6. SYPHON AQUEDUCTS

S.No.	ITEM / COMPONENT	REFERENCE
I	**GENERAL:**	
	1.The proposals, be scrutinised and verified by the Unit Officers before communicating to CDO for vetting.	
	2.Catchment Area (C.A.) of drains/rivers and the assessed MFD/OMFL be scrutinised, verified and confirmed by the Unit Officers.	
II	**SITE SURVEY:**	
1	Site Survey to be furnished as per check slip for CM & CD works with the following details.	Check Slip enclosed.
a	i) Report accompanying the Site survey ii) HPs of canal & drain / river.	
b	Site plan with flow direction of canal & drain with net levels @ 10 mts interval & contours.	IS ; 7784 (Part I) : 1993
c	LS of drain / river.	
	i) Covering 500 metres on U/S & D/S.	
	ii) The LS with levels @ 10m to 20m interval with Cross sections of drain on U/S, D/S @ centre line, 10 m, 25m, 50m,100m, & @ 100m interval beyond for a length of 500m.	
	iii) The Cross section levels shall be @ 3m to 5m interval in the gorge portion and 10m intervals in the flanks extended upto MFL touching the ground.	
d	The catchment area shall be marked on the Topo Sheet for all the C.As more than 2.5 Sq. Km. If the C.A. is less than 2.5 Sq.km., the C.A. is to be traversed on ground and to be furnished.	
e	**M.F.D.CALCULATIONS:**	
	The MFD may be computed as per the following formula.	CE/CDO Lr No:CDO/EEC1/1084/83-3 Dt.28/3/83.
	1.IN UPLAND AREAS:	
	Dicken's Formula, $Q = CM^{3/4}$	
	where Q = Discharge in Cusecs.	
	M = Catchment area in sq.miles	
	C = Coefficient depending on Catchment area.	
	CA upto 1 Sq.mile. C=1400	
	CA from 1 Sq.mile to 30 Sq.miles C=1200	
	CA more than 30 Sq.miles C=1060	

S.No.	ITEM / COMPONENT	REFERENCE
	(2) IN DELTAIC AREAS : Ryve's Formula $Q = CM^{2/3}$ C = 1000 for Q more than 500 cusecs C = 750 for Q less than 500 cusecs	
	iii) For deltaic catchment areas of Krishna & Godavari, the formula shall be Ryve's formula adopting 'c' value as per Mitra Committee Report for Upland & Deltaic Catchments.	Mitra Committee Report
f	Observed MFD may be computed from the observed MFL and shown on the LS & CSs.	
g	Bore hole data / TPs upto Hard strata or for min. depth of 2m for shallow foundations & upto 1/3rd embedment depth below maximum scour depth, along the Centre Line @ suitable intervals depending upon the importance of the structure with minimmum 5 Nos. of TPs covering both the Drain & Canal @ centre, U/S & D/S sides.	Table I & II of APERL for test results of foundation soils, IRC 78:2000.
III	**DESIGN :**	
a	Note on Principles of Design, the assumptions made & the general features of the structure.	
b	**HYDRAULIC DESIGN :**	
	1. MFL computations adopting Step by Step method.	Design of Small Dams by USBR.
	2. (a) Design of ventway for the Drain / river in Aqueduct limiting allowable velocity with minimum 1200 mm height of vent in case of barrel.	IS ; 7784 (Part II / section5) :1995, IS : 7784 (part I) - 1993
	(b) For small discharge of Drain, Pipes can be proposed limiting the velocity with minimum 900 mm dia.	IS 458 -1988, IS :783 - 1985
	3. Design of Tail channel & Approach channel keeping in view the Lacey's Formula for Wetted perimeter & velocity limits depending on stratification.	IS : 7784 (part - I) - 1993
	4.Lift Wall on D/S side of the structure may be avoided.	
	5. Transition lengths on U/S & D/S of drain.	IS ; 7784 (part 2/sec5) : 1995
	6. TEL calculations for the Drain considering eddy loss coefficients as per IS code along with flow diagram with dimensions and levels.	IS : 7784 (part - I) - 1993
	7. Scour depth calculations of drain.	IS : 7784 (part - I) - 1993
	$R = 1.34 (q^2/f)^{1/3}$ with relevant factor of safety.	
	8. Uplift calculations for the floor of the barrel and U/S & D/S side aprons	IS : 7784 (part - 2 / sec 5) - 2000
	9. Exit gradient calculations	IS : 7784 (part - I) - 1993
	$G_E = (H/d)x [1/(\pi\sqrt{\lambda})]$; Where $\lambda = [1+ \sqrt{(1+\alpha^2)}]/2$; $\alpha = b/d$	
	10.Proposal Sketch.	

