

BANGALORE METRO RAIL CORPORATION LTD.

PROPOSED COMPENSATORY PLANATION PLAN FOR RAISING 1260 NUMBER OF PLANTS BY BMRCL IN LIEU OF REMOVAL OF 126 NUMBER OF TREES BETWEEN CENTRAL SILK BOARD JUNCTION TO KODIBEESANAHALLI METRO STATION (UP TO PIER NO. 335).



(Ref: OM No. DCF/PR-1125/2022-23 Dated: 19.09.2022)

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PROPOSED COMPENSATORY PLANATION PLAN FOR RAISING 1260 NUMBER OF PLANTS BY BMRCL IN LIEU OF REMOVAL OF 126 NUMBER OF TREES BETWEEN CENTRAL SILK BOARD JUNCTION AND KODIBEESANAHALLI METRO STATION (UP TO PIER NO. 335).

1. Introduction

Bangalore Metro Rail Corporation Ltd is implementing of Metro Rail Project as part of Phase-2A (Package 1) between Central Silk Board and Kodibeesabahalli metro station Bengaluru urban limits.

There are total 129 number of trees standing between Central Silk Board and Kodibeesabahalli metro station Bengaluru urban limits Phase 2A, Package 1, Bengaluru. Out of 129 numbers of standing trees, 3 trees are retained on site, 12 trees proposed to be removed by means of translocation and 114 by felling which are infringing construction works in order to implement the project. These trees are coming under jurisdiction of Deputy Conservator of Forest (DCF)/Tree Officer, BBMP, Bengaluru.

As per OM No. DCF/PR-1125/2022-23 Dated: 19.09.2022 (**Annexure I**) issued by DCF/Tree Officer BBMP, Bengaluru. Tree Officer/DCF BBMP has given permission to BMRCL for removal of 12 trees by translocation and 114 trees by means of felling. Tree officer in his order page 5 of condition 8 directed BMRCL to raising compensatory planation in 1:10 ratio i.e., 1260 number of Saplings against 126 number of trees removal (Translocation & Felling). Also Hon'ble High Court of Karnataka has directed BMRCL in its Daily Order WP 17841/2018 dated 25.03.2021 (**Annexure- II**) in vide Para 5 (i) to submit plan for raising compensatory planation to be Tree Officer.

In view of above, BMRCL has identified the locations as follows:-

1. Park area 2 and 5 of Hardware sector at Hi-tech Defence and Aerospace Park Phase -1 (adjacent to Kempegowda International Airport), KIADB, Bengaluru.

Hereby propose to raise compensatory planation as per technique/scheme described here in this plan.

II. Location plan & Approval of land owner

Officials from BMRCL has approached KIADB (Karnataka Industrial Area and Development Board), Bengaluru for allotment of open space, Buffer zone & Park etc., for rasing compensatory planation, accordingly KIADB Authorities has given their approval in letter NO. KIADB/EE-3/2022-23 dated 08.06.2022 (**Annexure-III**) for taking up Compensatory Plantation in Park area 2 and 5 of Hardware sector at Hi-tech Defence and Aerospace Park Phase -1 (adjacent to Kempegowda International Airport), KIADB, Bengaluru. BMRCL has planned compensatory planation of total 1260 number of saplings of various species as per Forest Department Guide lines and Compensatory planation plan is also submitted to Trees Officer (**Annexure IV**).

| Compensatory Planation Plan in lieu of removal of trees in ORR Phase 2A (Package-1) | | | |
|--|---|------|------|
| 1 | Total Land Available for Compensatory Planation | Acre | 8.90 |
| 2 | Total Sapling Planned by BMRCL | Nos | 1260 |

III. Agency for compensatory planation

Bangalore Metro Rail Corporation will engage & take service of expert horticulture /planation agency for implementing the proposed compensatory planation including three years' comprehensive maintenance. An agreement will be entered with the approved agency for raising the planation as per the plan ensuring good survival rate.

IV. Scheme of Planation/Technique:

BMRCL has taken the responsibility of raising compensatory planation at the location suggested above as per standard practice & techniques through an expert agency in horticulture/ planation field.

Forest Department, Government of Karnataka has issued "General Guidelines for Species and Planation Technique Models" (**Annexure V**).

BMRCL has finalized a Scheme/ Technique for planation considering these guidelines relevant for Bangalore Urban Transitional Zone and institutional / office premises plantation model. The scheme is summarized as follows:

1. Park area 2 and 5 of Hardware sector at Hi-tech Defence and Aerospace Park Phase - 1 (adjacent to Kempegowda International Airport), KIADB, Bengaluru.
2. Plantation work will be taken up through an expert horticulture/ planation agency recommend by forest department/BBMP forest division.
3. Water required during rainy season i.e. from May-June to Oct-Nov in Bangalore Urban area would be minimal/nil. During dry season from November to April watering will be regularly done as per the standard practice specified in above guidelines and as per requirement of planation species.
4. Aligning, marking of pits of size 1m x 1m x 1m shall be done at the identified location.
5. Excavation of pits of size 1m x 1m x 1m at 5m x 5m or 7m X 7m grid interval will be taken up as per the general guidelines given for City and Town Planting Model by the Karnataka Forest Department. (refer Annexure-V of Page No.25)
6. The pit will be vertically cut and straight in shape. All loose materials will be removed from pit.
7. Supply of saplings of min 12 months old of 7-8 feet height of species suitable for the zone as specified in the guidelines.
8. Supply of 10% Red earth required for refilling the pits after saplings.
9. Refilling of pit to 75% of the pit with excavated soil after breaking the clods and formation of saucer shaped mound. Conveyance of polythene bag seedlings to the planting location including watering polythene bagged seedlings at site.
10. Supply of 2.5 to 2m length wooden sticks for supporting saplings.
11. Planting seedlings including scooping the soil to required depth pressing the soil gently around the seedlings after planting.

12. Carrying out de-weeding around the plants for a radius of 0.6m.
13. Hoeing and soil working with pickaxe around the plant to a depth of 15cm and to a radius of 60cm.
14. Application of chemical fertilizers around the plant about 15cm away in furrow duly covering with soil as and when required.
15. Scraping of grass and weeds to radius of 0.5m around the plants.
16. Application of FYM (Farm Yard Manure), watering the plants using water tanker with available water inside the premises/ water from outside as required.

V. Up keep of planation & Maintenance

The agency entrusted with the compensatory plantation will be responsible for comprehensive maintenance also. The planation being done will be maintained for 3 years from date of plantation. During the maintenance period of 3 years, following activities will be carried out by the agency and shall be monitored by the BMRCL.

1. Maintenance activities for 1st year, 2nd year and 3rd year to be carried out by agency responsible for planation in order to ensure 100% success rate. In case of failure of any plant, immediate replacement will be done by agency.
2. In summer season i.e., From December to May watering will be done at regular intervals of once in a week. During Monsoon season i.e., from June to November watering required may be minimal/Nil. However, watering need to be done for any dry spell as and when required. During monsoon season whenever there is a scanty rainfall, agency shall do watering to make shortfall.
3. Removing weeds/grass surrounding plantation area as and when required.
4. Preparing reports on growth of plants with photographs/videography and submission to authorities on quarterly basis.
5. The entire compensatory plantation and maintenance to be done under supervision of BMRCL Environmental officer and under the direction of Tree officer.
6. Replacement of causality plants to ensure maintaining 100 % survival.

VI Conclusion

BMRCL has accepted to take over compensatory planation for 1260 Saplings at Park area 2 and 5 of Hardware sector at Hi-tech Defence and Aerospace Park Phase -1 (adjacent to Kempegowda International Airport), KIADB, Bengaluru. as per OM dated 19.09.2022 as per the guidelines of Forest Department, GOK through an expert horticultural/forestry agency with aim to ensure good survival rate of planation with regular maintenance and adequate supervision.



BRUHAT BENGALURU MAHANAGARA PALIKE

No: DCF/PR-125/2022-23

Office of the
Deputy Conservator of Forests,
Bruhat Bengaluru Mahanagara Palike
N.R Square, Bangalore

Date: 19.09.2022

OFFICIAL MEMORANDUM

- Sub:** Permission regarding Translocation and Removal of trees which are standing in the BMRCL Project Area for 'Construction Activities Zone of BMRCL Project in an area extending from Central Silk Board (CSB) Junction to Kodibeesanahalli Metro Station (Up To Pier No. 335) – reg
- Ref:** a. BMRCL Application No. BMRCL/ORR/PH-2A/P1/2022/87/15215 dtd 24.03.2022
b. BMRCL Supplementary Application No. BMRCL/Advisor-Civil/ORR/Ph-2A/2021/1329 dtd 12.06.2021
c. Member Secretary, TEC and ACF Letter No. ACF/PR.42/2022-23 dtd 03.09.2022 along with Report of Tree Expert Committee

* * * * *

BACKGROUND

The BMRCL earlier had submitted an application dtd 12.06.2021 to the Tree Officer and Deputy Conservator of Forests, BBMP for removal of 833 number of trees which were falling within the Construction Activities Zone of BMRCL Project in an area extending from Central Silk Board (CSB) Junction to Kodibeesanahalli Metro Station (Up To Pier No. 335) over a stretch of 19.633 Kms.

After observing all the formalities as stipulated under Memorandum of Procedure (MOP), the Tree Expert Committee had compiled its Report dtd November 2021 and communicated the same vide letter. No. ACF/PR 57/2021-22 dtd. 18.11.2021 to the Tree Officer and DCF, BBMP along with the relevant Proceedings. The following was the summary of recommendations of the Committee based on the remarks as expressed in the Template-2 Part-III of each tree..

Thereafter, the Tree Officer, BBMP based on the TEC Report had issued directions vide his OM No. DCF/PR 1673/2021-22 dtd 26.11.2021 for retention, translocation and removal of trees depending on their growth status, morphological characters, species, location of trees, health of the trees and other factors. Out of these 833 Nos. of trees standing between Central Silk Board (CSB) Junction and Kodibeesanahalli Metro Station (Up to Pier No. 335), 44 trees were to be retained-on-site, 212 trees were to be translocated and the remaining 577 trees were to be felled/removed.

PRESENT CASE

The Tree Officer has reported that BMRCL at the time of implementing project works realized that certain changes may be required in the structural design and therefore submitted additional

application for removal of 127 trees at 05 locations for their on-going project on Outer Ring Road (ORR) from Central Silk Board Junction to Kodibeesanahalli and had placed the above proposal in the TEC Meetings held on 29.04.2022. The Committee had sought clarifications from the concerned BMRCL Engineers about the necessity for submission of the said additional application.

