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Executive Summary

Agriculture is the most important sector of Indian as well as state economy. Department of Agriculture & Co-operation (DAC), Ministry of Agriculture, Govt. of India launched Rasthriya Krishi VikasYojana (RKVY) from 2007-08, as an umbrella scheme for ensuring holistic development of agriculture and allied sectors with 4% annual growth. The Natural Resource Management component of the scheme is being implemented all over the State through the different Forest Divisions.

Based on the feedback from the States during implementation in the 12th Plan the aim of the scheme was shifted towards making farming a remunerative activity through strengthening farmers efforts, risk mitigation and promoting agri-business entrepreneurship. The erstwhile scheme of RKVY guidelines have been revamped as **RKVY- RAFTAAR – Remunerative Approaches for Agriculture and Allied sector Rejuvenation**, to enhance efficiency, efficacy and inclusiveness of the programme for the remaining period of the Fourteenth Finance Commission. The main objectives of RKVY-RAFTAAR are as follows: -

1. Creation of pre- and post-harvest infrastructures to strengthen the farmers efforts,
2. Promoting value chain addition linked production model,
3. Ensuring local/farmers' needs being better reflected in the agricultural plan of the State,
4. Mitigating risk of farmers with focus on additional income,
5. Empowering youth through skill development, innovation and agri-entrepreneurship,
6. Attending national priorities through sub schemes.

RKVY-RAFTAAR continues to be implemented as a Centrally Sponsored Scheme in the ratio of 60:40 (GOI and State Share respectively).

The State of West Bengal has nearly 3% of the nation's cultivable land and about 8% of the country's population. The agricultural sector is characterized by the predominance of small and marginal farmers tilling more than 68% of the cultivable area of the State. Since the scope of bringing more area under cultivation is limited emphasis has been laid mainly on increasing the productivity of different crops by using quality seeds, fertilizers, plant protection measures, introducing suitable mechanizations and emphasizing on soil amelioration and soil moisture conservation measures being **IMPORTANT PRE-HARVEST STRATEGIES** to ensure optimum crop production. Our objective is to undertake relevant soil moisture conservation works in the forestland to conserve natural resources and achieve consequent improvement in agriculture crop productivity in fringe areas. In order to achieve the goal, relevant work programme have been identified in different sites of West Bengal, which will help in rain water harvesting, reduced erosion, and increase canopy cover, and minimized impacts of floods, increase humidity, increase regeneration and change in micro-climate and thereby ensuring increased farming opportunity and



production to the forest fringe population. The major objectives of the RKVY-RAFTAAR 2018-19 are as follows;

1. To improve the productivity of the areas under treatment.
2. To improve the ground water regime.
3. To control soil erosion and arrest the sedimentation to the extent possible.
4. To create small irrigation system for the agricultural lands in the proximity of forest areas.
5. To develop/create modern infrastructures/centers for improved quality planting materials for enhancing tree covers productivity and biodiversity.

Despite having so much of potentialities forest fringe areas in the region has remained under developed. It is primarily because there are also a number of constraints and problems, which are responsible for the present state of natural resource management and production. These constraints can be grouped under five broad heads at local / regional / national level these are; climatic, infrastructural, biophysical, management and socio-economic constraints.

The major objectives are to improve the productivity of the areas through improving the ground water regime, controlling soil erosion and runoff and arresting the sedimentation to the extent possible, creating small irrigation system for the fringe agricultural lands and developing/creating modern infrastructures/centers for improved quality planting materials for enhancing productivity and biodiversity.

The major reasons for selecting the proposed strategy is to address the change in land use pattern, climate variability, and infrastructure development due to change in socio-economic condition of the adjacent population in the project area. The new approach envisages a broader vision of natural resource management to achieve goal of soil moisture conservation. The project is being implemented in the forest fringe, within the forestland, and aims to benefit the fringe area population in their agricultural endeavor. All the **major interventions** proposed in the **DPR** fall in the category of **Infrastructure & Assets – Pre-Harvest Infrastructure**.

To achieve the goal of soil moisture conservation and tall seedling production centre projects the proposed activities and the total estimated budget for 2018-19 are as follows;

- ✓ The 682 km of contour trenches at a budget of Rs. 27,33,456/-
- ✓ The 40 units of earthen dams at a total budget of Rs. 3,26,87,880/-
- ✓ The 5000 Cum of gully plugging and the total budget of Rs. 1,12,80,000/-
- ✓ The 500 Cum of River training works to prevent damage to agricultural fields and the total budget of Rs. 24,91,000/-



- ✓ The 5000 Cum of Hand packed Walls at a total budget of Rs. 1,15,20,000/-
- ✓ The 7000 Cum of Boulder Sausage Wall at a total budget of Rs. 3,48,74,000/-
- ✓ The 4 Km of Catch Water Drain at a total budget of Rs. 57,20,000/-
- ✓ The 6 unit Clonal seed orchard and seedling seed orchards at a total budget of 30,00,000/-
- ✓ The 60 ha Permanent Research Plots at a total budget of Rs. 50,00,000/-
- ✓ The 3 units Seed Testing Lab at a total budget of Rs. 60,00,000.-
- ✓ The 1 unit Watershed Management Cell at a total budget of Rs. 30,00,000/-
- ✓ The 20 Nos. of Production Center of 0.5 lakh tall QPM at a budget of Rs. 7,97,00,000/-
- ✓ The 1% administrative cost is Rs. 20,00,000/-
- ✓ The total infrastructure development proposed cost is Rs. 19,80,03,800/-
- ✓ Thus the total estimated budget for the proposed development is Rs. 20,00,00,000/-

There are many intangible and tangible benefits of all the proposed developmental activities to improve the agricultural activities. The respective Internal Rate of Return (IRR) calculated in Cost benefit Analysis (CBA) is as follows;

- ✓ Contour Trench; NPV – Rs. 3058117 and IRR is 38%
- ✓ Earthen Dam; NPV – Rs. 67144522 and IRR is 37%
- ✓ Gully Plugging; NPV – Rs. 7390091 and IRR is 27%
- ✓ River training works to prevent damage to agricultural fields; NPV – Rs. 2499770 and IRR is 37%
- ✓ Hand Packed Wall; NPV – Rs. 13832772 and IRR is 40%
- ✓ Boulder Susage Wall; NPV – Rs. 16343275 and IRR is 23%
- ✓ Catch water Drain; NPV – Rs. 3872291 and IRR is 30%
- ✓ Clonal seed orchard and seedling seed orchards; NPV – Rs. 4571730 and IRR is 30%
- ✓ Permanent Research Plots; NPV – Rs. 3755510 and IRR is 34%
- ✓ Seed Testing Lab; NPV – Rs. 2283227 and IRR is 22%
- ✓ Watershed Management Cell; NPV – Rs. 4018162 and IRR is 35%
- ✓ Production Center of 0.5 lakh tall QPM; NPV – Rs. 95695154 and IRR is 11%

The major outcome of the infrastructure development in the forest land is an increase in agricultural crop, timber, fuel wood, biomass, fodder, minor forest produce, hydrological services, soil conservation, biodiversity conservation, carbon sequestration and reduction in soil erosion.

Construction of contour trench, earthen dam, gully plugging, river training, catch water drains, boulder sausage works, hand packed walls, production center for tall QPM of 0.5 lakh capacity would be some of the most effective strategies for bringing climatic, hydrological and socio-



economic change to different parts of forest and non- forest land of West Bengal. These infrastructures would be highly beneficial for forest and agriculture by aligning various sectors through technological, soil and water conservation interventions, and land-use diversification. The various infrastructure developments for soil and water conservation programs and interventions - which are **Pre-Harvest** activities - would result in significant reduction in land degradation and improvement in productivity in different parts of the West Bengal.

Background:

The Additional Central Assistance Scheme-‘Rashtriya Krishi Vikash Yojana’ (RKVY) was launched by the Govt. of India mainly to incentivize the state to attain 4% annual growth rate in agriculture & allied sectors during the 11th plan period. RKVY was introduced as a new Additional Central Assistance Scheme to State Plan with 100% assistance. But from 2015-16, 60% grant is provided by the Govt. of India and the balance 40% fund comes from State Share. The project is taken up for holistic development of agriculture and allied sectors in which Forest Department is a stakeholder along with some other departments.

Some studies indicate that the surface water availability per capita per year for population living in basin area of River Damodar would be reduced in future leading to severe water shortage in the future. Studies have shown that the reduction of water availability would be more in case of the Rupnarayan than that of the Damodar watershed. Similarly the river Dwarakeswar including the river Gandheswari would face severe shortage of water followed by other basins such as Kailaghai and Ajoy river. The surface water available per capita per year for population living in catchment of River Kangsabati would face seasonal or regular water stress in the projected scenario where surface water availability per capita per year would be reduced.

As increase in population results in increased demand in agricultural production, conservation and replenishment of water resources and reducing runoff will be of utmost importance. To meet the increasing demand for water, rain water harvesting and recharging of ground water through appropriate soil conservation works for arresting soil erosion and runoff, need to be undertaken in areas with scanty tree cover and exposed to the elements of weathering. Forest sector is included as one of the allied sectors as it supplements to agricultural growth and the agricultural lands are mostly surrounded by forest. Forest Department takes up different forestry activities and soil & moisture conservation works with the objective of reducing runoff and erosion of



fertile topsoil through increase in tree cover and other ameliorating measures, thereby improving soil quality and soil moisture, soil productivity and rain water harvesting.

The **contour trench** construction is an extension of the practice of ploughing fields at a right angle to the slope. Contour trenches are ditches dug along a hillside/slope in such a way that they follow a contour and run perpendicular to the flow of water. The soil excavated from the ditch is used to form a berm (a narrow shelf) on the downhill edge of the ditch. The berm can be planted with permanent vegetation (native grasses, legumes) to stabilize the soil and for the roots and foliage in order to trap any sediment that would overflow from the trench in heavy rainfall events. Contour trenches are used to slow down and attract runoff water, which then infiltrates into the soil. Small scale contour trenches can also be used within field level. The water that infiltrates can be used as soil moisture for crops cultivated after a rainfall event, directly for pumped irrigation, or extracted from shallow wells in the area. Suitable conditions are locate trenches in natural run-off areas, but not on slope over 10 % and soil in vicinity needs to have sufficient infiltration capacity and potential sub-surface storage capacity.

An **earthen dam** will be unique to an individual site; although special emphasis will have been given to local conditions, certain guidelines and generalities can be applied to all dams. When followed, such guidelines will allow for the safe and economic construction of embankments. It must be stressed that, although most of the procedures are simple, and more a matter of common sense than advanced engineering knowledge. The main advantages involved in the construction of small earth dams are: Local natural materials are used. Design procedures are straightforward. Comparatively small plant and equipment are required. Foundation requirements are less stringent than for other types of dam. The broad base of an earth dam spreads the load on the foundation. Earthen dams resist settlement and movement better than more rigid structures and can be more suitable for areas where earth movements are common.

A **gully plug/hand packed wall** is a small, temporary or permanent dam constructed across a drainage ditch, gully, swale, or channel to lower the speed of concentrated flows (like an overflow weir) for a certain design range of storm events. They may be more categorized as a type of floodwater rather than a runoff harvesting technique. A gully plug can be built from logs of wood, stone, pea gravel-filled sandbags or bricks and cement. They have been used widely in India. Gully plugs have been built in riverbeds with no coarse sand transport may end up being used in this way. These structures are relatively cheap and can last about 2-5 years.



The **Catch Water drains/Runoff Diversion Sites** are manmade drains constructed along the contour lines for the Collection/Diversion of the flow of the streams or minor watercourses. These help in staggering the runoff in peak periods and for utilizing the water during lean periods.

