No.: - 2260-2262/1-W (Forest J&K)

Dated: - 03/07/2024

To

The PCCF/Nodal Officer FCA,
J&K, Jammu.

Subject:- Proposal for seeking prior approval of the Central Government under Section-2 (1) of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 in favour of Executive Engineer, Shahpurkandi Dam Division No.II, Project Shahpurkandi Township, for non-forestry use of 13.24 Ha. of forest land for construction of Shahpurkandi Dam Division-II Punjab, Shahpurkandi Township, under forest division and District Kathua, Jammu & Kashmir. (online proposal No. FP/JK/HYD/51783/2020):-regarding.

In reference to the subject cited above, please find enclosed herewith the reply to the observations raised by the Ministry of Environment, Forest and Climate Change, Government of India: -

Sr. No.	EDS	Reply
1.	The CAT plan submitted along with the proposal does not include financial implications. Revised CAT plan including Financial implications approved by Principal Chief conservator of Forest and HoFF, Government of Jammu & Kashmir needs to be submitted.	The Wildlife Warden, Kathua submitted the reply vide letter no. WLW/K/2024-25/515-17 dated 03/07/2024. (copy enclosed as Annexure-1)
2.	The State Government has not transferred the funds of the CAT plan into the National Authority CAMPA. The amount has to transferred into National Authority, CAMPA Account and details of the same needs to be submitted before Stage-II approval.	This office has already submitted the requisite funds in the account as provided by the Wildlife Warden, Kathua. The further transfer of funds into National Authority, CAMPA Account has been

			done by their office via UTR no. JAKA202407015000073977.
3.	Copy of wild life clearance obtained, if any, as per condition no.7 of Stage-I approval may also be submitted.		Copy of Wildlife clearance is enclosed. (Annexure - 2)
4.	The State Government has not submitted complete compliance of the FRA, 2006. In this regards the State Govt. is requested to submit FRA, 2006 certificate in prescribed format along with supporting documents viz. DLC, SDLC and concerned Gram Sabha resolution signed by the concerned authority		Copy of FRA, 2006 certificate in prescribed format along with supporting documents are enclosed. (Annexure-3)

(Er. Nitin Sood)
Executive Engineer,
SPK Allied Works Division,
Shahpurkandi Township.

Copy to: -

1. Superintending Engineer, Shahpurkandi Dam Circle, Shahpurkandi Township. - for information please.

2. Sub Divisional Officer, SPK Dam Reservoir Sub Division, Shahpurkandi Township. - for information & necessary action.

Department of Wildlife Protection J&K Government
OFFICE OF THE WILDLIFE WARDEN KATHUA
Tel/Fax No. 01922-234622, Email: -wildlifekathua1@gmail.com
****

ANNEXURE-1

The PCCF/Nodal Officer FCA,
J&K, Jammu.

No. WLW/K/2024-25/515-17   Dated: 03-07-2024.

Subject: Proposal for seeking prior approval of the Central Government under Section 2 (1) of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 in favour of Executive Engineer Shahpurkandi Dam Division No.II Project Shahpurkandi Township, for non-forestry use of 13.24 ha. of forest land for construction of Shahpurkandi Dam Division-II Punjab, Shapurkandi Township, under forest division and District Kathua, Jammu & Kashmir (online proposal No. FP/JK/HYD/51783/2020)-regarding.

Sir,

In reference to subject cited above certain shortcomings have been reported which are as under: -

S.No.	EDS	Reply
I)	The CAT plan submitted along with the proposal does not include financial implications. Revised CAT plan including financial implications approved by Principal Chief conservator of Forest & HoFF, Government of Jammu & Kashmir needs to be submitted.	Revised CAT Plan approved by PCCF (HoFF)J&K is enclosed as annexure "A"
II)	The State Govt. has not transferred the funds of the CAT plan into the National Authority CAMPA. The amount has to transferred into National Authority, CAMPA account and details of the same needs to be submitted before Stage-II approval.	Action already taken and funds for an amount of **330.25 lakhs** of CAT Plan from official a/c No. 0382040520000008 is Transfer to **CAMPA A/c No. SB-520101263743541 (IFSC Code UBIN0903710) "Compensatory Afforestation Fund – Jammu and Kashmir" in Corporation Bank (Now Union Bank of India) (O/o PCCF (HoFF) J&K)** vide Txn. UTR No. is **JAKA202407015000073977.**
III)	Copy of Wildlife clearance obtained, if any, as per *condition No. 7* of Stage- I approval may also be submitted.	Copy of Wildlife Clearance is enclosed.
IV)	The State Government has not submitted complete compliance of the FRA, 2006. In this regard the State Govt. is requested to submit FRA, 2006 certificate in prescribed format along with supporting documents viz. DLC, SDLC and concerned Gram Sabha resolution signed by the concerned authority.	Compliance of the FRA, 2006 is enclosed

Yours faithfully,

Wildlife Warden
Kathua 3/7/2024

Copy submitted to:
1. The Regional Wildlife Warden, Jammu Region, Jammu for kind information please.
2. The Executive Engineer, Shahpur Kandi Dam Division No. 2, Shahpur Kandi Township for information.

Wildlife Warden
Kathua 3/7/2024

Total Cost of Construction of Silt Detention Structures in Project Area

Structure No.	Type o Structure	Cost (Rs.)
	NORA NALA	
1	RCC	257622
2	RCC	620666
3	RCC	313139
4	RCC	692947
5	CC	296415
6	CC	384393
7	RCC	1240677
8	RCC	1244907
9	RCC	1267340
10	CC	799793
11	CC	294418
12	RCC	1271717
13	RCC	1569686
14	RCC	860238
15	Gabion	254086
16	Gabion	127624
Sub Total (I)		**11495668**
	GHARTI NALA	
1	CC	95230
2	CC	263942
3	CC	258024
4	RCC	645818
5	RCC	493072
6	RCC	831900
7	RCC	703299
Sub Total (II)		**3291285**
	THEIN MICRO-WATERSHED	
1	CC	357030
2	CC	430936
3	CC	451568
4	CC	421123
Sub Total (III)		**1660657**
Grand Total (I+II+III)		**16447610**

The planning and designing part was prepared by Sh Bhagwan Dass Former J.E of the Department of Soil and Water Conservation Punjab.

The estimating and costing was done by Er.Kirpal Singh, Former Divisional Soil Conservation Officer of Department of Soil and Water Conservation Punjab.

The civil engineering part was supervised and approved by Er.H.S.Lohan General Secretary of SPACE.

Summary of Cost Estimates of the Project

S. No	Particulars	Rate	Amount (Rs.)
	Total Cost of Structures		
1.	27 No. of Structures	As per estimates	16447610
2.	Work under Water 15% of Structure Cost	16447610 x 0.15	2467141
3.	Hard Rock Cutting 10% of Structure Cost	16447610 x 0.10	1644761
4.	Cost of Local Stores and Site infrastructure 2% of Structure Cost	16447610 x 0.02	328952
	Sub Total (1+2+3+4)		**20888464**
5.	Bio Engineering measures including establishment of nurseries 15% of Total Cost	20888464 x 0.15	3133270
	Sub Total (1+2+3+4+5)		**24021734**
	Total Cost		
6.	Supervision and Management (15% of Total Cost)	24021734 x 0.15	3603260
7.	Cost Escalation (20% of Total Cost)	24021734 x 0.20	4804347
8	Cost of preparing CAT Plan	5,96000	596000
	Total cost 6+7+8		**9003607**
	Grand Total	24021734 + 9003607	**33025341**

Rupees Three Crores Thirty Lakhs Twenty Five Thousand Three Hundred and Forty One Only

2nd Floor, Jal Wing
Indira Paryavaran Bhawan
JorBagh Road, Aliganj
New Delhi 110003
Date: 08.03.2021

To
All Members
Standing Committee of NBWL

Sub: Minutes of 61st Meeting of the Standing Committee of National Board for Wild Life- reg.

Sir / Madam,

Kindly find enclosed copy of the Minutes of 61st Meeting of the Standing Committee of National Board for Wild Life held on 18th February, 2021 under the chairmanship of Hon'ble Minister of Environment, Forest and Climate Change, Government of India.

Yours faithfully,

(Surender Gugloth)
Scientist 'D'
Email: ddwlmef@gmail.com

Encl: As above

Distribution

1. Secretary, MoEF&CC
2. DGF&SS, MoEF&CC
3. ADGF(WL), MoEF&CC
4. ADGF(FC), MoEF&CC
5. Member Secretary, NTCA
6. Director/IGF, PE Division, MoEF&CC
7. Director, WII, Dehradun
8. Director, GEER Foundation, Gandhinagar, Gujarat
9. Prof. R. Sukumar, Member, NBWL
10. Dr. H.S. Singh, Member, NBWL
11. Pr. Secretary, Forest Department, Govt. of Andhra Pradesh

Copy to
(1) PS to Hon'ble MoEF&CC
(2) PS to Hon'ble MoSEF&CC
(3) PPS to DGF&SS, MoEF&CC
(4) PSO to Addl.DGF(WL), Sr.PPS to IGF(WL)
(5) Additional Chief Secretary/Principal Secretary/Secretary, Forest Department, Assam, Andaman & Nicobar Islands, Uttarakhand, Uttar Pradesh, Jammu & Kashmir, Rajasthan, Gujarat, Kerala, Madhya Pradesh, Tamil Nadu, Telangana.
(6) CWLW Assam / CWLW Andaman & Nicobar Islands / CWLW Jammu & Kashmir / CWLW Kerala / CWLW Rajasthan/ CWLW Uttarakhand / CWLW Gujarat / CWLW Uttar Pradesh / CWLW Madhya Pradesh / CWLW Tamil Nadu / CWLW Telangana.

9. Approval under Forest (conservation) Act, 1980, if required shall be obtained separately for use of forest land.

10. The user agency shall deposit NPV for the user of land of Protected Area as per the existing rates before initiating any work on the allotted land.

11. The user agency shall install adequate number of bird diverters along the transmission line.

B. The animal passage plan submitted by the User Agency is placed as **ANNEXURE-III**. The project proponent shall implement the animal passage plan submitted *in toto*. The project proponent shall use the bird diverters as per the designs and specifications approved by the Central Electricity Authority.

C. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.8 Proposal for Shahpur Kandi Dam Project, Jammu & Kashmir (6-26/2021 WL; FP/JK/HYD/5444/2020).

The Member Secretary briefed the Standing Committee and stated that the proposal for Shahpur Kandi Dam Project, Jammu & Kashmir. Shahpurkandi Dam Project is located in the Ravi river terrain in Pathankot District of Punjab State. The excess water of the River Ravi at present is going waste through the Madhopur Headworks downstream to Pakistan. Implementation of the project would minimize such wastage of water. The proposed site for construction of Shahpurkandi Dam is strategically located on the Ravi river because the particular stretch is narrow on the said location There is no other possible alternative to avoid the submergence of the protected area in the Shahpurkandi Dam Reservoir. Therefore, wildlife clearance for 51.08 ha land falling under the Conservation Reserve has been submitted by the Government of Jammu and Kashmir.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. The proprietary and the legal status of the land shall remain.

2. The User Agency shall pay NPV (Net Present Value) in accordance with the orders of the Hon'be Supreme court.

3. The User Agency shall be responsible for obtaining requisite clearances under any other law in vogue.

4. No harm to any wildlife species shall be done if found accidentally in the said area.

5. User Agency shall abide by all the directions of the Hon'ble Supreme Court, provisions of Wild Life (Protection) Act, 1972, directions of the Ministry of Environment, Forest and Climate Change and orders of the Government of Jammu & Kashmir in this regard.

6. Waste material including muck generated during execution of project shall be disposed of outside the protected area.

7. The area proposed should not be used by the user agency for any purpose other than proposed.

8. The land so allowed to be used shall be returned to the department free of any encumbrances when it is no longer required by the User Agency.

9. The user agency shall have to abide by all the conditions laid down in the sanction order issued by the Competent Authority.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.9 Proposal to construct a bridge at Kumbichalkadavu in Neyyar Wildlife Sanctuary, Kerala (6-13/2021 WL; FP/KL/Others/32487/2018)

The Member Secretary briefed the Standing Committee and stated that the proposal is to construct a bridge at Kumbichalkadavu across Neyyar River. The project area falls in Neyyar Wildlife Sanctuary, Kerala. The proposed bridge is considered as an only solution for the hardship of the tribal people. So a seven span bridge of total length 253.4 m having a carriage way of 7.50m and 1.5m footpath on either side has been proposed. The total width of the bridge comes to 11.00m. The State Government has proposed for use of 0.416 ha from the Neyyar Wildlife Sanctuary.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

FORM II

(for projects other than linear projects and plantation)
Government of Jammu and Kashmir
Office of the District Collector Kathua

No. DCK.ISO.)2024-25)978   Dated..02-07-2024.

TO WHOMSOEVER IT MAY CONCERN

In compliance of Rule 6(3)(e) of the Forest (Conservation) Rules, 2003 [as amended vide the Forest (Conservation) Amendment Rules 2014; Forest (Conservation) second Amendment Rule 2014; and Forest (Conservation) Amendment Rule 2016) it is certified that **13.24 hectares** of forest land proposed to be diverted in favour of Shahpur Kandi Dam Project for the construction of Shahpur Kandi Dam Project in the district falls within the jurisdiction of village Basantpur in Kathua Tehsil. It is further certified that:

(a)   The complete process of recognition and vesting of forest rights under the FRA, 2006 has been carried out for the entire 13.24 hectares of forest land proposed for diversion. A copy of records of all consultation and meetings of the Forest Rights Committee(s), Gram Sabha(s), is enclosed as   Annexure   "A". No case/application was received in the office of Sub Division as well as District.

(b)   The proposal for such diversion was placed before each concerned Gram Sabha of forest –dwellers, who are eligible under the FRA, 2006.

(c)   The concerned Gram (Sabha) has certified that all formalities/processes under the FRA have been carried out, and that they have given their consent to the proposed diversion and the compensation and ameliorative measures, if any, having understood the purpose and details of proposed diversion. Copy of certificate issued by the Gram Sabha of Basantpur village is enclosed as Annexure "B".

(d)   The discussion and decision on such proposals has taken pace only when there was a quorum of minimum 50% of the members of Gram Sabhas present;

(e)   The diversion of forest land for facilities managed by the Government as required under section 3(2) of tine FRA have been completed and the and the Gram Sabhas have given their consent to it;

(f)   The   rights of Primitive Tribal Groups and Pre-Agricultural Communities, where applicable have been specifically safeguarded as per Section3 of the FRA,2006.

(Dr. Rakesh Minhas) IAS
District Collector
Kathua

Department of Wildlife Protection J&K Government
OFFICE OF THE WILDLIFE WARDEN KATHUA
Tel/Fax No. 01922-234622, Email: wildlifekathua1@gmail.com
****

The Executive Engineer,
Dam Reservoir Division,
Shahpurkandi Township.
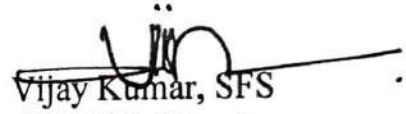
No. WLW/K/2022-23/2429-31   Dated: **01-03-2023.**

Subject: **Transfer of amount under Catchment Area Treatment Plan (CAT) Plan.**
Ref: Your office letter No.7891-93/1-W(forest J&K) dated 27.02.2023.
Sir,

On the above captioned subject and reference, it is to intimate that an amount of Rs 3,30,25,341/- has been received in the official account No. 0382040520000008 in J&K Bank Patel Nagar Kathua Branch for implementation of Catchment Area Treatment (CAT) Plan for Shahpurkandi Dam Project.

Yours faithfully,

Vijay Kumar, SFS
Wildlife Warden
Kathua

Copy submitted to:
1. The Pr.CCF/Chief Wildlife Warden, J&K Govt., for favour of kind information please.
2. The Regional Wildlife Warden J&K Govt. Jammu for favour of kind information please.

Wildlife Warden
Kathua

F.No.6-16/2021 WL
Government of India
Ministry of Environment, Forest and Climate Change
(Wildlife Division)

2nd Floor, Jal Wing
Indira Paryavaran Bhawan
JorBagh Road, Aliganj
New Delhi 110003
Date: 08.03.2021

To
All Members
Standing Committee of NBWL

Sub: Minutes of 61st Meeting of the Standing Committee of National Board for Wild Life- reg.

Sir / Madam,

Kindly find enclosed copy of the Minutes of 61st Meeting of the Standing Committee of National Board for Wild Life held on 18th February, 2021 under the chairmanship of Hon'ble Minister of Environment, Forest and Climate Change, Government of India.

Yours faithfully,

(Surender Gugloth)
Scientist 'D'
Email: ddwlmef@gmail.com

Encl: As above

Distribution

1. Secretary, MoEF&CC
2. DGF&SS, MoEF&CC
3. ADGF(WL), MoEF&CC
4. ADGF(FC), MoEF&CC
5. Member Secretary, NTCA
6. Director/IGF, PE Division, MoEF&CC
7. Director, WII, Dehradun
8. Director, GEER Foundation, Gandhinagar, Gujarat
9. Prof. R. Sukumar, Member, NBWL
10. Dr. H.S. Singh, Member, NBWL
11. Pr. Secretary, Forest Department, Govt. of Andhra Pradesh

Copy to
(1) PS to Hon'ble MoEF&CC
(2) PS to Hon'ble MoSEF&CC
(3) PPS to DGF&SS, MoEF&CC
(4) PSO to Addl.DGF(WL), Sr.PPS to IGF(WL)
(5) Additional Chief Secretary/Principal Secretary/Secretary, Forest Department, Assam, Andaman & Nicobar Islands, Uttarakhand, Uttar Pradesh, Jammu & Kashmir, Rajasthan, Gujarat, Kerala, Madhya Pradesh, Tamil Nadu, Telangana.
(6) CWLW Assam / CWLW Andaman & Nicobar Islands / CWLW Jammu & Kashmir / CWLW Kerala / CWLW Rajasthan/ CWLW Uttarakhand / CWLW Gujarat / CWLW Uttar Pradesh / CWLW Madhya Pradesh / CWLW Tamil Nadu / CWLW Telangana.

MINUTES OF 61st MEETING OF THE STANDING COMMITTEE OF NATIONAL BOARD FOR WILD LIFE HELD ON 18th FEBRUARY, 2021

The 61st Meeting of the Standing Committee of National Board for Wild Life was held on 18th February, 2021 through Video Conference and chaired by the Hon'ble Minister for Environment, Forest & Climate Change. List of participants is placed at ANNEXURE-I.

The Chairman welcomed all the participants to the 61st Meeting of the Standing Committee of National Board for Wild Life and asked the Member Secretary to initiate the discussions on the Agenda Items.

AGENDA ITEM No.1

61.1.1 Confirmation of the minutes of the 60th Meeting of the Standing Committee of National Board for Wild Life held on 5th January, 2021.

The Member Secretary stated that the minutes of the 60th meeting of the Standing Committee of National Board for Wild Life held on 5th January, 2021 were circulated on 22nd January, 2021 amongst all the Members of the Standing Committee. No comments have been received on the minutes of the meeting from the members.

Decision Taken: Based on the discussion held, the Standing Committee decided to confirm the minutes of the 60th meeting.

AGENDA ITEM No.2

(Action Taken Report)

61.2.1 Proposal for use of 98.59 ha of reserve forestland from Saleki proposed reserve forest which is a part of Dehing Patkai Elephant Reserve for Tikok OCP coal mining project by North-Eastern Coal Field, Coal India Limited, Assam State (Original Agenda – 54.4.3).

The Member Secretary stated that the Standing Committee in its 60th meeting decided to give extension of time up to 31.01.2021 for the enquiry team to submit its report and informed that a report has been received from the DDG, IRO, Shillong on 17.02.2021 and requires examination.

Decision Taken: After discussion, the Standing committee decided that Ministry shall examine the report submitted by the DDG, Shillong and therefore, deferred the matter.

61.2.2 Proposal for collection river bed materials from an area 10.0 ha located at Sajjanpur Village, Haridwar falls at distance of 9.0 km away from the boundary of Rajaji National Park, Uttarakhand State (Original Agenda – 54.4.27)

61.2.3 Proposal for collection river bed materials from an area 55.51 ha located at Satiwal, Kudkawala, Teliwala and Kheri, falls at distance of 1.5 km away from the boundary of Rajaji National Park, Uttarakhand State (Original Agenda – 55.4.21)

The Member Secretary stated that the Standing Committee in the 60th Meeting held on 5th January, 2021 decided to defer the proposals till the receipt of comments from NMCG and compliance certificate with respect to the Enforcement and Monitoring Guidelines for Sand Mining, 2020 and the same are still awaited.

Decision Taken: After discussions, the Standing Committee decided to delist the proposals.

61.2.4 Proposal for use of 6.704 ha of reserve forestland from Pilibhit Tiger Reserve for Mailani-Pilibhit Gauge Conversion chainage 212.520-213.070 KM and 242.310-250.140 KM (8.38 KM) between Kuriya-Dudhiyakhurd and Sandai Mala, Uttar Pradesh State-FP/UP/RAIL/4257/2019.

The member secretary stated that the Standing Committee in the 60th meeting decided to constitute a team comprising of representative of WII, Rail Vikas Nigam Limited and Uttar Pradesh Forest Department to study the site and suggest mitigation measures within two months' time. The Ministry has constituted the committee vide F. No. 6-4 /2020 WL dated 09.02.2021.

Decision Taken: After discussions, the Standing Committee decided to defer the matter.

61.2.5 Construction of Campierganj Branch Canal in between km.51 to 62.106 under Saryu Nahar Pariyojna in District: Maharajganj, Uttar Pradesh.

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of 21.864 ha land for construction of Campierganj Branch Canal in between km.51 to 62.106 under Saryu Nahar Pariyojna in District: Maharajganj. The Standing Committee in the 60th meeting desired that due to the importance of protected area for its biodiversity and presence of wild animals like tiger, the Standing Committee desired that a study might be conducted by the NTCA and report submitted within a month. The Ministry has

Scanned with CamScanner

requested the NTCA to conduct the study vide F.No.6-171/2020 WL dated 09.02.2021 and submit report within a month's time.

Decision Taken: After discussions, the Standing Committee to defer the matter.

61.2.6 Issue of Upgradation of Laldhang to Chillakhal road in buffer zone of Rajaji Tiger Reserve, Uttarakhand.

The Member Secretary briefed that the Standing Committee in the 60th meeting decided to constitute a committee comprising of representatives of NTCA, WII, NHAI and Government of Uttarakhand to look into the issue and suggest mitigation measures. Ministry has constituted the committee vide F.No.6-145/2019 WL dated 12.02.2021.

Decision taken: After discussions, the standing committee decided to defer the matter.

AGENDA ITEM No. 3

(Policy Matters, Court Orders/Rationalization of Boundaries of Protected Areas)

61.3.1 Guidelines on Ecotourism in Forest and Wildlife Areas 2021

The Member Secretary briefed the Standing Committee and stated that these Guidelines are aimed at promoting better understanding of nature and wildlife conservation while generating income and opportunities for the local communities in an ecologically, culturally and economically sustainable manner. The objectives of these Guidelines include promotion of low impact nature tourism, traditional ecological knowledge and heritage values of India's wilderness, engagement of local communities in nature tourism, partnerships amongst various stakeholders and finally enhancing potential of India as a global eco-tourism destination. He further stated that the FC Division of the Ministry felt the need to examine the Guidelines further with respect to the Forest (Conservation) Act, 1980.

Decision Taken: After discussions, the Standing Committee decided to defer the matter.

61.3.2 Rationalisation of Band Baretha Sanctuary, Bharatpur, Rajasthan

The Member Secretary briefed the Standing Committee and stated that the Band Baretha Sanctuary was notified on 5th October, 1985. The total area of the sanctuary at present is 19830.73 ha.

The State Government proposes to alter the boundaries of the Sanctuary by removing the Bansi Pahadpur Block A and B, Kot Block and Sookha Shila Block, which are disjointed and already ravaged, from the sanctuary to the tune of 2785.5 ha and adding forest blocks Pahadtali, Mevala, Banswari, Jamoora Timkoli in Karauli District to the tune of 19785.5 ha. After rationalisation, the area of the sanctuary will increase by 17000 ha and the final area of the sanctuary will be 36830.73 ha.

Dr. H.S. Singh, Member stated that a study should be conducted to assess the impact of the proposed alteration of boundaries. The Member Secretary explained that the WII has carried out a survey of the area and recommended rationalisation of the boundaries. Dr. Singh expressed his acceptance of the proposal in view of the explanation provided by ADG(WL).

Decision Taken: After discussion the standing committee decided to recommend the proposal.

AGENDA No. 4.

61.4.1 Amendments in minutes of meeting of SC-NBWL

The member secretary stated that the Standing Committee, in its 58th meeting held on 3rd July, 2020, recommended the proposal of Ujh Multipurpose Project, Jammu and Kashmir in the ESZ of Jasrota Sanctuary. The Government of Jammu and Kashmir vide letter no. FST/Parivesh/05/2020 dated 20.11.2020 has informed that it was mentioned in the minutes of the meeting that the Chief Wild Life Warden recommended the proposal without any conditions although the Chief Wild Life Warden had recommended the project with the conditions as approved/cleared by the Standing Committee of the State Board for Wild Life which were mentioned in the annexure to the agenda for the meeting of the Standing Committee of the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to amend the minutes of the 58th meeting to include conditions as imposed by the Chief Wild Life Warden with respect to recommendations made for the Ujh Multipurpose Project.

The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

The Chairman directed that the matter as to why the documents uploaded by the UT of Jammu and Kashmir in PARIVESH are not seen would be discussed in the next meeting.

AGENDA No.5

(Fresh Proposals Falling Inside / Outside the Protected Area)

61.5.1 **Proposal for temporary use of 0.7539 ha of PA land and 0.1911 ha of Reserved forest land falling within Notional ESZ of Mahatma Gandhi Marine National Park, Wandoor for laying of sub-marine pipeline from RM Point, Rutland Island to Phongibalu, South Andaman Island across McPherson Strait for augmentation of potable water supply in the Port Blair township. (File No.6-29/2021 WL; CWLW/WL/170/538).**

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of 0.7539 ha of PA land and 0.1911 ha of Reserved forest land falling within Notional ESZ of Mahatma Gandhi Marine National Park, Wandoor for laying of sub-marine pipeline from RM Point, Rutland Island to Phongibalu, South Andaman Island across McPherson Strait for augmentation of potable water supply in the Port Blair township. He further stated that the project outside the protected area does not require environment clearance and, therefore, the mandate of the Standing Committee is to consider the project falling inside the National Park only.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the project falling in Mahatma Gandhi Marine National Park subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. Vessels/boats used for execution of the project, should use the approved route for navigation and no boat should anchor on the reef areas.

2. The legal status of the diverted forest land shall remain the same.

3. The project authority should take necessary permission from Chief Wildlife Warden/Park Manager for the officials/staff and workers of the contractor before entering into the National Park.

4. No effluent or domestic sewage (liquid or. solid waste) shall be disposed into the sea or nearby forest areas, by the user agency.

5. The user agency will ensue that the natural drainages of the locality are not disturbed due to the construction and the dugout soil are stabilized in a proper way.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.2 **Proposal for diversion of 0.9613 ha of forest land from Saddle Peak National Park for augmentation of water supply by construction of weir and laying pipeline from Tambunallah towards existing pipeline near source no.1 at Dumornallah, Andaman & Nicobar Islands. (File. No 6-32/2021 WL; CWLW/WL/170/538).**

The Member Secretary briefed the Standing Committee and stated that the proposal is for diversion of 0.9613 ha of forest land from Saddle Peak National Park for augmentation of water supply by construction of weir and laying pipeline from Tambunallah towards existing pipeline near source no.1 at Dumornallah, Andaman & Nicobar Islands.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. The project proponent shall submit the names of the staff/workers engaged in the project to the Divisional Forest Officer (Wildlife), Mayabunder before commencement of the work.
2. Kindling of fire inside the PA is prohibited.
3. No person should carry any weapons/ammunitions/explosives etc. which may endanger the life of Wildlife while entering the national Park during the constructional and operational phase of the project.
B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.3 **Replacement of both offshore pipelines from Narara bet to Single Point Moorings (SPMs) & interconnecting loop line between SPMs, Replacing & Relocating Pipe Line End Manifold (PLEM) and Installation of SPM buoy at Vadinar, Gujarat. (6-5/2021 WL; FP/GJ/Pipeline/42481/2019).**

The Member Secretary briefed the Standing Committee and stated that the proposal is for replacement of both offshore pipelines from Narara bet to Single Point Moorings (SPMs) & interconnecting loop line between SPMs, Replacing & Relocating Pipe Line End Manifold (PLEM) and

Installation of SPM buoy at Vadinar, Gujarat. Proposed area falls under Marine National Park, Marine Sanctuary and Eco-sensitive Zone. The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. Conditions imposed by the Chief Wild Life Warden

1. The User Agency shall not violate any regulatory provisions under Section-9, 17A, 27, 29, 30, 31 32 of Wildlife (Protection) Act 1972.

2. The User agency shall not harm or destroy wildlife habitat including fauna and flora of the Sanctuary. The coral along the pipeline will have to be relocated at the cost of the company to a suitable nearby place under supervision of the Forest Department,

3. The User Agency shall have to bear the cost of double the area of Mangrove planation for all the Mangroves that would be effected due to the pipeline.

4. The User• Agency shall ensure that there would be no oil spillage in the work site and will not create any dumping site within the Protected Area.

5. The user agency will have to prepare a conservation plan relevant to the biological entity affected due to the project and deposit the fund before initiating any work on the land.

6. The User Agency shall not use the area for any other work other than the work permitted.

7. The User Agency shall not establish any temporary or permanent labour camp in the Protected Area.

8. The User Agency or his contractor shall not create any fire places inside the Protected Area.

9. All the material required for the work shall be prepared outside the Protected Area.

10. The work in the Sanctuary will be allowed only in the day time considering the local tidal effects.

11. Approval under Forest (Conversation) Act, 1980, if required, shall be obtained separately for use of forest land.

12. The User Agency shall deposit NPV for the use of land of Protected Area as per the existing rates before initiating any work on the land.

13. The User Agency shall restore the land in its original form after completion of the work.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.4 **Widening & Strengthening Four lane of Bilimora Chikhli Vansda Waghai Road Ch. Km. 53+400 to 59+600 passing through Vansda National Park for 6.2 km (6-11/2021 WL; FP/GJ/ROAD/4303/2019).**

The Member Secretary briefed the Standing Committee and stated that the proposal is for widening & strengthening Bilimora Chikhli Vansda Waghai Road passing through Vansda National Park to four lane.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. Conditions imposed by the Chief Wild Life Warden:

1. The User Agency shall not violate any regulatory provisions under section 9, 17A, 27, 29, 30 31 and 32 of Wild Life (Protection) Act, 1972.
2. The User Agency shall not harm or destroy wildlife habitat including fauna and flora of the National Park.
3. The User Agency shall not use the area for the proposed work other than the area permitted.
4. The User Agency shall not establish any temporary or permanent labour camp in the National Park.
5. The User Agency or his contractor shall not create any fire places inside the National Park.
6. All the material required for the work shall be prepared outside the National Park.
7. The Work in the National Park will be allowed only in the day time from 8 a.m. to 6 p.m.
8. Approval under Forest (Conservation) Act, 1980, if required, shall be obtained separately for use of forest land.
9. The User Agency shall deposit NPV for the use of land of Protected Area as per the existing rates.
10. The User Agency shall create a speed breaker at a distance of every 500 meters and put signage to observe speed limit of 30 km per hour at suitable interval.
11. The User Agency shall prepare Wildlife Mitigation Plan and get it approved from Chief Wild Life Warden before start of the work. The budget for the same should be made available separately.

B. User Agency has proposed animal passage and mitigation plan for Rs. 4 cr. The details of culverts provided for animal passage are as follows:

Sr. No.	Type	Chainage	Geo-Cordinate	
			Latitude	Longitude
1	Single Pipe Culvert	53+550	20°45'19"N	73°26'07"E
2	Slab Culvert	53+910	20°45'15"N	73°26'18"E
3	Box Culvert	54+390	20°45'16"N	73°26'34"E
4	Box Culvert	54+460	20°45'17"N	73°26'37"E
5	Box Culvert	54+570	20°45'17"N	73°26'40"E
6	Box Culvert	55+210	20°45'18"N	73°27'02"E
7	Single Row Pipe Culvert	55+430	20°45'19"N	73°27"10"E
8	Loose Pipe Single Culvert	55+660	20°45'19"N	73°27'18"E
9	Single Row Pipe Culvert	55+775	20°45'19"N	73°27'21"E
10	Box Culvert (Single Cell)	55+910	20°45'20"N	73°27'25"E
11	Single Pipe Culvert	56+220	20°45'23"N	73°27'35"E
12	Box Culvert	56+300	20°45'23"N	73°27'38"E
13	Single Row Pipe Culvert	56+630	20°45'27"N	73°27'51"E
14	Single Row Pipe Culvert	57+000	20°45'29"N	73°28'01"E
15	Single Row Pipe Culvert	57+230	20°45'32"N	73°28'08"E
16	Single Row Pipe Culvert	57+470	20°45'35"N	73°28'15"E
17	Single Row Pipe Culvert	57+600	20°45'36"N	73°28'18"E

The project proponent shall implement the animal passage plan submitted *in toto*.

C. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.5 Forest land diversion proposal (between km 13+500 to Km 130+073) of proposed new NH-754K greenfield alignment Sanchore-Santalpur section (EC-3) starting from Vantdau in Banaskantha district to Ranmalpura in Patan district, from km 4+888 to km 130+073. (6-15/2021 WL; FP/GJ/ROAD/34425/2018).

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of 2.617 ha land between km 13+500 to Km 130+073 of proposed new NH-754K greenfield alignment Sanchore-Santalpur section (EC-3) starting from Vantdau in Banaskantha district to Ranmalpura in Patan district, from km 4+888 to km 130+073. Due to increase in traffic and to enhance connectivity with other National Highway, the existing road is required to be widened to 4 lane configuration on/along existing alignment and new (greenfield) alignment is required.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. Conditions imposed by the Chief Wild Life Warden:

1. The User Agency shall not violate any regulatory provisions under section 9, 17A, 27, 29, 30 31 and 32 of Wild Life (Protection) Act, 1972.
2. The User Agency shall not harm or destroy wildlife habitat including fauna and flora of the Sanctuary.
3. The User Agency shall not use the area for any other work than the work permitted.
4. The User Agency shall not establish any temporary or permanent labour camp in the Sanctuary.
5. The User Agency will have a conservation plan relevant to the biological entity affected due to the project and deposit the fund before initiating any work on the land.
6. The User Agency or his contractor shall not create any fire places inside the Sanctuary.
7. All the material required for the work shall be prepared outside the Sanctuary.
8. The Work in the Sanctuary will be allowed only in the day time from 8 a.m. to 6 p.m.
9. Approval under Forest (Conservation) Act, 1980, if required, shall be obtained separately for use of forest land.
10. The User Agency shall deposit NPV for the use of land of Protected Area as per the existing rates before initiating any work on the land.
11. The User Agency will create adequate facilities for safe transit of wildlife across the road.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.6 Proposal of diversion of 9.749 ha of forest land Wild Ass Wildlife Sanctuary for construction of 765 kV D/C Lakadia to Banaskantha Transmission Line, Gujarat. (6-33/2021 WL; FP/GJ/TRANS/43664/2019).

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of 9.749 ha in Wild Ass Sanctuary for construction of 765 kV D/C Lakadia to Banaskantha Transmission Line, Gujarat. The project will facilitate evacuation of renewal energy generating from Bhuj, Dwarka and Lakadia area thereby increase in productivity in industrial sector and improve green energy.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. Conditions imposed by the Chief Wild Life Warden:

1. The user agency shall not violate any regulatory provisions under section-9,17 A, 27,29,30,31 & 32 of Wildlife (Protection) Act, 1972.
2. The user agency shall not harm or destroy wildlife habitat including fauna and flora of the sanctuary.
3. The user agency shall not use the area for any other work other than the work permitted
4. The user agency shall not establish any temporary or permanent labour camp in the sanctuary.
5. The User Agency or his contractor shall not create any fire places inside the sanctuary
6. The user agency will have to prepare a conservation plan relevant to the biological entity affected due to the project and deposit the fund before initiating any work on the land.
7. All the material required for the wok shall be prepared outside the sanctuary.
8. The work in the sanctuary will be allowed only in the day time from 8 AM to 6 PM.
9. Approval under Forest (conservation) Act, 1980, if required shall be obtained separately for use of forest land.
10. The user agency shall deposit NPV for the user of land of Protected Area as per the existing rates before initiating any work on the land.
11. The user agency shall install adequate number of Bird diverters along the transmission line.

B. The project proponent has submitted the animal passage plan which is placed at **ANNEXURE-II.** The project proponent shall implement the animal passage plan *in toto.* The project proponent shall use the bird diverters as per the designs and specifications approved by the Central Electricity Authority.

C. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.7 **Proposal of diversion of 30.81 ha from Wild Ass Sanctuary for construction of 765 KV D/C Lakadia-Vadodara Transmission line, Gujarat. (6-35/2021 WL; FP/GJ/TRANS/43086/2019).**

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of 30.81 ha from Wild Ass Sanctuary for construction of 765 KV D/C Lakadia-Vadodara Transmission line, Gujarat. The line passes through Kutch, Morbi, Surendranagar, Ahmedabad, Kheda, Anand & Vadodara Districts of Gujarat. The project proposal area falls in wild Ass Sanctuary. The project will facilitate evacuation of renewal energy generating from Bhuj, Dwarka and Lakadia area thereby increase in productivity in industrial sector and improve green energy.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. The user agency shall not violate any regulatory provisions under section-9,17 A, 27,29,30,31 & 32 of Wildlife (Protection) Act, 1972.
2. The user agency shall not harm or destroy wildlife habitat including fauna and flora of the sanctuary.
3. The user agency shall not use the area for any other work other than the work permitted
4. The user agency shall not establish any temporary or permanent labour camp in the sanctuary.
5. The User Agency or his contractor shall not create any fire places inside the sanctuary
6. The user agency will have to prepare a conservation plan relevant to the biological entity affected due to the project and deposit the fund before initiating any work on the land.
7. All the material required for the wok shall be prepared outside the sanctuary.
8. The work in the sanctuary will be allowed only in the day time from 8 AM to 6 PM.

9. Approval under Forest (conservation) Act, 1980, if required shall be obtained separately for use of forest land.
10. The user agency shall deposit NPV for the user of land of Protected Area as per the existing rates before initiating any work on the allotted land.
11. The user agency shall install adequate number of bird diverters along the transmission line.

B. The animal passage plan submitted by the User Agency is placed as **ANNEXURE-III**. The project proponent shall implement the animal passage plan submitted *in toto*. The project proponent shall use the bird diverters as per the designs and specifications approved by the Central Electricity Authority.

C. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.8 Proposal for Shahpur Kandi Dam Project, Jammu & Kashmir (6-26/2021 WL; FP/JK/HYD/5444/2020).

The Member Secretary briefed the Standing Committee and stated that the proposal for Shahpur Kandi Dam Project, Jammu & Kashmir. Shahpurkandi Dam Project is located in the Ravi river terrain in Pathankot District of Punjab State. The excess water of the River Ravi at present is going waste through the Madhopur Headworks downstream to Pakistan. Implementation of the project would minimize such wastage of water. The proposed site for construction of Shahpurkandi Dam is strategically located on the Ravi river because the particular stretch is narrow on the said location There is no other possible alternative to avoid the submergence of the protected area in the Shahpurkandi Dam Reservoir. Therefore, wildlife clearance for 51.08 ha land falling under the Conservation Reserve has been submitted by the Government of Jammu and Kashmir.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. Conditions imposed by the Chief Wild Life Warden:

1. The proprietary and the legal status of the land shall remain.

2. The User Agency shall pay NPV (Net Present Value) in accordance with the orders of the Hon'be Supreme court.

3. The User Agency shall be responsible for obtaining requisite clearances under any other law in vogue.

4. No harm to any wildlife species shall be done if found accidentally in the said area.

5. User Agency shall abide by all the directions of the Hon'ble Supreme Court, provisions of Wild Life (Protection) Act, 1972, directions of the Ministry of Environment, Forest and Climate Change and orders of the Government of Jammu & Kashmir in this regard.

6. Waste material including muck generated during execution of project shall be disposed of outside the protected area.

7. The area proposed should not be used by the user agency for any purpose other than proposed.

8. The land so allowed to be used shall be returned to the department free of any encumbrances when it is no longer required by the User Agency.

9. The user agency shall have to abide by all the conditions laid down in the sanction order issued by the Competent Authority.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.9 Proposal to construct a bridge at Kumbichalkadavu in Neyyar Wildlife Sanctuary, Kerala (6-13/2021 WL; FP/KL/Others/32487/2018)

The Member Secretary briefed the Standing Committee and stated that the proposal is to construct a bridge at Kumbichalkadavu across Neyyar River. The project area falls in Neyyar Wildlife Sanctuary, Kerala. The proposed bridge is considered as an only solution for the hardship of the tribal people. So a seven span bridge of total length 253.4 m having a carriage way of 7.50m and 1.5m footpath on either side has been proposed. The total width of the bridge comes to 11.00m. The State Government has proposed for use of 0.416 ha from the Neyyar Wildlife Sanctuary.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. Conditions imposed by the Chief Wild Life Warden:

1. A horizontal bar at appropriate height on the two ends of the bridge may also be thought of to restrict movement of heavy commercial vehicles on this road.

2. The road has to be completely sealed at Anamuzham (Kerala-Tamil Nadu border) and one forest check post at Kumbichal Kadavu may have to be erected for better management of wildlife sanctuary.

3. The road from Kumbichalkadavu to Anamukham should be used only for genuine tribal inhabitants and not as interstate road between Tamil Nadu and Kerala.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.10 Renewal of clearance earlier granted under WPA, 1972. At the same time to increase the periphery of mining pit within the lease area by about 10 Ha. of which 1.5 Ha will fall inside forest area. The total lease area of 275.963 Ha falls within Gangau Sanctuary of which 74.018 H, Madhya Pradesh (6-12/2021 WL; FP/MP/MIN/3966/2019).

The Member Secretary briefed the Standing Committee and stated that the proposal is for renewal of lease earlier granted vide recommendation of Standing Committee on 20th January, 2006 under Wild Life (Protection) Act, 1972 over total lease area of 275.963 ha falling within Gangau Sanctuary and at the same time to increase the periphery of mining pit within the lease area by about 10 ha. The project has already been operating in the area since 1968. There are no alternative areas in the immediate vicinity under NMDC with Diamond reserves of sufficient quantity. To extract the rare mineral, it is essential that the wildlife clearance is accorded for a further period of 20 years i.e. up to 31/12/2040.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

The Chief Wild Life Warden in his recommendations has stated that The matter is being monitored by the Monitoring Committee constituted by the State Government on the directions of Hon'ble Supreme Court of India. Any decision in this matter will have to be taken after the approval of Hon'ble Supreme Court of India.

The State Chief Wild Life Warden has recommended the proposal subject to the following conditions and approval of the mine closure plan duly

approved by the Monitoring Committee appointed by the State as per the directions of the apex court:

1. Slurry or the polluted water will not be released in the park.
2. No blasting during night time.
3. Only silent blasting to be allowed.
4. No High intensity lights to be allowed.
5. 5% of the project cost for Tiger Foundation Society

As the area falls within the Panna Tiger Reserve, comments from the National Tiger Conservation Authority (NTCA) were sought. NTCA has stated that the project area is falling within the Panna National Park/Wildlife Sanctuary. Member Secretary further stated that this project was examined by CEC and the Hon'ble Supreme Court of India vide order dated 13.08.2008 in I.A. No. 1485 and 1507 in W.P. (C) No. 202/1995 approved the wildlife clearance while imposing certain conditions as below:

I. *"NPV as per the applicable rate will be deposited by NMDC for the 74.018 ha. Under its possession and 70.202 ha of forest land used for Earthen Dam;*

II. *5% of the capital cost incurred on diamond mining project will be deposited for undertaking conservation and protection in the Panna National Park Panna (Gangau) Wildlife Sanctuary;*

III. *A proper Mine Closure Plan, which includes reclamation and rehabilitation measures, will be drawn and implemented at the cost of the NMDC*

IV. *The notification dated 12.4.2006 issued by the appropriate authority will be withdrawn;*

V. *A Monitoring Committee under the Chairmanship of the Chief Wildlife Warden with the Member Secretary, National Tiger Conservation Authority, Field Director, Panna National Park and a non-official Member of the National Board for Wildlife (to be nominated by the MoEF) as its members will be responsible for*

a. *Approval of the mine closure plan;*

b. *Prescribing and Monitoring of various safeguards for operation of the mines;*

c. *Approval and Monitoring of the annual work plan for utilization of funds received from the NMDC towards the NPV and 5% of the project cost."*

We nominate Ms. Belinda Wright, as a non-official Member in the above said Monitoring Committee. The above conditions are acceptable to the NMDC and the project is approved subject to fulfilment of the above conditions. Applications are disposed of accordingly."

DIG NTCA vide OM No. 7-3/2021-NTCA dated 15.02.2021 has conveyed the recommendations of NTCA under section 38O (1)(g) of the Wild Life (Protection) Act, 1972 for extension of diamond mining lease in 275.963 ha area under Gangau wildlife Sanctuary adjoining Panna Tiger Reserve subject to fulfillment of conditions laid down by Chief Wild Life Warden, Madhya Pradesh in Part-IV of online proposal and also subject to approval of the Hon'ble Supreme Court as per directions in aforesaid case.

Decision Taken: After detailed discussions, the Standing Committee decided to recommend the proposal subject to the conditions imposed by the Chief Wild Life Warden and the NTCA.

The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.11 Installation of Solar Powered Aviation Obstruction Lights at the peak of Vallanadu Hills Vagaikulam, Thoothukudi (6-30/2021 WL; FP/TN/Others/31029/2017).

The Member Secretary briefed the Standing Committee and stated that the proposal is for Installation of Solar Powered Aviation Obstruction Lights at the peak of Vallanadu Hills Vagaikulam, Thoothukudi. The terrain falls in the path meant for the take-off and approach of aircraft operating to Tuticorin Airport. Therefore, it is not safe for operation of aircraft during the hours from sunset to sunrise. The proposed area of 0.01 ha falls within Vallanadu Blackbuck Sanctuary.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. The project proponent shall obtain all other statuary clearances, impact mitigation and wildlife conservation plan of Vallanadu Blackbuck Sanctuary, Google map with GPS coordinates along with Land Use Pattern Map.

2. Any other condition stipulated by the Chief Conservator of Forests/District Forest Officer shall be followed.

3. The project proponent shall submit an undertaking that no disturbance will be caused to the wildlife during the project implementation.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.12 Upgradation of Urattum to Iylapur road via kondai from km 1/9 to km 23/9 in Warangal District (6-31/2021 WL; FP/TG/ROAD/20352/2016).

The Member Secretary briefed the Standing Committee and stated that the proposal is for Upgradation of Urattum to Iylapur road via kondai from km 1/9 to km 23/9 in Warangal District. The proposed road will provide better connectivity to the tribal villages to meet out their basic needs. The proposed project area falls in the Eturunagaram Wildlife Sanctuary.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

S.No.	Component	Financial target (Rs in Lakhs)
I	**To be carried out by user agency**	
1	The User Agency shall install chain link fencing on either side of the proposed passing through the wildlife areas at animal crossing zones indicated by the DFO/FDO concerned at their own cost.	Cost to be borne by User Agency
2	The User Agency shall also construct underpasses for movement of wild animals from one side of the road to the other. The underpasses shall be a per the design and specifications prescribed by Wildlife Institute of India, Dehradun at their own cost. The locations for the underpasses will be provided by the DFO/FDO concerned.	Cost to be borne by User Agency
3	The User Agency will set up speed breakers/speed controlling devices at all animal crossing zones as indicated by the DFO/FDO concerned at their own cost.	Cost to be borne by User Agency
II	**To be carried out by Forest Department with funds provided by User Agency**	

1	Installation of solar bore wells 8 Nos. @ Rs. 5.00 lakh each	40.00
2	Construction of percolation tanks for storage of water from solar bore wells 8 nos. @ Rs. 3.00 lakhs each	24.00
3	Development of natural grasslands 50 ha @ Rs. 30,000/- per ha	15.00
4	Construction of watch towers 1 No. @ Rs. 6.00 lakh each	6.00
5	Purchase of camera traps 20 Nos. @ Rs. 30,000/- each	6.00
6	Installation of publicity and informative hoardings 6 nos. @ 1.50 lakh each	9.00
7	Purchase of strike force vehicle 1 no. @ Rs. 6.00 lakh each	6.00
8	Operation and maintenance of strike force vehicle 5 years @ Rs. 1.60 lakh each	8.00
9	Maintenance of Eco-tourism facilities at Tadvai 5 years @ Rs. 2.00 lakh each	10.00
10	Administrative cost @ 5% of project cost	6.00
	Total	130.00 lakhs

The above amount of Rs. 130 lakhs shall be deposited by the User Agency in the BIOSOT account of Chief Wild Life Warden, Telangana

III. Other Conditions:

1. The User Agency shall fell only the barest minimum number of trees while executing the work.

2. The Work shall be carried out without disturbing or damaging flora, fauna or habitat of the area.

3. Work shall be carried out from 6.00 a.m. to 6.00 p.m. only.

4. The material for carrying out the proposed works shall be kept outside the sanctuary area. As and when required, they should be carried to the site during execution of work.

5. No labour camp should be established inside Tiger Reserve during execution of the work.

6. The debris formed due to execution of the works shall be taken away from the Tiger Reserve on day to day basis.

7. The User Agency shall construct masonry pillars to demarcate the proposed project area at every 25-meter interval.

8. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.13 Proposal for Sakida Soapstone Mine over an Area of 14.226 ha near village-Sakida, Tehsil-Bageshwar, District-Bageshwar (UK) within the 10 km of Binsar Wildlife Sanctuary (6-14/2021 WL; FP/UK/MIN/5424/2020).

The Member Secretary briefed the Standing Committee and stated that the proposal is for Sakida Soapstone Mine over an Area of 14.226 ha near village-Sakida, Tehsil-Bageshwar, District-Bageshwar (UK) within the 10 km of Binsar Wildlife Sanctuary. Proposed soap stone mining area is located at a distance of about 4.50 km from the project site.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. No Mining shall be allowed in the area by Sakida Soapstone Mine which has not been identified in the comprehensive mining plan of the District.

2. Replenishment study should be conducted on regular basis by Sakida Soapstone Mine.

3. Mining area shall be identified and put for auction with proper geo-tagged details by Sakida Soapstone Mine.

4. The latitude and longitude of each mining area lease shall be clearly mentioned in letter of intent issued to Sakida Soapstone Mine-Such information shall be provided on the website of the district administration.

5. There shall be no river bed mining operation allowed in monsoon period Sakida Soapstone Mine. The period as defined by IMD Nagpur for each state shall be adhered with.

6. The monitoring infrastructures including weighbridge and adequate fencing of lease area, CCTV, Transport permits, etc, shall be ensured by Sakida Soapstone Mine in order to reduce unrecorded dispatch.

7. Regular monitoring of mined minerals and its transportation and storage shall be ensured by Sakida Soapstone Mine and all information shall be captured at centralized database so that easy tracking of illegal material can be done.

8. The project proponent will abide by Enforcement and Monitoring Guidelines for Sand Mining 2020.

B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.14 Proposal for Bajeta Soapstone Mine (Area-17.967 ha) near village-Bajeta, Tehsil-Munsiyari and District-Pithoragarh Uttarakhand. The proposed site is 3.4 km from Askot Wildlife Sanctuary (6-18 /2021 WL; FP/UK/MIN/5414/2020).

The Member Secretary briefed the Standing Committee and stated that the proposal is for Bajeta Soapstone Mine (Area-17.967 ha) near village-Bajeta, Tehsil-Munsiyari and District-Pithoragarh Uttarakhand. The proposed site is 3.4 km from Askot Wildlife Sanctuary.

The proposal has been recommended by the Chief Wild Life Warden and the State Board for Wild Life.

Decision Taken: After discussions, the Standing Committee decided to recommend the proposal subject to following:

A. **Conditions imposed by the Chief Wild Life Warden:**

1. No Mining shall be allowed in the area by Bajeta Soapstone Mine which has not been identified in the comprehensive mining plan of the District.
2. Replenishment study should be conducted on regular basis by Bajeta Soapstone Mine.
3. Mining area shall be identified and put for auction with proper geo-tagged details by Bajeta Soapstone Mine.
4. The latitude and longitude of each mining area lease shall be clearly mentioned in letter of intent issued to Bajeta Soapstone Mine-Such information shall be provided on the website of the district administration.
5. There shall be no river bed mining operation allowed in monsoon period Bajeta Soapstone Mine. The period as defined by IMD Nagpur for each state shall be adhered with.
6. The monitoring infrastructures including weighbridge and adequate fencing of lease area, CCTV, Transport permits, etc, shall be ensured by Bajeta Soapstone Mine in order to reduce unrecorded dispatch.
7. Regular monitoring of mined minerals and its transportation and storage shall be ensured by Bajeta Soapstone Mine and all information shall be captured at centralized database so that easy tracking of illegal material can be done.
8. The project proponent will abide by Enforcement and Monitoring Guidelines for Sand Mining 2020.
B. The annual compliance certificate on the stipulated conditions should be submitted by the project proponent to the State Chief Wild

Life Warden and an annual compliance certificate shall be submitted by the State Chief Wild Life Warden to Government of India.

61.5.15 Proposal for collection of Minor Minerals from Song 1, 2, 3 and Jakhan 1, 2 of Dehradun Forest division, Uttarakhand (6-24/2021 WL; FP/UK/MIN/38285/2019).

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of collection of balu, bajri and boulders from Song 1, 2, 3 and Jakhan 1, 2 of Dehradun Forest division, Uttarakhand. Out of the 5 mining lots in the proposal, Song -3 is located about 0.2 km from the P.A. boundary. As the orders of Hon'ble Supreme Court of India dated 4.8.2006, mining within 1 km from the boundary of national park and sanctuary area. Another lot, Jakhan -1 is located more than 10 km from the boundary of national park, therefore, the SBWL excluded this lot from their recommendations. Regarding the certificate of compliance for Sustainable Sand Mining Management Guidelines 2016 and Enforcement and Monitoring Guidelines for Sand Mining, 2020, the project proponent has given the undertaking that the conditions in these guidelines will be followed. Chief Wild Life Warden, Uttarakhand has recommended the proposals subject to the condition that these guidelines will be adhered to by the User Agency. The Member Secretary further stated that the comments from NMCG were sought in similar cases.

Decision Taken: After discussions, the Standing Committee decided that Ministry shall seek comments from NMCG on the proposal and decided to defer the proposal till the certificate of compliance for Sustainable Sand Mining Management Guidelines 2016 and Enforcement and Monitoring Guidelines for Sand Mining, 2020 in the state of Uttarakhand is submitted by the State Government. The proposals from any state for mining sand from the river shall not be considered by SCNBWL unless a certificate regarding compliance of certificate for Sustainable Sand Mining Management Guidelines 2016 and Enforcement and Monitoring Guidelines for Sand Mining, 2020 in the state is given by State Government/UTs.

61.5.16 400kV D/C Jaunpur Obra Transmission Line (6-4 /2021 WL; FP/UP/TRANS/40906/2019)

The Member Secretary briefed the Standing Committee and stated that the proposal is for use of land inside Kaimur Sanctuary for laying 400kV D/C Jaunpur Obra Transmission line starting from LILO point of Obra-B Obra-C line, located at Chopan and terminating at substation constructed by UPPTCL at Machlisahar in Jaunpur District. The route of the above line passing through the Kaimur wildlife sanctuary located in Sonbhadra district, involves forest as well as non-forest land totalling to 55.447 ha

The Member Secretary stated that there are many transmission lines passing through the Kaimur Sanctuary. The Secretary, MoEF & CC opined that the possibility of bunching the transmission lines passing through the protected area may be examined if it is technologically feasible.

Decision Taken: After discussions, the Standing Committee decided that Ministry shall constitute a committee comprising of Dr. Sukumar,, representatives from Wildlife Institute of India, Central Electricity Authority and Power Grid Corporation of India Limited to examine the matter and suggest site-specific mitigation measures within a period of 30 days.

LIST OF PARTICIPANTS

1	Shri Prakash Javadekar, Hon'ble Minister for EF&CC	Chairman
2	Shri R P Gupta, Secretary, MoEF&CC	Member
3	Shri Sanjay Kumar, DGF&SS, MoEF&CC	Member
4	Shri Soumitra Dasgupta, AGF(WL), MoEF&CC	Member Secretary
5	Prof R Sukumar, Member, NBWL	Member
6	Dr H S Singh, Member, NBWL	Member
7	Shri R D Kamboj, Member, NBWL	Member
8	Dr Dhananjay Mohan, Member, NBWL	Member
9	Shri S.P. Yadav, ADG (PT) and MS, NTCA	Invitee
10	Shri Sisir Kumar Ratho, ADG(FC)	Invitee
11	Shri Rohit Tiwari, IGF(WL)	Invitee
12	Mr Brijendra Swaroop, IGF(PE)	Invitee
13	Shri M.K. Yadava, Chief Wild Life Warden, Assam	Invitee
14	Shri. A K Shukla, PCCF and Chief Wild Life Warden, Andaman and Nicobar Islands	Invitee
15	Shri. Shyamal Tikedar, Chief Wild Life Warden, Gujarat	Invitee
16	Ms. Sarita Chauhan, Commissioner Secretary, Forest, Environment and Ecology Department, Government of Jammu and Kashmir	Invitee
17	Shri. Suresh Gupta, Chief Wild Life Warden, Jammu & Kashmir	Invitee
18	Shri Surendra Kumar, Chief Wild Life Warden, Kerala	Invitee
19	Shri Vijay Kumar Gogi, Chief Wild Life Warden, Karnataka	Invitee
20	Shri Nitin Kakodkar, Chief Wild Life Warden, Maharashtra	Invitee
21	Shri. Alok Shrivastava, Chief Wild Life Warden, Madhya Pradesh	Invitee
22	Mrs R. Shoba, PCCF & HoFFF, Telangana	Invitee
23	Shri M.L Meena, Chief Wild Life Warden, Rajasthan	Invitee
24	Shri Sunil Pandey, Chief Wild Life Warden, Uttar Pradesh	Invitee
25	Shri J.S. Suhag, Chief Wild Life Warden, Uttarakhand	Invitee
26	Shri Rakesh Kr Jagenia, DIGF(WL), MoEF&CC	Invitee
27	Shri Surender Gugloth, Scientist D, MoEF&CC	Invitee

FORM-II
(for projects other than linear projects and plantation)
Government of Jammu and Kashmir
Office of the District Collector Kathua

No. DCK\SO\2024-25\978   Dated 02-07-2024.

TO WHOMSOEVER IT MAY CONCERN

In compliance of Rule 6(3)(e) of the Forest (Conservation) Rules, 2003 [as amended vide the Forest (Conservation) Amendment Rules 2014; Forest (Conservation) second Amendment Rule 2014; and Forest (Conservation) Amendment Rule 2016) it is certified that **13.24 hectares** of forest land proposed to be diverted in favour of Shahpur Kandi Dam Project for the construction of Shahpur Kandi Dam Project in the district falls within the jurisdiction of village Basantpur in Kathua Tehsil. It is further certified that:

(a)   The complete process of recognition and vesting of forest rights under the FRA, 2006 has been carried out for the entire 13.24 hectares of forest land proposed for diversion. A copy of records of all consultation and meetings of the Forest Rights Committee(s), Gram Sabha(s), is enclosed as Annexure "A". No case/application was received in the office of Sub Division as well as District.

(b)   The proposal for such diversion was placed before each concerned Gram Sabha of forest –dwellers, who are eligible under the FRA, 2006.

(c)   The concerned Gram (Sabha) has certified that all formalities/processes under the FRA have been carried out, and that they have given their consent to the proposed diversion and the compensation and ameliorative measures, if any, having understood the purpose and details of proposed diversion. Copy of certificate issued by the Gram Sabha of Basantpur village is enclosed as Annexure "B".

(d)   The discussion and decision on such proposals has taken pace only when there was a quorum of minimum 50% of the members of Gram Sabhas present;

(e)   The diversion of forest land for facilities managed by the Government as required under section 3(2) of tine FRA have been completed and the and the Gram Sabhas have given their consent to it;

(f)   The rights of Primitive Tribal Groups and Pre-Agricultural Communities, where applicable have been specifically safeguarded as per Section3 of the FRA, 2006.

(Dr. Rakesh Minhas) IAS
District Collector
Kathua

The Deputy Commissioner,
Kathua.

NO:- K/0@/ 2n-23/65   Date:- 05-05-2022

Subject:-Proposal for seeking prior approval of the contract Govt under section 2 of the Forest conservation Act 1980 for non forest use of 13, 24 for forest land for construction of shahpur Kandi Township under Forest Division Kathua.

Sir,

In refrence to the subject cited above and as reported by Naib Tehsildar Circle NO 3&4 Kathua the issue's pertaining to Forest Right claims has been settled along with PRI's and no claim was pending. So for as issue of shahpur Kandi Project is concerned no forest land is coming under the said project.

Hence the report is submitted for your kind persual Sir.

Your Sincerly

Dr. Vikram Kumar (JKAS)
Tehsildar, Kathua

No: KFD/2022-23/ 801

Dated: 20 / 05/2022

To,

The Deputy Commissioner,
Kathua.

Sub: Proposal for seeking prior approval of the Central Government under Section 2 of the Forest (Conservation) Act, 1980 for non-forest use of 13.24 ha for forest land for construction of Shahpur Kandi Township under Forest Division and District Kathua, Jammu and Kashmir (Online proposal) No. FP/JK/HYD/51783/020 reg.

Ref: Your office letter No. DCK/SQ/2022-23/2037-38 Dated 26/04/2022.