The Committee had sought clarification from the concerned BMRCL Engineers about the necessity for submission of additional application. In response to that, the BMRCL Authorities explained through a PPT presentation about the detailed reasons for removal of the additional trees because of the shift in position of certain allied structures. Subsequently the Tree Officer, BBMP issued a Public Notice with an intention to invite remarks/objections from public as per the stipulations of KPT Act, 1976.

Further the Tree Officer, BBMP during the course of TEC Meeting held on 30.06.2022 submitted the preliminary assessment of trees in accordance with the required Tree Templates for each tree along with other documents. The Committee had conducted the preliminary review of the BMRCL additional/supplementary application with the following inferences:

- 11 trees of this additional proposal form a part of already issued OM dated 26.11.2021 by the Tree Officer, BBMP
- 116 Nos are new additional trees

In response to the Public Notice, the Tree Officer stated that only 01 objection has been received in response to the public notice. Regarding the nature of objection received from the public, the person had opined that there is no need to cut the trees which are standing next to BBMP Office, Jakkasandra Ward near Carmel Garden School, as the trees are standing far from the proposed Metro Station. In this context, the Tree Officer, BBMP referred the matter to BMRCL and in turn, the BMRCL authorities informed that the trees are standing on RHS side after Naala on service road foot path and the trees will be affected by the construction activities of Foot Over Bridge (FOB) which will provide access for entry and exit structures to HSR Metro Station and that will ease the movements of passengers. The Tree Officer also emphasized that felling of trees is always kept to bare minimum and is based on the strategy being followed i.e., first option being retention-on-site of trees, second being translocation of trees if retention is not possible and only as a last resort felling of tree has to be there.

The TEC concurred with the replies furnished by the Tree Officer regarding the objections/suggestions received in response to Public Notice.

In this context, the field inspection for assessment of 127 Enumerated trees and 02 Unnumbered trees standing at the proposed Project Area between Central Silk Board (CSB) Junction and Kodibeesanahalli Metro Station (Up to Pier No. 335) for the BMRCL project was again carried out by the TEC 09.07.2022.

Further the Committee had decided to visit the areas and conduct field inspection. Now the Field Inspection has been conducted and the Field Inspection Report has been placed before the Committee for perusal.

On perusal of the Report, the following are the Committee's observations:

- I. Some trees, total 20 in number, which as per the earlier TEC Report (November 2021) were classified under Translocation and Felling Categories [Translocation category = 11 Nos of trees and Felling category = 09 Nos of trees] will now be retained-on-site because of the modification of the proposal.
- II. Another 11 trees which were in Retention category, as per the earlier TEC Report (November 2021) will now be reclassified with the changed circumstances. Out of these 11 trees, 02 trees will be translocated and 09 trees will have to be removed.
- III. There are totally 127 enumerated trees as per the BMRCL application. During field inspection, the Committee found 02 unnumbered trees. Therefore the total number of trees are 129 in number.
- IV. The 11 trees which were included under the Retention Category as per the earlier OM dtd. 26.11.2021 have been incorporated in this additional/supplementary proposal and assigned new consecutive numbers viz., Tree No. 117 to Tree No 127.
- V. There are totally 127 enumerated trees as per the BMRCL application. During field inspection, the Committee also found 02 unnumbered trees. Therefore the total number of trees are 129 (127 enumerated + 02 Unnumbered = 129) in number.

The Field Inspection Report was tabled during the TEC meeting held on 14.07.2022 and detailed discussions were held.

- i. The primary objective of the TEC was to retain-on-site as many trees as possible.
- ii. In case the trees are falling within the project activity area and their removal becomes inevitable, the next option for TEC was for translocation of trees depending upon its general condition and its location so that the extraction of root ball of adequate size becomes feasible.
- iii. The felling of trees has to be the last resort and that has to be done very judiciously in a prudent manner.

Based on the discussion held during TEC Meeting held on 14.07.2022 and subsequent the TEC Report was sent to the DCF, Bengaluru Urban Division and DCF, BBMP. The records/documents produced by BMRCL and DCF, BBMP followed by thorough scrutiny of the same.

Further detailed discussions of the field inspection reports which were prepared after examination of each and every tree, the following order is issued.

ORDER

Under the circumstances explained above and in exercise of the powers vested with the undersigned as per Section 8 (3) of Karnataka Preservation of Trees Act, 1976 and based on the guidelines and decisions taken as per the Field Inspection Report and Proceedings of the Meeting dated 14.07.2022 of the TEC for retention-on-site, translocation, and removal of trees which fall in the BMRCL Project of Construction Activities Zone in an area extending from Central Silk Board (CSB) Junction to Kodibeesanahalli Metro Station (Up To Pier No. 335), the below mentioned schedule is approved subject to the conditions mentioned thereon. This Order will come into effect after fifteen (15) days from the date of uploading of the order on the Official website of BBMP and for that purpose separate directions will be issued from this Office.

SCHEDULE

1. Two (03) trees which are listed in Annexure A appended to this Official Memorandum have to be retained-on-site. Hence, permission are declined to remove the said 03 tree and they should continue to stand at their present location.
2. Based on the considerations as stated above and also detailed in the Report, Twelve (12) trees which are listed with justification, enclosed to this Official Memorandum as Annexure B have to be translocated. Hence permission is accorded to translocate the said 12 trees to suitable places as mentioned below in the 'Conditions'.
3. The remaining One Hundred and Fourteen (114) trees only which are listed with justification, enclosed to this Official Memorandum as Annexure C can be removed. Hence permission is accorded for removal of these said 114 trees only as per the felling of trees norms adopted by Karnataka Forest Department (KFD).

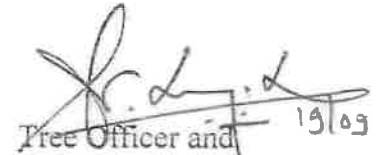
Conditions

1. No damage should be caused to the trees which are retained on the spot, while carrying out the civil works or any project related works.
2. The trees which are retained-on-site have to be properly protected and maintained. Accordingly BMRCL should give an assurance in this respect.
3. The translocation of trees should be done at suitable vacant spaces already identified by BMRCL in collaboration with the DCF, BBMP at the following area:

*"CMP Centre, Training area, HSR 1st Sector,
27th Cross, Ibluru, Bengaluru – 560 102"*

4. The Persons/Agencies who are entrusted with translocation works should have sufficient knowledge and experience in such works.

5. The work of translocation of trees has to be executed under close supervision of Officials/Officers of Forest Wing of BBMP and according to the formulated guidelines of UAS, Bengaluru.
6. The trees so translocated have to be properly maintained and taken care of, for a minimum period of three years.
7. The entire process of translocation of trees has to be properly documented and records compiled in a systematic manner.
8. In lieu of the trees translocated and felled, 10 healthy and heighted saplings have to be planted in lieu of each tree either translocated or felled. The saplings have to be planted as per forestry practices and maintained for a minimum period of three years. Photographs and proper documentation has to be there for saplings/seedlings planted.
9. Quarterly progress report about the translocated trees and seedlings/saplings planted have to be submitted by BMRCL to the Tree Officer. Regular monitoring must be done to ensure the conducive growth of translocated trees and planted saplings/seedlings.



Tree Officer and 19/09

Deputy Conservator of Forests
Bruhat Bengaluru Mahanagara Palike,
Bengaluru

Copy to:

1. The Managing Director, BMRCL, 3rd Floor, Shanthinagar, Bengaluru
2. The Chairman, Tree Authority and Chief Conservator of Forests, Bangalore Circle, Bangalore for kind information
3. The General Manager, SEMU, BMRCL, 5th Floor, Shanthinagar, Bengaluru
4. The Member Secretary – Tree Expect Committee, and the Assistant Conservator of Forests, BBMP for information and further action.
5. The Assistant Conservator of Forests, BBMP for information and further action
6. The Range Forest Officer/Deputy Range Forest Officers for information and further action
7. Office Copy



KARNATAKA INDUSTRIAL AREAS DEVELOPMENT BOARD

(A Government of Karnataka Undertaking)
 Maharshi Aravinda Bhavan, 14/3, 1st Floor Nrupathunga Road, Bengaluru -560 001
 Phone No. : 080-22223029/ 41511412
 website : www.kiadb.in email id : do3@kiadb.in

Date 08-06-2022

No KIADB/EE-3/ /2022-23

To,
The General Manager (SEMU),
 Bangalore Metro Rail Corporation Ltd.,
 Regd. Office: BMTCL Complex,
 3rd Floor, K H Road, Shantinagar,
 Bengaluru - 560 027

Sir,

Sub: Approval for taking up of compensatory plantation in Hi-Tech, Defence & Aerospace Park, Phase-1 (adjacent to Kempegowda International Airport) belonging to Karnataka Industrial Areas Development Board (KIADB).

- Ref: 1. Your letter No. BMRCL/ED-3/KIADB/Compensatory Plantation/2021/246 Dated: 06-04-2021.
 2. Head Officer letter No. 604 Dated: 15-04-2021.
 3. Your letter No BMRCL/GM-SEMU/KIADB/CP/2022/3000 Dated: 30-05-2022.

In continuation of Head Office letter cited under reference (2) as per the request vide reference, the Board is pleased to give consent to take up compensatory plantation in Hi-Tech, Defence and Aerospace Park, Phase-1 (adjacent to Kempegowda International Airport) developed by KIADB in the location cited under reference (2).

Now as requested by your goodself, the Board has given consent in reference (2), to take up compensatory plantation in Hi-Tech, Defence and Aerospace Park, Phase-1 developed by KIADB in the balance locations as detailed below:

| Sl. No. | Description | Extent (in Acres) |
|-------------------------|--------------------|-------------------|
| Aerospace Sector | | |
| 1 | Park Area - 2 | 3.12 |
| 2 | Park Area - 3 | 2.59 |
| 3 | Park Area - 4-P1 | 1.06 |
| 4 | Park Area - 4-P2-A | 1.38 |
| 5 | Park Area - 4-P2-B | 0.54 |
| 6 | Park Area - 6 | 8.65 |
| 7 | Park Area - 7 | 20.50 |
| Aerospace SEZ | | |
| 1 | Park Area - 1 | 23.50 |
| 2 | Park Area - 2 | 1.70 |

| IT Sector | | |
|-----------------|---------------|-------|
| 1 | Park Area - 1 | 8.88 |
| 2 | Park Area - 2 | 4.03 |
| 3 | Park Area - 3 | 1.90 |
| 4 | Park Area - 4 | 11.13 |
| 5 | Park Area - 5 | 26.73 |
| 6 | Park Area - 7 | 7.52 |
| Hardware Sector | | |
| 1 | Park Area - 2 | 5.60 |
| 2 | Park Area - 4 | 9.84 |
| 3 | Park Area - 5 | 3.30 |

Once again, it is requested to take up the work in presence of KIADB Engineer incharge in order to avoid any damages, during execution. Kindly acknowledge the receipt of the same.