Permanent Research Plots, are well demarcated areas laid down within plantations of important species for growth studies of those species. The studies provide us adaptability, germinability, rate of growth, annual increment etc for a species in a given site.

Clonal / Seedling seed orchards, the success of any plantation and its subsequent growth starts with the seeds that are planted. Therefore, it is of primary importance that seeds from good mother trees – trees with good form and growth factors – are collected and planted so that the trees in a plantation have good form and growth leading to quality timber production as well as providing good cover.

Clones are prepared from very high quality mother trees of species which are easy to root. Clones of such trees give rise to seedlings having all the good quality of a mother tree and perform very well under the same condition. Clonal orchards are repository of good clonal material and can be used to raise very good plantation.

Seed Testing Laboratory, good and quality seeds are a pre requisite for good seedling in nursery leading to a highly valuable plantation. All production units require to be supplied with quality seeds which are graded for same size and weight, devoid of impurities and debris, so that germination and growth are assured. Testing for vigour and germination, dormancy and seed storage are also important activities. To ensure this, seed testing laboratories are required equipped with seed grader and other equipments to grade the collected materials into clean and pure seeds and also test for germ inability and overcoming dormancy.

Watershed Management Shell, the GIS Lab under the Working Plan and GIS Circle, caters to the GIS needs of the State Forests Department. Since few years the Lab has been working in the field of forest fire detection, digitization of the forest boundaries, preparing the stock maps, preparing watershed maps for Namami Ganga project and GIM etc.

However, due to quick changes in the technologies associated with the GIS techniques, the GIS Lab need to be further upgraded so that the data generated is compatible with the data of institutes like FSI, Dehradun, NRSC Hyderabad etc., so that the exchange of the information is on the same platform.

This up gradation would also involve the analysis of the field information using the latest version of GIS software vis a vis the spatial information as available/acquired for the State by the way of digitized Maps from various sources from time to time



A. Problems to be addressed:

In spite of having access to abundant natural resources the fringe areas remain socio-economically under developed. It is primarily because there are a number of constraints which are responsible for the present state of low accessibility to natural resources.

The impact of climate change through increased evaporation (due to global warming) combined with regional changes in precipitation characteristics (such as total amount, variability, frequency of extremes) has the potential to affect runoff, frequency and intensity of floods and droughts, soil moisture relation, water availability for irrigation and hydroelectric power generation. In these watersheds with forested catchments, the hydrologic cycle involving precipitation, subsurface flow, groundwater flow and stream flow are closely linked to water quality as the water movement through the forest ecosystem also transports sediments, dissolved nutrients as well as fertilizers and pesticides. Understanding relationship between forested ecosystems and quality of surface and subsurface water, river ecological flow associated with these systems is a key component of river basin management.

Constraints of Climate include heavy rainfall with high intensity and periodic distribution and humidity, low temperature during winter, low light intensity and radiation, recurrent floods as well as drought conditions. Infrastructural Constraints include geographic isolation, lack of water harvesting structures to prevent flooding and erosion. The acidic soil, in accessible areas, the varied undulating topography, soil erosion and degradation, ecological imbalance, recurring floods, abundance of weeds, insects, pests, and diseases and low level technology are some of the important bio-physical constraints limiting agricultural and forest production. There are also a large number of problems connected with management and some important ones are the gap in extension, poor motivation and awareness, inadequacy of training, lack of incentive for the farmers including non-assurance of support price; non availability of improved inputs in time etc.

West Bengal has annual rainfall of 1000 – 2500 mm. North Bengal and Gangetic Delta Plains, has major problems of Gully and stream bankerosion. Many part of West Bengal where the rainfall is 1000 – 1500 mm do face problem of improper land management. (Bhattacharya & etal. 2016)

The major problems to be addressed through the different soil conservation works as:

1. Increased runoff of precipitation in land with reduced the cover;
2. Imbalances in water table;
3. Loss of agricultural production due to water shortage;



4. Loss of top soil due to water and wind erosion;
5. Decrease in soil moisture content and soil nutrition;
6. Decrease in regeneration, vegetation, timber, fuel wood, biomass, fodder;
7. Increase in sedimentation;
8. Soil loss due to soil erosion and sedimentation;
9. Decrease in carbon sequestration;
10. Paucity of modern infrastructures/centers for improved quality planting materials for enhancing productivity and biodiversity

Major crops in West Bengal are rice, potato and jute. The state possesses about 14 percent of the nation's rice cultivation area. West Bengal agricultural production includes high value commercial crops like jute and tea. The state also produces significant amount of fruits and vegetables. The absence of tree cover is resulting, the precipitation directly hitting the ground and increased runoff carrying alongwith the top soil, instead of reaching the underground water table and recharging it.

Forest cover reduces the magnitude of peak discharge during rainy months and ultimately controls excess runoff in the downstream. Forests induce infiltration which leads to more uniform flow round the year. The water quality results indicate that the organic loading as well as coliform and fecal coliform will be reduced substantially by dense forestlands compared to disturbed forest. In general, conversions to forestland have the potential to reduce erosion and subsequent sedimentation, as well as reduce levels of dissolved nutrients and pesticides in surface runoff and groundwater. These improvements in water quality are a function of lower amounts of runoff and leaching as well as lower concentration of potential pollutants that are expected to result from the conversion of forestland. Part of the banks of river Ganga which is mostly covered by forested catchment, the streams are functioning at present as perennial water safe source and also to maintain the base flow or ecological flow to some extent that may be due to high amount water retained and ultimately recharged through vegetation.

River runoff is a function of precipitation, land use, soil type, porosity, slope etc. Again water availability largely depends on river runoff. Larger runoff will imply lesser availability of water in the catchment. In Eastern India the problem of soil erosion largely causes the increase in runoff. Forest or vegetation can detain the runoff, absence of which may allow water to drain out of the basin with significantly small recharging. In some basins of West Bengal, namely Kangsabati, Rupnarayan, Gandeswari, Dwarkeswar, Damodar, Kalighai, Ajoyetc, high slope causes runoff to increase but dense forest cover helps the catchment to hold the surface runoff to a greater extent.

Some studies indicate that the surface water availability per capita per year for population living in basin area of River Damodar would be reduced in future leading to severe water shortage in the



future. Studies have shown that the reduction of water availability would be more in case of the Rupnarayan than that of the Damodar watershed. Similarly the river Dwarakeswar including the river Gandheswari would face severe shortage of water followed by other basins such as Kailaghai and Ajoy river. The surface water available per capita per year for population living in catchment of River Kangsabati would face seasonal or regular water stress in the projected scenario where surface water availability per capita per year would be reduced.

With populations rising explosively in some parts of the world and per capita demand of water increasing in others, optimization of water resources (both stream flow and groundwater reserves) is becoming increasingly important. Also, rising demands for timber products require the establishment of large areas of fast-growing plantation forests, often on land that is currently not forested. Coupled with the continued indiscriminate clearing of the world's natural forests, which in many areas serve as the traditional suppliers of high-quality water, the associated degradation of soil and water quality due to erosion, and the possibility of less dependable precipitation inputs due to climate change, a sound understanding of the hydrological functioning of forests is arguably more important than ever before.



B. Aim and objective:

Recently Government of India, 2014, has formulated a revised operational guideline, for RKVY. The present project proposal for 2018-19 has been prepared as per the revised guidelines of Government of India.

Objectives:

1. To improve the productivity of the areas under treatment.
2. To improve the ground water regime.
3. To control soil erosion and arrest the sedimentation to the extent possible.
4. To create small irrigation system for the agricultural lands in the proximity of forest areas.
5. To develop/create modern infrastructures/centers for improved tall quality planting materials for increasing tree cover and biodiversity.

Activities:

Based on the identified objectives, the following activities have been shortlisted in this project:

1. Construction of soil conservation and rainwater harvesting structures for water conservation, ground water recharging and irrigation.
2. River training works and slope stabilization in North Bengal.
3. Creation of modern infrastructures for producing quality tall planting materials to improve and enhance tree quality in agroforestry for increased productivity and tree cover and biodiversity.

The infrastructure items will improve the working of the front line staff of the Division and in effect develop the forest area under its jurisdiction by increasing the short agriculture crop, timber, quick growing (shed tree/ fire wood), game and fodder for wild life, Non Timber Forest Product (NTFP), herbal, fruits, ornamental plants and agriculture areas. The fringe area villages will be benefited from the project. We would be achieving soil moisture conservation, ground water recharge definitely with minimum rainfall. Reduced erosion, reduced run-off, increase canopy cover, increase litter and organic matter of the soil, increased agricultural crops and also increase in vegetable due to increase in water table of the area, the barren land and degraded forests would be regenerated.

The fringe community resilience would be increased due to change in microclimate by the interventions proposed. The erosion and flooding would be reduced and agricultural crop productivity will be increased. The infrastructure items will provide the forest division to effectively and efficiently implement its plans and schemes to improve the forest and better manage of its resources on a long term basis.



C. Strategy:

Among the identified sites of West Bengal, many are drought prone and many are flood prone districts. The only risk to this project is natural disaster like flood and drought etc. The major problems are soil erosion, run-off, decrease in ground water table, decrease in green cover and adverse impacts of crop productivity in changing climatic conditions. The proposed infrastructure developments will help in mitigating the adverse climate impacts. The construction of contour trench, gully plugging, earthen dam, river training will help in mitigating the impacts of drought & flood. All the proposed interventions will mitigate the soil moisture content in draught and flood prone areas of West Bengal. All the concerned DFOs have the list of existed and ongoing activities, and the proposed structures are an updated only so there will be no duplication of activities (Land use map of West Bengal is mentioned in page 13). The major problems and the respective proposed strategy for RKVY 2018-19 for the West Bengal are:

- 1. Increased runoff of precipitation in land with reduced the cover** – The proposed contour trench, gully plugging and river training works will help in reducing run-off during precipitation and also minimized the soil erosion. These infrastructures will help in increasing soil – moisture conservation and increased regeneration. This would increase the green cover and work in soil binding.
- 2. Imbalances in water table**– The proposed construction of contour trench will help in recharging aquifers, earthen dams to do rain water harvesting, gully plugging will also help in rain water harvesting. These rain water harvesting structures for water conservation, ground water recharging and irrigation.
- 3. Loss of agricultural production due to water shortage** – The proposed infrastructures e.g. contour trench, earthen dams, gully plugging and ring well will help to overcome the problem of water scarcity for agricultural produce.
- 4. Loss of top soil due to water and wind erosion** –The top soil erosion is very high due to decrease in canopy cover in West Bengal. The 0.5 lakh tall QPMseed planting material has been proposed to help in increase the ground cover. The QPM seed planting material has reduced mortality because of increase in root – shoot ratio.
- 5. Decrease in soil moisture content and soil nutrition** – All the proposed interventions e.g. contour trench, earthen dam, gully plugging, river training, production centre of quality planting material and ring wells will help in increase in soil moisture content and soil nutrition due to increase in biomass of the proposed areas.
- 6. Decrease in regeneration, vegetation, timber, fuel wood, biomass, fodder** – The ground water decrease, soil moisture & nutrient decrease is actually depleting the production of forest and



agriculture. All the proposed interventions will change the quality of natural resources and their management and also result in increase in regeneration, vegetation, timber production, fuel wood, biomass and fodder of the area.