S.No.	ITEM / COMPONENT	REFERENCE
c	**STRUCTURAL DESIGN :**	
	i) SUPER STRUCTURE	
	a) Design of Slab under canal trough & under earth bank / RCC Box for critical load combinations.	IS : 3370 - 1965 part I & part II, IS : 7784 (Part 2 / sec 5) : 1995
	b) Design of Head wall on U/S & D/S by adopting TVA procedure / Coulomb's Theory / Rankine's Theory with a top width of 500mm.	TVA Hand Book
	c) In case the structure is clubbed with Single lane / Double lane bridge refer guidelines for Bridges	
	ii) SUB STRUCTURE	
	I a) CONVENTIONAL TYPE :-	
	1. Design of Pier under canal trough & earth bank: Minimum thickness of pier shall be 1 M.	TVA Hand Book, IS - 7784 (part 2 / sec-5): 1995.
	2. Design of Abutment under canal trough and earth bank.	TVA Hand Book, IS - 7784 (part 2 / sec- 5): 1995.
	3. Abutment and Pier foundations shall be Isolated Footing / RCC raft as the case may be.	1) IRC - 78- 2000 2) SP - 16 ; 3) SP 34
	I b) RCC BOX :-	
	RCC box under canal trough, earth bank and Head wall.	IS : 7784 (Part 2 / sec5) : 1995
	I c) PIPE :-	
	Pipe details	IS 458 : 1988 , IS 783 - 1985
	II Design of Wing walls & Return walls both on U/S & D/S of drain - The walls adopting TVA procedure / Coulomb's Theory / Rankine's Theory with a top width of 500mm.	TVA Hand book
	III Tabulation of stress table :- A consolidated stress table has to be furnished indicating the stress in concrete & stress on soil for the Head wall, Abutment, Piers, Wings & Returns.	
	IV Unless otherwise mentioned, minimum Grade of concrete for PCC- M10 and for RCC- M20	IS - 456 : 2000
d	**MISCELLANEOUS ITEMS :-**	
	a) Water stops	IS : 7784 (part I) :1993
	b) Weep holes in the Retaining walls	IS : 7784 (part I) :1993
	c) Bearings	IS : 7784 (part I) :1993
	d) Expansion , Contraction & Construction Joints	IS : 3370 (part I) - 1965,
	e) Bell Mouth on U/S side	
	f) Cut & Ease waters	IS : 7784 (Part 2 / sec5) : 1995

S.No.	ITEM / COMPONENT	REFERENCE
IV	**DRAWINGS**	
	a) General Layout on net level plan duly showing contours.	
	b) General Plan, Sectional Elevation & End View - Plan indicating Half plan @Top & Half plan @ bottom & Sectional elevation along the LS of the drain & End view along the cross section of the drain.	Scale : 1:50, 1:100 (or) 1:200
	c) Wall Sections, RCC Details & Details of miscellaneous items.	i)Scale : 1:50 (or) 1:100 for sections
		ii)Scale : 1:25 (or) 1:20/1:10 for RCC details.
	The Drawings shall contain assumptions made, TPs, Specifications, HPs of canals, Hydrology of the drain,Bar bending schedule, Stress table etc.	