

PRINCIPLES OF PREPARATION OF DETAILED PROJECT REPORTS (DPR)

- *Preparation of Project Report, Plans and Estimates*
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PREPARATION OF PROJECT REPORT, PLANS AND ESTIMATES

After completion of the detailed investigation of a project, the detailed project report has to be prepared as per the guidelines of the Central Water Commission, 1980, 1983, and 1989 and furnished to the Central Water Commission for obtaining their clearance. Before the Report is finalised, the surveys are to be conducted in detail and the data is to be collected from various agencies or departments involved and is to be incorporated in the report. The project report should contain a checklist, statement of salient features, detailed report, estimates and plans. The details of particulars are indicated in the broad guide lines of C. W.C. and the report should conform to these specifications to make it acceptable to the C.W.C.

The details of each component of the report are discussed hereunder:

1. Checklist: The checklist is intended to verify whether there are no omissions in the report and ensure that the report is prepared as per guidelines.

2. Salient features: This statement will facilitate to have all the particulars of the scheme at one place arranged in an order and it will be very easy for verification of data and other features of the project.

The various aspects to be dealt under various chapters are discussed in detail in the following paras:

1. Introduction: In this chapter the details like Aims of the project, location, accessibility, general climatic conditions of the state and area, affected population, natural resources, land use and socio economic aspects, history of the proposals, choice of the project, stages of development of project, cost and benefit of the scheme are to be discussed.

2. Physical features: Details on geographical disposition and topography of the project area river system and basin characteristics are to be detailed in this chapter.

3. Interstate Aspects: All interstate aspects, agreements, existing riparian rights are to be discussed under this head.

4. Surveys and investigations: Details of all the surveys carried out, methodology adopted results of the investigations, data utilised etc., are to be covered under this chapter.

5. Hydrology: Particulars of hydrologic inputs, processing of data, sedimentation studies, simulation studies, design flood, determination of outlet levels, etc., are to be dealt in this chapter.

6. Design features: This chapter shall deal with structural and hydraulic calculations of Earth Dam, Masonry dam, spillway with gates and energy dissipation arrangements, outlets, Regulators, canals and canal structures.

7. Reservoir: The particulars of fixation of Standards of Reservoir i.e., MWL, FRL, MDDL and details of backwater levels, stage capacities of the reservoir, details of properties and people affected due to submergence and their rehabilitation etc., are to be dealt with in this chapter.

8. Irrigation Planning: In this chapter the details like G.C.A., C.C.A., Irrigated area, existing crop pattern, crop water requirements, nature of soils, groundwater support etc., are to be discussed.

9. Command area development: This chapter shall deal with particulars like classification of land, size of land-holdings, climate, socioeconomic aspects, depth and quality of groundwater, land development works, ayacut roads, cost estimates of land-development.

10 & 11 & 12 : Flood control, Power & Navigation:

The various details pertaining to above aspects are to be dealt in these chapter.

13. Construction Programme and man-power and plant planning:

Details of yearwise construction programme for each of the Major components of work, planning of Key materials like cement, steel, explosives, oils and lubricants, different types of

machinery required, workshop and stores facilities, man power planning, are to be discussed under this heading.

14. Foreign exchange element: The details of plant and Machinery to be imported and foreign exchange required etc., are to be dealt with under this heading.

15. Financial resources: Present position of the scheme in the Plan, requirements of funds and the yearly phasing etc., are to be discussed in this chapter.

16. Estimates: The project works shall be grouped into the following units.

Unit: I: Head works including main dam, spillway, regulators, diversion structures etc.

Unit II: Canals system including branches and distributaries. Cost of these units are to be subdivided into various subheads and the basis for arriving at the cost under these subheads is to be briefly mentioned in this chapter.

17. Revenues: The details of water rates, land revenue, yearly programme of development are to be discussed under this head.

18. B.C. Ratio: This chapter shall contain details in respect of assessment of benefit cost ratio and allocation of cost under each component.

19. Environmental and Ecological aspects:

The physical aspects, socio- cultural aspects, public health aspects, forest aspects are to be dealt with in this chapter.

Plans: The list of drawings to be enclosed are given as Appendix to this note.

ESTIMATES

The capital cost of a project includes all costs associated with investigations, design and construction of the project which are discussed hereunder.

a) The investigation costs include cost of collection of necessary hydrological, geological, topographical and structural data to form the base for design and estimates.

b) Design costs include the cost of all necessary analyses of data and studies to support the layout and dimensions of structures etc.,

c) Construction costs are the costs of bringing the project into being.

As per IS code 4877 - 1968, the project estimates are to be grouped in to the following units.

Unit I: Head works

Unit II: Canals

Unit III: Hydro electric installations.

Unit IV: Navigation works

Unit V: Water supply works

Account heads/Subheads:

Cost components of each Unit should be worked out under the following minor heads classified as direct and indirect charges.

Direct Charges	I	Works
	II	Establishment
	III	Tools and Plant
	IV	Suspense
	V	Receipts and recoveries on capital account.

Indirect Charges

- a) Capitalised value of abatement of land revenue
- b) Audit and account charges.

All the above costs are grouped into various subheads as listed below. The main items that are to be included under each subhead are also detailed below.

I. Works

A. Preliminaries:

Expenditure incurred on previous investigation, all topographical surveys, geological surveys, hydrological and meteorological surveys, foundation investigations, preparation and printing of project reports, vehicles, training of Engineers etc., should be covered under this subhead. Generally the cost under this subhead can be at 1 % to 2% of the total cost of works.

B. Land:

This head covers the following main items:

- (i) Acquisition of land for works and that coming under submergence.
- (ii) Compensation for property, movements etc.,
- (iii) Rent for use of land.
- (iv) Solatium charges for compulsory land acquisition - 15% of cost of compensation.
- (v) Rehabilitation measures - As per State Government norms.
- (vi) Establishment charges for land acquisition at 6 1/4% of the cost of compensation.
- (vii) Crop compensation - 25% to 50% of the cost of agriculture land being acquired.

Interest charges on compensation at 25% of compensation for 2 years.

C. Works:

This head covers the cost of head works viz., dam, spillway, energy dissipation works, outlets and head regulators. The cost of these items should be based on detailed estimates.

D-Regulator, E-Falls, F-Cross Drainage works, G- Bridges, H-Escapes.

The provision under the above subheads pertain to canal structures and will be required under subhead Unit II. It is necessary that preliminary designs are made for all important structures after proper survey and for framing the estimates. Typical structures of different capacity (two or more in number) should be analysed to form the basis of provision for each type of structure in each category.

K. Buildings:

The requirement of buildings for execution of the project depends upon whether the works are to be carried out departmentally or on contracts. The buildings may be classified into residential and nonresidential buildings. The buildings shall be again subdivided into two categories i.e., permanent and temporary. In addition to the cost of buildings, provision for the items like colony roads, fencing, service connections such as water supply, sanitation and electrification, lawns and gardens is also included under this subhead. The provision under this subhead will be generally between 3 to 5% of cost of works.

L. Earthwork: This subhead is required for Unit II. ie., canals only. The provision for excavation of main canals, lining, etc., based on detailed estimates will have to be made. This will generally

cover main canals and branch canals.

M. Plantation: This item provides for establishing of avenue trees on the downstream of dam and along canal banks and in the colonies. The provision shall be made on the basis of per Km rate of plantation for the total length of canals. The provision should also include maintenance and protection for 2/3 years.

N. Tanks and Reservoirs: This sub-head is meant for remodeling of tanks in the command area, if required.

O. Miscellaneous: Following are the main items to be considered under this head.

(a) Capital Cost of:

Electrification, Water supply (purification and distribution), Sewage disposal. Fire fighting equipment, Telephone, Telegraph, Post Offices, Wireless, Medical equipment for hospitals.

(b) Maintenance and Service of:

Electrification, Water supply, Sewage disposal, Medical Assistance, Telecommunication, Security arrangement, transport for labour and staff, school bus, ambulance. etc.,

(c) Other items like visits of dignitaries, Technical and Photographic record, Inaugural Ceremonies, power supply, compensation to workmen, publicity & information centres, Training of Engineers, canteen facilities etc., The total provision under this head is generally of the order of 4% of I-works.

P. Maintenance:

This head usually covers the items of cost of maintenance of buildings, roads and other structures during the period of construction.

The usual norm for provision under this head is 1 % of cost of I-works less A. Preliminary B-land and Q special T &P.

Q. Special T&P

The capital outlay on construction equipment on a project is to be made under this head. The capital cost of equipment will depend upon type and quantity of machinery. For an economically planned project, the machinery should generally be so planned that it spends 75 percent of its life at project i.e., 75% of the cost is recovered from the works on hourly rates. The provision under this head should therefore be 25% of the capital cost and again

75% of this provision should be shown under V -Receipts and Recoveries towards resale/ transfer value. For inspection and transport vehicles 100% of the capital cost should be provided. Under this head and 20% of the value should be considered as resale, transfer value of the vehicles and shown under V -Receipts and Recoveries.

The provision for this subhead should be worked out as under.

Capital cost - P

Cost recoverable on hourly use rate = $0.75P$.

Capital cost of inspection and transport vehicles = Q.

Capital cost of specialised capital intensive equipment = R.

Provision to be made under

Q - Special T & P = $0.25 P + Q + R$.