Sir,

On the subject and reference cited above, it is submitted that as reported by the Range Officer, Kathua vide his letter No. 369/RO/K Dated 20/05/2022 that 20 FRA claims for verification under Schedule Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 in respect of Basantpur Gram Panchayat have been received by FRC Basantpur. After joint verification and scrutiny of documents by the concerned FRC members, Forest and Revenue staff, all the 20 claims were found ineligible and have been rejected at the level of the Gram Panchayat, Basantpur and no further claim has been received by the said Gram Panchayat till date.

Hence submitted for your kind information.

Yours faithfully,

(Vivek Modi), SFS
Divisional Forest Officer
Kathua Forest Division, Kathua

Department of Wildlife Protection J&K Government
OFFICE OF THE WILDLIFE WARDEN KATHUA
Tel/Fax No. 01922-234622, Email: wildlifekathua1@gmail.com

The Assistant Commissioner Revenue,
Kathua.

No. WLW/K/2022-23/324-28   Dated: 19-05-2022.

Subject: Proposal for seeking prior approval of the Central Government under Section 2 of the Forest (Conservation) Act, 1980 for non-forest use of 13.24 ha for forest land for construction of Shahpurkandi Township under Forest Division and District Kathua, Jammu & Kashmir (online proposal) No. FP/JK/HYD/51783/2020/Reg.

Ref:- Your Office Letter No. DCK/SQ/2022-23/2037-38 dated: 26-04-2022.

Sir,

In reference to your office letter no. mentioned above, it is to intimate that this office has not received any application/claim under Forest Right Act till date with respect to the areas of panchyat Basantpur, Thein and Domar falling under Thein Conservation Reserve. Submitted for necessary action under rules at your end please.

Yours faithfully,

Wildlife Warden
Kathua

Copy submitted to:

1. The Pr.CCF/Chief Wildlife Warden, J&K Govt., Jammu for kind information please.
2. The Regional Wildlife Warden, Jammu Region, Jammu for kind information please.
3. The Deputy Commissioner Kathua for favour of kind information please.
4. The Divisional Forest Officer, Forest Division Kathua for favour of information please.

Wildlife Warden
Kathua

FOREST RIGHT COMMITTEE (F.R.C)

Pyt: Basantpur

A meeting of Forest Right Committee has convened by Chairman Farooq Khan at Pyt. Basantpur.

The main agenda of the meeting was for the settlement of pending claims if available. The members of the F.R.C verified through various medium and by itself that there is no claim pending for settlement in the entire Panchayat including the area of Shahpur Kandi project as well as the proposed road under NABARD at W. No 6. Hence F.R.C. Basantpur has no objection if the above mentioned project be executed in the Basantpur Pyt.

Sig. of F.R.C Members

1. Salima bibi

Rehman Ali

3. Gulzar Begum,

4. Mubarak A G.

5. Challan Singh & Pgs

6.

7. Fadul

Sd/

Jas... Ahmed
Chairman
Forest Rights Committee
Panchayat Halqa Basantpur
Block Keerian Gandyal

Far...
Fore...
Panci... ...tpur
Block ...ria.. Gandyal

Gupta
Sec. Pyt
(C. Basantpur)

Submitted in Original to B.D.o. Keerian Gandyal for Information and necessary action at your end Plz.

BASANTPUR

A Gram-Sabha meeting was conducted under the Chairmanship of Sarpanch Smt. Soni Sunita in the premises of Panchayat Ghar Basantpur.

The main agenda of the meeting is to verify the F.R.A claim if pending in the Pyt. for settlement so that the Project sanctioned under the Shahpur Kandi township and Road sanctioned under NABARD at W.No 6 Kuthlair. It is further verified by the P.R.I that No claim is existing/pending for settlement as F.R.C has already the claims & report in this regard has been submitted by the F.R.C to Gram Pyt which clearly depicts that there is no claim pending in the entire Pyt for settlement and Pyt. have no objection if the project/Construction started.

Sig. of Member

1. – Kamal Singh (Panch W.No 4)

2. Mohan Singh
   Mohan Singh
   Panch 3
   P.___

   Soni Sunita
   Soni Sunita
   SARPANCH
   Panchayat Halqa Basantpur
   Block Keerian Gandiyal (Kathua)
   Dy.
   Sec. Pyt

3.
   Kamlesh Kumari
   Pyt Halqa Basantpur
   Block Kathua
   (Basantpur)

4. Sunita Devie Panch w.no2 7.   Lekh Raj

5. Sudh chosh Panch. 7 8.   Pars Ram

6. HEM RAJ   9.   दर्शन

FINAL REPORT

Preparation of Catchment Area Treatment Plan (CAT) for Free Draining Catchment of Shahpur Kandi Dam Project on Ravi River Within the Boundary of J&K State

NORA NALA

Submitted to:

XEN Shahpur Kand Dam Project Division no 2

Submitted by:

The Society for Promotion and Conservation of Environment (SPACE) Chandigarh

CONTENT

Acknowledgement

The Society for Promotion and Conservation of Environment (SPACE) is extremely thankful to the worthy Er S.K. Saluja Chief Engineer Shahpur Kandi Dam Project for providing the opportunity to our organization to carry out the important assignment of **Preparation of Catchment Area Treatment Plan (CAT) for Free Draining Catchment of Shahpur Kandi Dam Project on Ravi River Within the Boundary of J&K State.** We also express our sincere thanks and gratitude to Er.Vijay Nagra, Executive Engineer, Shahpur Kandi Dam Division No 2 for providing all logistic support and facilitation in the conduct of this assignment. The help and support provided by Sh. Vijay Verma IFS, the Divisional Forest Officer Kathua and his field staff is thankfully acknowledged. Our appreciations are due to Sh. Gumesh Singh Forest Guard of the area for helping us to traverse the whole catchment and arrange discussions with the local farmers. The help provided by Sh Balwant Singh and Ramesh Singh of Nora village in survey work deserve our appreciation. The local area knowledge provided by Sh. Bashir Ahmid, Roshan Din, Sant Ram of Gharti village and Thundu Ram of Thein village proved extremely useful and we express our thanks to them.

The contributions of Sh Bhagwan Das Surveyor in topographic survey work and preparing plans and designs of civil structures deserve lot of appreciation and we express our gratitude for this important contribution. The help and support provided by Sh Kirpal Singh former Divisional Soil Conservation Officer Punjab in the estimating and costing of silt control structures is thankfully acknowledged. Sh Pawan Dev our Computer Operator painfully prepared all the drawings on computer and typed the manuscript. We place on record his rich contributions in the compilation of the report.

**Society for Promotion &
Conservation of Environment
(SPACE) CHANDIGARH**

 Dr. S.S.Grewal, 9417655612, Email drgrewal0114@yahoo.com

President SPACE

May 27th, 2021

Executive Summary

The silt loads in water bodies; hydro-electric reservoirs and lakes have increased due to severe soil erosion, glacial melts, landslides and faulty road construction and farming operations. Due to rapid loss of storage capacities, it has become necessary to prepare the comprehensive Catchment Area Treatment Plants (CAT Plans) for all major river systems. This being a specialized type of watershed based soil and water conservation work integrating both biological and mechanical measures, the services of expert agencies are generally hired to prepare CAT Plans. The Shahpur Kandi Dam (SPK) is being constructed across River Ravi 11km below the existing Ranjit Sagar Dam (RSD). This 55m high dam is to act as balancing reservoir for optimum utilization of release of RSD and irrigate 5000 ha of land of Punjab and parts of Jammu and Kashmir.

An area of 1760 ha of Kathua District freely drains from hydraulic right in the reservoir of SPK. In view of very high silt loads released from this area mainly forming the hilly catchment of Nora Nala, it was decided by the management of SPK Project to prepare a comprehensive CAT Plan of this area to reduce silt load so as to prolong the live storage of the reservoir. The services of the Society for Promotion and Conservation of Environment (SPACE), a Chandigarh based Consortium of experts in watershed based soil and water conservation technology were hired by the SPK Project Management. The SPACE team started the work on compilation of maps, demarcation of catchment area and its drainage system on Survey of India Toposheet No.43/P/11 of 1:50000 scale. This area falls in the Thein Wildlife Sanctuary. The SPACE team got the help of DFO Wildlife Kathua and arranged the help of their field staff in familiarizing the area, its problems, and works already done. The local forest guard was deputed to remain with the team while traversing the whole catchment area. The highest level of reservoir storage is 404.5m in above MSL and has been marked in the bed of Nora Nala near village Nora.

The catchment area is inhibited by small settlements having pockets of cultivated lands around them. Nora Nala has round the year perennial flow with pools of water. There is lot of sand, gravel, debris off loaded by runoff water in lower part of the drainage lines. Small creeks from both sides also bring with runoff load of gravel and discharge into the main channel. The geological formation is of uplifted Old River as indicated by round boulders on the vertical cliffs. The catchment area has a serious problem of grazing and seasonal settlement of Bakarwals. Some amount of mining of sand and gravel was also noted in lower areas. Though over all vegetation is good on northern hill slopes, but southern slopes are relatively bare and rock out crops are also common in top most area around village Kalmari. Lantana an obnoxious weed has covered bare areas. Some plantations of Bamboo and local species have been done by making closures. Few dry stone check dams have also been constructed. All the above said bio-physical features have been shown by photographs in this report.

The 1760 ha catchment area is mainly divided into three parts, area directly draining into Ravi River through nine small creeks is 425ha, an area of 122 ha is drained near RSD through

Thein Micro Watershed. The remaining area of 1213 ha mainly drains through Nora Nala with 190 ha self defended catchment of Gharti Nala forming a part of this watershed.

After detailed traversing the area, the expert team decided to put low height RCC and CC Silt Detention Structures across main and side gullies having characteristics of narrow section, strong converging shoulders, low gradient and open bowl above to store silt. Since the objective is to arrest silt and not water, low height structures of 1.5 to 3.0m (mostly 2.0m) height were planned. Mostly the hard rock narrow sections were selected with appropriate vertical intervals.

The standard design of drop spillways as a weir structure where the flow passes through the weir opening, drops to a level apron and passes downstream through a toe-wall. The design criteria of working out peak rate of discharge at the site using hydrological formula, working out weir section to pass the discharge using hydraulic formula and providing strength and stability to apron, head wall extensions and tow wall and foundations using standard structural designs were followed. The construction of some dry stone gabions has been proposed. The bio-engineering measures to support the mechanical measures in the form of intensive bamboo plantation, support of soil conserving plant species like Jamoa, Ipomea, Agave, Nara, are suggested.

The implementation of the project proposed especially structural measures is likely to face some unique type of challenges like:

- Handling high discharge with strength and stability of structure with RCC support.
- The execution under conditions of round the year flow and pools of water.
- Transport of material to interior areas. Some areas are tractorable but then animal transport would be required.
- Excavation of foundations by cutting of hard rock at narrow sections.
- Limited working period in view of continuous flow in Nora Nala.
- No removal of stones from the Nala beds as they are dissipating the energy of flowing water.
- Lastly, the core capacity of the Department which is to execute such a technical work.

The location of each structure has been shown on a drainage map and also indicated by latitude and longitude in a tabulated form. Most of the silt detention structures are of CC across side gullies having limited area. However, in the main Nora and Thein Nala, RCC structures have been provided. There are 4 SDS in Thein, 7 in Gharti and 16 in main Nora Nala. The drawings of all the structures have been prepared on computer and quantities of sand, bajri, saria have been worked out. The eight mapping units have been identified and prioritized for treatment based on the silt yield index. Based upon the current schedule of rates of Punjab,the total cost of the project has been worked out as Rs 33025340 (**Rupees Three Crores Thirty Lakhs Twenty Five Thousand Three Hundred and Forty One Only).** This includes the components of work under wet conditions, hard rock cutting and cost escalation. The cost of Rs18764/ha is within the norm of Rs 22500/ha for hilly areas by the Govt.of India, Directorate of Land Resources.

CHAPTER 1

INTRODUCTION AND BACKGROUND

Nature had covered the mother earth with most appropriate protective vegetation cover according to the climatic conditions of different ecosystems. The human interference triggered by increasing needs and coupled with greed lead to gradual removal of protective vegetation cover which disturbed the delicate ecological balance. Till the output was equal to or less than the annual increment of biomass, the ecosystem remained in harmony with nature. But as human and livestock population increased, the pressure on biological support systems also increased. The indiscriminate removal of vegetation cover triggered the phenomenon of soil erosions which kept on increasing with the vanishing forests from hilly and mountainous ecosystems. In the tropical and sub-tropical countries, where population pressure on forests was high, the intense monsoon rains accelerated the process of soil erosion. The high runoff and soil loss reduced the soil fertility, lowered organic carbon in the soil, created frequent moisture stress which lowered the production potential of the land. The frequent crop failures in the rain-fed conditions motivated farmers to integrate livestock in the farming system and shortage of farm grown fodder increased dependence on forests for fuel and fodder leading to accelerated deforestation. Ultimately, a vicious cycle of poverty and denudation started with downward spiral. The problems of poverty, deforestation, loss of productivity and biodiversity, floods and droughts and resultant social and economic crisis in rain-fed hilly and mountain regions of India posed serious challenges for natural resources conservation for sustainable and inclusive growth.

Participatory watershed development emerged as an important tool for economic and ecological rehabilitation of such degraded ecosystems where integrated , bottom up, need based and demand driven technological packages are adopted in active involvement of all stakeholders. The package includes biological and mechanical measures for soil and water conservation. The harvesting of runoff from treated watershed areas for easing the acute shortage of water forms part of the program. In order to prolong the life of storage reservoirs, the erosion control measures are adopted in the catchment areas for reducing the silt loads.

The Indian Himalayas have suffered the most from the onslaught of human interference resulting into vanishing natural forests. Due to its characteristic topography, geology and climate, the region is characterized by set of calamities in the form of excessive soil erosion, landslides and cloudburst which cause huge loss of life and property. Not only the problems of hill farmers increased but the reservoirs of prestigious hydro-electric projects like Gobind Sagar of Bhakhra Dam and Ranjit Sagar Dam started silting up very fast. Several integrated watershed development, drought prone area projects, river valley projects were initiated with State, Central and Foreign assistance to reverse the trend of natural resources degradation adopting participatory approaches. The need of energy is fast increasing in the country as the pace of economic development has been stepped up but faster siltation of reservoirs has become a matter of serious concern.

The silt loads have increased due to severe soil erosion, glacial melts, landslides and faulty road construction. This has necessitated the need of preparing comprehensive catchment area treatment plans popularly called CAT Plans for all the major river systems. This being a highly technical work, the services of private expert agencies are generally hired to prepare blue prints of CAT Plans.

The Shahpur Kandi Dam is being constructed across Ravi River 11km below the existing Ranjit Sagar Dam. The main purpose of this 55m high dam is to act as balancing reservoir for optimum utilization of release of Ranjit Sagar Dam and reduce the overflow of the river water to Pakistan. On completion, it would generate 200MW of power and irrigate 5000ha of land in Punjab and 32000ha of land of Sambha and Kathua districts of Jammu and Kashmir.

An area of 1760 hectares of Kathua district freely drains from hydraulic right in the reservoir of Shahpur Kandi Dam (SKD). In order to reduce the siltation problem of the reservoir of SKD, the Ministry of Forest and Environment (MOFE) a co-partner in this project has desired that the Catchment Area Treatment (CAT) Plan of the area be prepared. After deliberations, the work of CAT Plan was awarded to the Society for Promotion and Conservation of Environment (SPACE), a Chandigarh based Consortium of Experts in Watershed Development and Soil and Water Conservation and Management on 29.01.2021.The SPACE team visited the project area and marked the watershed boundaries on the Survey of India Topo-Sheet No.43/P/11 of 1:50000 scale. The major part of the catchment drains through Nora Nala and the remaining part drains through nine smaller gullies directly into the Ravi River. The road from Lakhanpur to Thein pass through the project area which mostly runs on the ridge line with catchment of Nora Nala on the north side and individual gullies on the southern side (Map). The details of CAT Plan prepared for 1760 ha drainage system are presented in this report.

CHAPTER 2

BIO-PHYSICAL CHRACTERISTIC OF THE PROJECT AREA

The salient features of 1760 ha freely draining area into Shahpur Kandi Dam reservoir area shown in the map drawn from Survey of India Topo-sheet no 43/P/11 and land set imagery.
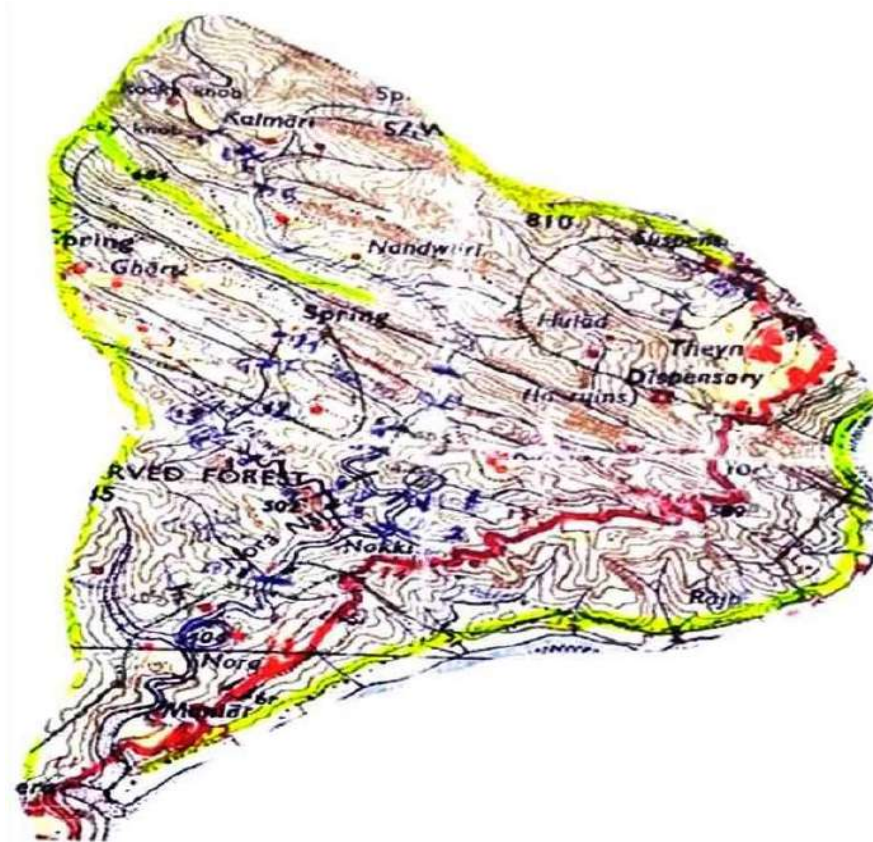
A view of Nora Nala from bridge on road to Thein Township

A view of Nora Nala is given below

This area is part of the Thein Wildlife Sanctuary and controlled by the Wildlife Protection Division Kathua. The highest flood level of SKD reservoir is 404.5m above MSL and the same is marked on pillars in the lower part of the catchment in Nora Nala (Photo).

The catchment area of Nora Nala is inhabited by small settlements of villages namely Nora, Nakua, Kurala, Gharti, Hulal, Nandwari and Kalmari. There are pockets of cultivated lands on hill tops of all these villages. The main Nora Nala has perennial flow of water round the year with large number of pools of water along its course (photo).

As the Nala widens in lower area, the velocity decreases and there is lot of sand and gravel debris off loaded by runoff water. The Nala meanders quite a lot in this portion and quantity and size of gravel increases with the width of the Nala (Photo).

9

Large numbers of smaller gullies (creeks) with steep slopes meet the main drainage line from both the sides and brings along with runoff load of gravels which form cones of transported gravel along the banks and this material is transported to main nala during rains (Photo). .

The silt and debris is in constant flux and moving downward with monsoon rains year after year (Photo).

This movement of debris is potential source of siltation and has to be checked by series of silt detention structures in the drainage lines.

Two gullies, one on opposite side of Nora and another 500m above on hydraulic right are full with large amount of stones. These are 400 to 500m long and 40 to 60m average width and slope of 3 to 5 percent. The stones and grave are in a flux and continuously move downward during floods (Photo).

The geological formation is of uplifted old river bed as indicated by round boulders on the vertical cliffs (Photo).

Due to soil erosion, the detached boulders are transported to the main drainage line and these are major source of sedimentation.

The catchment area has a serious problem of goat grazing as herds of goats browse every small tree and bush (Photo).

The area also falls on the route of *Bakarwals* who camp in the project area and denude the vegetation cover. Some of the erstwhile Bakarwals have settled at few locations along the course of Nora Nala and have started cultivation of crops.

There are signs of sand and gravel mining in the lower one third length of Nala and tractorable paths are used for this purpose. The Forest Department has carried out some plantations in blocks which are fenced. In view of wildlife needs most fruit plants are planted.

In the catchment area, there are vertical cliffs of sand stone which are devoid of vegetation cover and are prone to landslides and land slips.

In the different settlements, people keep livestock and heavily depend on the forest for green fodder. Head loads of pollarded green branches of fodder trees are carried to feed the livestock (Photo).

So far as the vegetation cover in the catchment of Nora Nala is concerned, there are two main categories. The southern facing desiccating slopes are dominated by thorny type bushes and also densely covered by Lantana an obnoxious weed with lot of leaf litter on ground but not allowing natural regeneration of useful tree species (Photo).

However, on the northern moist slopes, there is dense multilayer vegetation cover of trees on the top, bushes in the middle and grasses and large variety of small plants on the base (photo).

It was conspicuously noted that two most important plant species having strong root system and important members of conservation flora namely Jamoa and bamboo were present along the moist and perennial drainage lines.

The moisture loving plant species on northern slopes including mosses are very common and help in soil erosion control (Photo).

The Forest Department has constructed some dry stone structures in some of the creeks but most of these have silted and some are also damaged.

A cement concrete barrier wall was also constructed across main Nora Nala couple of years back but the same was breached and badly damaged (Photo).

Since the area is under wildlife sanctuary, efforts were also made to create some water sources for wildlife like baulies near natural springs (Photo).

Plantations have also been done in selected pockets and blocks are strongly fenced. The tree species which meet the requirements of wildlife are planted.

Rainfall amount and distribution

The rainfall records of Kathua were used to indicate rainfall amount and distribution from 2010 to 2018. The mean annual rainfall was 1307mm with mean monsoon rainfall was 1015mm which was 77.6 percent of mean annual rainfall (Table).

Table: Monthly rainfall (mm) of Kathua from 2010 to 2018

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2010	-	-	-	-	9	124	282	765	257	19	19	59	1534
2011	7	132	70	-	23	174	106	352	191	-	-	19	1074
2012	160	17	23	42	17	52	123	712	104	10	6	46	1312
2013	63	136	21	-	14	197	445	527	60	117	25	50	1655
2014	92	99	98	25	-	38	72	197	200	11	-	11	843
2015	20	84	54	82	2	52	286	342	188	36	-	-	1346
2016	-	2	95	-	-	145	427	349	181	-	-	110	1309
2017	120	29	11	10	-	118	316	532	100	77	8	105	1389
2018	-	66	9	17	-	62	267	626	167	9	6	17	1248
Mean	51	66	65	20	7	107	258	489	161	31	6	46	1307

Mean monsoon rainfall-1015, Percent monsoon rainfall=77.6

The designed rainfall for silt detention structures was taken as 1200mm because it would be monsoon rainfall which would generate runoff and peak discharge.

CHAPTER 3

TOPO SEQUENCE OF THE PROJECT AREA

The 1760 ha catchment area proposed for treatment to reduce silt load is basically divided into three drainage system:

A) Area directly draining into Ravi River = 425 ha
B) Areas of Thein Micro- Watershed = 122 ha
C) Areas draining through Nora Nala having 2 parts:
    a) Gharti micro-watershed draining into Nora Nala = 190 ha
    b) Catchment of main Nora Nala = 1023 ha

So 1213 ha drains through Nora Nala, 122 ha through Thein Micro Watersheds and 425 ha directly draining into Ravi River through small creeks. The Nora Nala catchment gets clearly divided into two segments. Area below road from Kurola to Gharti and area above this having settlement of Hulad and Kalmari. The main drainage line is divided into distinct parts as described below:

a) The length from the River Ravi to the elevation of 404.5 which would come under submergence. This part is 50-60m wide and full with boulders and no treatment is prescribed. The next length include one very wide khad locally called Chota Nala which joins main Nora Nala from hydraulic right opposite houses of Nora village. There are few houses on its left bank. This khad is 50-60m wide and about 1.5km long with large size gravel and steep slope. It appears difficult to hold back these stones with ordinary structural measures.

The area above 404.5m up to about 1km length another Khad joins the main Nora Nala from hydraulic right locally called Shikhri Nala which is relatively smaller in size but again full with boulders and gravels. It has about 50 ha catchment area with a km length. We have proposed RCC barrier walls to hold back the rolling stones.

In the main Nora Nala up to the settlement of Roshan Din, the nala is quite wide with presence of round boulders and at a narrow gorge first RCC silt detention structure (SDS) has been proposed.

b) Beyond this point the concentration of boulders decrease, the gradient reduces but base flow continues.Near the settlement of Bashir Ahmed, Gharti Nala (Gharti is small village at the top) joins from the hydraulic right having catchment area of 190ha. Gharti Nala is excessively wet, with dense vegetation cover as most part is located on northern aspect. The gradient is gentle and we have proposed four RCC Structures at narrow gorges.

c) Coming to the main Nora Nala beyond Bashir Ahmed settlement, the Nala meanders a lot in a 2km stretch with gentle gradient but base flow remains. In this stretch, we could locate suitable sites for RCC, SDS. The second SDS was selected near Bashir Ahment settlement (big mango tree), third Jaman wala and fourth one across Nada wala all in series. After this Nada wala structure, nala assumes narrower section and easy transport of material is difficult. However, one SDS was proposed at a narrow section.

d) In the fifth stretch above Kacha path from Karola to Gharti, there is one extremely narrow gorge with converging shoulders. But due to a large pool of water below the narrow section, no structure was proposed. But about 20m below and above the bridge a 30 m long circular barrier wall was proposed to act as silt trap. One CC SDS was proposed across khad draining from left side just by the left side of the narrow gorge

e) Beyond this narrow neck, Nora Nala takes a turn towards north, pass through very narrow inaccessible stretch which is full with vegetation cover having a length of 2km up to the base of village Kalmari. It is humanly not possible / advisable to traverse this area and taking construction material without cutting large number of mature trees is not possible. Since there is good natural vegetation cover, it could easily be left as such.

Thein Micro Watershed Catchment

The Thein micro-watershed mainly comprise of cultivated lands and Abadi of Thein village in the lower area and steeply sloping forest lands at the top bringing runoff of Palakhi Nala, Bagh Nala and Thundu Ram Nala.

Palakhi Nala forms the last drainage system having forest at top and small patch of cultivated land just below the Basoli Road. There is sharp curve and pulley over this Nala and it drains very close to the power house. Two silt detention structures have been proposed across the khad one above the road and second below the road just above the cultivated land.

The Bagh Nala has long narrow drainage line traversing through rocky hill slopes and enters the cultivated lands just close to Bagh settlement. There is base flow in this Nala and water is taken through rubber pipes to crop lands down below. In the cultivated lands down below, it cause lot of bank erosion. A silt detention structure has been proposed across this khad where Nala enter the farm lands.

The Thundu Ram Nala is between the Palkhi and Bagh Nala having relatively smaller catchment area. A SDS site was selected near the house of Thundu Ram House just below a well. This nala also cause lot of bank erosion in cultivated lands down below. Very close to the Basoli Road, just above the bridge, a check dam has already been constructed.

All these three nalas of Thein micro-watershed joins together just below the Ranjit Sagar Dam and a diversion drain has been constructed to divert their flow to protect the power house.

Area above Karola – Gharti Road

A very sharp narrow rocky shoulders join together just above the bridge to Gharti village. This narrow rocky neck is just 4m wide and steep rocks on both sides and a big pool of water below made this site not suitable for any type of structure. However, below the pool of water and above the bridge, a C type structure with length of 30m and 20m spillway section has been proposed to work as a silt trap. Very close to the neck, a gully joins from Hydraulic left on which a 2m high SDS has been proposed. Below this, one SDS was provided across a gully coming from right side and one RCC structure was proposed in the main Nora Nala. Below this structure, rest of the structures was inspected by traversing from lower area.

The area from Korala to Kalmari settlement is above the explained narrow neck and main drainage line takes a left turn and traverse along a sharp rocky hill slope up to Gujjar Basti of Kalmari and thereafter assumes a very narrow section and traverse through rocks to the ridge line. While on the hydraulic right is rocky forest land in a stretch of 2km but on the left, below the hills there are patches of flatter lands where pockets of cultivated lands of Kalmari are located in three different patches. There are bare rocky slopes in this area (Photo).

Photo: Kalmari area settlements and cultivated crops and meeting with farmers

We inspected the whole area and noted that all the smaller nalas draining from left side and join the main Nora Nala, are very steep, rocky and no suitable site for any type of SDS could be located. However, in the main Nora Nala, there is perennial flow, rocks on both the sides and pools of water all along the course up to Gujjar Basti. In this, we could locate two narrow necks one at the lower area and one below the Gujjar Basti where two RCC structures were proposed without apron and side walls because of the presence of hard rock in the bed and sides and then a steep fall. In between, just above the Nala coming from the side of Primary School Kalmari another RCC structure was provided.

In this whole stretch, three structures were proposed between the last narrow neck and narrow neck above the bridge to Gharti, the entire stretch is too difficult to carry out any type of Civil Work due to terrain related problems.

The Kacha Road up to Kalmari is tractorable or reachable by Tata Sumo type vehicle. Beyond the Kacha road, material shall have to be transported by mules. Rock cutting would be required to lay the foundations and side walls. The area is indeed difficult for the construction of civil work.

There is long narrow belt of forest land between Ravi River and pacca road from Nora Bridge to the Thein village. At the top along the road in a stretch of 5km, some khads originate close from the road which drain towards north and ends at the Nora Nala. However, nine small khads (creeks) starts from top near road and ends at the steep bank of Ravi River (Photo).

All these khads draining directly in the Ravi River are having steep gradient, are full with natural vegetation and would need few crate wire structures but main focus would be the reinforcement with bio-engineering measures where Bamboo needs to be preferred. The lower part of slopes would come under submergence. The Ravi River bed below these slopes is full with transported debris and stones with no tree and bush growth. Some signs of stone mining are visible in this area.

CHAPTER 4

DRAINAGE LINE TREATMENT

After detailed inspection of the catchment area mainly through the main drainage line, the following lines of action appeared appropriate to control the silt load to the reservoir of SKD.

4.1 Low height silt detention structures (SDS)

These check dams/drop structures to break the velocity of water and detain silt has been proposed in the main drainage line at strategic locations having the following features:

a) Relatively narrow gorges with converging shoulders of stable rock
b) Low gradient in the nala above the proposed structures so as to have more debris storage capacity.
c) Relatively open bowl above the structure for more storage capacity

Since, the purpose of CAT Plan is to arrest silt and not to store water, low height structures of 1.5 to2m net height are proposed. This is also necessary as some of the fields located close to the drainage line may not get submerged. These structures are planned in series giving due consideration to head and toe relationship but also keeping reasonable distance of 400 to 500m between them. Starting the work above 404.5m the catchment area of main Nora Nala is quite large 1500 hectares and runoff volumes are quite high particularly at peak discharges. RCC structures are suggested for strength and stability in the main nala and CC structures across smaller khads draining from the sides.

Generally there are hard rock sections at narrow gorges across which structures have been placed.

Similar low height RCC check dams are proposed in the 190 hectare catchment of Gharti Nala draining in the main from hydraulic right but having independent self defined catchment.

The area below 404.5 levels shall come under submergence and water shall enter into the creeks, so no treatment is proposed.

4.2 Planning and Site Selection Criteria

The planning principles of permanent soil erosion control structures as prescribed in the standard books and manuals (List given in annexure) have been followed. Since, the main objective of the CAT Plan is to hold back the boulders and sediment in the catchment area but not to hold back runoff as the same is needed to augment the storage capacity of SKD reservoir, the height of structures have been restricted to 1.5 to 2m in general. The following site selection criteria were followed:

a) Relatively narrow section in the drainage line. This can be inferred from the survey sheets contours and also be site inspection.
b) Stable converging shoulders of hills to anchor the structure on both sides. The land slip zones were not considered due to their weak geology. These shoulders are permanent features of consolidated sand stone rock.
c) As there should be sufficient debris storage capacity above the structure, efforts have been made to prefer wider bowls.
d) The steeper the slope in the drainage line, lesser is the storage capacity of any structure put across the flow path. The stretches having relatively milder slopes above the structures were prioritized.
e) No structure has been put at curvatures but with almost clear straight line of Nala above the settlement.
f) Efforts have also been made that the cultivated fields along the Nala are not submerged.

4.3 Design of Silt Detention Structures

The standard designs of drop spillways have been provided in large number of books and manuals on soil and water conservation / watershed management. The basic principles remain the same. We have followed the Participatory Integrated Watershed Management (A field manual) published by the Central Soil and Water Conservation Research and Training Institute (2006), 218 Kaulagarh Road, Dehra Dun, Uttaranchal.

In case of drop spillway (we name them silt detention structures) is a weir structure where the flow passes through the weir opening, drops to a level apron or spillway basin and then passes into the downstream channel across a toe wall. The drop spillways are used in gully stabilization, and grade control for stabilizing channels and water ways.

The design is basically divided into three parts namely hydrological design, hydraulic design and structural design. In the design, some experience dictated additions have also been suggested

Hydrological Design

The rainfall data of Basoli town which is nearest to the project area was collected. It was noted that the annual rainfall of the area varies from1100 to 1600 mm with average of 1300 mm.

The peak rate of runoff expected during the recurrence interval of 25 years from the watershed was computed using the Rational Formula given below:

Q = CIA / 360 where Q = Designed Peak rate of runoff m^3/sec
C = Runoff Coefficient
I = Intensity of rainfall mm/hr for the duration equal to time of concentration
A = Area of the water in hectares

The intensity of rainfall of 120mm/hr has been taken as prevalent norm of Shivalik of this region. The norms of 120mm/hr are explained as under:

Taking elevation difference of 64m and length of channel as 4500m the time of concentration comes to 1hr. The one hour intensity of rainfall for 25 years recurrence interval is 120mm/hr.

(This is from Watershed Management EM Tideman Omega Scientific Publishers New Delhi Page pp82-85.)

The C Value of forest land on sandy loam soil and overall 5-10% slope is 0.25. However, there is dense forest cover in almost 50% area with three layers vegetation cover. Another 15% area is under dense lantana and bush cover, hence the C value of 0.20 has been assumed in such a case. But when vegetation cover decreases and rocky areas are included, 0.35 has been taken as C value.

The area draining at the proposed site has been calculated from the Survey of India Topo sheet of 1:50000 scale

Hydraulic Design

The discharge through the broad crested rectangular spillway is governed by the following formula

$Q = 1.711 \, LH^{3/2}$ where
Q = Maximum discharge capacity of the weir including free board m^3/sec
L = Crest length of the weir m
H = Depth of flow over the crest m

This formula is slightly modified where there is possibility of wave action and about 10 percent more capacity of weir is provided. However, in our case, the trough area is very small and wave height generation in deep gorges in not possible and hence this factor was not considered.

The equation contains two unknown variables L and H and the equation cannot be solved as such and require some hit and trial. Based on gully cross section, generally the values are adjusted. Assume a suitable value of H when H/F (F is drop or fall) is >0.5 and maximum up to 0.75. By putting the value of H in the above equation, L is determined and adjusted to the cross section of the gully.

Structural Design

After L, H and F are decided by the hydraulic requirement, the dimensions of the component of the structure are computed from the following empirical relations:

E = Maximum length of head wall extension m
$= (3H + 0.6)$ or $1.5 \, F$
In case H is 1m it would be 3.6m
In case fall is 2m, it would be 1.5 X 2 = 3.0m
Take whichever is greater
L = Length of apron m
$= F (2.28 \, h/f + 0.52)$ [h is net height without wave height]
= For one m height and 2m drop
$L = 2(2.28 \times \frac{1}{2} + 0.52)$
$L = 2(1.14 + 0.52) = 2 (1.66) = 3.32m$
This equation can be simplified by
$L = 1.5 \, F + H = (1.5 \times 2) + 1.0 = 4.0m$
It is safe to take 4.0m for a fall of 2m
For drops above 2m, the above equation can be applied
S = Height of the end side m = H/3 m

Foundation depth is generally taken as 1/3 of total height. In plain concrete, the apron thickness is kept as 0.2 to 0.3m for height up to 3m. For masonry and gabion construction, the same is measured by 1.5 to 2.0 times.

The top and base widths of different walls of spillway are taken from the following table:

Type of construction	Maximum top width (m)	Maximum Base Width	
		Head Wall	Side Wall
Plain Concrete	0.25	0.67 (F-0.4) + 0.25	0.55 (F-0.45) + 0.25
Masonry	0.45 (Head Wall)	0.67 (F-0.67) + 0.45	0.55 (F-0.55) + 0.30
Gabion	0.75	0.67 (F-1.12) + 0.75	0.55 (F-1.40) + 0.75

Taking plain concrete with 2m fall

Head wall Base Width = 0.67 (F-0.4) + 0.25
= 0.67 (2-0.4) + 0.25
= (0.67 x 1.6) + 0.25
= 1.07 + 0.25 = 1.32m
In case we take 0.7 x Fall = 0.7 X 2 = 1.40
So we can take 0.6 to 0.7 of fall as base width of head wall or crest wall
Side wall base width = 0.55 (F – 0.45) + 0.25
= 0.55 (2 – 0.45) + 0.25
= 0.55 (1.55) + 0.25
= 0.85 + 0.25 = 1.1m

We take 1m base width for 2m drop

Top width of head wall is taken as 0.2 to 0.3 of drop

The head wall extensions and side walls are supported by earth fill on both the sides.

Load calculation on different parts of silt detention structures

As per Frewert et. al;1955, the stability of the soil conservation structures to remain unmoved by the forces acing upon them depends upon the ratio of forces capable of resisting movement to those forces that cause movement is approximately 1.5. In case of larger structures, the stability against headwater pressure, resistance to horizontal shear and the shearing stress in foundations are duly considered in the structural design. However, in case low height soil conservation masonry structures, the desired safety is provided by taking foundations of headwall/crest up to impervious layer, anchorage of structure to stable hill shoulders by headwall extensions, added stability by sidewalls, strong apron and deeply imbedded toe wall. In addition, when the crest length is more than three meters, butterest walls are provided at three meter interval. These support walls are netted with crest, pass through apron and linked to toe wall to make the structure stable against headwater pressures. Such structures remain safe against sliding and overturning. Long experience of constructing such RCC silt detention structures even up to five meter height has proved their strength and stability.

The designs of Nora Nala drop spillways are based on 2m drop and above formulae in simplified forms have been used.

Survey work in the drainage lines and interaction with farmers

4.4 Expected water yield

The expected annual water yield of 1760 ha catchment with 1200 mm mean annual rainfall has been worked out. The rainfall records of Kathua indicated 1050mm long time average and Basoli 1300mm. As catchment area falls between the two, so an average of 1200 mm has been considered. The common norms for Kandi area has been assumed to get the average water yield.

The mean annual rainfall of the project area	= 1200mm
The mean monsoon rainfall (80% of total)	=960mm
The mean runoff producing (60% off monsoon) rainfall	= 576mm
The integrated runoff coefficient of the forest dominated area	=0.30

This means 30 percent of runoff producing rainfall would end up at the reservoir. Small storms of less than 15mm would produce very negligible runoff. Most rainfall would be intercepted by multi-layered vegetation and leaf litter on the ground. However, larger storms and of high intensity may produce runoff of 60% of rainfall. Considering this fact,the C value of 0.2 and 0.35 have been taken in the estimates depending upon the features of the vegetation cove complex. The integrated value of 0.30 has been considered in this computation.

The expected water yield per unit area (576x0.3) = 173mm or 0.173m

The expected water yield of the catchment area = 1760x0.3= 528ham or 5280000 m^3

So, on an average, the freely draining catchment area is expected to augment the storage capacity of SKD reservoir by fifty two lakh eighty thousand cubic meters.

4.5 Expected Sediment Yield

Based upon the earlier studies on the silt yield of Shivalik watersheds and our own experiences of water harvesting dams, it is assumed that northern aspect slopes with dense vegetation cover may produce around 15t/ha/yr as silt load. However, the relatively under stocked southern slopes with high drainage density may produce around 40t/ha/year. With all the proposed works and effective closure and integration of vegetative measures, the overall 30t/ha/yr may come down to around 10t/ha/yr which is the permissible limit of such watersheds.

So, the present sediment load is expected as 30t/ha/yr or 52800t/ha/yr

The expected sediment load after proposed catchment treatment is 17600t/ha/yr.

The area below Nora Nala Bridge and along the upstream side of Ravi River on the right flank below the hill slope is a huge stone and debris filled basin with no tree and not even bushes. This area would be submerged in due course and filled with transported silt. This part falls in J and K state. In case there are no legal. Environmental and dam design related issues, this area could be de-silted and material appropriately used. This would not only generated revenue but also increase the storage capacity of the reservoir. The increase in storage capacity would be much more than the loss through siltation by the Nora Nala catchment.

CHAPTER 5

BIO-ENGINEERING MEASURES

Bio-Engineering is the homeopathy of Soil and Water Conservation Technology but basically it does not receive the attention it deserves in the restoration of degraded ecosystems. The Mother Earth always tend to cover the soil surface with type of vegetation to protect it from erosive powers of the rainfall and preserve soil and nutrients for biological growth. In most of the Catchment Area Treatment Plans of the Rivers, 15-20% of the total funds are earmarked for bio-engineering measures. In the maintenance of hill roads and protection against landslides, different types of vegetative measures are employed for retaining the hill slopes. In case of hydro-electric projects, the debris generated from the excavation of tunnels is dumped on identified areas and covered with different plants species for eco-restoration of that area. In case of the treatment of Nora Nala Catchment, in addition to the mechanical measures, the adoption of bio-engineering measures is equally important and should be made integral part of the treatment package. Some of the works on bio-engineering measures like bamboo plantation had already been done and this needs to be enlarged to cover more vulnerable areas.

The soil and water conservation technology is basically divided into two categories namely mechanical measures and biological measures. In case we remove the human interventions, the nature would nurse and protect the mother earth against the erosive powers of rainfall (its kinetic energy) by dense cover of vegetation starting from mosses on hard rock to trees and bushes depending upon the ecology of the ecosystem. Biotic pressure and forest fires have drastically reduced the protective power of the natural vegetation thus requiring the mechanical measures to reverse the process of degradation of forest areas. Once closed and fenced the natural vegetation takes over to protect the soil and conserve rainwater.

The catchment areas of Nora Nala and the adjoining areas suffer from intense biotic pressure including grazing by herds of sheep and goats and repeated cycles of Bakarwals. The geological formation are young, fragile, heterogeneous and unconsolidated and erode very fast once the protective vegetation cover is lost. Once the soil erodes, the finer soil fractions are carried away by runoff, the coarse sand and gravels remains with gradual reduction in soil depth. As the soil depth decreases, the trees are replaced by bushes and often bushes are replaced by grasses and bare rocks gets exposed in extreme circumstances. In the catchment of Nora Nala, there is thick vegetation cover on northern aspects and valleys but hill tops are highly eroded and devoid of vegetation cover and rocks are exposed particularly in Kalmari area..

While traversing the catchment area it was observed that most common trees are Khair, Simbal, Jamoa, Chir, Kamel, Dhak, Mango, Amaltas, Bahera, Amla, Swanjna, Shehtoot. Bamboo plantations have also been carried out in pockets. The dominant bushes include Lantana, Basuti, Kari Patta, Karonda and Beri. Large size Jamoa trees with very strong root

system are seen along the drainage lines. At some moist sites on northern aspect, even the rocky slopes are covered with mosses.

The bio-engineering measures commonly followed include brush wood check dams, vegetative barriers, live hedges and plantation of erosion resistant plant species like vetiver , vitex, Arundo donax, Agave, Ipomea, and Bamboo. Brush wood check dams have a problem of termites and vegetative barriers across the slopes in the smaller creeks starting

from top remains a better option. The earlier experiences show that Bamboo plantations have come up well and intensive plantation of Bamboo along the drainage lines is suggested. Vegetative measures are also proposed to stabilize the landslide areas. Effective closure is the single most important measure and more area needs to be covered.

Main Challenges

Nora Nala catchment comprise of one of the most difficult terrain and landscape for soil and water conservation treatment. The main challenges are:

a) Most of the catchment area drains through Nora Nala having large catchment area of about 1400 ha including one micro-watershed of Gharti of 190ha, The overall discharge is so large that structures when needs to be constructed in series would need lot of strength and RCC support for stability.

b) The major construction challenges are the regular flow of water round the year and pools of water here and there. The work has to be done under water flowing conditions by putting caufer dams and shuttering and engines to dry out the foundations.

c) Transport of material for RCC structures (steel, bajri, sand) may be possible for few structure but some of the sites are not tractorable and transport through mules shall be required.

d) Large size stones are not available and removal of stones from the bed is not advisable. So the carriage of stones from outside for crate wire structures is a problem.

e) How to hold back large quantity of stones from Bada Nala and Shikri Nala need special type of measures and this need discussion.

f) Lastly, in case work is to be executed by the Wildlife Protection Department, the core competence of the front line staff and need of expertise in civil engineering works are the issues for discussion.

g) The working period may be short in view of continuous flow of water round the year.

CHAPTER 6

PLANNING AND DESIGN OF STRUCTURES

After detailed survey, the following list of silt detention structures was compiled and accordingly the plans and estimates were prepared which are covered in this chapter.

Sr. No	Details of Structures	Area (Ha)
	NORA NALA	
1	RCC Silt Detention Structure No.1 Kulmari Near Gujjar Basti	75
2	RCC Structure 2 Kalmari Below School Left Side Hard Rock	90
3	RCC Silt Detention Structure No.3 Kalmari Above Narrow Neck	180
4	CC Silt Detention Structure No.5 just above Bridge	40
5	RCC SDS No.4 Across Main Nora Nala below pool of water above bridge (C-shape)	640
6	CC Silt Detention Structure No.6 (Main Below Bridge) Right Side	32
7	RCC Silt Detention Structure No.7 Across Nora Nala (Big Stones access problem)	710
8	RCC Silt Detention Structure No.8 Nada II across Main Nora Nala	755
9	RCC Silt Detention Structure No.9 Nada I Field at Top Across Main Nora Nala	810
10	RCC Silt Detention Structure no.10 (Jamanwala) Across Main Nora Nala	840
11	CC Silt Detention Structure No.11 Village Karola at Top	60
12	RCC Silt Detention Structure No.12 Near Basir Ahmed Settlement Across Main Nora Nala	910
13	RCC Silt detention structure no.13 near Roshandin Settlement across main Nora Nala	1220
14	RCC SDS No.14 Across Shikhri Nala Village Nora (Right Side)	52
15	7 No. Silt Detention Wire Crates Structure Both Side of Barha Nala (10-12 Ha) 2m crest-big	10-12
16	6 No. Silt Detention Wire Crates Structure Both side of Barha Nala (10-12 ha) 1.5m crest-small	10-12
	GHARTI NALA	
1	Silt Detention Structure No.1 - Extension of Head Wall	Ext.
2	CC SILT DETENTION STRUCTURE NO – 2	20
3	CC Silt Detention Structure No.3	40
4	RCC SDS No.4 Across Gharti Nala (Narrow Side Gully)	50
5	RCC SDS No.5 Across Gharti Nala	75
6	RCC SDS No.6 Across Gharti Nala	170
7	RCC SDS No.7 Across Gharti Nala	190
	THEIN MICRO-WATERSHED	
1	CC Silt Detention Structure No.3 Across Bagh Nala	52
2	CC Silt Detention Structure No.4 Across Thundu Ram Nala-I)	43
3	CC Silt Detention Structure I across Palki Nala	40
4	CC Silt Detention Structure No.2 Across Palki Nala	48

DRAINAGE SYSTEM OF PROJECT AREA

NOT TO SCALE

N

1 KALMARI

2

3

III

NANDWARI

GHARTI
WATERSHED

II

1

2

3

4   5

6

7

14

15

16

404.5

NORA

5

6   4

7   NADA-II

8   NADA-I

9   JAMANWALA

10

11

12

13

NAKKI

BASHIR AHMED

ROSHANDIN

BASOLI

THEIN MICRO-
WATERSHED

PAKKI   BASOLI

3

2   4   Ranjit Sagar Dam

1

HILAD

BAGH   THEIN

KUROTA
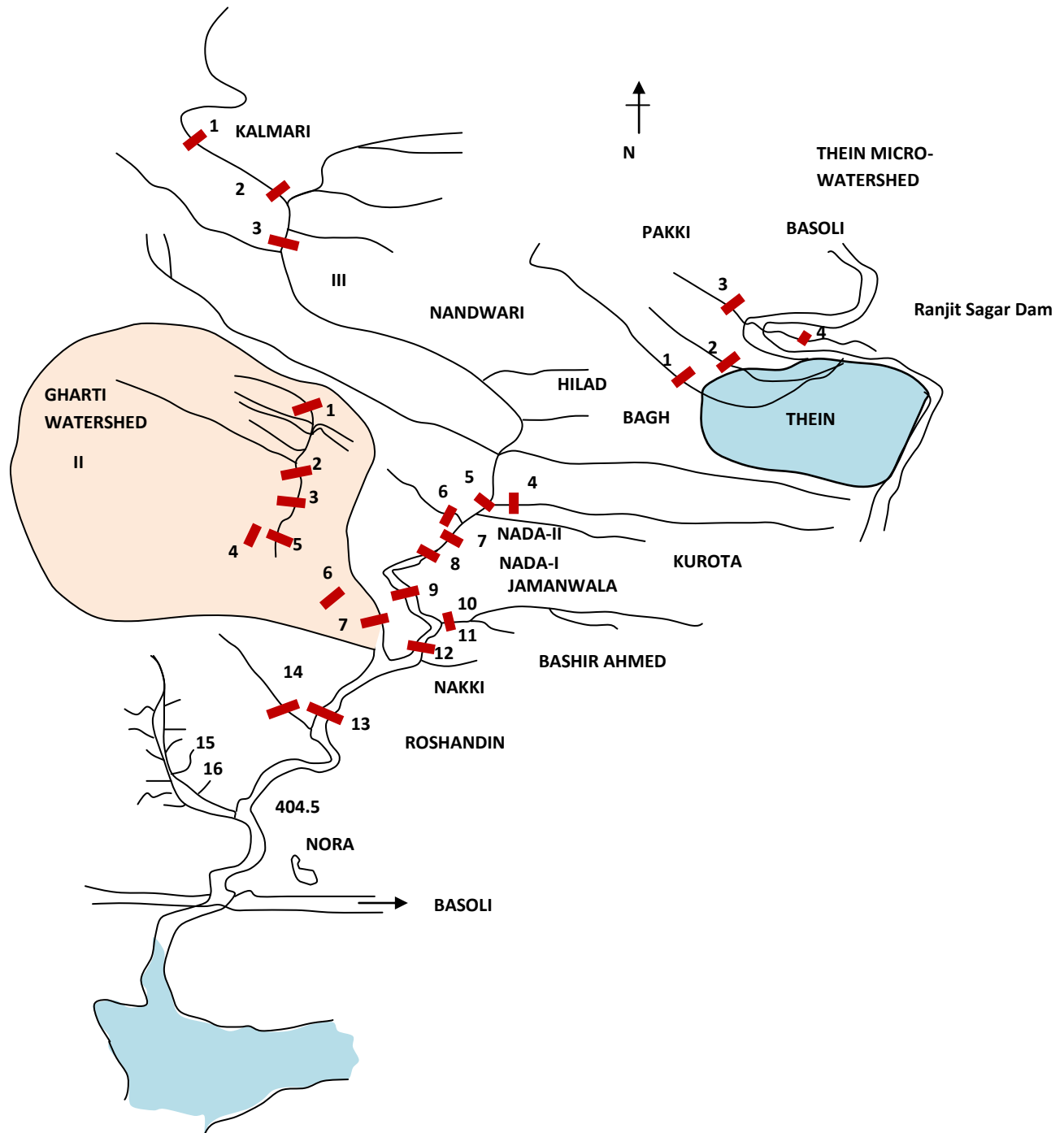
6.1 Silt Detention Structures in Nora Nala Catchment

RCC Silt Detention Structure No.1 Kulmari Near Gujjar Basti

1. **Hydrological Design**

Catchment Area (A) = 75 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 75 / 360 = 8.75 cum/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 1.0

8.75 = 1.711 L X 1 X √1

L = 8.75 / 1.711 = 5.11 say 5.0m

3. **Structural Design**

Drop = 2.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC Silt Detention Structure No.1 Kulmari Near Gujjar Basti

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation (Hard Rock) Head wall & Head wall extension	1	6.00	1.30	1.00	7.80 cum
	Anchoring of H.W Ext. L/Side Part A	1	10.50	0.80	0.50	0.42
	B	1	12.0	0.80	0.50	4.80
	C	1	13.0	0.80	0.50	5.02
	D	1	14.50	0.80	0.50	5.60
	E	1	6.50	0.80	1.0	5.20
	F	1	4.50	0.80	1.0	3.60
						32.44
2	CC 1:6:12 in foundation					
	Head wall & H.W. Ext	1	6.0	1.30	0.15	1.17cum
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	6.00	1.00	0.85	5.10cum
	Above foundation H.W. & H.W Ext Part A	1	10.50	0.60	0.50	3.15
	B	1	12.00	0.60	0.50	3.60
	C	1	13.00	0.60	0.50	3.90
	D	1	14.50	0.60	0.50	4.35
	E	1	6.50	0.60	1.0	1.90
	F	1	4.50	0.60	1.0	1.35
						19.00
4	Form work – Foundation					
	Head Wall & HW Ext.	1 X 2	7.0	-	1.0	14.00
	Head Wall & H.W. Ext above foundation Part A	1 X 2	10.50	-	0.50	10.50
	B	1 X 2	12.00	-	0.50	12.00
	C	1 X 2	13.00	-	0.50	13.00
	D	1 X 2	14.50	-	0.50	14.50
	E	1 X 2	6.50	-	1.00	13.00
	F	1 X 2	4.50	-	1.0	9.00
						86.00sqm
Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars 15cm c/c	500/15	33	2.50	82.50m say 83m	12mm Q
	10mm Q Horizontal bars 30cm c/c	200/20	10	5.50	55m	10mm Q

12mmQ 83 X 0.89   = 73.87

10mm Q 55 X 0.62   = 34.10

= 107.97 say 108kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	5.10	11.73	2.55	5.10	-
2	C.C 1:2:4	19.00	123.50	8.55	17.10	108kg
			135.23	11.10	22.20	108kg
		Say	135 bags	11.0 cum	22.00 cum	108 kg

RCC SILT DETENTION STRUCTURE – I KULMARI NEAR GUJJAR BASTI

0.60

1.00

0.60

12MM VERTICAL BARS 15CM CC

2.00

10MM HORIZONTAL BARS 20CM CC

NSL

NATURAL APRON HARD ROCK

0.85

0.15

HARD ROCK

1.30
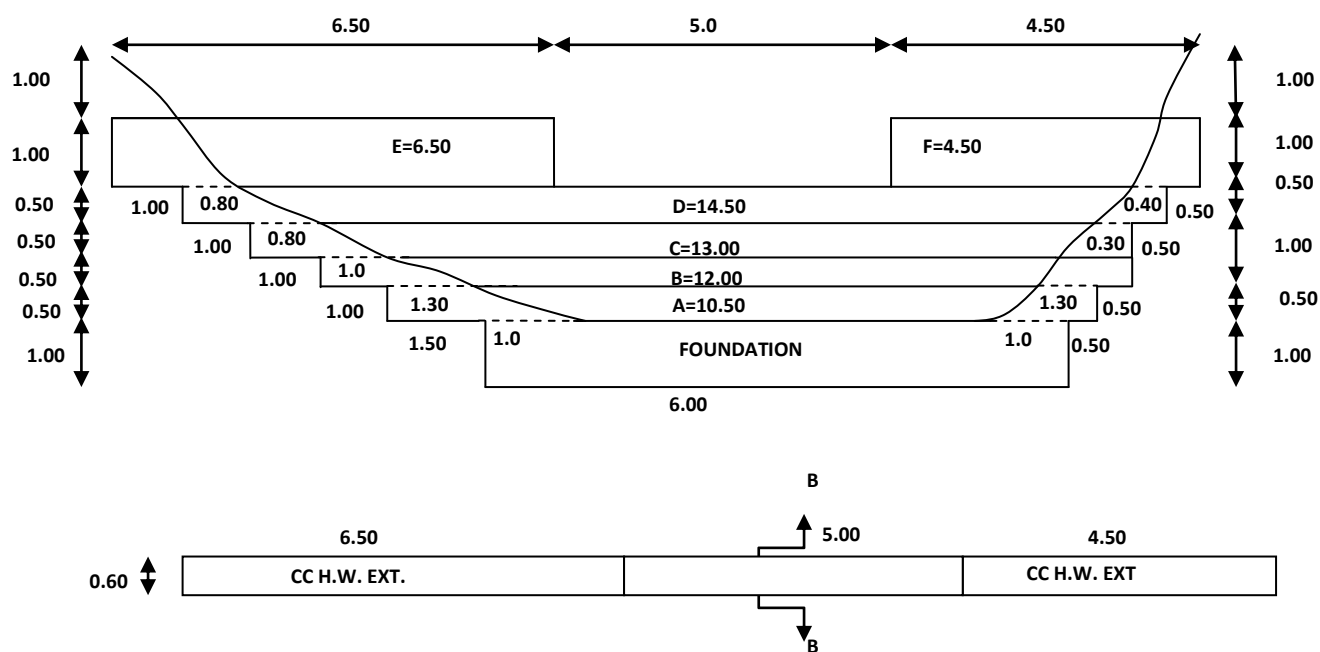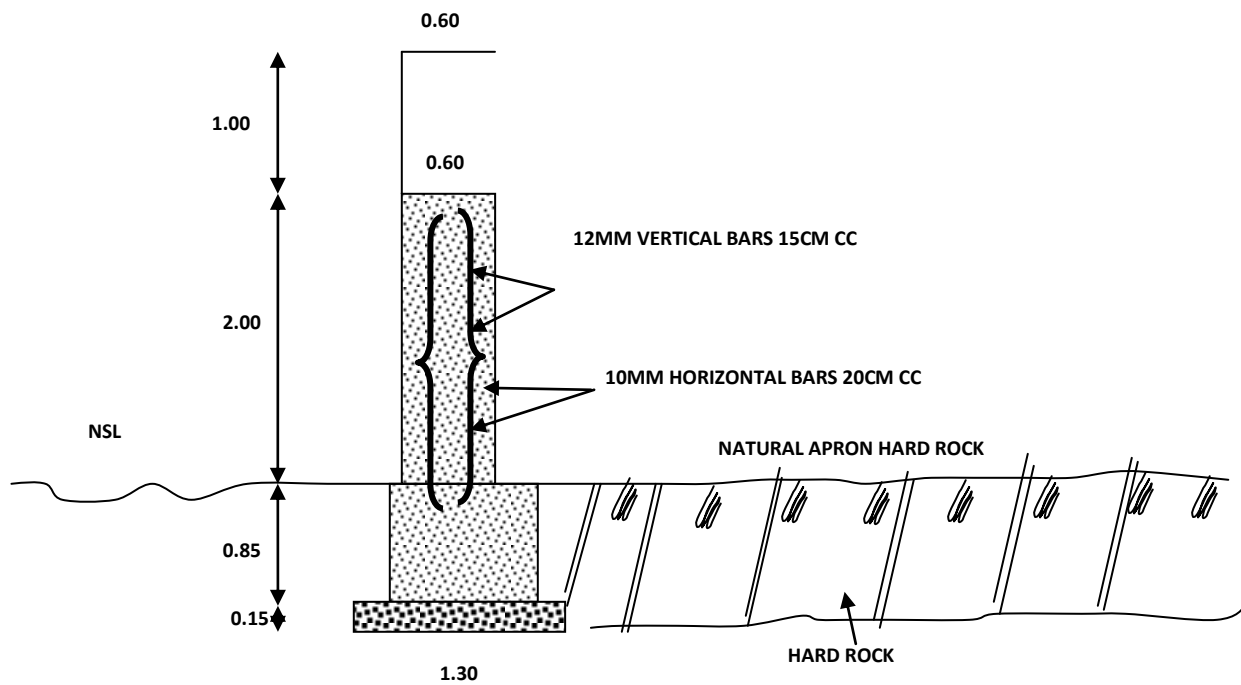
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Structure 2 Kalmari Below School Left Side Hard Rock

1. **Hydrological Design**

Catchment Area (A) = 90 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 90 / 360 = 10.5 m3/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 1.0

$10.50 = 1.711 \, L \times 1 \times \sqrt{1}$

L = 10.50 / 1.711

= 6.13 say 6.0m

3. **Structural Design**

Drop = 2.0

H = 1.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1.00 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC Structure 2 Kalmari Below School Left Side Hard Rock

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall & Head wall extension	1	8.0	1.30	1.0	10.4
	Toe wall & T.W. Ext	1	9.0	1.30	1.0	11.70
	Toe wall protection work	1	1.25	7.0	0.45	3.93
	Apron	1	3.50	7.30	0.45	11.49
	H.W. Ext L/side 1st Step	1	2.00+0.30/ 2	0.80	0.75	0.80
	2nd Step	1	1.70+0.60/ 2	0.80	0.75	0.69
	3rd Step	1	1.10+0.60/ 2	0.80	0.50	0.34
	4th Step	1	2.10+0/2	0.80	2.00	0.58
	R/side 1st Step	1	1.20+0.50/ 2	0.80	0.75	0.51
	2nd Step	1	1.25+0.50/ 2	0.80	0.75	0.52
	3rd Step	1	1.25+0.50/ 2	0.80	0.50	0.35
	4th Step	1	2.0+1.20/2	0.80	1.10	1.40
						43.42
					Say	43.00cum
2	CC 1:6:12 in foundation					
	Head wall & H.W. Ext	1	8.0	1.30	0.15	1.56cum
	Toe wall & T.W. Ext	1	9.0	1.30	0.15	1.75
	Toe wall Protection	1	1.25	7.0	0.15	1.31 cum
	Apron	1	3.50	7.30	0.15	3.83
						8.45
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	8.0	1.0	0.85	6.80
	Toe Wall & Ext	1	9.0	1.0	0.85	7.85
	Toe Wall Protection	1	1.25	7.0	0.30	2.62
	Apron	1	3.50	7.30	0.30	7.66
	Head wall & H.W. Ext Part A	1	10.0	0.60	0.75	4.50
	B	1	11.50	0.60	0.75	5.17
	C	1	13.0	0.60	0.50	3.90
	D	1	4.50	0.60	0.50	1.35
	E	1	4.50	0.60	0.50	1.35
	F	1	4.50	0.60	0.50	1.35
	G	1	5.50	0.60	0.50	1.65
	Toe Wall & T.W Ext	1	9.00	0.50	0.50	2.25