Yours faithfully,
Sd/-
Executive Engineer - 3

Copy to:

1. The Chief Executive Officer & Executive Member, KIADB Head Office, Race Course Road, Bengaluru - for kind perusal and further needful.
2. Office Copy.


Executive Engineer - 3

List of Tree species for Compensatory Plantation

Location :KIADB

OM Order NO; DCF/PR-1125/2022-23 Dated: 19.09.2022

Number of Saplings -1260 Nos

| SI NO | Tree Species Name | Category | No Of Saplings Proposed for Plantation |
|--------------|--------------------------------------|---------------|--|
| 1 | Tamarind | Fruit | 60 |
| 2 | Jackfruit | Fruit | 60 |
| 3 | Indian Almond | Fruit | 60 |
| 4 | Indian Fig Tree | Fruit | 60 |
| 5 | Goosseberry Tree (Phyllanthuscidus) | Fruit | 60 |
| 6 | Hole dasavala | Flower | 60 |
| 7 | Hole matti | Wood | 60 |
| 8 | Kadamba mara | Flower & Wood | 60 |
| 9 | Mahogany | Wood | 60 |
| 10 | champaka mara | Flower | 60 |
| 11 | Ala | Wood & Fruit | 60 |
| 12 | Arali mara | Wood & Fruit | 60 |
| 13 | Atti mara | Wood & Fruit | 60 |
| 14 | Basari mara | Wood | 60 |
| 15 | Narale mara | Fruit | 60 |
| 16 | Neem | Wood | 60 |
| 17 | Honge | Wood | 60 |
| 18 | Tare | Wood | 60 |
| 19 | Red Tamarind | wood | 60 |
| 20 | Wild Mango | fruit | 60 |
| 21 | Sihi Hunase | wood | 60 |
| Total | | | 1260 |

SPECIES AND PLANTING TECHNIQUE MODELS

General Guidelines

A. INTRODUCTION:

- 1) Karnataka Forest Department is afforesting around 80000 to 100000 ha. annually under various plan and non-plan programmes. Afforestation is also taken up under various models of planting. Assisted Natural Regeneration (ANR) and Artificial Regeneration (AR) accounts for large share of hectare being afforested. The department has gained lot of experience by way of feed back and evaluation of the planting programmes. Many successful planting techniques have been established and followed in the field. However there is no compilation of such successful planting techniques evolved and of collective experience of the department. Afforestation and Reforestation is one of the core activities of the department and there is an urgent need to codify successful practices, so that it serves as manual for all the field officers who are engaged in the task of afforestation. In addition uniform cost norms and model estimates for various types of afforestation works help in standardizing planting techniques across various schemes.
- 2) An effort in this regard began in a meeting of few field officers and senior officers on 3-11-2010. A concept paper was prepared and sent to all circles with a request to submit circle wise write up on important best practices. Based on the circle wise reports "A species and Planting Technique models for Karnataka" was prepared by a Core Committee comprising of Addl. Principal Chief Conservator of Forests (Development), Addl. Principal Chief Conservator of Forests (Projects), Conservator of Forests (Development) and Conservator of Forests (Projects).
- 3) The report was again circulated among field officers through circle Conservators of Forests / Chief Conservator of Forests during April 2011.
- 4) A series of workshops were held at Davanagere (Bellary circle), Shimoga (Shimoga, Chikmagalur and Mangalore circles), Dharwad (Dharwad, Belgaum and Kanara circles), Bangalore (Bangalore and Chamarajanagar circles), Mysore (Mysore, Kodagu and Hassan circles) and Gulbarga (Gulbarga circle) during May-June 2012. In these workshops all Chief Conservators of Forests, Deputy Conservators of Forests (Territorial) and (Social Forest), Assistant Conservators of Forests (Territorial) and (Social Forest) and selected Range Forest Officers participated. The report was also discussed in the meeting of Chief Conservators of Forests and senior officers of the department on 20-06-2012 and 17-12-2012. Based on the deliberations and inputs of senior officers and field officers the final report is prepared.

B. METHODOLOGY

- 1) The Approach: The state is divided in to 4 Silvi (Agro) climatic zones for the purpose of report. The Talukas / Districts in each zone are as per the agro-

climatic zones recognized by the State Agriculture Department. The details of areas falling in various agro-climatic zones is provided in Annexure-I. Karnataka state land use board has classified state in to 10 zones. These zones are further regrouped as follows for the purpose of this report.

| | | | |
|----|----------------------------|---|---|
| 1. | Dry Zone | : | North Eastern Dry Zone, Northern Dry Zone, Central Dry Zone, Eastern dry zone, Southern dry zone. |
| 2. | Transitional zone | : | Southern transition zone, Northern transition zone, North Eastern transition zone. |
| 3. | Malnad & Western Ghat zone | : | Corresponding to Hilly zone of Karnataka land use board classification. |
| 4. | Coastal zone | : | Coastal zone. |

2) Within Silvi (Agro) climatic zones and specially for the purpose of Artificial Regeneration Model two site qualities have been distinguished.

1. Poor site quality : Sites of low fertility having little (<30cm) or no top soil. Rocky in nature.
2. Moderate to High fertility site quality : Sites with >30 cm. soil depth. Can sustain growth of native species and production forestry.

3) Three canopy densities are also distinguished for deciding allotment of areas under ANR or AR model and working out specific treatments.

1. Open areas and areas with less than 10% canopy.
2. Areas with 10 to 25% canopy.
3. Areas with 25 to 40% canopy.

4) Following various models and topics have been considered for detailing out planting techniques and best practices.

1. Assisted Natural Regeneration (ANR)
2. Artificial Regeneration (AR)
3. NTFP plantation
4. Sandal Regeneration
5. Road side plantations.
6. School and Institutional planting.
7. City and Urban areas planting.
8. Canal Bank plantations.
9. Farm Forestry.
10. Nursery Practices.

5) The species and planting technique models for the states provide the following details.

- (1) **Brief description** of the area relevant to the Model. For actual geographical applicability and Taluks, districts in each zone Annexure-1 may be referred.
- (2) **List of core species:** The species which constitute core of nursery and planting for the given zone and model are listed based on the past experience.
- (3) **Planting Technique:** The details like site preparation, planting density per ha, size of polythene bags for raising seedlings, land preparation (pitting, T.M, Ripping etc.,) type of protection to be provided, watering, number of years a plantation to be maintained are indicated.

However to avoid repetition only the specific and important details of each model are only noted. Rest of the specifications are detailed out in Model Estimates relevant for each model of planting.

- (4) It is strongly recommended that the afforestation areas are delineated on water shed basis. A land scape of about 5-10 thousand ha. in each range including the areas outside forests may be taken as a unit of treatment of both arable and non-arable land. Such land scapes may be prioritised based on a composite index with proper weightage for extent of forest degradation, availability of waste lands, scope for Farm Forestry and Socio-economic backwardness of the areas etc.,
- 6) All resources available for afforestation including promotion of farm forestry may be allotted to such delineated land scapes based on its prioratisation so that the limited resources at the disposal of the department are spent on most needy areas.
- 7) The report also recommends the following common prescriptions.
 1. All block plantation sites are provided protection with Cattle Proof Trenches or Barbed Wire Fencing.
 2. SMC in terms of Gully checks and **SMC Trenches of 5X1X1 M dimension with outlets / spill ways and one or two nala bunds depending upon site requirement are provided in all block plantation.** A sum equal to 20% (a sum equal to 15% of the total cost of planting up to full maintenance is provided for SMC works in plain and gentle sloppy lands and 25% of the total cost of planting upto to full maintenance is provided in SMC works in sloppy and steep sloppy areas. This has to be certified by the officers at the rank of ACF / DCF after site visit.
 3. CPT is excavated to cover entire Micro Water Shed and plantings raised within the area for 5 years.
 4. Sowing of seeds, planting of cuttings and Agave shall be taken up on CPT mounds and SMC trenches.

5. Ripping is recommended as preferred in mode of site preparation in Dry and Transitional zones under AR Model.
6. Planting will be done in ripped furrows and mound formation taken up later. So no sowing of seeds on mounds is normally recommended. But in case where two seedlings are planted per trench, sowing of seeds of local species like Muttuga, Honge, Hale, Ode, Kamara etc. can be done in the trenches.
7. Watering of seedling is provided 5 times in the 1st year 3 times in 2nd year under Greening Urban Areas. Road side, NTFP, Canal Bank and Sandal Estate Models. However in Institutional Planting model watering will be done by individual institutions.
8. F.Y.M application @1CM/40 plants is recommended under Greening Urban Areas / Road side / NTFP models.
9. a) 500 T.M. of 4M length and 1500 plants/Ha is recommended for the area which do not have root stocks and do not likely to get root suckers after ripping / pitting.
b) However, in the locations where good number of root stocks are found and root suckers are likely to come up after ripping 1000 plants per hectare is recommended. Then the number of seedlings in each trench will be two per trench.
10. Plantation maintenance is kept at planting plus 2 year for Artificial Regeneration models which are planted with fast going species and 4 years for the models which are planted with slow going species. ANR Model, Greening Urban Areas, Road side, NTFP models where the plantations will be maintained up to 5 years.
11. Any major deviation based on site specific requirement shall be done only with the written approval of Deputy Conservator of Forests detailing out the reasons.
12. Detailed model estimates are provided for each model of planting.

C. SPECIES AND PLANTING TECHNIQUES MODELS

- I. Assisted Natural Regeneration (ANR) Model is further sub divided in to
 - IA. Eco-Restoration Model
 - IB. Supplemental Planting Model

I(A) ECO- RESTORATION MODEL:

1. **Area Description:** Sites in all 4 zones which contain canopy density between 25 – 40% and are under various stages of degradation but can rejuvenate given proper protection and soil moisture conservation treatment are treated under this model, so that the already present root stock and regeneration is helped to establish and grow.
2. **Core Species:** No planting is proposed in this model. Only dibbling of seeds of native species will be taken up.
3. **Planting Technique:**
 - 1) Protection through excavation of cattle proof trenches @ 72 RMT/ 90 CMT per ha.
 - 2) Sowing of seeds of Glyrecidia, Planting of Agave suckers on the CPT mounds in open area and Duranta cuttings on the CPT mounds in partially shaded area in high forest locations.
 - 3) Watch and Ward for every 50 ha.
 - 4) Dibbling of seeds of Sandal, Neem, Seetaphal, Honge and other native species.
 - 5) Clearing unwanted growth, Climber cutting, Tending, cutting back of half cut stumps / stools to get good coppice growth and singling of coppice growth @ 400 plants/ha. The training of local community/ VFC members and sharing of biomass and its documentation shall be made in this operation.
 - 6) Other details as per model estimate Model -01

I(B) SUPPLEMENTAL PLANTING MODEL:

1. **Area Description:** Sites in all 4 zones which have a canopy density between 10 – 25% which are deficient in regeneration and are under higher degree of degradation and with large open gaps are selected under this model. The presence of appreciable root stock of native species which can be nursed / nurtured to better health and supplemental planting with high value native species is main objective of this model.