Recoveries to be shown under

V-Receipts and Recoveries = $0.75(0.25P) + 0.2Q + R$.

R. Communications: Items to be considered under this head are construction of main approach road to dam site, quarry roads, temporary roads in work area, connecting roads etc., The cost should be provided on the basis of calculated road length and rate per km.

U. Distributaries:

The rate should be arrived on pro-rata basis based on the cost of distributary system in typical blocks covering an area of 10% of command area.

V. Water courses/Field channels:

The cost must be assessed on pro-rata basis from the CAD department.

W. Drainage

Provision should be made for surface drainage system under this head. The provision should be based on typical Surveys.

X. Environment and Ecology:

The important items to be considered under this head are:

- a) Compensatory afforestation.
- b) Restoration of land in construction areas.
- c) Rehabilitation measures required for flora and fauna, salvaging of monuments etc.,

The provisions required under this head are to be obtained from various departments like Forest Department, Fisheries, Archaeological Department, Health Department.

Y. Losses on Stock:

The provision under this subhead is generally made at 0.25% of the cost of I-works less - A. Preliminary, B-land and Q-Special T &P.

II. Establishment.

In addition to the provisions under 1- Works, 10% of the cost of I-works less B-land is to be made under this head.

III. Tools and Plant:

Provision at 1% of cost of I-Works is to be made under this head.

IV. Suspense:

The net provision under this head will be 'NIL' as all the outstanding suspense accounts are expected to be cleared by adjustment to appropriate heads on completion of project.

V. Receipts and Recoveries on Capital Account:

In addition to the items mentioned under Q-Special T&P, the recoveries on account of temporary buildings at 15% of the cost, rent charges from buildings etc., should be shown under this head.

Indirect Charges

In addition to above charges, provision towards the amount required to cover capitalisation of abatement of land revenue on the area required for works is made. This will generally be provided at 5% of the land cost or 20 times the annual revenue cost. In addition, Audit & Account charges at 1 % of I-works are also to be provided.

The total cost of the scheme will thus be the sum of Direct and Indirect charges.

DETAILED PROJECT REPORT

Section – I

Check List

Sl.No.	Item	Reference
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I. General Data

1. Name of the project
2. Location
 - a) State
 - b) District
 - c) Mandal
 - d) Longitude/Latitude
 - e) Survey of India Topographical Map reference No.(s)
 - f) Earthquake Zone number
 - g) Complete address for correspondence alongwith
pin code/ e-mail
3. Category of the project
 - a) Irrigation/Multipurpose
 - b) Storage/diversion

II. Planning

4. Has the Master plan for overall development of the river basin been prepared and stages of basin development discussed?
5. Have the alternative proposals (including set of smaller developments vis-a-vis a single large development) been studied and their merits

and demerits discussed ?

6. Does the scheme fit in the overall development of the river basin and has its priority in the overall development of the basin been discussed?
7. Have the other Departments concerned with the development been informed?
8. Is the present scheme proposed to be executed in stages? If so, are its various stages of execution and development discussed in the report?
9. Are the effects of the scheme on the riparian rights & existing upstream and downstream projects etc. discussed?
10. Has the provision for municipal and industrial water supply been made?

III. Interstate And International Aspects

11. Are there any International/Interstate issues involved? If so, have these issues been identified and present status of agreement or tribunal decision indicated specially in respect of:
 - a) Sharing of water
 - b) Sharing of cost
 - c) Sharing of benefits (irrigation, flood control, power etc.)
 - d) Acceptance of the submergence. by the upstream states
 - e) Acceptance by the upstream state(s) of compensation of land coming under submergence
 - f) Settlement of oustees
 - g) Any other

NOTE:- If there is no agreement, state the present position against each of the above item.

IV. Surveys

12. Have the detailed topographical surveys been carried out for the following items and maps prepared as per prescribed

scales

- a) River surveys
- b) Reservoir surveys
- c) Headworks surveys [dam(s), dyke(s), barrage(s), weir(s) etc.
and auxiliary components]
- d) Plant and Colonies' sites
- e) Canal(s), branch canals and water distribution system
- f) Major canal structures
- g) Power house, switch-yard, surge shafts, tailrace
- h) Tunnel(s), adit(s), penstocks etc.
- i) Surveys (detailed and sample) of areas of the command for OFD
and drainage works
- k) Soil surveys
- l) Surveys for soil conservation.
- m) Any other surveys i.e. archaeological, right of way,
communication etc.

V. Geological Investigations

13. Have the geological surveys for the following items been carried out and report on geology of the following appended?
- a) Region as a whole
 - b) Reservoir
 - c) Headworks and energy dissipation area
 - d) Power house and appurtenances
 - e) Intakes and regulators
 - f) Major canal structures
 - g) Tunnel(s), Penstock(s), hill(s) etc.

- h) Communication routes
- i) Any other

VI. Seismic Investigations

- 14. Has the seismicity of the region been studied and co-efficient of vertical/horizontal acceleration for the various structures discussed?
- 15. Has the approval of the Standing Committee for recommending design of seismic coefficients for River Valley Projects been obtained?
- 16. Is there possibility of liquefaction of foundations? If so whether liquefaction studies been carried out?

VII. Foundation Investigations

- 17. Have the detailed foundation investigations (including in-situ tests and laboratory tests) for the following structures been carried out and detailed report(s) appended?
 - a) Earth and rock fill dams
 - b) Masonry/concrete dams
 - c) Barrage(s)/Weir(s)/head regulator(s) etc.
 - d) Canal(s) & Canal Structures
 - e) Power house(s), tunnel(s), transformer caverns), de-silting chamber(s), surge tank(s)/shaft(s), intake(s)
 - f) Pump House(s)
 - g) Any other
- 18. Are there any special features like designs?

VIII Construction Material Surveys

- 19. Have the surveys and laboratory tests for the following construction materials been carried out and report(s) appended?
 - a) Soils for impervious, semi-pervious and pervious zones of earth and rock-fill dam(s)

- b) Sand
- c) Rock and coarse aggregates
- d) Bricks and tiles
- e) Pozzolana
- f) Cement and lime stone
- g) Steel
- h) Any other

20. Have the sources for each of the above material been identified and need etc. indicated?

21. Have the proposals for procurement of scarce materials been indicated?

IX. Hydrological And Meteorological Investigations

22. i) Have the hydrological and meteorological investigations been carried out and status of following data discussed in the report?

- i) Rainfall
- ii) Temperature
- iii) Sunshine
- iv) Gauge & Discharge
- v) Sediment
- vi) Water quality
- vii) Evaporation

ii) Has the above data been collected & appended?

X. Hydrology

23. Is the hydrology dealt with in detail in a separate volume? Have its brief details been included in this Report?

24. Have an index map and bar chart showing locations of various

hydro-metric, climatic and rainfall stations and the data availability at those stations been attached?

25. Are brief notes about quality, consistency, processing and gap filling of the data included?
26. Have hydrological studies been carried out for the following:
 - a) to establish the availability of water for the benefits envisaged?
 - b) to determine design flood for the various structures (spillway, weir, barrage etc.)
 - c) sediments storage
 - d) evaporation rates from reservoirs/concerned area
 - e) command area rainfall
27. Has the Ground Water Potential (existing use and additional availability) been indicated?
28. Have the studies regarding reservoir sedimentation been carried out and revised elevation-area-capacity curves been used in the simulation studies (Working Table)? ‘
29. Have the ecological requirements of water such as low flow augmentation and water quality control etc. and water requirement for domestic, industrial use and power generation (thermal, hydel, nuclear) been considered and included in the Project Report and incorporated in the simulation studies?
30. Have the details of the simulation studies (Working Tables) and conclusions arrived at from the various alternatives explaining the factors and assumptions made been included and discussed?
31. Has the number of failures for different aspects been indicated?
32. Have the likely desirable and undesirable changes in the hydrologic regime due to the project been brought out in the Report?
33. Is the criteria adopted for selection of the construction/diversion flood discussed?
34. Has the basis for determining the storage capacity been discussed.?

- 35. Have integrated working tables (for more than one reservoir in the system) been prepared?
- 36. Has carryover storage been provided? If so, whether studies for most economic carryover storage been done?
- 37. Have the flood routing studies been carried out?
- 38. Have the back water studies been carried out?

XI. Land Acquisition And Resettlement Of Oustees

- 39. Have the type and quantum of lands proposed to be acquired in the submerged area, project area, area coming under canals considered to reduce the canal capacities?

and distribution system, area required for rehabilitation of the oustees been detailed?

- 40. Is the basis for provision for land compensation indicated?
- 41. Have the rehabilitation measures, amenities and facilities to be provided to the Project Affected Persons been discussed and whether these provisions included in the report? Are these in accordance State's policy/project specific policy/draft national policy for rehabilitation and resettlement ?
- 42. Is the basis of land acquisition of the submerged area up to FRLI MWL etc. discussed?

XII. Designs

- 43. Does the state have an established Central Designs Organisation and State level multidisciplinary Advisory Committee and whether its composition has been indicated in the report?
- 44. Has the selection of final location of the headworks and appurtenances, in preference to the other sites investigated been discussed?
- 45. Has the layout of the project viz., location of headworks, workshop sheds, offices, colonies etc. been finalised and discussed?
- 46. Has the layout of the various major components of the head works been

discussed in the light of site features, geology, foundation characteristics etc?

