ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ
(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)
Karnataka Neeravari Nigam Limited
(A Government of Karnataka Enterprise)

No. KNN/ERC-35/2017/5617 Date: 21/12/2017

1. Managing Director, KNNL : Chairman
2. Prof. M.K. Nagaraj : Member
3. Prof. V.P. Huggi : Special Invitee
4. Sri. M.S. Wadakkannavar : Special Invitee
5. Concerned Chief Engineers : Member Secretary
6. Concerned Superintending Engineers : Member
7. Concerned Executive Engineers of QC Div : Member

Sir,

Sub: Proceedings of the 35th Meeting of ERC, KNNL held on 15/12/2017 at Bengaluru.

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Please find herein enclosed a copy of the proceedings of 35th Meeting of ERC, KNNL held on 15/12/2017 at the Registered Office of KNNL, 4th Floor, Coffee Board Building, Bengaluru for information.

Yours faithfully,

Encl: Copy of the Proceedings.

Managing Director

1. Copy for information to GM(F), KNNL, Bengaluru.
2. Copy for information and necessary action to all the Engineers in Technical Section & Design Wing, KNNL, Bengaluru.

KARNATAKA NEERAVARI NIGAM LIMITED

Extract of Proceedings – 35th Meeting of Estimate Review Committee held on 15/12/2017 at Bengaluru

~ : ADDITIONAL SUBJECT : ~

Subject No.22: **Package estimate and DTP for the work of survey, investigation, design, drawing to create 2723 ha of command area under Varahi lift canal including construction of jackwell cum pumphouse, delivery chamber, canal network, 33 KV substation and shifting of existing pumps to proposed new site under Varahi irrigation project.**

The Upper Tunga Project Zone, Shivamogga has submitted the Package estimate and DTP for the work of survey, investigation, design, drawing to create 2723ha of camand area under varahi lift canal including construction of Jackwell cum pumphouse, delivery chamber, canal network, 33kv substation and shifting of existing pumps to proposed new site under Varahi irrigation project for clearance.

22.2 Varahi River is one of the major west flowing rivers in Udupi District. This river takes its origin near Guddekoppa village in Hosanagar Taluk of Shimoga District at an altitude of about 761 Meters (2500ft.) above M.S.L. The river traverses a length of 88 Kms. entirely in Karnataka State (55 miles) and has many major tributaries like Humgodhole, Kabbehole, Dasanakatte, Chakranadi etc., during its course before joining to Arabian Sea. It enters the Arabian Sea near Gangolli in Kundapura Taluk. The river carries enormous quantity of water which has been harnessed for producing power at Hosangadi (upstream of Proposed Varahi Irrigation Project) by the Karnataka Power Corporation. The Varahi project is designed to use 1100 cusecs of water at present and its capacity is likely to be increased in future.

22.3 In view of the fact that there is an assured supply of 1100 cusecs of water as tail race discharge in the river, the same is proposed to be utilized for developing irrigation under the Varahi Irrigation Project with small storage at the diversion structure.

22.4 Varahi Right Bank Canal (VRBC) off takes from the diversion weir. The left bank canal off takes from 18.419 km of VRBC with a proposed length of 43.694 Km for commanding gross and net areas of 21976 Hectares (54281 acres) and 10987 hectares (27150 acres) respectively. The proposed cropping pattern is 5494 hectares (13570 acres) of I, II and III crop paddy and sugar cane for 5494 hectares (13570 acres) . The canal is designed for a head discharge of 19.50 cumecs with a bed width of 4.70m and full supply depth of 2.70 M. (Lined).

22.5 Varahi lift canal takes off at Ch 6.100 Km of Varahi Left bank Canal to irrigate an area of 2723.87 ha. The proposed length of Varahi lift canal is 26.215Km. The canal is designed for a head discharge of 4.238 cumecs with a bed width of 2.75m and FSD of 1.5m as lined canal. The proposed cropping pattern is sugarcane and paddy with 10% Rush irrigation and 25% transmission losses.

22.6 Varahi branch canal takes off at Ch 12.680 Km of Varahi Lift Canal to irrigate an area of 801.88 Ha. The proposed length of Varahi branch canal is 9.220Km. The canal is designed for a head discharge of 1.298 cumecs with a bed width of 1.50m and FSD of 0.9m as lined canal. The proposed cropping pattern is sugarcane and paddy with 10% Rush irrigation and 25% transmission losses.

22.7 **ALIGNMENT PROPOSAL:-** The survey maps at 1mt contour interval prepared by Survey of India for the Varahi Project area has been used. Consultants have procured required village maps from the Revenue Departments and have superimposed one meter interval aerial survey maps on the village maps to facilitate planning of the alignment of VLBC. After studying alternative alignments in various reaches proposed and after conducting topographical survey at site by the consultants, an economical alignment was submitted for approval. After verification at site the Chief Engineer has accorded approval for the alignment and L-section.

22.8 **Varahi Lift Main Canal :**

a) The Hydraulic Particulars of Varahi Lift Main Canal are as under: From Ch. 0.00 Km to 1.90 Km:

- Canal Discharge :
  Required (Qr) : 3.810 cumecs
  Designed (Qd) : 4.238 cumecs
- Bed Width : 2.75 mt
- Full Supply depth (FSL) : 1.50 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.665 m/s
- Bed Fall : 1 in 5000

b) From Ch. 1.90 Km to 3.45 Km

- Canal Discharge :
  Required (Qr) : 3.79 cumecs
  Designed (Qd) : 4.238 cumecs
- Bed Width : 2.75 mt
- Full Supply depth (FSL) : 1.50 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.665 m/s
- Bed Fall : 1 in 5000

c) From Ch. 3.45 Km to 4.152 Km

- Canal Discharge :
  Required (Qr) : 3.70 cumecs
  Designed (Qd) : 4.238 cumecs
- Bed Width : 2.75 mt
- Full Supply depth (FSL) : 1.50 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.665 m/s
- Bed Fall : 1 in 5000

d) From Ch. 4.152 Km to 7.10Km

- Canal Discharge :
  Required (Qr) : 3.50 cumecs
  Designed (Qd) : 3.801 cumecs
- Bed Width : 2.40 mt

