Detailed Project Report

A toolkit for use in the National Cyclone Risk Mitigation Project

Annexure – IV: Format for preparation of DPR on Embankments & Canals

National Disaster Management Authority

Government of India

Annexure IV- Format for the preparation of DPR on Embankments & Canals

The Indian coastline, especially the east coastline, is one of the most cyclone prone areas with occurrences of more than one hundred cyclones storms in the past 100 years. Heavy rainfall of up to 500mm within a 24-hour period associated with cyclones puts the drainage system in the coastal areas under severe stress. The expansion of the command area extending up to the sea has deprived the area of its natural defence against cyclone and storm surges. This is due to the disappearance of mangroves and absence of plantation liked Casuarinas trees, etc. A combination of flash floods, poor drainage and cyclonic storm surges cause inundation and consequential loss of agricultural production and other damages.

During the depressions, cyclones and the monsoon period, the average tidal height experienced is above 2-5 meters. High waves coupled with storm surges overflow and flood the low line back shore lands. This causes considerable loss of property belonging to weaker section like destruction of buildings, endangers the lives of people and livestock residing nearby affects the agricultural land, fishing industry and there by affecting the overall National Economy.

During the cyclone periods, the saline water due to tidal effect of the sea enters into the fields and villages causing Saline water inundation & Storm surge. The most vulnerable reaches along the coastline are to be identified and these areas (people, livestock and agricultural fields) are to be protected against the vagaries of the cyclonic action. Saline Embankments is one such mitigation mean to protect people, livestock and agricultural fields from saline water inundation/storm surge. The NCRMP includes the renovation of existing damaged embankments as well as construction of new embankments.

In addition, during the cyclonic rains, heavy flooding of the coastal area occur due to flooding in the rivers causing flash floods, far more exceeding the designed discharge. Normally the flash floods cause numerous breaches in the banks of the river resulting inundation to large extent of agriculture lands and villages causing livestock losses. The stream spreads over a large area during floods, damaging the standing crops valued crores of rupees. Coastal canals /drains have been constructed to drain the flood waters into the nearby sea. At times these canals/drains are damaged due to increased floodwaters as well as damages to the embankments. Increasing the carrying capacity of the canals/drains along with the outlet structures would ensure the expected functionality in acting as shock absorber for flood water and its' force during cyclonic events. As a consequence of this, the prospect of inundation of agricultural fields, villages and roads would be diminished at least to a manageable level. By adopting the State of art technology, for design and construction of the works, the drain will be able to function efficiently even in case of big cyclones.

This toolkit has been divided into two sections; the first section addresses the generic information to be submitted by the State encompassing all Embankments & Canals proposed under NCRMP, the second section addresses the information that is to be submitted for the individual Embankment and Canal project **or in workable packages** proposed by the State.

The States have to provide details on each of the sections as listed in the DPR Toolkit. However, additional sections/information may also be incorporated as per requirement. The procedure for preparation of DPR outlined in this toolkit addresses various key issues in each sector and is likely to ensure appraisal, approval and subsequent project implementation in a timely and efficient manner. The suggestions and the formats provided in the toolkit are for

reference only. The State may modify them to suit its requirement. However they may include all the information that would be required for obtaining World Bank approval.

Part A

IV(A).1 Proposed Embankments and Canals (to be constructed in Phases)

Table 1: Locations of the proposed Embankments and Canals

(mark on Multi-hazard Map and attach) (Prioritization of Construction of the proposed Embankments & Canals may be provided in this section.)

Sl. No.	Name of Embankment and Canal	Block/ taluk	District	Zone (III/ II/ I)	Serviced area		Total area that would be protected by the construction	Phase in NCRMP
					No. of villages covered	No. of hamlets covered		
1	2	3	4	5	6	7	8	9
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Phase - I Roads should be marked on map as RED, Phase - II as BLUE, Phase - III as GREEN. It is recommended that the human development Indices or a Block Non-Development index be calculated to assist in phasing. The following sections may also be considered while proposing the portfolio of roads and for phasing decision.