	T.W. Ext	2	1.50	0.50	1.00	1.50
	Side wall Part A	2	0.90	0.50	3.00	2.70
	Side wall Part B	2	0.50	0.50	1.50	0.75
	Side wall Part C	2	3.00	0.50	3+1.50/2	6.75
	Buttress Part A	1	0.50	0.50	1.50	0.37
	Buttress Part B	1	3.50	0.50	1.50+0.50/2	1.75
						60.07
4	Form work – Foundation					
	Head Wall & HW Ext.	1 X 2	9.0	-	1.0	18.0 sqm
	Toe Wall & T.W. Ext	1 X 2	9.0	-	1.0	18.00
	Toe wall protection work Length	1	7.0	-	0.45	3.15
	Width	1 X 2	1.0	-	0.45	0.90
	Apron	1 X 2	7.30	-	0.45	6.57
	Above foundation Head wall & H.W. Ext Part A	1 X 2	10.0	-	0.75	15.00
	B	1 X 2	11.50	-	0.75	17.25
	C	1 X 2	13.00	-	0.50	13.00
	D	1 X 2	4.50	-	0.50	4.50
	E	1 X 2	4.50	-	0.50	4.50
	F	1 X 2	4.50	-	0.50	4.50
	G	1 X 2	5.50	-	0.50	5.50
	Toe wall & T.W. Ext	1 X 2	9.00	-	0.50	9.00
	T.W. Ext	2 X 2	1.50	-	1.00	6.00
	Side walls Part A	2 X 2	0.90	-	3.00	10.80
	Part B	2 X 2	0.50	-	1.50	3.00
	Part C	2 X 2	3.0	-	3+1.50/2	27.00
	Buttress Part A	1 X 2	0.50	-	1.50	1.50
	Part B	1 X 2	3.50	-	1.50+0.50/2	7.0
						175.17
					Say	175.00sqm
5	Filling of E/work behind the side wall					
	L/Side	1	4+1/2	4.0	3+1.50/2	22.50
	R/Side	1	5+1.0/2	4.0	3+1.50/2	27.0
						49.50
					Say	50.00
6.Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars 15cm c/c	600/15	40	2.50	100m	12mm Q
	10mm Q Horizontal bars	200/30	7	6.50	65m	10mm Q

	30cm c/c					
2	Toe Wall 12mm Q Vertical Bars 15cm c/c	900/15	6.0	1.00	60m	12mm
	10mm Q Horizontal bars 30cm C/C	50/20	2	9.50	19m	10mm Q
3	Apron					
	12mm Q long bars 20cm c/c	400/20	20	6.50	130m	12mm Q
	10mm Q cross bars 20cm c/c	600/20	30	4.50	130m	10mm Q

12mmQ 100 + 60 + 130 = 290m X 0.89   = 258.10

10mm Q 65+19 + 130 = 214m X 0.62   = 132.68

                                   = 390.78 say 391kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	8.45	19.43	4.22	8.44	-
2	C.C 1:2:4	60.07	390.45	27.03	54.06	391kg
			419.88	31.25	62.50	391kg
		Say	420 bags	31.0 cum	62.00 cum	364 kg

RCC STRUCTURE NO.2 KALMARI BELOW SCHOOL

Top Section (Cross-section)

	4.50	6.00	5.50	

1.00

0.50 — E=4.50 — G=5.50 — V — 0.50

0.50 — IV — D=4.50 — F=4.50 — 1.40 — IV — 1.00 — 0.50

0.50 — 0.50 — 0.60 — III — C=13.0 — III — 0.50 — 1.50 — 0.50

0.75 — 0.50 — 0.60 — II — B=11.50 — 0.50 — 0.75 — 0.75

0.75 — 1.00 — 0.70 — I — A=10.0 — I — 0.50 — 0.75 — 0.75

1.00 — 1.50 — 0.50 — FOUNDATION — 0.50 — 1.00

L/Side   R/Side

8.00

Bottom Section (Plan)

A

4.50	6.00	5.50

0.60 — CC H.W EXT — RCC HEAD WALL — CC H.W EXT

EARTH FILL — S I D E W A L L — B U T T R E S S — S I D E W A L L — EARTH FILL

C — 0.50 — 0.50 — D — 0.50

4.00

0.50 — CC T.W EXT — RCC TOE WALL — CC T.W EXT

1.50 — 1.50 — 6.00 — 1.50

7.00

B

CC 1:2:4
SIDEWALL

0.50   0.90

3.00

1.00

0.50   0.50

CC 1:2:4
BUTTRESS

12MMQ VERTICAL
BARS 15CM C/C

2.00

3.50

1.0

12MMQ HORIZONTAL
BARS 20CM C/C

0.50

NSL

0.50

NSL

4.00

0.85

0.30

0.85

0.15

0.15

3.50

0.15

10MMQ CROSS BARS
20CM C/C

1.30

12MMQ LONG BARS
20CM C/C

SECTION AT AB

BUTTRESS

SIDEWALL

SIDEWALL

RCC SLAB

7.30

X-SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt Detention Structure No.3 Kalmari Above Narrow Neck

1. **Hydrological Design**

Catchment Area (A) = 180 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 180 / 360 = 21.0 m^3/sec

2. **Hydraulic Design**

Q = 1.711 LH$^{3/2}$

H = 1.50

21.0 = 1.711 L X 1.50 X √1.50

L = 21.0 / 1.711 X 0.50 X 1.22

= 21.0 / 3.13 = 6.70 say 7.0m

3. **Structural Design**

Drop = 2.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC Silt Detention Structure No.3 Kalmari Above Narrow Neck

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall	1	9.00	1.30	1.0	11.70
	H.Wall & H.W. Ext					
	1st Step	1	2.20+1.50/2	0.80	0.50	0.74
	2nd Step	1	2.30+0.80/2	0.80	0.50	0.62
	3rd Step L/Side	1	1.80+1.0/2	0.80	0.50	0.56
	4th Step	1	2+1/2	0.80	0.50	0.60
	5th Step	1	2+0.80/2	0.80	0.50	0.56
	6th Step	1	2.30+1.0/2	0.80	0.50	0.66
	7th Step	1	2.50+0/2	0.80	2.0	0.50
	R/side 1st Step	1	1+0.50/2	0.80	0.50	0.30
	2nd Step	1	1.0+0.80/2	0.80	0.50	0.36
	3rd Step	1	1.30+0.50/2	0.80	1.00	0.72
	4th Step	1	1.50+1.0/2	0.80	0.50	0.50
	5th Step	1	2.0+0/2	0.80	1.25	1.00
				1.30		**18.82**
					Say	**19.00**
2	CC 1:6:12 in foundation					
	Head wall	1	9.00	1.30	0.15	1.75cum
3	CC 1:2:4 in foundation	1	9.00	1.00	0.85	7.65
	Head wall & H.W. Ext Part A	1	10.0	0.60	0.50	3.00
	B	1	11.50	0.60	0.50	3.45
	C	1	13.00	0.60	0.50	3.90
	D	1	14.00	0.60	0.50	4.20
	E	1	6.0	0.60	0.50	1.80
	F	1	7.50	0.60	0.50	2.25
	G	1	9.0	0.60	0.50	2.70
	H	1	3.0	0.60	0.50	0.90
	I	1	4.0	0.60	0.50	1.20
	J	1	4.0	0.60	0.50	1.20
						32.35
4	Form work – Foundation	1 X 2	9.0	-	1.0	18.00 sqm
	H.W & H.W. Ext Part A	1 X 2	10.0	-	0.50	10.00
	B	1 X 2	11.50	-	0.50	11.50
	C	1 X 2	13.0	-	0.50	13.00
	D	1 X 2	14.0	-	0.50	14.00
	E	1 X 2	6.0	-	0.50	6.00
	F	1 X 2	7.50	-	0.50	7.50

	G	1 X 2	9.0	-	0.50	9.00
	H	1 X 2	3.0	-	0.50	3.00
	I	1 X 2	4.0	-	0.50	4.00
	J	1 X 2	4.0	-	0.50	4.00
						100.00
5	Calculation of M.S Bars					
		L	Nos.	HT		
	Head Wall					
	12mm dia vertical bars 15cm c/c	700/15	47	2.50	117.50m	Say 118.0m
	10mm Q Horizontal bars 30cm c/c	200/20	10	7.50	75m	

12mmQ 118 x 0.89kg/m = 105.02

10mm Q 75 x 0.62kg/m = 46.50

= 151.52 say 152kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12 & RCC	1.75	4.02	0.87	1.74	-
2	C.C 1:2:4	32.35	210.27	14.55	29.10	152kg
			214.29	15.42	30.84	152kg
		Say	214.0bags	15.50cum	31.0cum	152kg
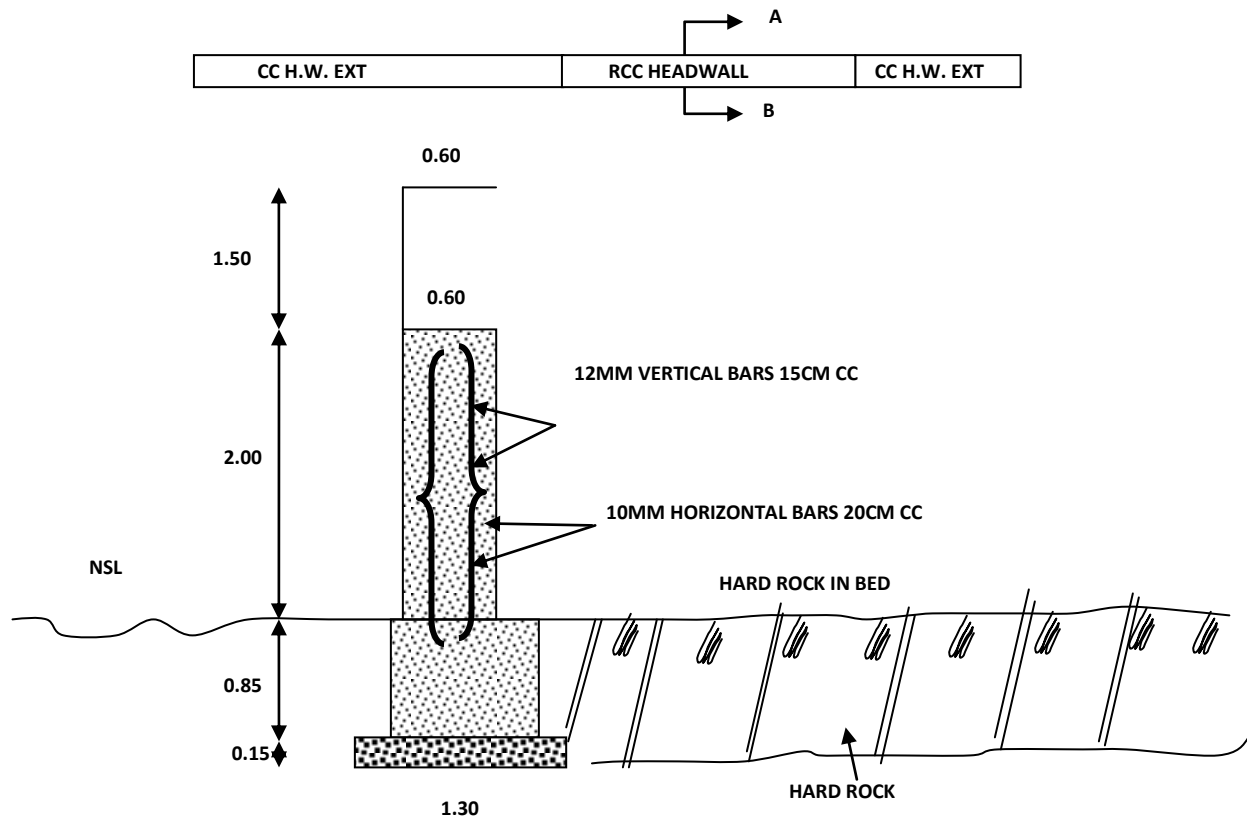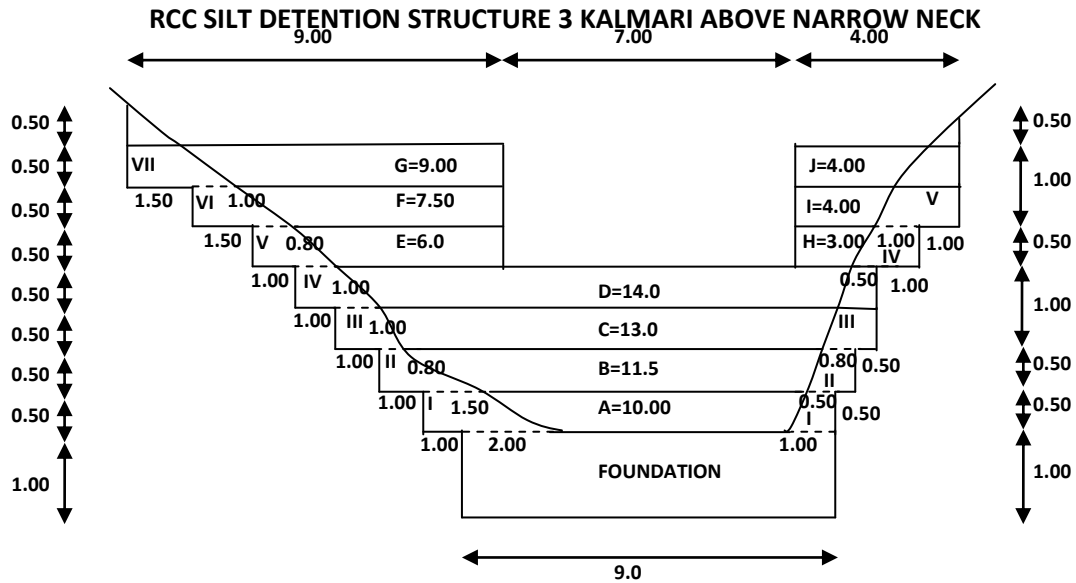
RCC SILT DETENTION STRUCTURE 3 KALMARI ABOVE NARROW NECK

9.00   7.00   4.00

0.50

0.50   VII   G=9.00   J=4.00   0.50

1.50   VI 1.00   F=7.50   I=4.00   V   1.00
0.50
       1.50 V 0.80   E=6.0   H=3.00 1.00   0.50
0.50
       1.00 IV 1.00   0.50   1.00   IV 1.00
0.50   D=14.0
       1.00 III 1.00   III   1.00
0.50   C=13.0
       1.00 II 0.80   0.80 0.50
0.50   B=11.5   II   0.50
       1.00 I 1.50   0.50 0.50
0.50   A=10.00   I   0.50
       1.00 2.00   1.00
1.00   FOUNDATION   1.00

9.0

A

| CC H.W. EXT | RCC HEADWALL | CC H.W. EXT |

B

0.60

1.50

0.60

12MM VERTICAL BARS 15CM CC

2.00

10MM HORIZONTAL BARS 20CM CC

NSL

HARD ROCK IN BED

0.85

HARD ROCK

0.15

1.30

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure No.4 just above Bridge

1. **Hydrological Design**

Catchment Area (A) = 40 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 40 / 360 = 4.66 cumecs

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 0.60

Peak Discharge = 4.66 cumecs

Therefore = $Q = 1.711 \, LH^{3/2}$

4.66 = 1.711 L X 0.60 X √0.60

L = 4.66 / 1.711 X 0.60 X 0.77

= 4.66 / 0.79 = 5.89 say 6.0m

3. **Structural Design**

Drop = 2.0

H = 0.60

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 0.60 = 3.60 say 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure No.4 just above Bridge

S. NO	Particulars	No.	L	B	H	Contents
1	CC 1:2:4 in foundation Head wall & Head wall extension	1	3.25	1.00	0.85	2.76cum
	H.W. Ext Part A	1	4.25	0.60	0.75	1.91cum
	B	1	5.25	0.60	0.50	1.57 cum
	C	1	6.25	0.60	0.50	1.87 cum
	D	1	8.50	0.60	0.25	1.27 cum
	E	1	1.0	0.60	0.60	0.36 cum
	F	1	1.50	0.60	0.60	0.54 cum
	Toe Wall & T.W Ext Foundation	1	8.00	0.50	0.85	3.40 cum
	Above foundation T.W. Ext	1	8.0	0.50	0.50	2.00 cum
	T.W. Ext L/Side	1	1.0	0.50	0.60	0.30 cum
	T.W. Ext R/Side	1	1.50	0.50	0.60	0.45 cum
	T.W Protection work	1	7.0	1.25	0.30	2.62 cum
	Side wall Part A	2	0.90	0.50	2.60	2.34
	Side wall Part B	2	0.50	0.50	1.10	0.55
	Side Wall Part C	2	3.0	0.50	2.60+1.10/2	5.55
	Buttress Part A	1	0.50	0.50	1.50	0.37
	Buttress Part B	1	3.50	0.50	1.50+0.50/2	1.75
	Apron	1	3.50	7.80	0.30	8.19
						37.80cum
4	Form work					
	Head Wall Foundation	1 X 2	4.25	-	1.0	8.50 sqm
	H.W Ext Part A	1 X 2	4.25	-	0.75	6.37
	B	1 X 2	5.25	-	0.50	6.25
	C	1 X 2	6.25	-	0.50	6.25
	D	1 X 2	8.50	-	0.25	4.25
	E	1 X 2	1.00	-	0.60	1.20
	F	1 X 2	1.50	-	0.60	1.80
	Toe Wall & T.W. Ext Foundation	1 X 2	9.0	-	1.0	18.00
	Above foundation					
	Toe Wall & T.W. Ext	1 X 2	8.0	-	0.50	8.00
	T.W. Ext L/Side	1 X 2	1.0	-	0.60	1.20
	T.W. Ext R/Side	1 X 2	1.50	-	0.60	1.80
	Toe Wall Protection Work	1 X 2	8.0	-	0.45	7.20
	Side walls Part A	2 X 2	0.90	-	2.60	9.36

	Part B	2 X 2	0.50	-	1.10	2.20
	Part C	2 X 2	3.0	-	2.60+1.10/2	22.20
	Buttress Part A	1 X 2	0.50	-	1.50	1.50
	Part B	1 X 2	3.50	-	1.50+0.50/2	7.0
	Apron	1 X 2	4.0	-	0.45	3.60
						115.68
					Say	116sqm

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12 @ 2.30 – 0.50 – 1.0	6.03	13.86	3.02	6.04
2	C.C 1:2:4 @ 6.50 – 0.45 – 0.90	37.80	245.70	17.01	34.02
			259.56	20.03	40.06
		Say	260 bags	20.0 cum	40.00 cum

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CC Silt Detention Structure No.4 just above Bridge

SECTION AT AB

X-SECTION AT CD
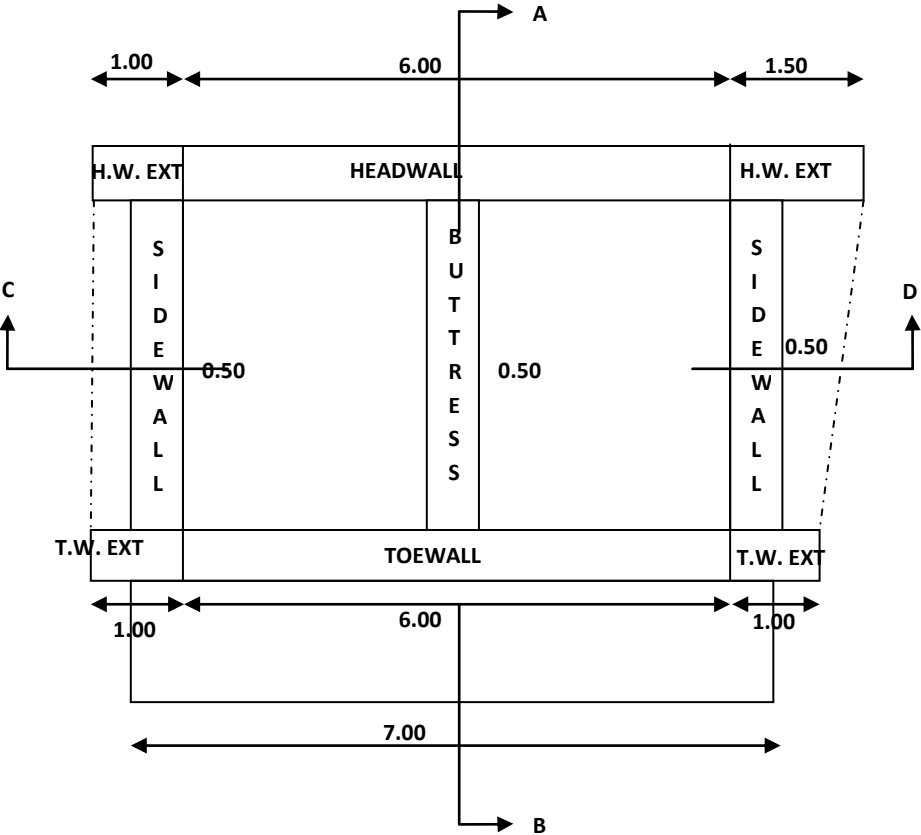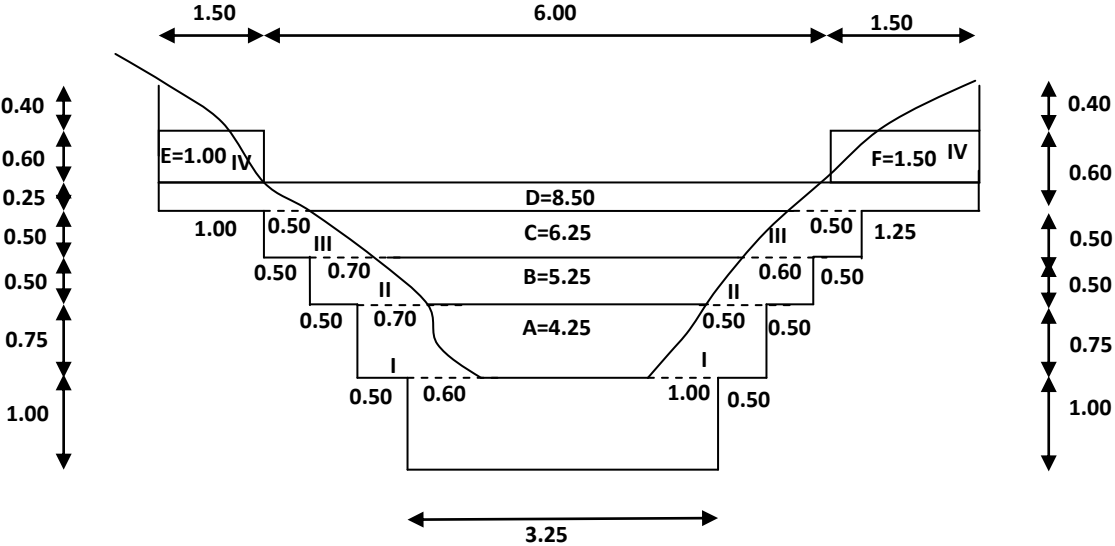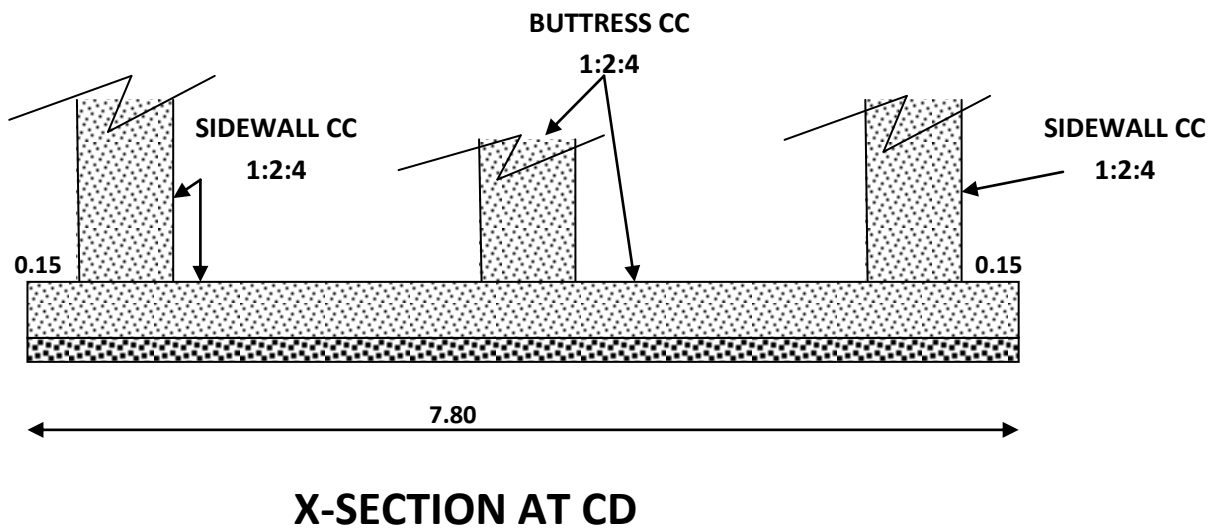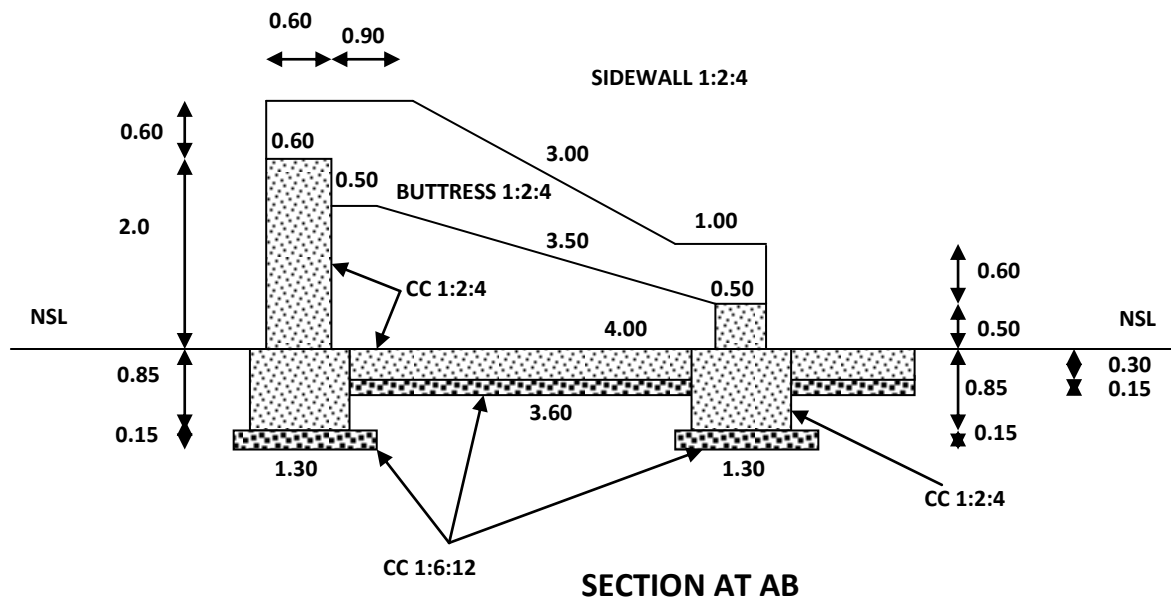
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC SDS No.5 Across Main Nora Nala below pool of water above bridge (C-shape)

1. **Hydrological Design**

Catchment Area (A) = 640 ha

Coefficient Runoff (C) = 0.30

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.30 X 120 X 640 / 360 = 64.0 cum/sec

2. **Hydraulic Design**

Q = 1.711 LH$^{3/2}$

H = 1.50

Peak Discharge = 64.0 cumecs

Therefore = Q = 1.711 LH$^{3/2}$

64.0 = 1.711 L X 1.50 X √1.50

L = 64 / 1.711 X 1.50 X 1.22

= 64 / 3.13113 = 20.44 say 20.00m

3. **Structural Design**

Drop = 1.50

H = 1.50

Top width = Drop X 0.30 = 1.50 X 0.30 = 0.45 say 0.50m

Base width = Drop X 0.60 = 1.50 X 0.60 = 0.90m say 1.30

Apron Length = Drop X 1.50 + H = 1.50 X 1.50 + 1.50 = 3.75 say 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 1.50 = 0.0.50 Say 1.0m

RCC SDS No.5 Across Main Nora Nala below pool of water above bridge (C-shape)

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall	1	22.0	1.30	1.00	28.60cum
	Toe Wall & T.W. Ext	1	24.0	1.30	1.0	31.20cum
	Toe wall Protection work	1	1.25	21.0	0.45	11.81cum
	Apron	1	3.50	21.30	0.45	33.54cum
	Above foundation L/Side					
	1st Step	1	2+0.90/2	0.80	1.00	1.16cum
	2nd Step	1	1.90+1.20/2	0.80	0.50	0.62 cum
	3rd Step	1	2.20+0.80/2	0.80	1.00	1.20 cum
	4th Step	1	-----	0.80	1.50	1.08cum
	R/side 1st Step	1	2.20+0.70/2	0.80	1.00	1.16 cum
	2nd Step	1	1.70+1.0/2	0.80	0.50	0.54 cum
	3rd Step	1	2.80+0.90/2	0.80	1.00	1.48 cum
	4th Step	1	1.90+0/2	0.80	1.25	0.95 cum
						113.34
					Say	**113.00cum**
2	CC 1:6:12 in foundation					
	Head wall	1	22.0	1.30	0.15	4.29cum
	Toe wall & T.W. Ext	1	24.0	1.30	0.15	4.68cum
	Toe wall Protection	1	1.25	21.00	0.15	3.93 cum
	Apron	1	3.50	21.30	0.15	11.18cum
						24.08 cum
3	Above Foundation					
	Head wall & H.W. Ext Part A	1	24.0	0.50	1.0	12.00cum
	B	1	26.00	0.50	0.50	6.50cum
	C	1	4.0	0.50	1.00	2.00cum
	D	1	5.0	0.50	0.50	1.25cum
	E	1	4.0	0.50	1.00	2.00cum
	F	1	5.0	0.50	0.50	1.25cum
	Side wall Part A	2	1.0	0.50	3.00	3.00
	Side wall Part B	2	0.50	0.50	2.00	1.00
	Side wall Part C	2	2.75	0.50	3+2/2	6.87
	Buttress	4	4.00	0.50	1.50+0.50/2	8.00
						43.87

4	Form work – Foundation					
	Head Wall	1 X 2	23.0	-	1.0	46.00 sqm
	Toe Wall & T.W. Ext	1 X 2	24.0	-	0.50	24.00
	Toe Wall Protection	1	23.50	-	0.45	10.57
	Apron	1 X 2	21.30	-	0.45	19.17
	Above Foundation					
	Head Wall & H.W. Ext A	1 X 2	24.00	-	1.0	48.00
	B	1 X 2	26.0	-	0.50	26.00
	C	1 X 2	4.0	-	1.0	8.00
	D	1 X 2	5.00	-	0.50	5.00
	E	1 X 2	4.00	-	1.00	8.00
	F	1 X 2	5.00	-	0.50	5.00
	Side walls Part A	2 X 2	1.00	-	3.00	12.00
	Part B	2 X 2	0.50	-	2.00	4.00
	Part C	2 X 2	2.75	-	1.50+0.50/2	11.00
	Buttress	4 X 2	4.00	-	1.50+0.50/2	32.00
						258.74
					Say	**259.00sqm**
Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars 15cm c/c	2000/15	134	2.00	268m	12mm Q
	10mm Q Horizontal bars 30cm c/c	150/20	8	20.50	164m	10mm Q
2	Toe Wall & T.W. Ext					
	12mm Q Vertical Bars 15cm c/c	2400/15	160	1.0	160m	12mm
	10mm Q Horizontal bars 30cm C/C	0.50/20	3	24.50	74m	10mm Q
3	Apron					
	12mm Q long bars 20cm c/c	400/20	20	22.0	440m	12mm Q
	10mm Q cross bars 20cm c/c	2130/20	107	4.50	482m	10mm Q

12mmQ bars 268 + 160 + 440 = 868 @0.89/kg/m = 772.52kg

10mm Q bars 164 + 74 + 482 = 720m@0.62kg/m = 446.40kg

= **1218.92 say 1219kg**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	24.08	55.38	12.04	24.08	-
2	C.C 1:2:4	43.87	285.15	19.74	39.48	1219kg
			340.53	31.78	63.56	1219kg
		Say	341 bags	32.0 cum	64.0 cum	**1219 kg**

RCC SILT DETENTION STRUCTURE NO.5 ACROSS MAIN GHARTI NALA(C-shape)
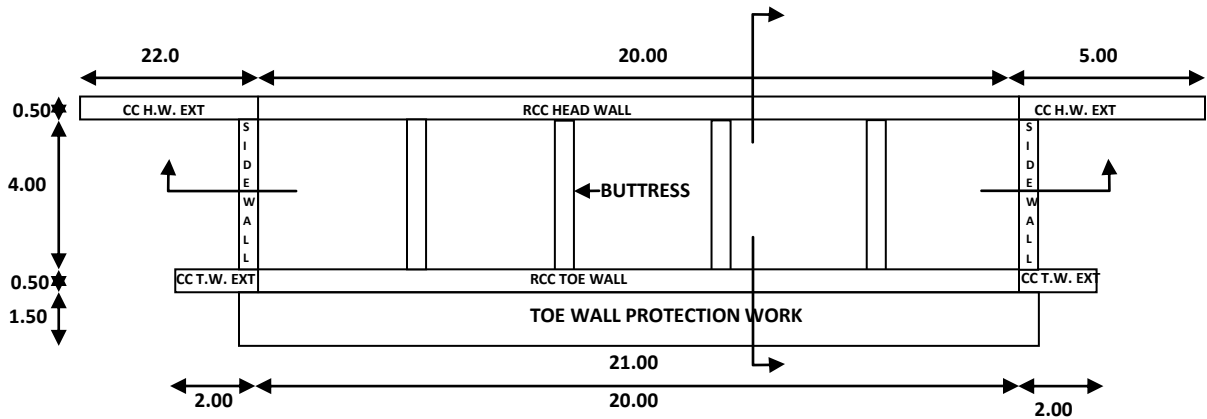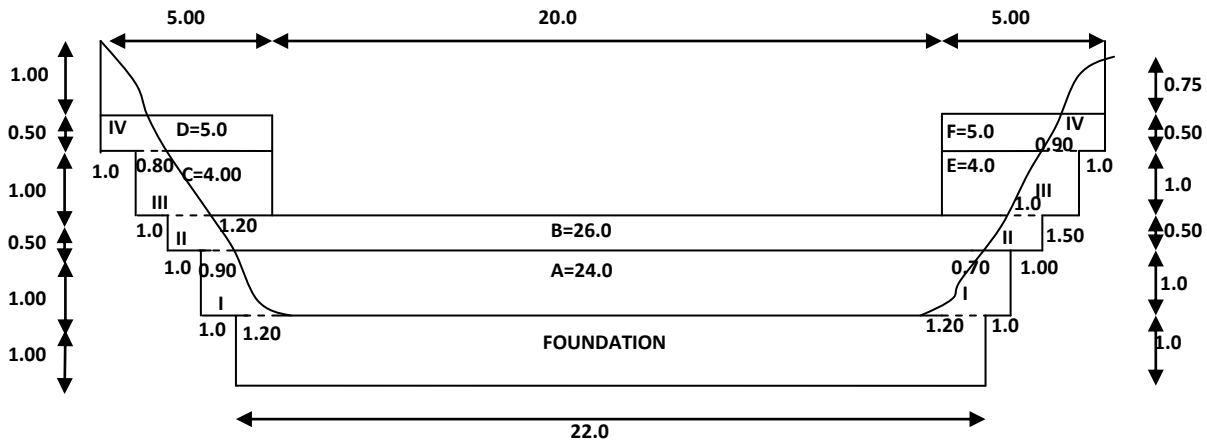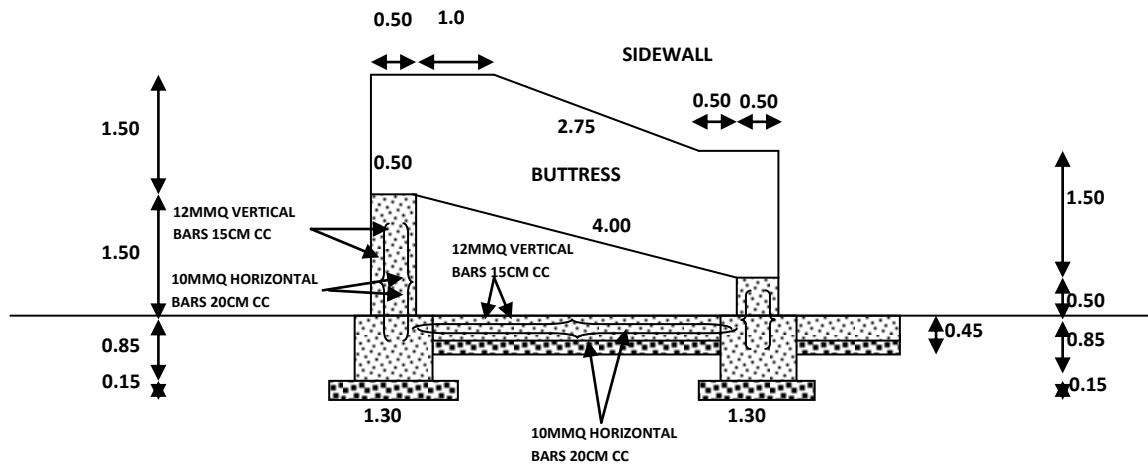
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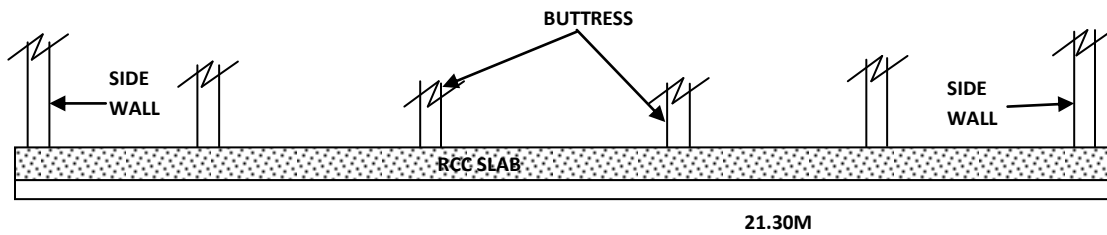
SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure No.6 (Main Below Bridge) Right Side

1. **Hydrological Design**

Catchment Area (A) = 32 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 32 / 360 = 3.73 cum/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 0.60

Peak Discharge = 3.73 cumecs

Therefore = $Q = 1.711 \, LH^{3/2}$

3.73 = 1.711 L X 0.60 X √0.60

L = 3.73/ 1.711 X 0.60 X 0.77

= 3.73 / 0.79 = 4.72 say 5.0m

3. **Structural Design**

Drop = 2.0

H = 0.60

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 0.60 = 3.60 say 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure No.6 (Main Below Bridge) Right Side

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/work in foundation H.Wall	1	5.00	1.30	1.00	6.50cum
	H.W. Ext L/Side 1st Step	1	1.70+1.00/2	0.80	0.50	0.52
	2nd Step	1	2+1/2	0.80	0.50	0.60
	3rd Step	1	2.50+1.0/2	0.80	0.50	0.70
	4th Step	1	2.50+1.10/2	0.80	0.50	0.72
	5th Step	1	2.10+0/2	0.80	1.50	1.26
	R/Side 1st Step	1	1.50+1.10/2	0.80	0.50	0.52
	2nd Step	1	1.10+0.50/2	0.80	0.50	0.32
	3rd Step	1	1.50+1.0/2	0.80	0.50	0.50
	4th Step	1	2.0+1.0/2	0.80	0.50	0.60
	5th Step	1	2.0+0/2	0.80	1.20	0.96
	Toe Wall & T.W. Ext	1	9.0	0.80	1.00	7.20
	Toe wall Protection work	1	1.25	6.00	0.45	3.37
	Apron	1	3.50	6.30	0.45	9.92
	Side walls	2	3.55	0.80	1.00	5.68
						39.37
					Say	40.00
2	CC 1:6:12 in foundation					
	Head Wall	1	5.0	1.30	0.15	0.97
	Toe Wall & T.W. Ext	1	9.0	1.30	0.15	2.28
	Toe Wall Protection work	1	1.25	6.00	0.15	1.12
	Apron	1	3.50	6.30	0.15	3.30
						7.67
3	CC 1:2:4 in foundation Head Wall & H.W. Ext	1	5.00	1.00	0.85	4.25cum
	Toe wall & T.W. Ext	1	9.00	1.00	0.85	7.65
	Toe Wall Protection work	1	1.25	6.00	0.30	2.25
	Apron	1	3.50	6.30	0.30	6.61
	Above foundation Head Wall & H.W. Ext Part A	1	6.00	0.60	0.50	1.80
	B	1	7.00	0.60	0.50	2.10
	C	1	8.50	0.60	0.50	2.55
	D	1	12.0	0.60	0.50	3.60
	E	1	5.50	0.60	0.60	1.98
	F	1	3.50	0.60	0.60	1.26

	Toe Wall & T.W. Ext	1	9.00	0.50	0.50	2.25
	Toe Wall Ext	2	2.00	0.50	0.60	1.20
	Side Wall Part A	2	0.90	0.50	2.60	2.34
	B	2	0.50	0.50	1.00	0.50
	C	2	3.00	0.50	2.30+1.0/2	5.40
	Buttress Part A	1	0.50	0.50	1.50	0.25
	B	1	3.50	0.50	1.50+0.50/2	1.75
						48.74cum
4	Form Work					
	Head wall foundation	1 X 2	6.0	-	1.0	12.0sqm
	Toe Wall & Toe Wall Ext	1 X 2	10.00	-	1.0	20.0
	Toe Wall Protection Work	1 X 2	7.50	-	0.45	6.75
	Apron	1 X 2	4.0	-	0.45	3.60
						42.35 sqm
	Head Wall & H.W. Ext above foundation Part A	1 X 2	6.00	-	0.50	6.00
	B	1 X 2	7.00	-	0.50	7.00
	C	1 X 2	8.50	-	0.50	8.50
	D	1 X 2	12.0	-	0.50	12.00
	E	1 X 2	5.50	-	0.60	6.60
	F	1 X 2	3.50	-	0.60	4.20
	Toe Wall & T.W. Ext Above foundation	1 X 2	9.0	-	0.60	10.30
	T.W. Ext	2 X 2	2.0	-	0.60	4.80
	Side Wall Part A	2 X 2	0.90	-	2.60	9.36
	B	2 X 2	0.50	-	1.00	2.00
	C	2 X 2	3.0	-	2.60+1.0/2	21.60
	Buttress Part A	1 X 2	0.50	-	1.50	1.50
	B	1 X 2	3.50	-	1.50+-0.50/2	7.00
						143.71
					Say	144.0sqm
5	Filling of E/work behind the side wall					
	L/Side	1	5+1.50/2	4.0	2.60+0/2	16.90
	R/Side	1	3.0+1.50/2	4.0	2.60+0/2	11.70
						28.60
					Say	29.00cum

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	CC 1 :6:12	7.67	17.64	3.83	7.66
2	CC 1:2:4	48.74	316.81	21.93	43.86
			334.45	25.76	51.52
		Say	334 bags	26.0 cum	52.00 cum

Lat: 32 – 43 – 083 Long: 75 – 70 - 55
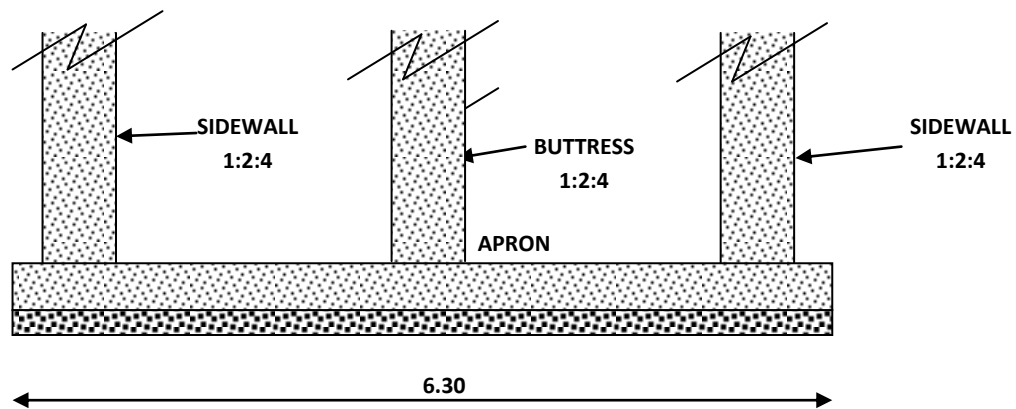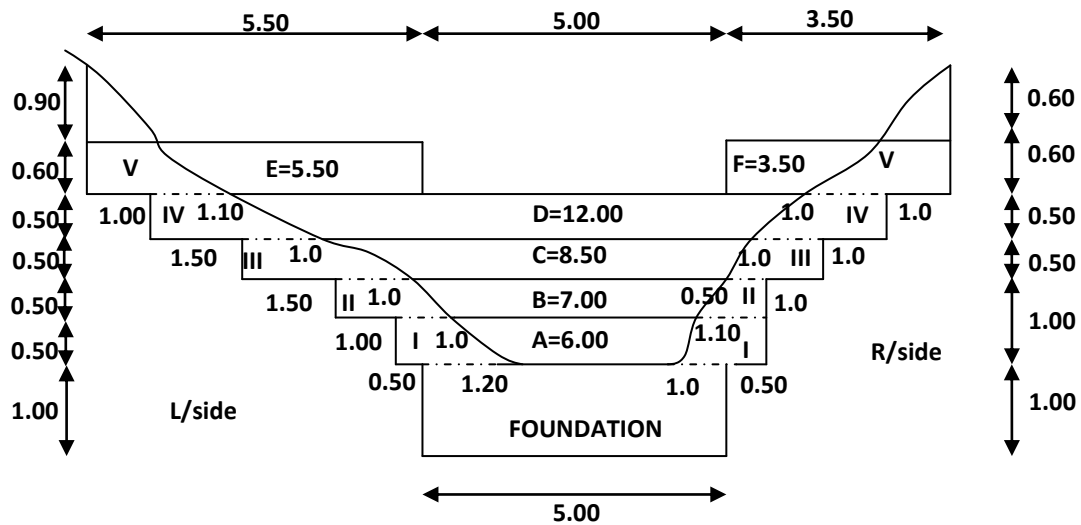
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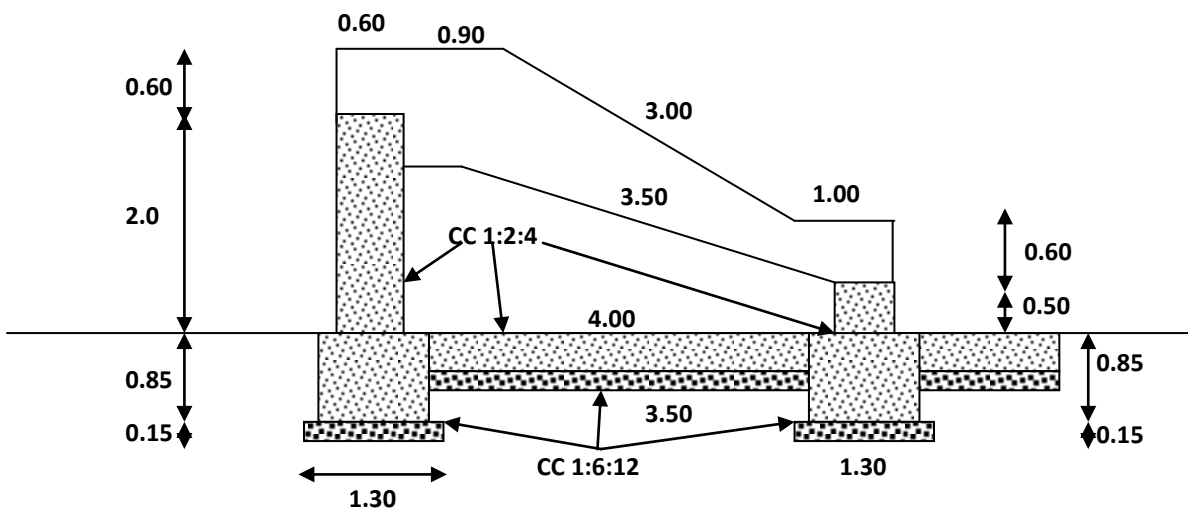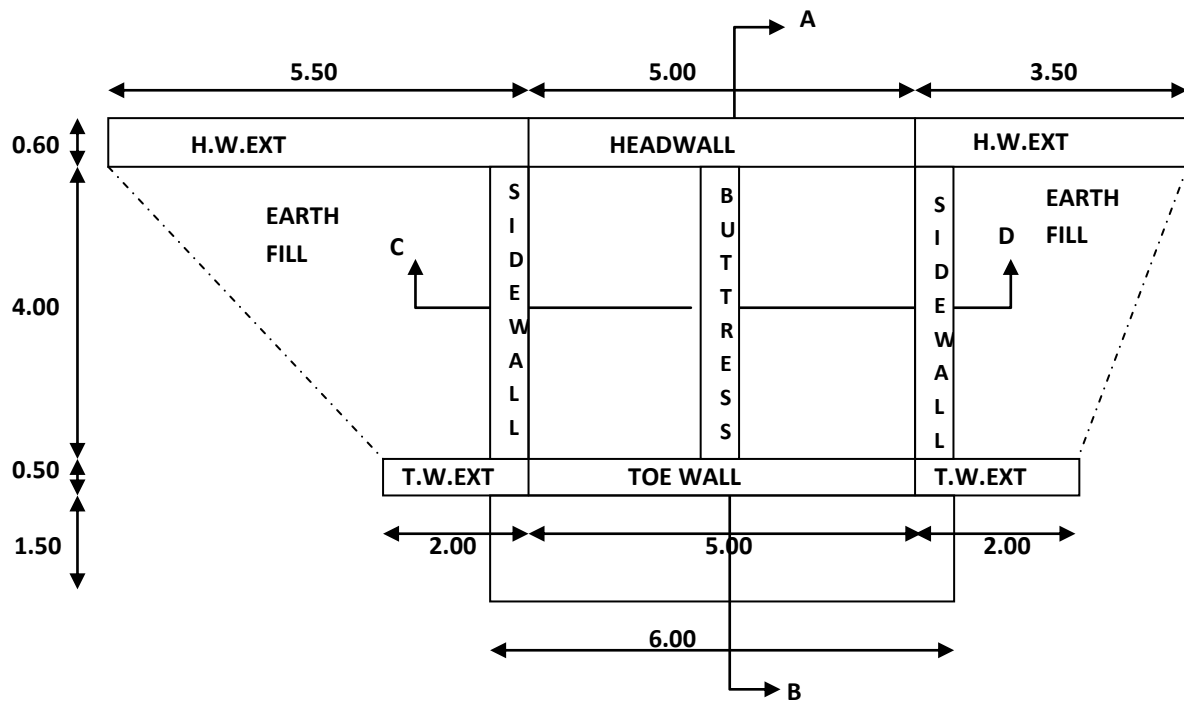
60

Top plan view dimensions: 5.50, 5.00, 3.50; H.W.EXT, HEADWALL, H.W.EXT; 0.60; EARTH FILL; SIDEWALL; BUTTRESS; SIDEWALL; EARTH FILL; C; D; 4.00; T.W.EXT, TOE WALL, T.W.EXT; 0.50; 1.50; 2.00, 5.00, 2.00; 6.00; A; B

SECTION AT AB

Section dimensions: 0.60, 0.90, 3.00, 0.60, 2.0, 3.50, 1.00, CC 1:2:4, 0.60, 0.50, 4.00, 0.85, 0.85, 0.15, 3.50, CC 1:6:12, 0.15, 1.30, 1.30

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt Detention Structure No.7 Across Nora Nala (Big Stones access problem)

1. **Hydrological Design**

Catchment Area (A) = 710 ha

Coefficient Runoff (C) = 0.30

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.30 X 120 X 710 / 360 = 71.0 cum/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 2.0

Peak Discharge = 71.0 cum/sec

Therefore = $Q = 1.711 \, LH^{3/2}$

$71.0 = 1.711 \, L \times 2.0 \times \sqrt{2.0}$

L = 71.0 / 1.711 X 2.0 X 1.41

= 71.0 / 4.82 = 14.73 say 15.0m

3. **Structure Design**

Drop = 2.0

H = 2.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 2.0 = 5.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC Silt Detention Structure No.7 Across Nora Nala (Big Stones access problem)

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/Work in foundation Head Wall Foundation	1	16.0	1.30	1.0	20.30
	Toe Wall & T.W. Ext	1	18.0	1.30	1.0	23.40
	Toe wall Protection work	1	16.0	1.25	0.45	18.00
	Apron	1	4.50	16.30	0.45	33.0
	Head wall & H.W. Ext L/Side					
	1st Step	1	4.0+0.60/2	0.80	1.0	1.84
	2nd Step	1	1.60+1.0/2	0.80	0.50	1.04
	3rd Step	1	2.40+0/2	0.80	3+0/2	1.44
	R/side 1st Step	1	1.70+1.0/2	0.80	1.0	1.08
	2nd Step	1	2+1/2	0.80	1.0	1.20
	3rd Step	1	1.50/2	0.80	2.50+0/2	0.75
						102.55
					Say	**103.00**
2	CC 1:6:12 in foundation					
	Head wall	1	16.00	1.30	0.15	3.12cum
	Toe wall & T.W. Ext	1	18.00	1.30	0.15	3.51
	Toe wall Protection	1	16.0	1.25	0.15	3.00
	Apron	1	4.50	16.30	0.15	11.00
						20.63 cum
3	CC 1:2:4 in foundation					
	Head Wall	1	16.0	1.0	0.85	13.60
	Tow Wall & T.W. Ext	1	18.00	1.0	0.85	15.30
	Toe Wall Protection Work	1	16.00	1.25	0.30	6.00
	Apron	1	4.50	16.30	0.30	22.00
	Head wall & H.W. Ext Part A	1	16.0	0.60	1.00	9.60
	B	1	18.0	0.60	0.50	0.54
	C	1	19.0	0.60	0.50	0.57
	D	1	3.50	0.60	2.0	4.20
	E	1	2.50	0.60	2.0	3.00
	CC 1:2:4 Above foundation					
	Toe Wall & T.W Ext	1	18.0	0.50	0.50	4.50
	T.W. Ext	2	1.50	0.50	1.0	1.50
	Side wall Part A	2	1.50	0.50	4.00	6.00
	Side wall Part B	2	0.50	0.50	2.50	1.25
	Side wall Part C	2	3.50	0.50	4.0+2.50/2	11.37

	Buttress Part A	3	1.0	0.50	1.50	2.25
	Buttress Part B	3	4.0	0.50	1.50+0.50/2	6.00
						107.68
4	Form work – Foundation					
	Head Wall & HW Ext.	1 X 2	17.0	-	1.0	34.00
	Toe Wall & T.W. Ext	1 X 2	19.0	-	1.0	38.00
	Toe Wall Protection	1	18.0	-	0.45	8.10
	Apron	1 X 2	4.50	-	0.45	4.05
	Head Wall & H.W. Ext Part A	1 X 2	16.0	-	1.0	32.0
	B	1 X 2	18.0	-	0.50	18.00
	C	1 X 2	19.0	-	0.50	19.00
	D	1 X 2	3.50	-	2.00	14.00
	E	1 X 2	2.50	-	2.0	10.00
	Toe Wall & T.W. Ext	1 X 2	19.00	-	0.50	19.00
	T.W. Ext	2 X 2	1.50	-	2.00	12.00
	Side Wall Part A	2 X 2	1.50	-	4.00	24.00
	B	2 X 2	0.50	-	2.50	5.00
	C	2 X 2	3.50	-	4+2.50/2	31.50
						268.65
	Form Work					
	Buttress Part A	3 X 2	1.00	-	1.50	9.00
	B	3 X 2	4.0	-	1.50+0.50/2	24.00
						107.81
						301.68sqm
					Say	**302sqm**
5	Filling of E/work behind the side wall					
	L/Side	1	2.50+1/2	5.0	4+2.0/2	18.75
	R/Side	1	2.50+1/2	5.0	4+2.0/2	18.75
						37.50
					Say	**38.00**
Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars 15cm c/c	1500/15	100	2.50	250m	12mm Q
		HT	Nos	L		
	10mm Q Horizontal bars 30cm c/c	200/20	10	15.50	155m	10mm Q
2	Toe wall					
	12mm Q long bars 20cm c/c	1500/15	100	1.50	150m	12mm Q

	10mm Q cross bars 20cm c/c	50/20	3	15.50	430mm	10mm Q
3	Apron					
	12mm Q Vertical Bars 15cm c/c	500/20	25	15.50	388m	12mm
	10mm Q Horizontal bars 30cm C/C	1500/20	75	5.50	413.00m	10mm Q

12mmQ 250+150+387.50 = 793 X 0.89kg/m = 705.77

10mm Q 150+47+413 = 610m X 0.89kg/m = 378.00

= 1083.97 say 1084kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	20.63cum	47.45	10.31	20.62	-
2	RCC & C.C 1:2:4	107.68	669.92	48.45	96.90	1084kg
			717.37	58.76	117.52	1084kg
		Say	717.0 bags	59.0 cum	118.00 cum	1084 kg