Species Proposed:

Dry Deciduous Forests:

| | | |
|-----|-----------|------------------------------|
| 1. | Bevu | Azadiracta indica |
| 2. | Tapasi | Holoptelia integrifolia |
| 3. | Seetaphal | Annona Squamosa |
| 4. | Honge | Pongamia pinnata |
| 5. | Kamara | Hardwickia binata |
| 6. | Bage | Albezzia lebbek |
| 7. | Ficus | Ficus bengalensis |
| 8. | Sisso | Dalbargia Sisso |
| 9. | Ailanthus | Ailanthus excelsa |
| 10. | Hale | Writia tinctoria |
| 11. | Ude | Steriospermum chelanoides |
| 12. | Dhupa | Boswella Serrata |
| 13. | Nelli | Emblica officinalis |
| 14. | Honne | Pterocarpus marsupium |

Moist Deciduous Forests

| | | |
|-----|---------|--------------------------|
| 1. | Teak | Tectona grandis |
| 2. | Nandi | Legarstroemia lanceolata |
| 3. | Honne | Pterocarpus marsupium |
| 4. | Mathi | Terminalia alata |
| 5. | Shivane | Gmelina arboria |
| 6. | Kindal | T.paniculata |
| 7. | Beete | Dalbargia latifolia |
| 8. | Tare | T.belerica |
| 9. | Bamboo | Bambusa arundinasia |
| 10. | Muthuga | Butea monosperma |
| 11. | Hippe | Madhuca latifolia |
| 12. | Sandal | Santalum album |
| 13. | Nelli | Emblica officinalis |
| 14. | Neral | Sizygium cumini |
| 15. | Dhaman | Grevia tilifolia |
| 16. | Kaval | Careya arborea |
| 17. | Harada | Terminatia chebula |

Semi Evergreen and Evergreen Forests:

| | |
|-----------------|------------------------------------|
| 1. Honne | Pterocarpus marsupium |
| 2. Beete | Dalbargia latifolia |
| 3. Dhoopa | Vateria indica |
| 4. Tare | T.belerica |
| 5. Hole mathi | T.arjuna |
| 6. Kindal | T.paniculata |
| 7. Bamboo | a) B.arundinasia b) D. Strictus |
| 8. Bharanigi | Vitex ultissima |
| 9. Bobbi | Lophopetalum whitianum |
| 10. Canes | Calamus species |
| 11. Gulmavu | Machilus macranta |
| 12. Saldhoopa | Vateria indica |
| 13. Nerale | Sizyium Cumini |
| 14. Hebbalasu | Artocarpus heterophyllus |
| 15. Halmaddi | Ailanthus malabaricum |
| 16. Mango | Mangifera indica |
| 17. Murugal | Garcinia indica |
| 18. Uppage | Garcinia gummigatta |
| 19. White cedar | Dysoxylon Malabaricum |

3. Planting Technique:

1. Identified area is demarcated and surveyed and area will be closed with CPT / barbed wire fence.
2. The SMC works are taken up from ridge to valley concept. SMC trenches of 5X1X1 mts. across rills with spill ways and nala bunds are created.
3. The young regeneration is protected, the coppice growth is promoted by cutting back of stumps, singling of multiple shoots. Training of local community / VFC members for singling, pruning, cutting back, sharing of biomass and its documentation is done. This to be done by watch and ward persons.
4. Advance work is done by digging upto 200 pits of 75cm³ in dry zones, upto 400 pits of 60cm³ in other zones avoiding pitting near the existing root stock / regeneration.
5. Sowing of seeds of Prosopis, Glyrecidia in dry areas only. Planting of Agave suckers on the CPT mounds in open area and Duranta cuttings on the CPT mounds in partially shaded area in high forest locations.
6. At least 12 month old seedling in 10" X 16" polythene bags in dry zones and 10 months old 8" X 12" / 6" X 9" (for teak) polythene bags in other zones are used for planting.

7. Planting with Agave, Suckers/ bulbils and sowing of seeds of Bamboo, Sandal, Glyrecedia, Cassia, honge etc., on Mounds of SMC trenches and on Cattle Proof Trenches is done.
8. If necessary, further tending of root suckers, cutting back stumps, singling of coppice growth and soil working up to 400 plants/ha. is done during 3rd year involving local community / VFC members with documentation.
9. Engaging watch and ward for every 25 ha.
10. Other operations as per Model estimate Model- 02 and 03.

II. ARTIFICIAL REGENERATION MODELS (AR)

1. Artificial regeneration is taken up on barren, open areas, waste lands, blanks and laterate patches and forest areas where the canopy density or root stock is less than 10%. The site preparation is normally done by ripping by D-80 / D-120 dozers in dry and transitional zones and pitting is also done in the patches where ripping can not be taken up in rocky patches, rugged nalas up to 100 pits per hectare with pit size 75 cm³.
2. Pitting is done in Malnad and coastal zones. The model by far constitutes very high extent of afforestation works in the state. Considering this fact the species choice and planting pattern is prescribed for all zones and two site qualities separately.

II(A) AR MODEL FOR LOW FERTILITY, ERODED AND ROCKY AREAS IN DRY ZONES.

1. **Area Description:** These are rocky eroded areas with very little or no top soil (less than 30 cm). The rainfall is scanty and ill distributed with high mean annual temperatures. The strategy for such areas is primarily to check the further degradation of sites and create a green cover using pioneer, colonizing species like Glyrecedia, C.Siamia, Agave etc., with a suitable mixture of hardy local species. The fast growing species like Glyrecedia cover up the site in 2-3 years and it is seen to compliment and facilitate the growth of inter planted local hardy species in course of time.

2. Core Species and Planting Pattern:

- a) In the locations where there is no chance of getting roots sucker and regeneration after ripping, the planting density is as follows:

| | | |
|----|---------------------------------|-------------------|
| 1. | Glyrecedia, C.Siamia, Agave | 1400 plants / ha. |
| 2. | Honge, Seetaphal, Tapasi, Ficus | 100 plants / ha. |

- b) In the locations where there are chances of sufficient roots sucker and natural regeneration after ripping, the following core species planting pattern shall be followed.

c)

| | | |
|----|---------------------------------|------------------|
| 1. | Glyrecedia, C.Siamia, Agave | 800 plants / ha. |
| 2. | Honge, Seetaphal, Tapasi, Ficus | 200 plants / ha. |

II(B) AR MODEL FOR MODERATE TO HIGH FERTILITY AREAS IN DRY ZONE.

Planting Pattern – I

1. **Area Description:** Two distinct areas can be identified for the purpose of species selection. The taluks falling in Northern and North eastern dry zones (Annexure-I) especially districts like Bijapur, Gokak division of Belgaum district, Yadgir, Raichur, Gulbarga, Koppal and Gadag districts the following planting pattern is recommended.

2. **Core Species:**

| | | |
|----|--|-------------------|
| 1. | Glyrecedia, C.Siamia, Sisso | 1300 plants / ha. |
| 2. | Seetaphal, Honge, Ficus, Tapasi, Nelli, Bevu, Nerale | 200 plants / ha. |

- b) In the locations where there are chances of sufficient roots sucker and natural regeneration after ripping, the following core species planting pattern shall be followed.

| | | |
|----|---------------------------------|------------------|
| 1. | Glyrecedia, C.Siamia, Agave | 800 plants / ha. |
| 2. | Honge, Seetaphal, Tapasi, Ficus | 200 plants / ha. |

3. **Planting Pattern – II :**

Area Description : The second distinct area comprises of Central, Eastern and Southern dry zones (Annexure-I) comprising of districts of Bagalkot, Bellary, Davanagere, Chitradurga, Tumkur, Kolar, Chikkaballapur, Bangalore Rural, Ramanagara etc.,

4. **Core Species:**

| | | |
|----|--|-------------------|
| 1. | Kamara, C.Siamia, Sisso, Stereospermum chelenoides, Soymida, Boswellia serrata | 1300 plants / ha. |
| 2. | Seetaphal, Honge, Tapasi, Ficus, Nelli, Cashew, Seemaruba, Bevu, Nerale, Mango | 200 plants / ha. |

- b) In the locations where there are chances of sufficient roots sucker and natural regeneration after ripping, the following core species planting pattern shall be followed.

| | | |
|----|--|------------------|
| 1. | Kamara, C.Siamia, Sisso, Stereospermum Chelenoides, Soymida, Boswellia serrata | 800 plants / ha. |
| 2. | Seetaphal, Honge, Tapasi, Ficus, Nelli, Cashew, Seemaruba, Bevu, Nerale, Mango | 200 plants / ha. |

II(C) AR MODEL FOR POORER SITES IN TRANSITIONAL ZONE:

1. **Area Description:** These areas also have little or no top soil, eroded, rocky and of low fertility. However the sites are located in better rainfall and moderate temperature and weather conditions.

2. **Core Species:**

| | | |
|-----|---|-------------------|
| 1. | Auriculiformis in >1000 mm rainfall areas and in JFPM areas | 1500 plants / ha. |
| 2a. | C.Siamia, Sisso, Sterospermum, Seemaruba, Kamara | 1300 plants / ha. |
| | Honge, Tapasi, Ficus, Nelli, Cashew, Bevu. | 200 plants / ha. |
| 2b. | In the locations where there are chances of sufficient roots sucker and regeneration after ripping the following core species planting pattern shall be followed. | |
| | C.Siamia, Sisso, Sterospermum, Seemaruba, Kamara | 800 plants / ha |
| | Honge, Tapasi, Ficus, Nelli, Cashew, Bevu | 200 plants / ha. |

II(D) AR MODEL FOR MODERATE TO HIGH FERTILE AREAS IN TRANSITIONAL ZONE.

1. Area Description: The sites are having better soil depth (30-60 cms) and are situated in better rainfall and moderate weather conditions, conducive for raising productive plantations of fuel and small timber. Very fertile areas in this zone are put under NTFP / Fruit Orchard Model.