IV (A).2 Detailed Engineering Design

This section should address the following:

- Alignment of embankment/canal
- Topographical survey maps showing details of surrounding areas, using preferably the GTS bench marks (plantation/trees/habitation/roads/cyclone shelters/any other important infrastructure in the vicinity). Topographical contour surveys for embankment axis/canal axis on 50m grid pattern, with contour intervals of 2-3m

- Details of field investigations for identification of construction material for embankment (High ground/burrow area)
- Tests on soil samples from foundation and burrow areas (construction material survey) as per relevant BIS and other standard procedures for:
    - Mechanical analysis
    - Triaxial shear
    - Atterberg's limits
    - Standard proctor compaction
    - Permeability
    - In-situ density/moisture content
    - Specific gravity
    - Conclusions and recommendations
- Rehabilitation / resettlement of displaced population
- Disposal plan for construction debris
- While new embankments/canals are being investigated, the selection of alignment for the work is to be examined for avoiding sharp curves and habitats as far as possible. The topographical survey shall be carried out with modern equipments, with reduced levels at the centre line and cross-sections at suitable intervals to suit the site conditions [at 50-100m intervals]. Quality of water [surface/ground] shall be tested for sea water intrusions. Details of fabrication facilities for gates in the area shall also be explored
- Seism city of the project area [IS:1893]
- XXXX
- XXXX

IV(A).2.1 Soil Exploration Data

(Relevant Charts and Maps should be enclosed)

The soil exploration data and suitability of soil for the construction of embankments/canals should be provided in this section. The detailed classification of soil met with along the entire length of the embankment/canal shall be carried out by means of excavating open trial pits and auger holes at every 0.5/1.0 km intervals and the details shown in the longitudinal section of embankment/canal. The samples of soil shall be tested for following properties as per IS;2720:

- Particle/Grain size analysis; Atterberg limits; plasticity index, Safe bearing capacity, Shear tests, specific gravity
- Aggregate for cement concrete

The details of the foundation treatment to be provided for the embankments/canals shall also be detailed as below:

1. Cleaning/removal of tree roots/debris etc.
2. Details of overburden soil[type/thickness]

3. Special treatment like grouting, if any
4. Details of core/cutoff for embankments

IV(A).2.2 Technical Specifications and Design

The design of canals shall be carried out using conventional methods as indicated in IS 8835-1978 and IS 12094-1978 with suitable drainage network and waterway. The Embankments to be designed as per guidelines indicated in CWC publication-Embankment Manual and IS: 1786. Locking gates/sluices where applicable shall be designed as per relevant BIS and Central Water Commission (CWC) standards.

This section should address, but not be limited to the following:

Embankment Design

- Technical specifications for embankments/canals (Type of soil should be specified as well e.g. sand / silty clay / sand with clay core) and allowable free board.
- Zoning of embankment section (zoning to be finalized as per strength parameters and material gradation) and compaction details
- Design of side slopes & slope protection (Stone pitching/ turfing)
- Stability analysis of side slopes (with/without earthquake effects) of both faces of the embankment by Swedish Slip Circle or any other method.
- Provision of drainage channels

Design of canals

- Details of lining of canals(type of lining, joint details, method of construction)
- Details of pressure relief arrangements

Design of outlet structure

- Design of outlet box
- Details of gate arrangements

IV(A).2.3 Detailed Drawings

This section should address, but not be limited to the following:

- Index plan (General map of the State, Individual maps for each structure)
- General alignment
- Longitudinal and Cross-section at salient locations
- Slope protection details
- Drainage arrangements
- Canal design XXXX
- Lining details
- Outlet structures
- Pavement details XXXX
- Plan, elevation and sections of outlet structures XXXX

IV (A).3 Project Costs

The Project cost should cover all distinct elements, including but not limited to the specific components listed below:

Table 2: Project Costs

S.No	Component	Cost[1]
1	Preliminary: Land acquisition Site development	
2	Cost of surveys and soil investigations	
3	Environmental compliance cost	
4	Component-wise physical infrastructure	
a	Earthwork	
b	Foundation treatment	
c	Soil stabilization	
d	Roadway constructions	
e	Side slope protection	
f	Drainage arrangement	
g	Outlet/regulator structures canal lining Any other Cost (T&P, Communications)	
5	Contingency	
Total		

The Abstract Estimate for each of the embankment/canal would be presented in the following manner for each of renovation/new works

[1] For all cost elements the applicable State Schedule of Rates are to be clearly mentioned with relevant cost escalation details

Table 3: Abstract Estimate

Name of Work:	Example-Renovation of Embankment XXXXX			
Location:				
Mechanical Work	Example - Fabrication and supply of xxx, xxxx m size gates including fixing of Fluro-carbon/ Teflon cladded rubber seal			
S.No	**Quanity**	**Description of Work**	**Rate Unit**	**Amount**

IV (A).4 Implementation Arrangement

Responsibilities of different agencies for implementation, monitoring and evaluation of the Project Component at local level shall be elaborated in this section.