- Full Supply depth (FSL) : 1.50 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.650 m/s
- Bed Fall : 1 in 5000

e) From Ch. 7.10 Km to 11.055 Km

- Canal Discharge :
  Required (Qr) : 3.330 cumecs
  Designed (Qd) : 3.677 cumecs
- Bed Width : 2.30 mt
- Full Supply depth (FSL) : 1.50 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.645 m/s
- Bed Fall : 1 in 5000

f) From Ch. 11.055 Km to 12.554 Km

- Canal Discharge :
  Required (Qr) : 3.120 cumecs
  Designed (Qd) : 3.449 cumecs
- Bed Width : 2.30 mt
- Full Supply depth (FSL) : 1.450 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.634 m/s
- Bed Fall : 1 in 5000

g) From Ch. 12.554 Km to 12.682 Km

- Canal Discharge :
  Required (Qr) : 3.120 cumecs
  Designed (Qd) : 3.375 cumecs
- Bed Width : 2.30 mt
- Full Supply depth (FSL) : 1.250 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.761 m/s
- Bed Fall : 1 in 3000

h) From Ch. 12.682 Km to 14.330 Km

- Canal Discharge :
  Required (Qr) : 2.000 cumecs
  Designed (Qd) : 2.204 cumecs
- Bed Width : 1.30 mt
- Full Supply depth (FSL) : 1.250 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.691 m/s
- Bed Fall : 1 in 3000

i) From Ch. 14.330 Km to 15.000 Km

- Canal Discharge :
  Required (Qr) : 1.790 cumecs
  Designed (Qd) : 1.979 cumecs
- Bed Width : 1.25 mt
- Full Supply depth (FSL) : 1.20 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.673 m/s
- Bed Fall : 1 in 3000

j) From Ch. 15.000 Km to 16.430 Km

- Canal Discharge :
  Required (Qr) : 1.790 cumecs
  Designed (Qd) : 1.979 cumecs
- Bed Width : 1.25 mt
- Full Supply depth (FSL) : 1.20 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.673 m/s
- Bed Fall : 1 in 3000

k) From Ch. 16.430 Km to 17.140 Km

- Canal Discharge :
  Required (Qr) : 1.640 cumecs
  Designed (Qd) : 1.926 cumecs
- Bed Width : 1.20 mt
- Full Supply depth (FSL) : 1.20 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.669 m/s
- Bed Fall : 1 in 3000

l) From Ch. 17.140 Km to 17.805 Km

- Canal Discharge :
  Required (Qr) : 1.560 cumecs
  Designed (Qd) : 1.719 cumecs
- Bed Width : 1.15mt
- Full Supply depth (FSL) : 1.15 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.650 m/s
- Bed Fall : 1 in 3000

m) From Ch. 17.805 Km to 18.995 Km

- Canal Discharge :
  Required (Qr) : 1.370 cumecs
  Designed (Qd) : 1.573 cumecs
- Bed Width : 1.15mt
- Full Supply depth (FSL) : 1.10 mt

- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.635 m/s
- Bed Fall : 1 in 3000

n) From Ch. 18.995 Km to 19.855 Km

- Canal Discharge :
  Required (Qr) : 1.200 cumecs
  Designed (Qd) : 1.263 cumecs
- Bed Width : 1.10mt
- Full Supply depth (FSL) : 1.00 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.601m/s
- Bed Fall : 1 in 3000

o) From Ch. 19.855 Km to 20.580 Km

- Canal Discharge :
  Required (Qr) : 1.020 cumecs
  Designed (Qd) : 1.184 cumecs
- Bed Width : 1.00mt
- Full Supply depth (FSL) : 1.00mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.592m/s
- Bed Fall : 1 in 3000

p) From Ch. 20.580 Km to 21.592 Km

- Canal Discharge :
  Required (Qr) : 0.810 cumecs
  Designed (Qd) : 0.960 cumecs
- Bed Width : 1.00mt
- Full Supply depth (FSL) : 0.90mt
- Free Board (FB) : 0.30mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.561m/s
- Bed Fall : 1 in 3000

q) From Ch. 21.592 Km to 22.580 Km

- Canal Discharge :
  Required (Qr) : 0.720 cumecs
  Designed (Qd) : 0.798 cumecs
- Bed Width : 0.90mt
- Full Supply depth (FSL) : 0.85mt
- Free Board (FB) : 0.30mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.536m/s
- Bed Fall : 1 in 3000

r) From Ch. 22.580 Km to 23.240 Km

- Canal Discharge :
  Required (Qr) : 0.580 cumecs
  Designed (Qd) : 0.623 cumecs
- Bed Width : 0.90mt
- Full Supply depth (FSL) : 0.75mt
- Free Board (FB) : 0.30mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.503m/s
- Bed Fall : 1 in 3000

s) From Ch. 23.240 Km to 24.255 Km

- Canal Discharge :
  Required (Qr) : 0.490 cumecs
  Designed (Qd) : 0.545 cumecs
- Bed Width : 0.90mt
- Full Supply depth (FSL) : 0.70mt
- Free Board (FB) : 0.15mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.486m/s
- Bed Fall : 1 in 3000

t) From Ch. 24.255 Km to 25.305Km

- Canal Discharge :
  Required (Qr) : 0.260 cumecs
  Designed (Qd) : 0.284 cumecs
- Bed Width : 0.70mt
- Full Supply depth (FSL) : 0.55mt
- Free Board (FB) : 0.15mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.413m/s
- Bed Fall : 1 in 3000

u) From Ch. 25.305 Km to 25.955 Km

- Canal Discharge :
  Required (Qr) : 0.10 cumecs
  Designed (Qd) : 0.12 cumecs
- Bed Width : 0.50mt
- Full Supply depth (FSL) : 0.40mt
- Free Board (FB) : 0.15mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.333m/s
- Bed Fall : 1 in 3000

v) From Ch. 25.955 Km to 26.215 Km

- Canal Discharge :
  Required (Qr) : 0.000 cumecs
  Designed (Qd) : 0.048 cumecs

- Bed Width : 0.30mt
- Full Supply depth (FSL) : 0.30mt
- Free Board (FB) : 0.15mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.265m/s
- Bed Fall : 1 in 3000

22.9 **Adoption of Side Slopes:** The Side Slope of Canal have been adopted in the estimate as per the direction given in the 69th meeting of TSC (Technical Sub Committee) held on 26-10-2006 at Kundapura. The side slopes of canal considered in the estimate are 1.5:1 in soil, 1:1 in soft rock, ¼:1 in hard rock for above free board level and 1:1 for water prism level irrespective of the classification. Berm of 3.00 m width is provided at free board level, 1.00m width is provided at every 6.00m interval and 2.00m in soil.