RCC Silt Detention Structure No.7 Across Nora Nala (Big Stones access problem)
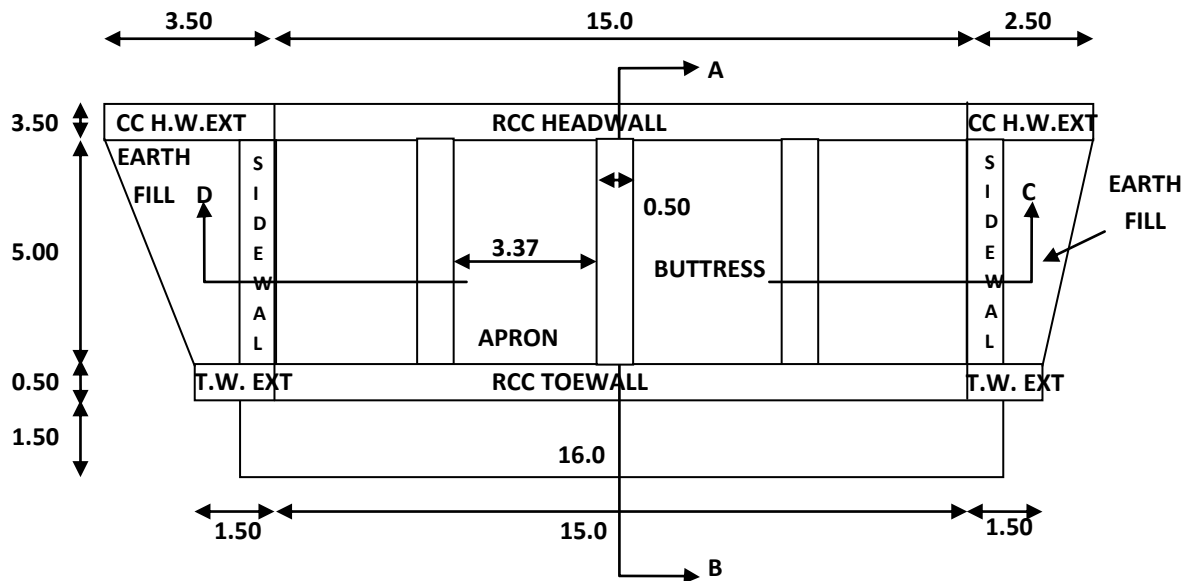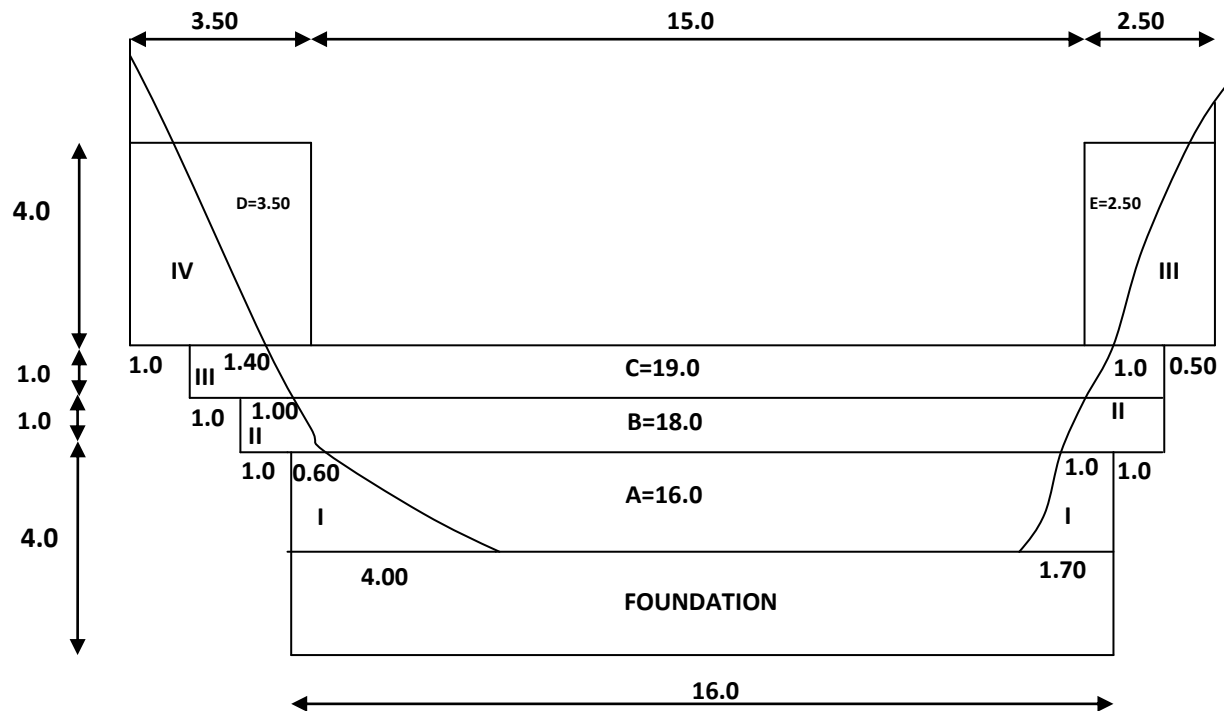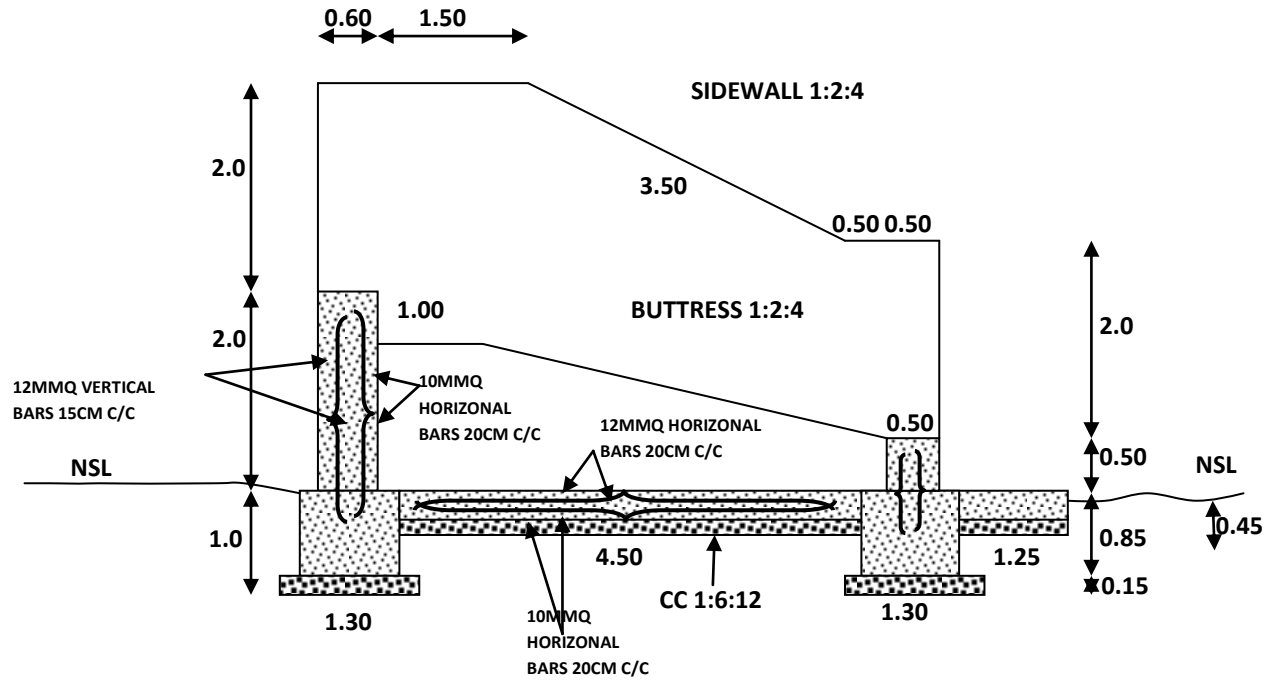
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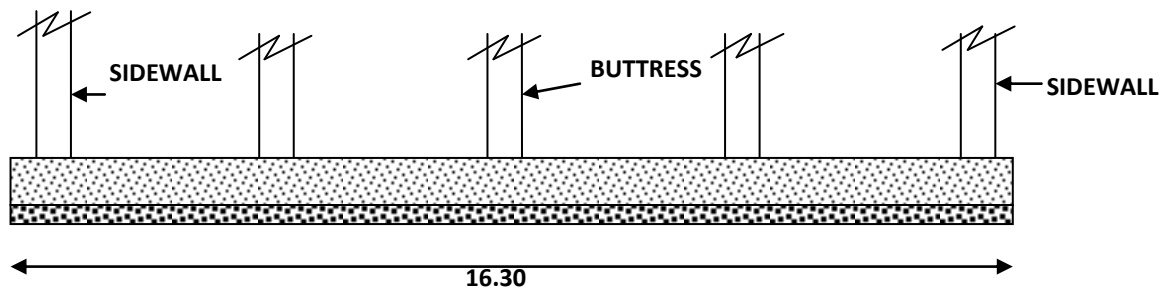
X-SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt Detention Structure No.8 Nada II across Main Nora Nala

   1. **Hydrological Design**

Catchment Area (A) = 755 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 755 / 360 = 88.08 cum/sec

   2. **Hydraulic Design**

$Q = 1.711\ LH^{3/2}$

H = 2.0

Peak Discharge = 88.08 cum/sec

Therefore = $Q = 1.711\ LH^{3/2}$

88.08 = 1.711 L X 2 X √2

L = 88.08 / 1.711 X 2 X 1.41

= 88.08 / 4.82 = 18.27 say 18.50m

   3. **Structural Design**

Drop = 2.0

H = 2.0m

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 2 = 5.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC SILT DETENTION STRUCTURE NO – 8 Nada II across main Nora Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall	1	12.0	1.30	1.00	15.60 cum
	Toe Wall & T.W. Ext	1	22.50	1.30	1.00	29.25cum
	Toe Wall Protection work	1	19.50	1.25	0.45	10.96cum
	Apron	1	4.50	19.50	0.45	39.48cum
	H.W Ext. L/Side					
	1st Step	1	2.10+1.0/2	0.80	0.50	0.62cum
	2nd Step	1	2.50+1.20/2	0.80	0.50	0.74 cum
	3rd Step	1	2.70+1.0/2	0.80	1.00	1.48 cum
	4th Step	1	2.50+0/2	0.80	3.50	2.18 cum
	R/side 1st Step	1	2.50+1.0/2	0.80	0.50	0.70 cum
	2nd Step	1	2.50+1.50/2	0.80	0.50	0.80 cum
	3rd Step	1	3.0+1.70/2	0.80	1.00	1.96 cum
	4th Step	1	3.40+0/2	0.50	3.0	4.08 cum
						107.85
					Say	**108.00**
2	CC 1:6:12 in foundation					
	Head wall	1	12.0	1.30	0.15	2.34cum
	Toe wall & T.W. Ext	1	22.50	1.30	0.15	4.38cum
	Toe wall Protection work	1	1.25	19.50	0.15	3.65 cum
	Apron	1	4.50	19.80	0.15	13.36
						23.73 cum
3	CC 1:2:4 in foundation					
	Head wall	1	12.00	1.0	0.85	10.20cum
	Toe Wall & T.W.Ext	1	22.50	1.0	0.85	19.12cum
	Toe Wall Protection work	1	1.25	19.50	0.30	7.42cum
	Apron	1	4.50	19.80	0.30	26.73cum
						63.47
	CC 1:2:4 above foundation	2	0.50	0.50	0.75	0.37
	Head wall Part A	1	14.0	0.60	0.50	4.20
	B	1	17.0	0.60	0.50	5.10
	C	1	20.00	0.60	1.0	12.00
	D	1	2.00	0.60	2.00	2.40
	E	1	2.0	0.60	2.0	2.40
	Side wall Part A	2	1.50	0.50	4.0	6.00
	B	2	0.50	0.50	2.50	1.25
	C	2	3.50	0.50	4+2.50/2	11.37
	Buttress Part A	3	0.50	0.50	1.50	1.12
	B	3	4.0	0.50	1.50+0.50/2	6.00
						115.31

4	Form work – Foundation					
	Head Wall & HW Ext.	1 X 2	13.0	-	1.0	26.00 sqm
	Toe Wall & T.W. Ext	1 X 2	22.50	-	1.0	45.00
	Toe Wall Protection work	1 X 2	21.50	-	0.45	9.67
	Apron	1 X 2	19.80	-	0.45	17.82
	Above foundation					
	Head Wall Part A	1 X 2	14.0	-	0.50	14.00
	B	1 X 2	17.0	-	0.50	17.00
	C	1 X 2	20.0	-	1.00	40.00
	D	1 X 2	2.0	-	2.0	8.00
	E	1 X 2	2.0	-	2.0	8.00
	Side walls Part A	2 X 2	1.50	-	4.0	24.0
	Part B	2 X 2	0.50	-	2.50	5.00
	Part C	2 X 2	3.50	-	4.0+2.50/2	45.50
	Buttress Part A	3 X 2	0.50	-	1.50	4.50
	Part B	3 X 2	4.0	-	1.50+0.50/2	24.00
						288.49
					Say	**288sqm**
5	Calculation of M.S. Bars	No.	L	B	H	Content
1	Head Wall	L	No.	HT		
	12mm dia vertical bars 15cm c/c	1200/15	80	2.50	200m	12mm Q
	10mm Q Horizontal bars 30cm c/c	200/20	10	12.50	125m	10mm Q
2	Toe Wall & T.W. Ext					
	12mm Q Vertical Bars 15cm c/c	2250/15	150	1.0	150m	12mm
	10mm Q Horizontal bars 30cm C/C	0.50/20	2	23.00	46m	10mm Q
3	Apron					
	12mm Q long bars 20cm c/c	500/20	25	20.30	506m	12mm Q
	10mm Q cross bars 20cm c/c	1920/20	99	5.50	445m	10mm Q

12mmQ 200 + 150 + 506 = 856m @0.89 kg/m   = 761.84

10mm Q 125 + 46 + 445 = 616m @0.62 kg/m   = 381.92

                                 = **1143.763 say 1144kg**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	23.73	54.57	11.86	23.72	-
2	C.C & RCC 1:2:4	115.31	749.51	51.88	103.76	1144kg
			804.08	63.74	127.48	1144kg
		Say	804 bags	64.00 cum	127.00 cum	**1144 kg**

RCC SILT DETENTION STRUCTURE NO.8 NADA-II ACROSS MAIN NORA NALA
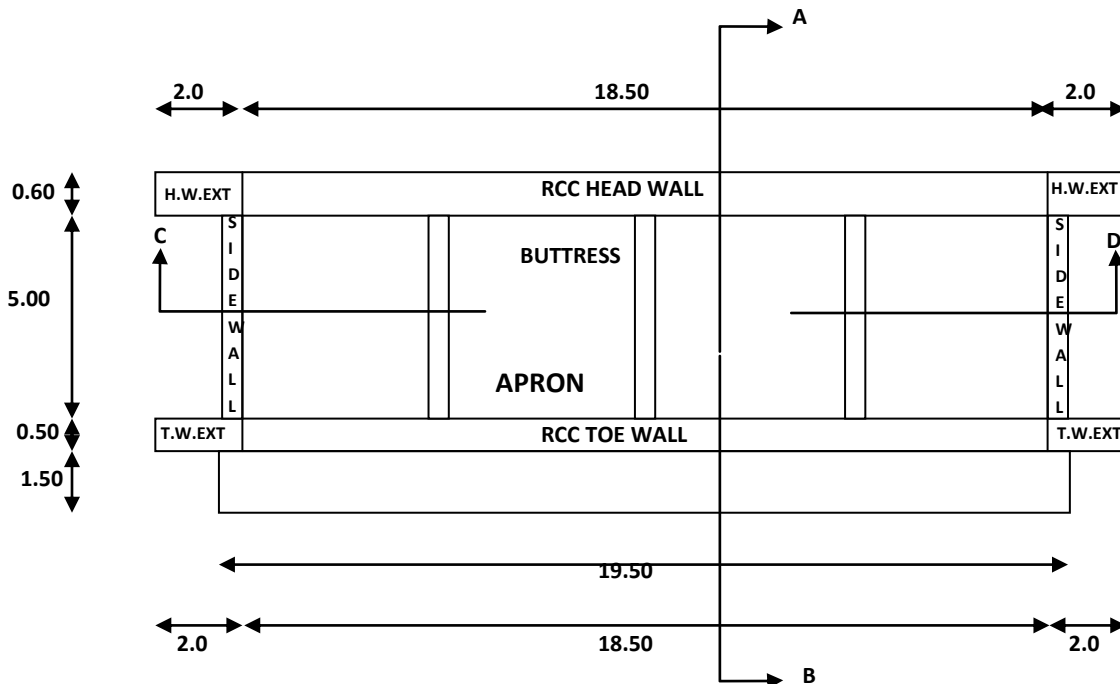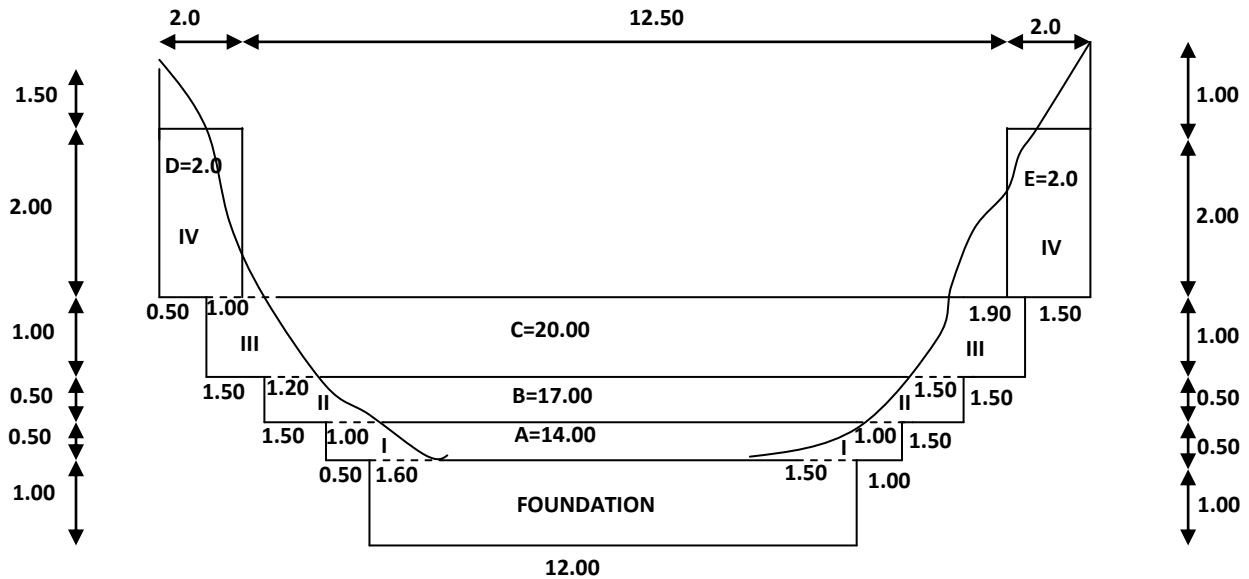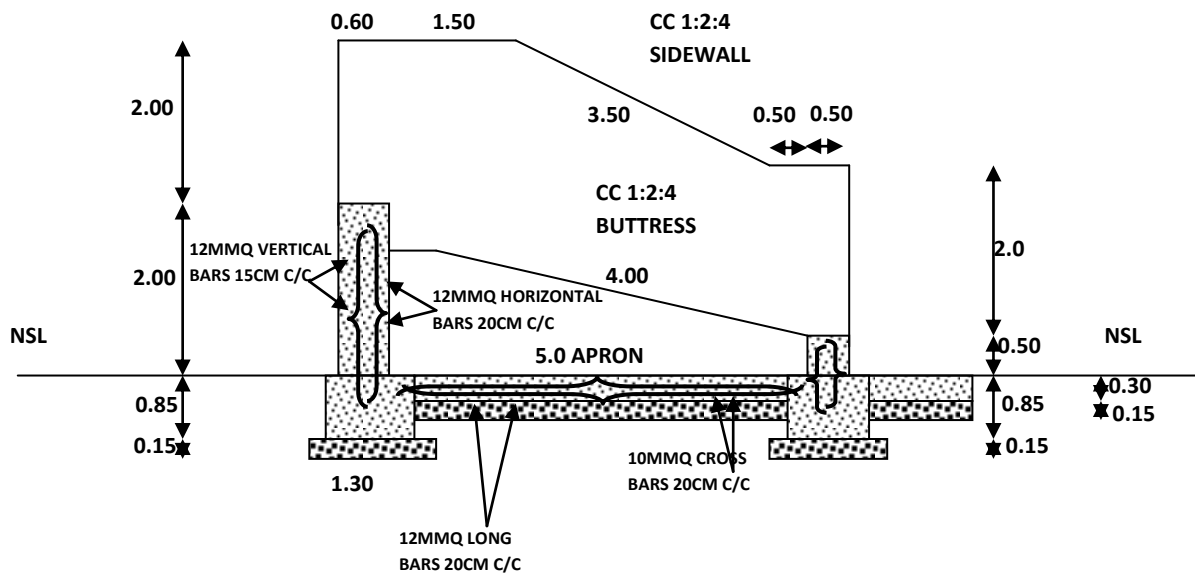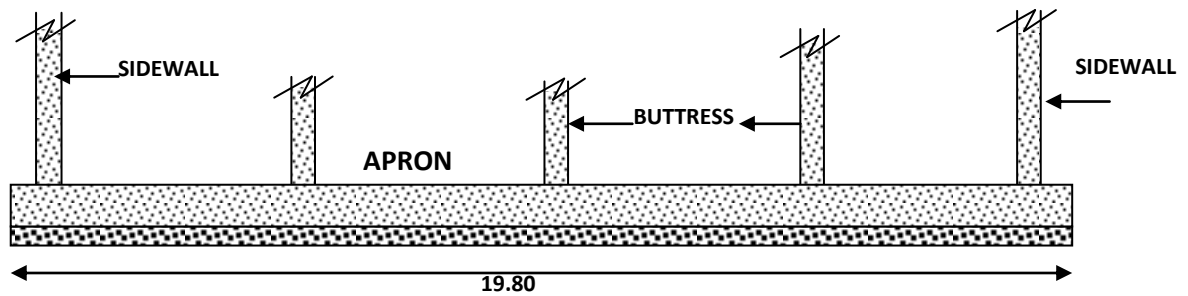
SECTION AT AB

0.60   1.50

CC 1:2:4
SIDEWALL

2.00

3.50   0.50 0.50

CC 1:2:4
BUTTRESS

2.0

12MMQ VERTICAL
BARS 15CM C/C

2.00

12MMQ HORIZONTAL
BARS 20CM C/C

4.00

0.50

5.0 APRON

NSL

NSL

0.85

0.30
0.15

0.15

0.85

1.30

0.15

10MMQ CROSS
BARS 20CM C/C

12MMQ LONG
BARS 20CM C/C

SECTION AT AB

SIDEWALL

SIDEWALL

BUTTRESS

APRON

19.80

SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt Detention Structure No.9 Nada I Field at Top Across Main Nora Nala

1. Hydrological Design

Catchment Area (A) = 810 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 810 / 360 = 94.50 m^3/sec

2. Hydraulic Design

Q = 1.711 LH$^{3/2}$

H = 2.00

94.50 = 1.711 L X 2.0 X √2

L = 94.50 / 1.711 X 2.0 X 1.41

= 94.50 / 4.82 = 19.60 say 20.0m

3. Structural Design

Drop = 2.0

H = 2.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 2.0 = 5.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC Silt Detention Structure No.9 Nada I Field at Top Across Main Nora Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in Earthwork in foundation Head Wall	1	21.0	1.30	1.0	27.30
	H.W & H.W. Ext Step L/Side					
	1st Step	1	7+4.50/2	0.80	2.0	9.04
	2nd Step	1	6.50+3.70/2	0.80	2.0	8.40 cum
	3rd Step	1	3.70+0/2	0.80	1.75	2.59 cum
	R/side 1st Step	1	9.0+5.0/2	0.80	2.0	11.20
	2nd Step	1	7+3/2	0.80	2.0	8.00
	3rd Step	1	3+0/2	0.80	1.50	1.80
	Toe Wall & T.W. Ext	1	24.50	1.30	1.00	31.85 cum
	Toe wall Protection Work	1	21.0	1.25	0.45	11.81
	Apron	1	4.50	21.0	0.45	42.52
						154.51
					Say	**155.00**
2	CC 1:6:12 in foundation					
	Head wall	1	21.0	1.30	0.15	4.09
	Toe wall & T.W. Ext	1	24.50	1.30	0.15	4.77cum
	Toe wall Protection	1	21.00	1.25	0.15	3.93
	Apron	1	4.50	21.0	0.15	14.17
						26.96 cum
3	CC 1:2:4 in foundation					
	Head Wall	1	21.0	1.30	0.15	4.09cum
	Toe Wall & Ext	1	24.50	1.0	0.85	20.82
	Toe Wall Protection	1	21.0	1.25	0.30	7.87cum
	Apron	1	4.50	21.0	0.30	23.35cum
	CC 1:2:4 Above foundation					
	Head Wall & H.W. Ext Part A	1	21.0	0.60	2.00	25.20
	Part B Head Wall Ext L/S	1	2.50	0.60	2.00	3.00
	Part C Head Wall Ext R/S	1	2.0	0.60	2.0	2.40
	Toe Wall & T.W Ext	1	24.50	0.50	0.50	6.12
	T.W. Ext L/Side	1	2.50	0.50	2.00	2.50cum
	R/Side	1	2.0	0.50	2.0	2.00
	Side wall Part A	2	1.50	0.50	4.0	6.00
	Side wall Part B	2	0.50	0.50	2.50	1.25

	Side wall Part C	2	3.50	0.50	4+2.50/2	11.37
	Buttress Part A	4	1.0	0.50	1.50	3.00
	Buttress Part B	4	4.0	0.50	1.50+0.50/2	8.00
						145.73
4	Form work – Foundation					
	Head Wall	1 X 2	22.0	-	1.0	44.0
	Toe Wall & T.W. Ext	1 X 2	24.50		1.0	49.00
	Toe Wall Protection Work	1	24.0	-	0.45	10.80
	Apron	1 X 2	5.0	-	0.45	4.50
	Above foundation Head Wall Part A	1 X 2	21.0	-	2.0	84.00
	B	1 X 2	2.50	-	2.0	10.00
	C	1 X 2	2.0	-	2.0	8.00
	Toe Wall & T.W. Ext	1 X 2	24.50	-	0.50	24.50
	T.W. Ext	2 X 2	2.0	-	2.0	16.00
	Side Wall Part A	2 X 2	1.50	-	4.0	24.00
	B	2 X 2	0.50	-	2.50	5.00
	C	2 X 2	3.50	-	4+2.50/2	45.90
	Buttress Part A	4 X 2	1.0	-	1.50	12.00
	Part B	4 X 2	4.0	-	1.50+0.50/2	32.00
						369.70
					Say	370.00sqm
Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars 15cm c/c	2000/15	133	2.50	333m	12mm Q
	10mm Q Horizontal bars 30cm c/c	200/20	1.0	20.50	205m	10mm Q
2	Toe Wall & T.W Ext					
	12mm Q long bars 20cm c/c	450/15	163	1.0	163m	12mm Q
	10mm Q cross bars 20cm c/c	50/20	3	25.0	75m	10mm Q
3	Apron					
	12mm Q Vertical Bars 15cm c/c	500/20	25	22m	550m	12mm
	10mm Q Horizontal bars 30cm C/C	2000/20	100	5.50	550m	10mm Q

12mmQ 333 + 163 + 550 = 1046@0.89kg/m   = 930.94

10mm Q 205 + 75 + 550 = 830@0.89kg/m   = 514.60

                          = 1445.54 say 1446kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	26.96 cum	62.0	13.48	26.96	-
2	C.C 1:2:4	143.73	947.24	65.57	131.14	1446kg
			1009.24	79.05	158.10	1446kg
		Say	1009 bags	79 cum	158.00 cum	1446 kg

RCC SILT DETENTION STRUCTURE NO.9 NADA-I ACROSS MAIN NORA NALA
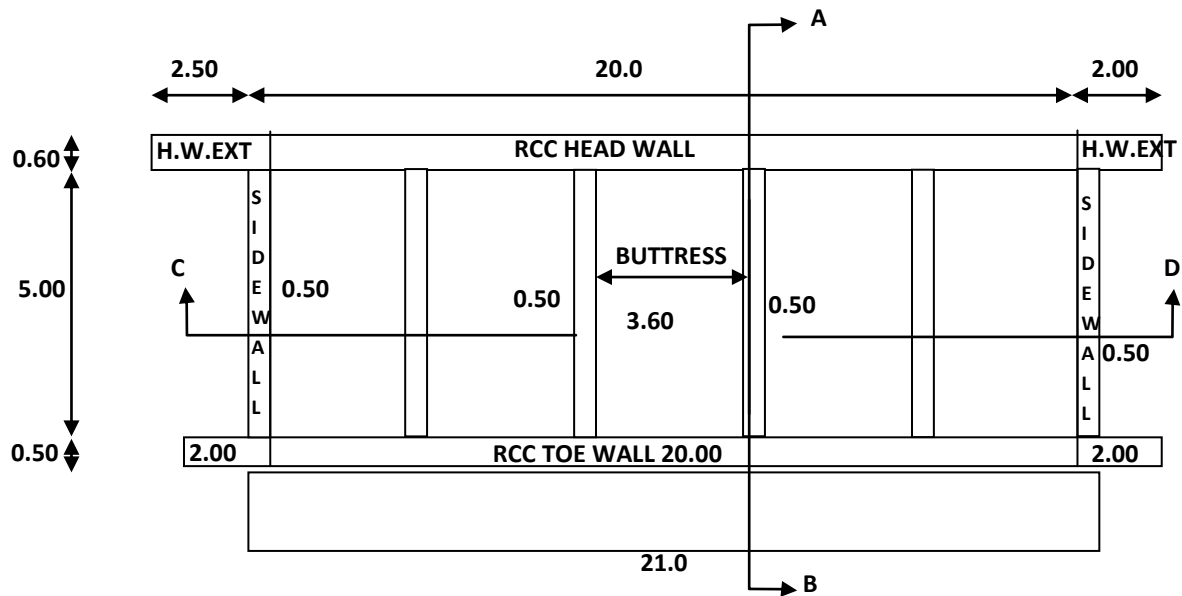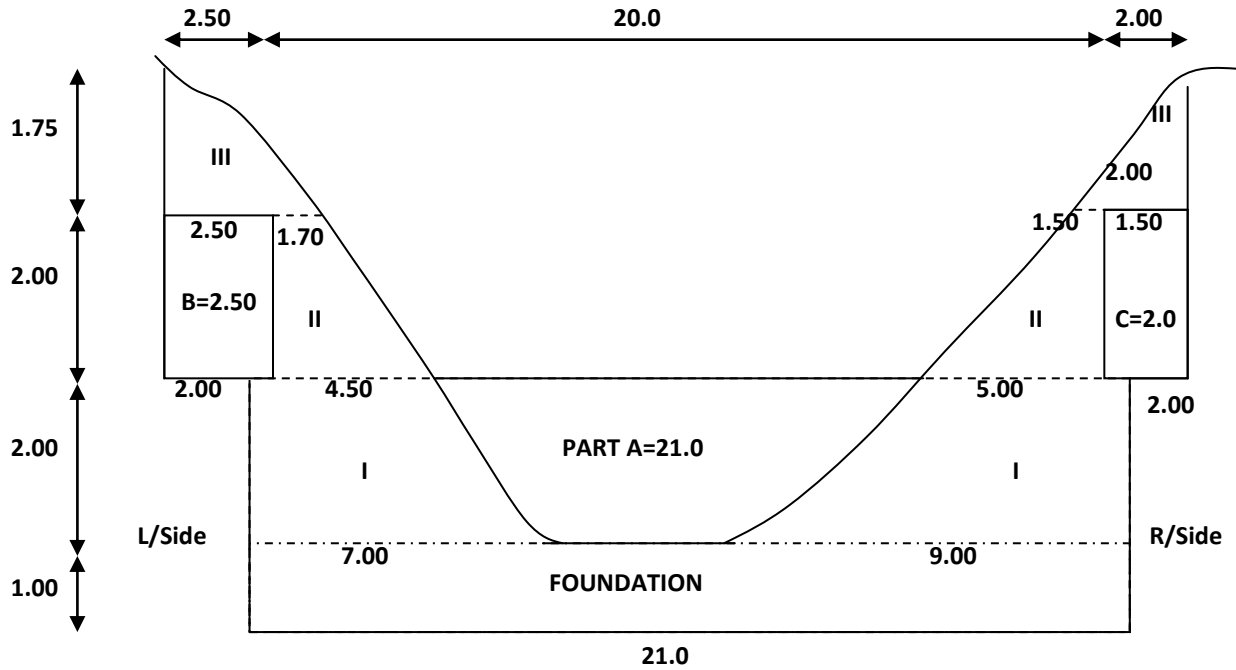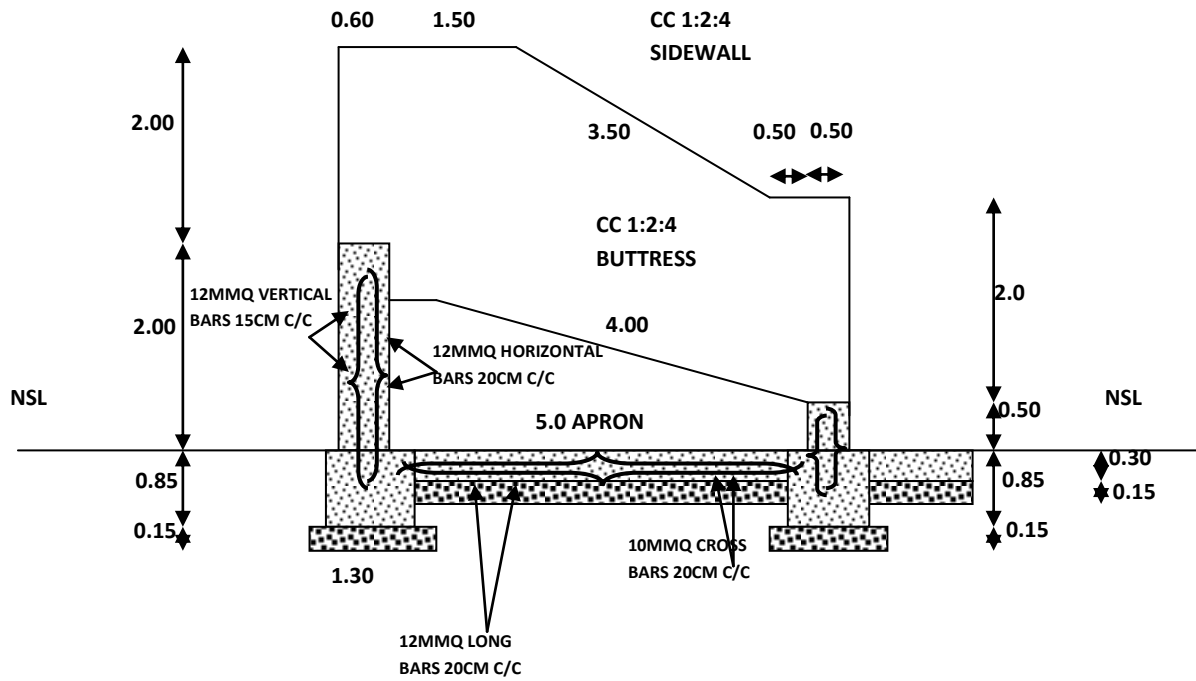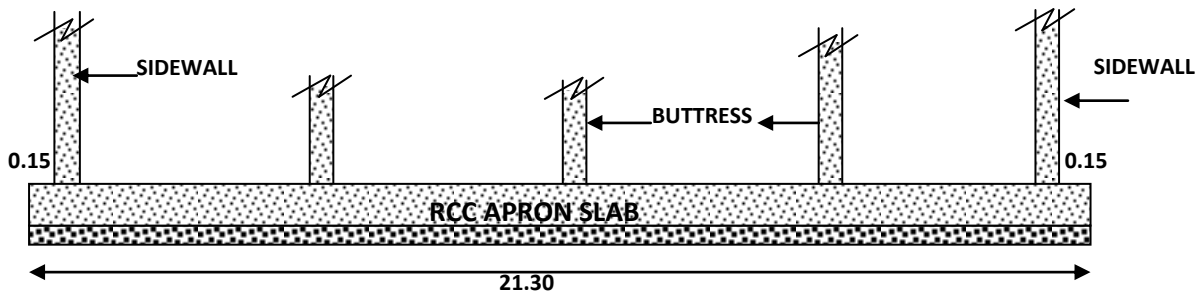
0.60   1.50   CC 1:2:4 SIDEWALL

2.00

3.50   0.50   0.50

CC 1:2:4 BUTTRESS

12MMQ VERTICAL BARS 15CM C/C

2.00   4.00   2.0

12MMQ HORIZONTAL BARS 20CM C/C

NSL   5.0 APRON   NSL

0.50

0.85   0.85   0.30

0.15   0.15   0.15

10MMQ CROSS BARS 20CM C/C

1.30

12MMQ LONG BARS 20CM C/C

SECTION AT AB

SIDEWALL   BUTTRESS   SIDEWALL

0.15   0.15

RCC APRON SLAB

21.30

SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt Detention Structure no.10 (Jamanwala) Across Main Nora Nala

1. **Hydrological Design**

Catchment Area (A) = 840 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 840 / 360 = 98.0 m^3/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 2.00

98.0 = 1.711 L X 2.0 X √2.0

L = 98.0 / 1.711 X 2.0 X 1.41

= 98 / 4.82 = 20.33 say 20.50m

3. **Structural Design**

Drop = 1.50

H = 2.0

Top width = Drop X 0.30 = 1.50 X 0.30 = 0.45m say 0.50m

Base width = Drop X 0.60 = 1.50 X 0.60 = 0.90m say 1.30m

Apron Length = Drop X 1.50 + H = 1.50 X 1.50 + 2.0 = 3.50 say 5.0m

Foundation Depth = 1/3 X Drop = 1/3 X 1.50 = 0.45 Say 1.0m

RCC Silt Detention Structure no.10 (Jamanwala) Across Main Nora Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall & Head wall extension	1	12.0	0.50	1.15	34.50
	Toe Wall	1	12.0	1.30	1.0	15.60
	Anchoring of H.Wall L/Side 1st Step	1	3.50+0/2	2.50	4.0	17.50
	R/Side 1st Step	1	4+0/2	1.30	4.0	10.40
	Apron	1	5.0	12.0	0.75	80.00
	4th Step					158.00
2	CC 1:6:12 in foundation Head Wall	1	12.0	2.50	0.15	4.50
	Toe Wall	1	12.0	1.30	0.15	2.34
	Apron	1	5.00	12.0	0.25	15.00
						21.84
3	CC 1:2:4 in foundation Head Wall	1	12.0	2.0	1.00	24.00
	Toe Wall	1	12.0	1.0	0.85	10.20
	Apron	1	5.0	12.0	0.50	30.00
	Above foundation Headwall	1	12.0	1.0+2.0/2	2.00	36.00
	Toe Wall	1	12.0	0.50	1.00	6.00
						106.20
4	Form work Head Wall	1 X 2	12.0	-	1.15	27.60
	Toe Wall	1 X 2	12.0	-	1.0	24.0
	Apron	1 X 2	5.0	-	0.75	7.50
	Above foundation Headwall	1 X 2	12.0	-	2.0	48.00
	Toe Wall	1 X 2	12.0	-	1.0	24.00
						131.10
					Say	**131.0 sqm**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	21.84	50.23	10.92	21.84
2	C.C 1:2:4	106.20	690.20	47.79	95.58
			740.43	58.71	117.42
		Say	740 bags	59.0 cum	117.00 cum

Prepared by Sh.Bhagwan Dass,Checked by Er Kirpal Singh, Approved by Er. H.S.Lohan

CC SILT DETENTION STRUCTURE NO.10 (JAMANWALA) ACROSS MAIN NORA NALA

81
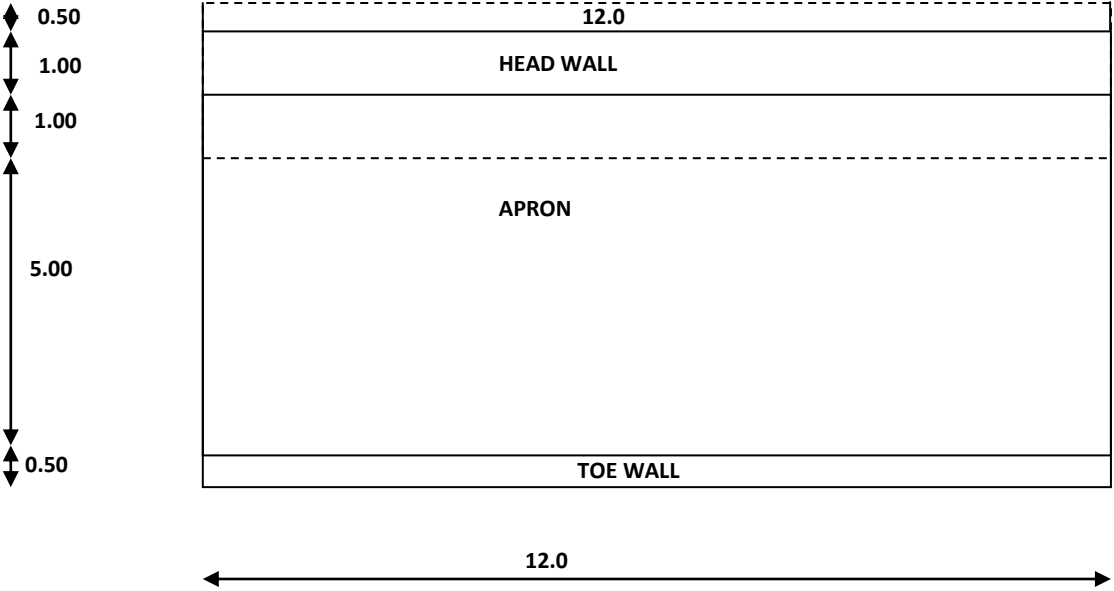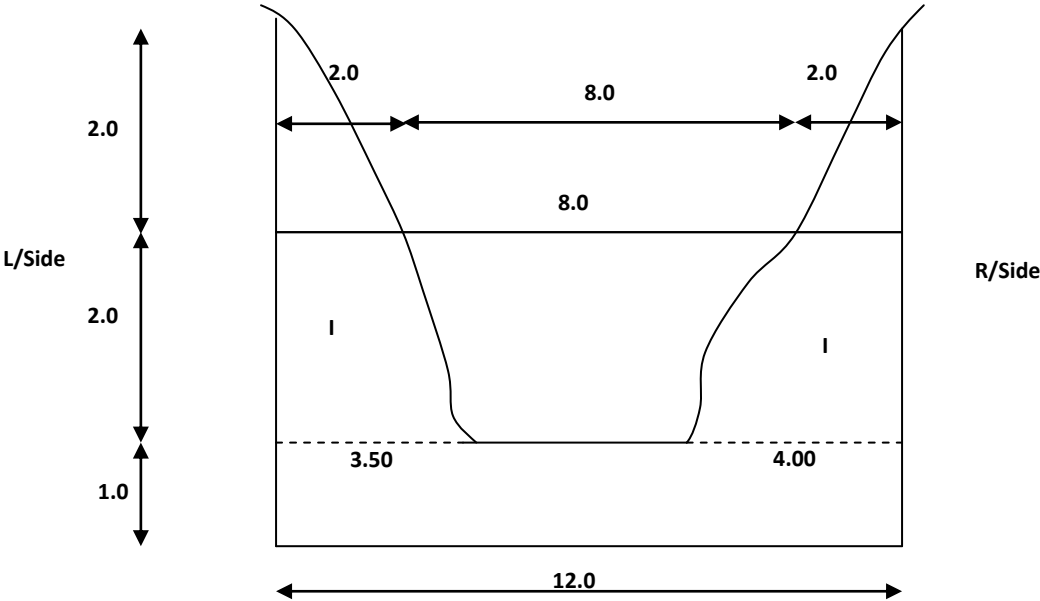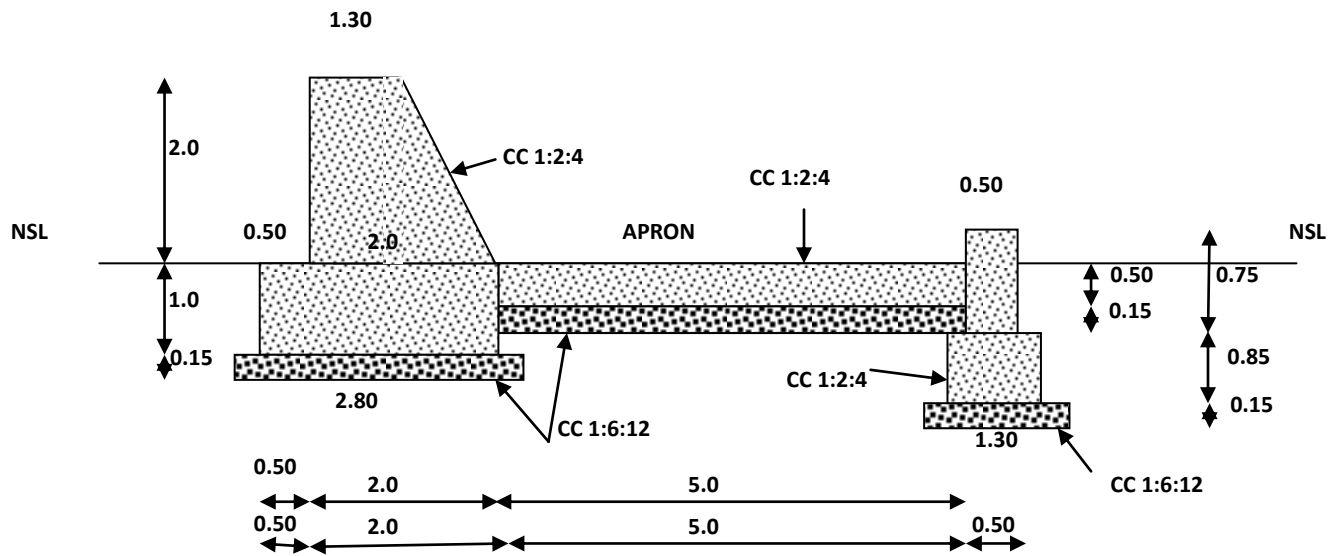
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure No.11 Village Karola at Top

1. Hydrological Design

Catchment Area (A) = 60 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 60 / 360 = 7.0 m^3/sec

2. Hydraulic Design

$Q = 1.711 \, LH^{3/2}$

H = 1.0

Drop = 1.50m

Crest Length = $Q = 1.711 \, LH^{3/2}$

7.0 = 1.711 X 1 X √1.0

L = 7.0 / 1.711

= 4.09 say 4.0m

3. Structural Design

Drop = 1.50

Top width = Drop X 0.30 = 1.50 X 0.30 = 0.45m say 0.50m

Base width = Drop X 0.60 = 1.50 X 0.60 = 0.90m say 1.00

Apron Length = Drop X 1.50 + 1.0 = 1.50 X 1.50 + 1.0 = 3.25 say 3.50m

Foundation Depth = 1/3 X Drop = 1/3 X 1.50 = 0.50 Say 1.0m

CC Silt Detention Structure No.11 Village Karola at Top

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation					
	Head wall & Head wall extension L/Side					
	1st Step	1	5.0	1.30	1.0	6.50
	2nd Step	1	1.50+0.70/2	0.80	0.50	0.24
	3rd Step	1	1.20+0.70/2	0.80	0.50	0.38
	4th Step	1	1.20+0.50/2	0.80	0.50	0.34
	5th Step	1	1.0+0/2	0.80	1.25	1.00
	R/side 1st Step	1	1.50+0.60/2	0.80	0.50	0.42
	2nd Step	1	1.10+0.50/2	0.80	0.50	0.32
	3rd Step	1	1.0+0.50/2	0.80	0.50	0.30
	4th Step	1	1.0+0.60/2	0.80	0.50	0.32
	5th Step	1	1.10+0/2	0.80	1.50	0.66
	Toe Wall & T.W. Ext Foundation	1	7.0	1.30	1.0	9.10
	Toe Wall Protection Work	1	5.0	1.25	0.45	2.81
	Apron	1	3.0	5.30	0.45	11.90
	Side Wall	2	3.0	0.80	1.0	4.80
						39.09
					Say	39.00cum
2	CC 1:6:12 in foundation					
	Head wall	1	5.0	1.30	0.15	0.97
	Toe wall & H.W. Ext	1	7.0	1.30	0.15	1.36
	Toe wall Protection	1	5.0	1.25	0.15	0.93
	Apron	1	3.0	5.30	0.15	2.38
						5.64 cum
3	CC 1:2:4 in foundation					
	Head wall	1	5.0	1.0	0.85	4.25
	Toe Wall & T.W Ext	1	7.0	1.0	0.85	5.95
	Toe Wall Protection	1	5.0	1.25	0.30	1.87
	Apron	1	3.0	5.30	0.30	4.77
	Head wall & H.W. Ext above foundation Part A	1	6.0	0.50	0.50	1.50
	B	1	7.0	0.50	0.50	1.75
	C	1	8.0	0.50	0.50	2.00
	D	1	2.50	0.50	0.50	0.62
	E	1	2.50	0.50	0.50	0.62
	F	1	3.00	0.50	0.50	0.75
	G	1	3.00	0.50	0.50	0.75

	Toe Wall & T.W Ext	1	7.0	0.50	0.50	1.75
	T.W. Ext	2	1.50	0.50	1.00	1.50
	Side wall Part A	2	0.50	0.50	2.50	1.25
	Side wall Part B	2	0.50	0.50	1.50	0.75
	Side wall Part C	2	2.75	0.50	2.50+1.50/2	5.50
	Buttress Part A	1	0.50	0.50	1.00	0.25
	Buttress Part B	1	4.00	0.50	1.0+0.50/2	1.50
						37.33
4	Form work – Foundation					
	Head Wall	1 X 2	6.0	-	1.00	12.00sqm
	Toe Wall & T.W. Ext	1 X 2	7.50	-	1.0	15.00
	Toe wall Protection work	1 X 2	1.25	-	0.45	1.12
	Toe Wall Protection	1		-	0.45	2.25
	Apron	1 X 2	3.50	-	0.45	3.15
						33.52
	Form Work – Head Wall Ext. above foundation Part A	1 X 2	6.00	-	0.50	6.00
	B	1 X 2	7.0	-	0.50	7.00
	C	1 X 2	8.0	-	0.50	8.00
	D	1 X 2	2.50	-	0.50	2.50
	E	1 X 2	2.50	-	0.50	2.50
	F	1 X 2	3.00	-	0.50	3.00
	G	1 X 2	3.00	-	0.50	3.00
	Toe Wall & T.W. Ext	1 X 2	7.00	-	0.50	7.00
	T.W. Ext	2 X 2	1.50	-	1.00	6.00
	Side Wall Part A	2 X 2	0.50	-	2.50	5.00
	B	2 X 2	0.50	-	1.50	3.00
	C	2 X 2	2.75	-	2.50+1.50/2	22.00
	Buttress Part A	1 X 2	0.50	-	1.00	1.00
	B	1 X 2	4.0	-	1.00+0.50/2	6.00
						115.50
					Say	116.00sqm
5	Filling of E/Work behind the side wall L/Side	1	2.50+1.0/2	3.50	2.50+1.0/2	10.71cum
	R/Side	1	2.50+1.0/2	3.50	2.50+1.0/2	10.71cum
						21.42
					Say	21.00

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	5.64	12.97	2.82	5.64
2	C.C 1:2:4	37.33	242.64	16.79	33.58
			255.61	19.61	39.22
		Say	256 bags	20.0 cum	39.00 cum

CC SILT DETENTION STRUCTURE NO.11 VILL KAROLA
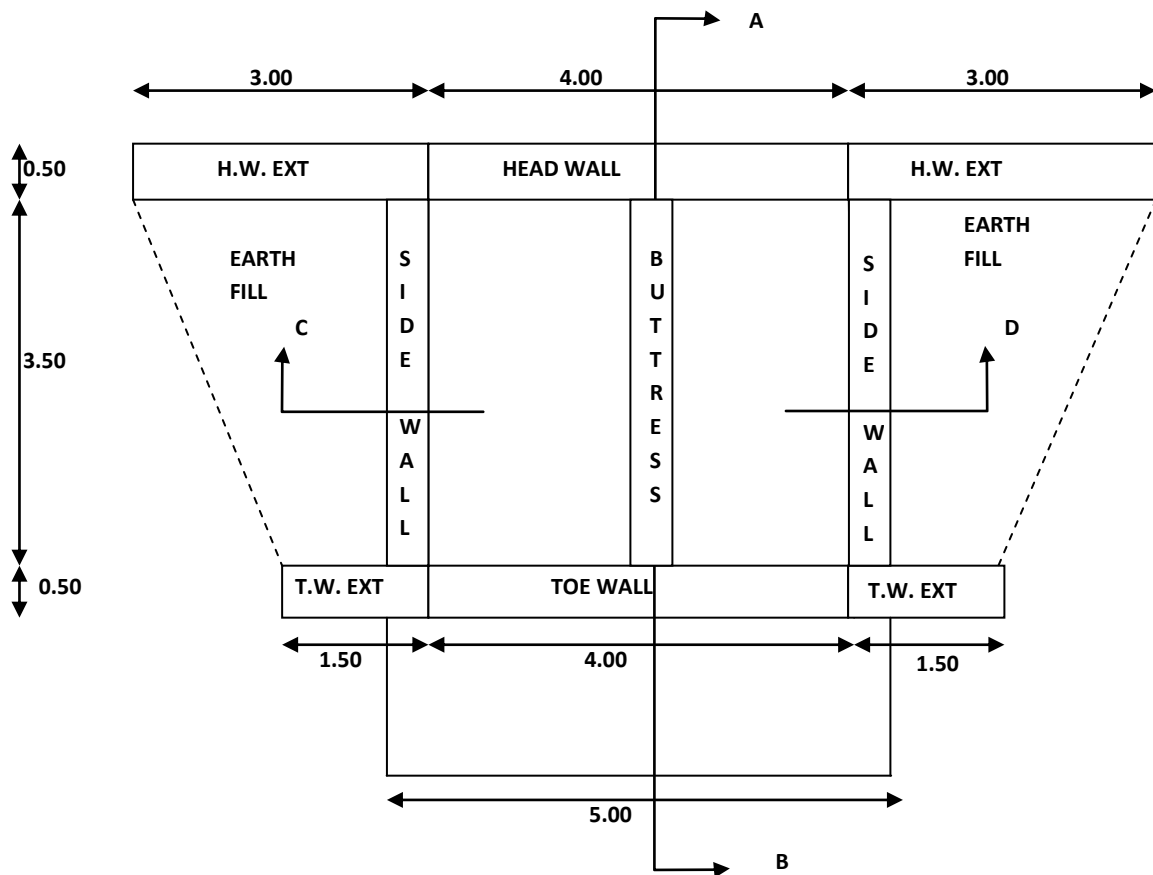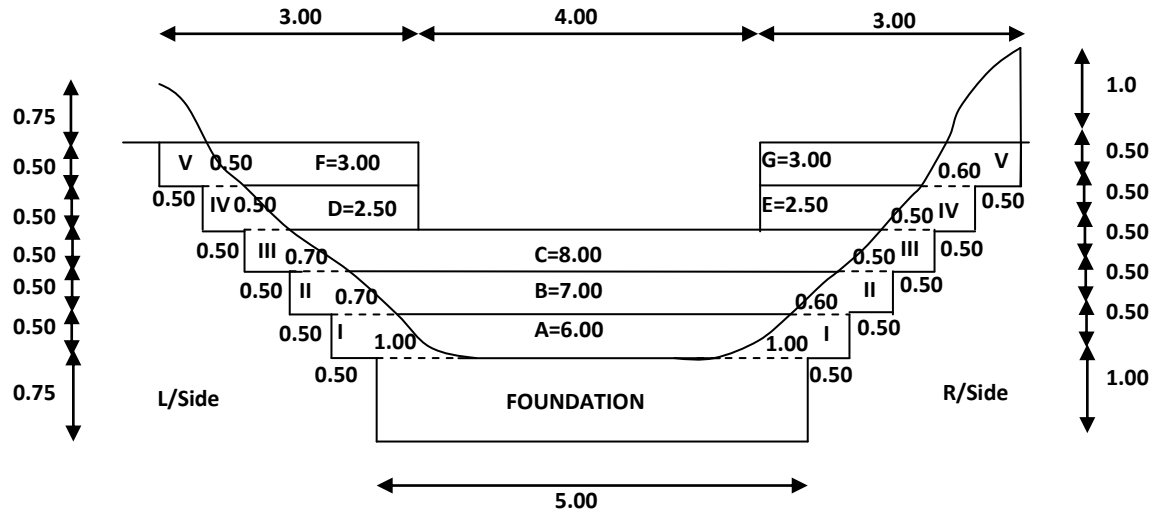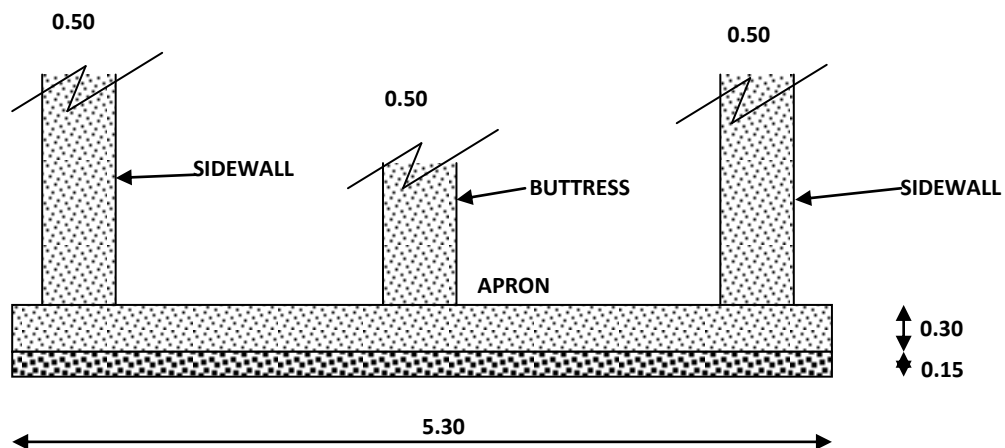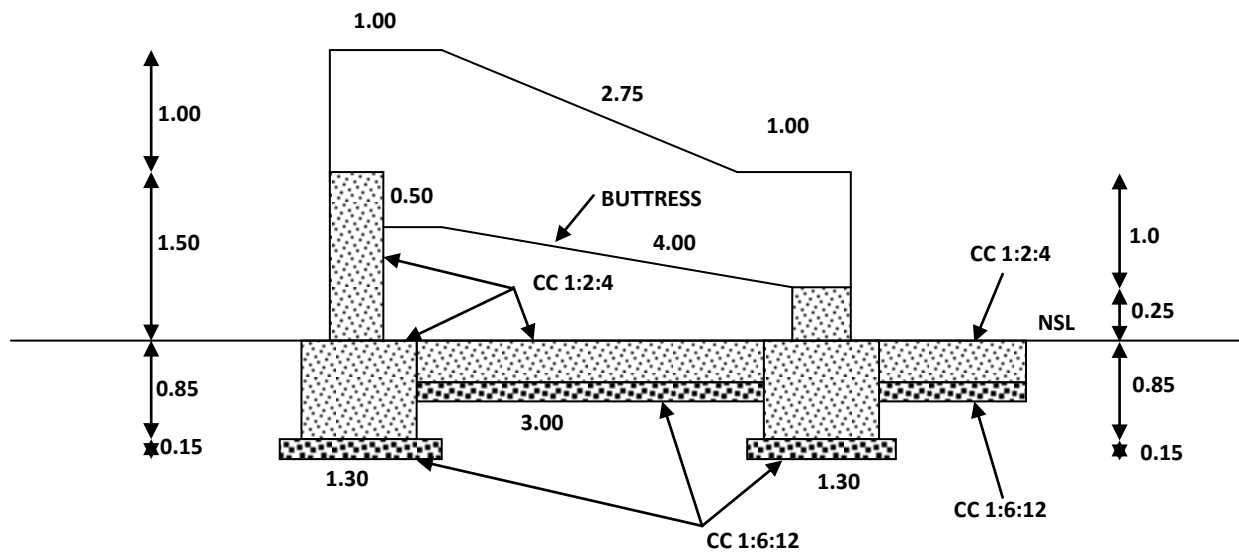
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0.75

1.0

0.50

0.50

V 0.50 F=3.00

G=3.00 0.60 V

0.50

0.50 IV 0.50 D=2.50

E=2.50 0.50 IV 0.50

0.50

0.50

0.50 III 0.70 C=8.00

0.50 III 0.50

0.50

0.50

0.50 II 0.70 B=7.00

0.60 II 0.50

0.50

0.50

0.50 I 1.00 A=6.00

1.00 I 0.50

0.50

0.75

0.50 L/Side FOUNDATION 0.50 R/Side

1.00

5.00

A

3.00	4.00	3.00

0.50

| H.W. EXT | HEAD WALL | H.W. EXT |

3.50

EARTH FILL

S I D E

C

B U T T R E S S

S I D E

EARTH FILL

D

W A L L

W A L L

0.50

| T.W. EXT | TOE WALL | T.W. EXT |

1.50	4.00	1.50

5.00

B

SECTION AT AB

X SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt Detention Structure No.12 Near Basir Ahmed Settlement Across Main Nora Nala

1. **Hydrological Design**

Catchment Area (A) = 910 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 910 / 360 = 106.16 cum/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 2.0

Therefore = $Q = 1.711 \, LH^{3/2}$

$106.16 = 1.711 \, L \, X \, 2 \, X \, \sqrt{2}$

L = 106.16 / 1.711 X 2 X 1.41

= 106.16 / 4.82 = 22.02 say 22.00m

3. **Structural Design**

Drop = 1.50m

H = 2.0m

Top width = Drop X 0.30 = 1.50 X 0.30 = 0.45m say 0.50m

Base width = Drop X 0.60 = 1.50 X 0.60 = 0.90m say 1.30

Apron Length = Drop X 1.50 + H = 1.50 X 1.50 + 2.00 = 3.25 say 3.50m

Foundation Depth = 1/3 X Drop = 1/3 X 1.50 = 0.50 Say 1.0m

RCC Silt Detention Structure No.12 Near Basir Ahmed Settlement Across Main Nora Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall & Head wall extension	1	23.0	1.30	1.0	29.90
	Toe Wall & T.W. Ext	1	26.00	1.30	1.30	33.80
	Toe Wall Protection Work	1	23.0	1.25	0.45	12.93
	Apron	1	3.0	28.30	0.45	31.45
	Head wall & H.W. Ext L/Side 1st Step	1	9.50+4.50/2	0.80	1.50	8.40
	2nd Step	1	6+0/2	0.80	3.00	7.20
	R/side 1st Step	1	9.50+4.50/2	0.80	1.50	8.40
	2nd Step	1	6+0/2	0.80	3.75	9.00
						141.08
					Say	141.00cum
2	C.C. 1:6:12 in foundation Head wall	1	23.0	1.30	0.15	4.48
	Toe wall & T.W. Ext	1	26.0	1.30	0.15	5.07
	Toe wall protection work	1	23.0	1.25	0.15	4.31
	Apron	1	3.0	23.30	0.15	10.45
						24.31
3	C.C.1:2:4 in foundation Head Wall	1	23.0	1.0	0.85	19.55
	Toe wall & T.W. Ext	1	26.0	1.0	0.85	22.10
	Toe wall protection work	1	23.0	1.25	0.30	8.62
	Apron	1	3.0	23.30	0.30	20.97
	Above foundation Head wall Part A	1	23.0	0.50	1.50	17.25
	B	1	2.0	0.50	2.0	2.00
	C	1	2.0	0.50	2.0	2.00
	Side wall Part A	2	1.0	0.50	3.50	3.50
	B	2	0.50	0.50	2.50	1.25
	C	2	2.0	0.50	3.50+2.50/2	6.00
	Buttress Part A	4	0.50	0.50	1.50	1.50
	B	4	3.00	0.50	1.50+0.50/2	6.00
	Toe wall & T.W. Ext	1	26.0	0.50	0.50	6.50
	T.W. Ext	2	2.0	0.50	2.00	4.00
						121.24cum
4	Form work – Foundation					
	Head Wall	1 X 2	23.00	-	1.0	46.00

	Toe Wall & T.W. Ext	1 X 2	26.0	-	1.0	52.00
	Toe Wall Protection work	1 X 0	26.00	-	0.45	1.17
	Apron	1 X 2	3.0	-	0.45	2.70
						101.87
	Form Work – above foundation Head wall & H.W. Ext A	1 X 2	23.0	-	1.50	69.00
	B	1 X 2	2.0	-	2.00	8.00
	C	1 X 2	2.0	-	2.00	8.00
	Side walls Part A	2 X 2	1.0	-	3.50	14.00
	Part B	2 X 2	0.50	-	2.50	5.00
	Part C	2 X 2	2.00	-	3.50+0.50/2	24.00
	Buttress Part A	4 X 2	0.50	-	1.50	6.00
	Part B	4 X 2	3.00		1.50+0.50/2	24.00
	Toe wall & T.W. Ext	1 X 2	26.00	-	0.50	26.00
	T.W. Ext	2 X 2	2.00	-	2.00	16.00
						301.87
					Say	302.00sqm
5.Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	15mm dia vertical bars 15cm c/c	2200/15	147	2.0	294.00	12mm Q
	10mm Q Horizontal bars 20cm c/c	150/20	8	22.50	180m	10mm Q
2	Toe Wall & T.W. Ext					
	15mm Q long bars 15cm c/c	2600/15	174	1.0	174m	12mm Q
	10mm Q cross bars 20cm c/c	50/20	3	26.50	80m	10mm Q
3	Apron 12mm Q Vertical Bars 15cm c/c	2200/20	110	4.0	440m	12mm
	10mm Q Horizontal bars 20cm C/C	350/20	18	22.50	405m	10mm Q