47. Have the detailed designs been prepared for the following components & got vetted by CDO ?
- a) Earth or rockfill dam, masonry or concrete dam, spillway, barrage, weir, etc. and appurtenances.
 - b) Energy dissipation arrangements, training walls etc.
 - c) Openings through dams galleries, head regulators, penstocks other outlets, sluices etc.
 - d) Regulators
 - e) Canal and water conductor system
 - f) Canal structures
 - g) Pump house & intake structures
 - h) Power House, tunnels, surge shaft
 - i) Instrumentation
 - k) Power evacuation arrangement
48. Have the salient features of the above components and the assumptions made in the design of above components of the project been indicated and their basis discussed?
49. Have any model studies been carried out for location of the dam, spillway and other appurtenances & checking the design profile of the spillway, energy dissipation arrangements, location of outlets/regulators etc?
50. Has the final alignment of canal(s) and branch canals(s) been discussed in the light or various alignments studied?
- a) Does the canal design provide for meeting requirements of rush irrigation?
 - b) Have any intermediate storages and tail tanks been provided ?
51. Are the canals and distribution system being lined and if so what is the minimum capacity of the channel proposed to be lined?

52. Is the location of cannl structures on main and branch canals fixed after detailed surveys of the final alignments?
53. Are the regulation arrangements of the off-taking channel both near and away from the cross regulators discussed?
54. Are sufficient escapes including terminal escapes provided on the main/branch canals/distributaries/minors?
55. Have the basis for adopting water ways for the cross drainage works been discussed?
56. Have the proposals for rating the canal section by providing standing wave flumes, rating of the falls, broad crested weirs. V - notches etc. been discussed for the canal and distribution system?
57. Have any model studies for major canal structure(s) been carried out and if so are the results discussed and incorporated in the design(s)?

XIII. Irrigation and Command Area Development

58. Have the conveyance and field irrigation efficiencies for paddy and upland crops during kharif, rabi etc., been indicated, discussed and justified?
59. Have the 10-daily/monthly crop water requirements at the canal heads been worked out?
60. Are there any proposals for introducing warabandi and if so have these proposals been discussed in the Report and sample calculations for a typical distributary/minor/sub-minor furnished?
61. Has the present position of irrigation in the command through existing canals, tanks, lift schemes, wells etc. been brought out in the Report?
62. Are the particulars of all irrigation projects (including minor schemes) existing/proposed in the command been indicated?
63. Are there any potential areas where ground water is available? If so, has the quantity & quality of the ground water been indicated?
64. Has the quantum of available ground water been assessed and plan for its conjunctive use with surface water been prepared and incorporated in the Report?

65. Have the semi-detailed soil surveys been carried out for the entire command? If not, the extent of area surveyed may be indicated.
66. Have soil and land irrigability classifications brought out in the Report?
67. Is the method used for determining the crop water requirements discussed?
68. Has the pre-project cropping pattern and the proposed cropping pattern alongwith justification been furnished?
69. Are the areas and percentages of the CCA that will be irrigated during kharif, rabi, two seasonal, summer and perennial seasons been indicated?
70. Is justification furnished for irrigating perennials and summer crops from the reservoir?
71. Have the monthly reservoir operation studies been carried out at least for 20 years and summary on annual basis attached?
72. Have the number of blocks selected for detailed surveys for On Farm Development (OFD) works including drainage and total area covered by such blocks been indicated?
73. Have the existing locations of the Trial cum Demonstration Farm, input centres (seeds, fertiliser and insecticides) in the command been indicated and proposal to strengthen the same discussed?
74. Have the arrangements for financing the OFD works and proposals, if any, for strengthening the same been discussed?
75. Have the agencies responsible for execution of OFD works been identified and simultaneous planning of execution of OFD works alongwith engineering works discussed?
76. Has the year-wise phasing of irrigation development as a result of the project been discussed?
77. Is the existing communication system viz. telephone, wireless and roads within command area sufficient to meet the requirement after full development of irrigation? If not, have new proposals been planned and discussed?

78. Is the adequacy of the marketing centres in the Command Area and new proposals to meet the requirements after full development of irrigation been discussed?

79. Is there any stabilisation of existing irrigation proposed?

XIV. Flood Control And Drainage

80. Have the various flood control components of the multipurpose project been indicated?

81. Have the damage areas in pre-project & post project situations been identified and flood intensities worked out at each of the damage centre(s) which gets affected?

82. Have the following flood aspects been discussed?

- a) Flood cushion in the reservoir.
- b) Maximum moderated flood out flows over the spillway etc. and their frequency.
- c) Existing and proposed safe carrying capacities of the channel below the dam after construction of flood embankment, channel improvement, river diversion etc.
- d) Synchronized moderated peak floods due to release(s) from the dam upstream and uninterrupted catchment upto the damage centres.
- e) Average annual expenditure incurred on flood relief works.
- f) Area and population affected likely to be affected before/after the project.
- g) Estimated saving in annual loss of life, property, cattle, crops, etc. (evaluated in terms of money) due to flood control.

83. Have the following drainage aspects of command area been discussed?

- a) Existing surface and sub-surface drainage network and problems of drainage congestion, water logging, alkalinity/salinity if any.

- b) Studies on sub soil water table (pre-monsoon, post-monsoon etc.)
- c) Maximum intensity of 1,2 and 3 day rainfall.
- d) Deficiencies in farm drains.
- e) Deficiencies in existing natural drains.
- f) Proposal for improvement of drainage/water logging /alkalinity/ salinity of the area along with justification thereof.
- g) identification of the area in Command which will get benefited due to execution of drainage network and benefits thereof in terms of relief from crop damage, increased yields, etc.

XV Navigation

- 84. Is the present scheme for remodelling of the existing facilities and/or extension of the navigable reach or establishing new navigable reach?
- 85. Is the existing inland transport system being fully utilised? If not, have the bottlenecks in its full utilisation been identified and discussed?
- 86. Have the surveys for goods and passenger traffic been carried out and discussed?
- 87. Is the extent of modification required in the existing system discussed and justified?
- 88. Do design for the canal sections and structures take into account the navigation requirements?
- 89. Have the proposals to develop the new scheme and phases of development in the different reaches been discussed?
- 90. If the area is being served by inland water transport, have the following been discussed:
 - a) The existing toll rates and registration fees for the crafts (sizewise);
 - b) Proposals for revision of toll rates and fees, if any.
 - c) Concurrence of the competent authorities for revision of rates and fees.

- d) Proposal to subsidise the tariff, tolls, craft registration fee, passenger fare etc to attract traffic.

- 91. Has the State Inland Water Authority been consulted while finalising the scheme and its view point discussed?
- 92. Has economic justification and viability of the navigation component of the multipurpose project been discussed?

XVI. Power

- 93. Have the following points been discussed?
 - a) Availability of the power generating capacity in the State as well as in the region from different sources.
 - b) Total energy available and peaking capacity of the system in the State as well as in the region from different sources.
 - c) Integrated operation of the system and present status of utilisation in the State as well as in the region.
 - d) Surpluses and shortfalls in the system in the State as well as in the region.
 - e) Future plans of power development from different sources in the State/region.
 - f) Fitment of the scheme in planning of power development of the State/region.
 - g) Energy generated from the project, firm power, seasonal power and total power.
 - h) Proposal for transmission lines connecting to the existing system/ grid.
 - i) Project cost per KWH installed and per kwh generated at bus bar as compared to the different hydro-electric, thermal generation and gas projects and different sources in the State as well as in the region to justify the power component of the project.
 - j) Whether the proposed addition to the transmission system has been shown on a geographical map. Whether options considered for the proposed addition have been discussed with statement of

justification for the selected option after carrying out supporting studies covering load flow studies, short-circuit studies (three phase and single phase) and stability studies.

- k) *Whether sufficient surplus of peak power is available for pumping of water from lower to upper reservoir.
- l) *Actual off peak energy requirement of proposed scheme
- m) *Cost of peak and off peak energy

** for pumped storage schemes only*

XVII Construction Programme And Plant And Manpower Planning

- 94. Are the major components of work proposed to be done departmentally or through contractor?
- 95. Have the various alternative construction programmes been studied and proper justification furnished for the final programme adopted?
- 96. Has the proposed construction programme been prepared and synchronised for timely completion of each of the major component of work including Command Area Development?
- 97. Have the yearwise quantities of the following materials of construction been worked out for various components of the project:
 - a) Excavation separately in soft and hard strata
 - b) Earthwork in filling-impervious, semi-pervious and pervious
 - c) Rockfill - for dam, toe, riprap etc.,
 - d) Stone for masonry
 - e) Coarse aggregate for concrete
 - f) Sand - for filter, masonry/concrete
 - g) Gravel - for filter
 - h) Steel of various sizes and type

- i) Cement-normal, quick/slow setting with or without pozzolana, special types
 - j) Lime-surkhi-pozzolana
 - k) Scarce materials-special steel
 - l) Other materials-fuel, electricity, explosives etc.
98. Have the yearwise quantities to be executed by machinery/labour for each of the major component been worked out for each of the above material?
99. Have the labour intensive items of the various major components of the project been identified and the quantities of such items worked out?
100. Have PERT chart or CPM diagrams for construction programme of various components been made and included in report? Has organisational set up and frequency for project monitoring been indicated in the Report?