22.10 **The Salient Features of Varahi Lift Main Canal from CH 0.00 to 26.215 km:** The entire length of the canal runs almost in cutting but for small reaches of embankment. The depth of cut varies from 0.02 m to 13.10 m.

22.11 **STRUCTURES:**

i) Super Passage

There are 34 proposed super passages in Varahi lift main canal. Based on catchment area, using Ryve's formula and considering a co-efficient of 15, the discharge for each of the catchment for the respective location of super passage is arrived at. Based on this discharge, the vent size is fixed. The vents size arrived at all the chainages is 1.5x0.8 m with respective free board. The super passage trough is designed for water load considering stress in steel as 1300 kg/m^2 for both the faces as per BIS-3370 with M25 grade of concrete and thickness arrived at. At some chainages the super passages are supported by abutments at the ends since the canal is at FSD + FB cutting and where the depth of cut is more, three spans are proposed with piers. Suitable transitions are proposed at the ends.

The abutment is designed to take the respective loads from the trough and earth pressure and is checked for stability. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete for abutment is considered with neck is M20 20mm d/s and without neck is M15 40mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment.

Where NALA is diverted to super passage and the catchment of that NALA is within the proposed to negotiate this height by constructing a suitable structure of 6 numbers at suitable chainages in main canal, such that the velocity is reduced and the bed of Nala and sides are not eroded by the flow of water.

ii) Road bridge

There are 6 proposed road bridges in Varahi Lift Main Canal. The canal crosses footpath like small roads connecting inter villages, where the depth of cut is 4.15 m. The top width of the canal at the place of crossing is 6.95 m. Hence Road Bridge for 7.75 m span is designed. The bridge is designed for class A-A double lane loading with a carriage way width of 7.5 m and M25 grade concrete. The overall width of the deck slab is 8.45 m with 0.475 m width of kerb at both sides of the deck slab. RCC hand rails are proposed for a height of 0.575 m over the kerb. Approach slab for a length of 6.97 m with 0.3m thick

M20 Grade is proposed on both sides of the deck slab over leveling course. Suitable wearing coat is proposed over the deck slab with suitable slopes towards the kerb. Drainage spouts are proposed at both sides of deck slab for drainage of rain water. The abutment is designed to take the respective vertical and horizontal loads from the slab and earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete considered is M20 20mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment.

iii) **Under tunnel**

There are 47 proposed under tunnels in Varahi Lift Main Canal, where the Nala crosses the canal and the canal bed level is above the Nala bed level. Hence under tunnel with single vent box having dimension of 1.20 m X 1.20 m in M25 is proposed at all the places to pass the Nala discharge. The discharge is arrived based on topo sheet using Ryve's formula with value of "C" as 15. The box is designed as a framed structure for the overburden soil including live load. The thickness of top slab & bottom slab arrived as per design is 0.25 m and the thickness of side walls proposed is 0.25 m. Suitable gradient is provided for smooth flow of water with inlet and exit transitions. Since soil is encountered at the bed 0.6m sand and boulder provision is made below the box with all round cutoff to improve SBC. Further, suitable provision is also made for draft channel clearance at the exit. In order to protect the embankment above the box, suitable skin steel is provided for lining with toe beam and end beam.

iv) **Aqueduct**

There are 11 Aqueducts in Varahi Lift Main Canal. The following details are considered for the maximum proposed trough length of 661m for an example.

- Canal Discharge :
  Required (Qr) : 3.330 cumecs
  Designed (Qd) : 3.801cumecs
- Bed Width : 2.40 mt
- Full Supply depth (FSL) : 1.50 mt
- Free Board (FB) : 0.60 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.650 m/s
- Bed Fall : 1 in 5000

Nala bed at deepest point is 29.314 m below CBL.
The aqueduct is designed with single trough vent.
Total length of Trough Aqueduct = 661 m

Size of trough proposed = 3.30 m X 1.5 m
FSD =1.5 m
FB =0.6 m
Bed fall in trough portion = 1 in 4081
Velocity in trough = 0.748 m/sec
Length of each span= 15.00 mts
No of spans =44 No's

22.12 **HYDRAULIC DESIGN OF TROUGH:-** The Hydraulic design of trough is done to carry a design discharge of 3.663 Cumecs. The necessary fluming with bed fall 1 in 4081 is done to economize the section of aqueduct. The section of trough so obtained is 3.30 m wide and 1.5m deep. The necessary free board (FB) of 0.6 m in addition to 1.5 m FSD in the trough, as in canal section is also provided.

22.13 **STRUCTURAL DESIGN OF TROUGH:-** Based on the Hydraulic requirements, the preliminary dimensions of trough are fixed. The walls are designed as Girders. The complete trough is analyzed and the moments are arrived at the ends of bottom slab and at the center.

The side walls are designed as a girder supporting the bottom slab. The Trough side walls are designed as beams. The total span of the trough is 661m, supported by piers 15 m apart. Tie beams of size 0.3 X 0.20 m are provided at 2.0 m c/c.

22.14 **DESIGN OF SUB STRUCTURE:-** Piers are taken at 15 m apart to receive the load from trough. The grade of concrete adopted is M25 20mm d/s and steel Fe-500. It is proposed to provide open type of foundation for pier as the founding strata is available at an average depth of 4.471 m below the ground level.

The maximum height of Pier is 31.446 m at the deepest portion excluding pier cap. The piers are designed for load from the trough and earthquake acceleration in the direction of flow of water in the trough. The resultant load and moments are considered to check the stresses in the material. The stresses are within the permissible limits as specified in the IS: 3370 (part 2) - 2009.