- 7. Increase in sedimentation** – Due to continuous decrease in green cover resulting increased soil erosion. This is depleting all the water bodies and agriculture productivity. All the proposed interventions will help in reducing sedimentation and conserve water bodies and agricultural lands.
- 8. Soil loss due to soil erosion and sedimentation** – Contour trench, gully plugging, River training works will help in slope stabilization in North Bengal which will reduce soil loss due to soil erosion and sedimentation.
- 9. Decrease in carbon sequestration** – The proposed strategy to water harvesting structures i.e. contour trench, gully plugging, earthen dam, and construction of quality planting material will help in increase in carbon sequestration of the area.
- 10. Paucity of adequate modern infrastructures/centers for improved quality tall planting materials for enhancing tree cover and biodiversity** – To achieve the target of bringing 33% of the geographical area under tree/forest cover it is important to bring non-forest vacant lands such as the road side stretches, bunds, institutional areas etc., under afforestation. In such areas it is important to plant tall seedlings, in order to give the planted seedlings a ‘height’ advantage to overcome biotic interference. Creation of modern infrastructures/facilities for producing quality tall planting materials to improve and enhance tree quality in non-forest areas and improved biodiversity of the area.



Table: Land Use Pattern

District	Geo Area (Reorting Area)	Forest Area	Land under Non Agri. Use	Barren Land	Pasture & other grazing land	Land under Misc. trees	Cultivable Land	Total Rainfed Areas		Other fallow	Current fallow	Not shown areas	Net Irrigated Area	Gross cropped Area
								Cultivat ed	Cultural waste land					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Burdwan	698762	21165	208526	1367	222	1418	479365	117606	5605	1371	4978	452395	361759	861894
Birbhum	451118	15853	98348	477	231	854	342717	150115	3601	3170	6357	320078	192601	568120
Bankura	687998	148930	147002	2313	806	2823	389258	193116	2035	1620	32317	346866	196082	514447
Purba Medinipur	396594	899	101834	521	47	1964	303400	201983	205	281	1789	287967	101417	519922
Paschim Medinipur	928581	171935	159371	2451	827	10037	593531	356544	4061	2816	12690	560359	236987	982084
Howrah	138676		52031	2	83	1370	91576	50991	90	181	4699	79655	40585	15826A
Hooghly	313379	530	94327	226	89	1552	226369	68231	1569	460	377	214640	158138	554606
North 24 Parganas	386524		123226	64		4475	272055	172769			39125	257405	99286	510901
South 24 Parganas	948710	426300	141297	475		2685	397297	301757	1473	34	18911	373660	95540	539916
Nadia	390655	1216	88938	245	49	3912	308811	136649	788	367	4399	289169	172161	697229
Murshidabad	532499	771	129403	1958	12	1193	409039	202100	1023	155	512	399561	206939	937768
Uttar Dinajpur	312466	580	32671	63	26	2087	279686	203799	88	47	1394	276990	75887	508263
Dakshin Dinajpur	221909	932	32382	88	43	1028	162573	110983	72	193	1465	185592	51590	326675



District	Geo Area (Reorting Area)	Forest Area	Land under Non Agri. Use	Barren Land	Pasture & other grazing land	Land under Misc. trees	Cultivable Land	Total Rainfed Areas		Other fallow	Current fallow	Not shown areas	Net Irrigated Area	Gross cropped Area
								Cultivated	Cultural waste land					
Malda	370862	1679	88623			3430	285603	178764	92	332	60709	212455	106839	450766
Jalpaiguri	622700	179000	87939	3090		5276	363041	286215	101	79	11441	335694	76826	550759
Darjeeling	325469	124575	40165	2135	1126	2333	164590	133996	1555	3646	17666	132507	30602	194119
CoochBehar	331565	4256	68081	851	35	5633	264968	224965	116	40	1196	251955	40003	551876
Purulia	625646	75048	104477	5307	2559	3190	443984	377560	8232	4722	102703	317092	66424	373907
West Bengal	8684113	1173669	1798641	21633	6155	55260	5807871*	3468143	30706	19514	322728	5294040	2309666	9801516

Excluding Kolkata,(Source: Evaluation wing,Directorate of Agriculture & Economic Review,Govt. of West Bengal,2010-2011 & Census Hand book 2001)

* This includes Net Area sown + Current Falow + Fallow other than current fallow + Culturable waste land + Land under Misc. Tree



D. Target Beneficiaries:

According to the provisional results of the 2011 national census, West Bengal is the fourth most populous state in India with a population of 91,347,736 (7.55% of India's population). There are 18 administrative districts (excluding Kolkata), 66 Sub- divisions, 341 blocks, 333 Panchayat Samities, 3356 Gram Panchayat and 38975 numbers of villages. Hindu population is 6,43,85,546 in West Bengal while Muslim population is 2,46,54,825 as per 2011 census. The state's 2001–2011 decennial growth rates was 13.93%, lower than 1991–2001 growth rate of 17.8%, and also lower than the national rate of 17.64%. The gender ratio is 947 females per 1000 males. As of 2011, West Bengal has a population density of 1,029 inhabitants per square kilometer, making it the second-most densely populated state in India, after Bihar. West Bengal's total fertility rate is 1.6, way below Bihar's 3.4, which is the highest in the entire country. The literacy rate is 77.08%, higher than the national rate of 74.04%. The Scheduled Castes (SC) and Tribes (ST) form 28.6% and 5.8% of the population respectively in rural areas, and 19.9% and 1.5% respectively in urban areas. Kolkata (with a population of 132.05 lakh) and Asansol (population 10.67 lakh) are the largest cities in West Bengal.

Table: Demographic details of West Bengal

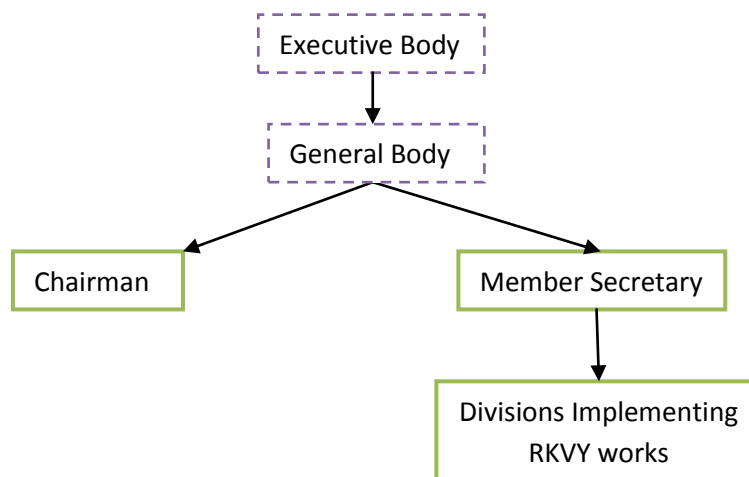
S. No	Indicators	Year	Unit	West Bengal	India
1	Geographical Area	2011	Lakh Sq. Km	0.88	32.87
2	Population	2011	Crores	9.13	121.02
3	Decadal Growth Rate	2011	Percentage	13.93	17.64
4	Density of Population	2011	Population/Sq. Km.	1029	382
5	Urban to Total Population	2011	Percentage	31.89	31.16
6	Sex Ratio	2011	Females/1000 Males	947	940
7	Literacy Rate (LR)	2011	Percentage	77.08	74.04

The major implementing divisions where the infrastructure has been proposed are Purulia, Kangshabati (N), Kangshabati (S), Kurseong S.C., Kalimpong S.C., Jalpaiguri S.C., Raigunj, Malda, Howrah, Baikunthapur, Coochbehar, Jalpaiguri, Jaldapara Wild life, Gorumara Wildlife, Darjeeling Wildlife, Bankura (N), Bankura (S), Panchet, Nadia-Murshidabad, Birbhum, Durgapur, Burdwan, Rupnaraya, , Jhargram, Kharagpur, Purba- Medinipur, Medinipur, Kurseong, and Darjeeling.



E. Management:

The State Forest Development Agency (SFDA), Department of Forest (DoF), Govt. of West Bengal (GoWB) will be implementation agency of the Forestry Interventions of RKVY scheme, 2017-18. The concerned Divisional Forest Officials (DFO) and their subordinates Range Officers will be implement the RKVY scheme in the field. The monitoring will be taken care of by SFDA. The organization structure of SFDA is as follows;



Implementation of the RKVY 2018 – 19 in the states needs a well-organized and dynamic institution. As per the advice of the NAEB, Government of India, 'State Forest Development Agencies' (SFDA) have been created in 2010. PCCF, HoFF will designate one DFO of the district as the Convener. DAP has been managed by all the districts of West Bengal. Baseline share of agriculture and allied sector in its total plan has been maintained. The funds will be channeled through WBSFDA to the Divisions which are the implementing units in the field.



F. Finance:

The cost estimates, budget for the RKVY – 2018 project is attached in Annexures. The means of financing and phasing of expenditure is RKVY funds for one year (2018-19). The options for cost sharing and cost recovery (user charges) rule has oriented and there is no scope for explore. The major issues of project sustainability is the state's forests are under tremendous pressure due to the indiscriminate removal of timber, fuel wood, fodder & other forest produce and also decrease in soil moisture, water table, erosion in throughout the West Bengal. Though there are various afforestation and plantation programs being implemented by the State Forest Department, the results will be positive when supported by good and useful infrastructure.

The steady depletion of forest resources and increasing deforestation has brought into focus- the realization that the constructions of contour trench, earthen dam, gully plugging, river training, Hand packed wall, Boulder Susage wall, Catch water drain and production centers for tall seedling QPM 0.5 lakh capacity. Operation and maintenance of assets after project completion would depend on type of land on which project would be implemented. On forest lands the maintenance would be takecare by Forest Department and on private lands by private individuals.

G. Infrastructure and Assets: (Pre-Harvest Infrastructures).

H. Natural Resource management

Under this component Soil and Moisture Conservation activities shall be taken and are described below in detail.

1. Contour Trenches in Forest Areas:

Objectives:

- a. Recharge ground water.
- b. To conserve soil moisture in the plantation areas in the dry seasons.

Activities:-

Under this sub component the digging of contour trenches in the plantation areas along the contour is taken up so that the soil water runoff may be prevented. This activity also helps in conserving the soil moisture, which is of great help for young plantations in the dry seasons. The activity is labour intensive and generates wages in rural areas.



2. Earthen Dam:

Objectives:

- a. To prevent soil erosion.
- b. To harvest Rain water.
- c. To recharge ground water.
- d. To irrigate agricultural field in the command area downstream.
- e. To use the water body for pisciculture and other house hold purpose.

Activities:

Earthen dams are constructed for the purpose of holding excess run-off water by creating bund of suitable size with a small inner core wall. This structure slows down the run-off and water during rainy season is harvested. These have been proved very useful for South West Bengal. This work is labour intensive and generates employment for the local people.

3. Gully Plugging work/ Hand Packed Walls in hills:

Objectives:

- a. To prevent accelerated erosion.
- b. To harvest Rain water.
- c. To improve soil moisture regime.
- d. To recharge ground water.

Activities:

Gully Plugging's are constructed for the purpose of holding excess run-off water by creating obstructions of suitable size. Generally series of such check dams are constructed. These structures slow down the run-off and water during rainy season is harvested. These have been proved very useful for checking gully and reel erosion in South West Bengal. The work is labour intensive and generates employment for the local people.

4. River Training Works/Boulder sausage works to prevent damage to agriculture fields:

Objectives:

- a. To prevent stream bank erosion.
- b. To check landslides and stabilization hill slopes.
- c. To reduce the chance of flooding of agricultural fields by hilly torrents.

Activities:

Boulder sausage works: Upper reaches are treated with this work where bigger boulders are used to construct sausage works to stabilize the slopes.



5. Catch Water drains/Runoff Diversion Sites:

Objectives:

- a. To prevent water runoff.
- b. To stagger runoff in peak periods.
- c. To store water for use during lean periods.