12mmQ 294 + 174 + 440 = 908m X 0.89 = 808.12

10mm Q 180+80 + 405 = 665m X 0.62 = 412.30

= 1220.42

= Say 1220kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	24.31	55.91	12.15	24.30	-
2	C.C 1:2:4	121.24	788.06	54.55	109.10	1220kg
			843.97	66.70	133.40	1220kg
		Say	844 bags	67.0 cum	133.00 cum	1220 kg

RCC SILT DETENTION STRUCTURE NO.12 NEAR BASHIR AHMED SETTLEMENT ACROSS MAIN NORA NALA
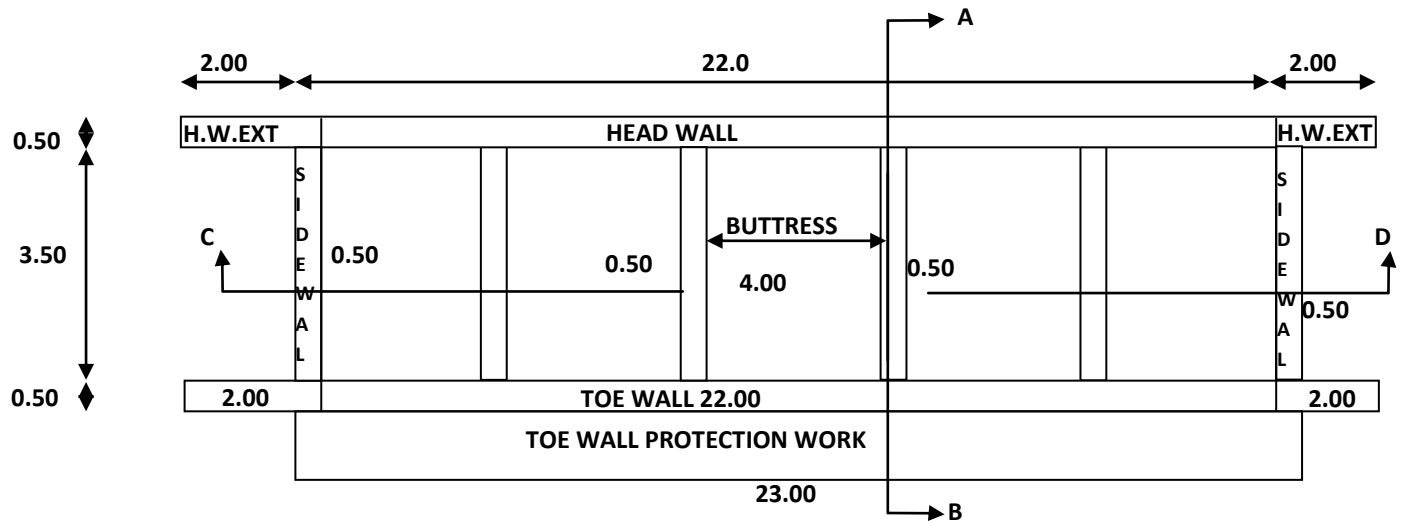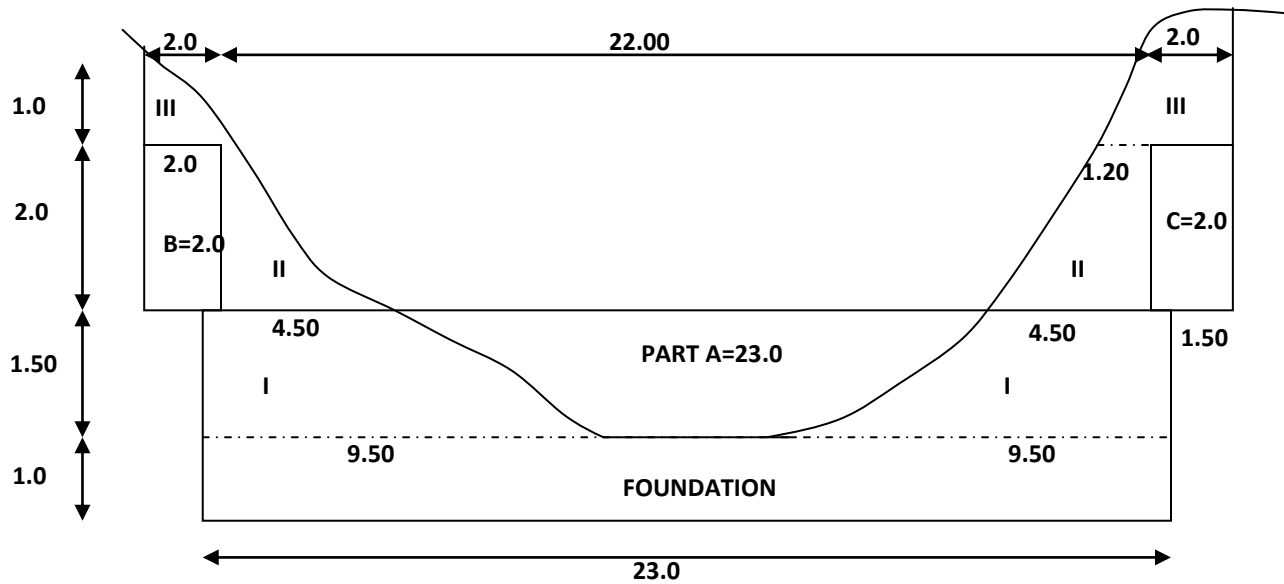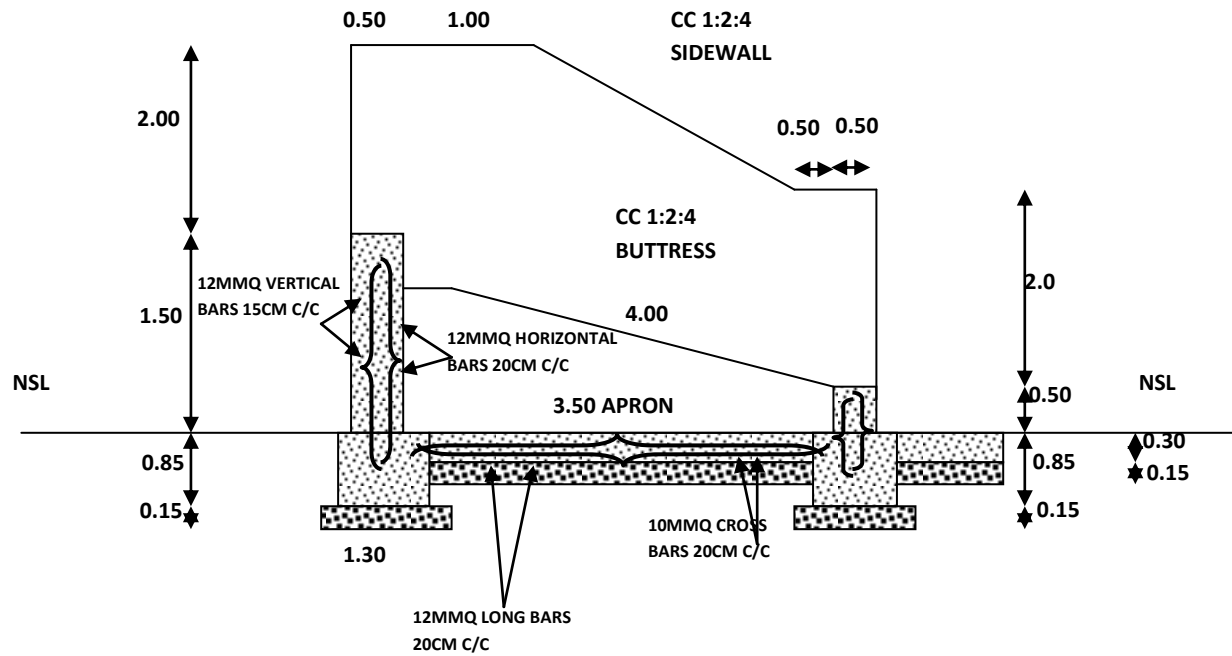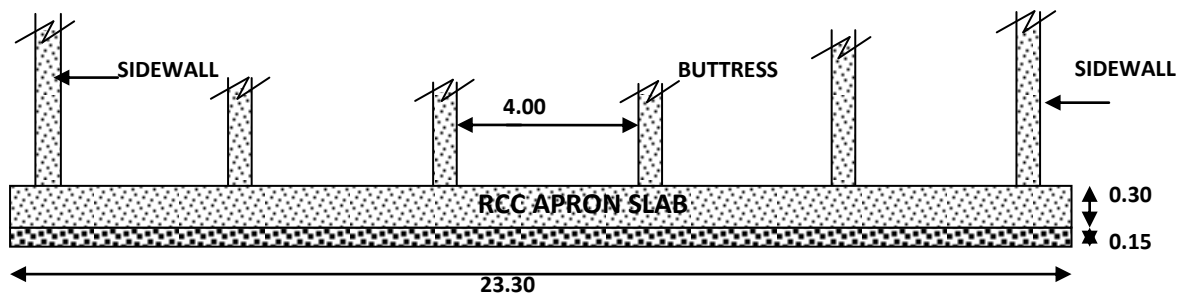
SECTION AT AB

SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC Silt detention structure no.13 near Roshan Din Settlement across main Nora Nala

1. **Hydrological Design**

Catchment Area (A) = 1220 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 1220 / 360 = 142.33 m^3/sec

2. **Hydraulic Design**

Q = 1.711 LH$^{3/2}$

H = 2.50

Peak Discharge = 142.33 cumecs

Therefore = Q = 1.711 LH$^{3/2}$

142.33 = 1.711 L X 2.50 X √2.50

L = 142.33 / 1.711 X 2.50 X 1.58

= 142.33 / 6.76 = 21.05 say 21.0m

3. **Structural Design**

Drop = 2.0

H = 2.50

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 2.50 = 5.50 say 6.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC Silt detention structure no.13 near Roshan Din Settlement across main Nora Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/work in Foundation Head Wall	1	22.0	1.30	1.0	28.60cum
	Toe Wall + T.W. Ext	1	25.0	1.30	1.0	32.50
	Toe Wall Protection Work	1	22.0	1.25	0.45	12.37
	Apron	1	5.50	22.30	0.45	55.19
						128.66
					Say	**129.00**
2	CC 1:6:12 in foundation					
	Headwall	1	22.0	1.30	0.15	4.29 cum
	Toe Wall & T.W. Ext	1	25.0	1.30	0.15	4.87
	Toe Wall Protection Work	1	22.0	1.25	0.15	4.12
	Apron	1	5.50	22.30	0.15	18.39
						31.67 cum
3	CC 1:2:4 in foundation					
	Head wall	1	22.0	1.0	0.85	18.70
	Toe Wall & T.W. Ext	1	25.0	1.0	0.85	21.25
	Toe Wall Protection Work	1	22.0	1.25	0.30	8.25
	Apron	1	5.50	22.30	0.30	36.79
	Head wall & H.W. Ext Part A	1	22.0	0.60	2.00	26.40
	Part B	1	2.0	0.60	2.50	3.00
	Part C	1	2.0	0.60	2.50	3.00
	Side wall Part A	2	1.50	0.50	4.50	6.75
	Part B	2	0.50	0.50	3.0	1.50
	Part C	2	4.75	0.50	4.50+3.0/2	17.81
	Buttress Part A	4	0.50	0.50	2.0	2.00
	Part B	4	5.50	0.50	2.0+0.50/2	13.75
						159.20
4	Form work – Head wall	1 X 2	23.0	-	1.0	46.00
	Toe Wall & T.W. Ext	1 X 2	25.0	-	1.0	50.00
	Toe Wall Protection work	1	25.0	-	0.45	11.25
	Apron	1 X 2	6.00	-	0.45	5.40
	H.W. & H.W. Ext Part A	1 X 2	22.0	-	2.00	44.00
	Part B	1 X 2	2.0	-	2.50	10.00
	Part C	1 X 2	2.0	-	2.50	10.00
	Side Wall Part A	2 X 2	1.50	-	4.50	27.00

	Part B	2 X 2	0.50	-	4.50	9.00
	Part C	2 X 2	4.75	-	4.50+3.0/2	71.25
	Buttress Part A	4 X 2	0.50	-	2.00	8.00
	Part B	4 X 2	5.50	-	2.0+0.50/2	55.00
						346.90
					Say	**347.00sqm**

Calculation of M.S. Bars

Sr. No	Particulars	L	No.	HT		
1	Head Wall					
	12mm Q vertical bars 15cm c/c	2100/15	140	2.50	350m	12mmQ
	10mm Horizontal bars 20cm c/c	200/20	10	21.50	215m	10mmQ
2	Toe Wall & T.W. Ext					
	12mm Q vertical bars 15cm c/c	2100/15	140	1.0	140m	12mmQ
	10mm Horizontal bars 20cm c/c	50/20	2	21.50	43m	10mmQ
3	Apron					
	12mm Q long bars 20cm c/c	600/20	30	21.50	645m	12mmQ
	10mm Q cross bars 20cm c/c	2100/20	105	6.50	583m	10mmQ

Weight = 12mm Q bars = 350+140+645 = 1135 x @0.89 kg/m = 1010.15 kg

10mm Q bars = 215+436+683 = 941 x @0.62 kg/m = 583.42

Total = 1010.15 + 583.42 = 1593.57 say 1594kg

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	31.67	72.84	15.83	31.66	-
2	C.C 1:2:4	159.20	1034.80	71.64	143.25	1594kg
			1107.64	87.47	174.91	1594kg
		Say	1108 bags	87.0 cum	175.00 cum	1594kg

RCC Silt detention structure no.13 near Roshan Din Settlement across main Nora Nala

Lat = 32 – 42 – 977 Long: 75 – 70 - 142
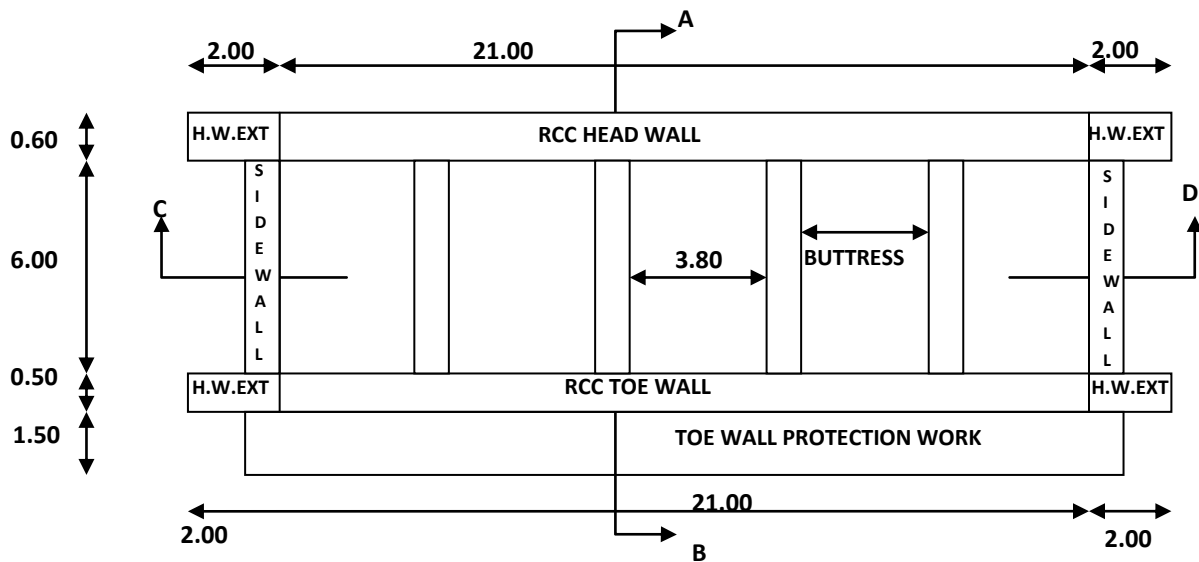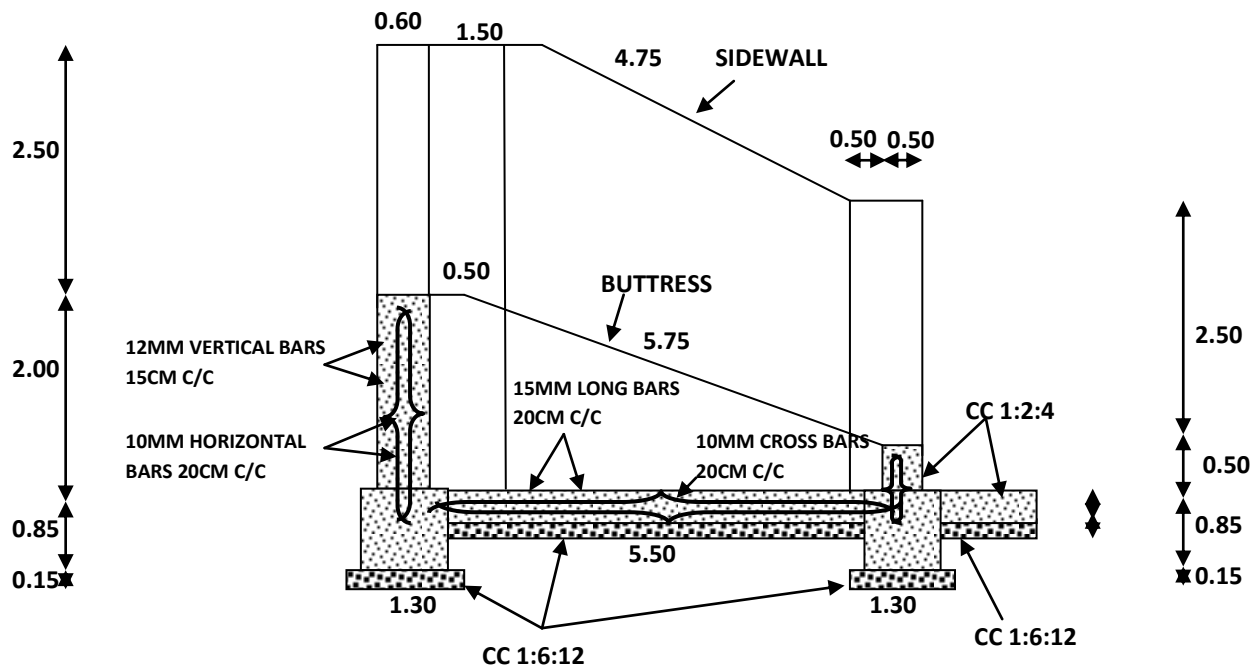
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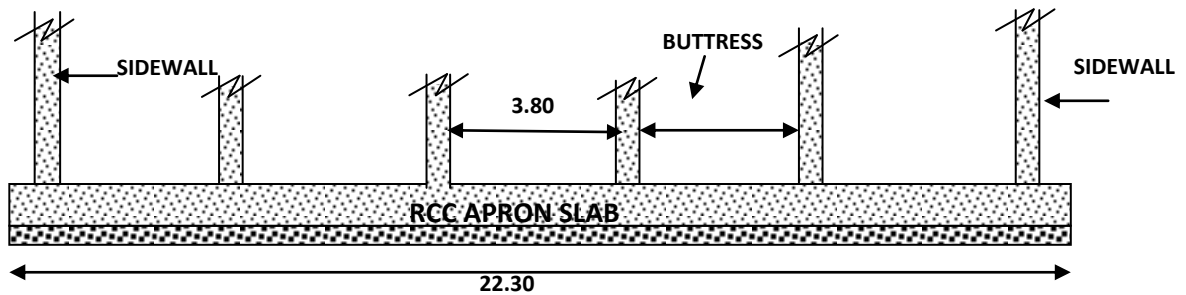
SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC SDS No.14 Across Shikhri Nala Village Nora (Right Side)

1. **Hydrological Design**

Catchment Area (A) = 52 ha

Coefficient Runoff (C) = 0.20

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.20 X 120 X 52 / 360 = 3.46 cumecs

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 0.50

Peak Discharge = 3.46 cumecs

Therefore = $Q = 1.711 \, LH^{3/2}$

3.46 = 1.711 L X 0.50 X √0.50

L = 3.46 / 1.711 X 0.50 X 0.70

= 3.46 / 0.60 = 5.76 say 6.0m

3. **Structure Design**

Drop = 2.0

H = 0.50

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 0.50 = 3.50 say 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC SDS No.14 Across Shikhri Nala Village Nora (Right Side)

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall & Head wall extension	1	20.0	1.30	1.0	26.00 cum
	Anchoring of H.W Ext. L/Side					
	1st Step	1	1.80 + 1.0 / 2	0.80	0.50	0.56cum
	2nd Step	1	1.50 + 0.60 / 2	0.80	0.50	0.42 cum
	3rd Step	1	2.10 + 1.0/2	0.80	0.50	0.62 cum
	4th Step	1	2.50 + 0 / 2	0.80	1.0	1.00 cum
	R/side 1st Step	1	2+1 / 2	0.80	0.50	0.60 cum
	2nd Step	1	1.50 + 0.50 /2	0.80	0.50	0.40 cum
	3rd Step	1	1.50 + 1.0 / 2	0.80	0.50	0.50 cum
	4th Step	1	1.50 + 0.80 / 2	0.80	0.50	0.46 cum
	5th Step	1	1.80 + 0 / 2	0.80	0.50	0.36 cum
	Toe Wall T.W. Ext	1	10.00	1.30	1.0	13.00 cum
	Apron	1	3.25	5.60	0.45	8.19 cum
	Toe wall protection	1	1.10	7.0	0.70	5.39
						57.50
					Say	**58.00**
2	CC 1:6:12 in foundation					
	Head wall	1	20.0	1.30	0.15	3.90cum
	Toe wall & T.W. Ext	1	10.0	1.30	0.15	1.95cum
	Toe wall Protection	1	1.25	7.0	0.15	1.31 cum
	Apron	1	3.50	7.30	0.15	3.83
						10.99 cum
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	20.0	1.0	0.85	17.00cum
	Toe Wall & Ext	1	10.0	1.0	0.85	8.50cum
	Toe Wall Protection	1	7.0	1.25	0.30	2.62cum
	Head wall & H.W. Ext Part A	1	21.50	0.60	0.50	6.45cum
	B	1	22.50	0.60	0.50	6.75cum
	C	1	25.0	0.60	0.50	7.50cum
	D	1	27.0	0.60	0.50	8.10cum
	E	1	11.0	0.60	0.50	3.30cum
	F	1	11.0	0.60	0.50	3.30cum

	Toe Wall & T.W Ext	1	10.0	0.50	0.50	2.50cum
	T.W. Ext	2	2.0	0.50	0.50	1.00
	Toe Wall Protection	1	1.0	1.25	0.30	2.62
	Side wall Part A	2	0.90	0.50	2.50	2.25
	Side wall Part B	2	3.25	0.50	2.50+0.50/2	4.87
	Side wall Part C	2	0.50	0.50	0.75	0.37
	Buttress Part A	1	0.50	0.50	1.50	0.37
	Buttress Part B	1	3.75	0.50	1.50+0.20/2	1.59
	Buttress Part C	1	0.50	0.50	0.75	0.18
	Apron	1	7.30	4.0	0.30	8.76
						88.03
4	Form work – Foundation					
	Head Wall & HW Ext. Length	1 X 2	20.0	-	1.0	40.0 sqm
	Width	1 X 2	1.0	-	1.0	2.0
	Toe Wall & T.W. Ext					
	Length	1 X 2	10.0	-	1.0	20.0
	Width	1 X 2	1.0	-	1.0	2.0
	Toe Wall Protection Length	1	7.0	-	0.45	3.15
	Width	1 X 2	1.25	-	0.45	1.12
						68.27
	Form Work – Toe Wall	1 X 2	6.00	-	0.50	10.00
	T.W Ext	2 X 2	2.0	-	0.50	4.00
	Head wall Part A	1 X 2	21.50	-	0.50	21.50
	B	1 X 2	22.50	-	0.50	22.50
	C	1 X 2	25.0	-	0.50	25.00
	D	1 X 2	27.0	-	0.50	27.00
	E	1 X 2	11.0	-	0.50	11.0
	F	1 X 2	11.0	-	0.50	11.0
	Side walls Part A	2 X 2	0.90	-	2.50	9.00
	Part B	2 X 2	3.25	-	2.50+0.50/2	19.50
	Buttress Part A	1 X 2	0.50	-	1.50	1.50
	Part B	1 X 2	3.75	-	1.50+2.0/2	6.37
	RCC Slab	1 X 2	4.00	-	0.45	3.60
						250.24
					Say	**250sqm**
Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars	600/15	40	2.50	100m	12mm Q

		HT	Nos	L		
	15cm c/c					
	10mm Q Horizontal bars 30cm c/c	2.00/30	7	6.50	46m	10mm Q
2	RCC slab in Apron					
	12mm Q long bars 20cm c/c	600/20	30	4.50	135m	12mm Q
	10mm Q cross bars 20cm c/c	450/20	23	6.30	145m	10mm Q
3	Toe Wall 12mm Q Vertical Bars 15cm c/c	600/15	40	0.80	32m	12mm
	10mm Q Horizontal bars 30cm C/C	50/30	2 No	6.50	13m	10mm Q

12mmQ 100 + 135 + 32 = 267m X 0.89   = 237.63

10mm Q 46+145 + 13 = 204m X 0.62   = 126.48

= **364.11 say 364kg**

S. No	Particulars	No.	L	B	H	Content
6	Filling of E/W behind the side wall					
	L/ Side	1	11.0	4.0	2+0.50/2	55.0
	R/ Side	1	11.0	4.0	2+0.50/2	55.0
						110.0cum

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12 in foundation	10.99 cum	25.27	5.49	10.98	364kg
2	C.C 1:2:4 in foundation and above foundation	88.03	572.20	39.61	79.22	364kg
			597.47	45.10	90.20	364kg
		Say	597 bags	45.0 cum	90.00 cum	**364 kg**

RCC SDS No.14 Across Shikhri Nala Village Nora (Right Side)

DRAWING
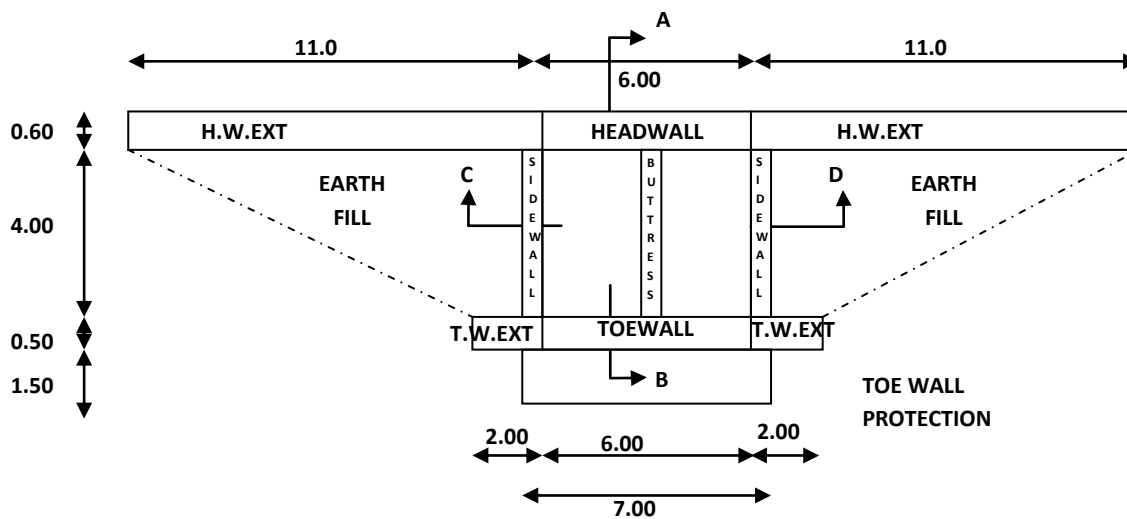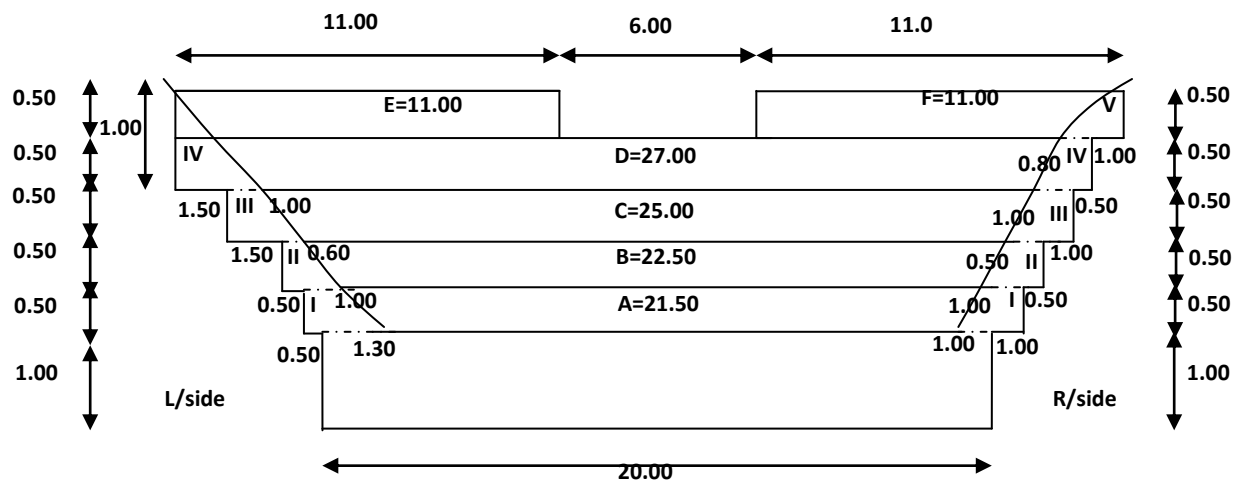
RCC SDS No.14 Across Shikhri Nala Village Nora (Right Side)

SECTION AT AB

X-SECTION AT CD
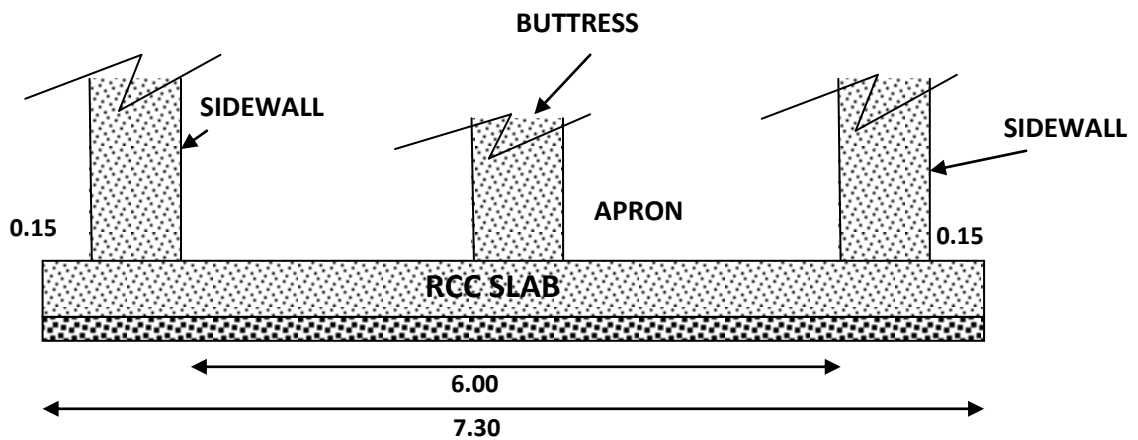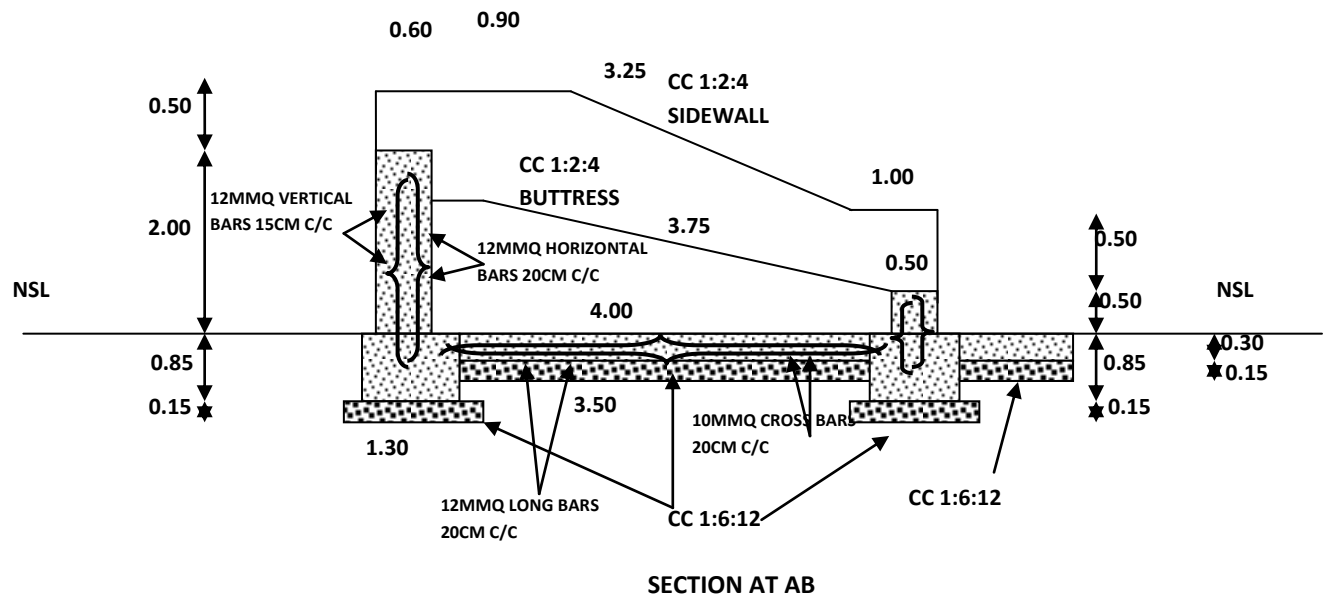
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

15. No. Silt Detention Wire Crates Structure Both Side of Barha Nala (10-12 Ha)-7No-Big

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/Work in foundation Head Wall & Apron	1 X 7	3.0	1.50	1.0	31.50
	Head Wall & H.W Ext					
	1st Step	1 X 7	1.30+0.40/2	1.50	1.0	8.92
	2nd Step	1 X 7	0.90+0.40/2	1.50	1.0	6.82
	3rd Step	1 X 7	0.90+0/2	1.50	1.25	5.90
	R/side 1st Step	1 X 7	1.30+0.50/2	1.50	1.0	9.45
	2nd Step	1 X 7	1.0+0.30/2	1.50	1.0	6.82
	3rd Step	1 X 7	1.30+0/2	1.50	0.70	4.77
						74.18
					Say	**74.00cum**
2	**Weaving of wire netting for wire crates**					
	Foundation 3.0X1.50X1.0					
	Head Wall & Apron					
	Top & Bottom	2 X 7	3.0	1.50	-	31.50sqm
	Front & Back	2 X 7	3.0	-	1.0	42.00
	Sides	2 X 7	-	1.50	1.0	21.00
	Head Wall & H.W. Ext Part A					
	4 X 1.50 X 1.0					
	Top & Bottom	2 X 7	4.0	1.50	1.0	84.00
	Front & Back	2 X 7	4.0	-	1.00	56.00
	Sides	2 X 7	-	1.50	1.0	21.00
	Part B 5 X 1.50 X 1.0					
	Top & Bottom	2 X 7	5.0	1.0	1.0	70.00
	Front & Back	2 X 7	5.0	-	1.0	70.0
	Sides	2 X 7	-	1.0	1.0	14.00
	Part C & D					
	Top & Bottom	2 X 7	2.0	1.0	-	56.00
	Front & Back	2 X 7	2.0	-	0.50	28.00
	Sides	2 X 7	-	1.0	0.50	14.00
						507.50sqm
					Say	**508.00sqm**
3	Filling of Stones into the					

	wire crate in foundation					
	Head Wall & Apron	1 X 7	3.0	1.50	1.0	31.50
	Head Wall & H.W. Ext					
	Part A	1 X 7	4.0	1.50	1.0	42.00
	Part B	1 X 7	5.0	1.0	1.0	35.00
	Part C & D	2 X 7	2.00	1.0	0.50	14.00
						122.50
					Say	**123.00cum**

Material Statement

S. No	Particulars	Qty.	5mmQ G.I. Wire		Stone
1	Weaving wire netting for wire crates mesh 15x15cm @2.23kg/sqm	508sqm	1132.84kg		-
2	Filling of stone into wire crate @1.1/cum	123.0	-		135.30
			1132.85	Less 1/2 Voids	19.30
		Say	1133.00kg		116.00cum

15. No. Silt Detention Wire Crates Structure Both Side of Barha Nala(10-12 Ha)-6 No small

Crest Length = 2.00
Drop = 2.00
Head over crest = 0.50
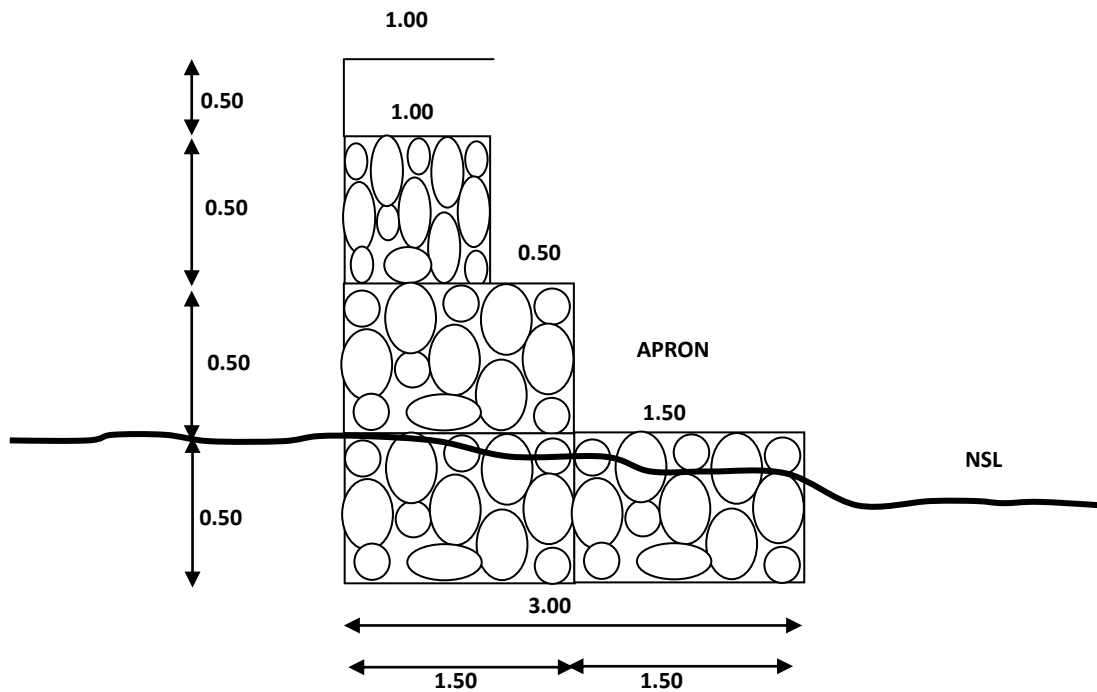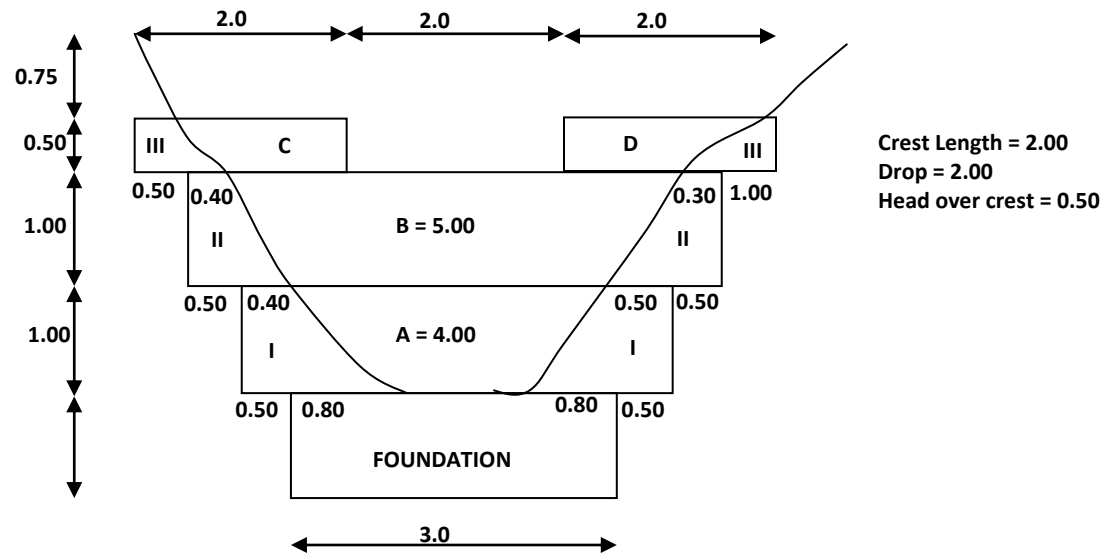
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

16. No. Silt Detention Wire Crates Structure Both side of Barha Nala (10-12 ha)6 No small

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in e/work in foundation Head Wall & Apron	1 X 6	3.0	1.0	0.50	9.00cum
	H.Wall & H.W. Ext L/Side					
	1st Step	1 X 6	0.80+0.30/2	1.0	0.50	1.65
	2nd Step	1 X 6	0.80+0.50/2	1.0	0.50	1.95
	3rd Step	1 X 6	0.50+0.40/2	1.0	0.50	1.35
	4th Step	1 X 6	0.65+0/2	1.0	1.20	2.34
	R/side 1st Step	1 X 6	0.80+0.40/2	1.0	0.50	1.80
	2nd Step	1 X 6	0.90+0.60/2	1.0	0.50	2.25
	3rd Step	1 X 6	0.60+0.40/2	1.0	0.50	1.50
	4th Step	1 X 6	0.65+0/2	1.0	1.0	1.95
						23.79
					Say	**24.00**
2	Weaving wire netting for wire crates mesh 15cmX15cm					
	Foundation + Apron 3X1.0X0.50					
	Bottom & Top	2 X 6	3.0	1.0	-	36.00
	Front & Back	2 X 6	3.0	-	0.50	18.00
	Sides	2 X 6	-	1.0	0.50	6.00
	Head wall & H.W. Ext					
	Part A 3 X 1.0 X 0.50					
	Bottom & Top	2 X 6	3.0	1.0	-	36.00
	Front & Back	2 X 6	3.0	-	0.50	18.00
	Sides	2 X 6	-	1.0	0.50	6.00
	Part B & C 4.0X1.0X1.0					
	Bottom & Top	2 X 6	4.0	1.0	-	48.00
	Front & Back	2 X 6	4.0	-	1.0	48.00
	Sides	2 X 6	-	1.0	1.0	12.0
	Part D & E 1.50X1.0X0.50					
	Bottom & Top	2X2X6	1.50	1.0	-	36.00
	Front & Back	2X2X6	1.50	-	0.50	18.00

	Sides	2X2X6	-	1.0	0.50	12.00
						294.0
3	Filling of stone into wire crate foundation					
	3X1.0X0.50					
	Head wall & Apron	1 X 6	3.0	1.0	0.50	9.00
	Headwall & H.W. Ext. Part A	1 X 6	3.0	1.0	0.50	9.00
	Part B & C	1 X 6	4.0	1.0	1.0	24.0
	Part D & E	2 X 6	1.50	1.0	0.50	9.00
						51.0

Material Statement

S. No	Particulars	Qty.	50mmQ G.I Wire		Stone
1	Weaving wire netting for wire crates (mesh 15cmX15cm) @2.23kg/sqm	294sqm	655.62	-	-
2	Filling of Stone into wire crates 1.1/cum	51.0cum	-	-	56.10
			655.62	-	56.10
		Say	656kg	Less 1/2 Void	8.01
					48.09
				Say	48.00cum

16 No. Silt Detention Wire Crates Structure Both side of Barha Nala (10-12 ha) small

Crest Length = 1.50
Drop = 1.50
Head over crest = 0.50
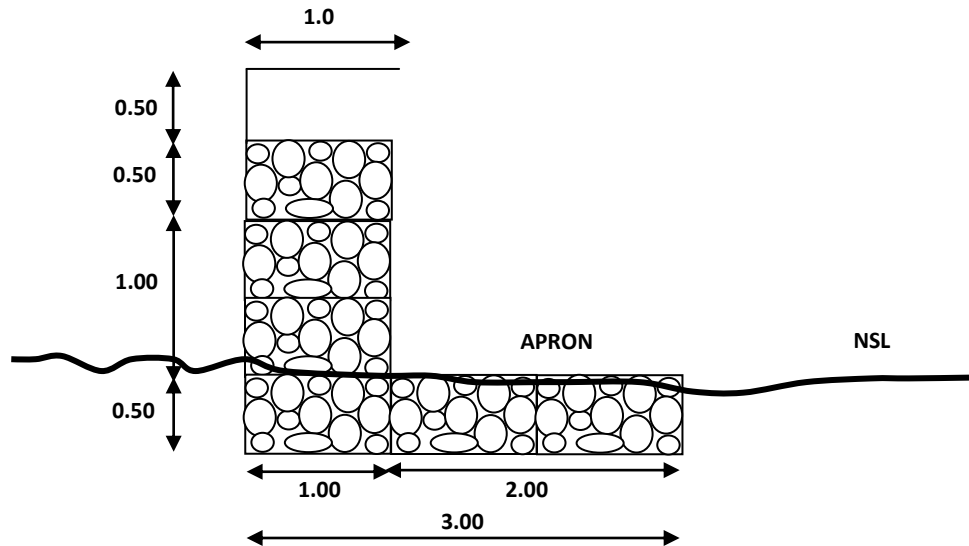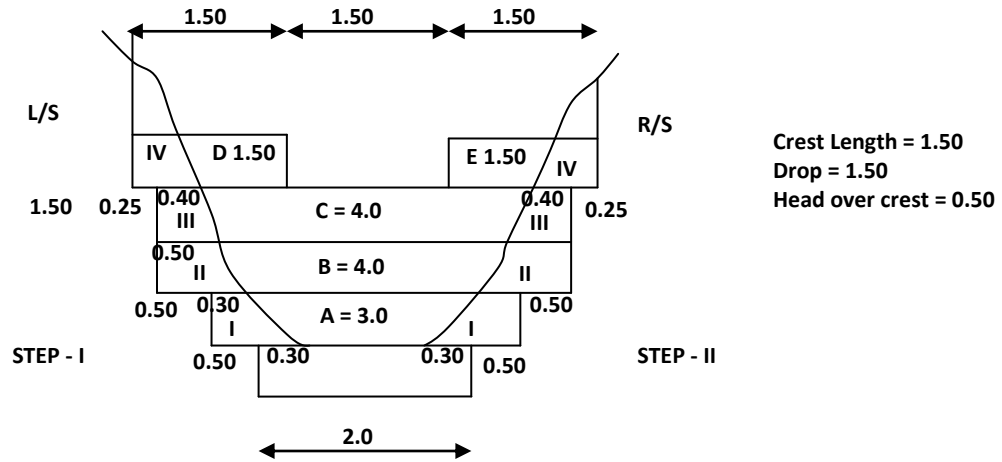
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

6.2 Silt Detention Structures in Gharti Nala Catchment

Silt Detention Structure No.1

Extension of Head Wall of SDS No.1

S. NO	Particulars	No.	L	B	H	Contents
1	CC 1:2:4 Raising of Head wall Ext					
	L/Side	1	11.0	0.60	1.00	6.60
	R/Side	1	11.0	0.60	1.0	6.60
						13.20cum
2	Form Work					
	H.W Ext L/Side	1 X 2	11.0	-	1.0	22.00
	R/Side	1 X 2	11.0	-	1.0	22.0
						44.00sqm

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:2:4	13.20	85.80	5.94	11.80
		Say 13	86.0	6.00	12.00 cum

EXTENSION OF HEAD WALL EXT. OF SDS NO.16
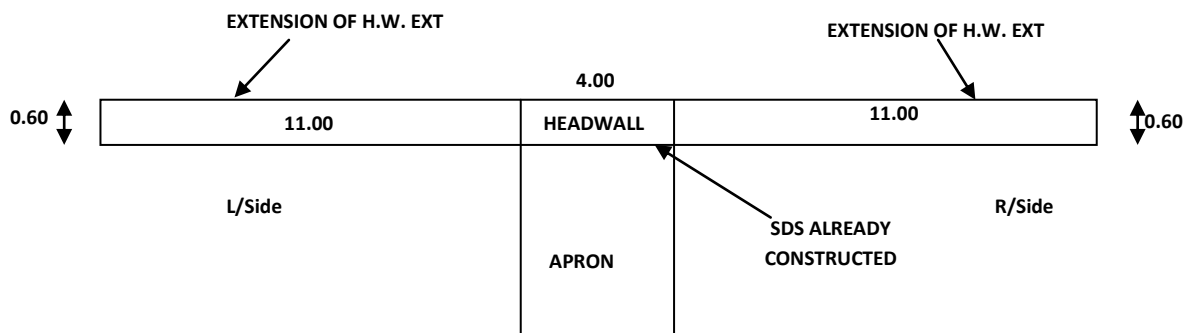
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC SILT DETENTION STRUCTURE NO – 2

1. Hydrological Design

Catchment Area (A) = 20 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 20 / 360 = 2.33 cum/sec

2. Hydraulic Design

$Q = 1.711 \, LH^{3/2}$

H = 0.60

Peak Discharge = 2.33 cum/sec

Therefore = $Q = 1.711 \, LH^{3/2}$

2.33 = 1.711 L X 0.60 X √0.60

L = 2.33 / 1.711 X 0.60 X 0.77

= 2.33 / 0.79 = 2.94 say 3.0m

3. Structural Design

Drop = 2.0

H = 0.60

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 0.60 = 3.60 say 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC SILT DETENTION STRUCTURE NO.2

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/work in foundation Headwall	1	4.0	1.30	1.0	5.20cum
	Toe Wall & T.W. Ext	1	6.0	1.30	1.0	7.80
	Toe Wall Protection work	1	4.0	1.25	0.45	2.25
	Apron	1	3.50	4.30	0.45	6.77
	Anchoring of Head Wall Ext Left Side 1st Step	1	1.20+0.50/2	0.80	0.50	0.38
	2nd Step	1	1.20+0.60/2	0.80	1.00	0.72
	3rd Step	1	1.10+0/2	0.80	2.50	1.10
	R/Side 1st Step	1	1.70+1.0/2	0.80	0.50	0.54
	2nd Step	1	1.50+0.60/2	0.80	0.50	0.42
	3rd Step	1	1.60+0.80/2	0.80	0.50	0.48
	4th Step	1	1.80+0.80/2	0.80	0.50	0.52
	5th Step	1	1.30+0/2	0.80	1.25	0.65
						26.83
					Say	**27.00cum**
2	CC 1:6:12 in foundation					
	Head Wall	1	4.0	1.30	0.15	0.78
	Toe Wall & T.W. Ext	1	6.00	1.30	0.15	1.17
	Toe Wall Protection Work	1	4.0	1.25	0.15	0.75
	Apron	1	3.50	4.30	0.15	2.25
						4.95
3	CC 1:2:4 in foundation					
	Head Wall	1	4.0	1.0	0.85	3.40
	Toe Wall & T.W. Ext	1	6.0	1.0	0.85	5.10
	Toe Wall Protection Work	1	4.0	1.25	0.30	1.50
	Apron	1	3.50	4.30	0.30	4.51
	Head Wall & H.W. Ext above Foundation A	1	5.50	0.60	0.50	1.65
	B	1	6.50	0.60	0.50	1.95
	C	1	7.50	0.60	0.50	2.25
	D	1	9.00	0.60	0.50	2.70
	E	1	2.00	0.60	0.60	0.72
	F	1	4.50	0.60	0.60	1.62
	Side Wall Part A	2	1.0	0.50	2.60	2.60

	B	2	0.50	0.50	1.10	0.55
	C	2	2.50	0.50	2.60+1.10/2	4.62
						33.17
4	Form work Foundation					
	Head Wall	1 X 2	5.0	-	1.0	10.00
	Toe Wall & T.W. Ext	1 X 2	6.0	-	1.0	12.00
	Toe Wall Protection Work	1 X 2	5.25	-	0.45	4.72
	Apron	1 X 2	4.0	-	0.45	3.60
	Above foundation Head Wall A	1 X 2	5.50	-	0.50	5.50
	B	1 X 2	6.50	-	0.50	6.50
	C	1 X 2	7.50	-	0.50	7.50
	D	1 X 2	9.0	-	0.50	9.00
	E	1 X 2	2.0	-	0.60	2.40
	F	1 X 2	4.50	-	0.60	5.40
	Toe Wall & T.W. Ext	1 X 2	6.00	-	0.50	6.00
	T.W. Ext	2 X 2	1.50	-	0.60	3.60
	Side Wall Part A	2 X 2	1.0	-	2.60	10.40
	Part B	2 X 2	0.50	-	1.10	2.20
	Part C	2 X 2	2.50	-	2.60+1.10/2	18.50
						107.32
					Say	**107.00sqm**
5	Filling of E/Work behind the side wall					
	L/Side	1	1.50+1.0/2	4.0	2.60+0.50/2	7.75cum
	R/Side	1	4.0+1.0/2	4.0	2.60+0.50/2	15.50
						23.25
					Say	**23.00**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	4.95	11.38	2.47	4.94
2	C.C 1:2:4	33.17	215.60	14.92	29.84
			226.98	17.39	34.78
		Say	227 bags	17.0 cum	35.00 cum

CC SILT DETENTION STRUCTURE NO.2

Cross-section dimensions:

Top: 2.00 | 3.00 | 4.50

Left side (L/Side): 1.50, 0.60, 0.50, 1.00, 0.50, 1.00

Right side (R/Side): 0.60, 0.60, 0.50, 0.50, 0.50, 0.50, 1.00

Layers: III, E=2.00 | F=4.00, V | D=9.00, IV (0.50) | C=7.50, III (1.0) | B=6.50, II (1.0) | A=5.50, I (0.50) | FOUNDATION

Left labels: 0.50, II, 0.50, I, 0.50

FOUNDATION width: 4.00

Plan dimensions:

Top: 2.00 | 3.00 | 4.50

Left: 0.60, 4.00, 0.50, 1.50

H.W. EXT | HEADWALL | H.W. EXT

EARTH FILL | SIDEWALL | APRON | SIDEWALL | EARTH FILL

T.W. EXT | TOE WALL | T.W. EXT

1.50 | 1.50

TOE WALL PROTECTION

4.00

0.60 1.00

0.60

2.00

CC 1:2:4

A

C

0.500.50

B

0.60

0.50

NSL

NSL

0.85

4.00

0.30

0.15

0.85

0.15

1.30

CC 1:6:12

1.30

SIDEWALL

SIDEWALL

APRON

4.30

X-SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure No.3

   1. **Hydrological Design**

Catchment Area (A) = 40 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 40 / 360 = 4.66 cum/sec

   2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 1.0

$4.66 = 1.711 \, L \times 1 \times \sqrt{1}$

L = 4.66 / 1.711

= 2.73 say 3.00m

   3. **Structural Design**

Drop = 2.0

H = 1.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1.00 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure No.3

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall & Head wall extension	1	4.0	1.30	1.0	5.200 cum
	Toe Wall & T.W. Ext	1	5.00	1.30	1.00	6.50
	Toe Wall Protection	1	4.0	1.25	0.45	2.25
	Apron	1	3.50	4.00	0.45	6.30
	Anchoring Head wall Ext. L/Side 1st Step	1	2.0+1.30/2	0.80	0.50	0.66
	2nd step	1	1.80+1.0/2	0.80	0.50	0.56
	3rd step	1	1.50+0.70/2	0.80	0.50	0.44
	4th step	1	1.20+0.70/2	0.80	0.50	0.38
	5th step	1	1.20+0/2	0.80	0.50	0.24
	R/Side 1st step	1	1.50+0.30/2	0.80	2.00	1.44
	2nd step	1	1.30+0/2	0.80	1.50	0.78
						24.75
					Say	25.00cum
2	CC 1:6:12 in foundation					
	Head wall	1	4.0	1.30	0.15	0.78 cum
	Toe wall & T.W. Ext	1	5.0	1.30	015	0.97
	Toe wall Protection	1	4.0	1.25	0.15	0.75
	Apron	1	3.50	4.30	0.15	2.25
						4.75 cum
3	CC 1:2:4 in foundation					
	Head wall	1	4.0	1.0	0.35	3.40
	Toe Wall & Ext	1	6.0	1.0	0.85	4.25
	Toe Wall Protection	1	4.0	1.25	0.30	1.50
	Apron	1	3.50	4.30	0.30	4.51
	Above foundation Head wall & H.W. Ext Part A	1	4.50	0.60	0.50	1.35
	B	1	5.00	0.60	0.50	1.50
	C	1	5.50	0.60	0.50	1.65
	D	1	6.00	0.60	0.50	1.80
	E	1	3.00	0.60	1.00	1.80
	F	1	1.50	0.60	1.0	0.90
	Toe Wall & T.W. Ext	1	5.0	0.50	0.50	1.25
	T.W. Ext	2	1.0	0.50	0.60	0.60
	Side wall Part A	2	1.0	0.50	3.10	3.10
	Side wall Part B	2	0.50	0.50	1.54	1.50
	Side wall Part C	2	2.50	0.50	3.10+1.5	5.75

					0/2	
						34.86
4	Form work – Foundation					
	Head Wall	1 X 2	4.0	-	1.0	8.00
	Toe Wall & T.W. Ext	1 X 2	5.0	-	1.0	10.00
	Toe Wall Protection work	1 X 2	7.0	-	0.45	6.30
	Apron	1 X 2	3.50	-	0.45	3.15
	Head wall & H.W Ext Part A	1 X 2	4.50	-	0.50	4.50
	B	1 X 2	5.0	-	0.50	5.00
	C	1 X 2	5.50	-	0.50	5.50
	D	1 X 2	6.00	-	0.50	6.00
	E	1 X 2	3.00	-	1.00	6.00
	F	1 X 2	1.50	-	1.00	3.00
	Toe Wall & T.W. Ext	1 X 2	5.00	-	0.50	5.00
	T.W. Ext	2 X 2	1.0	-	0.60	2.40
	Side wall Part A	2 X 2	1.00	-	3.10	12.40
	Part B	2 X 2	0.50	-	1.50	3.00
	Part C	2 X 2	2.50	-	3.10+1.50/2	23.00
						103.25
					Say	103.00sqm
5	Filling of E/work behind the side wall L/Side	1	2.50+0.50/2	4.00	3+1/2	12.00
	R/Side	1	1.0+0.50/2	4.0	3+1/2	6.00
						18.00

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	4.75	10.92	2.37	4.74
2	C.C 1:2:4	34.86	226.59	15.68	31.36
			237.51	18.05	36.10
		Say	238 bags	18.0 cum	36.00 cum

CC Silt Detention Structure No.3

Upper diagram — Cross section:

3.00 | 3.00 | 1.50

1.00

E=3.00

V 0.70

II

F=1.50

0.50

0.50 IV 0.70   D=6.00   0.30   1.00

0.50 III 1.00   C=5.50   I

0.50 II 1.30   B=5.00

0.50 I 1.50   A=4.50

L/Side   0.70   R/Side

0.50   FOUNDATION

1.00

4.00

Lower diagram — Plan:

3.00 | 3.00 | 1.50

0.60

| H.W EXT | HEADWALL | H.W EXT |

EARTH FILL

C   SIDE WALL   APRON   SIDE WALL   D

EARTH FILL

4.00

L/Side   R/Side

0.50

| T.W EXT 1.00 | TOEWALL 3.00 | T.W EXT 1.00 |

TOE WALL PROTECTION WORK

1.50

4.00

SECTION AT AB

0.60   **1.00**

SIDEWALL

1.00

0.60

A

0.50   **0.50**

C

1.00

2.00

B   **0.50**

0.50

1.50

4.00

0.85

0.30

0.15

1.00

0.15

3.50

1.30   **1.30**

SECTION AT AB

X-SECTION AT CD

0.15   **APRON**   **0.15**

4.30

X-SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC SDS No.4 Across Gharti Nala (Narrow Side Gully)

1. **Hydrological Design**

Catchment Area (A) = 50 ha

Coefficient Runoff (C) = 0.20

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.20 X 120 X 50 / 360 = 3.33 cum/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 0.50

Peak Discharge = 3.33 cum/sec

Therefore L = Q / 1.711 X 0.50 X √0.50

= 3.33 / 1. 711 X 0.50 X 0.70

L = 3.33 / 0.60 = 5.55 say 6.0m

3. **Structural Design**

Drop = 3.0

H = 0.50

Top width = Drop X 0.30 = 3 X 0.30 = 0.90m

Base width = Drop X 0.60 = 3 X 0.60 = 1.80m say 2.0

Apron Length = Drop X 1.50 + H = 3 X 1.50 + 0.50 = 5.00m

Foundation Depth = 1/3 X Drop = 1/3 X 3.0 = 1.0m

RCC SDS No.4 Across Gharti Nala (Narrow Side Gully)