2. Core Species:

| | | |
|-----|--|-------------------|
| 1. | A.auriculiformis in better rainfall areas and JFPM areas. | 1500 plants / ha. |
| 2a | C.Siamia, Sisso, Sterospermum, Seemaruba, Kamara | 1100 plants / ha. |
| | Bamboo, Shivani, Nelli, Mango, Nerale, Cashew, Bage, Honge, Tapasi, Ficus | 400 plants / ha. |
| 2b. | In the locations where there are chances of sufficient roots suckers and regeneration after ripping the following core species planting pattern shall be followed. | |
| | C.Siamia, Sisso, Sterospermum, Seemaruba, Kamara | 800 plants / ha |
| | Bamboo, Shivani, Nelli, Mango, Nerale, Cashew, Bage, Honge, Tapasi, Ficus | 200 plants / ha. |

3. Planting Pattern : Fast growing species like Kamara, C.Siamia, Sisso etc., in single species rows and species like Mango, Nerale, Nelli, Cashew at 10M spacing but in the ripped line only, without resorting to excavation of separate pits.

II(E) PLANTING OF EUCALYPTUS IN TRANSITIONAL ZONES

1. Moderate to high fertile areas in transitional zone as well as areas under JFPM in transitional zone are also suitable for raising Clonal and seed origin of better provinces Eucalyptus plantations. These plantations can yield appreciable biomass at the end of rotation period of 8 years. This will also improve supply of fuel wood, poles, small timber to meet local needs. It can also generate income to Village Forest Committees. In this model Eucalyptus preferably clonal planting material is planted 100% @ 1500 plants per hectare without mixing with any other species.

However adopting this planting model is subject to overall policy of growing of eucalyptus by Government.

II(F) AR MODEL FOR FORESHORE AREAS IN DRY AND TRANSITIONAL ZONE.

1. **Area Description** : These areas are situated in foreshores of Tanks and Reservoirs in dry and transitional zones. The sites are fertile due to accumulation of salt, but have high degree of salinity and water logging.
2. **Core Species:**

| | | |
|----|---|------------------|
| 1. | A.Nilotica / A.auriculiformis | 550 plants / ha. |
| 2. | Honge, T.arjuna, Nerale, Sisso and Bamboo | 550 plants / ha. |

3. **Planting Technique:** Only pitting is done for foreshore planting. A.nilotica is raised in 5"X8" polythene bags and miscellaneous species raised in 8"X12" polythene bags. While planting care should be taken to scrape the salt entrusted surface soil away. While doing soil working, raised mounds are formed so that the salt is leached down during rains. The planting should be done beyond HFL of Tank.

Planting Technique for AR model for Dry and Transitional Zone:

- 1) Site preparation is done by using D-80 / D-120 dozers in dry zones and by D-8 dozers in transitional zones.
- 2) 500 Trenches of 4M length are formed per ha. Pitting is also done in patches where ripping can not be taken up in rocky patches, rugged nalas etc up to 100 trenches of 4X11M or 100 pits per hectare with pit size 75cm³.
- 3) No refilling and formation of mounds is done before planting. This operation will be done after planting.

- 4) Fast growing species like Glyrecedia, C.Siamia, Kamara etc., are raised in 5"X8" polythene bags and miscellaneous species like Honge, Bevu, Ficus, Seetaphal etc., raised in 8"X12" polythene bags.
- 5) The planting proportion of fast growing species and miscellaneous shall be as indicated.
- 6) No separate pitting will be excavated for planting miscellaneous species, but are planted in the ripped line only.
- 7) Fast growing species like C.Siamia, Glyrecedia, Kamara etc., are planted. Single species in a row and the miscellaneous species mixed in each line at appropriate spacing.
- 8) SMC works are carried out by Gully checks and SMC trenches of size 5X1X1m across the rills with spill way and nala bunding wherever required only.
- 9) Other details as per Model estimate – Model 04, 05, 06 and 07.

II(G) AR MODEL FOR MALNAD AND WESTERN GHAT ZONE AND COASTAL ZONE.

1. Core species and Planting Pattern: Planting Pattern-I

| | |
|---|--|
| Open degraded areas with <10% canopy cover. Areas assigned to JFPM, Harvested areas, Encroachment evicted areas in Malnad and Coastal zones including the area having lateritic stones and outcrops. In all types of forest areas viz., Moist deciduous, SEG or EG areas. | Acacia auriculiformis 1500 plants / ha. |
|---|--|

Planting Pattern-II

| | |
|---|---|
| Moist deciduous forest types areas with bigger gaps and deficient regeneration. Moderate to high fertile areas. | Teak: 550 plants / ha. |
| | Honne, Matti, Kindal or Hunal, Heddi, Kalam, Nandi, Bamboo, Cashew, Mango, Nerale, Antawala, Shivani, Albezia 550 plants / ha. |

Planting Pattern-III

| | |
|---|---|
| Semi Evergreen, Evergreen areas with gaps and difficient regeneration. Moderate to high fertility in Malnad and Coastal zones | Acacia auriculiformis |
| | Hopea Whitiana 550 plants / ha. |
| | Hopea Parviflora, T.arjuna, Mango, Nerale, Cashew, Lophopetalumwhitianum, Hebbalasu, Saldhupa, Kaidhupa (Canarium strictum), Murugal, Uppage. 550 plants / ha. |

Planting Technique :

- 1) Acacia auriculiformis is planted in pits of 45cm³ and planted 100% without mixing with any other species.
- 2) Teak in planting pattern II and Hopea whitiana is planting pattern-III are planted at 3X3M spacing (1100/ha) in 45cm³ pits in open areas.
- 3) Miscellaneous species are planted @400/ha in 5X5 M spacing.

- 4) Acacia is raised in 5"X8" polythene bags. Teak and Hopea are raised in 6"X9" polythene bags. Other miscellaneous species raised in 8"X12" polythene bags.
- 5) Protection is provided by Cattle Proof Trenches.
- 6) Sowing of seeds of Prosopis, Glyrecidia, Planting of Agave suckers on the CPT mounds in open area and Duranta cuttings on the CPT mounds in partially shaded area in high forest locations. SMC works provided by Gully checks are SMC trenches of 5X1X1 Mts size across the rills with spill ways and nala bunding wherever required only.
- 7) Other details as per Model estimate No.06 and 07.

NOTE ON PLANTING ACACIA IN AR MODEL:

1. Acacia is a gregarious, highly productive species which can attain high productivity in 8 years. It also gives highly valued timber after 20 years.
2. It is suitable for barren lateritic areas.
3. It can be planted in degraded forests, open areas with <10% canopy in Malnad and Coastal zones.
4. It can be grown as a pioneer species in Western ghats to build up fertility of the area and make it suitable for planting native species later.
5. It can be planted on Encroachment prone / evicted sites for quick site recovery and coverage.
6. It can be planted on Degraded forests and JFPM areas identified in JFPM management plan in Transitional, Malnad and Coastal zones.
7. Replanting after harvesting of JFPM areas as per VFC management plan.
8. Acacia should not be planted in ANR model as under planting.
9. Acacia should not be planted in dry zones.

II(H) AR MODEL SPECIAL AREAS IN COASTAL ZONES

1. **Area Description:** The sites in coastal area fall in 3 categories.
 1. Lateritic soils.
 2. Mangrooves.
 3. Sand dune stabilization

DEGRADED / LATERITIC SOILS:

| | |
|-------------------------------|---|
| Open degraded lateritic soils | Acacia auriculiformis 550 plants / ha. A.catachu 550 plants / ha. |
| Very hard lateritic patches | Ficus, A.catachu, T.belerica, Callophyllum oenophyllum, Cashew, Jummanakai (Fagara budrunga) planted 100 plants / ha. |

Planting Technique:

1. Acacia auriculiform is raised in 5"X8" polythene bags and Acacia catachu in 8"X12" polythene bags planted in pits of 45cm³ and 60cm³ respectively.
2. Protection is provided by Cattle Proof Trenches / Barbed wire fence/ Laterite block rubble wall.
3. Standard SMC works with Gully checks and SMC trenches across the rills with spill ways and nala bunding wherever required only provided.
4. Other planting details as per Model estimate No.07.

MANGROVE PLANTING MODEL

1. **Area description:** Mangroove are typical areas in estuaries. They are both viviparous and saline tolerant in nature.
2. **Core species** : Avicennia marina, A.officinalis, Kandelia candel, Rhizophora apiculata, R.mucronata, Sonnaratia alba, S.Caseolaris, Exocaria agallocha, Aegiceras Corniculatum.
3. **Planting Pattern** : Seedlings of the species are collected and planted in estuaries in low sites at 1X1M spacing. Nursery seedlings can also be raised by wildling and planting can be done.

COASTAL SAND DUNE PLANTING:

Coastal sand dune belts are planted in Shelter belt fashion. Vegetative barrier created by shelter belt can be very effective in halting erosion of sand dumes.

- Species : Spinifix littorate (Ravanana meese), Ipomea species, Pandanus species, Morinda citrifolia, Callophyllum inophyllum, Anacardium occedentale, Cauarina equisitifolia
- Planting Technique : These species listed above are planted from sea shore towards inlands in the listed order. Smaller plants can be planted at 2X2M spacing with callophyllum, Cashew can be planted at 4X4 M spacing.