Activities:

The Catch Water drains/Runoff Diversion Sites are man-made box drains built with boulders constructed along the contour lines for the Collection/Diversion of the flow of the streams or minor watercourses. These help in staggering the runoff in peak periods and for utilizing the water during lean periods.

6. Clonal / Seedling seed orchards:

Objectives:

To provide exclusive areas for,

- a. Collection of high quality seeds.
- b. Collection of improved clonal material.

Activities:

The success of any plantation and its subsequent growth starts with the seeds that are planted. Therefore, it is of primary importance that seeds from good mother trees – trees with good form and growth factors – are collected and planted so that the trees in a plantation have good form and growth leading to quality timber production as well as providing good cover.

Clones are prepared from very high quality mother trees of species which are easy to root. Clones of such trees give rise to seedlings having all the good quality of a mother tree and perform very well under the same condition. Clonal orchards are repository of good clonal material and can be used to raise very good plantation.

7. Permanent Research Plots:

Objectives:

- a. Provide adaptability data.
- b. Provide rate of growth.
- c. Provide annual increment.

Activities:

Permanent Research Plots, are well demarcated areas laid down within plantations of important species for growth studies of that species. The studies provide us adaptability, germ inability, rate of growth, annual increment etc for a species in a given site.



8. Seed Testing Laboratory:

Objectives:

- a. To test seeds for viability and germination percentage.
- b. To grade seeds and remove all impurities.
- c. To test for dormancy breaking methods.
- d. To test for invigoration procedures of seeds.
- e. Seed storage methods for different species.

Activities:

Good and quality seeds are a pre requisite for good seedling in nursery leading to a highly valuable plantation. All production units require to be supplied with quality seeds which are graded for same size and weight, devoid of impurities and debris, so that germination and growth are assured. Testing for vigor and germination, dormancy and seed storage are also important activities. To ensure this, seed testing laboratories are required equipped with seed grader and other equipment's to grade the collected materials into clean and pure seeds and also test for germ inability and overcoming dormancy.

9. Watershed Management Cell or Up-gradation of GIS facilities

Objectives:

- a. To improve monitoring and analysis of the spatial data
- b. Error correction in existing data base for stock Maps, boundary demarcation, watershed layer etc., using upgraded computers, accessories and soft-wares
- c. To improve coordination with other institutes like FSI, SOI, NRSC, IIRS, etc., on same data platform
- d. Planning the plantations as per micro water-shed spatial layers, by analysis in GIS Lab

Activities:

The GIS Lab under the Working Plan and GIS Circle, caters to the GIS needs of the State Forests Department. Since few years the Lab has been working in the field of forest fire detection, digitization of the forest boundaries, preparing the stock maps, preparing watershed maps for Namami Ganga project and GIM etc.

However, due to quick changes in the technologies associated with the GIS techniques, the GIS Lab need to be further upgraded so that the data generated is compatible with the data of institutes like FSI, Dehradun, NRSC Hyderabad etc., so that the exchange of the information is on the same platform



This upgradation would also involve the analysis of the field information using the latest version of GIS software *vis a vis* the spatial information as available/acquired for the State by the way of digitized Maps from various sources from time to time

10. Production centers for Tall QPM 0.50 lakh capacity:

Objectives:

- a. To produce improved QPM 0.50 lakh capacity.
- b. To increase tree cover of non-forest areas and enhance green cover and biodiversity.

Activities:

For producing better quality high grade tall planting materials – for successfully providing tree cover in barren areas, along road/avenue, institution lands, - modern production centers are required for having modern facilities with improved growth media, seed grading facilities, containers/polypots suitable for maintaining the seedlings for a longer period of time to achieve desirable height growth, modern watering system with improved plant protection measures, and facilities of hardening chambers for acclimatizing the seedlings to withstand the out planting stress.

**Principal Chief Conservator of Forests,
Head of Forest Force**



Detailed work program for this stream is shown below:-

	Natural Resource Management	Rate (Rs)	Unit	Nos.	Amount (Rs)
1	Contour trench in Forest Areas	4008.00	km	682	27,33,456.00
2	Earthen Dam	8,17,197.00	Unit	40	3,26,87,880.00
3	Gully Plugging	2,256.00	Cum	5000	1,12,80,000.00
4	River training works to prevent damage to agricultural fields	4,982.00	Cum	500	24,91,,000.00
5	Hand Packed Walls in Hills	2,304.00	Cum	5000	1,15,20,000.00
6	Boulder Sausage Walls	4982.00	Cum	7000	3,48,74,000.00
7	Catch Water Drains	14,30,000.00	Km	4	57,20,000.00
8	Clonal seed orchard and seedling seed orchards	5,00,000.00	Units	6	30,00,000.00
9	Permanent Research Plots	1200.00	Mt	4160	50,00,000.00
10	Seed Testing Lab	20,00,000.00	Units	3	60,00,000.00
11	Watershed Management Cell	30,00,000.00	Units	1	30,00,000.00
12	Production centers for Tall QPM 0.50 lakh capacity	39,85,000.00	No.	20	7,97,00,000.00
	Sub Total				19,80,06,336.00
13	Administrative Cost (1% of total project cost for monitoring & evaluation)				20,00,000.00
	Total				20,00,06,336.00

(Rupees Twenty Crores SixThousandsThree Hundred Thirty Six Only)

Or Say Rs. Twenty Crores.

Implementing divisions: Purulia, Kangshabati (N), Kangshabati (S), Kurseong S.C., Kalimpong S.C., Jalpaiguri S.C., Raigunj, Malda, Howrah, Baikunthapur, Coochbehar, Jalpaiguri, jaldapara Wild life, Gorumara Wildlife, Darjeeling Wildlife, Bankura (N), Bankura (S), Panchet, Nadia-Murshidabad, Birbhum, Durgapur, Burdwan, Rupnarayan, Jhargram, Kharagpur, Purba- Medinipur, Medinipur, Kurseong, Darjeeling.

Estimates: ANNEXURE I,II,III,IV,V,VI,VII,VIII,XIX,X,XI,XII.



Annexure - RKVY 2018-19 Tentative estimates of project activities

RKVY: Work Programme for 2018-19					
I. Infrastructure & Assets--(Pre-Harvest Infrastructure)					
(i) Natural Resource Management					
S. No.	Particulars of Work	Rate (Rs.)	Physical	Unit	Financial (Rs.)
1	Contour trench in Forest Areas	4008.00	km	682	27,33,456.00
2	Earthen Dam	8,17,197.00	Unit	40	3,26,87,880.00
3	Gully Plugging	2,256.00	Cum	5000	1,12,80,000.00
4	River training works to prevent damage to agricultural fields	4,982.00	Cum	500	24,91,,000.00
5	Hand Packed Walls in Hills	2,304.00	Cum	5000	1,15,20,000.00
6	Boulder Sausage Walls	4982.00	Cum	7000	3,48,74,000.00
7	Catch Water Drains	14,30,000.00	Km	4	57,20,000.00
8	Clonal seed orchard and seedling seed orchards	5,00,000.00	Units	6	30,00,000.00
9	Permanent Research Plots	1200.00	Mt	4160	50,00,000.00
10	Seed Testing Lab	20,00,000.00	Units	3	60,00,000.00
11	Watershed Management Cell	30,00,000.00	Units	1	30,00,000.00
12	Production centers for Tall QPM 0.50 lakh capacity	39,85,000.00	No.	20	7,97,00,000.00
	Sub Total				19,80,06,336.00
13	Administrative Cost (1% of total project cost for monitoring & evaluation)				20,00,000.00
	Total				20,00,06,336.00

(Rupees Twenty Crores Six Thousands Three Hundred Thirty Six Only)

Or Say Rs. Twenty Crores.



Annexure.1 - Estimate for Making/Digging Contour Trench

Component of the Scheme :

B. Soil & Moisture Conservation

Unit = 1 km.

SL. No.	Particulars Of Works	Unit	Qty.	Rate	Amount
1	Cost of Surveying, mazdoor engaged	No.	1	224.58	224.58
2	Supply of bamboo peg, rope, lime etc for necessary alignment	LS			49.90
3	Cost of excavation of earth for making/digging contour trench around 1 KM area where necessary over $5.00\text{mt} \times 0.45\text{mt} \times 0.30\text{mt} = 0.675\text{m}^3 \times 60\text{nos} = 40.5\text{m}^3$	m^3	40.5	92.2	3734.10
TOTAL(Rs)					4008.00

Physical	Rate		Amount
700 km.	4008.00	/km	28,05,600.00

Rupees Twenty Eight Lakhs FiveThousandsSix Hundred Only.

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Head of Forest Force**



Annexure.2 - Estimate for Construction of Earthen Dam

Component of the Scheme :

Soil & Moisture Conservation

S. No	Particular of Works	Man-days (md) / Quantity	Rate	Material Cost	Total Cost
	Cost of doing the following works in connection with construction of an E.D. in forest area as follows :				
1	Survey, demarcation & cleaning of the site	5 md	224.58 /md		1122.90
2	Digging key trench in mixed medium hard soil with morrum over : - Length - 50mt.; Top width - 2.5mt.; Bottom width - 2mt.; Depth - 90cm. = $(2.5+2.0)/2 \times 0.9\text{mt.} \times 50\text{mt.} = 101.25 \text{ m}^3 = 3543.75\text{cft.}$ Or say 3544cft. by engaging daily labour	70 md	224.58 /md		15720.00
3	Making core wall including rain water depression of mud and placing layer after layer (layer not excluding 30cm. Height) by ordinary mixed soil to be excavated over : 1) $(2.5+2.0)/2 \times 0.9\text{mt.} \times 50\text{mt.} = 101.25\text{m}^3$ 2) $(2.0+0.6)/2 \times 1.5 \text{ mt.} \times 50\text{mt.} = 97.50\text{m}^3 = 198.75 \text{ m}^3$	75 md	224.58 /md		16843.50
4	Digging earth and depositing the same layer after layer not excluding 15cm. Including breaking of clodes and rough dressing in mixed medium hard soil with morrum over : 950 m ³ + (add) 10% for settlement i.e. 95 m ³ = 1045 m ³ - (less volume of earth excavation for spill way and core wall) 112.25 m ³ = 932.75 m ³ (a) Spill way - 30mt. x 0.90cm. x $(2.0+1.5)/2$ and (b) Core wall 47.25 m ³ + 65.00 m ³ = 32646 cft.				
	Lead upto 80 ft. and lift upto 3 ft., 55% of earth = 17955 cft. by engaging daily labour	245 md	224.58 /md		55022.10
	Lead upto 80 ft. and lift from 3 ft. to 6 ft. 45% of earth = 14691 cft. by engaging daily labour	190 md	224.58 /md		42670.20
5	Digging spill way to drain out excess water over 47.25 m ³ = 1654 cft. by engaging daily labour	21 md	224.58 /md		4716.18
	Total :	606 md	224.58 /md	0.00	136095.48
	Overhead Expenditure		L.S.	104.00	104.00
7	Estimate for 50 mt. length				136199.48
	Estimate for 300 mt length of E.D				817197.00

Cost of 40 units of 300 mt E.D @ Rs. 8,17,197=Rs. 3,26,87,880/-

[Rupees Three Crores Twenty Six Lakhs Eighty Seven Thousand EightHundred Eighty Only]

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Head of Forest Force**



Annexure.3 - Estimate for Construction of Gully Plugging

Component of the Scheme :