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall	1	5.00	2.00	1.0	10.00 cum
	Anchoring of H.W Ext. L/Side					
	1st Step	1	0.80+0.50/2	1.20	0.50	0.39cum
	2nd Step	1	1.0+0.60/2	1.20	1.00	0.96 cum
	3rd Step	1	1.10+0.50/2	1.20	1.00	0.96 cum
	4th Step	1	1.0+0.50/2	1.20	0.50	0.45 cum
	5th Step	1	1.0+0/2	1.20	1.50	0.90 cum
	R/side 1st Step	1	1.0+0.60/2	1.20	0.50	0.48cum
	2nd Step	1	1.10+0.50/2	1.20	0.50	1.44 cum
	3rd Step	1	1.0+0.50/2	1.20	1.0	0.90 cum
	4th Step	1	1.0+0/2	1.20	1.50	0.90 cum
	Toe Wall & T.W. Ext	1	8.0	1.30	1.0	10.40 cum
	Toe wall protection	1	7.0	1.25	0.45	3.93 cum
	Apron	1	4.05	7.30	0.45	13.30
						45.01
					Say	**45.00cum**
2	CC 1:6:12 in foundation					
	Head wall	1	6.00	2.00	0.15	1.80cum
	Toe wall & T.W. Ext	1	8.0	1.30	0.15	1.56cum
	Toe wall Protection	1	7.0	1.25	0.15	1.31 cum
	Apron	1	5.0	7.30	0.15	5.47
						10.14 cum
3	CC 1:2:4 in foundation					
	Head wall foundation	1	5.00	1.70	0.85	7.22cum
	Toe Wall & Ext foundation	1	8.0	1.0	0.85	6.80cum
	Toe Wall Protection	1	7.0	1.25	0.30	2.62cum
	CC 1:2:4 above foundation Head Wall Part A	1	5.50	0.90	0.50	2.47cum
	B	1	6.50	0.90	1.0	5.85cum
	C	1	7.0	0.90	0.50	3.15cum
	D	1	7.50	0.90	0.50	3.37cum
	E	1	8.0	0.90	0.50	3.60cum
	F	1	1.50	0.90	0.50	0.67cum
	G	1	1.50	0.90	0.50	0.67cum
	Toe Wall & T.W Ext	1	8.0	0.50	0.50	2.00cum

	T.W. Ext	2	1.00	0.50	0.50	0.50
	Side wall Part A	2	1.00	0.50	3.50	3.50
	Side wall Part B	2	4.50	0.50	3.50+0.75/2	9.56
	Side wall Part C	2	0.50	0.50	0.75	0.37
	Buttress Part A	1	0.50	0.50	2.0	0.50
	Buttress Part B	1	5.00	0.50	2.0+0.25/2	2.81
	Apron	1	5.0	7.30	0.30	10.95
						66.61
4	Form work					
	Head Wall Foundation Length	1 X 2	5.0	-	1.0	10.0 sqm
	Width	2 X 2	1.0	-	1.0	4.0
	Toe Wall & T.W. Ext					
	Length	1 X 2	8.0	-	1.0	16.00
	Width	1 X 2	1.0	-	1.0	2.0
	Toe Wall Protection Length	1 X 2	7.0	-	0.45	6.30
	Width	1 X 2	1.25	-	0.45	1.12
	Toe Wall and T.W. Ext above foundation	1 X 2	8.0	-	0.50	8.00
	T.W Ext	2 X 2	2.0	-	0.50	4.00
	Head wall & H.W. Ext Part A	1 X 2	5.50	-	0.50	5.50
	B	1 X 2	6.50	-	1.0	13.00
	C	1 X 2	7.0	-	0.50	7.00
	D	1 X 2	7.50	-	0.50	7.50
	E	1 X 2	8.0	-	0.50	8.00
	F	1 X 2	1.50	-	0.50	1.50
	G	1 X 2	1.50	-	0.50	1.50
	Apron RCC Slab	1 X 2	5.00	-	0.45	4.50
	Filling of E/work behind the side wall					
	L / Side	1	1.50+0.50/2	5.0	3.50+0.75/2	10.62
	R/ Side	1	1.50+0.50/2	5.0	3.50+0.75/2	10.62
						21.24
					Say	**21.00cum**
Calculation of MS Bars						
		L	Nos.	HT		
1	Head Wall					
	12mm dia vertical bars 15cm c/c	600/15	40	3.50	140m	12mm Q

	10mm Q Horizontal bars 30cm c/c	300/30	10	6.50	65m	10mm Q
2	RCC slab in Apron					
	12mm Q long bars 20cm c/c	830/20	42	5.50	231m	12mm Q
	10mm Q cross bars 20cm c/c	500/20	25	8.50	213m	10mm Q
3	Toe Wall					
3	12mm Q Vertical Bars 15cm c/c	600/15	40	0.80	32m	12mm
	10mm Q Horizontal bars 30cm C/C	50/30	2	6.50	13m	10mm Q

12mmQ 140 + 231 + 32   = 403m @0.89/kg/m = 358.67

10mm Q 65 + 213 + 13   = 291m@0.62kg/m = 100.42

                                                  = **459.09 say 459kg**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12 in foundation @ C 2.30 S 0.50 B 1.0	10.14cum	23.32	5.07	10.14	-
2	C.C 1:2:4 @ C 6.50 S 0.45 B 0.90	66.61 cum	432.96	29.97	59.94	459kg
			456.28	35.04	70.08	459kg
		Say	456 bags	35.0 cum	70.00 cum	459 kg

RCC SDS No.4 Across Gharti Nala (Narrow Side Gully)

L – SECTION, PLAN & X-SECTION OF SILT DETENTION STRUCTURE NO.13 ACROSS GHARTI NALA
VILLAGE NORA TEH & DISTT KATHUA
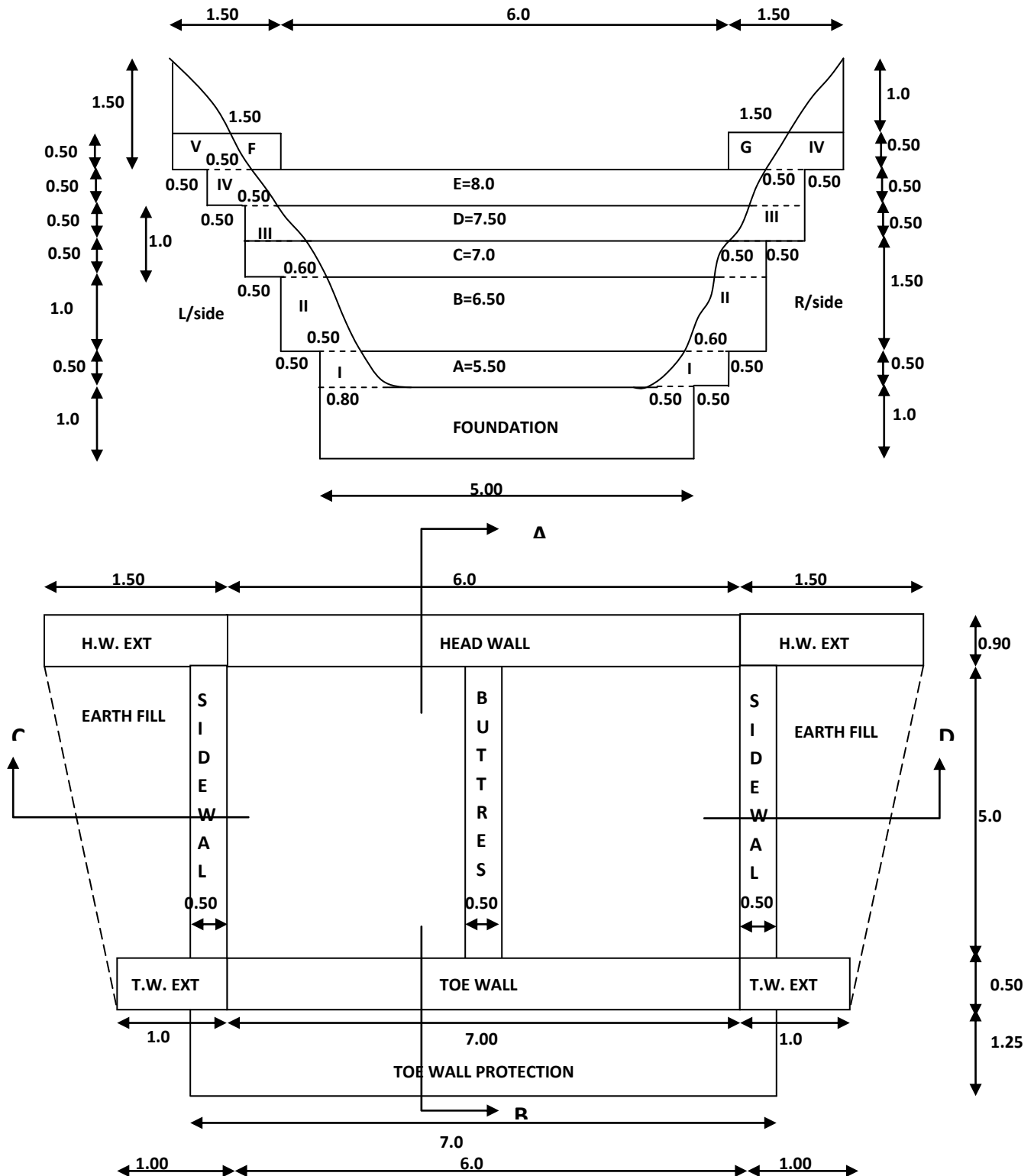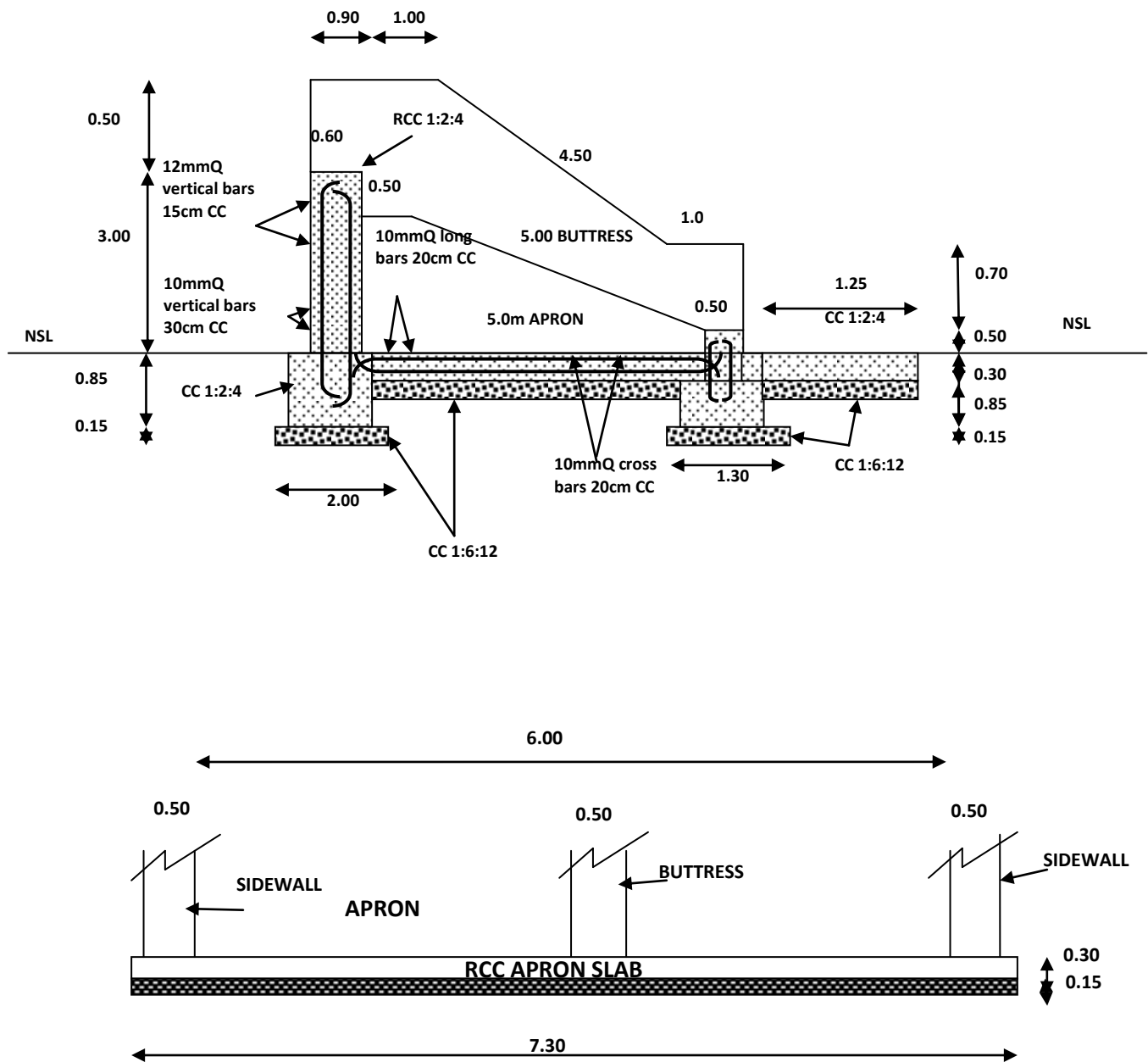
0.90   1.00

0.50
12mmQ
vertical bars
15cm CC

3.00

0.60
RCC 1:2:4
0.50
10mmQ long
bars 20cm CC

4.50

1.0

5.00 BUTTRESS

5.0m APRON

10mmQ
vertical bars
30cm CC

NSL

0.85
CC 1:2:4

0.15

0.50

0.50

1.25
CC 1:2:4

0.70

NSL

0.50

0.30

0.85

0.15

2.00

10mmQ cross
bars 20cm CC

1.30

CC 1:6:12

CC 1:6:12

6.00

0.50

0.50

0.50

SIDEWALL

SIDEWALL

BUTTRESS

APRON

RCC APRON SLAB

0.30

0.15

7.30

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

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RCC SDS No.5 Across Gharti Nala

1. Hydrological Design

Catchment Area (A) = 75 ha

Coefficient Runoff (C) = 0.20

Intensity of Rainfall (I) = 120mm/hr

Using rational formula

Peak Discharge - Q = CIA/360

= 0.20 X 120 X 75 / 360 = 5.0 cum/sec

2. Hydraulic Design

$Q = 1.711 \, LH^{3/2}$

H = 0.60

Peak Discharge = 5.0 cum/sec

Therefore = L = Q/ 1.711 X $H^{3/2}$ = 5.0 / 1.711 X 0.60 X $\sqrt{0.60}$

= 5.0 / 1.711 X 0.60 X 0.77 = 5.0 / 0.79 = 6.32 Say 6.50m

3. Structural Design

Drop = 2.0

H = 0.60

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 0.60 = 3.60 say 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC SDS No.5 Across Gharti Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation	1	6.00	1.30	1.0	7.80cum
	Anchoring of H.W Ext. L/Side					
	1st Step	1	1.25+1.0/2	0.80	0.50	0.45cum
	2nd Step	1	1.50+0.75/2	0.80	0.50	0.45 cum
	3rd Step	1	1.25+0.75/2	0.80	0.50	0.40 cum
	4th Step	1	1.25+0.75/2	0.80	0.50	0.40 cum
	5th Step	1	1.75+0/2	0.80	1.50	1.05cum
	R/side 1st Step	1	2.0+0.75/2	0.80	0.50	0.55 cum
	2nd Step	1	1.25+0.50/2	0.80	0.50	0.35 cum
	3rd Step	1	1.0+0.50/2	0.80	0.50	0.30 cum
	4th Step	1	1.25+0.75/2	0.80	0.50	0.40 cum
	5th Step	1	1.20+0/2	0.80	1.25	0.60 cum
	Toe Wall T.W. Ext Foundation	1	9.50	1.30	1.0	12.35 cum
	Toe wall protection	1	7.50	1.50	0.45	5.06 cum
	Apron	1	6.50	8.30	0.45	24.27 cum
						54.43 cum
					Say	**54.00cum**
2	CC 1:6:12 in foundation					
	Head wall	1	6.0	0.60	0.15	0.54cum
	Toe wall & T.W. Ext	1	9.50	0.60	0.15	0.85cum
	Toe wall Protection	1	7.50	1.25	0.15	1.40 cum
	Apron	1	4.0	7.80	0.15	4.68cum
						7.47 cum
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	6.0	1.30	0.85	7.80 cum
	Toe Wall & Ext	1	9.50	1.30	0.85	12.35 cum
	Toe Wall Protection	1	7.50	1.25	0.30	4.21cum
	Head wall & H.W. Ext Part A	1	7.25	0.60	0.50	2.17cum
	B	1	8.25	0.60	0.50	2.47cum
	C	1	9.25	0.60	0.50	2.77cum
	D	1	10.50	0.60	0.50	3.15cum
	E	1	2.50	0.60	0.50	0.75cum
	F	1	3.00	0.60	0.50	0.90cum

	Toe Wall & T.W Ext	1	9.50	0.50	0.50	2.37cum
	T.W. Ext	2	1.50	0.50	0.50	0.90
	Toe Wall Protection	1	7.50	1.25	0.30	2.81
	Side wall Part A	2	0.50	0.50	2.60	1.30
	Side wall Part B	2	3.50	0.50	2.60+1.10/2	6.47
	Side wall Part C	2	0.50	0.50	0.85	0.42
	Buttress Part A	1	0.50	0.50	1.50	0.37
	Buttress Part B	1	3.75	0.50	1.50+0.25/2	1.64
	Apron	1	4.00	7.80	0.30	9.36
						62.21cum
4	Form work – Foundation					
	Head Wall & HW Ext. Length	1 X 2	6.00	-	1.0	12.00 sqm
	Width	1 X 2	1.0	-	1.0	2.0
	Toe Wall & T.W. Ext					
	Length	1 X 2	9.50	-	1.0	19.00
	Width	1 X 2	1.0	-	1.0	2.0
	Toe Wall Protection Length	1 X 2	7.50	-	0.45	6.75
	Width	1 X 2	1.25	-	0.45	1.12
						42.87
	Form Work – Toe Wall & T.W Ext	1 X 2	9.50	-	0.50	9.50
	T.W Ext	2 X 2	1.50	-	0.60	3.60
	Head wall Part A	1 X 2	7.25	-	0.50	7.25
	B	1 X 2	8.25	-	0.50	8.25
	C	1 X 2	9.25	-	0.50	9.25
	D	1 X 2	10.50	-	0.50	10.50
	E	1 X 2	2.50	-	0.60	3.00
	F	1 X 2	3.00	-	0.60	3.60
	Side walls Part A	2 X 2	0.50	-	2.60	5.60
	Part B	2 X 2	3.50	-	2.60+1.10/2	25.90
	C	2 X 2	0.50		0.85	1.70
	Buttress Part A	1 X 2	0.50	-	1.50	1.50
	Part B	1 X 2	3.75	-	1.50+0.25 / 2	6.56
	RCC Slab	1 X 2	4.00	-	0.45	3.60
						142.68
					Say	**143.0sqm**
5	Filling of E/W behind the side walls					
	L/Side	1	2.50+1.50/	4.0	2.60+1.1	14.80cum

		No.	L	B	H	Content
			2		0/2	
	R/Side	1	3+1.50/2	4.0	2.60+1.10/2	16.65
						31.45
					Say	**31.0cum**
Calculation of MS Bars						
		No.	L	B	H	Content
1	Head Wall		L	No	HT	
	12mm dia vertical bars 15cm c/c		650/15	44	2.50	110m 12mm
	10mm Q Horizontal bars 30cm c/c		200/30	7	7.00	49m 10mmQ
2	RCC slab in Apron					
	12mm Q long bars 20cm c/c		400/20	20	8.00	160m 12mmQ
	10mm Q cross bars 20cm c/c		780/20	39	4.50	176m 10mmQ
3	Toe Wall					
	12mm Q Vertical Bars 15cm c/c		650/15	44	0.80	35m 12mmQ
	10mm Q Horizontal bars 30cm C/C		50/30	2	6.50	13m 10mmQ

12mmQ 110+160+35 = 305m X 0.89 kg/m = 271.45

10mm Q 49+176+13 = 238 X 0.62 kg/m   = 147.56

= **419.01 say 419kg**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12 in foundation @C 2.30 S 0.50 B 1.00	7.47cum	17.18	3.73	7.46	-
2	C.C 1:2:4 above foundation @ C 6.50 S 0.45 B 0.90	62.21	404.36	27.99	55.98	419kg
			421.54	31.72	63.44	419kg
		Say	422 bags	32.0 cum	63.50 cum	**419 kg**

RCC SDS No.5 Across Gharti Nala

L – SECTION, PLAN & X-SECTION OF SILT DETENTION STRUCTURE NO.12 ACROSS GHARTI NALA
VILLAGE NORA TEH & DISTT KATHUA
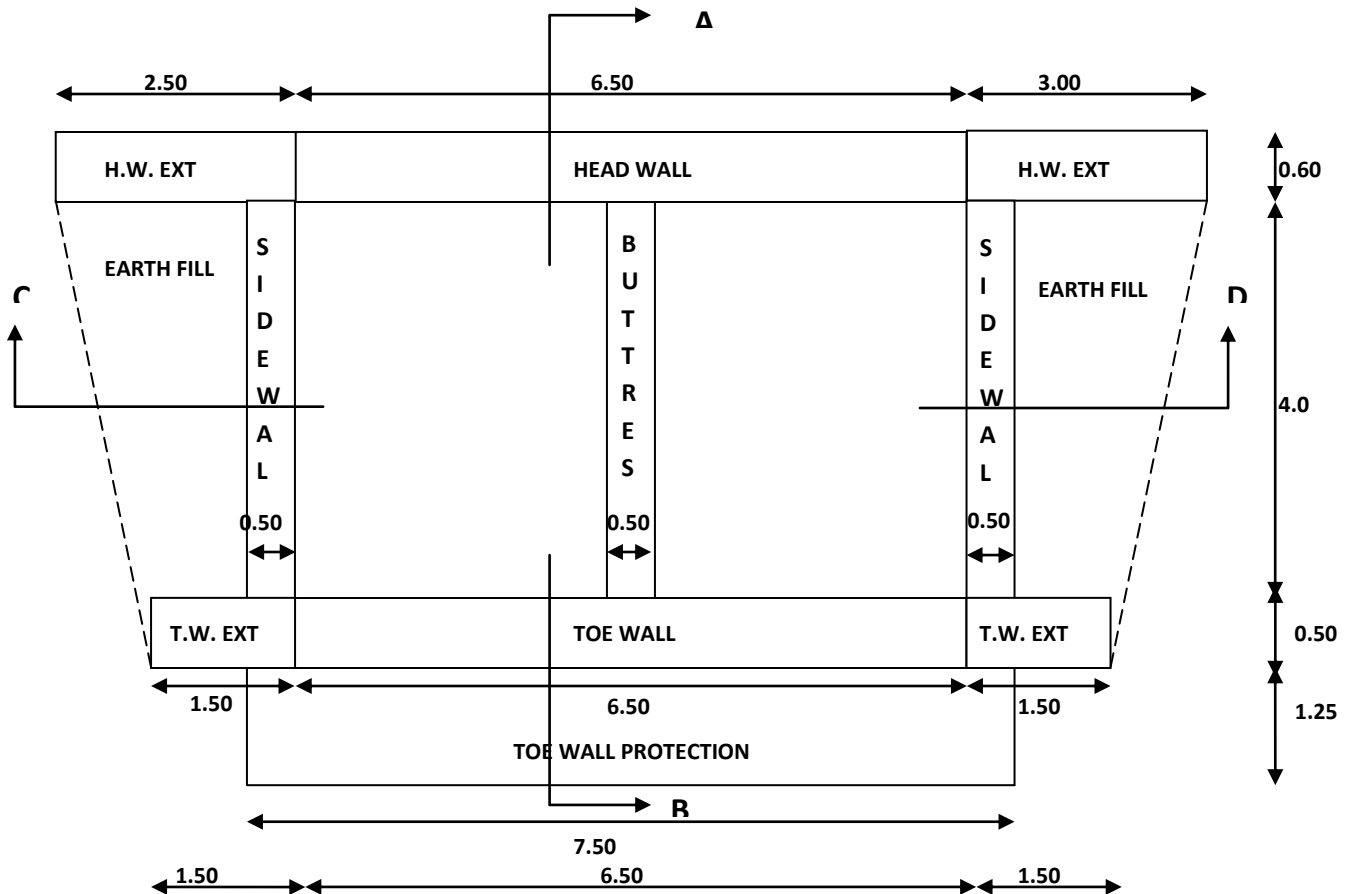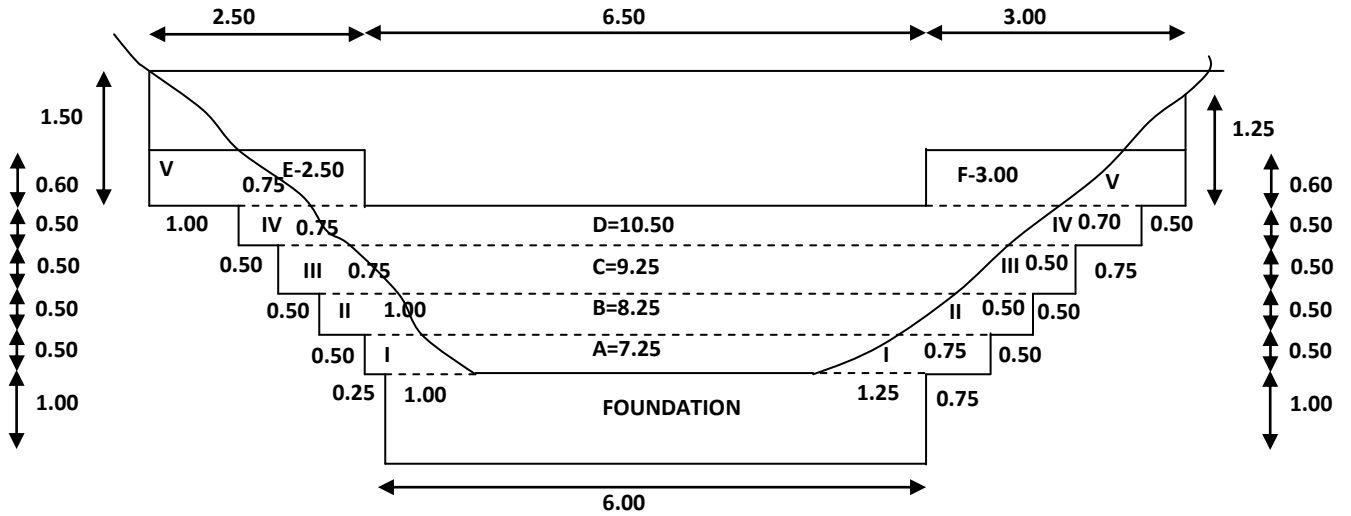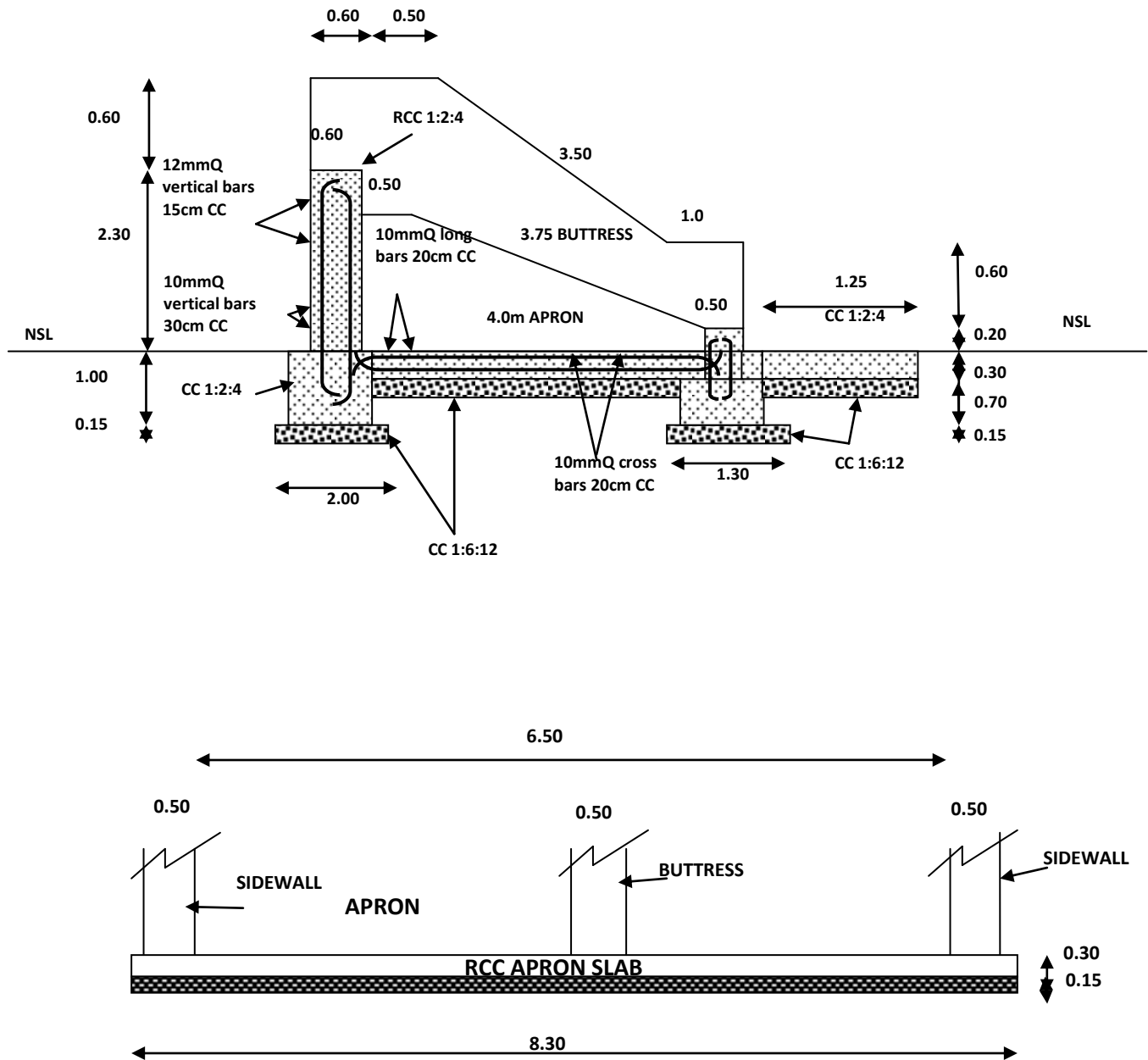
0.60   0.50

0.60

RCC 1:2:4

0.60

3.50

0.50

12mmQ
vertical bars
15cm CC

10mmQ long
bars 20cm CC

3.75 BUTTRESS

1.0

2.30

1.25

0.60

CC 1:2:4

10mmQ
vertical bars
30cm CC

4.0m APRON

0.50

NSL

0.50

0.20

NSL

CC 1:2:4

1.00

0.30

CC 1:2:4

0.70

0.15

10mmQ cross
bars 20cm CC

1.30

0.15

2.00

CC 1:6:12

CC 1:6:12

CC 1:6:12

6.50

0.50

0.50

0.50

SIDEWALL

BUTTRESS

SIDEWALL

APRON

SIDEWALL

RCC APRON SLAB

0.30

0.15

8.30

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

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RCC SDS No.6 Across Gharti Nala

1. Hydrological Design

Catchment Area (A) = 170 ha

Coefficient Runoff (C) = 0.20

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.20 X 120 X 120 / 360 = 11.33 cum/sec

2. Hydraulic Design

Q = 1.711 LH$^{3/2}$

H = 1.0

Peak Discharge = 3.46 cumecs

Therefore = Q = 1.711 LH$^{3/2}$

11.33 = 1.711 L X 1 X √1

L = 11.33 / 1.711

= 6.62 say 7.00m

3. Structural Design

Drop = 3.0

H = 1.00

Top width = Drop X 0.30 = 3 X 0.30 = 0.60m

Base width = Drop X 0.60 = 3 X 0.60 = 1.20m say 1.50

Apron Length = Drop X 1.50 + H = 3 X 1.50 + 1.0 = 5.50 say 6.0m

Foundation Depth = 1/3 X Drop = 1/3 X 3.0 = 1.0m

RCC SDS No.6 Across Gharti Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall & Head wall extension	1	6.00	2.00	1.00	12.00cum
	Anchoring of H.W Ext. L/Side					
	1st Step	1	1.30+0.75/2	1.20	0.50	0.61cum
	2nd Step	1	1.25+0.80/2	1.20	0.50	0.61 cum
	3rd Step	1	1.30+0.60/2	1.20	1.00	1.14 cum
	4th Step	1	1.10+0.60/2	1.20	1.00	1.02 cum
	5th Step	1	1.60+0/2	1.20	1.80	1.72 cum
	R/side 1st Step	1	1.30+0.60/2	1.20	0.50	0.57 cum
	2nd Step	1	1.10+0.50/2	1.20	0.50	0.48 cum
	3rd Step	1	1.00+0.40/2	1.20	0.50	0.42 cum
	4th Step	1	0.90+0.30/2	1.20	1.00	0.72 cum
	5th Step	1	1.30+0/2	1.20	2.0	1.56 cum
	Toe Wall T.W. Ext	1	10.00	1.30	1.0	13.00 cum
	Toe wall protection	1	1.50	8.0	0.45	5.40
	Apron	1	5.05	8.30	0.45	18.86 cum
						58.11
					Say	**58.00 cum**
2	CC 1:6:12 in foundation					
	Head wall	1	7.00	2.00	0.15	2.10cum
	Toe wall & T.W. Ext	1	10.0	1.30	0.15	1.95cum
	Toe wall Protection	1	1.50	8.0	0.15	1.80 cum
	Apron	1	5.05	8.30	0.15	6.28
						12.13 cum
3	CC 1:2:4 in foundation					
	Head wall	1	7.0	1.70	0.85	10.11cum
	Toe Wall & T.W. Ext	1	10.0	1.0	0.85	8.50cum
	Toe Wall Protection	1	8.0	1.50	0.30	3.60cum
	Head wall & H.W. Ext Above foundation					
	Part A	1	7.00	0.90	0.50	3.15cum
	B	1	8.00	0.90	0.50	3.60 cum

	C	1	9.00	0.90	1.00	8.10 cum
	D	1	10.00	0.90	1.00	9.00cum
	E	1	2.50	0.90	1.00	2.25cum
	F	1	2.50	0.90	1.00	2.25cum
	Toe Wall & T.W Ext	1	10.0	0.50	0.50	2.50cum
	T.W. Ext	2	1.50	0.50	1.00	1.50
	Apron	1	6.00	8.30	0.30	14.94
	Side wall Part A	2	1.00	0.50	4.00	4.00
	Side wall Part B	2	5.25	0.50	4+1/2	13.12
	Side wall Part C	2	0.50	0.50	1.25	0.62
	Buttress Part A	1	0.50	0.50	2.0	0.50
	Buttress Part B	1	5.75	0.50	2+0.25/2	3.23
						90.97
4	Filling of earthwork behind the side wall					
	Left Side	1	6.00	2+1.00/2	4+1.0/2	22.50 cum
	Right Side	1	6.00	2+1.0/2	4+1.0/2	22.50 cum
						45.00 cum
	Form Work					
	Head Wall & H.W. Ext Length	1 X 2	7.0	-	1.0	14.00 sqm
	Width	1 X 2	1.0	-	1.0	2.00
	Toe Wall & T.W. Ext Length	1 X 2	10.0	-	1.0	20.00
	Width	1 X 2	1.0		1.0	2.00
	Toe Wall Protection Length	1 X 2	8.0		0.45	7.20
	Width	1 X 2	1.50		0.45	1.35
	Above foundation Toe Wall & T.W. Ext	1 X 2	10.00		0.50	10.00
	T.W. Ext	2 X 2	1.50		1.00	6.00
	Head Wall & H.W. Ext. Part A	1 X 2	7.00		0.50	7.00
	B	1 X 2	8.00	-	0.50	8.00
	C	1 X 2	9.00	-	1.00	18.00
	D	1 X 2	10.00	-	1.00	20.0
	E	1 X 2	2.50	-	1.0	5.0
	F	1 X 2	2.50	-	1.0	5.0
	Toe Wall & T.W. Ext	1 X 2	10.00	-	0.50	10.00
	T.W. Ext	2 X 2	1.50	-	1.0	6.00
	Apron	1 X 2	6.00	-	0.45	5.40
	Side Wall Part A	2 X 2	1.00	-	4.00	16.00
	B	2 X 2	5.25	-	4+1/2	52.50

	C	2 X 2	0.50		1.25	2.50
	Buttress Part A	1 X 2	0.50		2.00	2.00
	B	1 X 2	5.75		2+0.25/2	12.93
						231.88
					Say	**232sqm**

Calculation of MS Bars

	Particulars	No.	L	B	H	Content
	Calculation of M.S. Bars					
1	Head Wall		L	No	HT	
	12mm dia vertical bars 15cm c/c		700/15	47	3.50	165m 12mmQ
			HT	No	L	
	10mm Q Horizontal bars 30cm c/c		300/30	10	7.50	75m 10mmQ
2	RCC slab in Apron		L	No	L	
	12mm Q long bars 20cm c/c		600/20	30	8.50	255m 12mmQ
	10mm Q cross bars 20cm c/c		700/15	47	0.80	38m 12mmQ
3	Toe Wall		L	No.	HT	
	12mm Q Vertical bars 15cm C/C		700/15	47	0.80	38m 12mmQ
	10mm Q long bars		50/30	2	7.50	15m 10mmQ

12mmQ 165 + 255 + 38   = 458m X 0.89kg/m   = 407.62kg

10mm Q 75 + 265 + 15   = 355m X 0.62kg/m   = 220.10kg

= **627.72kg say 628kg**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12	12.13cum	27.90	6.06	12.12	-
2	C.C 1:2:4	90.97cum	591.30	40.93	81.86	628kg
			619.20	46.99	93.98	628kg
		Say	619 bags	47.0 cum	94.00 cum	628 kg

RCC SDS No.6 Across Gharti Nala

L –SECTION, PLAN & X-SECTION OF SILT DETENTION STRUCTURE NO.9 ACROSS GHARTI NALA VILLAGE NORA TEH & DISTT KATHUA
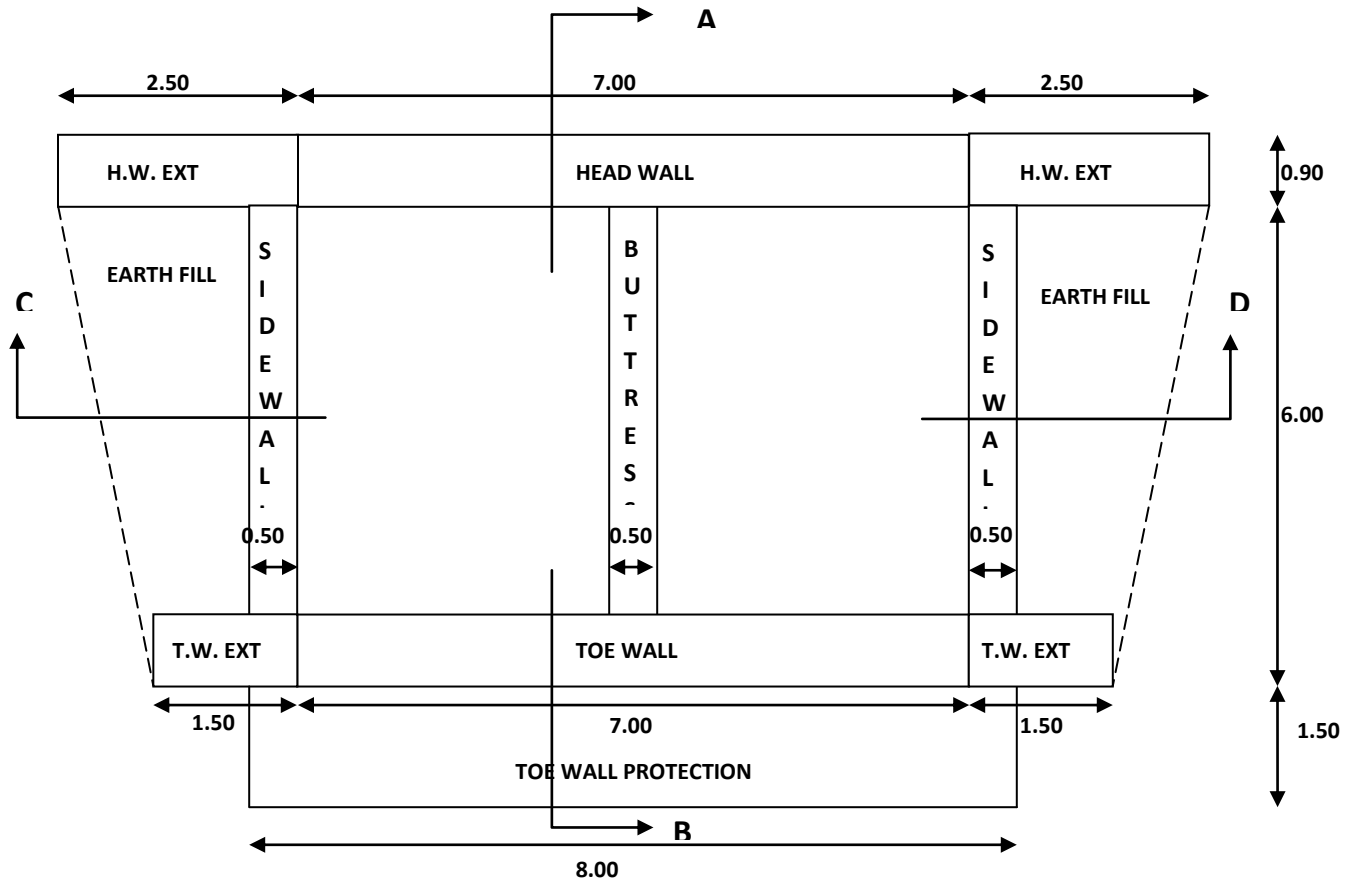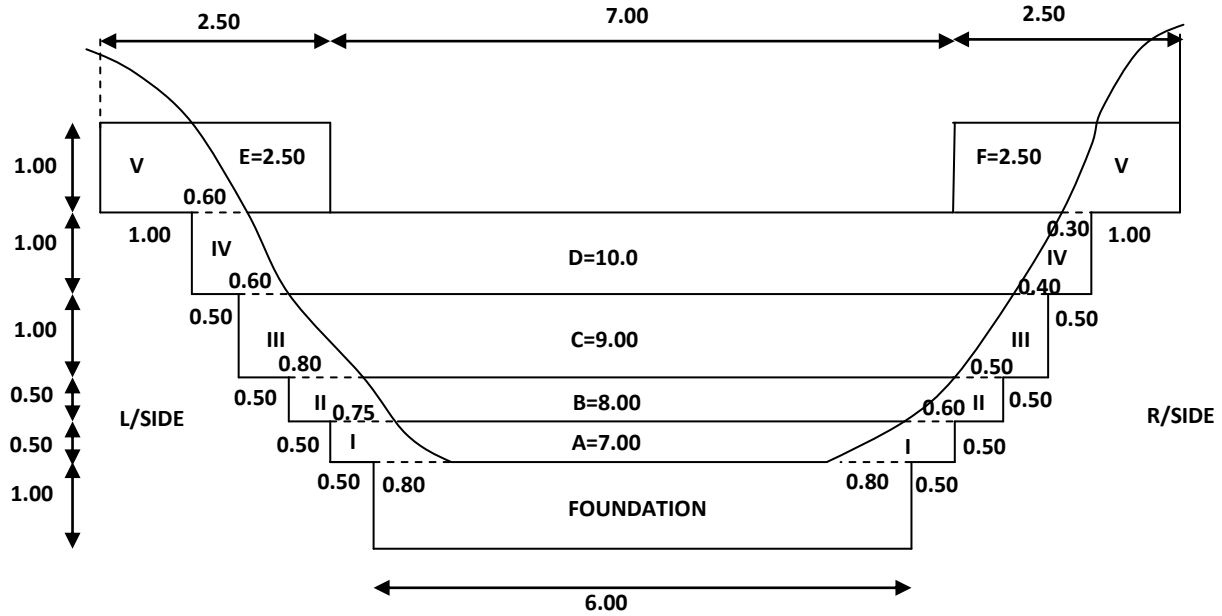
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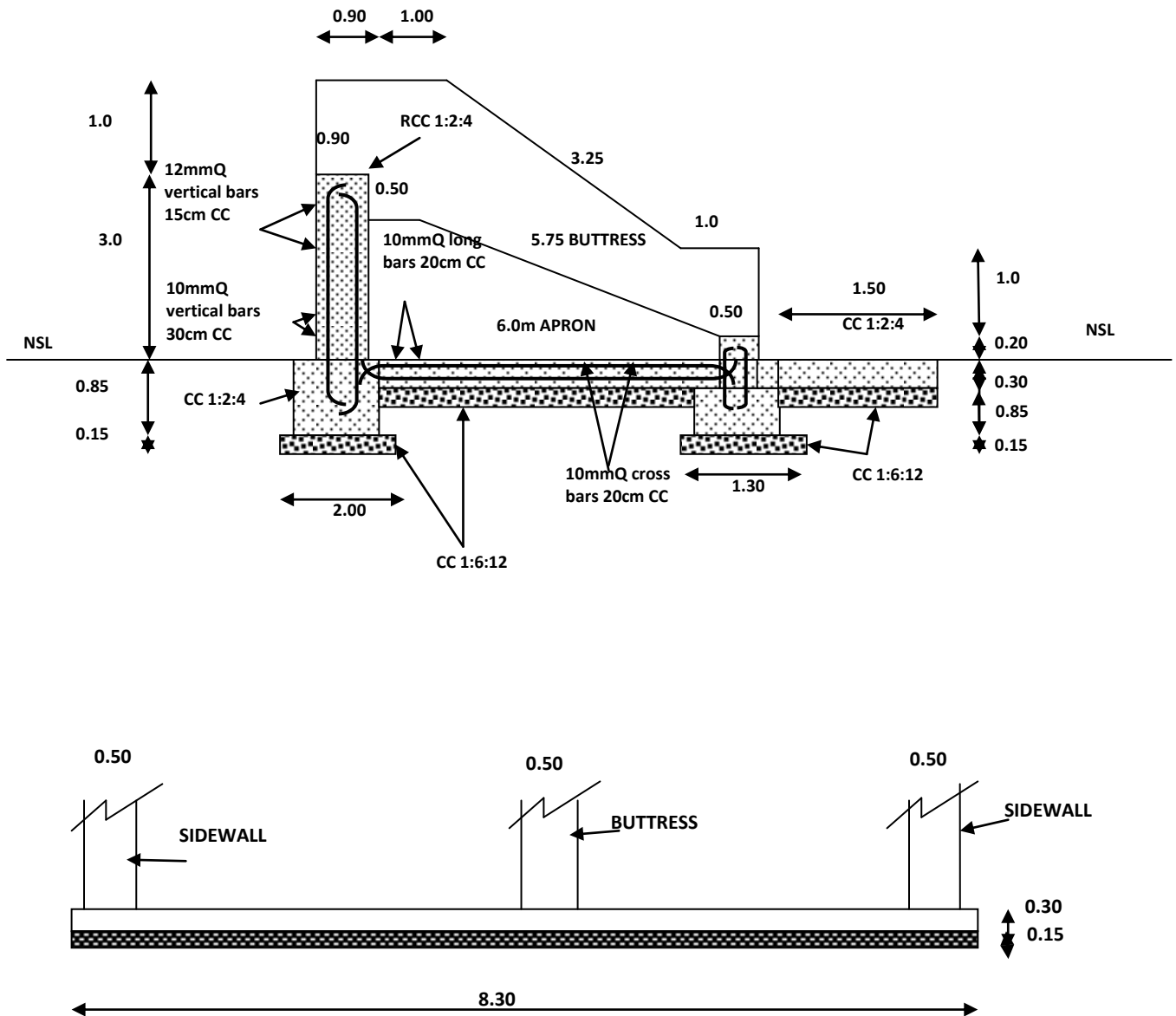
Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

RCC SDS No.7 Across Gharti Nala

1. Hydrological Design

Catchment Area (A) = 190 ha

Coefficient Runoff (C) = 0.20

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.20 X 120 X 190 / 360 = 12.66 cum/sec

2. Hydraulic Design

$Q = 1.711 \, LH^{3/2}$

H = 1.0

Peak Discharge = 3.46 cumecs

Therefore = $Q = 1.711 \, LH^{3/2}$

$12.66 = 1.711 \, L \times 1 \times \sqrt{1}$

L = 12.66 / 1.711

= 7.40 say 7.50m

3. Structural Design

Drop = 2.0

H = 1.00

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.50

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

RCC SDS No.7 Across Gharti Nala

S. NO	Particulars	No.	L	B	H	Contents
1	Earthwork in excavation in foundation Head wall	1	7.50	1.30	1.0	9.75 cum
	Anchoring of H.W Ext. L/Side					
	1st Step	1	3+1/2	0.80	0.50	0.80cum
	2nd Step	1	2.50+1.0/2	0.80	0.50	0.70cum
	3rd Step	1	3.50+1.20/2	0.80	0.50	0.94 cum
	4th Step	1	3.20+1.0/2	0.80	0.50	0.84 cum
	R/side 1st Step	1	2+1 / 2	0.80	0.50	0.60 cum
	2nd Step	1	2+1.50/2	0.80	0.50	0.70 cum
	3rd Step	1	2.50+1.20/2	0.80	0.50	0.74 cum
	4th Step	1	2.20+1.0/2	0.80	0.50	0.64 cum
	5th Step	1	1.50+0.80/2	0.80	0.50	0.46 cum
	6th Step	1	1.80+0/2	0.80	1.25	0.90 cum
	Toe Wall & T.W Ext Foundation	1	11.50	1.30	1.0	14.95
	Toe wall protection	1	1.50	8.50	0.45	5.73
	Apron	1	3.25	8.80	0.45	12.87
						52.12
					Say	**52.0cum**
2	CC 1:6:12 in foundation					
	Head wall	1	7.50	1.30	0.15	1.46cum
	Toe wall & T.W. Ext	1	11.50	1.30	0.15	2.24cum
	Toe wall Protection	1	8.50	1.50	0.15	1.91 cum
	Apron	1	3.25	8.80	0.15	4.29cum
						9.90 cum
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	7.50	1.0	0.85	6.37cum
	Toe Wall & Ext	1	11.50	1.0	0.85	9.77cum
	Toe Wall Protection	1	8.50	1.50	0.30	3.82cum
	Head wall & H.W. Ext Part A	1	9.0	0.60	0.50	2.70cum
	B	1	11.50	0.60	0.50	3.45cum
	C	1	15.0	0.60	0.50	4.50cum
	D	1	18.0	0.60	0.50	5.40cum
	E	1	8.50	0.60	1.00	5.10cum
	F	1	4.0	0.60	0.50	1.20cum
	G	1	5.0	0.60	0.50	1.50cum
	Toe Wall & T.W Ext	1	11.50	0.50	0.50	2.87cum

	T.W. Ext	2	2.0	0.50	0.50	1.00
	Apron	1	4.0	8.80	0.30	10.56
	Side wall Part A	2	0.90	0.50	3.00	2.70
	Side wall Part B	2	3.25	0.50	1.25	4.06
	Side wall Part C	2	0.50	0.50	1.0	0.50
	Buttress Part A	1	0.50	0.50	1.50	0.37
	Buttress Part B	1	3.75	0.50	1.50+0.20/2	1.59
						67.46cum
4	Filling of E/W behind the side walls L/side	1	8.50+2.0/2	4.0	3.0+1.5	47.25
	R/Side	1	5+2/2	4.0	3+1.5/2	31.50
						78.75
					Say	**79.00cum**
	Form Work					
	Foundation – Head wall & H.W. Ext Length	1 X 2	7.50	-	1.0	15.00sqm
	Width	1 X 2	1.0	-	1.0	2.00
	Toe Wall & T.W. Ext. Length	1 X 2	11.50	-	1.00	23.00
	Width	1 X 2	1.50		0.45	1.35
	Above foundation – Toe Wall & T.W. Ext	1 X 2	11.50		0.50	11.50
	T.W. Ext	2 X 2	2.0		0.50	4.00
	Head wall Part A	1 X 2	9.00	-	0.50	9.00
	B	1 X 2	11.50	-	0.50	11.50
	C	1 X 2	15.00	-	0.50	15.00
	D	1 X 2	18.00	-	0.50	18.00
	E	1 X 2	8.50	-	1.00	17.00
	F	1 X 2	4.00	-	0.50	4.00
	G	1 X 2	5.00		0.50	5.00
	Toe Wall & T.W. Ext	1 X 2	11.50	-	0.50	11.50
	T.W. Ext	2 X 2	2.00	-	0.50	4.00
	Apron	2	4.00	-	0.45	3.60
	Side Wall Part A	2 X 2	0.90	-	3.00	10.80
	B	2 X 2	3.25		3.0+1.25/2	27.62
	C	2 X 2	0.50		1.25	2.50
	Buttress Part A	1 X 2	0.50	-	1.50	1.50
	B	1 X 2	3.75	-	1.50+0.25/2	6.56
	RCC Slab	1 X 2	4.00	-	0.45	3.60
						213.85
					Say	**214.0sqm**

S. No1	Particulars	No.	L	B	H	Content
	Calculation of M.S. Bars					
1	Head Wall					
	12mm Q Vertical bars 15cm C/C/		750/15	50	2.50	125m 12mm
				No	L	
	10mm Q Horizontal bars 30cm C/C		200/30	7	8.0	56m 10mm
2	RCC Slab in Apron					
	12mm Q long bars 20cm C/C		880/20	44	4.50	198m 12mm
	10mm Q cross bars 20cm C/C		450/20	23	8.80	202m 10mm
3	Toe Wall					
	12mm Q Vertical bars 15cm C/C		750/15	50	0.80	40m 12mm
	10mm Q Horizontal bars 30cm C/C		50/30	2	8	16m 10mm

12mmQ 125 + 198 + 40 = 363 X 0.89 = 323.07

10mm Q 56 + 202 + 16 = 274 X 0.62 = 169.88

= **492.95 say 493kg**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri	M.S. Bars
1	C.C 1:6:12 in foundation	9.90cum	22.70	4.95	9.90	
2	CC & RCC 1:2:4	67.46cum	438.49	30.35	60.70	493kg
	Total		461.19	35.30	70.60	493kg
		Say	461 bags	35.0 cum	71.0 cum	**493 kg**

RCC SDS No.7 Across Gharti Nala
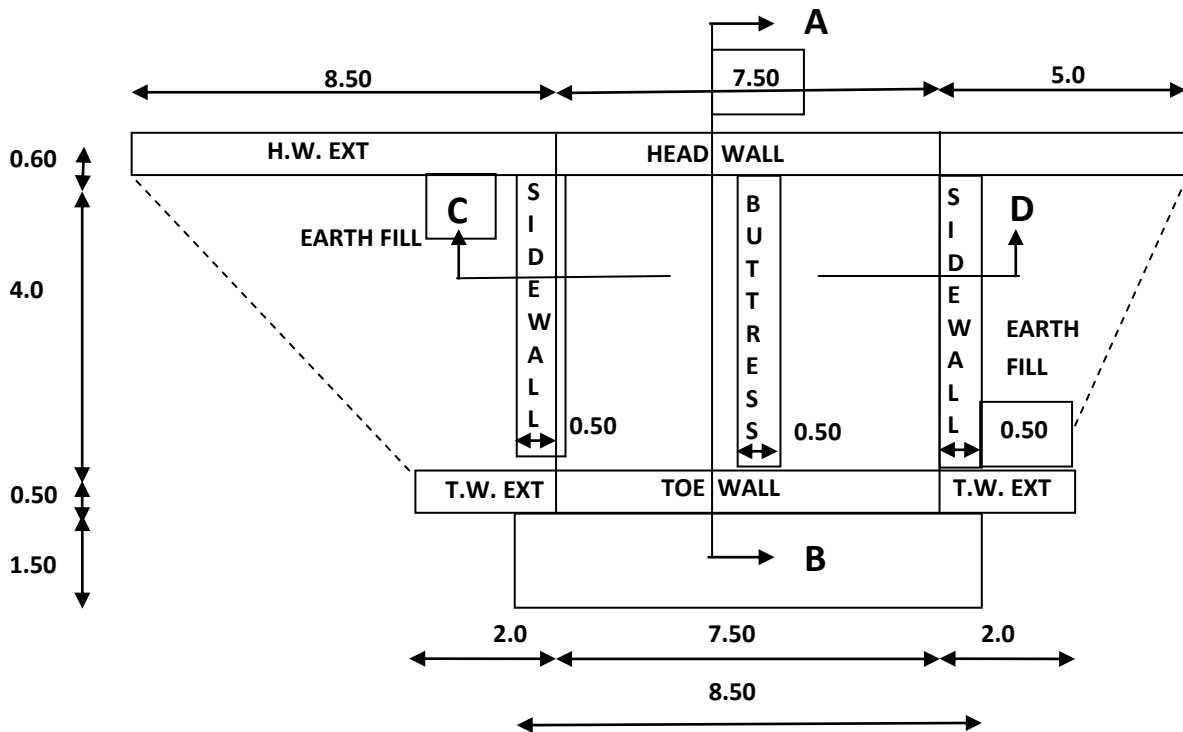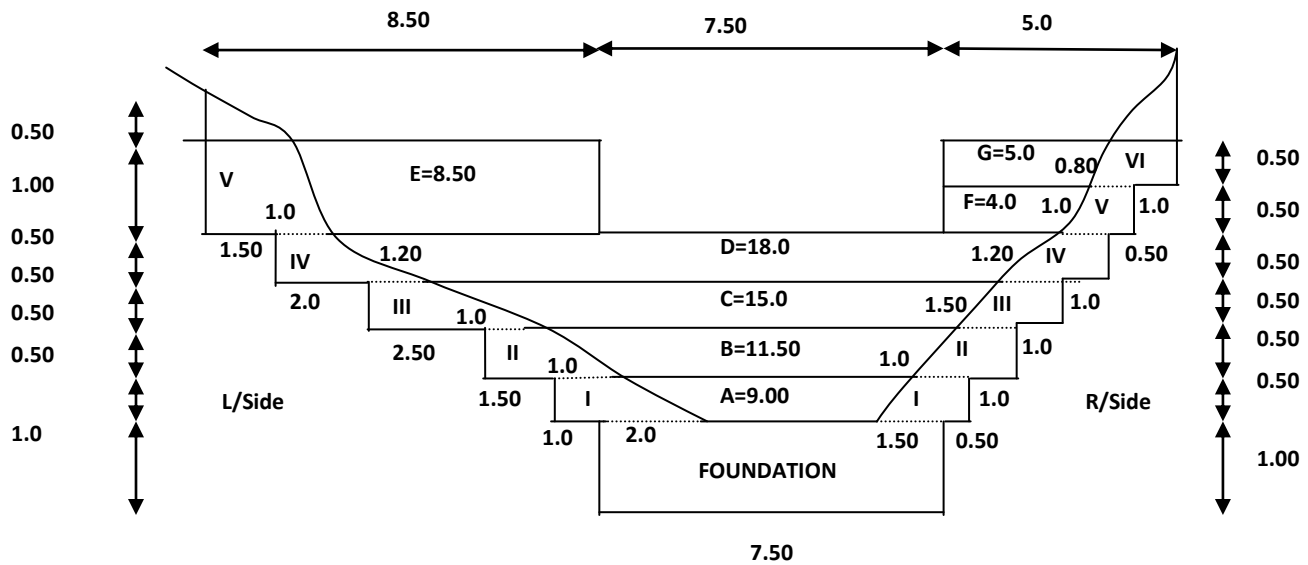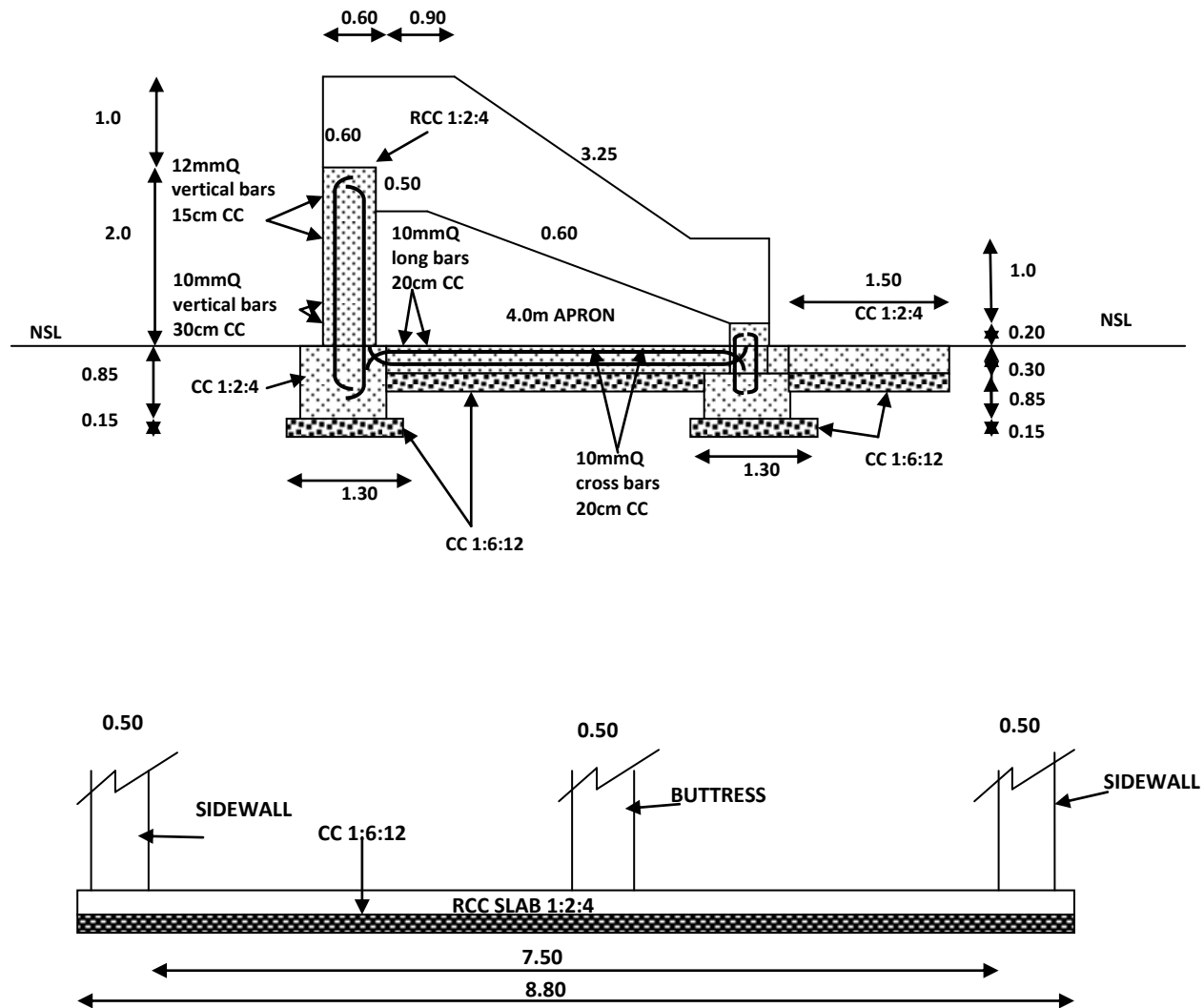
L- SECTION, PLAN & X –SECTION OF SILT DETENTION STRUCTURE ACROSS GHARTI NALA VILLAGE NORA TEH & DISTT. KATHUA