IV (A).4.1 Construction Package

Brief description of the strategy for the overall works programme including information on indicative packages for tendering as per the following format should also be provided:

Table 4: Tendering Packages

List of Tendering Packages		Costs
Package No.	Package description	Estimate
1		
2		
3		
4		
5		
6		
7		
Total		

IV (A).5 Work Plan

Section shall deal with the detailed construction methods and implementation planning proposed for all components of the work (embankment/canal/lining/outlet structure). The construction methodology (manual/mechanized) for each type of structure shall be described under separate subsections. The types and sizes of equipment to be deployed shall also be indicated while explaining the methodology. The sequencing of the construction activities shall be attempted indicating the critical activity, if any. The work plan should address the following:

- Duration of the construction period. The standard format for the work plan is attached below:
    - Project activity scheduling with implementation charts
    - Risks during implementation Stage and risk mitigation plans

IV (A).6 Financial and Economic Analysis

IV (A).6.1 Fund Flow

The DPR to provide a flow-chart showing the budgeted fund-flow diagram from State Nodal Agency level to the level of disbursement.

Table 5: Planned Fund requirements per quarter

Sl. No.	Activity	Total cost (Rs. In Lakhs)	Quarter-wise requirements (Rs. In Lakhs)			
			Q1	Q2	Q3	Q4
A.	**Survey**					
1	Site survey and soil exploration					
B.	**Designing**					
2	Fees for consultants for preparation of designs, estimates etc.					
C.	**Procurement and Implementation**					
3	Costs for site development					
4	Cost of construction (summation of Cost Estimates prepared at road-specific cost estimates phase-wise) Phase – I: xxxxx nos. Phase – II: xxxxx nos. Phase – III: xxxxx nos.					

5	Likely escalation cost @ xx% as per RBI price index.					
6	Contract tax/ other taxes as applicable					
7	Fees for agencies/consultants for monitoring					
8	Fees for Agencies/ Consultants for Quality Control and Assurance					
9	Costs for hiring professional services of coordination cell @ Rs. xxxx/- per annum for xx years					
10	Environmental compliance cost					
11	Administrative overheads of Nodal Agency including audit expenses.					
12	Corpus fund to generate 2% of cost for maintenance per annum					
	TOTAL					
	Expected overall progress of Implementation in %ages of Estimated cost.					

Table 6: Abstract for fund requirement (Quarterly) from Centre and State

	Planned requirement (Rs. in Lakhs)		
	Total	Centre (75%)	State (25%)
Quarter 1			
Quarter 2			
Quarter 3			
Quarter 4			

Total			

The objective of this section is to estimate the success criteria of various components (the value of benefits and costs to the community) of the projects and to establish their worth from economic and social perspective.

IV (A).6.2 Social Benefits

A list of benefits from societal perspective (both social and economic) should be supported by the following:

- Explanation or description in qualitative terms
- Quantification of these benefits to the extent possible (or wherever possible) along with underlying assumptions and should cover, but not limited to the following elements:
    a. Improved quality of life
    b. Safety to livestock/housing
    c. Availability of access roads
    d. Supply continuity during emergency
    e. Employment opportunity during construction
    f. Others

IV (A).6.3 Adverse Impacts

This section should incorporate adverse impacts from a societal perspective (both social & economical) supported by:

1. Explanation or description in qualitative terms
2. Quantification of these negative/adverse impacts to the extent possible (or wherever possible) along with underlying assumptions and should cover, but not limited to the following elements:
    a. Pollution, environmental distortions
    b. Displacement of inhabitants
    c. Disruption in livelihood (e.g. fishermen etc.)
    d. Others

The following format may be used for depicting the benefits and Impacts of the projects:

Table 7: Benefits and Impacts

S.No	**Social benefits**	Comments	Quantitative impacts[2]
1.			
2.			
3.			
	Adverse Impacts		
1.			
2.			
3.			

IV (A).7 Environment Impact Assessment

This section shall derive from the environmental and social screening undertaken at the IP level. Based on the category in which the project has been classified. Appropriate impact assessment as defined in the ESMF shall be undertaken and detailed reports shall be annexed to the DPR.