B. Soil & Moisture Conservation

UNIT = 1 M3

S. No	Item of work	Man days in Nos.	Material in unit.	Rate (in Rs.)	Amount (in Rs.)
	Cost of doing the following works in connection with treatment of gully for protection of gully & soil and moisture conservation works over 1 m ³ . (Size 1mt. X 1m. X 1mt.)				
1	Making structural works for protection of gully by using of morrum blocks, fitting fixing including foundation trench & supplying of all materials over 1 mt.	6.5		224.58	1459.77
2	Cost of morrum blocks (1mt. X 1mt. X 1mt. = 1m ³) Bamboo Posts, Bushes etc. including carriage		L.S.	796	796
	Total				2256

Cost of Gully plugging of 7595 Cum @ Rs.2256/-= Rs. 1,71,34,320.00

(Rupees One Crore Seventy One Lakhs Thirty Four Thousands Three Hundred Twenty only)

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Head of Forest Force**



Annexure.4 - Estimate for River Training

Item No.	Particulars of works	Md	Labour (Rs)	Material (Rs)	Total (Rs)
1.	<p><u>Making Boulder Sausage wall (@1m³)</u> Mazdoors engaged for making Hand packed wall with Sausage wire net :</p> <p>a) Collection of stones boulders, carriage up to road site & stacking 3.00</p> <p>b) Carriage of stones boulders from road site to Work site. 4.00</p> <p>c) Excavation of earth in all sorts of soil. 1.00</p> <p>d) Cutting of sausage wire netting to require Sizes rolling the same & making bundles. 1.50</p> <p>e) Carriage of sausage from road side to working site by head load. 2.00</p> <p>f) Making sausage wall with stone boulders by way of handpacking including laying with G.I. wire stretching and tightening complete. Skilled mazdoor - 1.00 no 1.00 Mason - 1.00 no 1.00 Ordinary - 2.00 no 2.00</p> <p>g) Filling the gap with stone boulders including collection & carriage of stone boulders, dressing etc. 2.00</p> <p><u>Abstract of mazdoor P/m³</u> Mason- 1 nos @ Rs.400.00 Each = Rs400.00 Skilled - 2nos@ Rs. 235.00 Each = Rs470.00 Ordinary-15.50 nos@ Rs.224.58 Each=<u>Rs 3480.99</u></p> <p>h) Supplying of 8 gauge sausage wire netting mesh of 15 cm X 15 cm including carriage up to road site. (4.50m² per/m³) @ Rs. 120.00 per m² including Vat 540.00</p> <p>i) Supplying of 8 gauge G.I. Wire for ties 0.5 kg/per m³ @ Rs.80.00/kg including Vat 40.00 50.52</p> <p>j) Contingencies for threads, etc.</p>				
	Cost per m ³		4350.99	630.52	4982.00

Cost of River training works / Boulder Sausage Wall1000cum @ Rs.4982/- = Rs. 49,82,000/-

(Rupees Forty Nine Lakhs Eighty Two Thousands Only).

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Annexure.5 - Estimate for Hand Packed Walls in Hills

Sl.No	Particulars	Labour		Contingency	Amount
		Skilled	Un-skilled		
	Cost of doing the following works in connection with making Hand Packed Wall with boulder.				
1	Breaking & Collection of Stone Boulders 150 mm and above.		1.00 Md		
2	Carriage of Stone Boulders upto work site and stacking.		4.00 Md		
3	Excavation of Foundation.		0.50 Md		
4	Hand Packed Masonry Wall with boulders obtained from nearby stacks.	1.00 Md	2.00 Md		
5	Back Filling with small stones and earth obtained from excavation of foundation.		1.00 Md		
	Total	1.00 Md	8.50 Md		
	Rate (Rs.)	350.00	224.58		
	Cost for 1 M3 (Rs.)	350.00	1908.93	44.64	2304.00

Cost of Hand Packed Walls 5000 cum @ Rs.2304/- = Rs. 1,15,20,000/-

(Rupees One Crore Fifteen Lakhs Twenty Thousands Only).

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Head of Forest Force**



Annexure. 6 - Estimate for Boulder Sausage Wall

Item No.	Particulars of works	Md	Labour (Rs)	Material (Rs)	Total (Rs)
1.	<u>Making Boulder Sausage wall (@1m³)</u> Mazdoors engaged for making Hand packed wall with Sausage wire net : a) Collection of stones boulders, carriage up to road site & stacking b) Carriage of stones boulders from road site to Work site. c) Excavation of earth in all sorts of soil. d) Cutting of sausage wire netting to require Sizes rolling the same & making bundles. e) Carriage of sausage from road side to working site by head load. f) Making sausage wall with stone boulders by way of handpacking including laying with G.I. wire stretching and tightening complete. Skilled mazdoor - 1.00 no Mason - 1.00 no Ordinary - 2.00 no g) Filling the gap with stone boulders including collection & carriage of stone boulders, dressing etc. <u>Abstract of mazdoor P/m³</u> Mason- 1 nos @ Rs.400.00 Each = Rs400.00 Skilled - 2nos@ Rs. 235.00 Each = Rs470.00 Ordinary-15.50 nos@ Rs.224.58 Each= <u>Rs 3480.99</u> h) Supplying of 8 gauge sausage wire netting mesh of 15 cm X 15 cm including carriage up to road site. (4.50m ² per/m ³) @ Rs. 120.00 per m ² including Vat i) Supplying of 8 gauge G.I. Wire for ties 0.5 kg/per m ³ @ Rs.80.00/kg including Vat j) Contingencies for threads, etc.	3.00 4.00 1.00 1.50 2.00 1.00 1.00 2.00 2.00	4350.99	540.00 40.00 50.52	4982.00
	Cost per m³		4350.99	630.52	4982.00

Cost of River training works / Boulder Sausage Wall1000cum @ Rs.4982/- = Rs. 49,82,000/-

(Rupees Forty Nine Lakhs Eighty Two Thousands Only).

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Head of Forest Force



Annexure.7- Estimate for Catch Water Drain

SI no	Items of works	Unit	Quantity	Rate(Rs)	Amount(Rs)
	Page no. 1-2 Item No. 2(a).				
1	Earth work in excavation of drains, in all sorts of soil (including mixed soil but excluding laterite or sandstone) including removing, spreading or stacking the soil/earth within a lead of 75 m. as required. Depth of excavation not exceeding 1500 mm.	% M3	0.55	12047	66.26
	1x1.00x1.10x0.50= 0.55 m3				
	Attached : Analysis of Rate-1				
2	cost of supplying stone boulders minimum 150 mm of local variety and labour for laying soiling including rough dressing, hand packing, and ramming down small pieces in the interstics without rolling and preparing the bed to proper level and filling up all joints with sandy clay or earth.	M2	1.1	196.52	216.17
	1x1.00x1.10=1.10m2				
	Page 11 Item No. 5. PWD current schedule of rate (b) River bazree				
3	Ordinary Cement concrete (mix 1:2:4) with graded stone chips (20 mm nominal size) excluding shuttering and reinforcement, If any, in ground floor as per relevant IS codes.	M3	0.05	7116	355.80
	1x1.00x1.10x0.05=0.05m3				
	Page No. 83-84 Items No. 53(a).				
4	Rubble masonry in cement (1:6) with hard dressed stones collected locally and clean, coarse and washed sand including carriage of all materials to site.	M3	0.24	2906.62	697.59
	2x1.00x0.40x0.30=0.24m2				
	Page 11 Item No. 5. PWD current schedule of rate (b) River bazree				
5	Ordinary Cement concrete (mix 1:2:4) with graded stone chips (20 mm nominal size) excluding shuttering and reinforcement, If any, in ground floor as per relevant IS codes.	M3	0.01	7116	71.16
	1x1.00x0.30x0.05(Ave.th)=0.01m3				
	Total			Rs	1406.98
	Contingency			Rs	23.02
	Cost of 1 RMT				1430.00
	Cost of 1000 RMT				1430000.00

Cost of Catch Water Drain 10 Km @ Rs.14,30,000/- = Rs. 1,43,00,000/- (Rupees One Crore Forty Three Lakhs Only).

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Head of Forest Force**



Annexure.8 - Estimate for Clonal Seed Orchard and Seedling Seed Orchard

Sl. No	Particulars of Work	Unit/quantity	Rate/mt	Amount (Rs.)
1	Advance Work: Raising of Seedlings in 150 cc Root Trainer. No. of seedlings 2000 nos, for 1.0 ha.	1 ha. / 2000 nos.	16000/ha.	16000
2	Creation of plantation including of labour and material.	1 ha. / 1600 nos.	55000	55000
3	Cost of erection of live hedge fencing with supporting bamboo post including supply of material and labour.	400 rmt.		5000
4	Cost of engagement of plantation protection watcher for 8 months @ 3000/- per month. To protect biotic interference, (since most of the plantation area located far away from Silviculture Range Head Quarter and paucity of field staff, therefore engagement of watcher is necessary to protect plantation.)	8 months	3000/- per month	24000
	Total :			100000

30 ha. @ Rs. 100000 = 3000000.00
Rupees Thirty lakhs only.

6 Spp. to be raised 5.0 ha. each = 30 ha. in three Divisions. So total Rs.30,00,000 (Rupees thirty lakhs) only.

Principal Chief Conservator of Forests,
Head of Forest Force



Annexure.9 - Estimate for Research Plots at 3 units @ 20ha. Area in each unit.

Sl. No.	Particulars of Work	Unit/quantity	Rate/mt	Amount (Rs.)
1	Supply and fitting, fixing of chain link fencing of approved quality 6ft height with standard angle iron post at standard interval including fixing post of (1:3:6) cc by digging hole in the ground.	4160	1200	4,992,000
2	Contingent expenses.			8000
	Total:			5,000,000

(Rupees Fifty Lakhs only)

**Principal Chief Conservator of Forests,
Head of Forest Force**



Annexure.10 - Estimate for Seed Testing Lab

SI No	Particulars of works	Unit/Quantity	Rate/mt	Amount (Rs)
1	Upgradation of Seed testing lab at Salugarah, Misnapore and Darjeeling in the existing building	3	500000	1500000
2	Construction of three seed storage godown under Silviculture(Hills), (North), & (South) division	3	100000	3000000
3	Expension of existing store house under SilviCulture(hills),(North) & (South)	3	500000	1500000
				6000000

(Rupees Sixty lakh only).

Principal Chief Conservator of Forests,
Head of Forest Force



Annexure.11 - Watershed Management Cell

Proposed procurement for Working Plan GIS Lab upgradation

	Item	Quantity	Rs. In Lakhs (Approx.)
Hardware and related Software upgradations	Scanner & Plotter (Multifunction) with accessories	1Nos.	13
	A3 Printer	1 Nos.	
	Three hi-end Desktop computers for GIS analysis works in place of old computers which were acquired reportedly in 2013 (preferably HP-Z440) along with wide monitors and other accessories	3 Nos.	8
Software Purchase	Geomedia	1 No	9
Total			30

**Principal Chief Conservator of Forests,
Head of Forest Force**



Annexure.12 Estimate for establishment of Tall Seedlings nursery Capacity 50000 Seedlings

For making 50000 seedlings, 3.3 ha area would be required and for continuous supply of 50000 seedlings per year, double of it. So, initially gaping is not prescribed as cost will go very high and therefore for making 50000 seedlings, 0.80 ha (0.70 for beds)+(0.10 other than beds) area would be required and for continuous supply double of it i.e. 1.5 ha. Provision for Extension of nursery up to 6 ha to be kept for future use.

