCM)

*[Signature]*

Shri. Flaviano Jose Miranda

*[Signature]*

Shri. Devendra Gaonkar

## 2.0 Issues before the Committee

Issues raised as mentioned in Hon'ble NGT order, are as follows:

The Committee is directed to visit the place and submit a factual report on the position of the spot as to whether restitution has already taken place naturally. The Joint committee went into above issues and prepared a report and attached as **Annexure II**.

### ANNEXTURE II

#### 1.0 Location

The project site is situated at Sernabatim Village, Salecete Taluk of South Goa District, Goa, within the Latitude, Longitude of 15°15'51.684"N, 73°55'2.294"E (Fig. 1: Location Map).



Figure 1: Location map

*[Signature]*

Dr. Badares KO (NCSCM)

*[Signature]*

Shri. Flaviano Jose Miranda

*[Signature]*

Shri. Devendra Gankar

## 2.0 Coastal Sand Dunes and formation

The size and morphology of coastal dunes is dependent on the complex interaction between controlling winds, sediment supply, and the geomorphology of the nearshore and beach environment. At the most basic level, dunes can be divided into those that form from the direct supply of sediment from the beach face (primary dunes), and those that form from the subsequent modification of primary dunes (secondary dunes). In the present study area, the coastal dune is very close to shore and is classified as Primary dunes.

### 2.1 Primary Dunes

Davies (1980) defined "primary dunes" as dunes with a sand supply derived primarily from the beach and "impeded primary" dunes as those in which vegetation plays a major role (i.e., impedes downwind transport) in the development of the dune. They are the dunes closest to the shoreline, dynamically linked to beach processes, and significantly influenced by wave action as both a constructional and erosional force.

#### 2.1.1 Foredunes and incipient foredunes

Foredunes develop at the rear of the backshore environments (landward of the active beach) and generally comprise shore-parallel, convex, symmetrical to asymmetrical dune ridges.

Incipient foredunes are the initial dunes which accumulate above the high spring tide mark and form due to the presence of some roughness element at the rear of the beach that rapidly reduces wind flow velocities, resulting in sediment accumulation (Hesp 1999, 2002, Sloss *et al*). The incipient dunes may survive and grow to become a larger established foredune, or become relict and stable as a new incipient foredune develops to seaward (Hesp 1999, 2002).

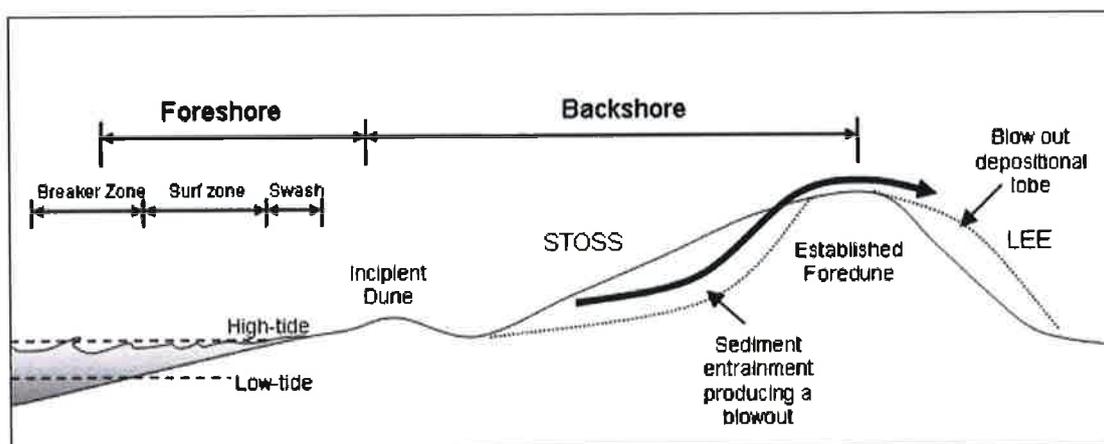


Fig. 2: The beach-dune system showing the nearshore zone back-beach environment and the formation of dunes.

Dr. Badarees KO (NCSCM)

Shri. Flaviano Jose Miranda

Shri. Devendra Gankar

If the sediment supply is adequate, a new incipient dune may form seaward of the established foredune, resulting in the established foredune being relatively isolated from the sediment supply. The isolation of the dune, coupled with coastal progradation, can result in the development of successive foredunes that may eventually form a wide foredune plain.