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

6.3 **Silt Detention Structures in Thein Micro Watershed**

CC Silt Detention Structure No.1 Across Bagh Nala of Thein Micro-watershed

1. Hydrological Design

Catchment Area (A) = 52 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 52 / 360 = 6.06 cum/sec

2. Hydraulic Design

$Q = 1.711 \, LH^{3/2}$

H = 1.0

$6.06 = 1.711 \, L \, X \, 1 \, X \, \sqrt{1}$

L = 6.06 / 1.711

= 6.06 / 1.711 = 3.54 say 3.50m

3. Structural Design

Drop = 2.0

H = 1.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1.0 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure No.1 Across Bagh Nala of Thein Micro-watershed

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/work in foundation – Foundation Headwall	1	4.50	1.30	1.0	5.85
	Toe Wall & T.W. Ext	1	7.50	1.30	1.0	9.75
	Toe Wall Protection Work	1	1.25	4.50	0.45	2.53
	Apron	1	3.50	4.80	0.45	7.56
	Head Wall Ext L/Side					
	1st Step	1	2.70+1.50/2	0.80	0.50	0.84
	2nd Step	1	2.00+0.70/2	0.80	0.50	0.54
	3rd Step	1	1.20+0.80/2	0.80	0.50	0.40
	4th Step	1	1.80+1.20/2	0.80	0.50	0.60
	5th Step	1	2.20+1.10/2	0.80	0.50	0.66
	6th Step	1	2.10+0/2	0.80	1.25	1.05
	R/side 1st Step	1	1.20+0.50/2	0.80	1.00	0.68
	2nd Step	1	1.0+0.60/2	0.80	0.50	0.32
	3rd Step	1	1.10+0.60/2	0.80	0.50	0.34
	4th Step	1	1.10+0/2	0.80	1.50	0.66
						31.78
					Say	**32.00**
2	CC 1:6:12 in foundation					
	Head wall	1	4.50	1.30	0.15	0.87
	Toe wall & T.W. Ext	1	7.50	1.30	0.15	1.46
	Toe wall Protection	1	1.25	4.50	0.15	0.84
	Apron	1	3.50	4.80	0.15	2.52
						5.69
3	CC 1:2:4 in foundation					
	Head Wall	1	4.50	1.0	0.85	3.82
	Toe Wall & Ext	1	7.50	1.0	0.85	6.37
	Toe Wall Protection	1	1.25	4.50	0.30	1.68
	Apron	1	3.50	4.80	0.30	5.04
	Above Foundation Head wall & H.W. Ext Part A	1	6.50	0.60	0.50	1.95
	B	1	7.0	0.60	0.50	2.10
	C	1	8.0	0.60	0.50	2.40

	D	1	8.50	0.60	0.50	2.55
	E	1	5.00	0.60	0.50	1.50
	F	1	6.00	0.60	0.50	1.80
	G	1	2.50	0.60	1.00	1.50
	Toe Wall & T.W Ext	1	7.50	0.50	0.50	1.87
	T.W. Ext	2	2.0	0.50	1.00	2.00
	Side wall Part A	2	0.90	0.50	3.00	2.70
	Side wall Part B	2	0.50	0.50	1.50	0.75
	Side wall Part C	2	3.0	0.50	3.00+1.50/2	6.75
						44.76cum
4	Form work – Foundation					
	Head Wall	1 X 2	5.50	-	1.0	11.00
	Toe Wall & T.W. Ext	1 X 2	8.0	-	1.0	16.00
	Toe Wall Protection Work	1	3.50	-	0.45	1.57
	Toe wall protection work	1 X 2	1.25	-	0.45	1.12
	Apron	1 X 2	4.80	-	0.45	4.32
	Above foundation Formwork					
	Head wall Part A	1 X 2	6.50	-	0.50	6.50
	B	1 X 2	7.0	-	0.50	7.0
	C	1 X 2	8.00	-	0.50	8.00
	D	1 X 2	8.50	-	0.50	8.50
	E	1 X 2	5.00	-	0.50	5.00
	F	1 X 2	6.00	-	0.50	6.00
	G	1 X 2	2.50	-	0.50	2.50
	Toe Wall & T.W. Ext	1 X 2	7.50	-	0.50	7.50
	T.W. Ext	2 X 2	2.0	-	1.00	8.00
	Side walls Part A	2 X 2	0.90	-	3.00	10.80
	Part B	2 X 2	0.50	-	1.50	3.00
	Part C	2 X 2	3.00	-	3.00+1.50/2	27.00
						133.81
					Say	**134.00sqm**
5	Filling of E/Work behind the side wall					
	Left Side	1	5.50+1.50/2	4.00	3+1.50/2	31.50sqm
	Right Side	1	2+1.50/2	4.0	3+1.50/2	15.75
						47.25
					Say	**47.00m**

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	5.69	13.08	2.84	5.68
2	C.C 1:2:4	44.76	290.94	20.14	40.28
			304.02	22.98	45.96
		Say	304 bags	23.0 cum	46.00 cum

CC SILT DETENTION STRUCTURE NO.1 ACROSS BAGH NALA (THEIN MICROWATERSHED)
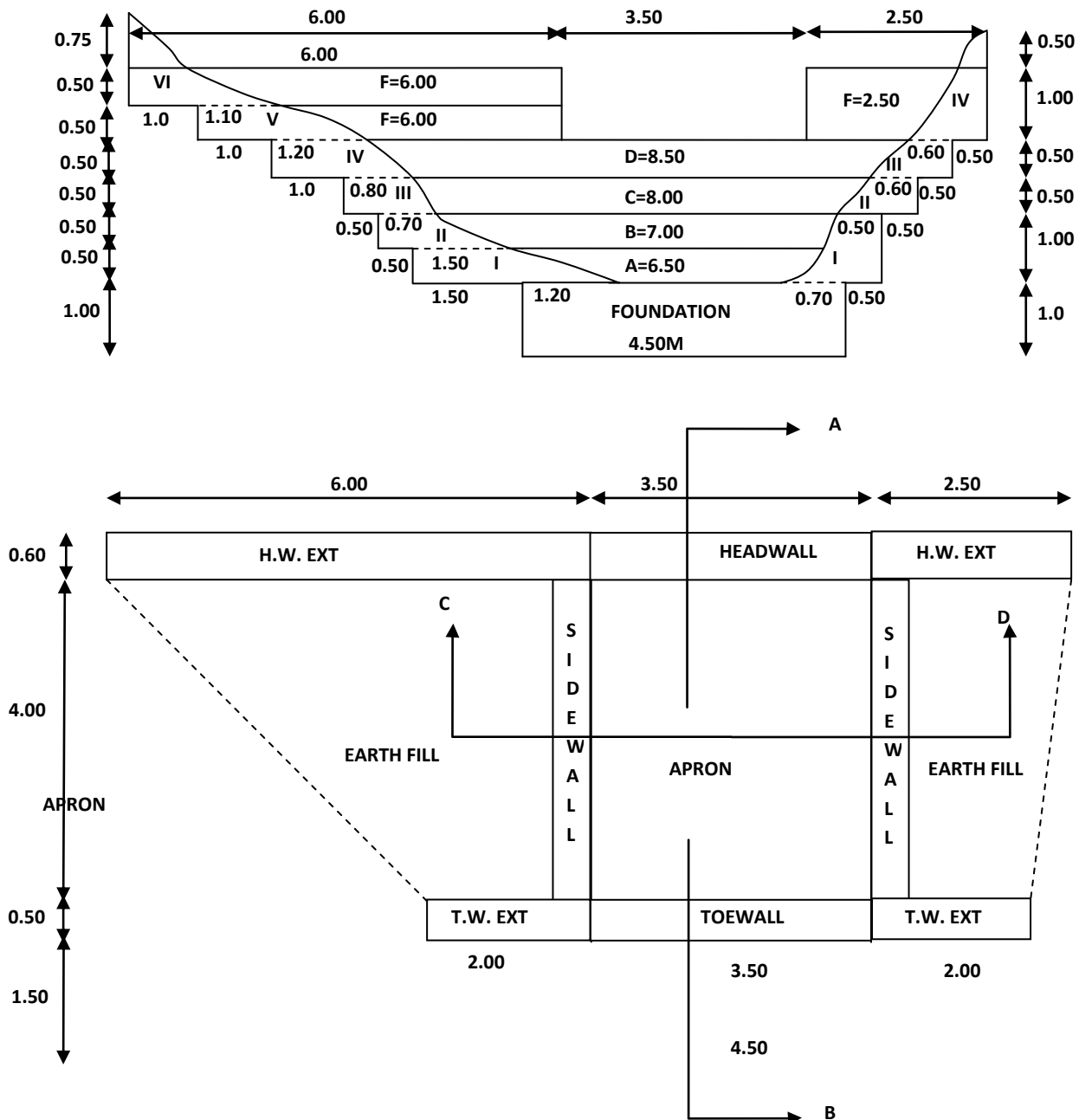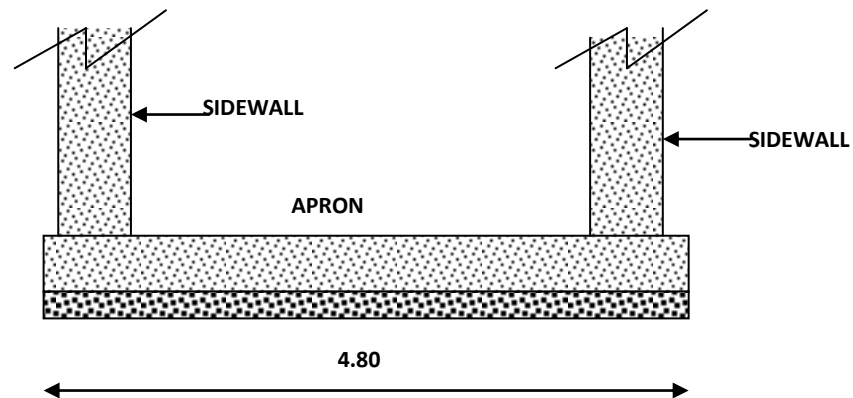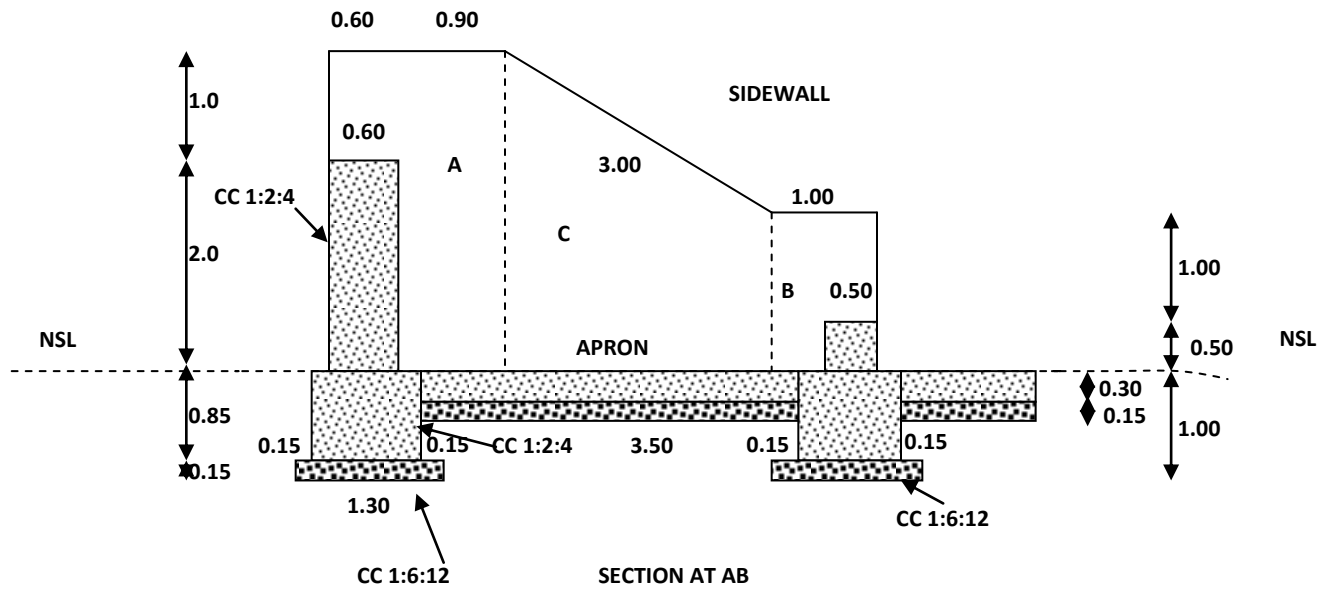
SECTION AT AB

Prepared by <u>Sh. Bhagwan Dass</u>, Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure No.2 Across Thundu Ram Nala-I (Thein Micro Watershed)

1. Hydrological Design

Catchment Area (A) = 43 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 43 / 360 = 5.01 m^3/sec

2. Hydraulic Design

$Q = 1.711 \, LH^{3/2}$

H = 1.0

Crest Length = $1.711 \, LH^{3/2}$

5.01 = 1.711 L X 1 X √1

L = 5.01 / 1.711

= 2.92 say 3.00m

3. Structural Design

Drop = 2.0

H = 1.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1.00 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure No.2 Across Thundu Ram Nala-I (Thein Micro Watershed)

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in Earthwork in foundation Head Wall	1	4.50	1.30	1.0	5.85 cum
	Toe Wall & T.W. Ext	1	7.0	1.30	1.0	9.10
	Toe Wall Protection work	1	1.25	4.0	0.45	2.25
	Apron	1	3.50	4.0	0.45	6.30
	Head Wall & H.W. Ext L/Side 1st Step	1	2.10-1.0/2	0.80	0.50	0.62
	2nd Step	1	2.50+1.0/2	0.80	0.50	0.70
	3rd Step	1	3+1/2	0.80	0.50	1.60
	4th Step	1	2.50+1.0/2	0.80	0.50	0.70
	5th Step	1	2.50+1.0/2	0.80	0.50	0.70
	6th Step	1	3+0/2	0.80	1.0	1.60
	R/side 1st Step	1	2.0+1/2	0.80	0.50	0.60
	2nd Step	1	2+1/2	0.80	0.50	0.60
	3rd Step	1	4+1/2	0.80	0.50	1.00
	4th Step	1	4+1.50/2	0.80	0.50	1.10
	5th Step	1	2.50+1.0/2	0.80	0.50	0.70
	6th Step	1	3+0/2	0.80	1.00	1.20
						34.62
					Say	**35.00cum**
2	CC 1:6:12 in foundation					
	Head wall	1	4.50	1.30	0.15	0.87
	Toe wall & T.W. Ext	1	7.0	1.30	0.15	1.36
	Toe wall Protection	1	1.25	4.0	0.15	0.75
	Apron	1	3.50	4.30	0.15	2.25
						5.23 cum
3	CC 1:2:4 in foundation					
	Head wall	1	4.50	1.0	0.85	3.82
	Toe Wall & Ext	1	7.0	1.0	0.85	5.95
	Toe Wall Protection	1	1.25	4.0	0.30	1.50
	Apron	1	3.50	4.30	0.30	4.51
	CC 1:2:4 Above foundation Head Wall Ext Part A	1	7.50	0.60	0.50	2.25
	B	1	10.0	0.60	0.50	3.00
	C	1	15.0	0.60	0.50	4.50
	D	1	19.50	0.60	0.50	5.85
	E	1	8.50	0.60	0.50	2.55
	F	1	10.50	0.60	0.50	3.15
	G	1	10.50	0.60	0.50	3.15
	H	1	12.50	0.60	0.50	3.75

	Side wall Part A	2	0.90	0.50	3.00	2.70
	Side wall Part B	2	0.50	0.50	1.50	0.75
	Side wall Part C	2	3.0	0.50	3.0+1.50/2	6.75
						54.18cum
4	Form work – Foundation					
	Head Wall	1 X 2	4.50	-	1.0	9.00sqm
	Toe Wall & T.W. Ext	1 X 2	7.00	-	1.0	14.00
	Toe Wall Protection work	1 X 2	1.25	-	0.45	1.12
	Toe Wall protection work	1	4.0	-	0.45	1.80
	Apron	1 X 2	4.30	-	0.45	3.87
						29.79

CC SILT DETENTION STRUCTURE NO.2 ACROSS THUNDU RAM NALA –I (THEIN MICROWATERSHED)
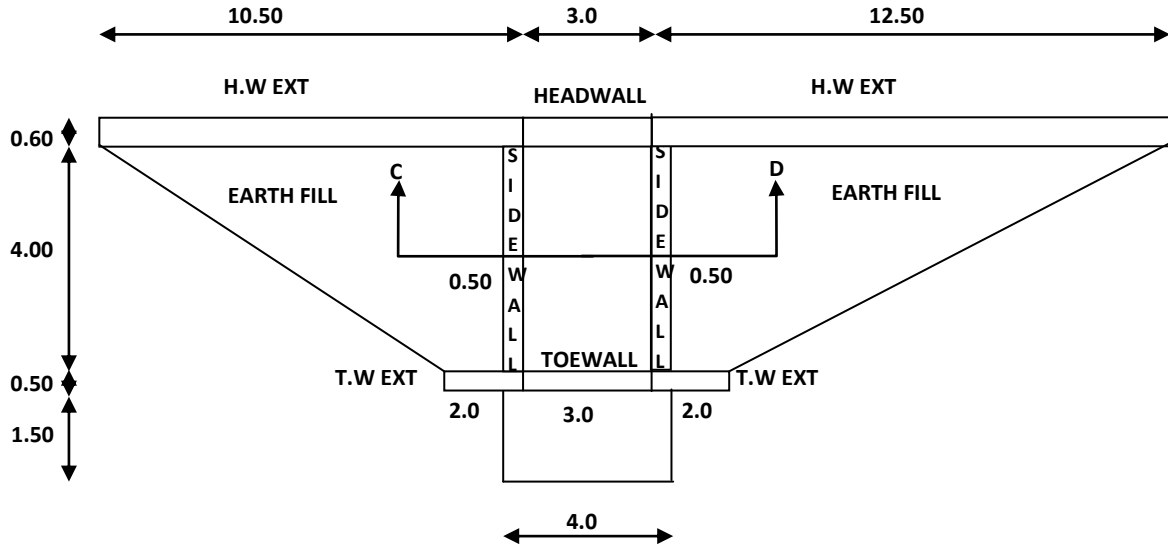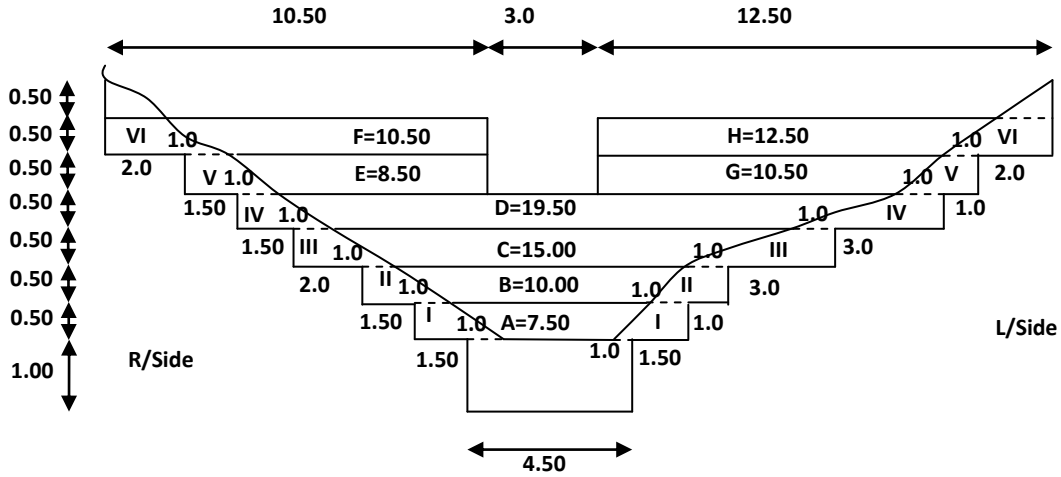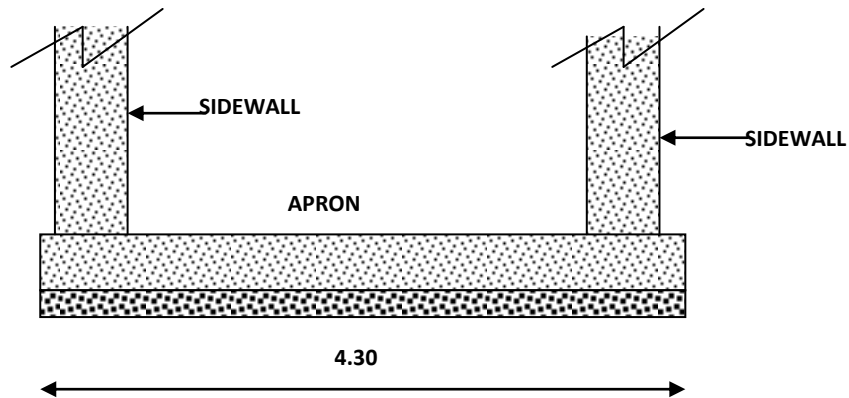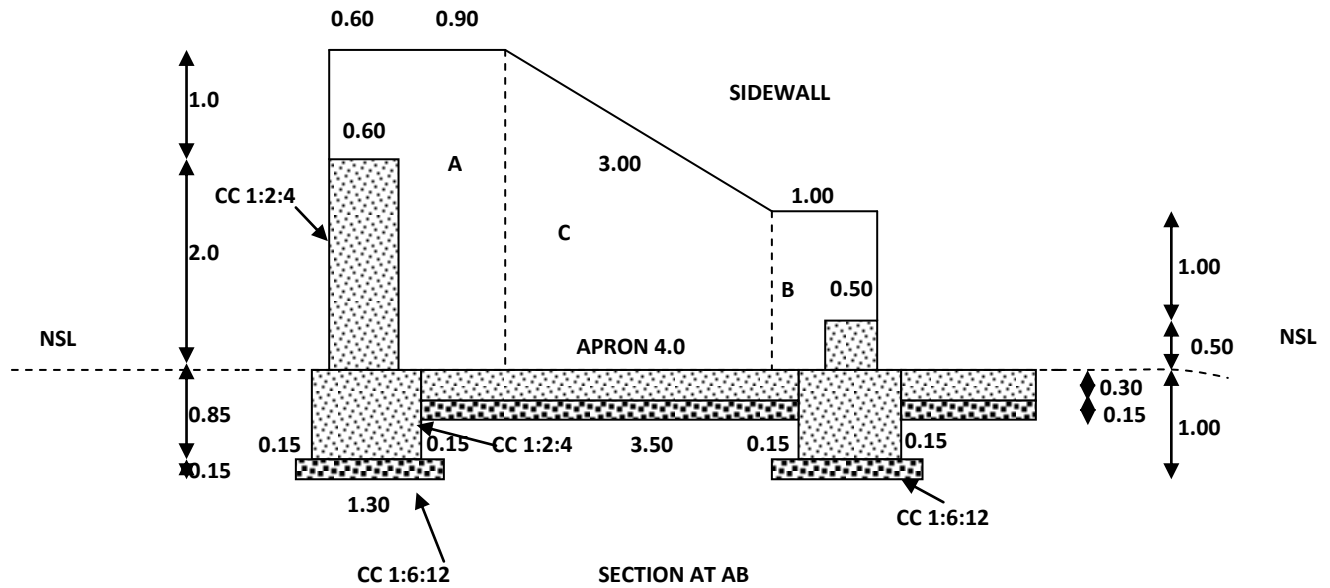
SECTION AT AB

APRON

SIDEWALL

4.30

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure 3 across Palki Nala (Thein Micro Watershed)

1. **Hydrological Design**

Catchment Area (A) = 40 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 40 / 360 = 4.66 m^3/sec

2. **Hydraulic Design**

$Q = 1.711 \, LH^{3/2}$

H = 1.0m

$Q = 1.711 \, LH^{3/2}$

4.66 = 1.711 L X 1 X √1

L = 4.66 / 1.711

= 2.72 say 3.0m

3. **Structural Design**

Drop = 2.0

H = 1.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1.00 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure I across Palki Nala (Thein Micro Watershed)

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/work in foundation Head wall & Head wall extension	1	8.0	1.30	1.0	10.40 cum
	H.W Ext 1st step L/Side	1	1.50+0.50/2	0.80	0.50	0.40
	2nd Step	1	1.0+0.80/2	0.80	0.50	0.36
	3rd Step	1	1.30+0.70/2	0.80	0.50	0.40
	4th Step	1	1.20+0.70/2	0.80	0.50	0.38
	5th Step	1	2.70+1.0/2	0.80	0.50	0.74
	6th Step	1	3.0+1.0/2	0.80	1.0+0/2	0.80
	R/side 1st Step	1	2+1 / 2	0.80	0.50	0.60 cum
	2nd Step	1	1.50+1.0/2	0.80	0.50	0.50 cum
	3rd Step	1	1.50 + 1.0 / 2	0.80	0.50	0.50 cum
	4th Step	1	1.50+1.0/2	0.80	0.50	0.50 cum
	5th Step	1	1.50+0.60/2	0.80	0.50	0.40 cum
	6th Step	1	2.10+0/2	0.80	0.80	0.67cum
	Toe Wall & T.W. Ext	1	9.0	1.30	1.0	11.70 cum
	Toe Wall Protection work	1	1.25	4.0	0.45	2.25 cum
	Apron	1	3.50	4.30	0.45	6.77
						37.37
					Say	37.00
2	CC 1:6:12 in foundation					
	Head wall	1	8.0	1.30	0.15	1.56cum
	Toe wall & T.W. Ext	1	9.0	1.30	0.15	1.75cum
	Toe wall Protection	1	1.25	4.0	0.15	0.75 cum
	Apron	1	3.50	4.30	0.15	2.25
						6.31 cum
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	8.0	1.0	0.85	6.80cum
	Toe Wall & Ext	1	9.0	1.0	0.85	7.65cum
	Toe Wall Protection	1	1.25	4.0	0.30	1.50cum
	Apron	1	3.50	4.30	0.30	4.51cum
	Above foundation					
	Head Wall & H.W. Ext Part A	1	9.50	0.60	0.50	2.85
	B	1	10.50	0.60	0.50	3.15
	C	1	11.50	0.60	0.50	3.45

	D	1	12.50	0.60	0.50	3.75
	E	1	6.50	0.60	0.50	1.95
	F	1	8.50	0.60	0.50	2.55
	G	1	5.50	0.60	0.50	1.65
	H	1	7.00	0.60	0.50	2.10
	Toe Wall & T.W Ext	1	9.0	0.50	0.50	2.25cum
	T.W. Ext	2	3.00	0.50	1.00	3.00
	Side wall Part A	2	0.90	0.50	3.00	2.70
	Side wall Part B	2	0.50	0.50	1.50	0.75
	Side wall Part C	2	3.00	0.50	3.0+1.50/2	6.75
						57.36
4	Form work					
	Head Wall Foundation	1 X 2	9.0	-	1.0	18.0 sqm
	Toe Wall & T.W. Ext Foundation	1 X 2	9.50	-	1.0	19.00
	Toe Wall Protection Work	1 X 2	6.00	-	0.45	2.70
	Apron	1 X 2	4.0	-	0.45	3.60
	Head wall & H.W. Ext above foundation Part A	1 X 2	9.50	-	0.50	9.50
	B	1 X 2	10.50	-	0.50	10.50
	C	1 X 2	11.50	-	0.50	11.50
	D	1 X 2	12.50	-	0.50	12.50
	E	1 X 2	6.50	-	0.50	6.50
	F	1 X 2	8.50	-	0.50	8.50
	G	1 X 2	5.50	-	0.50	5.50
	H	1 X 2	7.0	-	0.50	7.0
	Toe Wall & T.W. Ext above foundation	1 X 2	9.50	-	0.50	9.50
	T.W. Ext	2 X 2	3.00	-	1.00	12.00
	Side Wall Part A	2 X 2	0.90	-	3.00	10.80
	B	2 X 2	0.50	-	1.50	3.00
	C	2 X 2	3.0	-	3.0+1.50/2	27.00
						177.10
					Say	177.0sqm
5	Filling of earthwork behind the side wall					
	L/Side	1	8.0+2.50/2	4.0	3+1.0/2	42.0
	R/Side	1	6.50+2.50/2	4.0	3+1/2	36.0
						78.0cum

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	6.31	14.50	3.15	6.30
2	C.C 1:2:4	57.36	372.84	25.81	51.62
			387.34	28.96	57.92
		Say	387 bags	29.0 cum	58.00 cum

CC SILT DETENTION STRUTURE I ACROSS PALKI NALA (THEIN MICROWATERSHED)
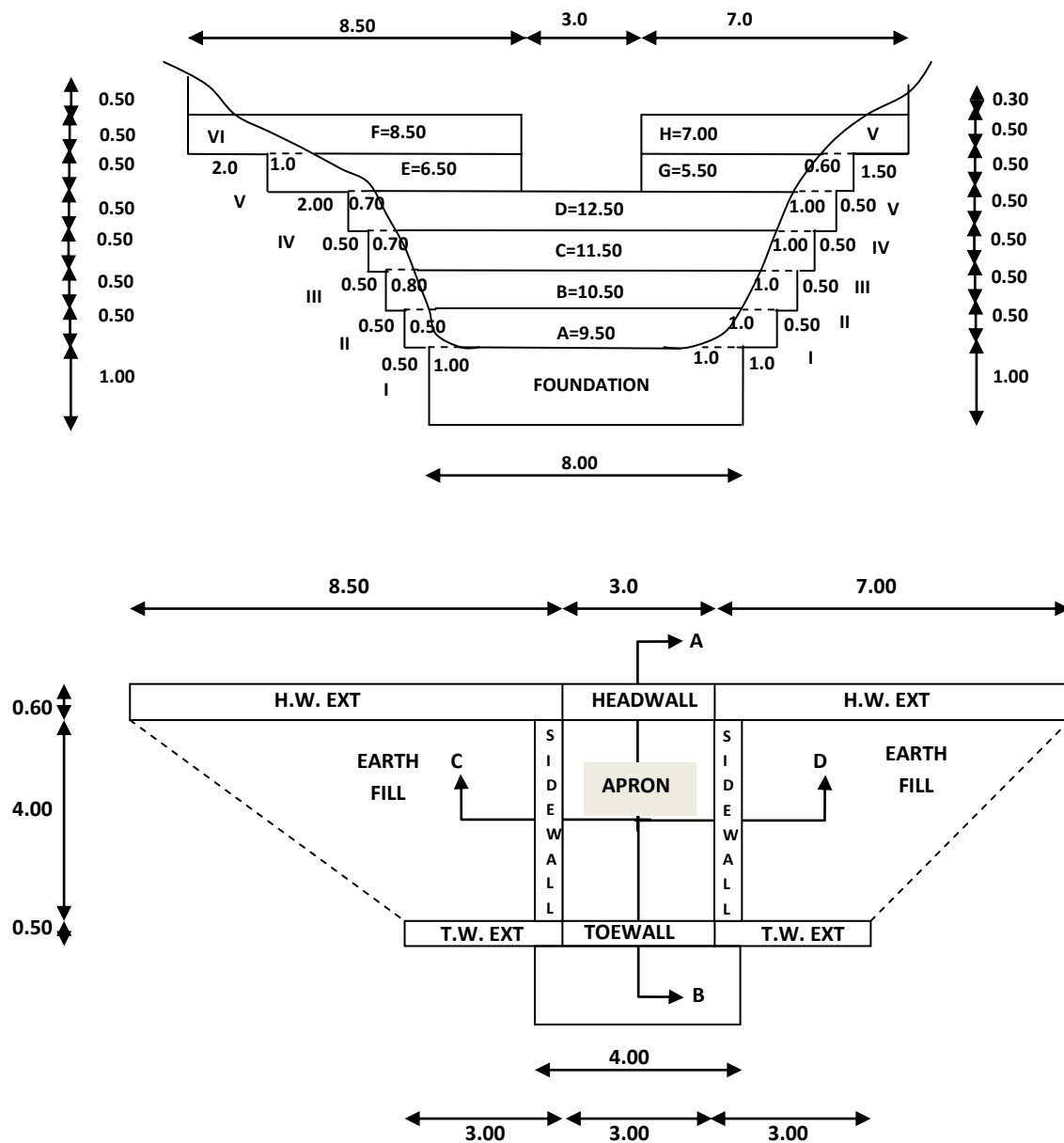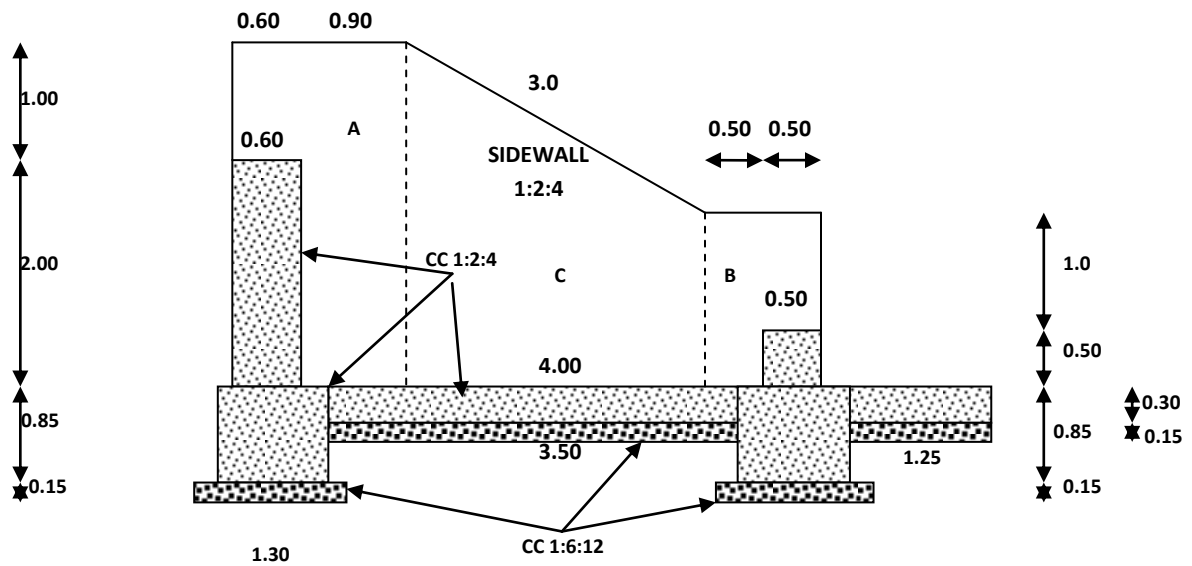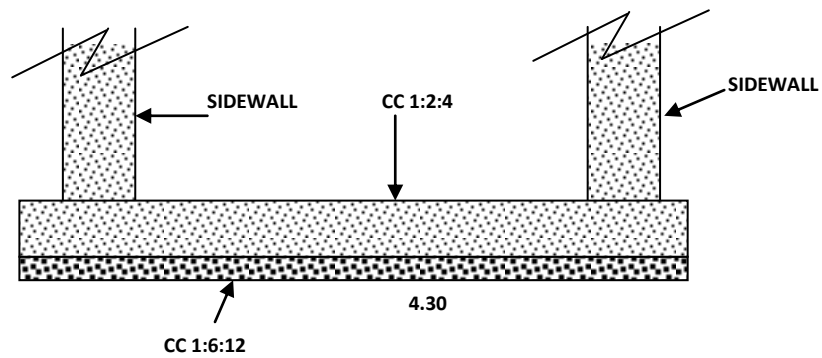
SECTION AT AB

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CC Silt Detention Structure No.4 Across Palki Nala (Thein Micro Watershed)

1. **Hydrological Design**

Catchment Area (A) = 48 ha

Coefficient Runoff (C) = 0.35

Intensity of Rainfall (I) = 120mm/hr

Using rational formula = Q = CIA/360

= 0.35 X 120 X 48 / 360 = 5.60 cumecs

2. **Hydraulic Design**

$Q = 1.711 \ LH^{3/2}$

H = 1.0

Peak Discharge = 5.60 cumecs

Therefore = $Q = 1.711 \ LH^{3/2}$

5.60 = 1.711 L X 1 X √1.0

Crest Length = 5.60 / 1.711

= 3.27 say 3.50m

3. **Structural Design**

Drop = 2.0

H = 1.0

Top width = Drop X 0.30 = 2 X 0.30 = 0.60m

Base width = Drop X 0.60 = 2 X 0.60 = 1.20m say 1.30

Apron Length = Drop X 1.50 + H = 2 X 1.50 + 1.0 = 4.0m

Foundation Depth = 1/3 X Drop = 1/3 X 2.0 = 0.66 Say 1.0m

CC Silt Detention Structure No.2 Across Palki Nala (Thein Micro Watershed)

S. NO	Particulars	No.	L	B	H	Contents
1	Excavation in E/W in foundation Head wall & Head wall extension					
	Head wall & H.W. Ext	1	8.50	1.30	1.00	11.05 cum
	Toe Wall & T.W. Ext	1	7.50	1.30	1.00	9.75
	Toe wall protection work	1	1.55	4.50	0.45	5.53
	Apron	1	3.50	4.80	0.45	7.56
	Headwall Ext L/Side 1st Step	1	1.50+0.60/2	0.80	0.50	0.42cum
	2nd Step	1	1.60+0.70/2	0.80	0.50	0.26 cum
	3rd Step	1	1.70+1.0/2	0.80	0.50	0.54 cum
	4th Step	1	2+1/2	0.80	0.50	0.60 cum
	5th Step	1	2+1/2	0.80	0.50	0.60 cum
	6th Step	1	2+0/2	0.80	1.50	1.20 cum
	R/side 1st Step	1	1.20+0.40/2	0.80	1.00	0.32 cum
	2nd Step	1	1.40+1.0/2	0.80	0.50	0.28 cum
	3rd Step	1	1.50+0.80/2	0.80	0.50	0.46 cum
	4th Step	1	1.30+0/2	0.80	1.50	0.78 cum
						36.35
					Say	**36.00**
2	CC 1:6:12 in foundation					
	Head Wall & H.W Ext	1	8.50	1.30	0.15	1.65cum
	Toe wall & T.W. Ext	1	7.50	1.30	0.15	1.46cum
	Toe wall Protection work	1	1.25	4.50	0.15	0.84 cum
	Apron	1	3.50	4.80	0.15	2.52
						6.47 cum
3	CC 1:2:4 in foundation					
	Head wall & H.W. Ext	1	8.50	1.0	0.85	7.22cum
	Toe Wall & Ext	1	7.50	1.0	0.85	6.37cum
	Toe Wall Protection	1	1.25	4.50	0.30	1.68cum
	Apron	1	3.50	4.80	0.30	5.04
	CC 1:2:4 above foundation					
	Head wall & H.W. Ext Part A	1	9.50	0.60	0.50	2.85cum
	B	1	10.50	0.60	0.50	3.15cum
	C	1	12.50	0.60	0.50	3.75cum
	D	1	14.0	0.60	0.50	4.20cum
	E	1	7.00	0.60	0.50	2.10cum

	F	1	8.0	0.60	0.50	2.40cum
	G	1	5.0	0.60	1.0	3.00
	Toe Wall & T.W Ext	1	7.50	0.50	0.50	1.07cum
	T.W. Ext	2	2.0	0.50	0.50	1.00
	Side wall Part A	2	0.90	0.50	3.00	2.70
	Side wall Part B	2	0.50	0.50	1.50	0.75
	Side wall Part C	2	3.00	0.50	3.0+1.50/ 2	6.75
						54.83
4	Form work – Foundation					
	Head Wall & HW Ext.	1 X 2	9.50	-	1.0	9.50 sqm
	Toe Wall & T.W. Ext	1 X 2	8.0	-	1.0	16.00
	Toe Wall Protection	1	4.50	-	0.45	2.02
	Toe Wall Protection	1	2.0	-	0.45	0.90
	Apron	1 X 2	4.80	-	0.45	4.32
						32.74
	Form work above foundation Head Wall Ext Part A	1 X 2	9.50	-	0.50	9.50
	B	1 X 2	10.50	-	0.50	10.50
	C	1 X 2	12.50	-	0.50	12.50
	D	1 X 2	14.0	-	0.50	14.00
	E	1 X 2	7.0	-	0.50	7.00
	F	1 X 2	8.0	-	0.50	8.00
	G	1 X 2	5.0	-	1.00	10.00
	Toe Wall & T.W. Ext	1 X 2	7.50	-	0.50	7.50
	T.W. Ext	2 X 2	2.00	-	1.00	8.00
	Side Wall Part A	2 X 2	0.90	-	3.00	10.90
	Part B	2 X 2	0.50	-	1.50	3.00
	Part C	2 X 2	3.00	-	3+1.50/2	27.00
						160.64
					Say	161.00sqm
5	Filing of earthwork behind the side wall					
	L/Side	1	7.50+1.50/ 2	4.0	3+1.50/2	40.50
	R/Side	1	4.50+1.50/ 2	4.0	3+1.50/2	27.00
						67.50
					Say	68.00

Material Statement

S. No	Particulars	Qty.	Cement	Sand	Bajri
1	C.C 1:6:12	6.47	14.88	3.23	6.46
2	C.C 1:2:4	54.83	356.39	24.67	49.34
			371.27	27.90	55.80
		Say	371 bags	28.0 cum	56.00 cum

CC Silt Detention Structure No.2 Across Palki Nala (Thein Micro Watershed)
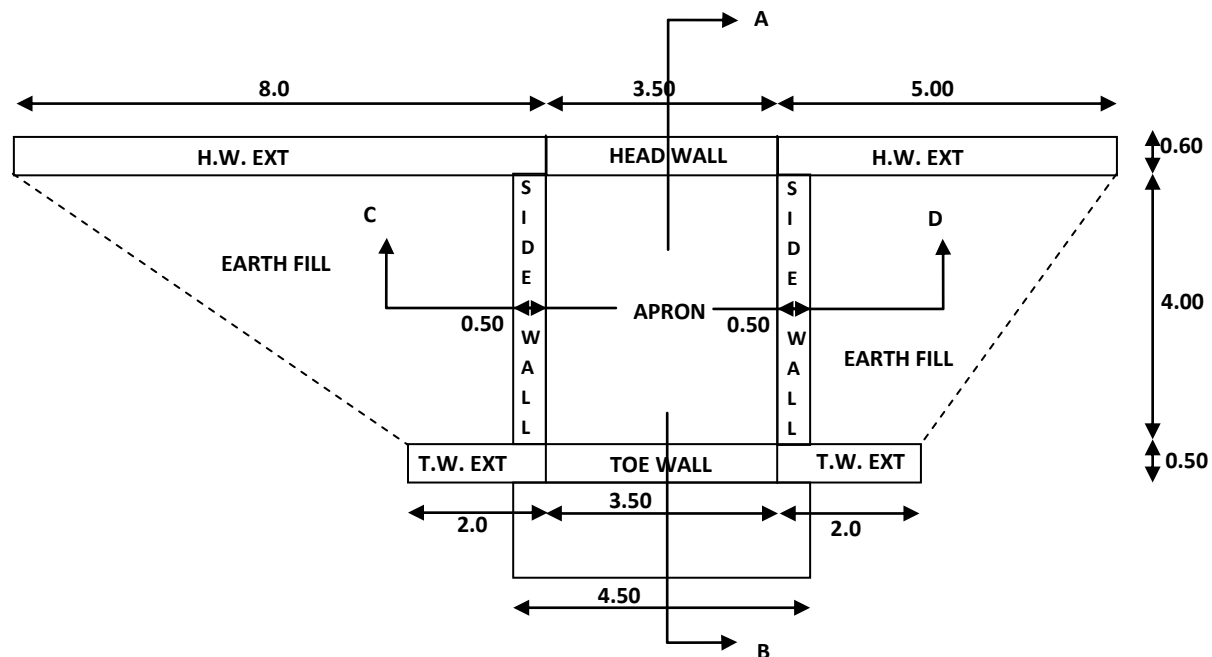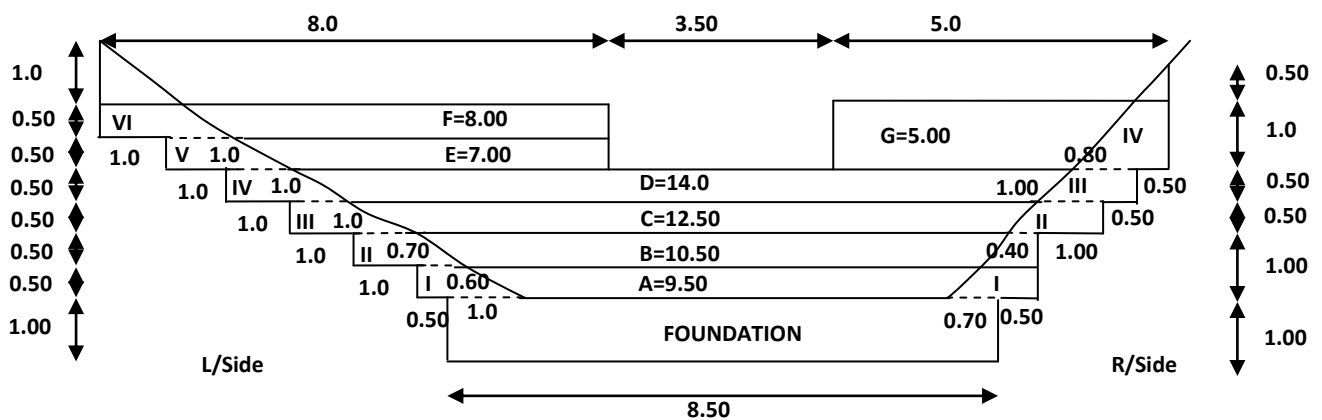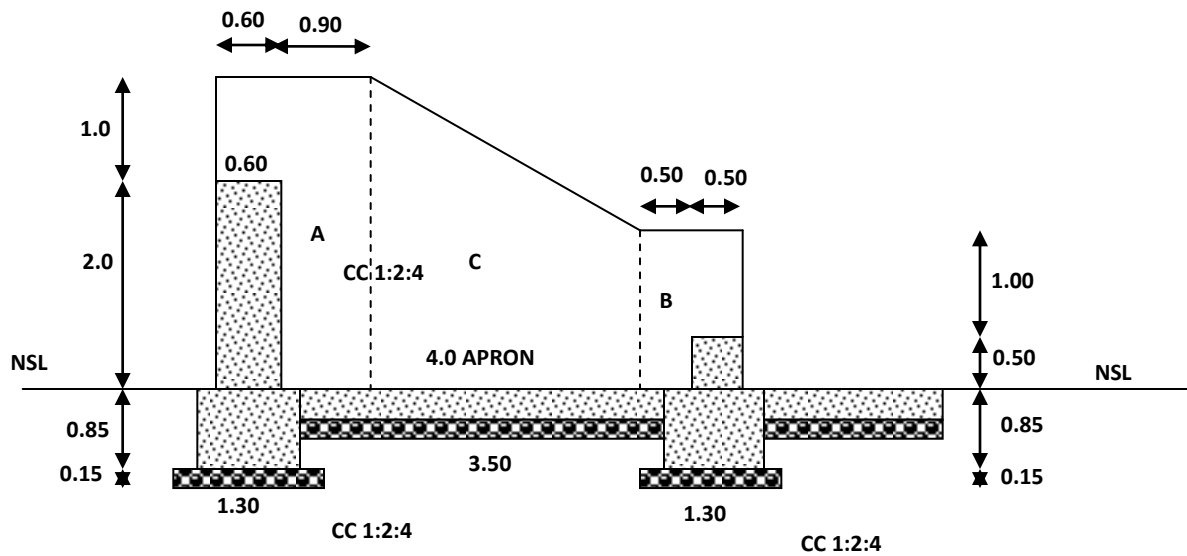
0.60   0.90

1.0

0.60

A

CC 1:2:4   C

2.0

4.0 APRON

0.50   0.50

B

1.00

NSL

0.50

NSL

0.85

3.50

0.85

0.15

0.15

1.30

1.30

CC 1:2:4

CC 1:2:4

X SECTION AT AB

0.50

0.50

SIDEWALL

SIDEWALL

CC 1:2:4

CC 1:2:4

APRON

4.80M
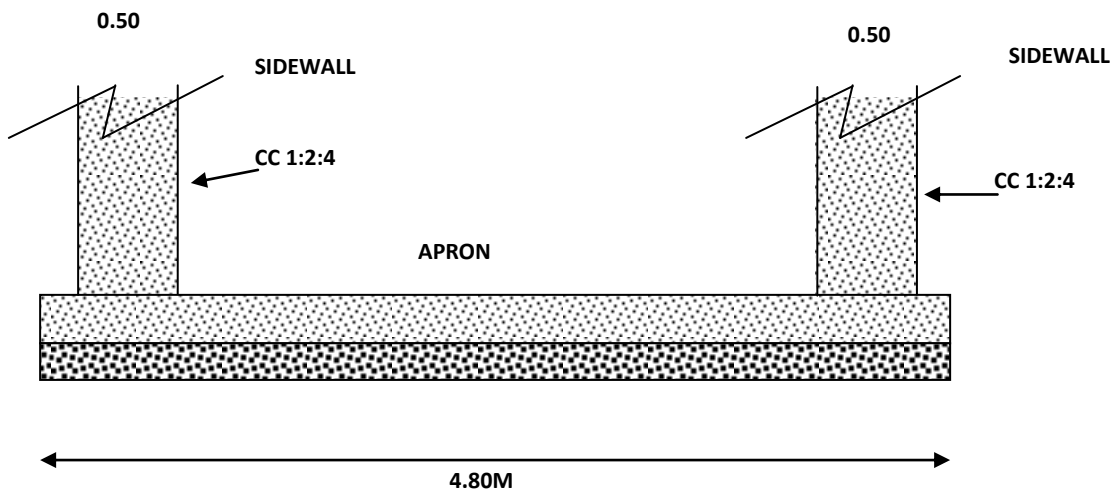
X- SECTION AT CD

Prepared by <u>Sh. Bhagwan Dass,</u> Checked by <u>Er Kirpal Singh</u>, Approved by <u>Er. H.S.Lohan</u>

CHAPTER – 07

ESTIMATING AND COSTING OF STRUCTURES

NORA NALA

Structure No. 1

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	1.17	2.69	0.58	1.17	-	-	-	
2	RCC Work 1:2:4	26.70	173.55	12.00	24.00	148	68	-	
3	Shuttering work	86.0	-	-	-	-	-	86.00	
4	E/W excavation	33.00	-	-	-	-	-	-	33.0 cum
			176.24	12.58	25.17	148	68	86	33
		Say	176	13.00	26.00	148	68	86	33

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	25.17	521.22	Cum/	13119.10	M1 36a Chapter 31 VII
2	Course Sand	13.0 cum	714.71	Cum/	9291.23	Page 37
3	Bajri M-40 1:6:12	1.17	511.61	Cum/	598.58	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	148 68	55000 57000	Per ton	8140.00 3876.00	M.R.
5	Cement	176 bags	400/	Per bag	70400	MR
					105424.81	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	33.0 cum	183.40	Cum/	6052.20
2	10.8 (b) i	RCC 1:6:12 in foundation	1.17 cum	1326.60	Cum/	1552.12
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	25.17	2806.00	Cum/	70627.02
4	9.3	Shuttering work	86.00 sqm	400/	Sq.m.	34400
						112631.34

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	176 bags	15/	Per bag	2640.00
2	Sand, Bajri, Gatka	39 cum	261.18	Cum	10186.02
3	MS bar			Qtl	
	12mm	216kg	16.90		36.50
	10mm		18.81		40.62
			35.71		12762.52
					40.62
					12803.14

B. Site Carriage by Odd Job 15-20% of the total quantity of the material

S. No	Particulars	Qty 50% of Total	Rate	Unit	Amount
1	Cement	35 trip	76.80	Per trip	2688
2	Sand, Bajri, Gatka	312 trip	76.80	Per trip	23961.60
3	MS Bars 12mm, 10mm	2 trip	76.80	Per trip	153.60
					26803.20

Total Carriage A + B

12803 + 26803 = 39606

Cost of Material   = **105425.00**

Labour Charges   = **112631.00**

Carriage & Site charges   = **39565.72**

Total   = **257621.72**

Structure No.2

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	8.45	19.43	4.22	8.44	516	272	-	
2	RCC Work 1:2:4	60.27	391.75	27.03	54.06	-	-	-	
3	Shuttering work	175 sqm	-	-	-	-	-	175.00 sqm	
4	E/W excavation	43.0	-	-	-	-	-	-	43.0 cum
			411	31.26	62.50	516	272	175	43.0
		Say	411	31.00	62.00	788		175.0	43.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	54.00	521.22	Cum/	28145.88	M1 36a Chapter 31 VII
2	Course Sand	31.00	714.71	Cum/	22156.01	Page 37
3	Bajri M-40 1:6:12	8.00	511.61	Cum/	4092.88	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	788 kg	55000/	Per ton	43340.00	M.R.
5	Cement	411 bags	400/	Per bag	164400	MR
					262134.77	
				Say	262135	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	43.0 cum	183.40	Cum/	7886.20
2	10.8 (b) i	RCC 1:6:12 in foundation	8.45 cum	1326.60	Cum/	11209.77
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	60.27	2806.00	Cum/	169117.62
4	9.3	Shuttering work	175.0 sqm	400/	Sq.m.	70000
						258213.59
					Say	258214

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	411 bags	15/	Per bag	6165.00
2	Sand, Bajri, Gatka	31.26 + 62.50 = 94.00cum	261.18	Cum	24289.97
3	MS bar 12mm 10mm	788kg	16.90 18.81	Qtl	133.17 148.22
			35.71		30588.14
					148.22
					30736.00

B. Site Carriage by Odd Job

S. No	Particulars	Qty 50% of Total	Rate	Unit	Amount
1	Cement 20%	82 trip	76.80	Per trip	6297.60
2	Sand, Bajri, Gatka 20%	816 trip	76.80	Per trip	62668.80
3	MS Bars 12mm, 10mm	8 trip	76.80	Per trip	614.40
					69580.80

Total Carriage A + B

30736 + 69580 = 100317

Cost of Material = 262135.00

Labour Charges = 258214.00

Carriage & Site charges = 100317.00

Total = 620666.00

Structure No.3

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars 12mm	MS Bars 10mm	Shuttering work	
1	CC 1:6:12 in foundation	1.75	4.02	0.87	1.74	-	-	-	
2	RCC Work 1:2:4	32.35	210.27	14.55	29.10	210	93.0	-	
3	Shuttering work	100 sqm	-	-	-	-	-	100 sqm	
4	E/W excavation	19.0	-	-	-	-	-	-	19.0 cum
			214.0	15.42	30.84	210	93	100.00	19.00
		Say	214	15.50	26.00	148	68	86	33

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	29.10	521.22	Cum/	15167.50	M1 36a Chapter 31 VII
2	Course Sand	15.50 cum	714.71	Cum/	11113.74	Page 37
3	Bajri M-40 1:6:12	1.74	511.61	Cum/	890.20	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	210 93 303kg	55000/	Per ton	16665	M.R.
5	Cement	214 bags	400/	Per bag	85600	MR
					129436.44	
				Say	129436	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	19.0 cum	183.40	Cum/	3484.60
2	10.8 (b) i	RCC 1:6:12 in foundation	1.75 cum	1326.60	Cum/	2321.55
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	32.35	2806.00	Cum/	90774.10
4	9.3	Shuttering work	100 sqm	400/	Sq.m.	40000
						136580.25
					Say	136580

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	214 bags	15/	Per bag	3210
2	Sand, Bajri, Gatka	15.50+30.84 = 46.34 cum	261.18	Cum	12092.63
3	MS bar 12mm 10mm	303kg	16.90 18.81	Qtl	10820
			35.71		15353.83
					57.00
				Say	15411

B. Site Carriage by Odd Job

S. No	Particulars	Qty of Total	Rate	Unit	Amount
1	Cement	43 trip	76.80	Per trip	3302.40
2	Sand, Bajri, Gatka 20%	368 trip	76.80	Per trip	28262.40
3	MS Bars 12mm, 10mm	2 trip	76.80	Per trip	153.60
					31718.40

Total Carriage A + B

15411 + 31718 = 47129

Cost of Material = **129430.00**

Labour Charges = **136580.00**

Carriage & Site charges = **47129.00**

Total = **313139.00**

Structure No.4

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	24.08	55.38	1204	24.08	2438		-	
2	RCC Work 1:2:4	43.87	285.15	19.74	39.48	-	-	-	
3	Shuttering work	259sqm	-	-	-	-	-	259sqm	
4	E/W excavation	113cum	-	-	-	-	-	-	113.0 cum
			341	31.78	63.56	2438		259	113
		Say	341	32.00	64.00	2438		259	113

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	64.00	521.22	Cum/	33350.00	M1 36a Chapter 31 VII
2	Course Sand	32.0 cum	714.71	Cum/	22870.72	Page 37
3	Bajri M-40 1:6:12	12.04	511.61	Cum/	6159.78	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	2438	55000/ 57000/	Per ton	134090.00	M.R.
5	Cement	341 bags	400/	Per bag	136400	MR
					332871.00	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	113.0 cum	183.40	Cum/	20724.20
2	10.8 (b) i	RCC 1:6:12 in foundation	24.08 cum	1326.60	Cum/	31944.53
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	43.87	2806.00	Cum/	123099.22
4	9.3	Shuttering work	259.00 sqm	400/	Sq.m.	103600
						279367.95

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	341 bags	15/	Per bag	5115.00
2	Sand, Bajri, Gatka	32+64 = 96 cum	261.18	Cum	19849.68
3	MS bar 12mm 10mm	2438kg	16.90 18.81	Qtl	870.60 40.62
			35.71		25875.82
					25876.00

B. Site Carriage by Odd Job

S. No	Particulars	Qty 50% of Total	Rate	Unit	Amount
1	Cement	68 trip	76.80	Per trip	5222.90
2	Sand, Bajri, Gatka	250 410 trip	76.80	Per trip	50688.00
3	MS Bars 12mm, 10mm	12 trip	76.80	Per trip	921.60
					56831.60
					56832

Total Carriage A + B

25876 + 56832 = 82708

Cost of Material = **332871.00**

Labour Charges = **279368.00**

Carriage & Site charges = **80708**

Total = **692947**

Structure No.5

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	6.03	13.86	3.02	6.04	-	-	-	
2	RCC Work 1:2:4	37.80	245.70	17.01	34.02	-	-	-	
3	Shuttering work	116	-	-	-	-	-	116 sqm	
4	E/W excavation	37.0	-	-	-	-	-	-	37.0 cum
			259.56	20.03	40.06			116	37
		Say	260	20.00	40.00			116	37

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	34.00	521.22	Cum/	17721.48	M1 36a Chapter 31 VII
2	Course Sand	20.0 cum	714.71	Cum/	14294.20	Page 37
3	Bajri M-40 1:6:12	6.00	511.61	Cum/	3069.66	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	260 bags	400/	Per bag	104000	MR
					139085.34	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	37.0 cum	183.40	Cum/	6785.80
2	10.8 (b) i	RCC 1:6:12 in foundation	6.00 cum	1326.60	Cum/	7959.60
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	34.00	1326.60	Cum/	45104.40
4	9.3	Shuttering work	116.00 sqm	400/	Sq.m.	46400
						106249.80
						106250

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	260 bags	15/	Per bag	3900
2	Sand, Bajri, Gatka	34+20+6 = 60cum	261.18	Cum	15670.80
3	MS bar 12mm 10mm	-	-	-	-
					19570.80
					19571.00

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	52 trip	76.80	Per trip	3993.60
2	Sand, Bajri, Gatka	370 trip	76.80	Per trip	28416.00
3	MS Bars 12mm, 10mm	-	-	-	-
					32409.60

Total Carriage A + B

19571 + 32409 = 51980

Cost of Material   = **139085.00**

Labour Charges   = **106250.00**

Carriage & Site charges   = **51080.00**

Total   = **296415.00**

Structure No.6

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	7.67	17.64	3.83	7.66	-	-	-	
2	RCC Work 1:2:4	47.0	305.50	21.93	43.86	-	-	-	
3	Shuttering work	144.0 sqm	-	-	-	-	-	-	
4	E/W excavation	40 cum	-	-	-	-	-	-	40.0 cum
			323	26.0	52.0	-	-	-	40.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	44.00	521.22	Cum/	22933.68	M1 36a Chapter 31 VII
2	Course Sand	26.00	714.71	Cum/	18582.46	Page 37
3	Bajri M-40 1:6:12	8.00	511.61	Cum/	4092.88	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	323 bags	400/	Per bag	129200	MR
					174809	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	40.0 cum	183.40	Cum/	7336.00
2	10.8 (b) i	RCC 1:6:12 in foundation	8.00 cum	1326.60	Cum/	10612.80
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	47.00 cum	2806.00	Cum/	65350.00
4	9.3	Shuttering work	144.00 sqm	400/	Sq.m.	57600
						140899.00

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	323 bags	15/	Per bag	4845.00
2	Sand, Bajri, Gatka	78 cum	261.18	Cum	20372.04
3	MS bar 12mm 10mm	-	-	-	-
			-		25217

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	60 trip	76.80	Per trip	4608.00
2	Sand, Bajri, Gatka	506 trip	76.80	Per trip	38860.80
3	MS Bars 12mm, 10mm	-	76.80	Per trip	-
					43468.80