XVIII. Foreign Exchange

101. Have the details of the plant and machinery, spares, instruments and scarce materials to be imported worked out?
102. Has the phasing of imports and source(s) of imports been discussed itemwise?
103. Are the imports to be effected under foreign grants/credits or internal resources of the country?
104. Is the scheme covered under State sector or Central sector?

XIX. Financial Resources

105. Has the concurrence of the State Finance Department been obtained?
106. Is the scheme included in the Five Year/Annual Plan? If not what is the present position regarding its inclusion in the Plan?
107. Whether the scheme has already been started? If so, is the present stage of construction indicated?

108. Have the yearwise requirement of funds been indicated?
109. Is the scheme covered or proposed to be covered under any foreign assistance/aid agreement?

XX. Estimate

110. Is the separate volume of estimate attached as appendix?
111. Is the year to which the rates adopted in the estimate relate to indicated?
112. Have the analysis of rates for various major items of work for the major components of the project been furnished and with basis of analysis described?
113. Are the provision for the following items made on the basis of sample survey and sub-estimates:
- a) Distributaries, minor and sub-minors
 - b) Water courses
 - c) Drainage
 - d) CAD Works

XXI. Revenue

114. Are the bases for the following sources of revenues furnished?
- a) Betterment levy and proposal for its recovery
 - b) Irrigation cess
 - c) Flood protection cess
 - d) Cropwise water rates
 - e) Sale of water for village/city/industrial/power/water supply
 - f) Miscellaneous
115. Have these rates been compared with the existing rates at the other projects in the State/region?
116. In case the rates are being enhanced, has the concurrence of the

concerned department(s) been obtained.

117. Has the organisational set up for the collection of revenue been indicated?

XXII B.C. Ratio

118. Are the allocated costs for the following components of the multipurpose project worked out and basis therefor furnished?

a) irrigation

b) power

c) flood control

d) navigation

e) water supply

f) any other

119. Have the various departments of the State/Centre agreed to the sharing of the above allocated costs?

120. Have the cropwise benefits been worked out for irrigated and unirrigated crops being grown before project in consultation with the agriculture department and a statement furnished?

121. Have the cropwise benefits been worked out for proposed cropping pattern after the introduction of irrigation in consultation with the agriculture department and statement furnished?

122. Is the BC ratio of Irrigation Project acceptable or otherwise justified?

123. Is the B.C. Ratio for Flood Control Project acceptable or otherwise justified?

124. Is the B.C. ratio for power component of the project acceptable or otherwise justified?

125. Have the financial and economic return statements been furnished keeping in view the phasing of development?

126. Are the benefits other than those considered in the B.C. Ratio and financial return statement been identified?

XXIII. Ecological Aspects

127. (a) Is the area likely to have any of the following environmental and ecological problems due to the altered surface water pattern? If yes, whether preventive measures have been discussed?

- i) Excessive sedimentation of the reservoir and the upper reaches of the river and its tributaries falling into reservoir
- ii) Water logging, salinity/alkalinity
- iii) Quality of surface and ground water
- iv) Ground water recharge
- v) Health hazards-water borne
- vi) Submergence of important mineral deposits
- vii) Submergence of monuments/archaeological sites
- viii) Fish culture and aquatic life
- ix) Plant life (flora)
- x) Wild Life
- xi) Migratory birds
- xii) National parks and sanctuaries
- xiii) Seismicity due to filling of reservoir
- xiv) Likely change in the regime of the river
- xv) Any other

b) Have the environmental and forest clearances from MOE&F been obtained? If not, what is status thereof?

XXIV. Colonies And Buildings

128. Has the planning of the colony/buildings been done keeping in view the ultimate use for optimum utilisation of investment?
129. Has an estimate of the extent of higher cost involved been made and details discussed?
130. Are the permanent buildings being constructed required for maintenance of the project only?
131. Can the buildings other than required for maintenance of the project being constructed be put to some other use after the completion of the project by the department or any other agencies?

Buildings to suit their requirements later on?

133. Have the proposals for disposal of temporary buildings been discussed?

XXV. Public Participation And Cooperation

134. Have the possibilities of these been discussed in:
 - a) Planning
 - b) Construction
 - c) Improved agricultural practices
 - d) any other
- 135) Have public debates about utility of project been held and the response thereof outlined in the Report?

XXVI. Soil Conservation

136. Is the need for soil conservation measures in the catchment of the project discussed?

SECTION – 2

SALIENT FEATURES

The following salient features (and any others) as applicable to the project to be furnished:

1. Name of the Project :
2. Type of Project
(Irrigation or Multipurpose)
3. Location
 - 3.1. River Basin
 - a) Name
 - b) Located in
 - i) State (s)
 - ii) Countries (if an international river)
 - 3.2 River / Tributary
 - 3.3 State(s)/District(s)/Taluka(s) or Tehsils in which following are located:
 - a) Reservoir
 - b) Headworks
 - c) Command Area
 - d) Power house
 - 3.4 Name of village near the Headworks
 - 3.5 Location of Headworks
 - a) Longitude
 - b) Latitude
 - c) Lies in Earthquake Zone No...
 - 3.6 Project area reference to
 - a) Degree Sheets
 - b) Index Plan
 - 3.7 Access to the project

	Name	Distance from project site
a) Airport		
b) Railhead		

- c) Roadhead
- d) Riverhead
- e) Seaport

3.8 Rail/Road transportation limit of

- a) Weights (T)
- b) Dimensions (LxBxH)

4. International/Interstate aspects of the project

- a) Catchment area of the basin
- b) Statewise/countrywise details of catchment area
- c) Submergence due to the project
 - i) In the state
 - ii) In other states
 - iii) In other countries
- d) Water allocation for the state (if any)/country
- e) Water allocation for other states/countries
- f) Committed utilisation

Upstream Projects

Irrigation Water Supply Thermal Industrial Hydel
(including evaporation losses)

- i) Projects completed
- ii) Projects under construction
- iii) Future Projects
- iv) Any other

Downstream Projects

Irrigation Water Supply Thermal Industrial Hydel
(including evaporation losses)

- i) Projects completed
- ii) Projects under construction
- iii) Future Projects
- iv) Any other

SUB-TOTAL (f) :

g) Proposed utilisation by the Project (including evaporation losses)

i) Irrigation

– Khariff

– Rabi

– Hot weather

Total:

ii) Water supply

iii) Hydel

iv) Thermal power

v) Industrial

vi) Gross annual utilisation (sum of (i) to (v))

h) Minimum agreed/ proposed flow in the river for maintaining ecology

5. Estimated Life of the project (years)

6. Irrigation (ha.)

By flow

By lift

a) Gross command area (GCA)

b) Culturable command area (CCA)

c) Area under Irrigation (break up):

i) Khariff

ii) Rabi

iii) Hot weather

iv) Two seasonal

v) Perennial

vi) Gross Irrigated area (GIA)**

vii) Intensity of irrigation

$$\left(\frac{GIA}{CCA} \times 100\% \right)$$

viii) District(s) Benefitted (if the district benefited is predominantly tribal or drought-prone, it may be so indicated against each district).

** = Irrigated area under Kharif, two seasonal, perennial, rabi and hot weather shall be indicated.

d) Cost per hectare of gross area irrigated

e) Cost per 1000 cum of gross/live storage

f) Cost per 1000 cum of water delivered at the (canal head/outlet)

g) Water utilisation

7. Flood control

a) Area protected from floods (ha)

b) Population protected from floods (no.)

c) Average annual flood damage (Rs. million)

i) without project

ii) with project (anticipated)

e) Safe carrying capacity of the river (m³/sec.)

i) Without project

ii) with project

8. Navigation

a) Location of the navigable reach

b) Length of the navigable reach

c) Minimum draft

d) Total tonnage of goods to be carried annually

e) Expected passenger traffic (annual)

9. Water Supply

9.1 Domestic

- a) Names of towns/villages served
- b) Size of population served
- c) Quantum of water made available (m^3)
- d) Quantum of water per capita (litre)

9.2 Industrial location(s)

- a) Name(s) [location(s)]
- b) Quantum of water made available (m^3)

10. Project Performance

	Period of Simulation	No. of failures
a) Irrigation		
b) Power		
c) Flood control		
d) Water supply		
e) Navigation		

11. Hydrology

11.1 Catchment

11.1.1 Catchment area at headwork site (sq.km)

- a) Gross
- b) Intercepted:
 - i) By existing projects
 - ii) By ongoing projects
 - iii) By contemplated projects
- c) Unintercepted

Note : In case of a downstream weir/barraige regulating the supply to the canal(s) similar details shall be furnished for the catchment between headworks and the weir/barraige

11.1.2. Catchment area classification according to mode of precipitation (sq.km.)

- a) Rainfed
- b) Snowfed

11.2. Precipitation

11.2.1. Catchment

	Rainfall (weighted mm)		Snowfall (mm)
	Annual	Monsoon (June-Oct.)	Annual
a) Average			
b) Maximum			
c) Minimum			
d) Co-efficient of variation			

11.2.2 Command

	Cropping Season			
	Annual	Kharif	Rabi	Hot
		(June-October)	(November-February)	(March-May)
a) Average				
b) 80% dependable				
c) ETO (mm)				

11.3 Annual yield calculated at the proposed site (M.cum)

Gross Net

- a) Maximum
- b) Minimum
- c) Average
- d) Dependable (per cent)

Annual

Monsoon

(June-October)

i) 50

ii) 75

iii) 90

iv) 98

11.4 Climatic Data (Command)

11.4.1 Name of station(s) and period of record

Sl.No.	Name of station	Period of Record	
		From	To
1.			
2.			
3.			
4.			