IV (A).7.1 Social Impact

Construction of roads will have a great positive social impact, immediate as well as far-reaching, as enumerated here. An indicative list of social impacts that may be addressed are listed below

- Minimization of risks due to reduction in loss of lives of human and livestock due to shorter travel times.
- Immediate livelihood for local construction workers unskilled / workers.
- Training of construction workers to adopt safer construction practices in future, thereby reducing vulnerabilities of built environs.
- Promotion of child and adult education – as Schools, training centres, etc. will be easily accessible.
- Scope for immunization and health-camps in these remotely accessed villages will improve health care.
- Scope for income-generation programmes for women SHGs and even setting up of small industries/cottage industries etc.

[2] Please include the underlying assumption wherever applicable. The assumptions must be specific and not generic or general Statements.

IV (A).8 Project Monitoring & Evaluation

A Monitoring Agency having adequate capacity should be appointed or set up in-house to monitor physical and financial progress of the Embankments & Canals. The DPRs are to specify the Profile, Responsibilities and Powers of the members in the Monitoring Committee/ Agency.

Mechanisms to ensure the quality of material & construction and progress of work on-site shall be elaborated in this section

IV (A).9 Project Sustainability

Project sustainability requires that long term O&M is planned in terms of Institutional framework and strategy for sustainability of the embankments.

The State may incorporate the following information:

- Arrangement for the O&M of the created infrastructure asset
- Brief outline of the existing method of O&M practice
- Brief description/analysis of key issues in regard to O&M (including provisions in the State budget for O&M) and proposed counter measures to overcome them for the project
- Scope for stakeholders (indicated in section 5.1) in the defined aspects of O&M for any specific/all components of the asset
- Requirements of manpower, energy, spares and consumables for O&M on annual basis giving details of existing norms and proposed additional requirements

Part B

IV (B).1 Context and Background

Construction of Embankments and Canals under NCRMP-is complementary to various other risk mitigation programmers under NCRMP. General features, design and technical specifications would be based on Section-I. In this Section details for individual embankment/canal in the cyclone affected project area would be provided. This section shall provide following details (A sample proforma is enclosed)

1. Identification of saline embankment/canal:
2. Location of the structure:
3. Length of Embankment/Canal-Km:District:.....Taluka/Mandal:.....

   Town/Village nearby:
4. Access to project:

   Rail Head:.....;Road head;.....
5. Connection to other road/embankment/canal through which supplies will come to this project
6. Details of floods/indundation in the area:

   Maximum water level (EL m):

   Year of Occurrence (Date/Year):
7. Beneficiaries:

   (The total number of persons/livestock expected to benefit due to this project from the revenue villages, as well as the hamlets are to be included).
8. Missing links of the existing Embankments/Canals, if any, are to be clearly brought out and detailed proposals for repair/renovation/new construction of embankments/canals necessary are to be furnished.
9. Technical Details to be furnished, in respect of
   - Saline Embankment:
     - **a.** Type of Embankment (Homogeneous/zoned/rockfil]):
     - **b.** Length of embankment (m):
     - **c.** Top width (m):
     - **d.** Max height from deepest bed level (m):
     - **e.** Long section
     - **f.** Cross Sections at reasonable intervals (Embankment protection measures are to be included to ensure that the embankment is functional even after the severest calamity)
     - **g.** Drainage arrangement details
   - Canal:

a. Length of canal (m):

b. Design discharge (cumecs):

c. Full Supply Level (m):

d. Lined/Unlined (Details of lining details-concrete slabs/in-situ concrete etc., with pressure release arrangements to be indicated)

- Outlet Structures:

a. Type of opening (rectangular/circular):

b. Dimensions of opening (mxm)

c. Material of construction:

d. Details of gates

10. Engineering Design

(Relevant technical specifications followed for all structures)

- Suitability of the present alignment [axis of embankment/canal]
- Topographical survey/contour map of the embankment/canal with outlet structure
- Construction material survey to ascertain the quality and engineering properties of construction materials- burrow areas/foundation material [mechanical analysis, consolidation & atterberg/limits].
- Hydrological survey and drainage plans
- Specifications for carriageway (CC/WBM/Bitumen)(Material specifications of carriageway shall be as per relevant MORD specifications for rural roadways
- Designs of outlet structure:
- Construction methodology and equipment requirement
- Estimation of qualities and analysis of rates are to be done to arrive at individual estimates.