1	Barbed wire fencing with RCC pillars – around the administrative area & nursery 1.5 ha, 500mt @650	325000
2	Sinking deep tube-well	170000
3	Composting area	20000
4	Chopping machine & fixing the same at the location	30000
5	Shed for storage purpose (compost heap, potting media storage, scrap material etc.)	150000
6	Labour shed	20000
7	Raised 8000 lit. PVC water tank with pump generator house including 1no. Generator	300000
8	Drying platform & platform for seed treatment	30000
9	Cleaning Site, Filling depressions & Land Development	150000
10	Road	250000
11	Drainage	50000
12	Laying of Water Pipe line network	200000
13	Hygropits 2 nos for seed germination	15000
14	Shed area in first & second year	700000
15	Van and other equipments for carriage of big seedlings	50000
16	Ramp for loading & un-loading	25000
17	Cost of making of sand beds for keeping the seedlings Y1, 35 beds @3500*2	245000
18	Cost of making of sand beds for keeping the seedlings Y2 10 mt wide beds*2	390000
19	Cost of making of sand beds for keeping the seedlings Y3 10 mt wide beds*2	865000
Total Rs.		3985000.00

Cost of Production Centre for tall QPM 0.50 lakh capacity 20nos. @ Rs.39,85,000/- = Rs. 7,97,00,000/- (Rupees Seven CroresNinety Seven Lakhs Only).

**Principal Chief Conservator of Forests,
Head of Forest Force**



I. Time Frame:

S. No	Activities (Time Line)	2018 - 19											
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
		1	2	3	4	5	6	7	8	9	10	11	12
i.	Natural Resource Management												
1	Contour trench-682 km												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Contour trench							█	█	█	█	█	█
2	Earthen Dam - 40 Unit												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Earthen Dam							█	█	█	█	█	█
3	Gully Plugging - 5000 Cum												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Gully Plugging							█	█	█	█	█	█
4	River training works to prevent damage to agricultural fields- 500 cum												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of River training work to prevent damage to agricultural							█	█	█	█	█	█



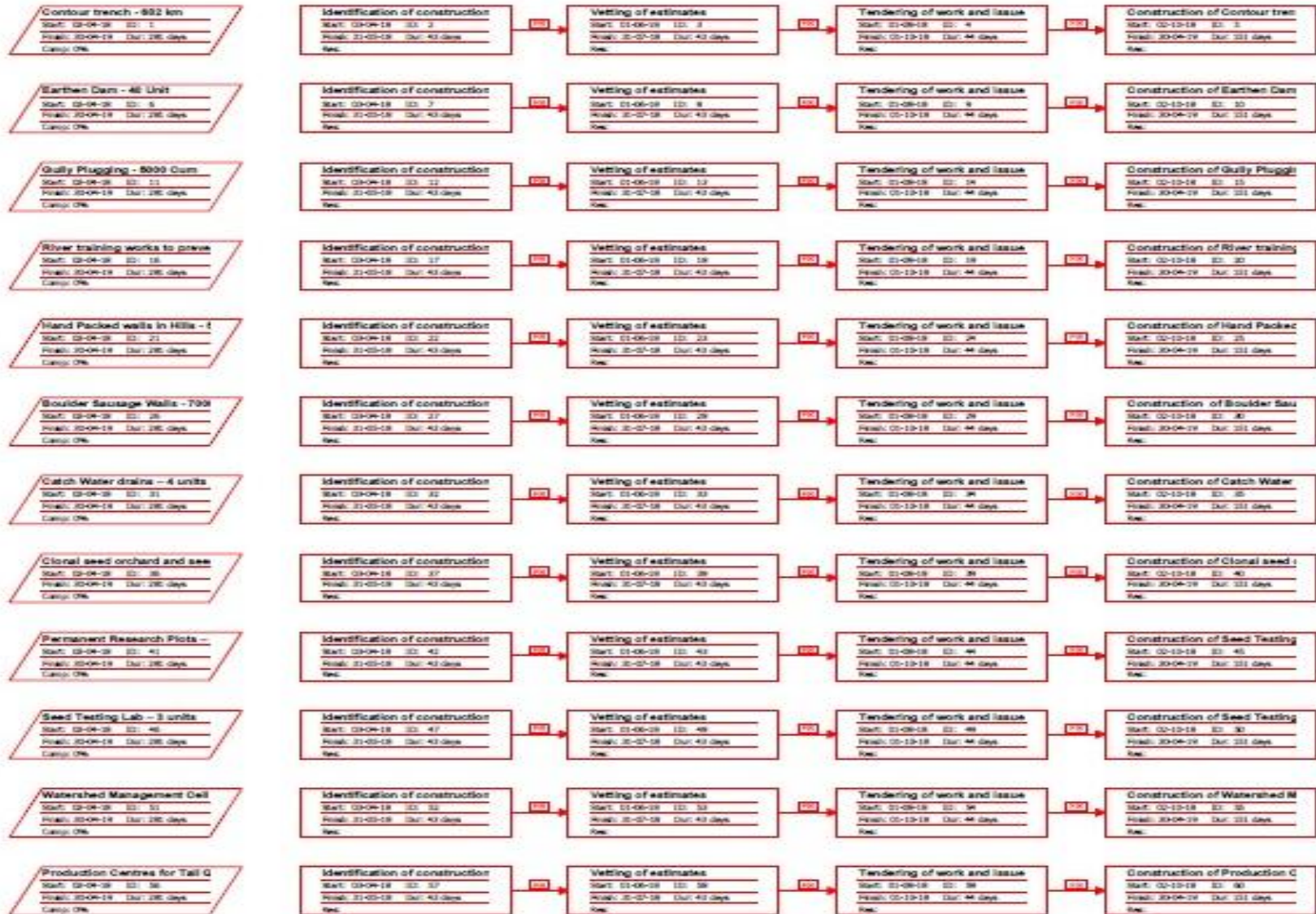
S. No	Activities (Time Line)	2018 - 19											
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
		1	2	3	4	5	6	7	8	9	10	11	12
	fields												
5	Hand Packed walls in Hills - 5000km												
A.1.	Identification of construction area & approval												
A.2	Vetting of estimates												
A.3	Tendering of work and issue of work order												
A.4	Construction of Hand Packed walls in Hills												
6	Boulder Sausage Walls - 7000km												
A.1.	Identification of construction area & approval												
A.2	Vetting of estimates												
A.3	Tendering of work and issue of work order												
A.4	Construction of Boulder Sausage Walls												
7	Catch Water drains – 4 units												
A.1.	Identification of construction area & approval												
A.2	Vetting of estimates												
A.3	Tendering of work and issue of work order												
A.4	Construction of Catch Water drains												
8	Clonal seed orchard and seedling seed orchards – 6 units												
A.1.	Identification of construction area & approval												
A.2	Vetting of estimates												
A.3	Tendering of work and issue of work order												
A.4	Construction of Clonal seed orchard and seedling seed orchards												
9	Permanent Research Plots – 60 ha												



S. No	Activities (Time Line)	2018 - 19											
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
		1	2	3	4	5	6	7	8	9	10	11	12
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Permanent Research Plots							█	█	█	█	█	█
10	Seed Testing Lab – 3 units												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Seed Testing Lab							█	█	█	█	█	█
11	Watershed Management Cell – 1 units												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Watershed Management Cell							█	█	█	█	█	█
12	Production Centres for Tall QPM 0.5 lakh capacity – 20 units												
A.1.	Identification of construction area & approval	█	█										
A.2	Vetting of estimates			█	█								
A.3	Tendering of work and issue of work order				█	█	█						
A.4	Construction of Production Centre Tall Seedling 0.5 lakh QPM capacity saplings							█	█	█	█	█	█



PERT Chart – Soil Moisture Conservation Project (RKVY-RAFTAAR– 2018-19) and cost Rs. 20,00,00,000.00





J. Cost Benefit Analysis:

1. Cost Benefit analysis of Contour Trenches

Cost Benefit Analysis (CBA) - Contour Trench in Forest Area		
Input parameters	Unit	Value
Total Capital Cost Contour Trench	Rs/ km	27,33,456
Number of Contour Trenches	per km	682
Unit Capital Cost Contour Trench	Rs/ km	4,008
Operational Cost (Annual) (O&M)	Percentage of Capital cost	1%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation	hours	24
Depreciation (on straight line basis)	Percentage	20%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Contour Trench

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			



S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Improvement in Plant mortality rate by 4%	Direct	Tangible			
10a	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	7920	4	10%
11	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
11a	Labour Charges (person - day)	Direct	272	8160	2	10%
11b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		6500	2	10%
12	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	22580		
13	Benefits	Direct		1893559		



Cost Benefit Analysis - Contour Trench

CBA - Contour Trench						
Cash Flow	0	1	2	3	4	5
Capital Cost	27,33,456	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	5,46,691	5,46,691	5,46,691	5,46,691	5,46,691	5,46,691
Escalation cost	41,002	41,002	41,002	41,002	41,002	41,002
Benefits	0	1893559	2082915	2291206	2520327	2772359
Total Benefit	-33,21,149	13,05,866	14,95,222	17,03,513	19,32,634	21,84,666
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-3321149	1187151	1235720	1279875	1320015	1356506
Net Present Value (NPV)	3058117					
IRR	38%					



2. Cost Benefit analysis of Earthen Dam

Cost Benefit Analysis (CBA) - Earthen Dam		
Input parameters	Unit	Value
Total Capital Cost Earthen Dam	Rs/ km	32687880
Number of Earthen Dam	Number of Unit	40
Unit Capital Cost Earthen Dam	Rs/ km	817197
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	10
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	4
Depreciation (on straight line basis)	Percentage	10%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Earthen Dam

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Water availability for irrigation	Direct	Intangible			
11	Improvement in Plant mortality rate by 4%	Direct	Tangible			
11a	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	7920	4	10%
12	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
12a	Labor Charges (person - day)	Direct	272	81600	2	10%
12b	Net Farm Productivity(rice) http://sap.ipni.net/article/west-bengal	Direct		65000	2	10%
13	Pisciculture Productivity	Direct	Tangible			
14	Labor Charges (person - day)	Direct	272	8160	2	10%
15	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
16	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	166180		
17	Benefits	Direct		13935855		



Cost Benefit Analysis –Earthen Dam

Cash Flow	0	1	2	3	4	5	6	7	8	9	10
Capital Cost	326,87,880	0	0	0	0	0	0	0	0	0	0
Operational Cost	0	0	0	0	0	0	0	0	0	0	0
Depreciation (on straight line basis)	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788	32,68,788
Escalation cost	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318	4,90,318
Benefits	0	13935855	15329440	16862384	18548623	20403485	22443834	24688217	27157039	29872742	32860017
Total Benefit	-364,46,986	101,76,749	115,70,334	131,03,278	147,89,517	166,44,379	186,84,727	209,29,111	233,97,932	261,13,636	291,00,910
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323	0.5644739	0.5131581	0.4665074	0.4240976	0.3855433
Present Value	-36446986	9251590	9562260	9844687	10101439	10334850	10547041	10739943	10915308	11074731	11219661
Net Present Value (NPV)	67144523										
IRR	37%										



3. Cost Benefit analysis of Gully Plugging

Cost Benefit Analysis (CBA) - Gully Plugging		
Input parameters	Unit	Value
Total Capital Cost Gully Plugging	Rs/ km	11280000
Number of Gully Plugging	Cum	5000
Unit Capital Cost Gully Plugging	Rs/ km	2256
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation	hours	24
Depreciation (on straight line basis)	Percentage	20%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Gully Plugging

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Improvement in Plant mortality rate by 4%	Direct	Tangible			
10a	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	7920	4	10%
11	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
11a	Labor Charges (person - day)	Direct	272	13600	2	10%
11b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		54440	2	10%
12	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
13	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	79460		
14	Benefits	Direct		6663516		