11.4.2. Data (average of all stations in comand area)

Normal

Maximum

Minimum

a) Air temp. (°C)

b) Humidity (per cent)

c) Wind speed (km/hr)

d) Water temperature (°C)

11.5 Seismic coefficients

- a) Horizontal
- b) Vertical

11.6 Utilisation within the State (m.cum)

11.6.1 Water availability (State's share in case of interstate river)

11.6.2 Committed Utilisation

	Major	Medium	Minor
a) Upstream Projects			
i) Projects completed			
ii) Projects under construction			
iii) Future projects			
iv) Any other			

	Major	Medium	Minor
b) Downstream Projects			
i) Projects completed			
ii) Projects under construction			
iii) Future projects			
iv) Any other			

11.6.3 Proposed utilisation by the project

- a) irrigation
 - i) Khariff
 - ii) Rabi
 - iii) Hot Weather
 - iv) Perennials
- Total

- b) Water supply

11.7 Floods near the headworks site

11.7.1. Historical period of record from to.....

Location(s)

1 2 3

- a) Maximum water level (El-m)
- b) Maximum Discharge estimated (cumec)
- c) Year of occurrence date

11.7.2. Observed-period of record fromto.....

Location(s)

1 2 3

- a) Maximum water level (El-m)
- b) Maximum Discharge (cumec)
- c) Year of occurrence date

11.7.3. Estimated Flood

Magnitude (cumec)

- a) 50 year return period
- b) 100 year return period
- c) 1000 year return period
- d) Standard project flood (cumec)
- e) Maximum probable flood (cumec)

11.7.4 Design flood (cumec)

- a) Dam
- b) Weir/Barrage
- c) Construction/ Diversion
- d) Flood Control Works

11.7.5. River flows (minimum observed)

- a) Water level (El-m)
- b) Discharge (cumec)
- c) Months of 'nil' flow, if any.

12. Reservoir

12.1 Water levels (El-m)

- a) Maximum Water Level (MWL)
- b) Full Reservoir Level (FRL)
- c) Minimum Draw Down Level (MDDL)
- d) Outlet levels
 - i) Irrigation
 - ii) Power
 - iii) Others (Please specify)
- e) Dead Storage Level

12.2 Free board (m)

12.3 Wave height (m)

12.4 Live storage (M cum)

12.5 Capacity (M cum) at :

- a) Maximum water level
- b) Full reservoir level
- c) Minimum draw down level
- d) Dead storage level

12.6 Flood absorption capacity (M cum)

- a) Below FRL
- b) Between FRL & MWL

12.7 Sedimentation (M cum) and levels after

Years

50 100

- a) Above MDDL
- b) Below MDDL
- c) Encroachment of live storage (per cent)

12.8. Average monthly evaporation losses from the reservoir (M cum)

Month	Average Evaporation Loss (M.Cum)
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

13. Submergence

13.1 Land and property submerged

	MWL	FRL
	(1)	(2)
a) Villages affected (No.)		
i) Fully		
ii) Partially		
b) Land affected (ha.)		
i) Gross		
ii) Culturable		
iii) Irrigated		
iv) Forest		
v) Others (specify)		
c) Buildings/houses (No.)		
i) Private		
ii) Communities		
iii) Government		
d) Wells (No.)		
e) Road/rail (km)		
f) Transmission lines (km.)		
g) Any other		

13.2 Submergence ratio (with reference to culturable command areas)

13.3 Number of families/persons affected

	Families	Persons
a) Total		
b) Scheduled Castes		
c) Scheduled Tribes		
d) Other Backwards Castes		
e) General		

13.4 Anticipated backwater levels at important places along the periphery of the reservoir

S.No.	Name of place	Back water level (El-m)

14. Headworks

14.1 Dam

14.1.1. Embankment Dam

- a) Type of dam
(Homogeneous/Zoned/Rock-fill/Concrete faced)
- b) Length of the dam at top (m)
 - i) Right Flank
 - ii) Left Flank
- c) Top Width (m)
- d) Maximum Height above G.L. (m)
 - i) Right Flank
 - ii) Left Flank

- e) Dyke(s)
 - i) Number
 - ii) Total length (m)
 - iii) Maximum height (m)
- f) Type of cut-off and maximum depth
(upstream blanket/open trench/diaphragm/grout curtain/combination of alternatives).

14.1.2. Masonry and Concrete Dam (Non-over flow section)

Left side Right Side

- a) Type of Dam (Masonry/Concrete/Composite/any other)
- b) EL of top (m)
- c) EL of deepest foundation (m)
- d) Length at top (m)
- e) Length at the river bed (m)
- f) Width at top (m)
- g) Width at deepest bed level (m)
- h) Maximum height above deepest foundation level (m)

14.1.3. Spillway (overflow section)

- a) Type of spillway
(Ogee/chute/side channel / tunnel/siphon/any other type (specify))
- b) Full reservoir level (El-m)
- c) Maximum water level (El-m)
- d) Length (m)
- e) Maximum height above the deepest foundation (m)
- f) Crest level (El-m)

- g) Number of gates
- h) Type of gate
- i) Size of gate (m)
- j) Maximum discharging capacity (cumec)
 - i) FRL
 - ii) MWL
- k) Flood lift (m)
- l) Tail water level (El-m)
 - i) Maximum
 - ii) Minimum
- m) Type of energy dissipation arrangements

Note: Similar details shall be furnished for subsidiary and auxiliary spillway, if any.

14.1.4. River sluice(s), Irrigation/Power outlet(s)

- a) Purpose
- b) Number
- c) Size(m)
- d) Sill level (El-m)
- e) Discharging capacity (cumec) at
 - i) Full reservoir level
 - ii) Minimum draw-down level
- f) Number of gates
- g) Type of gate
- h) Size of gate

Note: The above detail shall be furnished for all the sluices provided for different purpose.

14.2 Barrage

14.2.1. Location with respect to dam, if any

14.2.2. Length (m)

14.2.3. Spillway bays

- a) Total length (m)
- b) Full Pond level (El-m)
- c) Maximum water level (El-m)
- d) Maximum height of spillway crest above deepest foundation (m)
- e) Length of bay (m)
- f) Crest level (El-m)
- g) Number of gates
- h) Type of gates
- i) Size of gate (m)
- j) Type of energy dissipation arrangement
- k) Maximum discharging capacity (cumec)
- l) Tail water level (El-m)
 - i) Maximum
 - ii) Minimum

14.2.4. Under Sluice Bays

Left side

Right side

- a) Total length (m)
- b) Crest level(El-m)
- c) Maximum height of under sluice

crest above deepest foundation-(m)

- d) Length of bay (m)
- e) Sill level (EI-m)
- f) Number of gates
- g) Type of gates (m)
- h) Size of gate (m)
- i) Type of energy dissipation arrangements
- j) Maximum discharging capacity of undersluices (cumec)
- k) Silt excluder tunnel (s)
 - i) Number
 - ii) Length
 - iii) Size (m)
 - iv) Floor level (EI-m)

14.2.5. Guide bunds/afflux bunds

- | | Left side | | Right side | |
|--|-----------|-----------|------------|-----------|
| | length | top level | length | top level |
| | (m) | (EI-m) | (m) | (EI-m) |
- a) Guide bunds
 - i) Upstream
 - ii) Downstream
 - b) Afflux bunds

- c) Other protective works (if any)

14.3 Weir

Concrete/Masonry/any other type

- a) Type of weir
- b) Length of weir (m)
- c) Deepest foundation (El-m)
- d) Type of energy dissipation arrangement
- e) Crest level(El-m)
- f) Maximum water level (El-m)
- g) Tail water level (El-m)
 - i) Maximum
 - ii) Minimum
- h) Maximum discharging capacity (cumecs)

Note: For gated weir, information as asked under 14.2 Barrage shall be furnished.

14.4. Head Regulator(s)

Left side

Right side

- a) Total length (m)
- b) Height above deepest foundation (m)
- c) Length of bay (m)
- d) Sill level (El-m)
- e) Number of gates
- f) Type of gate
- g) Size of gates
- h) Number of silt excluder bays

- i) Type of energy dissipation arrangement

15. Canal System

15.1 Main canal (Name)

15.1.1. Purpose of canal (Irrigation/Power/Navigation/Diversion/Water Supply/Multipurpose)

15.1.2. Type

- a) Flow/lift
- b) Lined-unlined
- c) Discharging capacity of the channel above which lining is proposed
- d) Type of lining

15.1.3. Design data

- a) Length (km)
- b) Full supply level at head/tail (El-m)
- c) Full supply depth at head/tail (El-m)
- d) Bed width at head/tail (El-m)
- e) Side slope at head/tail (El-m)
- f) Bed slope (range)
- g) Maximum discharging capacity at head/tail (El-m) cumec)
- h) Total number of canal structures
- i) Total assumed head losses across the structure (m)
- j) Gross Command Area (ha)
- k) Culturable Command Area (ha)

Note: Similar information to be furnished for all main canals taking off from headworks and branch canals.