The combination of hydrodynamic forces (as per clause 6.5.2, page 35 of IS: 1893 - 1984) are also considered in addition to self load of pier, load from the trough and earthquake forces and resulting moments. The resulting stresses are well within the permissible values.

Suitable transitions of length 4 m at entry 5 m at exit are provided on either side of the Aqueduct. Mass concrete structure is proposed for transitions. End transition abutments are seated on SR/HR. The grade of concrete considered is M15 40mm d/s. Skin steel at 6kg/ m^2 is proposed for the transitions.

22.15 **Foot bridge :-** There are 17 proposed foot bridges in Varahi Lift Main Canal. The canal crosses footpath like small roads connecting inter villages, where the depth of cut is 5.9 m. The top width of the canal is 6.95 m. Hence single span foot bridge is proposed. The bridge is designed for live load of 500 kgs. The depth of slab as per design is 0.38 m.

The abutment is designed to take the respective vertical and horizontal loads from the slab and earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete considered is M15 20mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment. Where the depth of cut is more steps are provided on either side of Foot Bridge for easy access.

22.16 **DIRECT OUT-LET :-** There are 30 proposed direct outlets in Varahi Lift Main Canal. Direct outlets are designed by using NP-3 pipes of suitable dia to carry the required discharge to irrigate required area. M.S. screw type manually operated vertical gate is designed as regulating arrangement with necessary head walls.

22.17 **Box Type Cart Bridge** :- There are 29 proposed box type cart bridges in Varahi Lift Main Canal. The canal crosses footpath like small roads connecting inter villages, where the depth of cut is 4.60 m. The bridge is designed for class -A single lane loading with a carriage way width of 4.25 m and single span of 4.25 m is proposed. The overall width of the deck slab is 5.5 m with 0.625 m width kerb at both sides of the deck slab. RCC hand rails are proposed for a height of 0.85 m over the kerb. Approach slabs are proposed on both sides of the deck slab over leveling course. Suitable wearing coat is proposed over the deck slab with suitable slopes towards the kerb.
The abutment is designed to take the respective vertical and horizontal loads from the slab and earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete considered is M20 20mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment.

22.18 **Canal Drop** :- There are 31 drops in Varahi Lift Main Canal. Drops are proposed and designed, where there is a sudden fall in the natural ground level for a shorter length. Hence Canal Drop of 1.0 m, 1.5m, and 0.5m height is proposed, keeping the crest wall slightly above the CBL. The top width of crest wall is kept as 0.3 m with suitable length of crest and cistern of 0.2m water cushion. Cistern floor of 0.20 m thickness is provided considering the uplift force to an extent of tail water depth with nominal steel.

22.19 **Head work for Branch canal taking off @ Ch: 12680m:-** There is a branch canal which takes off at Ch: 12680m on left side of main canal with a head discharge of 1.123 cumecs to irrigate an atchkut of 801.88 Ha. The Hydraulic particulars of main canal are BW-2.30m, FSD-1.25m, FB-0.6 m Side slope-1:1 and Bed fall – 1 in 3000. The Hydraulic particulars of branch canal are BW-1.5m, FSD-0.9m, FB-0.45 m Side slope-1:1 and Bed fall - 1 in 3000. With these particulars head regulator for the branch canal is designed to carry the required discharge. It is proposed to provide a vent size of 1.2 x 1.2m box. The box is designed to carry the overburden of 1.240 m earth. Single vertical lift type gate of size 1.5 x 1.5 m is also designed as regulating arrangement. M25 grade of concrete is adopted for the box. IS 3370 is considered while designing the box. In order to divert the required quantity of discharge into the branch canal, a cross regulator is also proposed across main canal. The cross regulator consists of two vents of size 2.5x1.70 m with two vertical lift gates of size 2.8x2.0 m. Vents are suitably designed. Suitable exit transition is also provided for smooth flow.

22.20 **SUPER PASSAGE cum CART TRACK CROSSING** :- There are 4 proposed super passages in Varahi Lift Main Canal. Super Passage cum Cart track crossings are proposed at the crossings, where field track cum Nala crosses the canal at FSD+FB level and above. For super passage, catchment area is considered based on topo sheet at the location to arrive at discharge to fix the dimensions of trough. Since the super passage also acts as bridge, the bottom slab of trough is designed for cart track crossing considering class-A loading and for 4.25 m carriage way width. The span of super passage cum cart track is fixed at FSD level considering the width at the locations. The bed width and FSD+FB cuttings of the distributory at respective locations will be considered for the design. The structures are designed as water retaining structure considering IS 3370. Flumes are provided on either side of the trough for smooth entry and exit of water. In between flumes approach slab is provided and beyond approach slab revetment with cut-offs are provided to prevent erosion of bed.

22.21 **Pipe Type Cart Bridge :-** There are 5 proposed pipe type cart bridges in Varahi Lift Main Canal. The canal crosses small roads connecting inter villages, where the depth of cut is 1.850m, 1.541m, 1.350m, 3.800m & 1.730m at the respective chainages. Since the canal section is small and also the discharge carrying capacity, two numbers of NP-3 pipes of suitable diameter is proposed. Since there is sufficient depth of cut, there is sufficient cushion for the pipes at all the above said locations. Further, a carriage way width of 4.60 m is maintained at all the above locations.

The headwalls are designed to take the respective horizontal loads from the earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The headwall also satisfies the required criteria for sliding and friction. The grade of concrete considered is M15 40mm d/s with skin steel at 6kg/ m^2. Parapet of height 0.85m and 0.20m thick is also proposed to be constructed monolithically with the headwall.