SUMMARY OF SPECIES, PLANTING PATTERN AND TECHNIQUE UNDER ARTIFICIAL REGENERATION MODELS

| Sl. No. | Site specification | No. of plants / Ha | Core species | Planting Pattern | | | Model Code |
|---------|--|--------------------|--|------------------|----------|--|------------|
| | | | | No. of Plants | Bag size | Site Preparation | |
| 1. | Poorer sites in Dry zones all over state. | 1500 | Glyrecedia, C.Siamia, Agave | 1400 | 5"X8" | Ripping / pitting (upto 100) in area where ripping can not be done | IIA |
| | | | Honge, Tapasi, Sitaphal, Ficus | 100 | 8"X12" | | |
| 2. | Moderate-High Fertile areas in Northern and North Eastern dry zone | 1500 | Glyrecedia, C.Siamia, Sisso | 1300 | 5"X8" | Ripping / pitting (upto 100) in area where ripping can not be done | IIB |
| | | | Seetaphal, Honge, Ficus, Tapasi, Nelli, Bevu, Nerale | 200 | 8"X12" | | |
| 3. | Moderate - High fertile areas in Central, Eastern and Southern Dry zone. | 1500 | Kamara, C.Siamia, Sisso, Sterospermum, Seemaruba. | 1300 | 5"X8" | Ripping / pitting (upto 100) in area where ripping can not be done | IIB |
| | | | Seetaphal, Honge, Saymeda, Tapasi, Ficus, Nelli, Cashew, Bevu, Nerale. | 200 | 8"X12" | | |
| 4. | Poorer sites in Transitional zone | 1500 | Acacia auriculiformis in JFPM areas and areas receiving >1000 mm | 1500 | 5"X8" | Ripping / pitting (upto 100) in area where ripping can not be done | IIC |
| | | | C.Siamia, Sisso, Sterospermum, Seemaruba, | 1300 | 5"X8" | | |
| | | | Kamara, Honge, Tapasi, Ficus, Nelli, Cashew, Bevu | 200 | 8"X12" | | |

| Sl. No. | Site specification | No. of plants / Ha | Core species | Planting Pattern | | | Model Code |
|---------|--|--------------------|--|------------------|----------|--|-----------------------|
| | | | | No. of Plants | Bag size | Site Preparation | |
| 5. | Moderate to fertile sites in Transitional zones | 1500 | Acacia auriculiformis in JFPM areas and areas receiving >1000 mm rainfall | 1500 | 5"X8" | Ripping / pitting (upto 100) in area where ripping can not be done | II D |
| | | | C.Siamia, Sisso, Stereosperum, Seemaruba, Kamara | 1100 | 5"X8" | | |
| | | | Bamboo, Shivani, Nelli, Mango, Nerale, Cashew, Bage, Honge, Tapasi, Ficus. | 400 | 8"X12" | | |
| | | | Eucalyptus | 1500 | 5"X8" | | II E |
| 6. | Dry zone, Transitional zone where there are chances of sufficient root suckers and natural regeneration after Ripping. | 1000 | As recommended for respective sites. | 800 | 5"X8" | Ripping | IIA/IIB/ IIC / IID |
| | | | | 200 | 8"X12" | | |
| 7. | Foreshore areas of Tanks and Reservoirs. | 1500 | A.Nilotica | 750 | 5"X8" | 45cm ³ | II F |
| | | | Honge, T.arjuna, Nerale, Sisso | 750 | 8"X12" | 60cm ³ | |

| Sl. No. | Site specification | No. of plants / Ha | Core species | Planting Pattern | | | Model Code |
|---------|---|--------------------|--|------------------|----------|-----------------------------------|------------|
| | | | | No. of Plants | Bag size | Site Preparation | |
| 8. | Degraded, Open areas, JFPM areas, Harvested areas, Encroachment evicted areas in Transition, Malnad, Coastal zones. | 1500 | Acacia auriculiformis | 1500 | 5"X8" | Ripping or 45cm ³ pits | II G |
| 9. | Open areas in Moist deciduous areas, Moderate to high fertility areas | 1500 | Teak | 550 | 6"X9" | 45cm ³ pits | II G |
| | | | Honne, Matti, Nandi, Bamboo, Cashew, Mango, Nerale, Antawala, Shivani, Alberia | 550 | 8"X12" | 60cm ³ pits | |
| 10. | Semi evergreen and evergreen forest types in Malnad, Coastal zones. Deficient in regeneration, Moderate to high fertility | | Hopea Whitiana | 550 | 6"X9" | 45cm ³ pits | II G |
| | | | Hopea Parriflones, T.arjuna, Mango, Nerale, Cashew, Lophopetalum Whitannum, Hebbalasu. | 550 | 8"X12" | 60cm ³ pits | |
| 11. | Degraded Lateritic sites | 1500 | Acacia auriculiformis | 750 | 5"X8" | 45cm ³ | II H |
| | | | A.Catachu | 750 | 8"X12" | 60cm ³ pits | |
| 12. | Very Hard Lateritic Patches | 100 | Ficus, A.Catachu, T.Belerica, Callophyllan inofillum | 100 | 10"X16" | 1M ³ pits | |

III. N.T.F.P. PLANTING MODEL

Area Description : Non Timber Forest produce plantations may be raised in sites of high fertility. Even while taking up ANR or AR Model, NTFP plantations may be raised on small portion of the plantation areas, which has high fertility.

2. Core Species:

| | | |
|------------------------|---|---|
| Dry zone | : | Hunse, Mango, Neral, Nelli, Hippe, Bevu, Honge, Seetaphal, Kadgeru, Bucnania, Cashew, Feronia, Seemaruba and other local NTFP Species. Halsu may also be taken up in better sites in Districts like Kolar, Tumkur, Bangalore. |
| Transitional zone | : | Sandal, Bamboo, Antwala, Nelli, Hippe, Mango, Nerale, Muttuga, Kadgeru, Bucnania, Harada, Cashew, Hunse, Halsu, Seege and other local NTFP Species. |
| Malnad & Western Ghats | : | Antawala, Murugal, Uppage, Dalchinni, Wate, Cashew, Halmaddi, Kaidhoopa, Harada, Nelli, Mango, Halsu, Sandal, Xanthoxylum ritsa, Bamboo, Canes and other local NTFP Species. |
| Coastal zone | : | Murugal, Vate, Jummanakai, Myristica, Uppage, Cashew, Suragi, Urhonne, Antawala, Halsu, Mango and other local NTFP Species. |

3. Planting Technique:

1. Atleast 12 months old, 7-8 feet tall seedlings raised in 10"X16" polythene bags to be planted.
2. 0.75m³ pits excavated for planting. 275 plants per ha. planted at spacing of 6X6 mts and 1m³ pits excavated for planting Hunse, Mango, Halsu at 10x10m spacing raised in 14"X20" bags.
3. Protection to be provided by Barbed wire fencing.
4. Sowing of seeds of Prosopis, Glyrecidia, Planting of Agave suckers on the CPT mounds in open area and Duranta cuttings on the CPT mounds in partially shaded area in high forest locations.
5. F.Y.M. application 1 cm / 40 plants for first 2 years. D.A.P. fertilizer applied for 2 years.
6. Watering to be provided 5 times during 1st year and 3 times during 2nd year.
7. Maintenance up to 5 years. S.M.C. works from ridge to valley provided wherever necessary by standard SMC works with Gully checks and SMC trenches across the rills with spill ways and nala bunding wherever required only provided.
8. Other details as per Model estimate Model-08.

IV. MODEL FOR CREATION OF SANDAL ESTATES:

1. Area Description: Sandal was once very widely distributed in the Malnad and transition zone of the state. There is need to protect sandal regeneration areas as well as to create sandal on an estate management basis. Sandal can be planted in Malnad and transition zone extensively. The sites selected must be prepared by uprooting stumps and dozing with a dozer prepare like farm land for establishing estates.

2. Species : Sandal with planting of Teak / Bamboo along the boundaries.

3. Planting Technique:

A. Protection of Sandal Regeneration Model

1) A minimum of 200 ha area where the sandal regenerate profusely identified and the seedlings have attained 5-10 cms girth has to be selected with 200 plants/ha. minimum density.

2) The area is fenced with chain link mesh which is embedded in concrete foundation. For each such unit, 6 number of watch and ward are employed on 24/7 basis.

3) Requisite ration is provided to the watchers.

4) A temporary residential accommodation is constructed within the area.

5) Dibbling of sandal seeds and planting in open areas taken up.

6) Other details as per Model estimate. Model-09.

B. Creation of Sandal Estates with chain link mesh

1) The site selected shall be moderate to high fertility area in Transition and Malnad zone.

2) Preferably an old harvested Acacia / Eucalyptus plantation or encroachment evicted area is suitable.

3) Site preparation is done by uprooting the stumps and dozing the area, ripping done 5M apart.

4) Standard SMC works with Gully checks and SMC trenches across the rills with spill ways and nala bunding wherever required only provided.

5) Well grown sandal seedlings raised in 8"X12" polythene bags planted at 5X5M spacing.

- 6) The treated sandal seed should be shown on mounds of SMC, in the trenches.
- 7) For sustainable management of sandal estate, people participation should be encouraged by forming VFC or strengthening existing VFC. Sufficient seed money and corpus fund shall be made available to VFC.
- 8) In order to ensure sustainable financial resources for maintenance of the chain link mess, providing watch and ward and protection of sandalwood trees beyond 5th year fast growing species like Teak, Marihal bamboo, Burma bamboo, Shivane, Hebbevu, Hale, Acacia auriculiformis, Eucalyptus species including clones shall be planted all along the boundary inside the outer inspection path and also all along internal inspection paths and fire lines @ 200 plants per hectare. The revenue out of thinned material from fast growing species and also from sale of sandal seeds would be made available by VFC for keeping watch and ward and also to maintain a dog squad of local breeds.
- 9) Area is fenced by chain link mess fixed on steel anglers and maintained regularly.
- 10) Watering and FYM application cultural operations as per Model estimate. Model-10.
- 11) Where sufficient funds are available, construction of compound wall as protection measure can be taken up.

V. INSTITUTION AND SCHOOL PLANTING MODEL.

1. Area description : Vacant lands and the boundaries of Institutions, Government offices, Schools and Colleges.

2. Core Species :

Dry zone : Bevu, Honge, Kadbadam, Nerale, Mango, Seethaphal, Ala, Nelli, Mellingtonia, Seehunse, Singapur Cherry, Chakra Nelli, Arali, Bela and other suitable fruit & ornamental plants.

Transitional zone : Mango, Halsu, Nelli, Hunse, Nerale, Singapur Cherry, Chakra Nelli, Kadbadam, Sampige, Mahagony, Tabubia, Spathodia, Bela, Antuwala, Ala, Arali and other local native species.

Malnad and Western Ghats : Sampige, Mavu, Halsu, Nelli, Nerale, Ranjal, Kadbadam, Cashew, Murugal, Saldhoopa, Uruhonne Saludhupa and other local species.

3. Planting Technique.

- (1) At least 12 months old 7-8 feet tall plants raised in 10"X16" bags to be planted.
- (2) Block planting or Boundary planting at 5X5 m or 7X7m spacing, as the case may be. On an average 200 pits/ha.
- (3) If the area is not fenced or does not have a compound wall, staking and thorn fencing to be done, as provided for Road side planting.
- (4) Application of F.Y.M., watering, watch and ward as provided in Model Estimate-11.
- (5) Protection of such plantations shall also be the responsibility of concerned institutions.

VI. CITY AND TOWN PLANTING MODEL.

1. Area Description: Planting can be taken up along the roads within the city. Vacant lands meant for parks can also be taken up for planting. Care has to be taken to avoid electricity lines and telephone lines during alignment.