Cost Benefit Analysis –Gully Plugging

Cash Flow	0	1	2	3	4	5
Capital Cost	112,80,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	22,56,000	22,56,000	22,56,000	22,56,000	22,56,000	22,56,000
Escalation cost	1,69,200	1,69,200	1,69,200	1,69,200	1,69,200	1,69,200
Benefits	0	6663516	7329867	8062854	8869139	9756053
Total Benefit	-137,05,200	42,38,316	49,04,667	56,37,654	64,43,939	73,30,853
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-13705200	3853014	4053444	4235653	4401297	4551883
Net Present Value (NPV)	7390091					
IRR	27%					



4. Cost Benefit analysis of River training works to prevent damage to agricultural fields

Cost Benefit Analysis (CBA) - River Training		
Input parameters	Unit	Value
Total Capital Cost River Training	Rs/ km	2491000
Number of River Training	Cum	500
Unit Capital Cost River Training	Rs/ km	4982
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation	hours	24
Depreciation (on straight line basis)	Percentage	20%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from River Training

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
10a	Labor Charges (person - day)	Direct	272	8160	2	10%
10b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		5444	2	10%
11	Pisculture Productivity	Direct	Tangible			
12	Labor Charges (person - day)	Direct	272	2720	2	10%
13	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
14	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	84	19824		
15	Benefits	Direct		166244 1		



Cost Benefit Analysis – River Training

CBA - River Training						
Cash Flow	0	1	2	3	4	5
Capital Cost	24,91,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	4,98,200	4,98,200	4,98,200	4,98,200	4,98,200	4,98,200
Escalation cost	37,365	37,365	37,365	37,365	37,365	37,365
Benefits	0	1662441	1828685	2011553	2212708	2433979
Total Benefit	-30,26,565	11,26,876	12,93,120	14,75,988	16,77,143	18,98,414
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-3026565	1024432	1068694	1108932	1145512	1178766
Net Present Value (NPV)	2499771					
IRR	36%					



5. Cost Benefit analysis of Hand Packed Wall

Cost Benefit Analysis (CBA) - Hand Packed Wall		
Input parameters	Unit	Value
Total Capital Cost Hand Packed Wall	Rs/ km	11520000
Number of Hand Packed Wall	Cum	5000
Unit Capital Cost Hand Packed Wall	Rs/ km	2304
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation	hours	24
Depreciation (on straight line basis)	Percentage	20%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Hand Packed Wall

S.No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			



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S.No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Improvement in Plant mortality rate by 4%	Direct	Tangible			
10a	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	0	4	10%
11	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
11a	Labor Charges (person - day)	Direct	272	32640	2	10%
11b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		65000	2	10%
12	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	97640		
13	Benefits	Direct		8188090		



Cost Benefit Analysis of Hand Packed Wall

CBA - Hand Packed Wall						
Cash Flow	0	1	2	3	4	5
Capital Cost	115,20,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	23,04,000	23,04,000	23,04,000	23,04,000	23,04,000	23,04,000
Escalation cost	1,72,800	1,72,800	1,72,800	1,72,800	1,72,800	1,72,800
Benefits	0	8188090	9006899	9907589	10898348	11988183
Total Benefit	-139,96,800	57,11,290	65,30,099	74,30,789	84,21,548	95,11,383
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-13996800	5192082	5396776	5582862	5752031	5905821
Net Present Value (NPV)	13832772					
IRR	40%					



6. Cost Benefit analysis of Boulder Sausage Wall

Cost Benefit Analysis (CBA) - Boulder Sausage Wall		
Input parameters	Unit	Value
Total Capital Boulder Sausage Wall	Rs/ km	34874000
Number of Boulder Sausage Wall	Cum	7000
Unit Capital Cost Boulder Sausage Wall	Rs/ km	4982
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation	hours	24
Depreciation (on straight line basis)	Percentage	20%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Boulder Sausage Wall

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Improvement in Plant mortality rate by 4%	Direct	Tangible			
11	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	7920	4	10%
12	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
12a	Labor Charges (person - day)	Direct	272	97920	2	10%
12b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		97500	2	10%
13	Pisciculture Productivity	Direct	Tangible			
14	Labor Charges (person - day)	Direct	272	21760	2	10%
15	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
16	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	84	228600		
17	Benefits	Direct		19170396		



Cost Benefit Analysis of Boulder Sausage Wall

CBA - Boulder Sausage Wall						
Cash Flow	0	1	2	3	4	5
Capital Cost	348,74,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	69,74,800	69,74,800	69,74,800	69,74,800	69,74,800	69,74,800
Escalation cost	5,23,110	5,23,110	5,23,110	5,23,110	5,23,110	5,23,110
Benefits	0	19170396	21087436	23196179	25515797	28067377
Total Benefit	-423,71,910	116,72,486	135,89,526	156,98,269	180,17,887	205,69,467
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-42371910	10611351	11231013	11794342	12306459	12772021
Net Present Value (NPV)	16343276					
IRR	23%					



7. Cost Benefit analysis of Catch Water Drain

Cost Benefit Analysis (CBA) - Catch Water Drain		
Input parameters	Unit	Value
Total Capital Cost Catch Water Drain	Rs/ km	5720000
Number of Catch Water Drain	Number of Unit	4
Unit Capital Cost Catch Water Drain	Rs/ km	1430000
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	12
Depreciation (on straight line basis)	Percentage	10%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Catch Water Drain

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Water availability for irrigation	Direct	Intangible			
13	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
13a	Labor Charges (person - day)	Direct	272	8160	2	10%
13b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		16332	2	10%
14	Pisiculture Productivity	Direct	Tangible			
15	Labor Charges (person - day)	Direct	272	5440	2	10%
16	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
17	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	33432		
18	Benefits	Direct		2803608		



Cost Benefit Analysis of Catch Water Drain

CBA - Catch Water Drain						
Cash Flow	0	1	2	3	4	5
Capital Cost	57,20,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	5,72,000	5,72,000	5,72,000	5,72,000	5,72,000	5,72,000
Escalation cost	85,800	85,800	85,800	85,800	85,800	85,800
Benefits	0	2803608	3083968	3392365	3731602	4104762
Total Benefit	-63,77,800	21,45,808	24,26,168	27,34,565	30,73,802	34,46,962
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-6377800	1950734	2005098	2054519	2099448	2140292
Net Present Value (NPV)	3872291					
IRR	30%					



8. Cost Benefit analysis of Clonal seed orchard and seedling seed orchards

Cost Benefit Analysis (CBA) - Clonal seed orchard and seedling seed orchards		
Input parameters	Unit	Value
Clonal seed orchard and seedling seed orchards	Rs/ km	3000000
Number of Clonal seed orchard and seedling seed orchards	Number of Unit	6
Unit Capital Cost Clonal seed orchard and seedling seed orchards	Rs/ km	500000
Operational Cost (Annual) (O&M)	Percentage of Capital cost	6%
Life	Years	10
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	8
Depreciation (on straight line basis)	Percentage	10%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Clonal seed orchard and seedling seed orchards

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Water availability for irrigation	Direct	Intangible			
11	Cost of Water used for Plantation during Dry Season	Direct	Tangible			
11a	Labor Charges associated with procurment of water	Direct	272	1360	2	10%
11b	Electricity Cost for pumping water for Plantation	Direct	50	250	2	10%
11c	Other associate Cost for procureing water for the plantation	Direct	100	500	2	10%
12	Improvement in Plant mortality rate by 4%	Direct	Tangible			
12a	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	600	4	10%
13	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
13a	Labor Charges (person - day)	Direct	272	1360	2	10%
13b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		5444	2	10%
14	Pisciculture Productivity	Direct	Tangible			
15	Labor Charges (person - day)	Direct	272	1360	2	10%
16	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
17	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	14374		
18	Benefits	Direct		1205404		



Cost Benefit Analysis of Clonal seed orchard and seedling seed orchards

Cash Flow	0	1	2	3	4	5	6	7	8	9	10
Capital Cost	30,00,000	0	0	0	0	0	0	0	0	0	0
Operational Cost	0	180000	180000	180000	180000	180000	180000	180000	180000	180000	180000
Depreciation (on straight line basis)	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000	3,000	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
Escalation cost	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Benefits	0	1205404	1325944	1458538	1604392	1764831	1941315	2135446	2348991	2583890	2842279
Total Benefit	-33,45,000	6,80,404	8,00,944	9,33,538	10,79,392	15,36,831	14,16,315	16,10,446	18,23,991	20,58,890	23,17,279
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323	0.5644739	0.5131581	0.4665074	0.4240976	0.3855433
Present Value	-3345000	618549	661937	701381	737239	954251	799473	826413	850905	873170	893411
Net Present Value (NPV)	4571731										
IRR	30%										



9. Cost Benefit analysis of Permanent Research Plots

Cost Benefit Analysis (CBA) - Permanent Research Plots		
Input parameters	Unit	Value
Total Capital Cost Permanent Research Plots	Rs/ km	5000000
Number of Permanent Research Plots	Number of Unit	60
Unit Capital Cost Permanent Research Plots	Rs/ km	83333
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	12
Depreciation (on straight line basis)	Percentage	0%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Permanent Research Plots

SNo	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			



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SNo	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
10	Water availability for irrigation	Direct	Intangible			
13	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
13a	Labor Charges (person - day)	Direct	272	1360	2	10%
13b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		16332	2	10%
14	Pisiculture Productivity	Direct	Tangible			
15	Labor Charges (person - day)	Direct	272	2720	2	10%
16	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
17	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	23912		
18	Benefits	Direct		2005260		



Cost Benefit Analysis of Permanent Research Plots

CBA - Permanent Research Plots						
Cash Flow	0	1	2	3	4	5
Capital Cost	50,00,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	0	0	0	0	0	0
Escalation cost	75,000	75,000	75,000	75,000	75,000	75,000
Benefits	0	2005260	2205786	2426365	2669001	2935902
Total Benefit	-50,75,000	19,30,260	21,30,786	23,51,365	25,94,001	28,60,902
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-5075000	1754782	1760980	1766615	1771738	1776395
Net Present Value (NPV)	3755511					
IRR	34%					



10. Cost Benefit analysis of Seed Testing Lab

Cost Benefit Analysis (CBA) - Seed Testing Lab		
Input parameters	Unit	Value
Total Capital Cost Seed Testing Lab	Rs/ km	6000000
Number of Seed Testing Lab	Number of Unit	3
Unit Capital Cost Seed Testing Lab	Rs/ km	2000000.0
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	12
Depreciation (on straight line basis)	Percentage	5%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Seed Testing Lab

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
8	Improvement in Micro-climate	Direct	Intangible			
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Water availability for irrigation	Direct	Intangible			
13	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
13a	Labor Charges (person - day)	Direct	272	4080	2	10%
13b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		16332	2	10%
14	Pisciculture Productivity	Direct	Tangible			
15	Labor Charges (person - day)	Direct	272	2720	2	10%
16	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
17	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	26632		
18	Benefits	Direct		2233360		



Cost Benefit Analysis of Seed Testing Lab

CBA - Seed Testing Lab						
Cash Flow	0	1	2	3	4	5
Capital Cost	60,00,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
Escalation cost	90,000	90,000	90,000	90,000	90,000	90,000
Benefits	0	2233360	2456695	2702365	2972602	3269862
Total Benefit	-63,90,000	18,43,360	20,66,695	23,12,365	25,82,602	28,79,862
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-6390000	1675781	1708013	1737314	1763952	1788168
Net Present Value (NPV)	2283227					
IRR	22%					