22.22 **Varahi Lift Branch Canal :-**

The Hydraulic Particulars of Varahi Lift Branch Canal are as under:

i) From Ch. 0.00 Km to 0.81 Km

- Canal Discharge :
  - Required (Qr) : 1.120 cumecs
  - Designed (Qd) : 1.298 cumecs
- Bed Width : 1.50 mt
- Full Supply depth (FSL) : 0.90 mt
- Free Board (FB) : 0.45 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.601 m/s
- Bed Fall : 1 in 3000

ii) From CH: 0.81 Km to 2.42 Km

- Canal Discharge :
  - Required (Qr) : 0.940 cumecs
  - Designed (Qd) : 1.195 cumecs
- Bed Width : 1.35 mt
- Full Supply depth (FSL) : 0.90 mt
- Free Board (FB) : 0.30 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.590 m/s
- Bed Fall : 1 in 3000

iii) From Ch. 2.42 Km to 3.29 Km

- Canal Discharge :
  - Required (Qr) : 0.830 cumecs
  - Designed (Qd) : 0.929 cumecs
- Bed Width : 1.30 mt
- Full Supply depth (FSL) : 0.80 mt
- Free Board (FB) : 0.30 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.553 m/s
- Bed Fall : 1 in 3000

iv) From Ch. 3.29 Km to 4.75 Km

- Canal Discharge :
  Required (Qr) : 0.770 cumecs
  Designed (Qd) : 0.845 cumecs
- Bed Width : 1.15 mt
- Full Supply depth (FSL) : 0.80 mt
- Free Board (FB) : 0.30 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.542 m/s
- Bed Fall : 1 in 3000

v) From Ch. 4.75 Km to 6.08 Km

- Canal Discharge :
  Required (Qr) : 0.660 cumecs
  Designed (Qd) : 0.735 cumecs
- Bed Width : 0.95 mt
- Full Supply depth (FSL) : 0.80 mt
- Free Board (FB) : 0.30 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.525 m/s
- Bed Fall : 1 in 3000

vi) From Ch. 6.08 Km to 6.905 Km

- Canal Discharge :
  Required (Qr) : 0.520 cumecs
  Designed (Qd) : 0.574 cumecs
- Bed Width : 0.80 mt
- Full Supply depth (FSL) : 0.75 mt
- Free Board (FB) : 0.30 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.494 m/s
- Bed Fall : 1 in 3000

vii) From Ch. 6.905 Km to 8.175 Km

- Canal Discharge :
  Required (Qr) : 0.260 cumecs
  Designed (Qd) : 0.284 cumecs
- Bed Width : 0.70 mt
- Full Supply depth (FSL) : 0.55 mt
- Free Board (FB) : 0.15 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.413 m/s
- Bed Fall : 1 in 3000

viii) From Ch. 8.175 Km to 8.720 Km

- Canal Discharge :
  Required (Qr) : 0.080 cumecs
  Designed (Qd) : 0.086 cumecs
- Bed Width : 0.45 mt

- Full Supply depth (FSL) : 0.35 mt
- Free Board (FB) : 0.15 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.306 m/s
- Bed Fall : 1 in 3000

ix) From Ch. 8.720 Km to 9.220 Km

- Canal Discharge :
  Required (Qr) : 0.000 cumecs
  Designed (Qd) : 0.048 cumecs
- Bed Width : 0.30 mt
- Full Supply depth (FSL) : 0.30 mt
- Free Board (FB) : 0.15 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.265 m/s
- Bed Fall : 1 in 3000

\22.23 **Adoption of Side Slopes:-** The Side Slope of Canal have been adopted in the estimate as per the direction given in the 69th meeting of TSC (Technical Sub Committee) held on 26-10-2006 at Kundapura. The side slopes of canal considered in the estimate are 1.5:1 in soil, 1:1 in soft rock, ¼:1 in hard rock for above free board level and 1:1 for water prism level irrespective of the classification. Berm of 3.00 m width is provided at free board level, 1.00m width is provided at every 6.00m interval and 2.00m in soil.

22.24 **The Salient Features of Varahi Lift Branch Canal from CH 0.00 to 9.22 km:-** The entire length of the canal in this reach runs in cutting and some reaches are in embankment. The depth of cut varies from 0.05 m to 10.66 m.

22.25 **STRUCTURES:-**

i) **Super Passage :-**

There are 13 proposed super passages in Varahi lift branch canal. Based on catchment area, using Ryve's formula and considering a co-efficient of 15, the discharge for each of the catchment for the respective location of super passage is arrived at. Based on this discharge, the vent size is fixed. The vents size arrived at all the chainages is 1.5x0.8 m with respective free board. The super passage trough is designed for water load considering stress in steel as 1300 kg/m^2 for both the faces as per BIS-3370 with M25 grade of concrete and thickness arrived at. At some chainages the super passages are supported by abutments at the ends since the canal is at FSD + FB cutting and where the depth of cut is more, three spans are proposed with piers. Suitable transitions are proposed at the ends.

The abutment is designed to take the respective loads from the trough and earth pressure and is checked for stability. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete for abutment is considered with neck is M20 20mm d/s and without neck is M15 40mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment.

Where NALA is diverted to super passage and the catchment of that NALA is within the catchment of super passage. However there is a difference in level for some height, hence it is proposed to negotiate this height by constructing a suitable structure of 3 numbers at

suitable chainages in branch canal, such that the velocity is reduced and the bed of Nala and sides are not eroded by the flow of water.

ii) Road bridge:-

There are 7 proposed Road bridges in Varahi lift branch canal. The canal crosses small road connecting inter village, where the depth of cut is 2.57 m. The top width of the canal at the place of crossing is 4.20 m. Hence Road Bridge for 5.00 m span is designed. The bridge is designed for class A-A double lane loading with a carriage way width of 7.5 m and M25 grade concrete. The overall width of the deck slab is 8.45 m with 0.475 m width of kerb on both sides of the deck slab. RCC hand rails are proposed for a height of 0.575 m over the kerb. Approach slab for a length of 5.695 m with 0.3m thick M20 Grade is proposed on both sides of the deck slab over leveling course. Suitable wearing coat is proposed over the deck slab with suitable slopes towards the kerb. Drainage spouts are proposed on both sides of deck slab for drainage of rain water.

The abutment is designed to take the respective vertical and horizontal loads from the slab and earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete considered is M20 20mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment.

iii) Under tunnel :-

There are 12 proposed under tunnels in Varahi Lift Branch Canal, where the Nala crosses the canal and the canal bed level is above the Nala bed level. Hence under tunnel with single vent box having dimension of 1.20 m X 1.20 m in M25 is proposed at all the places to pass the Nala discharge. The discharge is arrived based on topo sheet using Ryve's formula with value of "C" as 15. The box is designed as a framed structure for the overburden soil including live load. The thickness of top slab & bottom slab arrived as per design is 0.25 m and the thickness of side walls proposed is 0.25 m. Suitable gradient is provided for smooth flow of water with inlet and exit transitions. Since soil is encountered at the bed 0.6m sand and boulder provision is made below the box with all round cutoff to improve SBC. Further, suitable provision is also made for draft channel clearance at the exit. In order to protect the embankment above the box, suitable skin steel is provided for lining with toe beam and end beam.

iv) Aqueduct :-

Two Aqueducts are proposed in Varahi Lift Branch Canal. The following details are considered for the maximum proposed trough length of 223m for an example.