2. Core Species :

| | | |
|----------------------------|---|--|
| Dry zone | : | Bevu, Kadbadam, Arli, Bahaunia, Honge, Mellingtonia, Nelli, Thespesia, Peltophorum, Sissoo. |
| Transitional zone | : | Bevu, Arli, Sisso, Bahaunia, Kadbadam, Sampige, Tabubia, Mango, Halsu, Nerale, Spathodia, Peltophorum, Holedasawal, Mahagony, Honge. |
| Malnad & Western Ghat zone | : | Sampige, Mavu, Halsu, Nelli, Mango, Nerale, Saldhoopa, Mahagony, Kadamba Ranjal and other ornamental species. |
| Coastal zone | : | Sampige, Mango, Mahagony, Bahaunia, Uruhonne, Halsu, Spathodia, Ranjal, Tabubia. |

Suitable ornamental species which provide flowers round the year may also be planted.

3. Planting Technique:

1. At least 12 months old 7 to 8 feet tall seedlings raised in 10" X 16" bags to be planted.
2. 75 cm³ pits excavated at a spacing of 10 mts along roads and 5X5 m or 7X7 mts for block planting.
3. Staking, Protection, application of F.Y.M. watering provided as per Model estimate. Model-12
4. Pretreated stakes are used for enhancing life of stakes.

VII. ROADSIDE PLANTING MODEL:

1. Area description : The Road margins available along NH, SH, MDR's and Village roads throughout the state. These margins are often encroached. The species along roadsides are required to be planted with species which should be compatible with agricultural crops, to avoid hostility from adjoining cultivators.

2. Core Species :

1. Dry Zone : Bevu, Ala, Arali, Basri, Goni, Honge, Tapasi, Hunse, Sisso, Bage, Mango, Nerale, Seehunse and other suitable local species.
2. Transition zone : Bevu, Ala, Arali, Basri, Hunse, Sisso, Bage, Honge, Mango, Nerale, Hippe, Tapsi and other suitable local species.
3. Malnad and Western Ghats : Mango, Halsu, Nerale, Mahagony, Sampige, Veteria, Hippe Hole dasval and other suitable local species.
4. Coastal Zone : Sampige, Holedasavala, Tare, Mahagony, Vateria, Mango, Halsu, Uruhonne and other suitable local species.

Other suitable local species shall be personally decided by concerned Deputy Conservator of Forests, after proper assessment with regard to the site, climatic and other local conditions.

3. Planting Technique:

1. At least 14-18 months old minimum 7-8 feet tall seedlings raised in 14"X20" bags to be planted.
2. Pits of 1X1X1 Mts at a spacing of 10 Mts on either side of the road, 200 plants/km
3. Application of F.Y.M. 1 cum / 40 plants during 1st year.
4. Protection with staking and tying of thorns every year for 3 years. Proper treatment of stakes for long life.
5. Watch & Ward for minimum of 5 years; the watcher will do replacements and maintain thorn fencing.
6. Watering in Dry zones and Transitional zones 5 times in first year and 3 times in the second year.
7. Other Cultural operations like weeding, Saucer Bharav, Fire tracing etc., as per model estimate. Model-13

XIII. CANAL BANK MODEL

1. **Area Description** : Planting can be taken up along canals of irrigation projects. Since water is available for part of the year these sites are suitable for raising fruit yielding and NTFP species. If the site along Canals is very poor due to dumped soil, the pits can be filled with imported soil.

2. Core Species :

Dry zone : Bevu, Honge, Mango, Nerale, Seemaruba, Sissoo, Bage, and other suitable local species. Cassia siamea and Glyricidia in poorer sites

Transitional zone : Bevu, Honge, Sissoo, Cashew, Seemaruba, Mango, Hippe, Hunse, Halasu, Nerale, Nelli and other suitable local species.

3. Planting Technique :

1. Atleast 12 months old 7-8 feet tall seedlings raised in 10" X 16" bags to be planted at 10 m apart in pits of 0.75 m³.
2. C.siamea, Sissoo, Glyricidia are raised in 5"X8" Polythene Bags and planted in trenches of 4X0.5X0.5 mts in poorer sites.
3. Seed sowing is taken up on mounds with C.siamea and Glyricidia.
4. Miscellaneous plants provided with staking, protection, F.Y.M. application, watering on par with Road side plantations.
5. Barbed wire fencing may be taken up, if sufficient width strip is available.
6. Watch and ward provided for 5 years.
7. Other details as per Road side planting model estimate, Model-13.

FARM FORESTRY

Karnataka Forest Department has realized that the task of bringing 33% of geographical area cannot be achieved without facilitating voluntary tree planting by people outside the forest areas. Various schemes, especially the externally aided projects have tried to implement ambitious Farm Forestry components in the past.

The present status of farm forestry envisages that the seedlings raised for farm forestry in departmental nurseries and priced at subsidized rates will be purchased by interested farmers and they will take care of such assets.

However in view of the magnitude of the programme and the shortage of staff, lack of extension expertise, lack of mechanism to ascertain species preference of people, lack of proper distribution network, it is suggested that a comprehensive policy for farm forestry with following components be put in place.

- 1) The species preference of farmers is mandatorily assessed by a systematic demand survey, well in advance of nursery season.
- 2) The seedlings raised for farm forestry should be from known, superior seed source.
- 3) Wherever feasible clonal / grafted seedlings to be made available to farmers.
- 4) A stable policy on pricing of seedling supplied to farmers for planting, to be put in place after wider consultations. This is pertinent in view of pricing of seedling in plan schemes, where as the seedlings are not only given free but the planting costs are also paid under National Rural Employment Guarantee Scheme.
- 5) Krishi Aranya Protsaha Yojane, A scheme to incentivize for farmers @ Rs.10, 15, and 20 at the end of 1st, 2nd and 3rd year for each surviving seedling is a good initiative in encouraging Farm Forestry.
- 6) Well organized network of distribution centre using the existing infrastructure like the Forest Department offices, Panchayat Office premises, Temples, Schools etc., where the required number of seedlings are stocked and replenished as and when the seedlings are lifted by the public. Any person interested in buying seedling should be able to pay and carry the required number of seedlings from the centers. The cost involved in creating distribution centers should be budgeted and made available to field officers.
- 7) About 5000 Village Forest Committees and around 6000 self help groups, created under various programmes and NGOs may be involved in demand survey, raising of seedlings and establishing and running distribution centers. Suitable remuneration and incentives may be paid to those organizations and persons for this purpose.

- 8) Tree felling and transportation rules have to be made farmers friendly to facilitate farm forestry on large scale.

Species proposed: The species list is only indicative. The assessment may be done by a systematic demand survey.

Dry zone: Teak, Silver oak, Sandal, Neem, Tamarind, Mango, Nelli, Bamboo, Feronia, Drumstick, Karibevu, Kadbadam, Honge, Seemaruba, Hebbevu, Ailanthus excelsa, Sissoo etc.

Transitional zone: Teak, Silver oak, Hebbevu, Sandal, Cashew, Nelli, Mango, Halsu, Marihal, Bamboo, Neem, Tamarind, Drumstick, Karibevu, Red sanders, Honge, Seemaruba, Shivani, Sissoo etc.

Malnad, Western Ghats and Coastal zone: Teak, Sandal, Beete, Silver oak, Hebbevu, Cashew, Mango, Halasu, Nelli, Acacia auriculiformis, Casurina equisitifolia, Murugal, Uppage, Wate, Antawala, Dalchinni, Shivani, Ber Halsu, Marihal Bamboo and Burma Bamboo etc.

Eucalyptus has been traditionally preferred species in southern dry and transitional zones of the state, because of its fast growing, high yielding, coppicing and non-browsing qualities. There is a perception about not encouraging the planting of Eucalyptus. There is no conclusive evidence substantiating labelling of Eucalyptus as an ecological disaster. Similarly Acacia auriculiformis and Casurina are also in high demand in Malnad and Coastal areas. At present Eucalyptus, Acacia, Casurina are not covered under Krishi Aranya Protsaha Yojane. However **Government may take a final view on promoting these species based on wider consultations.**

NURSERY PRACTICES

Raising of successful plantation has 3 critical components (1) Selection of right species for the site (2) Raising right planting material (3) Following right planting technique and practices.

Nursery practices should aim at raising right planting material. The seed for raising planting material should come from known superior quality source. The seedling should be of the right age, sturdiness, attain critical height, so that within the period of normal plantation maintenance (3-5 years), the plantation is established beyond damaging factors. This is all the more important when native, slow growing species form the core of our planting programme. These species not only need to be raised in bigger containers, they need to be nursed for sufficient period in nursery, so that they attain status of right planting material. This is the most important critical factor that has direct bearing on raising successful native species plantations.

The following points are very important to streamline the nursery practices:

- 1) A list of core species have to be prepared for various models at planting in the department and Farm Forestry to assess the species wise seedling targets, seed requirement etc.,
- 2) All the seed source for planting programme should come from identified seed source only, either from plus trees, seed stands, clonal orchards and facilities for seed processing and certification upgraded to achieve this target in next 3-5 years.
- 3) To begin with all seedlings for distribution to public should come from known sources. In case of fruit yielding species like Mango, Hunsu, Nelli, Nerale, and Halsu etc grafted seedlings can also be supplied to public.
- 4) For raising quality and healthy seedlings, the seeds should not be directly shown in to the bags and they should be first shown in the mother seed beds. In order to ensure genetically superior quality of seedling , it is essential to sow the genuine quality seeds in the beds at least 3 times the number of required of seed beds. The seeds can be sown in staggered period of 3 days each – 1/3rd number of seed beds are sown at the beginning, another 1/3rd number of seed beds are sown after three days and remaining 1/3rd number of seed beds are sown after six days. The sprouts of seeds as soon as they are germinated from first, 1/3rd set of seed beds shall be transplanted to polythene bags at first stage (1/3rd) , the sprouts of second 1/3rd set of seed beds shall be transplanted in to another set of polythene bags(1/3rd) and the sprouts of germinated seeds from third, 1/3rd set of seed beds can be transplanted to 3rd set of polythene bags (1/3rd). Seedlings which sprout within 3 days of emergence of first sprouts only have to be transplanted and sprouts which emerge after 3 days should be discarded. To enhance further quality of seedlings, rigorous culling of weak seedlings in the polythene bags should be done within one month by pulling out such seedlings The empty

bags should be separated and shall be used for transplanting earliest germinated quality sprouts as explained above. This method shall be followed meticulously for most of the species which do not exhibit 'root shock' after transplanting of sprouts. For species which exhibit 'root shock', the seeds can be shown smaller polythene bags as in case of raising tall seedlings as explained below.