11. Cost Benefit analysis of Watershed Management Cell

Cost Benefit Analysis (CBA) - Watershed Management Cell		
Input parameters	Unit	Value
Total Capital Cost Watershed Management Cell	Rs/ km	3000000
Number of Watershed Management Cell	Number of Unit	1
Unit Capital Cost Watershed Management Cell	Rs/ km	3000000.0
Operational Cost (Annual) (O&M)	Percentage of Capital cost	0%
Life	Years	5
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	12
Depreciation (on straight line basis)	Percentage	60%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Watershed Management Cell

S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			



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S. No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Water availability for irrigation	Direct	Intangible			
13	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
13a	Labor Charges (person - day)	Direct	272	8160	2	10%
13b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		27220	2	10%
14	Pisiculture Productivity	Direct	Tangible			
15	Labor Charges (person - day)	Direct	272	2720	2	10%
16	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
17	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	41600		
18	Benefits	Direct		3488576		



Cost Benefit Analysis of Watershed Management Cell

CBA - Watershed Management Cell						
Cash Flow	0	1	2	3	4	5
Capital Cost	30,00,000	0	0	0	0	0
Operational Cost	0	0	0	0	0	0
Depreciation (on straight line basis)	18,00,000	18,00,000	18,00,000	18,00,000	18,00,000	18,00,000
Escalation cost	45,000	45,000	45,000	45,000	45,000	45,000
Benefits	0	3488576	3837434	4221177	4643295	5107624
Total Benefit	-48,45,000	16,43,576	19,92,434	23,76,177	27,98,295	32,62,624
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323
Present Value	-4845000	1494160	1646639	1785257	1911273	2025833
Net Present Value (NPV)	4018162					
IRR	35%					

**12. Cost Benefit analysis of Tall Seeding Nursery 0.50 Lakh QPM**

Cost Benefit Analysis (CBA) - Tall Seeding Nursery 0.50 Lakh QPM		
Input parameters	Unit	Value
Total Capital Cost Tall Seeding Nursery	Rs/ km	79700000
Number of Tall Seeding Nursery	Number of Unit	20
Unit Capital Cost Tall Seeding Nursery	Rs/ km	3985000
Operational Cost (Annual) (O&M)	Percentage of Capital cost	10%
Life	Years	10
No of days of operation	Days	365
Average daily hours of operation (Dry Season)	hours	8
Depreciation (on straight line basis)	Percentage	10%
Escalation cost	Percentage	1.5%
Discount Factor	Percentage	10%

Expected Benefits from Tall Seeding Nursery 0.50 Lakh QPM

S.No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
1	Recharge of Ground water	Direct	Intangible			
2	Increase in Soil Moisture Content during dry season	Direct	Intangible			
3	Reduced Run-Off / Erosion	Direct	Intangible			
4	Reduced Evaporation	Direct	Intangible			
5	Increase in Canopy Cover	Direct	Intangible			
6	Increase in Biomass	Direct	Intangible			
7	Increased Humidity	Direct	Intangible			
8	Improvement in Micro-climate	Direct	Intangible			



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S.No	List of Benefits	Direct/Indirect	Cost associated with Benefit /day	Cost per year	Expected year of Benefit	Yearly increment expected in Benefit
9	Drinking water availability for wild animals & birds	Direct	Intangible			
10	Water availability for irrigation	Direct	Intangible			
11	Cost of Water used for Plantation during Dry Season	Direct	Tangible			
11a	Labor Charges associated with procurment of water	Direct	272	40800	2	10%
11b	Electricity Cost for pumping water for Plantation	Direct	50	7500	2	10%
11c	Other associate Cost for procureing water for the plantation	Direct	100	15000	2	10%
12	Improvement in Plant mortality rate by 4%	Direct	Tangible			
12a	4% more stock of timber quality plants that can be felled after (http://www.fao.org/docrep/ARTICLE/WFC/XII/0634-C2.HTM)	Direct	Tangible	16000	4	10%
13	Increased Agriculture Productivity (conventional method) ftp://ftp.fao.org/agl/agll/docs/sb79.pdf	Direct	Tangible			
13a	Labor Charges (person - day)	Direct	272	97920	2	10%
13b	Net Farm Productivity (rice) http://sap.ipni.net/article/west-bengal	Direct		97500	2	10%
14	Pisiculture Productivity	Direct	Tangible			
15	Labor Charges (person - day)	Direct	272	40800	2	10%
16	Net fish catch http://rkvy.nic.in/static/SAP/WB/WB.PDF	Direct	Kg/ Ha / year	3500	2	10%
17	2% EDC & FPCs benefited in West Bengal http://www.westbengalforest.gov.in/publication_pdf/state_forest_report_06_07.pdf	Direct	83.86	255720		
18	Benefits	Direct		21444679		



Cost Benefit Analysis of Tall Seeding Nursery

Cash Flow	0	1	2	3	4	5	6	7	8	9	10
Capital Cost	797,00,000	0	0	0	0	0	0	0	0	0	0
Operational Cost	0	7970000	7970000	7970000	7970000	7970000	7970000	7970000	7970000	7970000	7970000
Depreciation (on straight line basis)	79,70,000	79,70,000	79,70,000	79,70,000	79,70,000	79,700	79,70,000	79,70,000	79,70,000	79,70,000	79,70,000
Escalation cost	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500	11,95,500
Benefits	0	21444679	23589147	25948062	28542868	31397155	34536870	37990557	41789613	45968574	50565432
Total Benefit	-888,65,500	43,09,179	64,53,647	88,12,562	114,07,368	221,51,955	174,01,370	208,55,057	246,54,113	288,33,074	334,29,932
Discount Factor (10%)	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323	0.5644739	0.5131581	0.4665074	0.4240976	0.3855433
Present Value	-88865500	3917436	5333593	6621008	7791386	13754621	9822620	10701942	11501326	12228038	12888686
Net Present Value (NPV)	5695155										
IRR	11%										



K. Risk Analysis:

In the process of drafting the FIG for West Bengal, the Forest Directorate has held consultations with several departments, institutions, stakeholders. The consultative groups are given in the chart enclosed. The program is designed with plans and resources to ensure transparent decision making and implementation, including mechanisms for redressing potential grievances. Given the framework approach adopted for infrastructure investments, the proposed project has some high inherent risks.

Table: Major Risks, Mitigation Measures, and Rating of Residual Risks

<i>Risk factors</i>	<i>Description of risk</i>	<i>Rating^a of Risk</i>	<i>Mitigation measures</i>	<i>Rating of Residual risk</i>
I. Sector-specific Risks				
Sector Governance	Governance and financial accountability framework rest with multiple agencies. Issues include: (a) weak coordination, resulting in poor planning and implementation delays; (b) weak capacity at intermediate and lower levels which are responsible for service delivery; and inadequate performance management and accountability systems; (c) M&E systems are not very strong; and (d) despite a strong framework of sanctions, there remains patronage and direct theft of public money.	Substantial	(a) Institutionalization of co-ordination with dedicated institutions for implementing FIG, WB with emphasis on training of staff. (b) Sector governance and financial accountability assessments have to be conducted at the executing agency level. (c) Various technical assistance activities have to be initiated including capacity building of all associated agencies, (d) The design of the project includes better internal control systems, third party quality assurance, better systems for M&E and expenditure tracking; prudent systems for financial and procurement management; and process reforms supporting transparency and accountability.	Moderate
Sector Institutions and Policies	Basin-level management across three key sectors – water resources, environment, and urban development - will be challenging, with weak service delivery institutions, insufficient cross-sectoral coordination, and no proven models for river basin clean-up/management in the country	Substantial	(a) Cross-sectoral coordination to be built with institutional design, (b) The program will be supported by ongoing reforms in these sectors/states, (c) Improving financial sustainability of service delivery through rational charges and tariffs and improved financial management.	Moderate
II. Operation-specific Risks				
Operational	ULBs do not currently have adequate technical	High	(a) No investments will be considered without explicit consent of	Substantial



capacity and ownership at the ULB level	and financial capacity.		ULB. (b) ULBs are being sensitized through workshops and communications program.	
Operational Capacity of institutions	Successful implementation requires competent and dedicated executive bodies at state levels.	Substantial	(a) The SPMGs at the state level are to be set up as registered societies, with agreed structure and staffing plans, to enhance administrative and financial autonomy and promote single-point accountability. (b) Up-front support for capacity building being provided, including project management and technical support consultancies.	Moderate
Investments Preparation and Execution	Technical quality of investment preparation (including city-level planning) is inadequate, and long-term sustainability is not addressed satisfactorily	Substantial	(a) Investments framework with criteria for selecting, appraising and implementing investments have to be developed to ensure technical quality, effectiveness and sustainability of investments. (b) A rigorous review process has to be designed, requiring feasibility and planning analyses and independent reviews	Moderate
	Householders do not connect to sewer networks	Substantial	ULB to be empowered for suitable mechanism for the same	Moderate
Transparency, Accountability redressal	Lack of citizen voice in investment planning and implementation; inadequate disclosure measures; weak grievance redressal	Moderate	(a) Consultations, communication and disclosure are mandated by framework (b) All RTI Act provisions will apply, (c) Project to include social audits and publicly disclose all M&E reports (d) Dedicated grievance redressal system to be incorporated.	Low
Social and environmental safeguards	Inadequate attention to social and environmental impacts of project/program interventions.	Moderate	(a) SPMG to be staffed with competent social and environmental specialists to ensure ESMF compliance (b) Project provides for systematic and long-term effort to track social and environmental issues in the basin,	Low
Reputational risks	Unrealistic public expectations that the river will become clean by the time the project is completed.	High	(a) Design includes strong communications and outreach program, (b) Communications will focus on managing expectations, including the fact that the Ganga clean-up will require longer time and more resources than possible in one project.	Substantial
III. Overall Risk				
Overall Risk	The project is complex in scope and of high visibility in India. Even though the PDO, components, and institutional arrangements have been designed to integrate the mitigation measures described above, the overall risk remains high.			High
^a Rating of risks on a four-point scale – High, Substantial, Moderate, Low – according to the likelihood of occurrence and magnitude of potential adverse impact.				



L. Outcome:

Land use type	Activities	Forest	Outcome of the infrastructure development (Service and Benefit)									
			Timber	Fuel Wood	Biomass	Fodder	Reduced Erosion	Minor produce	Hydrological benefit	Soil Conservation	Biodiversity	Carbon Sequestration
Degraded Natural Forest	Contour Trench		+	++	++	++	+++	++	+++	+++	++	++
	Earthen Dam		++	++	++++	++	+++	++	+++	+++	++	+++
	Gully Plugging		+	++	++	+++	+++	+	++	+++	+	++
	River Training		++	+	++	+++	+++	0	+	+++	+	+
	Hand packed wall in hills		+	++	++	+++	+++	+	++	+++	+	++
	Boulder Sausage Walls		++	+	++	+++	+++	0	+	+++	+	+
	Catch Water Drains		+	++	++	+++	+++	+	++	+++	+	++
	Clonal seed orchard and seedling seed orchards		+++	+++	+++	+++	+++	++	+++	+++	++	+++
	Research Plots & Seed Testing Lab		+	+	+	+	+	+	+	+	+	+
	Watershed Management		++	++	+++	++	+++	++	+++	+++	++	++
	Production Centers for Tall QPM 0.50 lakh capacity		+++	+++	+++	+++	+++	++	+++	+++	++	+++

Extent of Benefit – +++ High, ++ Medium, + Low, 0 None, - Negative

Type of beneficiary – Local Regional National / Global



M. Evaluation:

The primary monitoring of the RKVY works is done by the Divisional Forest Offices at the Divisional level and by the Chief Conservator of Forests in the Circle comprising different Divisions.

However as per the recent guidelines an independent 3rd party monitoring of the RKVY projects, implemented in the field, has been put in auction following the observation of CAG that deficiency in monitoring in monitoring was the biggest weakness of the programme.