- Canal Discharge :
  Required (Qr) : 0.940 cumecs
  Designed (Qd) : 1.195 cumecs
- Bed Width : 1.35 mt
- Full Supply depth (FSL) : 0.90 mt
- Free Board (FB) : 0.30 mt
- Side Slope : 1:1 (water prism)
- Velocity : 0.590 m/s
- Bed Fall : 1 in 3000

Nala bed at deepest point is 5.922 m below CBL.
The aqueduct is designed with single trough vent.

Total length of Trough Aqueduct = 223 m
Size of trough proposed = 1.5 m X 0.9 m
FSD =0.90 m
FB =0.30 m
Bed fall in trough portion = 1 in 1500
Velocity in trough = 0.790 m/sec
Length of 14 span= 15.00 mts
Length of end span, which is located at exit transition= 13.00 mts
Total No of spans =15 No's

22.26 **HYDRAULIC DESIGN OF TROUGH:-** The Hydraulic design of trough is done to carry a design discharge of 1.034 Cumecs. The necessary fluming with bed fall 1 in 1500 is done to economize the section of aqueduct. The section of trough so obtained is 1.50 m wide and 0.90m deep. The necessary free board (FB) of 0.3m in addition to 0.9m FSD in the trough, as in canal section is also provided.

22.27 **STRUCTURAL DESIGN OF TROUGH:-** Based on the Hydraulic requirements, the preliminary dimensions of trough are fixed. The walls are designed as Girders. The complete trough is analyzed and the moments are arrived at the ends of bottom slab and at the center.
The side walls are designed as a girder supporting the bottom slab. The Trough side walls are designed as beams. The total span of the trough is 223m, supported by 15 piers, 14 piers are 15 m apart and the pier which is located at exit transition is 13m apart. Tie beams of size 0.3 X 0.20 m are provided at 2.0 m c/c.

22.28 **DESIGN OF SUB STRUCTURE: -** Piers are taken at 15 m apart to receive the load from trough. The grade of concrete adopted is M25 20mm d/s and steel Fe-500. It is proposed to provide open type of foundation for pier as the founding strata is available at an average depth of 4.10 m below the ground level.
The maximum height of Pier is 7.179 m at the deepest portion excluding pier cap. The piers are designed for load from the trough and earthquake acceleration in the direction of flow of water in the trough. The resultant load and moments are considered to check the stresses in the material. The stresses are within the permissible limits as specified in the IS: 3370 (part 2) - 2009.
The combination of hydrodynamic forces (as per clause 6.5.2, page 35 of IS: 1893 - 1984) are also considered in addition to self load of pier, load from the trough and earthquake forces and resulting moments. The resulting stresses are well within the permissible values.
Suitable transitions of length 3 m at entry 5 m at exit are provided on either side of the Aqueduct. Mass concrete structure is proposed for transitions. End transition abutments are seated on SR/HR. The grade of concrete considered is M15 40mm d/s. Skin steel at 6kg/ m^2 is proposed for the transitions.

22.29 **Foot bridge:-**
There are 11 proposed Foot bridges in Varahi lift branch canal. The canal crosses small roads connecting inter villages, where the depth of cut is 0.13m 7.69m and the top width of the canal is 3.90m & 3.75m respectively. Hence single span foot bridge is proposed at these locations. The bridges are designed for live load of 500 kgs. The depth of slab as per design is 0.25 m & 0.60m respectively.

The abutment is designed to take the respective vertical and horizontal loads from the slab and earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete considered is M15 20mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment. Where the depth of cut is more steps are provided on either side of Foot Bridge for easy access.

22.30 **DIRECT OUT-LET :-**
There are 11 proposed direct outlets in Varahi Lift Branch Canal. Direct outlets are designed by using NP-3 pipes of suitable dia to carry the required discharge to irrigate required area. M.S. screw type manually operated vertical gate is designed as regulating arrangement with necessary head walls.

22.31 **Canal Drop :-**
There are 14 drops in Varahi Lift Branch Canal. Drops are proposed and designed, where there is a sudden fall in the natural ground level for a shorter length. Hence Canal Drop of 1.0 m, 1.5m, and 0.5m height is proposed, keeping the crest wall slightly above the CBL. The top width of crest wall is kept as 0.3 m with suitable length of crest and cistern of 0.2m water cushion. Cistern floor of 0.20 m thickness is provided considering the uplift force to an extent of tail water depth with nominal steel.

22.32 **Cart bridge :-**
There are 13 proposed cart bridges in Varahi Lift Branch Canal. The canal crosses small roads connecting inter villages, where the depth of cut is 1.230m & 3.250m at respective chainages. The bridges are designed for class -A single lane loading with carriage way width of 4.25 m and single span of 4.25 m is proposed. The overall width of the deck slab is 5.5 m with 0.625 m kerb at both sides of the deck slab. RCC hand rails are proposed for a height of 0.85 m over the kerb. Approach slabs are proposed on both sides of the deck slab over leveling course. Suitable wearing coat is proposed over the deck slab with suitable slopes towards the kerb.
The abutment is designed to take the respective vertical and horizontal loads from the slab and earth and is checked for stability. The base width provided is sufficient. The pressure developed at the base is well within the SBC of respective strata. The abutment also satisfies the required criteria for sliding and friction. The grade of concrete for abutment is considered with neck is M20 20mm d/s and without neck is M15 40mm d/s. Skin steel at 6kg/ m^2 is proposed for the abutment.