For raising tall seedlings, sufficient number of seedlings should be raised to take care of rigorous culling at early stage. For re-bagging, seedlings in 4"x6" should be raised in large number, at least thrice the number of required number of seedlings for the species which are difficult to survive after transplanting of spout seedlings or which do not with stand root shock or which can not be transplanted due to unfavorable weather conditions like continuous rainy season. After germination in the 4"x6" polythene bags, the earliest germinated vigorous seedlings should be retained and late germinated weak seeding should be mercilessly pulled out from the polythene bags and the empty bags can be used subsequently for other species or for next round of sowing. The culling out shall be done within one month. The selected seedlings in polythene bags shall be maintained and they shall be transplanted to bigger bag within two to three months before root coiling. For bigger seed species like mango, vateria etc. 5"x8" polythene bags can be used by following above explained procedure.

The cost of raising such seedlings for transplanting has to be provided for. At the time of re-bagging the selected and retained seedlings should be at least 2 months old.

- 5) Good quality, vigorous seedlings of Teak, Bamboo and sandal can be raised by proper precautions detailed below:
 - I. For teak seeds from known source should be used for sowing. From standard seed bed, stumps of thumb thickness, maximum 400 per bed only should be used. Rest of the stumps which are thinner in size and come up later should not be used and they should be discarded.
 - II. **Bamboo** : Bamboo seeds must be sown in seed beds first. Then 4-6 week old bamboo seedlings should be transplanted in to ridges and forrows Transplant beds. The seedlings should be allowed to grow in transplant beds for about 10-12 months. The seedlings which have well developed rhizome only should be transplanted in to 10"x16" bags and maintained for about 6 months. Thus raising proper bamboo seedlings will have 3 stages and require about 18 months of planning prior to planting.
 - III. **Sandal** : Sandal seeds have large proportion of immature seeds, which produce weak seedlings and they die after transplanting in to Polythene Bags or remain yellowish and weak throughout. It is very important to segregate well matured seeds and select only vigorous / dormant seedlings from seed beds. Seedlings which sprout within 3 days of the emergence of first

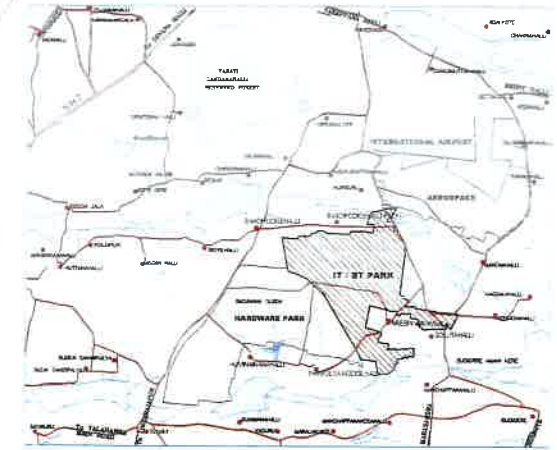
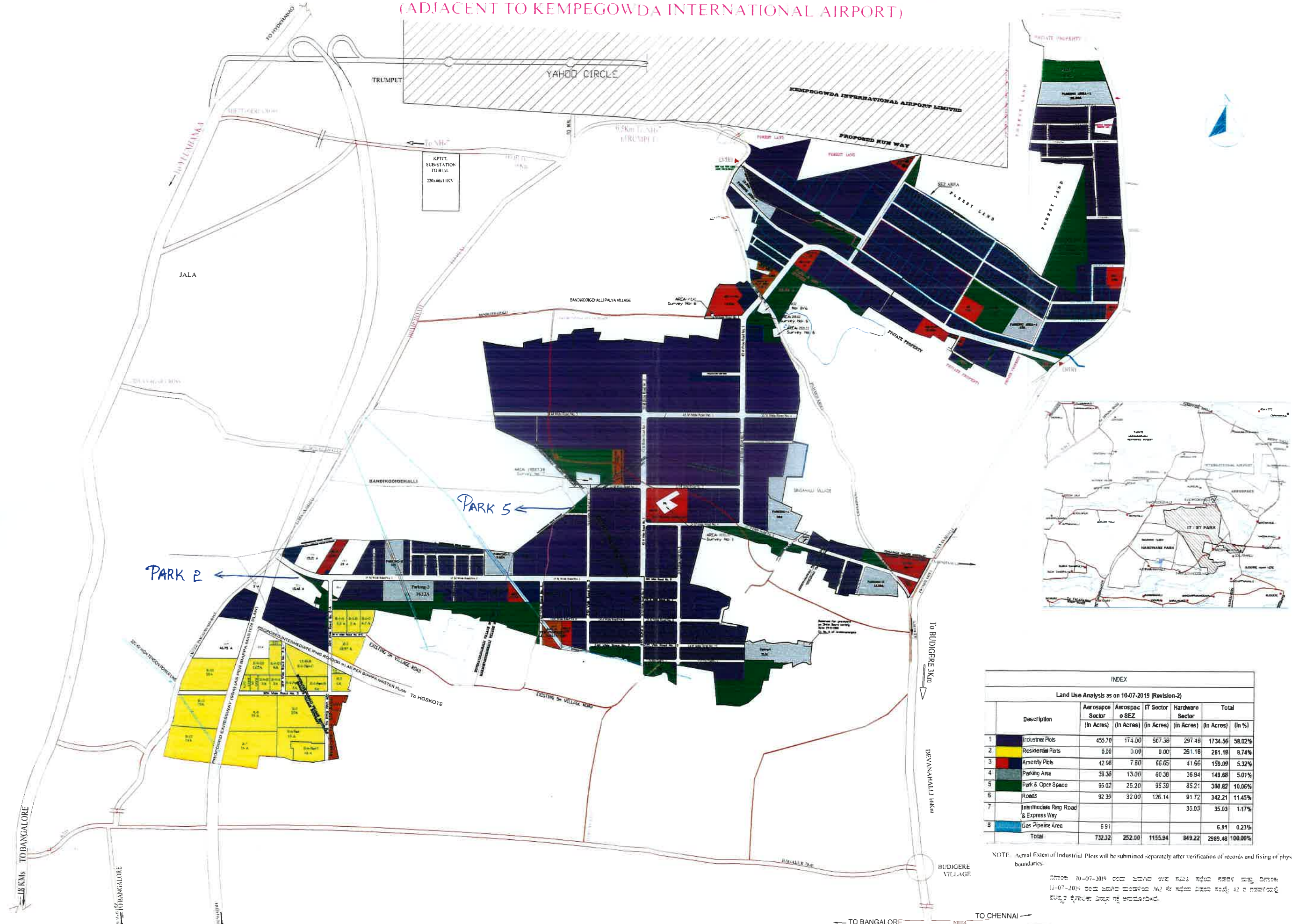
sprouting only should be used. Seeds should be treated with G.A (Gibberillic Acid) 500 PPM for 16 hours for better germination and periodic, regular plant protection should be done using DithaneM-45 (0.25%) and Ekalnx (0.02%) sprayed at monthly intervals.

- 6) The **nursery calendar** for raising right planting material is tabled below:

| Sl. No. | Size of Polythene Bags/HDP E Bags. | Right age for planting | Month of sowing or Re-bagging | Month of raising 4"X6" , 5"X8", seed beds for Re-bagging / transplanting |
|---------|------------------------------------|-------------------------|-------------------------------|--|
| 1. | 5"X8" | Not less than 6 months | Before end of November | TPs from seed bed / Direct Sowing in the thrice the number of bags. |
| 2. | 6"X9" | Not less than 8 months | Before end of October | Direct sowing from teak beds. |
| 3. | 8"X12" | Not less than 10 months | Before end of July | Before end of April. |
| 4. | 10"X16" | Not less than 12 months | Before end of May | Before end of February |
| 5. | 14"X20" | Not less than 12 months | Before end of April | Before end of January |

- 7) There should be a strict mechanism to monitor collection of seed and the timely raising of seedlings. The nursery infrastructure has to be suitably developed. This has to be personally monitored / ensured by Deputy Conservators of Forests / Chief Conservators of Forests of the circle.
- 8) Quality seeds should be procured from research and seed units of the department. Only if the requirement exceeds their capacity, that such seeds should be procured from elsewhere under proper certification about area of collection, viability, germination percentage and other relevant information.
- 9) The quality of ingredients viz., sand, good quality FYM and red earth should be ensured. Stringent action including disallowance of expenditure should be done for using poor quality ingredients.
- 10) All Nurseries should have proper records, Registers, display boards, name boards and proper layout, water tanks and pipelines for watering and sanitation to be maintained.

LAYOUT MAP OF HI-TECH. DEFENCE AND AEROSPACE PARK INDUSTRIAL AREA
(ADJACENT TO KEMPEGOWDA INTERNATIONAL AIRPORT)



| INDEX | | | | | | |
|---|-----------------------------|--------------------------|----------------------|----------------------------|------------------|----------------|
| Land Use Analysis as on 10-07-2019 (Revision-2) | | | | | | |
| Description | Aerospace Sector (In Acres) | Aerospace SEZ (In Acres) | IT Sector (In Acres) | Hardware Sector (In Acres) | Total (In Acres) | Total (In %) |
| 1 Industrial Plots | 453.70 | 174.00 | 507.38 | 297.48 | 1734.56 | 58.02% |
| 2 Residential Plots | 0.00 | 0.00 | 0.00 | 261.18 | 261.18 | 8.74% |
| 3 Amenity Plots | 42.98 | 7.80 | 66.65 | 41.66 | 159.09 | 5.32% |
| 4 Parking Area | 39.38 | 13.00 | 60.38 | 36.94 | 149.68 | 5.01% |
| 5 Park & Open Space | 95.02 | 25.20 | 95.59 | 85.21 | 300.82 | 10.06% |
| 6 Roads | 92.35 | 32.00 | 126.14 | 91.72 | 342.21 | 11.45% |
| 7 Intermediate Ring Road & Express Way | | | | 35.03 | 35.03 | 1.17% |
| 8 Gas Pipeline Area | 6.91 | | | | 6.91 | 0.23% |
| Total | 732.32 | 252.00 | 1155.94 | 849.22 | 2989.48 | 100.00% |

NOTE: Aerial Extent of Industrial Plots will be submitted separately after verification of records and fixing of physical boundaries.

ಆಂತರಿಕ: 10-07-2019 ರಂತೆ ಒದಗಿಸಿದ ಉತ್ತರ ಕೆಳಗೆ ಕೊಡಲಾಗಿದೆ. 11-07-2019 ರಂತೆ ಒದಗಿಸಿದ ಉತ್ತರ 362 ಕ್ಕೆ ಸಮಾನವಾಗಿ 42 ಕ್ಕೆ ಸಮಾನವಾಗಿ ಕೊಡಲಾಗಿದೆ.