15.1.4. Distribution System

	Distributaries	Minors	Sub-minors	Water Courses
a) Number				
b) Total length (km)				

Note : Total length of distribution system upto minimum discharge capacity of 0.7 m³/sec. maybe given

15.2 Efficiencies (percent)

- i) Conveyance
- ii) Field application

16. Cropping Pattern

Percentage area (CCA)

Existing	Proposed
----------	----------

16.1 Name of crop (season-wise)

- (1)
- (2)
- (3)
- (4)
- (5)

Note: If there are different cropping patterns in different reaches of the canal, information for each reach shall be given separately.

17. Power

17.1 Type-Conventional/Pumped storage

17.2 Installed capacity (MW)

17.3 Load factor

17.4 Annual energy (m kwh)

- a) Firm
- b) Seasonal
- c) Total

17.5 Off peak requirement for pumping*

17.6 Cost per kW installed

17.7 Cost per k Wh at the busbar

17.8 Head Race Channel/Tunnel

- a) Length (m)
- b) Shape
- c) Size (m)
- d) Rock type reach-wise-RMR/Q values
- e) Rock cover reach-wise
- f) Free/Pressure flow
- g) Lining type-PCC/RCC/Steel
- h) Reach-wise Design Internal & external pressures
- i) Thickness of lining (m)
- j) Designed discharge (cumec)
- k) Invert level at (El-m)
- l) Gates-No, type & size
- x) For pumped storage projects only.

17.9 Balancing Reservoir

- a) Capacity (1000 cu.m)
- b) Full reservoir level (El-m)
- c) Maximum reservoir level (El-m)
- d) Minimum Drawdown Level (El-m)
- e) Live Storage (1000 cum)
- f) Balancing period (hrs.)

17.10 Forebay:

- a) Size of forebay (m)
- b) Sill level of forebay (El-m)

- c) Full reservoir level(EI-m)
- d) Maximum reservoir level (EI-m)
- e) Minimum drawdown level (EI-m)
- f) Duration of storage
- g) Number of off-takes
- h) Size of off-takes
- i) Invert level at off-take (EI-m)
- j) Capacity of each off-take (cumec)
- k) Escape arrangement
 - Location
 - Length
 - Discharging capacity (cumecs)

17.11 Surge tank/shaft

- a) Nos. &location (HRT/TRT or both)
- b) Type, height &size
- c) Orifice – size & position (or anyother relevant detail)
- d) Toplevel (EI-m)
- e) Bottom Level (EI-m)
- f) Steady state level (EI-m)
- g) Capacity (1000 cum)
- h) Lower expansion chamber – size & location
- i) Upper expansion chamber – size &location
- j) Maximum surge level (EI-m)
- k) Minimum surge level (EI-m)

17.12 Penstocks / pressure shafts:

- a) Number, diameter & length
- b) Inclination
- c) Liner type
- d) Grade of steel
- e) Reachwise rock cover
- f) Reachwise rock properties– RMR/Q
- g) Reachwise rock participation factors – computed & adopted
- h) Reachwise liner thickness
- i) Necessity for heat treatment, if any.
- j) Bifurcation/trifurcation
- k) Gate – Number; Type & Size

17.13 Power House:

- a) Type : (Surface or underground)
- b) Orientation
- c) Rock types encountered – RMR/Q Values
- d) Major wedge formations, if any
- e) Rock ledge dimension between cavities
- f) Maximum level (m)
- g) Minimum Level (m)
- h) Average head (m)
- i) Head loss in water conductor system
- j) Design level (m)
- k) Dimensions (m)

- l) Unit capacity
- m) Installed capacity (MW)
- n) Type of turbine
- o) Type of generator
- p) Type of power house crane

17.14 Switch yard

- a) Type
- b) Voltage level
- c) No. of incoming and outgoing bays

17.15 Transformer Cavern

- a) Dimension
- b) Orientation
- c) Rock types encountered – RMR/Q Values
- d) Major wedge formations, if any
- e) Rock ledge – dimension between cavities

17.16 Tail Race Channel

- a) Shape & size
- b) Length
- c) Recovery slope
- d) Side slope
- e) Maximum tail water level (El-m)
- f) Minimum tail water level (El-m)
- g) Average tail water level (El-m)
- h) Tail water level corresponding to one unit discharge.

- i) Tail water level corresponding to maximum flood condition / one in thousand years flood.
- j) HFL of recipient river channel at outfall.
- k) Draft tube gates – number, type, size

17.17 Tail Race Tunnel

- a) Number, Size and shape
- b) Length
- c) Reachwise rock cover
- d) Reachwise rock properties – RMR/Q
- e) Type of lining
- f) Maximum tail water level (El-m)
- g) Minimum tail water level (El-m)
- h) Average tail water level (El-m)
- i) Tail water level corresponding to one unit discharge.
- j) Tail water level corresponding to maximum flood condition/one in thousand years flood.
- k) HFL of recipient river channel at outfall.
- l) Draft tube gates number, type, size.

17.18 Intakes

- i) Upper Intake
 - a) Type & size of intake
 - b) Entry profile with details of transition
 - c) Stability of the slope/cuts around intake
 - d) Design velocity through trash-rack and bellmouth
 - e) Submergence of the entry below water level
 - f) Intake gates
 - g) Details of anti-vortex arrangements
- ii) Lower intake (for pumped storage scheme)
 - a) Type & size of intake
 - b) Entry profile with details of transition

- c) Stability of the slope/cuts around intake
- d) Design velocity through trash rack and bellmouth
- e) Submergence of the entry below water level
- f) Intake gates
- g) Details of anti-vortex arrangements

18. Construction facilities

19. Cost

19.1 Cost of the project (Rs. Lakhs) Unitwise (Refer Part II Section-3 para 18)

19.2 Allocated cost (Rs. Lakhs)

- a) Irrigation
- b) Power
- c) Flood control
- d) Navigation
- e) Water Supply
- f) Any other

20. Benefits/Revenue

20.1 Benefits

Item			
		Benefits	
	Quantity	Unit price	Value Rs. Lakhs
a) Food Production (tonne)			
b) Power (kwh)			
c) Food Production			
d) Navigation (tonnage)			
e) Water supply (Population served)			
f) Any other (fisheries)			

Total:

20.2 Revenue

Item	Benefits		
	Quantity	Rate	Amount Rs. Lakhs
1) Betterment levy			
2) Water rates			
3) Irrigation cess			
4) Pisciculture rights auction			
5) Power rates			
6) Navigation			
i) Cargo Rates			
ii) Regd. Charges			
iii) Passenger Tax			
7) Others			
Total:			

21. Benefit Cost Ratio:

- a) B.C. Ratio
 - i) Irrigation
 - with cost of CAD works
 - without cost of CAD works
 - ii) Flood control
 - iii) Power
- b) Internal Rate of Return (IRR)
 - with cost of CAD works
 - without cost of CAD works
- c) Financial Rate of Return (FRR)
 - with cost of CAD works
 - without cost of CAD works

Annexure – 1

PREAMBLE: While preparing geological maps of dam sites and other components of the project like spillway, HRT, power house, etc., with the help of the site-plans furnished by the project authorities and prepared based on grid leveling, difficulty has been experienced, more often than not, because of depiction of physiographic features like river boundaries, water channel; course, river banks – their bottom and top; maximum HFL, nallas, escarpments, mounds, etc. These features form an essential part of a geological map for interpretation of geology, structure etc. with respect to the foundation conditions obtaining at the site of the proposed structure. Similarly, the L-sections and X-sections should clearly depict the physiographic features.

Therefore, it is suggested that the project authorities should prepare detailed site plans, L-sections and X-sections by means of accurate topographic surveys (carried out by plane table or theodolite or any modern survey instrument) showing benchmarks, coordinates, Reduced Distances along the proposed dam axis, etc. and all the physiographic features. Maps and sections prepared by chain survey and block leveling are not accurate and not considered adequate for the purpose.

The details are given at Table-I.

Table – 1

Sl. No.	Description	Area to be covered Extent of Surveys	Scale		Contour Interval	Remarks
			Horizontal	Vertical		
1.	River Surveys					
	(a) L-Section	(i) Upstream L-Section upto MWL + 5m or to a point up to which the back water effect is likely to extend from the axis of the structure, whichever is less. In case of any headworks situated upstream within MWL + 5m or the farthest point affected by back water, L-Section to be taken upto the headworks.	1:10,000	1:100	–	Levelling at 50m or less interval along the fair weather deep channel. Following items shall be indicated on L-Section: i) Date of survey of the particular reach and water level on that day. ii) Deep pools and rapids including their bed, bed levels, rock outcrops, etc. iii) Maximum Historical observed HFL.
		(ii) Downstream 10 km from the axis of the structure or upto nearest headwork whichever is less	1:10,000	1:100	–	– DO –
	(b) X-Section	(i) Upstream X-Section @ 200m interval upto MWL + 5m or 1 km on either side of the firm bank whichever is less and for a distance of 2 km from the axis of the structure and thereafter at one km interval corresponding to the length of the L-Section.	1:2,000	1:100	–	Levelling at 50 m or less intervals. Following items shall be shown on the X-Section a. Date of survey and water level on that day. b. Minimum water level. c. Maximum historical/observed HFL. d. Rapids and Rock Outcrops etc.
		(ii) Downstream X-Section @ 200m interval upto historical/observed HFL + 1 m on either side of firm bank for a distance of 2 to 5 km from the axis of the structure depending upon the meandering nature of the river.	1:2,000	1:100	–	– DO –
		(iii) Along the axis of the structure	1:1,000	1:100	–	– DO –
2.	Reservoir	Contour plan covering an area upto an elevation of MWL +5m	1:2,000 to 1:10,000 (Depending on the total area)	–	1 or 2 or 3m	Contour interval for slope, less than 10° to horizontal – 1m or less; slope 10° to 30°–2m; and slope more than 30° – 3m.
3.	Dam and Dyke	Topographic plan of the site with contours, covering the area upto 4 H on upstream and downstream of the axis OR a minimum of 250 m on the upstream and 500 m on the downstream of the axis, and extending upto MWL + 2H where H is the height of dam (tail channel area shall be adequately covered).	1:1,000	–	1 – 3 m	Contour intervals as per item 2 above. Levelling to be at least at 10 m grids.