22.33 **Cut and Cover type Cart Bridge :-**
There are 2 proposed cut and cover type cart bridges in Varahi Lift Branch Canal. The canal crosses a village road, where the depth of cut is 10.31m. This portion of the canal is in deep cut and the top width of canal at GL is 27.275m. Since the canal section at this chainage is very small and also the discharge carrying capacity, cut and cover type bridge with embankment over top of box is proposed. For this, RCC box of size 1.4x1.2m is proposed in M25 grade concrete. The box is designed for 8.81m earth overburden and class-A live load. The road width is proposed as 6.0m at top with 1.5:1.0 overburden slope. The length of box is restricted to 30m by constructing 1.0m high headwall. The head wall is keyed to the sides of the canal for 0.5m length. Suitable transitions are provided on either side of the box. The width of embankment at top i.e., road width is limited to 6.0m with 4.6m carriageway width.

RCC parapet wall of 0.75m height is proposed on either side of carriageway. It is proposed to fill the top of box using casing soil. It is proposed to protect the slopes of embankment by providing turfing.

22.34 **SUPER PASSAGE cum CART TRACK CROSSING :-**

There are 2 proposed super passages cum cart track crossing in Varahi Lift Branch Canal. Super Passage cum Cart track crossings are proposed at the crossings, where field track cum Nala crosses the canal at FSD+FB level and above. For super passage, catchment area is considered based on topo sheet at the location to arrive at discharge to fix the dimensions of trough. Since the super passage also acts as bridge, the bottom slab of trough is designed for cart track crossing considering class-A loading and for 4.25 m carriage way width. The span of super passage cum cart track is fixed at FSD level considering the width at the locations. The bed width and FSD+FB cuttings of the distributory at respective locations will be considered for the design. The structures are designed as water retaining structure considering IS 3370. Flumes are provided on either side of the trough for smooth entry and exit of water. In between flumes approach slab is provided and beyond approach slab revetment with cut-offs are provided to prevent erosion of bed.

Where stream is diverted to super passage/ CTC, the catchment of this stream is within the catchment of super passage/CTC. However there is a difference in level for some height, hence it is proposed to negotiate this height by constructing a suitable structure, such that the velocity is reduced and the bed of Nala and sides are not eroded by the flow of water.

22.35 **PUMPING MACHINERY:**

In Varahi Lift Irrigation scheme the procurement of pumping machineries, panel board and, motors are been done earlier through tender basis. The existing pumping machinery capacity is 650HP. The same machineries, motors and panel boards are to be used in this scheme. The only cost of the shifting of these machineries is considered in the estimate.

22.36 **PROVISIONS:**

1.0 Provisions made in the lining estimate

1. Excavation in all types of soils namely AKS and SR/HR.
2. For the embankment reaches 85% of suitable casing material is proposed to be obtained from excavated stuff.
3. S. R. and I. P. embankment of widths of 5.5m and 3.0m respectively.
4. Varahi Lift Main Canal - The canal is designed as a lined canal. The top level of lining is kept at FBL. Concrete lining will be in CC M15 grade using 20 mm and downsize granite metal. The thickness of lining is 10.00 cm both for bed and sides. Paver lining is proposed from Ch: Km 0.00 to Km 17.140 for bed and side lining and manual lining is proposed from Ch: Km 17.140 to Km 26.215 for templates and lugs.

   Varahi Lift Branch Canal - Paver lining is proposed from Ch: Km 0.00 to Km 3.290 for bed and side lining and manual lining is proposed from Ch: Km 3.290 to Km 9.220 for templates and lugs.
5. Provision is made for fixing kilometer stones, hectometer stones, and Boundary stones.
6. Provision is also made for expansion joints and contraction joints in CC lining.
7. P.C.C. Templates are proposed at 15 M intervals in straight reaches.

2.0 Provisions made in respect of structure estimates

1. Earthwork excavation for foundation in all types of soils like A. K. S. and SR/HR.

2. CC M-10 grade concrete using 40mm and down size granite metal in the foundation bed of structures.
3. CC M-15 grade concrete using 40mm and down size granite metal for all walls like abutment, head wall, wing wall, return wall guide wall, basin side wall, Flume wall, cradle concrete below pipe, impervious floor etc.,
4. CC M-25 with 20mm and down size metal for all R.C.C. structures & for Bed block & Dirt wall.
5. Nominal reinforcement for all concrete walls using 10mm dia RTS/HYSD Bars at 200mm centers both ways.
6. Rough stone pitching for a thickness of 30cm wherever necessary.
7. Expansion joints 20mm thick wherever necessary.
8. R.C.C. Hume pipes of NP-3 grade for Head regulator.
9. Gates of suitable size for Head regulator.

The leads for metal, sand, cement, and steel are taken as per the leads approved by Superintending Engineer, KNNL, Varahi Project Circle, Siddapura, Kundapura Taluk, Udupi Dist. The rate analysis is prepared based on the approved leads and WRD SR for the year 2016-17 issued with effect from 22-12-2015. For the items for which rates are not available in WRD SR, the rates in the PWD & ITD South Zone SR for the year 2016-17 is adopted.

The Estimate for the work of construction of Varahi Left Bank Lift Main Canal from 0.000 to 26.215 Km & construction of Varahi Left Bank Lift Branch Canal from 0.00 to 9.22 Km is works out to Rs 25880.71Lakhs and the land Acquisition, Construction of FIC and for Miscellaneous works out to 9119.29 Lakhs.

The Package Estimate For Survey, Investigation, Design, Drawing To Create 2723 Ha Of Command Area Under Varahi Lift Canal Including Canstruction Of Jackwell Cum Pump house, Delivery Chamber, Canal Networks, 33kv Substation And Shifting Of Existing Pumps To Proposed New Site Under Varahi Irrigation Project in Kundapura Taluk Of Udupi District is amounting 35000.00 Lakhs is submitted for obtaining approval and according technical sanction.