**3.0 Field Observations:** The following scenarios are observed during the field investigation.

- a) Presence of an unmetalled/mud-road, which is utilising at present, is separated from the foredune under restitution and the beach.
- b) Remnants of debris/mud above the area under restitution
- c) The area under restitution is naturally covered with scrubs and grass.
- d) The presence of an incipient dune or area for sediment supply is about 20 to 25m away from the restitution area which is separated by an unmetalled / mud road.

#### 4.0 Summary and Conclusion

- a) Naturally restitution is not possible due to the presence of the existing unmetalled/mud road very adjacent to the area under restitution because of the lack of sediment supply from the beach face naturally by wind.

To recover the natural sand dune associated environment, and morphology which were present earlier, the following steps need to be taken which may be a long-term process.

- 1) Removal of existing remnants of debris and refilling with sand.
- 2) Planting of sand dune stabilisation plants such as *Spinifex sericeus*, *Saccharum spontaneum*, *Ipomoea pes-caprae*, *Physalis minima*, etc
- 3) Protecting the area from anthropogenic activity.

The above procedure only substantiates the sand dune environment. A map showing the site along with existing mud road in front of the area of restitution with field photographs is enclosed for reference as Fig. 2.



Dr. Badarees KO (NCSCM)



Shri. Flaviano Jose Miranda



Shri. Devendra Gankar

**Fig. 2: Map showing the area of restitution along with existing unmetalled / mud road seaward side of the area of restitution**

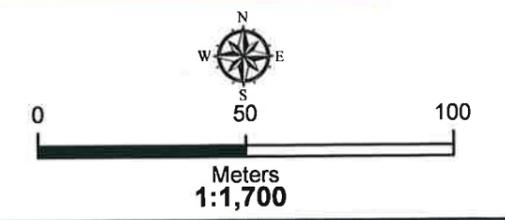
**Existing Remnant Mud Road above the Damaged Sand Dune**



**Towards North - Grass and Scrubs above the Damaged Sand Dune**



**A View from Beach Side**



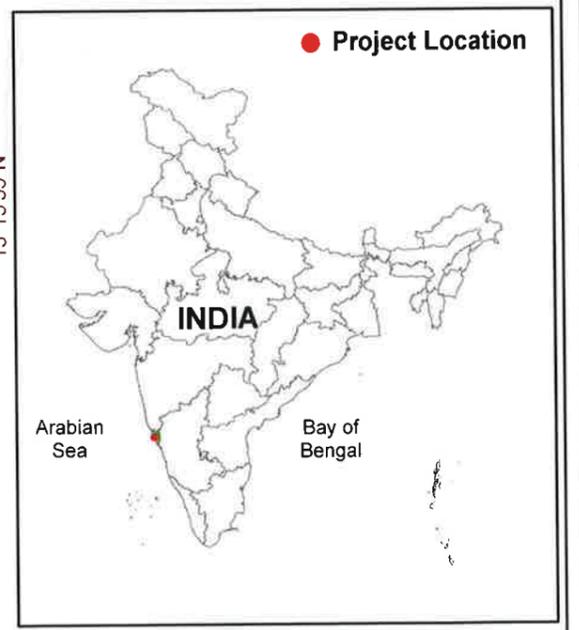
**Legend**

- Road
- Unmetalled Road
- Survey Plot
- Unmetalled Road Constructed above Sand Dune
- Village Boundary
- Taluk Boundary
- Project Site Boundary

**Towards South- Grass and Shrubs above the Damaged Sand Dune**



**Existing Unmetalled/Mud Road West of the Damaged Sand Dune**



**STATUS OF RESTORATION OF SAND DUNES AT PLOT NO 16/4 & 16/4A AT SERNABATIM VILLAGE, SALCETE TALUKA, GOA**

<i>Verified by</i>	<i>Approved by</i>
<p style="text-align: center;"><i>Prepared by</i></p>	
<p><b>National Centre for Sustainable Coastal Management</b> (Ministry of Environment, Forest &amp; Climate Change) Chennai - 25</p>	
<p><i>Prepared for</i></p> <p><b>Goa Coastal Zone Management Authority</b></p>	

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