Table – 1 (Contd....)						
Sl. No.	Description	Area to be covered Extent of Surveys	Scale		Contour Interval	Remarks
			Horizontal	Vertical		
4.	Barrage/Weir	Topographic plan with contours of the site covering an area upto 1 km on either side of the firm bank and 100 m from the upstream/downstream tip of the guide bunds, parallel to the flow (tail channel area shall be adequately covered).	1:2,000	–	0.5 to 1 m	Levelling to be atleast at 50 m grids or less depending on the slope of the land.
5.	Canal and water conductor system	(i) L-Section (ii) Cross-section at 50 m interval (iii) Strip Contour Plan covering 150 m on either side of the centre line of the canal or depending upon the requirement whichever is more.	1:2,000 1:2,000 1:1,000	1:100 1:100	– – 0.5	Levelling at 50 m or less interval. Levelling at 50 m or less interval Levelling as per item 4 above
6.	Canal structures	(i) Grid plan with contours of the site to cover an area upto 300 m on either side of the centre line of the canal – 100 m down stream of the point of exit of water and 100 m upstream of the point of water inlet. (ii) Cross-section of the drain along the centre line of the canal.	1:2,000	–	0.5	Levelling as per item 4 above
		(ii) Drainage surveys for upstream and downstream of the centre line of the canal for adequate length as required for hydraulic calculations: For plan Longitudinal & Cross-sections	1:10,000 1:2,000	– 1:100	–	Bed level/bank level and FSL of the canal and Max HFL of drain to be indicated on the Cross Section.
7.	Power House, Switch yard, Surge shaft, Tail Race etc.	Contour plan of the site to cover full area of the component(s) and alternative layouts. Area to include 50 to 100 m on all sides of the component(s).	1:1,000	–	0.5 or 1 or 2 or 3 m	Refer item 1 also -do- Contour intervals as per item 2 above. Levelling as per item 4 above.
8.	Plant and Colony	Contour plan of required area	1:2,000	–	0.5	Block levelling as per item 4 above.
9.	Tunnel and Adit	(i) Contour plan the area of covering the length of the tunnel and 500 m on either side of the centre line of the tunnel/adit including approach, portal and dump areas. (ii) L-Section	1:1,000 to 1:10,000 (Depending on the length of the tunnel and adit)	–	1 or 2 or 3 m	Contour interval as per item 2 above. Levelling as per item 4 above in case of ground surveys.
			1:1,000 to 1:10,000	1:100 to 1,000	–	Vertical scale depending upon steepness of the slope and drop.

Table - 1 (Contd....)						
Sl. No.	Description	Area to be covered Extent of Surveys	Scale		Contour Interval	Remarks
			Horizontal	Vertical		
10.	Penstocks	(i) Contour plan of the area covering the length of the structures and 150 m on either side of the centre line of penstocks (ii) L-section	1:1,000	–	1 or 2 or 3 m	Contour interval as per item 2 above. Levelling as per item 4 above.
			1:1,000	1:100 to 1:1,000	–	Vertical scale depending upon steepness of the slope.
11.	Command area survey including survey for drainage system	(i) Contour plan of the area (a) Plains and plateau OFD works (b) Hilly terrain OFD works	1:10,000 or 1:15,000	–	0.5	
			1:2,000	–	0.1 or 0.2	Block levelling on 50 m or less grid basis. Contours interval depending upon the steepness of the country. Marshy land/depressions, if any, to be shown in the plan.
			1:1,000 1:500	–	0.2 or 0.5 or 1 m	– DO –
12.	Soil Conservation survey	Plan of are subject to erosion slides and slips	1:10,000 or 1:50,000	–	10 m or less	Depending upon the location of the area.
13.	Geological Maps	Reservoir and river valley structures (Dams, Barrage, Tunnel, Power House, Pens-tocks important structures on canal and water conductor system)	Same as recommended under each item above or otherwise stated in the text			Depending upon the location of the area.
14.	Foundation Investigation Maps	(i) Plan (ii) Cross-section	As specified above for corresponding structures	–	As specified above for corresponding structures	Showing locations of structures, boreholes, trial pits, drifts and points where in situ tests were conducted etc.
			– DO –	1:1,000	–	Showing logs of boreholes, trial pits, drifts, etc, and other features of the foundation.
15.	Borrow Areas and Quarries	(i) Plan (ii) Sections	1:2,000	–	0.5 or 1 m	Location of different materials of construction pit/drill holes.
			1:2,000	1:1,000	–	Showing profile along the grid lines upto the depth explored.
16.	Soil surveys	Plan	1:1,000 to 1:15,000	–	–	

Note: All the site plans and sections are to be prepared by accurate surveying methods.

ANNEXURE – 2

PREAMBLE: When it is decided that the Project sites have to be geologically studied, it would be appropriate and fruitful if the geologist of the State Organisation, GSI, CSMRS etc. are consulted before finalising the exploration programme which includes drilling, pitting and trenching, drifting, in situ testing, geophysical surveys, etc.

In case of explorations for earth and rock-fill dams, no particular attention is given in exploring the depth of overburden in terms of the thickness of different soil types, their physical parameters such as permeability, cohesion, classification, etc., occurring at the dam site or in the reservoir area. The thumb rule of taking down the COT up to a maximum depth of $\frac{1}{2}$ FRL and therefore exploring the site only upto that depth, has proved to be inadequate in some cases where it has been observed that no water is retained in the reservoir after the earth dam is constructed. Therefore, it is imperative that the dam site is investigated for an economical alignment where a positive cut-off going into bed rock or into continuous impermeable strata is at a little depth.

In most cases, the core recoveries obtained in bore holes drilled in hard rock are poor and erratic leading to varying and sometimes inappropriate interpretations of the lost core. Therefore, it is suggested that the drilling should be done in such a manner as to achieve a core recovery of not less than 90% in hard rocks and not less than 70% in soft rocks. The cores obtained should be properly preserved as per standard practice and a record of colour photographs of the cores maintained.

Location and Depth of Exploratory/Holes/Drifts/Pits etc.

Structures	Minimum Pattern of Drilling	
	Spacing of Drill holes/Pits/Drifts	Depth of Drill Holes/Pits/Drifts
(a) Earth and rock-fill dam	(i) Drill holes along the axis, 150m or less apart, with intermediate pits to delineate weak and vulnerable strata with a minimum number of 3 to 5 holes in the gorge portion and additional two on each abutment parallel to the flow (ii) Drift on each abutment at about 60m elevation interval with a minimum of one on each abutment	Depth equal to half the height of dam at the elevation of the hole or 5 m in the fresh rock (proved by the geophysical or any other suitable method) whichever is less. About two holes to be extended deep (equal to the maximum height of the dam in the absence of rock at higher elevations), in the gorge portion and one each in abutments. Drifts to be extended 5m in geologically sound strata for keying the dam in the absence of rock.
(b) Masonry and Concrete dam	(i) Drill holes along the axis at 100m interval or less apart to delineate weak and vulnerable strata with a minimum number of 3 to 5 holes in the gorge portion and additional two on each abutment parallel to the flow. (ii) 2-3 drill holes down stream of spillway (iii) Drifts on each abutment at about 60m elevation	10m in fresh rock (proved by geophysical or any other suitable method). About two holes to be extended deep (equal to the maximum height of dam in the absence of rock at higher elevation) in gorge portion, and one each in abutment. 10m in highrock or equal to maximum height of dam in absence of rock. 10m in fresh rock (proved by geophysical or any other suitable method).
(c) Tunnels	(i) Drills holes one at each of the portal and adit sites and additional at least one every 1-5km. interval depending upon the length of the tunnel. (ii) Drift one each at the portal and adit sites	Drill holes 5-10m below the tunnel grade of maximum possible depth. Wherever, it is not possible to drill along the central line of the tunnel the holes can be shifted. The exploration shall be so planned as to satisfactorily portray the geological structure and tunneling conditions. Drifts shall be extended up to 10m in fresh rock or upto tunnel face.
(d) Barrage and weirs	Drill holes along the axis, 150m or less apart with intermediate pits to delineate weak and vulnerable strata with a minimum of two additional holes on each abutment parallel to the flow.	Drill hole 1.5-2 times to maximum head of water below the average foundation level or 5m in the fresh rock whichever is less Rock to be proved by geophysical or any other method.
(e) Power House	Two to four or more drill holes and/or drifts covering the area to satisfactorily portray the geological condition and delineate weak and vulnerable zones, if any.	Drill hole one to two times the maximum width of the structure or 5-10 m in the fresh rock proved by geophysical or any other method whichever is less. For underground power house the strata shall be examined by the explorations with adequate number of drill holes. If found feasible and necessary according to the site condition, one drift with cross cut may be excavated at the roof level to prove fresh rock conditions along the length and breadth of the cavity structure.
(f) Major canal structures	Sufficient number of drill holes with a minimum of three (one on each bank and one in the bed)	Twice the width of the foundation of the biggest component of the structures below foundation level.
(g) Canal and water conductor system	Drill holes or pits 500m or less apart to depict the complete profiles details.	Equal to the full supply depth of canal or one meter below the design bed level in rock whichever is less.