22.37 **DTP:** The DTP for the work of survey, investigation, design, drawing to create 2723ha of camand area under varahi lift canal including construction of Jackwell cum pumphouse, delivery chamber, canal network, 33kv substation and shifting of existing pumps to proposed new site under Varahi irrigation project as submitted by the CE is as under:

Sl. No.	Name of work	Approximate amount put to tender. Rs.in Crores	E.M.D @ 1% Rs. In Crores	Tender processing fee in Rs.	Stipulated period for Completion	Category of Contractor Eligible
01	"Survey, Investigation, design, and Commissioning of Lift Irrigation system (Head Works consisting of Intake Channel, Jack well cum pump house, Rising Main Delivery chamber, shifting of existing pumps and sub-station etc) and Construction of Main Canal and Distribution System including Aqueducts , other CD works for providing Irrigation facility for 2,723.00Ha including Operation and Maintenance for a period of 5 years after successful commissioning on Turn-Key Basis for VARAHI Lift Irrigation Scheme in Udupi District, Karnataka".	266.50	2.67	As specified in the e-procuremen t portal -	18 Months (excluding Monsoon)	KNNL category-I enrolled contractor

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22.38 **Pre-Qualification criteria:**

4.1. The intending bidders can submit bids as an Individual/ Company and should be a registered contractor in KNNL category-I enrolled contractor. Joint Venture is not allowed

4.2. The intending bidder should have satisfactorily completed (At least 90% of the contract value) one similar work related to canal construction costing not less than 50% of the amount put to tender during the last 5 years from the date of tender notification. The work done certificate should be obtained duly signed from an officer not below the rank of Executive Engineer of the concerned Division and counter signed by the Superintending Engineer of the same circle or equivalent in case of other Government undertaking within India. The Cost will be updated to the present value by giving a weightage of 10% for each year, if the work is completed prior to the tender notification.

Note: Similar work means "Construction of irrigation canals comprising of canal lining with mechanical paver, aqueduct, cut & cover, retaining wall, road bridge and Irrigation structures".

4.3. The intending bidder should have satisfactorily completed one Pump House costing not less than Rs.2.00 crores during the last 5 years (i.e., from 2012-13 to 2016-17). The work done certificate should be obtained duly signed from an officer not below the rank of Executive Engineer of the concerned Division and counter signed by the Superintending Engineer of the same circle or equivalent in case of other Government undertaking within India.

4.4. The intending bidder should have in the last 5 years annual turnover of at least Rs.348.47 crores (in any of the Two financial years during the last 5 years (i.e., from 2012-13 to 2016-17). Audited profit and Loss account certified by a practicing Chartered Accountant along with copy of Income Tax returns filed for the two years indicated above should be furnished. The turnover will be updated to the present value by giving a weightage of 10% for each year prior to the tender notification.

The intending bidder should have executed the minimum quantity of items as said below in any one financial year in previous 5 financial years.

a) Earthwork excavation in Soil and SR - 4,80,000 cum
b) Earthwork excavation in Hard Rock with controlled blasting - 19,000 cum
c) CC Lining with mechanical paver - 34,600 Sqm
d) RCC M25 and above grade in aqueducts – 24500 Cum
e) Reinforcement steel – 3850 MT
f) The intending bidder should have executed Construction of Aqueduct work for a length of **1750m.**
g) The intending bidder should have executed Construction of Cut cover and Retaing wall for a length of **640m.**

4.6 The intending bidder should have executed pier height not less than 20m for an aqueduct.

Note: 1) The work done certificate with the above said experience for construction of head works / canal construction works/ canal distribution network should be obtained duly signed from an officer not below the rank of Executive Engineer of the concerned Division and counter signed by the Superintending Engineer of the same circle or equivalent in case of other Government undertaking within India.

2) During technical evaluation, if the employer finds that any certification / information furnished is false, such bidders will be disqualified and barred from participation in the bid.
3) If any bidder fails to satisfy the conditions mentioned above, such bids will be rejected and their financial bids will not be opened
4) The intending bidder has to submit the component wise detailed designs after award of the work.

22.39 The proposal was scrutinized in the Design Wing and LIS Consultant, KNNL and following points are noted:

- **Design wing:-**

The proposal is verified on general broad outlines and the following points are noted and the points may be adopted before sanctioning the estimate.

1. The enclosed cut-off statement needs to be got approved from competent authority.
2. The rugosity co-efficient (n) is considered as 0.02 for concrete lining, in normal practice the rugocity co-efficient adopted is 0.018. The same needs to be reviewed and adopted. Further, adopting 'n' value as 0.018 will also reduce the canal section and thereby economize the cost.
3. The canal section is designed for a discharge of 4.238 cumecs as against the required discharge of 3.81 cumecs, the same may be reduced and adopted.
4. The lining thickness adopted is 10cm, the same needs to be provided as per IS 3873 for the different discharges in the canals.
5. Transmission losses in the canal system are considered as 25% as per the report. This may be suitably reviewed as per modified penmen method.
6. Typical cross sections in cutting, embankment, and partial cutting &partial embankment reaches need to be enclosed. The canal parameters like side slopes, SR & IP width, free board etc., needs to be provided as per codal provisions and norms. Velocities in all the canals need to be maintained so that non-silting and non-scouring criteria is satisfied.
7. Box culverts/under tunnels have been provided in reaches where depth of cut is more than 10m, however in 69th TSC, it is suggested that, whenever the depth of cut is more than 10m, cut and cover shall be provided. The same may be reviewed and adopted.
8. An additional bay has been provided between pump house and hoisting chamber required for thrash rack and stop log gates. This chamber is found to be redundant; hence the necessity of this chamber may be reviewed.
9. Details of rising main viz, longitudinal section, cross section all details like thrust blocks, soil data etc., needs to be enclosed.
10. Component wise detailed designs and drawings of pump house, rising main, thrust blocks, delivery chamber etc., needs to be enclosed.

- **LIS Consultant:**

Observations are incorporated and parallelly the CE may please be advised to get service engineer from M/s WPIL (O & M) for assessment of the pumping system.

22.40 The estimate amounting to Rs.35000.00 lakhs and DTP amounting to Rs.26135.00 lakhs and along with the observations of Design wing and LIS Consultant of KNNL is placed before ERC for deliberation.

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22.41 After deliberations, comments / recommendations of Committee are as follows:

i) The observations raised by the Design Wing, KNNL at para 22.39 (i) above are to be duly complied by the CE.

ii) The CE should once again verify the provisions made in the estimate and the designs & drawings should be approved by the competent authority. The PQ conditions are to be strictly in accordance with KTPP Act.

iii) Subject to above, the estimate and DTP is cleared for further action.

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