Note:

1. A minimum pattern of drilling holes and excavation of pits and drifts has been suggested above. It is however suggested that the subsurface exploration programme of the Project is chalked out in consultation with the Geologist in order to bring out clearly the foundation and abutment characteristics especially the weak zones requiring special treatment and the type and depth of cut-off in case of earth and rock-fill dams, etc.
2. The core recoveries obtained from the bore-holes should be preferably not less than 90% in hard rock, and less than 70% in soft rock. The cores should be properly labeled and preserved as per standard practice. Colour photographs of the core obtained may be taken for purpose of record.
3. Disturbed and/or undisturbed soil samples, foundation rock samples, etc. shall be collected and tested at an interval of 1.5 m depth or change of strata for laboratory tests. In situ permeability tests shall be carried out in the selected drill holes in different strata at different elevations including the over burden material. Other in situ tests, shear tests etc. shall be carried out in the holes or other suitable location depending upon the nature of the strata and design requirements.
4. The bearing capacity test and in situ testing of the foundation rock shall be carried out for item (b) to (f) at average foundation level.
5. The plans and cross-sections shall be prepared on the scale as indicated in Annexure-I unless otherwise stated and shall be attached with the appendix.
6. The logs of the holes/pits/drifts shall be prepared as per IS No. 4453-1967 and 4464-1967 (Codes of practice).

MATERIAL SURVEY

As far as possible the sample for testing shall be collected by qualified persons from the testing laboratory. Alternatively, sufficient quantity of samples shall be collected as per procedure prescribed in IS codes and in consultation with the laboratory.

1. Soils

Pits/auger holes (diameter 75mm to 100mm) shall be taken in the proposed borrow area on 30 to 50 meter grid and representative samples collected/tested for different types of strata/soil to determine their properties and delineate the soil zones.

The depth of the pits/auger holes shall depend upon the availability of the soils and economic exploitation.

The borrow area shall be located as near the dam site as possible but at least at a distance 5-10 times the head (H) of water away from the toe or heel of the dam (for small and medium dams the distance shall not be less than 10 H and for high dams not less than 5 H).

Note: The plan and section showing the stratification of the borrow area shall be included in the appendix. The lead for different types of soils from the site(s) of work for different borrow areas shall be included in the appendix.

2. Aggregate and rocks

Samples from the different approved rock quarry(s) for different type of rocks shall be collected for laboratory tests. Lead from the site(s) of work to different quarry(s) shall be indicated. For assessment of quantities, drill holes shall be taken in consultation with geologist, if required.

3. Natural/crushed sand

Samples from the approved quarry/source shall be collected for Laboratory tests. The type i.e., natural/crushed sand shall be indicated clearly. The lead from the sources to the site(s) of work and quantity available shall be indicated.

4. Bricks/Tiles

Samples shall be collected from the proposed areas demarcated for preparation of bricks/tiles for laboratory tests to prove the suitability of the soil. For preparation of Surkhi to be used for pozzolanic material representative samples of bricks shall be collected and tested in the laboratory to prove the suitability. The average lead from the site(s) of work shall be indicated.

Natural Pozzolona

Samples shall be collected from the quarry for laboratory test to prove its suitability. The lead and quantity available shall be indicated.

Lime Stone

Stone shall be collected for laboratory tests to prove its suitability for manufacture of cement/lime. The lead to the proposed site(s) of manufacture of cement/lime and quantity available shall be indicated.

Cement

The source of cement and the distance from the nearest railhead to the site(s) of work shall be indicated.

Steel

The sources/stockyard etc. and its distance from the work site (s) shall be indicated.

Scarce material

The source of the scarce materials shall be indicated.

Any other material

Required details as indicated in the earlier items shall be indicated.

DETAILED PROJECT REPORT LIST OF DRAWINGS

1. Location map of the area showing location of the headworks site, catchment area, submerged area, command area, approach road to the dam site, roads in the project area, (NII, SII, MDR, ODR etc.) railway line, nearest railway station, nearest airport, important places, etc.
2. Hydrological map of the area showing the headworks site, catchment area, submerged area, command area, location of the IMD) stations raingauge stations, gauge, discharge and sediment sites, considered in the project report, Isohyets, etc.
3. Map showing area flooded under normal floods and depth of flooding at important points (in case of projects with flood component).
4. Condensed longitudinal section of the river showing maximum flood level, minimum water level (before project) and back water curve (upstream of the headworks site after project).
5. Reservoir contour plan.
6. Elevation versus area and capacity curves before and after 50 years of sedimentation.
7. Stage discharge curve of the site nearest to the headworks site and that water rating curves.
8. Site contour plan and layout plan of the headworks and appurtenant/auxiliary works.
9. Plan showing the location of the bore-holes drilled and pits/drifts excavated at site, geology and bed rock contours. (to be marked on the layout plan of headworks).
10. Section along the axis of the headworks showing MWL, FRL, DWL, LWL, log of the bore holes drilled and pits/drifts excavated along the axis and log of the other holes drilled and pits/drifts excavated upstream and downstream (indicating the location).
11. Plan showing the location of the borrow area for different earth-fill materials, quarry sites for rock aggregate, sand etc. layout of haul roads, etc.
12. Cross-section of the earth/rock fill dam in the deepest section showing the zoning, cutoff, blanket, grouting details, etc.
13. Cross-section of the earth/rock fill dam showing the details of instrumentation.
14. Cross-section of the earth/rockfill dam showing details of the outlets upstream well, bridge, etc.
15. Cross-section of the masonry/concrete dam at maximum height showing details of zoning gallery(s) outlets, foundation drainage, grouting etc.

16. Cross-section of the concrete/masonry spillway showing details of zoning, foundation treatment, sluices, gallery(s) etc.
17. Cross-section of the masonry/concrete dam showing details of instrumentation.
18. Contour plan showing layout of the barrage, weir, appurtenant/auxiliary works and location of the bore holes drilled and pits excavated.
19. Cross-section along the axis of the barrage/weir & regulator showing FRL, MWL, log of the bore holes.
20. Section along the axis of the barrage/weir and regulator showing FRL, MWL, Logging of the bore holes drilled and pits excavated along the axis and log of the other bore holes, pits etc. drilled/excavated upstream and downstream indicating the location.
21. Cross/section(s) through spillway under sluice bay(s) fish ladder and regulator bay(s).
22. Layout of the power house from inlet to outlet.
23. L-section of the power generating system from inlet to outlet.
24. Layout Plan of the power house and appurtenant works with contours.
25. Longitudinal section and cross-section of the power house.
26. Map showing the general layout including the headworks, water conductor system, power house, step up sub-station, out-going transmission lines etc.
27. Plan of the command area (scale 1:10,000 contour interval 1.5 m) showing the alignment of the canal(s), location of the off-taking channel(s), area commanded (CCA) by each off-taking channel alignment of the off-taking channels, bed level, full supply depth and discharge of the main canal at the off-taking point and bed level, full supply depth and discharge of the off-taking channel.
28. Condensed L-section of the canal showing the ground profile and logging of the auger/bore holes drilled and pits excavated demarcating the stratification based on the logging.
29. Condensed L-section of the canal(s), ground profile, full supply level, bed slopes, location of the canal structures indicating the type of the structure at each location.
30. Typical cross-section of the canal in deep cutting and deep filling upto 150 meters on either side of the centre line of the canal showing natural ground profile, bed level, bed width, side slopes, full supply depth, berms, inspection path, drainage arrangements, lining free board etc.

31. Contour plan, L-section and cross-section of major canal structures designed. The location of the bore holes drilled and pits excavated to be shown on the plan and logs of the pits and bore holes on the sections.
32. Contour map of the sample area (surveyed for estimation of distributaries, minors, subminors, water courses drainage) showing the alignment of the channels of the distribution and drainage systems.
33. Index map showing the navigable reach of the river and canal system (existing and proposed) its hinter land, location of the industries, minerals, other resources, important industrial centres, towns, etc.
34. Cross-section of the navigation lock(s) provided in the body of the headworks or site channel(s)
35. Sounding charts for navigation.
36. Condensed longitudinal section of the navigable waterway/canal showing the location of the navigation structures.
37. Typical cross-sections of the navigable waterway/canal showing the location of the navigation structures.
38. Plan showing the course of river at least for five years.
39. Plates showing the facilities of the current in the various regions of the waterway during floods and rainy season.
40. Route-wise traffic density chart indicating the present day traffic and further projections.
41. Bar charts showing the construction programme and programme of development of benefits (irrigation, power, etc.)

NOTE: All drawings shall be prepared to the scale indicated in chapter 3.4.1. and annexure-1 unless otherwise stated.