Total Carriage A + B

25217 + 43468 = 68685.80

Cost of Material   = **174809.00**

Labour Charges   = **140899.00**

Carriage & Site charges   = **68685.00**

Total   = **384393**

Structure No.7

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	20.63	47.45	10.31	20.62	-	-	-	
2	RCC Work 1:2:4	118.00	767.0	53.10	106.20	2385		-	
3	Shuttering work	302.00 sqm	-	-	-	-	-	302 sqm	
4	E/W excavation	102	-	-	-	-	-	-	102.0 cum
			814	63.0	127.0	2385kg		302	102

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	106.00	521.22	Cum/	55249.52	M1 36a Chapter 31 VII
2	Course Sand	63.0 cum	714.71	Cum/	45026.73	Page 37
3	Bajri M-40 1:6:12	21	511.61	Cum/	10743.81	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	2385	55000 57000	Per ton	131175	M.R.
5	Cement	814 bags	400/	Per bag	325600	MR
					567794.86	
				Say	567795	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	102.0 cum	183.40	Cum/	18706.80
2	10.8 (b) i	RCC 1:6:12 in foundation	21.0 cum	1326.60	Cum/	27858.60
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	118.00 cum	2806.00	Cum/	331108
4	9.3	Shuttering work	302.00 sqm	400/	Sq.m.	120800
						498473.40
					Say	498473

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	814 bags	15/	Per bag	12210
2	Sand, Bajri, Gatka	63+127 = 190 cum	261.18	Cum	49624.00
3	MS bar 12mm 10mm	2385kg	16.90 18.81	Qtl	851.68
			35.71		62685.68

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	150 trip	76.80	Per trip	11520
2	Sand, Bajri, Gatka	1300 trip	76.80	Per trip	99840.00
3	MS Bars 12mm, 10mm	4.73 trip	76.80	Per trip	363.26
					111723.26

Total Carriage A + B

62686 + 111723 = 174409

Cost of Material   = **567795.00**

Labour Charges   = **498473.00**

Carriage & Site charges   = **174409**

Total   = **1240677**

Structure No.8

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars 12mm	MS Bars 10mm	Shuttering work	
1	CC 1:6:12 in foundation	22.85	52.55	11.42	22.85	-	-	-	
2	RCC Work 1:2:4	115.58	751.27	51.88	103.76	2643kg		-	
3	Shuttering work	288 sqm	-	-	-	-	-	288 sqm	
4	E/W excavation	108 cum	-	-	-	-	-	-	108.0 cum
			803.82	64.00	127.0	2643kg		288	108

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	104.0	521.22	Cum/	54206.88	M1 36a Chapter 31 VII
2	Course Sand	64	714.71	Cum/	45741.44	Page 37
3	Bajri M-40 1:6:12	23.0	511.61	Cum/	11767.03	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	2643kg	55000 57000	Per ton	145365.00	M.R.
5	Cement	804 bags	400/	Per bag	321600	MR
					578680.35	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	108.0 cum	183.40	Cum/	19807.20
2	10.8 (b) i	RCC 1:6:12 in foundation	22.85 cum	1326.60	Cum/	30312.81
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	116.00	2806.00	Cum/	325496
4	9.3	Shuttering work	288.00 sqm	400/	Sq.m.	115200
						490816

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	804 bags	15/	Per bag	12060.00
2	Sand, Bajri, Gatka	64+127= 191 cum	261.18	Cum	49885.38
3	MS bar 12mm 10mm	2643kg	35.71	Qtl	943.82
					62889.20

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	160 trip	76.80	Per trip	12288
2	Sand, Bajri, Gatka	1300 trip	76.80	Per trip	99840
3	MS Bars 12mm, 10mm	5 trip	76.80	Per trip	394.00
					112522

Total Carriage A + B

62889 + 112522 = 175411

Cost of Material = 578680.00

Labour Charges = 490816.00

Carriage & Site charges = 175411.00

Total = 1244907.00

Structure No.9

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars 12mm	10mm	Shuttering work	
1	CC 1:6:12 in foundation	26.96	62.00	13.48	26.96	-	-	-	
2	RCC Work 1:2:4	127 cum	925	57.00	114.00	2891kg		-	
3	Shuttering work	370sqm	-	-	-	-	-	370 sqm	
4	E/W excavation	154.0	-	-	-	-	-	-	154.0 cum
			887	70	140	2891		370	154

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	114	521.22	Cum/	59419.08	M1 36a Chapter 31 VII
2	Course Sand	70.0 cum	714.71	Cum/	50029.70	Page 37
3	Bajri M-40 1:6:12	27.00	511.61	Cum/	13813.47	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	2891 kg	55000 57000	Per ton	159005	M.R.
5	Cement	887 bags	400/	Per bag	354800	MR
					637067.25	
					637067	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	154.0 cum	183.40	Cum/	28243.60
2	10.8 (b) i	RCC 1:6:12 in foundation	26.96 cum	1326.60	Cum/	35765.13
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	127 cum	2806.00	Cum/	356362.00
4	9.3	Shuttering work	370.00 sqm	400/	Sq.m.	148000
						542950.73

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	887 bags	15/	Per bag	13305.00
2	Sand, Bajri, Gatka	141 cum	261.18	Cum	36826.38
3	MS bar 12mm 10mm	28.91	35.71	Qtl	1032.38
					51163.76

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	135 trip	76.80	Per trip	10368.00
2	Sand, Bajri, Gatka	987 trip	76.80	Per trip	75801.60
3	MS Bars 12mm, 10mm	15 trip	76.80	Per trip	1152.00
					87321.60
					87322.00

Total Carriage A + B

51164 + 87322 = 138486

Cost of Material   = **637067.00**

Labour Charges   = **542950.00**

Carriage & Site charges   = **87322.00**

Total   = **1267340.00**

Structure No.10

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars 12mm	MS Bars 10mm	Shuttering work	
1	CC 1:6:12 in foundation	21.84	50.23	10.92	21.84	-	-	-	
2	RCC Work 1:2:4	106.20	690.30	47.79	95.58	-	-	-	
3	Shuttering work	131.0	-	-	-	-	-	131.00	
4	E/W excavation	158.00	-	-	-	-	-	-	158.0 cum
			740	59.0	117.0	-	-	131.0	158.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	95.58	521.22	Cum/	49818.20	M1 36a Chapter 31 VII
2	Course Sand	59.0 cum	714.71	Cum/	42167.89	Page 37
3	Bajri M-40 1:6:12	21.84	511.61	Cum/	11173.56	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	740 bags	400/	Per bag	296000	MR
					399159.65	
					399160.00	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	158.0 cum	183.40	Cum/	28977.20
2	10.8 (b) i	RCC 1:6:12 in foundation	21.84 cum	1326.60	Cum/	28972.94
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	106.20	1326.60	Cum/	140884.92
4	9.3	Shuttering work	131.00 sqm	400/	Sq.m.	52400
						251235.06
					Say	251235.00

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	740 bags	15/	Per bag	11100
2	Sand, Bajri, Gatka	59+117 = 176 cum	261.18	Cum	45967.68
3	MS bar 12mm 10mm	-	-	-	-
					57067.68

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	150 trip	76.80	Per trip	11520.00
2	Sand, Bajri, Gatka	1053 trip	76.80	Per trip	80870.40
3	MS Bars 12mm, 10mm	-	-	-	-
					92390.40

Total Carriage A + B

57067.68 + 92390.40 = 149458.08

Cost of Material = **399160.00**

Labour Charges = **251235.00**

Carriage & Site charges = **149458.00**

Total = **799793.00**

Structure No.11

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	5.64	13.00	2.82	5.64	-	-	-	
2	RCC Work 1:2:4	37.33	243	16.79	33.58	-	-	-	
3	Shuttering work	116.0 sqm	-	-	-	-	-	116.00	
4	E/W excavation	39.00	-	-	-	-	-	-	39.0 cum
			256	19.61	39.22	-	-	116.00	39.0
		Say	256	20.00	39.00	-	-	116	39.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	33.00	521.22	Cum/	17200.26	M1 36a Chapter 31 VII
2	Course Sand	20.0 cum	714.71	Cum/	14294.20	Page 37
3	Bajri M-40 1:6:12	6.00	511.61	Cum/	3069.66	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	256 bags	400/	Per bag	34564.12	MR
					136964.12	
				Say	136964	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	39.0 cum	183.40	Cum/	7152.60
2	10.8 (b) i	RCC 1:6:12 in foundation	5.64 cum	1326.60	Cum/	7482.02
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	37.33	1326.60	Cum/	49521.98
4	9.3	Shuttering work	116.00 sqm	400/	Sq.m.	46400
						110556.60
					Say	110557

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	256 bags	15/	Per bag	3840.00
2	Sand, Bajri, Gatka	20+39 = 59 cum	261.18	Cum	15409.62
3	MS bar 12mm 10mm	-	-	-	-
					19249.62

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	50 trip	76.80	Per trip	3840.00
2	Sand, Bajri, Gatka	310 trip	76.80	Per trip	23808
3	MS Bars 12mm, 10mm	-	-	-	-
					27648

Total Carriage A + B

19249+ 27648= 46897

Cost of Material   **= 136964.00**

Labour Charges   **= 110557.00**

Carriage & Site charges   **= 46897.00**

Total   **= 294418**

Structure No.12

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	24.31	55.91	12.15	24.30	-	-	-	
2	RCC Work 1:2:4	121.24	788	54.55	109.10	2441 kg		-	
3	Shuttering work	302 sqm	-	-	-	-	-	302 sqm	
4	E/W excavation	141.00	-	-	-	-	-	-	141.0 cum
			844	67.0	133.0	2441 kg		302 sqm	141

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	109 cum	521.22	Cum/	56812.98	M1 36a Chapter 31 VII
2	Course Sand	67.0 cum	714.71	Cum/	47885.57	Page 37
3	Bajri M-40 1:6:12	24.00	511.61	Cum/	12278.64	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	2441	55000 57000	Per ton	134255.00	M.R.
5	Cement	844 bags	400/	Per bag	337600	MR
					588832	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	141.0 cum	183.40	Cum/	25859.40
2	10.8 (b) i	RCC 1:6:12 in foundation	24.31 cum	1326.60	Cum/	32249.64
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	121	2806.00	Cum/	339526
4	9.3	Shuttering work	302.00 sqm	400/	Sq.m.	120800
						518435

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	844 bags	15/	Per bag	12660.00
2	Sand, Bajri, Gatka	67+133 = 200 cum	261.18	Cum	52236
3	MS bar 12mm 10mm	2441 kg	35.71	Qtl	871.68
					65754.34

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	125 trip	76.80	Per trip	9600
2	Sand, Bajri, Gatka	1150 trip	76.80	Per trip	88328
3	MS Bars 12mm, 10mm	10 trip	76.80	Per trip	768
					98696

Total Carriage A + B

65754 + 98696 = 164450

Cost of Material = **588832.00**

Labour Charges = **518435.00**

Carriage & Site charges = **164450.00**

Total = **1271717**

Structure No.13

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	31.67	72.84	15.83	31.66	-	-	-	
2	RCC Work 1:2:4	159.20	1034.80	71.64	143.25	3187kg		-	
3	Shuttering work	347.0	-	-	-	-	-	347.0	
4	E/W excavation	129.00	-	-	-	-	-	-	129.0 cum
			1108	87.0	175.0	3187		347	129

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	143.0	521.22	Cum/	74534.46	M1 36a Chapter 31 VII
2	Course Sand	87.0 cum	714.71	Cum/	62179.77	Page 37
3	Bajri M-40 1:6:12	32.0	511.61	Cum/	16371.52	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	3187	55000 57000	Per ton	175285.00	M.R.
5	Cement	1108 bags	400/	Per bag	443200	MR
					771570	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	129.0 cum	183.40	Cum/	23658.60
2	10.8 (b) i	RCC 1:6:12 in foundation	31.67 cum	1326.60	Cum/	42013.42
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	159.0	2806.00	Cum/	446154.00
4	9.3	Shuttering work	147.00 sqm	400/	Sq.m.	58800
						570626.02
					Say	570626

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	1108 bags	15/	Per bag	16620
2	Sand, Bajri, Gatka	175+87 = 262 cum	261.18	Cum	68429.16
3	MS bar 12mm 10mm	3187	35.71	Qtl	1138.07
					86187.23

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	180 trip	76.80	Per trip	13824.00
2	Sand, Bajri, Gatka	1500 trip	76.80	Per trip	115200
3	MS Bars 12mm, 10mm	16 trip	76.80	Per trip	12288
					141312

Total Carriage A + B

86187 + 141312 = 227490

Cost of Material = **771570.00**

Labour Charges = **570626.00**

Carriage & Site charges = **227490.00**

Total = **1569686.00**

Structure No.14

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	11.00	25.27	5.49	10.98	771.0 kg		-	
2	RCC Work 1:2:4	88.00	572.20	39.61	79.22			-	
3	Shuttering work	250 sqm	-	-	-	-	-	250 sqm	
4	E/W excavation	110 + 58 = 168	-	-	-	-	-	-	168.0 cum
			597.0	45.0	90.0	771.0 kg		250	168

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	79.00	521.22	Cum/	41176.38	M1 36a Chapter 31 VII
2	Course Sand	45.0 cum	714.71	Cum/	32161.95	Page 37
3	Bajri M-40 1:6:12	11.0	511.61	Cum/	5627.71	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	771	55000 57000	Per ton	42405.0	M.R.
5	Cement	597 bags	400/	Per bag	238800	MR
					360171.04	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	58+110.0 cum	183.40	Cum/	29160
2	10.8 (b) i	RCC 1:6:12 in foundation	11 cum	1326.60	Cum/	14592.60
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	88.0	2806.00	Cum/	246928.00
4	9.3	Shuttering work	250.00 sqm	400/	Sq.m.	100000
						390681.20

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	597 bags	15/	Per bag	8955
2	Sand, Bajri, Gatka	45+90 = 135 cum	261.18	Cum	35259.30
3	MS bar 12mm 10mm	771 kg	35.71	Qtl	275.32
					44489.62

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	90 trip	76.80	Per trip	6912.00
2	Sand, Bajri, Gatka	750 trip	76.80	Per trip	57600.00
3	MS Bars 12mm, 10mm	5 trip	76.80	Per trip	384.00
					64896.00

Total Carriage A + B

44490+ 64896 = 109386

Cost of Material = **360171.00**

Labour Charges = **390681.00**

Carriage & Site charges = **109386.00**

Total = **860238.00**

Structure No. 15 – Crate Wire Structures

Material Statement

S. No	Particulars	Qty	GI Wire	Boulders
1	Weaving wire crate of GI Wire 15x15 cm	581 sqm	1296 kg	-
2	Filling stones in wire crate	135 cum	-	116.cum
	Total	-	1296 kg	116 cum

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount
1	GI Wire 5mm	1296 kg	60/	Kg/(MR)	77760
2	Carriage of GI Wire lead 10 km	12.96 qtl	35.71	Qtl	462.80
3	Site carriage of GI Wire	20 trip	76.80	Trip	78222.80
					995.33
					79218.21

Labour Charges

CSR Item No.	Particulars	Qty	Rate	Unit	Amount
6.5 (a) P.101	E/w excavation on foundation	74.0 cum	183.40	Cum/	13571.60
23.29	Weaving wire crate of GI Wire 15x15cm mesh	581 sqm	58/	Sqm	33698.00
23.37	Spreading wire netting	581 sqm	70/	Sqm	40670.00
23.33	Tipping wire crate	135 cum	232/	Cum	31320.00
23.32	Filling boulders in wire crate	135 cum	321/	Cum	43335.00
					162594.60
				Say	162595

Local Collection of Boulders

S. No	Particulars	Qty	Rate	Unit	Amount
CSR 4.2	Loading and Unloading of Boulders = 31.36 + 18.29 = 49.65	135 cum	49.65	Cum/	6702.75
	Carriage by manual 1st claim of 30m = 28.78 2nd and 3rd claim of 30m each @6.24/c = 12.48 Total = 41.26	135 cum	41.26	Cum	5570.10
					12272.85
				Say	12273

Cost of boulder (collection of stones)   = 12273.00

Cost of GI Wire   = 79218.00

Labour charges   = 162595.00

Total   = 254086

Unit cost = 2190/ say 2200

Structure No.16 – Crate Wire Structure 6 Nos

Material Statement

S. No	Particulars	Qty	GI Wire	Boulders
1	Weaving wire crate of GI Wire 15x15 cm	294 sqm	655.62 kg	-
2	Filling stones in wire crate	56.0 cum	-	56.cum
	Total	-	656 kg	56 cum

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount
1	GI Wire 5mm	656 kg	60/	Kg/(MR)	39360
2	Carriage of GI Wire lead 10 km	656kg or 6.56 qtl	35.71	Qtl	234.25
3	Site carriage of GI Wire	10 trip	76.80	Trip	768.00
					40362.25
				Say	40362

Labour Charges

CSR Item No.	Particulars	Qty	Rate	Unit	Amount
6.5 (a) P.101	E/w excavation on foundation	74.0 cum	183.40	Cum/	13571.16
23.29	Weaving wire crate of GI Wire 15x15cm mesh	294 sqm	58/	Sqm	17052.00
23.37	Spreading wire netting	294 sqm	70/	Sqm	20580.00
23.33	Tipping wire crate	56 cum	232/	Cum	12992.00
23.32	Filling boulders in wire crate	56 cum	321/	Cum	17976.00
					82171.16
				Say	82171

Local Collection of Boulders

S. No	Particulars	Qty	Rate	Unit	Amount
CSR 4.2	Loading and Unloading of Boulders = 31.36 + 18.29 = 49.65	56 cum	49.65	Cum/	2780.40
	Carriage by manual 1st claim of 30m = 28.78 2nd and 3rd claim of 30m each @6.24/c = 12.48 Total = 41.26	56 cum	41.26	Cum	2310.56
					5090.96
				Say	5091

Cost of boulder (collection of stones)   **= 5091.00**

Cost of GI Wire   **= 40362.00**

Labour charges   **= 82171.00**

Total   **= 127624.00**

GHARTI NALA

Structure No.1

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work
						12mm	10mm	
1	CC 1:6:12 in foundation	-	-	-	-			-
2	RCC Work 1:2:4	13.20 cum	85.0	6.00	12.00			
3	Shuttering work	44.00 sqm	-	-	-	-	-	44.0 sqm
4	E/W excavation	-	-	-	-	-	-	-
			85.0	6.0	12.0			44.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	12.00	521.22	Cum/	6254.64	M1 36a Chapter 31 VII
2	Course Sand	6.00 cum	714.71	Cum/	4288.26	Page 37
3	Bajri M-40 1:6:12	-	511.61	Cum/	-	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	85 bags	400/	Per bag	34000	MR
					44542.90	
				Say	44543	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	-	183.40	Cum/	-
2	10.8 (b) i	RCC 1:6:12 in foundation	-	1326.60	Cum/	-
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	13.20	1326.60	Cum/	17511.12
4	9.3	Shuttering work	44.00 sqm	400/	Sq.m.	17600
						35111.12
					Say	35111

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	85 bags	15/	Per bag	1275.00
2	Sand, Bajri, Gatka	18 cum	261.18	Cum	4701.24
3	MS bar 12mm 10mm	-	35.71	Qtl	-
					5976.24
				Say	5976.00

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	17 bags	76.80	Per trip	1305.60
2	Sand, Bajri, Gatka	108 trip	76.80	Per trip	8294.40
3	MS Bars 12mm, 10mm	-	76.80	-	-
					9600.00

Total Carriage A + B

5976+ 9600= 15576

Cost of Material   **= 44543.00**

Labour Charges   **= 35111.00**

Carriage & Site charges   **= 15576.00**

Total   **= 95230.00**

Structure No.2

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	5.00	11.38	2.47	4.94			-	
2	RCC Work 1:2:4	33.17	215.60	14.92	29.84	-	-	-	
3	Shuttering work	107 sqm	-	-	-	-	-	107 sqm	
4	E/W excavation	27 + 23 = 50	-	-	-	-	-	-	50.0 cum
			227.0	17.00	35.00			107.0 sqm	50.0 cum

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	30.00	521.22	Cum/	15636.60	M1 36a Chapter 31 VII
2	Course Sand	17.0	714.71	Cum/	12150.07	Page 37
3	Bajri M-40 1:6:12	5.00	511.61	Cum/	2558.05	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	227 bags	400/	Per bag	90800	MR
					121144.67	
				Say	121144	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	50.0 cum	183.40	Cum/	9170.00
2	10.8 (b) i	RCC 1:6:12 in foundation	5.00 cum	1326.60	Cum/	6633.0
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	30.0	1326.60	Cum/	39798.00
4	9.3	Shuttering work	107.00 sqm	400/	Sq.m.	42800
						98401

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	227 bags	15/	Per bag	4305
2	Sand, Bajri, Gatka	55 cum	261.18	Cum	14364.90
3	MS bar 12mm 10mm	-	-	-	-
					18669.90

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	45 trip	76.80	Per trip	3456.0
2	Sand, Bajri, Gatka	290 trip	76.80	Per trip	22272
3	MS Bars 12mm, 10mm	-	76.80	Per trip	-
					25728

Total Carriage A + B

18669+ 25728 = 44397

Cost of Material = **121144.00**

Labour Charges = **98401.00**

Carriage & Site charges = **44397.00**

Total = **263942.00**

Structure No.3 – Gharti Nala

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	4.75	10.92	2.37	4.74			-	
2	RCC Work 1:2:4	35.71	232.0	15.68	31.36			-	
3	Shuttering work	103.0 sqm	-	-	-	-	-	103.0 sqm	
4	E/W excavation	43 cum	-	-	-	-	-	-	43.0 cum
			243 bags	18.0	36.00			103	43.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	31.0	521.22	Cum/	16157.82	M1 36a Chapter 31 VII
2	Course Sand	18.0 cum	714.71	Cum/	12864.78	Page 37
3	Bajri M-40 1:6:12	5.0	511.61	Cum/	2558.05	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	243 bags	400/	Per bag	97200	MR
					128780.65	
				Say	128781	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	43.0 cum	183.40	Cum/	7886.20
2	10.8 (b) i	RCC 1:6:12 in foundation	5 cum	1326.60	Cum/	6633.00
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	31.0	2806.00	Cum/	41124.60
4	9.3	Shuttering work	103.00 sqm	400/	Sq.m.	41200
						96843.20
					Say	96843.00

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	243 bags	15/	Per bag	3645
2	Sand, Bajri, Gatka	36.0 cum	261.18	Cum	9402.48
3	MS bar 12mm 10mm	-	35.71	Qtl	-
					13047.48

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	40 trip	76.80	Per trip	3072.00
2	Sand, Bajri, Gatka	212 trip	76.80	Per trip	16281.60
3	MS Bars 12mm, 10mm	-	76.80	Per trip	-
					19353.60

Total Carriage A + B

13047+ 19353 = 32400

Cost of Material = **128781.00**

Labour Charges = **96843.00**

Carriage & site charges = **32400.00**

Total = **258024.00**

Structure No.4 – Gharti Nala

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars 12mm	10mm	Shuttering work	
1	CC 1:6:12 in foundation	10.14	23.32	5.07	10.14			-	
2	RCC Work 1:2:4	66.61	432.96	29.97	59.94	1078.kg		-	
3	Shuttering work	99 sqm	-	-	-	-	-	99 sqm	
4	E/W excavation	21 + 45 = 66	-	-	-	-	-	-	66.0 cum
			456 bags	35.00	70.08	1078 kg		99.0	66.0

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	60.00	521.22	Cum/	31273.20	M1 36a Chapter 31 VII
2	Course Sand	35.0 cum	714.71	Cum/	25014.85	Page 37
3	Bajri M-40 1:6:12	10.0	511.61	Cum/	5116.10	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	1078	55000 57000	Per ton	59290.0	M.R.
5	Cement	456 bags	400/	Per bag	182400	MR
					303094.15	
				Say	303094.00	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	66 cum	183.40	Cum/	12104.40
2	10.8 (b) i	RCC 1:6:12 in foundation	10.14 cum	1326.60	Cum/	13398.66
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	66.61 cum	2806.00	Cum/	186907.66
4	9.3	Shuttering work	99.00 sqm	400/	Sq.m.	39600
						252010.22
					Say	252011.00

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	456 bags	15/	Per bag	6840.00
2	Sand, Bajri, Gatka	105 cum	261.18	Cum	27423.90
3	MS bar 12mm 10mm	1078 kg	35.71	Qtl	384.95
					34648.85
				Say	34649.00

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	90 trip	76.80	Per trip	6912.00
2	Sand, Bajri, Gatka	630 trip	76.80	Per trip	48384.00
3	MS Bars 12mm, 10mm	10 trip	76.80	Per trip	768.00
					56064.00

Total Carriage A + B

34649+ 56064 = 90713

Cost of Material = 303094.00

Labour Charges = 252011.00

Carriage & Site charges = 90713.00

Total = 645818.00

Structure No.5 – Gharti Nala

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	7.47	17.18	3.73	7.46			-	
2	RCC Work 1:2:4	57.63 cum	374.59	26.00	52.00	838kg		-	
3	Shuttering work	141 sqm	-	-	-	-	-	141 sqm	
4	E/W excavation	85 cum	-	-	-	-	-	-	85.0 cum
			392	30.00	59.46	838kg		141 sqm	85 cum

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	52.00 cum	521.22	Cum/	27103.44	M1 36a Chapter 31 VII
2	Course Sand	30.0 cum	714.71	Cum/	21441.30	Page 37
3	Bajri M-40 1:6:12	8.0	511.61	Cum/	4092.88	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	838 kg	55000 57000	Per ton	46090.00	M.R.
5	Cement	392 bags	400/	Per bag	156800	MR
					232227.62	
				Say	232228.00	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	54+31 = 85 cum	183.40	Cum/	15589.00
2	10.8 (b) i	RCC 1:6:12 in foundation	7.47 cum	1326.60	Cum/	9909.70
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	57.63 cum	2806.00	Cum/	161709.78
4	9.3	Shuttering work	143.00 sqm	400/	Sq.m.	57200
						244407

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	392 bags	15/	Per bag	5880.0
2	Sand, Bajri, Gatka	60 cum	261.18	Cum	15670.80
3	MS bar 12mm 10mm	838 kg	35.71	Qtl	300.00
					21850.80
				Say	21851.00

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	80 trip	76.80	Per trip	6144.00
2	Sand, Bajri, Gatka	360 trip	76.80	Per trip	27648.00
3	MS Bars 12mm, 10mm	8 trip	76.80	Per trip	614.40
					34406.40

Total Carriage A + B

21851+ 34406 = 56257

Cost of Material   = **244407.00**

Labour Charges   = **192408.00**

Carriage & Site charges   = **56257.00**

Total   = **493072.00**

Structure No.6 – Gharti Nala

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	12.13	27.90	6.06	12.12			-	
2	RCC Work 1:2:4	91.00	591.30	40.93	81.86	974kg		-	
3	Shuttering work	232 sqm	-	-	-	-	-	232 sqm	
4	E/W excavation	43+58 = 103	-	-	-	-	-	-	103.0 cum
			619	47.0	94.0	974.0 kg		232	103

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	82.00	521.22	Cum/	42740.04	M1 36a Chapter 31 VII
2	Course Sand	47.0 cum	714.71	Cum/	33591.37	Page 37
3	Bajri M-40 1:6:12	12.0	511.61	Cum/	6139.32	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	974	55000 57000	Per ton	53570.00	M.R.
5	Cement	619 bags	400/	Per bag	247600	MR
					345170.73	
				Say	345171.00	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	103 cum	183.40	Cum/	10650.20
2	10.8 (b) i	RCC 1:6:12 in foundation	12.13 cum	1326.60	Cum/	16091.66
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	91.0	2806.00	Cum/	255346.00
4	9.3	Shuttering work	232.00 sqm	400/	Sq.m.	92800
						374887.86
					Say	374888.0

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	619 bags	15/	Per bag	9285.00
2	Sand, Bajri, Gatka	47+94 = 141 cum	261.18	Cum	36826.38
3	MS bar 12mm 10mm	974 kg	35.71	Qtl	374.82
					46486.20

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	120 trip	76.80	Per trip	9216.00
2	Sand, Bajri, Gatka	735 trip	76.80	Per trip	55448.00
3	MS Bars 12mm, 10mm	9 trip	76.80	Per trip	691.20
					65355.20
				Say	65355.00

Total Carriage A + B

46486+ 65355 = 111841

Cost of Material = **345171.00**

Labour Charges = **374888.00**

Carriage & Site charges = **111841.00**

Total = **831900.00**

Structure No.7 – Gharti Nala

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	9.90	22.70	4.95	9.90			-	
2	RCC Work 1:2:4	67.46	438.49	30.35	60.70	986kg		-	
3	Shuttering work	214 sqm	-	-	-	-	-	214 sqm	
4	E/W excavation	131	-	-	-	-	-	-	131.0 cum
			461	35.00	71.0	986.0 kg		214	131

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	61.00	521.22	Cum/	31794.42	M1 36a Chapter 31 VII
2	Course Sand	35.0 cum	714.71	Cum/	25014.85	Page 37
3	Bajri M-40 1:6:12	10.0	511.61	Cum/	5116.10	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	986	55000 57000	Per ton	54230.00	M.R.
5	Cement	461 bags	400/	Per bag	184400	MR
					300555.37	
				Say	300555	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	131.0 cum	183.40	Cum/	24025.40
2	10.8 (b) i	RCC 1:6:12 in foundation	9.90 cum	1326.60	Cum/	13133.34
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	67.46	2806.00	Cum/	189292.76
4	9.3	Shuttering work	214.00 sqm	400/	Sq.m.	85600
						312651.50
					Say	312651.00

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	461 bags	15/	Per bag	6915.00
2	Sand, Bajri, Gatka	106 cum	261.18	Cum	27685.08
3	MS bar 12mm 10mm	986 kg	35.71	Qtl	352.10
					34952.18

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	92 trip	76.80	Per trip	7065.60
2	Sand, Bajri, Gatka	630 trip	76.80	Per trip	48384.00
3	MS Bars 12mm, 10mm	9 trip	76.80	Per trip	691.20
					56140.80
				Say	56141

Total Carriage A + B

34952+ 56141 = 91093

Cost of Material   **= 300555.00**

Labour Charges   **= 312651.00**

Carriage & Site charges   **= 91093.00**

Total   **= 703299.00**

THEIN DAM MICROWATERSHED

STRUCTURE NO.1 PALKI NALA

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	6.31	14.50	3.15	6.30	-	-	-	
2	RCC Work 1:2:4	57.36	372.84	25.81	51.62			-	
3	Shuttering work	177 sqm	-	-	-	-	-	177 sqm	
4	E/W excavation	78+37 =115	-	-	-	-	-	-	115.0 cum
			387	29.0	58.00	-	-	177	115

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	52	521.22	Cum/	27109.44	M1 36a Chapter 31 VII
2	Course Sand	29.0 cum	714.71	Cum/	20726.59	Page 37
3	Bajri M-40 1:6:12	6.00	511.61	Cum/	3069.66	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	387 bags	400/	Per bag	154800	MR
					205699.69	
				Say	205700	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	115 cum	183.40	Cum/	21091
2	10.8 (b) i	RCC 1:6:12 in foundation	6.30 cum	1326.60	Cum/	8357.59
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	57.36	1326.60	Cum/	76080.51
4	9.3	Shuttering work	177.00 sqm	400/	Sq.m.	70800
						176329

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	387 bags	15/	Per bag	5805.00
2	Sand, Bajri, Gatka	87 cum	261.18	Cum	22722.66
3	MS bar 12mm 10mm	-	35.71	Qtl	-
					28527.66

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	62 trip	76.80	Per trip	4761.60
2	Sand, Bajri, Gatka	472 trip	76.80	Per trip	36249.60
3	MS Bars 12mm, 10mm	-	76.80	Per trip	-
					41011.20

Total Carriage A + B

28528+ 41011= 69539

Cost of Material   = 205700.00

Labour Charges   = 176329.00

Carriage & Site charges   = 69539.00

Total   = 451568.00

Structure No.2 – PALKI NALA

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	6.47	14.88	3.23	6.46	-	-	-	
2	RCC Work 1:2:4	54.83	356.39	24.67	49.34			-	
3	Shuttering work	161 sqm	-	-	-	-	-	161 sqm	
4	E/W excavation	104	-	-	-	-	-	-	104.0 cum
			371	28.0	56.0			161	104

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	49	521.22	Cum/	25539.78	M1 36a Chapter 31 VII
2	Course Sand	28.0 cum	714.71	Cum/	20011.88	Page 37
3	Bajri M-40 1:6:12	7.00	511.61	Cum/	3581.27	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	371 bags	400/	Per bag	148400	MR
					197532.93	
				Say	197533	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	104.0	183.40	Cum/	19073.60
2	10.8 (b) i	RCC 1:6:12 in foundation	7.0 cum	1326.60	Cum/	9286.20
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	49.0	1326.60	Cum/	65003.40
4	9.3	Shuttering work	161.00 sqm	400/	Sq.m.	64400
						157763.20
					Say	157763

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	371 bags	15/	Per bag	5565.00
2	Sand, Bajri, Gatka	28+56 = 84 cum	261.18	Cum	21939.12
3	MS bar 12mm 10mm	-	-	-	-
					27504.12

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	59 trip	76.80	Per trip	4531.20
2	Sand, Bajri, Gatka	440 trip	76.80	Per trip	33792.00
3	MS Bars 12mm, 10mm	-	-	-	-
					38323.20

Total Carriage A + B

27504+38323 = 65827

Cost of Material = **197533.00**

Labour Charges = **157763.00**

Carriage & Site charges = **65827.00**

Total = **421123.00**

Structure No.3 – Bagh Nala

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	5.69	13.08	2.84	5.68			-	
2	RCC Work 1:2:4	44.76	290.94	20.14	40.28			-	
3	Shuttering work	134 sqm	-	-	-	-	-	134 sqm	
4	E/W excavation	79.00	-	-	-	-	-	-	79.0 cum
			304.0	23.0	46.00			134	79

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	40	521.22	Cum/	20848.80	M1 36a Chapter 31 VII
2	Course Sand	23.0 cum	714.71	Cum/	16438.31	Page 37
3	Bajri M-40 1:6:12	6.0	511.61	Cum/	3069.66	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	304 bags	400/	Per bag	121600	MR
					161956.77	
				Say	161957	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	79.00	183.40	Cum/	14488.60
2	10.8 (b) i	RCC 1:6:12 in foundation	5.69 cum	1326.60	Cum/	7548.35
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	44.76.0	1326.60	Cum/	58378.62
4	9.3	Shuttering work	134.00 sqm	400/	Sq.m.	53600
						134016
					Say	134016

A. Carriage of Total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	304 bags	15/	Per bag	4560.00
2	Sand, Bajri, Gatka	69 cum	261.18	Cum	18021.42
3	MS bar 12mm 10mm	-	35.71	Qtl	-
					22581.42
				Say	22581

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	48 trip	76.80	Per trip	3686.40
2	Sand, Bajri, Gatka	375 trip	76.80	Per trip	28800
3	MS Bars 12mm, 10mm	-	76.80	Per trip	-
					32486.40
				Say	32486

Total Carriage A + B

22581+ 32486 = 61057

Cost of Material = **161957.00**

Labour Charges = **134016.00**

Carriage & Site charges = **61057.00**

Total = **357030.00**

Structure No.4 – Across Thundu Ram Nala-I

Material Statement

S. No	Item of Work	Qty	Cement	Sand	Bajri	MS Bars		Shuttering work	
						12mm	10mm		
1	CC 1:6:12 in foundation	5.23	12.02	2.61	5.22			-	
2	RCC Work 1:2:4	54.18	352.17	24.38	48.76			-	
3	Shuttering work	165 sqm	-	-	-	-	-	165 sqm	
4	E/W excavation	147	-	-	-	-	-	-	147.0 cum
			364.0	27.0	54.0			165	147

Cost of Material

S. No	Particulars	Qty	Rate	Unit	Amount	CSR Item
1	Bajri 12.4 M.20	49.0	521.22	Cum/	25539.78	M1 36a Chapter 31 VII
2	Coarse Sand	27.0 cum	714.71	Cum/	19297.17	Page 37
3	Bajri M-40 1:6:12	5.0	511.61	Cum/	2558.05	Page 36 Ch-3
4	MS Rod 12mm and 10 mm	-	55000 57000	Per ton	-	M.R.
5	Cement	364 bags	400/	Per bag	145600	MR
					192995	

Labour Charges

S. No	CSR Item No.	Particulars	Qty	Rate	Unit	Amount
1	6.5 (a) Page 101	E/w excavation & refilling around foundation	147 cum	183.40	Cum/	26959.80
2	10.8 (b) i	RCC 1:6:12 in foundation	5.23 cum	1326.60	Cum/	6938.12
3	CSR 10.20 p.127	RCC 1:2:4 in foundation and structure	54.18	2806.00	Cum/	71875.19
4	9.3	Shuttering work	165.00 sqm	400/	Sq.m.	66000
						171773.10
					Say	171773

A. Carriage of total material average lead (10 km)

S. No	Particulars	Qty.	Rate	Unit	Amount
1	Cement	364 bags	15/	Per bag	5460.00
2	Sand, Bajri, Gatka	27+54 = 81 cum	261.18	Cum	21155.58
3	MS bar 12mm 10mm	-	35.71	Qtl	-
					26616

B. Site Carriage by Odd Job

S. No	Particulars	Qty	Rate	Unit	Amount
1	Cement	55 trip	76.80	Per trip	4224.00
2	Sand, Bajri, Gatka	460 trip	76.80	Per trip	35328.00
3	MS Bars 12mm, 10mm	-	76.80	Per trip	-
					39552.00

Total Carriage A + B

26616+ 39552 = 66168

Cost of Material = **192995.00**

Labour Charges = **171773.00**

Carriage & Site charges = **66168.00**

Total = **430936.00**

MATERIAL RATE

S. No	Material	Ref. of CSR Pb.2020 (Pathankot Quarry) Rate
1	Bajri M.20mm for 1:2:4	CSR Page 36 MI (vii)(a) Chapter No.3 (Rs.521.22)
2	Bajri M.40mm 1:6:12	CSR Page 36 MI (a) (iv) (Rs.511.61)
3	Coarse Sand	CSR Page 37 MI (a) (Rs.714.71)
4	MS Road (Saria)	Local at Kathua
5	Cement	Market Rate (Local)

Carriage Rate for 10km Lead

S. No	Item of Work	CSR Item	Unit	Amount
1	Cement			
	Loading & Unloading	4.5 (b)	100 bags	313.60+313.60 = 627.20/100bags

One ton = 20 bags

Loading & Unloading for one ton = 627.20/5 = 125.44

Carriage charges = 1km to 5km   = 92.15

5km to 10 km   = 81.00

                    Total   = 298.59

                    Say   = Rs.300/

Cost per bag = 300/20 = Rs.15/bag

Carriage by odd job

CSR (5.3)(a)	Mazdoor load up to 40kg & distance up to 3.00km	each trip	Rate 76.80/per trip

Carriage of Sand, Bajri & Gatka

S. No	Particulars	Qty	Analysis of Rate	Total Amount
1	Carriage of Sand, Bajri, Gatka Lead 1km to 10km	1 cum	CSR item no. 4.1 A lead up to 10 km 5.2 (1) csr	19.48 loading 6.27 unloading 25.75total 235.43 Rate per cum = 261.18

MS ROD

CSR 4.9(1) Loading & unloading   = Rs188.16

Carriage charges 1km to 10km   = Rs168.95

            Total   = Rs357.11/ton

Rate per qtl = 357.11/10 = Rs 35.71/qtl

Total Cost of Construction of Silt Detention Structures in Project Area

Structure No.	Type o Structure	Cost (Rs.)
	NORA NALA	
1	RCC	257622
2	RCC	620666
3	RCC	313139
4	RCC	692947
5	CC	296415
6	CC	384393
7	RCC	1240677
8	RCC	1244907
9	RCC	1267340
10	CC	799793
11	CC	294418
12	RCC	1271717
13	RCC	1569686
14	RCC	860238
15	Gabion	254086
16	Gabion	127624
Sub Total (I)		**11495668**
	GHARTI NALA	
1	CC	95230
2	CC	263942
3	CC	258024
4	RCC	645818
5	RCC	493072
6	RCC	831900
7	RCC	703299
Sub Total (II)		**3291285**
	THEIN MICRO-WATERSHED	
1	CC	357030
2	CC	430936
3	CC	451568
4	CC	421123
Sub Total (III)		**1660657**
Grand Total (I+II+III)		**16447610**

The planning and designing part was prepared by Sh Bhagwan Dass Former J.E of the Department of Soil and Water Conservation Punjab.

The estimating and costing was done by Er.Kirpal Singh, Former Divisional Soil Conservation Officer of Department of Soil and Water Conservation Punjab.

The civil engineering part was supervised and approved by Er.H.S.Lohan General Secretary of SPACE.

Summary of Cost Estimates of the Project

S. No	Particulars	Rate	Amount (Rs.)
	Total Cost of Structures		
1.	27 No. of Structures	As per estimates	16447610
2.	Work under Water 15% of Structure Cost	16447610 x 0.15	2467141
3.	Hard Rock Cutting 10% of Structure Cost	16447610 x 0.10	1644761
4.	Cost of Local Stores and Site infrastructure 2% of Structure Cost	16447610 x 0.02	328952
	Sub Total (1+2+3+4)		**20888464**
5.	Bio Engineering measures including establishment of nurseries 15% of Total Cost	20888464 x 0.15	3133270
	Sub Total (1+2+3+4+5)		**24021734**
	Total Cost		
6.	Supervision and Management (15% of Total Cost)	24021734 x 0.15	3603260
7.	Cost Escalation (20% of Total Cost)	24021734 x 0.20	4804347
8	Cost of preparing CAT Plan	5,96000	596000
	Total cost 6+7+8		**9003607**
	Grand Total	24021734 + 9003607	**33025341**

Rupees Three Crores Thirty Lakhs Twenty Five Thousand Three Hundred and Forty One Only

CHAPTER – 08

PRIORTIZATION OF MICRO-WATERSHEDS BASED UPON SILT YIELD INDEX

An overview of sedimentation problem

The problems of poverty, deforestation, loss of productivity and biodiversity, floods and droughts and resultant social and economic crisis in rain-fed hilly and mountain regions of India posed serious challenges for natural resources conservation for sustainable development. The Indian Himalayas have suffered the most from the onslaught of human interference resulting into vanishing natural forests. Due to its characteristic topography, geology and climate, the region is characterized by set of calamities in the form of excessive soil erosion, landslides and cloudburst which cause huge loss of life and property. The silt loads to the reservoirs and other water bodies have increased due to severe soil erosion, glacial melts, landslides and faulty road construction. Not only the problems of hill farmers increased but the reservoirs of prestigious hydro-electric projects like Gobind Sagar of Bhakhra Dam,Ranjit Sagar Dam started silting up very fast. The need of energy is fast increasing in the country as the pace of economic development has been stepped up but faster siltation of reservoirs has become a matter of serious concern.

Reservoir sedimentation and consequent loss of valuable stored water is a cause of concern particularly in countries where the livelihood of large population depends on reliable supplies of impounded water (Brabben, 1988). The reservoir siltation has direct negative economic and environmental consequences since water availability is reduced for intended purpose and hence appropriate measures to protect the reservoirs from sedimentation is essential (Pandey et.al;2016). There are reports around the world indicating how rapidly the reservoirs are filling with sediment but very few reports indicate the economic loss of such sedimentation and benefits from sediment removal (Jebari, 2010). Reservoir sedimentation is one of the major problems in water security which is emerging as serious concern because the water availability for irrigation and domestic use is fast decreasing and available water resources are suffering from pollution and contamination problems (CWC, 2019). As per Patra et. al; 2019, a dam and reservoir is conventionally designed and operated to eventually get filled up with sediment and the ramification of sedimentation is always left to future and this future has already arrived for more than fifty percent reservoirs in India. According to them, most other reservoirs will eventually meet the same fate and unfortunately creating new reservoirs is difficult because the country's inventory of ideal reservoir sites is limited. The reservoirs would continue to fill with sediment but most effective techniques in the long run is by means of drainage basin treatment which includes afforestation, erosion control structures, dam height raising, de-weeding, bio-remediation, sluicing, flushing and wet and dry dredging (UNDP, 1994, CPHEED 2013 MOWR, RD, GR 2017, CWC, 2019). Soil erosion, sediment transport and sedimentation are very complex phenomenon and issues involved are frequently region specific (Keller et. al, 2000, CWPC 2017). Grewal (2016) reported drastic reduction in silt loads from more than 150 to less than 6 t/ha/yr with the construction of large numbers of silt detention dams in the catchment of a

rapidly silting lake which helped to sustain the functional life of the recreation lake at Chandigarh.

The Drainage System of Nora Nala

An area of 1760 hectares of Kathua district freely drains from hydraulic right in the reservoir of Shahpur Kandi Dam (SKD). The SPACE team visited the project area and marked the watershed boundaries on the Survey of India Topo-Sheet No.43/P/11 of 1:50000 scale. The major part of the catchment drains through Nora Nala. The road from Lakhanpur to Thein pass through the project area which mostly runs on the ridge line with catchment of Nora Nala on the north side and individual gullies on the southern side drains directly into the Ravi River.. Along the river up to the Ranjit Sagar Dam, there is a flat boundary bed having variable width and most of it is in the territory of the J and K state. A small independent area of Thein micro-watershed also drains into the Ravi River just below the Ranjt Sagar Dam. The salient features of the catchment area of1760 ha are depicted in the map given below.

As explained above the 1760 ha catchment area proposed for treatment to reduce silt load is basically divided into three drainage systems:

A) Area directly draining into Ravi River   = 425 ha
B) Areas of Thein Micro- Watershed   = 122 ha
C) Areas draining through Nora Nala having 2 parts:
    a) Gharti micro-watershed draining into Nora Nala   = 190 ha
    b) Catchment of main Nora Nala   = 1023 ha

1. **Areas draining through Nora Nala**

A total of 1213 ha drains through Nora Nala, 122 ha through Thein Micro Watersheds and 425 ha directly draining into Ravi River through small creeks. The main drainage line is divided into distinct parts as described below:

a)   The area from the River Ravi to the elevation of 404.5 would come under submergence. This part is 50-60m wide and full with boulders and no treatment is prescribed.   The next length include one very wide khad locally called Chota Nala which joins main Nora Nala from hydraulic right opposite houses of Nora village. The area above 404.5m up to about 1km length another Khad joins the main Nora Nala from hydraulic right locally called Shikhri Nala.In the main Nora Nala up to the settlement of Roshan Din, the nala is quite wide with presence of round boulders.

b)   Near the settlement of Bashir Ahmed, Gharti Nala (Gharti is small village at the top) joins from the hydraulic right having catchment area of 190ha.

c)   The Nora Nala beyond Bashir Ahmed settlement meanders a lot in a 2km stretch with gentle gradient but base flow remains. Above the Kacha path from Karola to Gharti, there is one extremely narrow gorge with converging shoulders.

d)   Beyond this narrow neck, Nora Nala takes a turn towards north, pass through very narrow inaccessible stretch which is full with vegetation cover up to the base of village Kalmari.

e)   The area from Korala to Kalmari settlement is above the explained narrow neck and Nala traverse along a sharp rocky hill slope up to Gujjar Basti of Kalmari and thereafter assumes a very narrow section and traverse through rocks to the ridge line. While on the hydraulic right is rocky forest land in a stretch of 2km but on the left, below the hills there are patches of flatter lands where pockets of cultivated lands of Kalmari are located in three different patches. There are bare rocky slopes in this area. But area is again approachable from village Kalmari.

2. **Thein Micro Watershed Catchment**

The Thein micro-watershed mainly comprise of cultivated lands and Abadi of Thein village in the lower area and steeply sloping forest lands at the top bringing runoff of Palakhi Nala, Bagh Nala and Thundu Ram Nala. Palakhi Nala forms the last drainage system having forest at top and small patch of cultivated land just below the Basoli Road. There is sharp curve and pulley over this Nala and it drains very close to the power house. All these three nalas of Thein micro-watershed joins together just below the Ranjit Sagar Dam and a diversion drain has been constructed to divert their flow to protect the power house.

3. **Area directly draining into Ravi River**

There is long narrow belt of forest land between Ravi River and pacca road from Nora Bridge to the Thein village having an area of 425 ha. At the top along the road in a stretch of

5km, nine small khads (creeks) starts from top near road and ends at the steep bank of Ravi River. All these khads draining directly in the Ravi River are having steep gradient.The lower part of slopes would come under submergence. The river bed below these slopes is full with transported debris and stones with no tree and bush growth. Some signs of stone mining are visible in this area.

Prioritization of Mapping Units Based on Silt Yield Index

All the hydro-electric dam projects executed in the Shivaliks of North India experienced rapid siltation due to heavy soil erosion in the catchment areas of such projects. Keeping in view the chances of faster siltation in the reservoir of the Shahpurkandi Dam Project, it was decided by the management that the catchment area should be treated with soil conservation measures. The micro-watersheds in the catchment area are prioritized for treatment based upon their potential for generation of silt load which was worked out on the basis of the Silt Yield Index (SYI). Such a potential is based upon several catchment area characteristics which were critically evaluated following a standard methodology.

The total catchment area of the watershed is 1760 ha and as per All India Land Use Survey classification it is designated as 1C1B3k and further divided into mini-watersheds. The area of each such mapping unit was computed from the geo-referenced survey of India topo-sheets (43P/15 & 43P/16 of 1:50000 scale) super imposed on these mini-watersheds and area of each was measured planimetrically. The silt yield indices based upon parameters like overland slope, land use, soil type, drainage density, and erosion intensity, presence of landslides and intensity of soil conservation measures already adopted were worked out. The weighted values were ranged from 10 to 20 for each parameter and SYI was found by multiplication with delivery ratio following a standard equation.

Methodology

The Silt Yield Index (SYI) is defined as the Yield per unit area and SYI value for hydrologic unit is obtained by taking the weighted arithmetic mean over the entire area of the hydrologic unit by using suitable empirical equation. The prioritization of smaller hydrologic units within the catchments is based on the Silt Yield Indices (SYI) of the smaller units. The range of SYI values for different priority categories are arrived at by studying the frequency distribution of SYI values and locating the suitable breaking points. The watersheds/sub T watersheds are subsequently rated into various categories corresponding to their respective SYI values. The application of SYI model for prioritization of sub-watershed in the catchment areas involves the evaluation of:

a) Climatic factors comprising total precipitation, its frequency and intensity,
b) Geomorphic factors comprising land forms, physiography, slope and drainage characteristics,
c) Surface cover factors governing the flow hydraulics and

d) Management factors

The data on climatic factors can be obtained for different locations in the catchment area from the meteorological stations whereas the field investigations are required for estimating the other attributes.

The various steps involved in the application of model area;

- Preparation of a framework of sub-watersheds through systematic delineation
- Rapid reconnaissance surveys on 1:50000 scale leading to the generation of a map indicating erosion-intensity mapping units.
- Assignment of weight age values to various mapping units based on relative silt-yield potential.
- Computing Silt Yield Index for individual watersheds/sub-watersheds.
- Grading of watersheds/sub-watersheds into very high, high medium, low and very low priority categories.

The area of each of the mapping units is computed and silt yield indices of individual sub watersheds are calculated using the following equations:

a. Silt Yield Index

$$SYI = \frac{\sum (A_i \times W_i) \times 100}{A_w}; \text{ where } i = 1 \text{ to } n$$

Where

Ai = Area of ith unit (EIMU)
Wi = Weightage value of ith mapping unit
n = No. of mapping units
Aw = Total area of sub-watershed.

The SYI values for classification of various categories of erosion intensity rates are given in Table

Table: Criteria of prioritization rating based on silt yield index

Priority Rating	Silt Yield Index
Very High	More than 1500
High	1400-1499
Moderate	1300-1399
Low	1200-1299
Very Low	1100-1199

Higher the number means high priority for treatment.

The total catchment area of the watershed is 1760 ha and as per All India Land Use Survey classification it is designated as ICIB3k (see map).
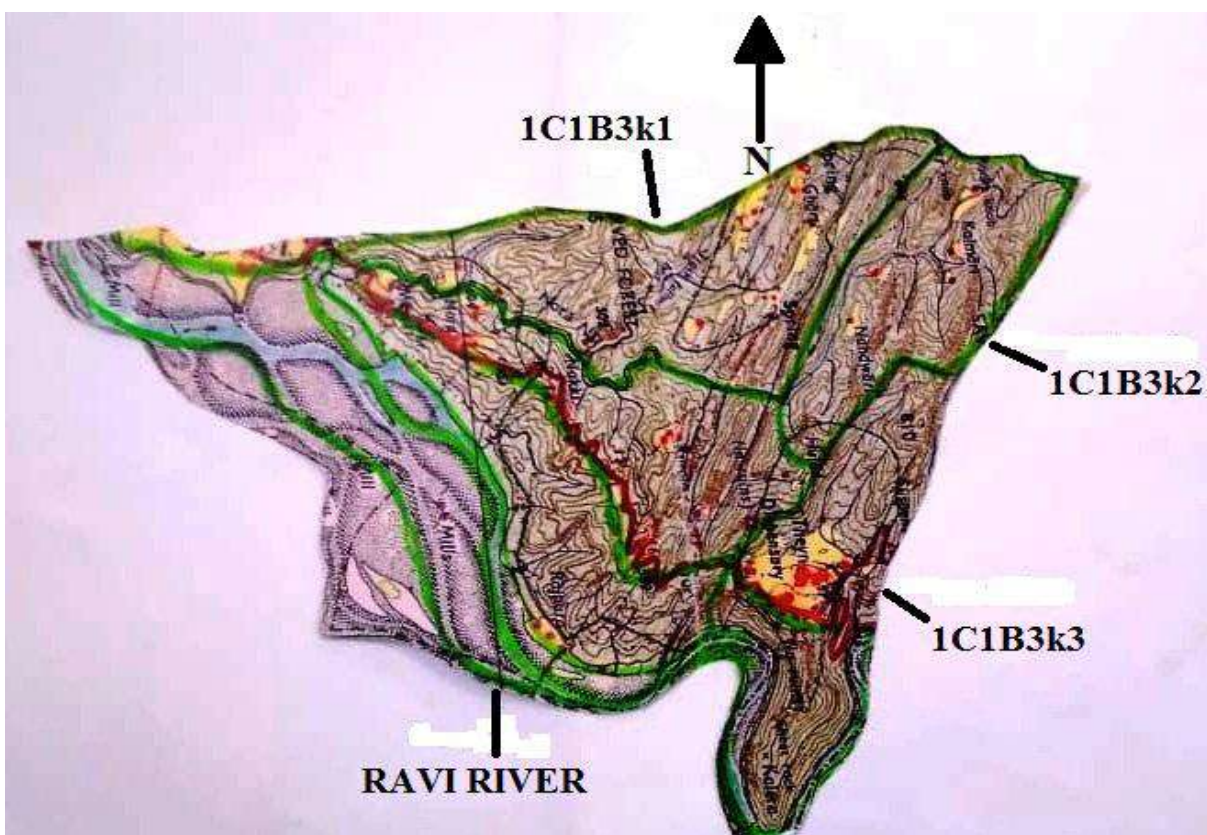
From the geo-referenced map, the area under different land uses was calculated plannimetrically (table).

Table: Area under different land uses of identified mapping units(ha)

| S. No | Mapping unit Codes | Area under different land uses (ha) | | | | | Total |
		Moderately Dense Forest	Degraded Scrub Forest	Agri. land	Road/ Settlement	River on J&k Side	
1	1C1B3k1- U	100	47	24	9	-	**190**
2	1C1B3k1-L	75	88	-	2	-	**165**
3	1C1B3k2-U	107	149	9	5	-	**270**
4	1C1B3k2-M	171	283	1	1		**456**
5	1C1B3k2-L	30	93	5	4	-	**132**
6	1C1B3k3-U	5	86	22	9	-	**122**
7	1C1B3k3-La	97	241	4	16	-	**358**
8	1C1B3k3-Lb		60	-	-	67	**67**
	Total	602	1047	65	46	67	**1760**
	% of Total	**34.2**	**59.5**	**3.7**	**2.6**	**3.9**	**100.0**

Seven parameters were identified to work out the silt yield index and weighted values namely, overland slope, land use, soil type, drainage density, erosion intensity, presence of landslides and intensity of soil conservation measures already adopted. The weighted values

ranged from 10 to 20 are worked for each parameter and SYI is found following a standard equation.

Weighted values ranged from 10 to 20 of seven parameters having potential for silt load generation

% Slope	Weighted Value	Land Use	Weighted Value	Soil Type	Weighted Value
<2	10.5	Moderately Dense Forest	14	Sandy	10
2-7	11	Degraded Scrub Forest	18	Sandy Loam	12
7-15	12	Agriculture	11	Loam	14
15-30	14	Settlement/Road	12	Silty Clay	16
30-45	16	River/ water bodies		Silty Clay Loam	18
45-60	18				
>60	20				

Drainage Density (Km/Km^2)	Weighted Value	Erosion Intensity (Ton/ha)	Weighted Value	Land Slides (No./Km^2)	Weighted Value	Intensity of Works	Weighted Value
0-1	11	<1	11	0-2	11	Very Good	11
1-3	12	1-5	12	2-4	12	Good	12
3-5	14	5-10	14	4-6	14	Moderate	14
5-7	16	10-20	16	6-8	16	Slight	16
7-10	18	20-40	18	>8	18		
		40-80	19				
		>80	20				

10 means soil detached= soil arrested in transit and not reached the reservoir. Higher the value means higher the transport of detached silt to the water body.

DELIVERY RATIO – Distance from the watershed to the nearest drainage point (km)

0-0.9	1.00
1-2	0.95
2-5	0.90
5-15	0.80
15-30	0.70

The report was prepared by traversing all the mini-watersheds and after group discussion with the farmers, field staff of forest dept. and Shahpur Kandi Project Staff.

Result and discussion

Based upon the methodology suggested, the calculations of weighted values for each parameter for eight units are given below in the following tables.

Calculation of Silt Yield Index of Mapping Units 1C1B3k1-Upper: Geographical area = 190 ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Weighted Value	Calculation	Value	Index Unit
1	Slope	MD Forest	45-50%	110	18	110 x 18	1980	
		DS	15-30%	47	14	47 x 14	658	
		Agri.	3-5%	24	11	24 x 11	264	2992.5/190
		Settl/Roads	<2%	9	10.5	9 x 10.5	90.5	
		River		-	-	-	-	
		TOTAL		**190**			**2992.5**	15.75
2	Land Use	MD Forest	MD Forest	110	14	110 x 14	1540	
		DS	DS	47	18	47 x 18	846	
		Agri.	Agri.	24	11	24 x 11	264	2758 / 190
		Settl/Roads	Settl/Roads	9	12	9 x 12	108	
		River	River	-	-	--	-	
		TOTAL		**190**	-	-	**2758**	14.52
3	Soil Type	MD Forest	Sandy loam	110	12	110x12	1320	
		DS	Sandy loam	47	12	47x12	564	
		Agri.	Loam	24	14	24x14	336	2328 / 190
		Settl/Roads	Sandy loam	9	12	9x12	108	
		River	-	-	-	-	-	
		TOTAL		**190**			**2328**	12.25
4	Drainage Density	MD Forest	1-3km/km^2	110	12	110x12	1320	
		DS	3-5km/km^2	47	14	47x14	658	
		Agri.	0-1km/km^2	24	11	24x11	264	2341 / 190
		Settl/Roads	0-1km/km^2	9	11	9x11	99	
		River		-				
		TOTAL		**190**			**2341**	12.32
5	Erosion Intensity	MD Forest	1-5 t/ha	110	11	110x11	1210	
		DS	5-10 t/ha	47	14	47x14	658	
		Agri.	1-5 t/ha	24	11	24x11	264	2231 / 190
		Settl/Roads	1-5 t/ha	9	11	9x11	99	
		River		-	-			
		TOTAL		**190**			**2231**	11.74
6	Land slide	MD Forest	0-2/km^2	110	11	110x11	1210	
		DS	2-4/km^2	47	12	47x12	564	
		Agri.	0-2/km^2	24	11	24x11	264	2137 / 190
		Settl/Roads	0-2/km^2	9	11	9x11	99	
		River	-	-	-	-	-	
		TOTAL		**190**			**2137**	11.24
7	Intensity of Soil Cons. closure	MD Forest	V.Good	110	11	110x11	1210	
		DS	Good	47	12	47x12	564	
		Agri.	Good	24	12	24x12	288	2171 / 190
		Settl/Roads	Good	9	12	9x12	109	
		River		-	-	--		
		TOTAL		**190**			**2171**	11.43

Calculation of Silt Yield Index of Mapping Units 1C1B3k1-Lower

Geographical area = 165ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	15-30%	75	14	75x14	1050	
		DS	30-45%	88	16	88x16	1408	2479 / 165
		Agri.	<2%	-	10.50	-		
		Settl/Roads	<2%	2	10.50	2x10.5	21	
		River		-	-		-	
		TOTAL		**165**			**3479**	15.02
2	Land Use	MD Forest	MD Forest	75	14	75x14	1050	
		DS	DS	88	16	88x16	1408	2480 / 165
		Agri.	Agri.	-	11	--	-	
		Settl/Roads	Settl/Roads	2	11	2x11	22	
		River	River	-	-	-		
		TOTAL		**165**			**2480**	15.03
3	Soil Type	MD Forest	Loam	75	14	75	1050	
		DS	Loam	88	14	88	1232	2306 / 165
		Agri.	Sandy Loam	-	12	-	-	
		Settl/Roads	Sandy Loam	2	12	2	24	
		River		-		-		
		TOTAL		**165**			**2306**	13.98
4	Drainage Density	MD Forest	3-5 km/km^2	75	14	75x14	1050	
		DS	5-7 km/km^2	88	16	88x16	1408	2480 / 165
		Agri.	0-1 km/km^2	-	11	-	-	
		Settl/Roads	0-1 km/km^2	2	11	2x11	22	
		River		-	12	-	-	
		TOTAL		**165**			**2480**	15.03
5	Erosion Intensity	MD Forest	1-5 t/ha	75	11	75x11	825	
		DS	20-40 t/ha	88	18	88x18	1584	2431 / 165
		Agri.	<1 t/ha	-	11	-	-	
		Settl/Roads	<1 t/ha	2	11	2x11	22	
		River		-				
		TOTAL		**165**			**2431**	14.73
6	Land slide	MD Forest	4-6	75	14	75x14	1050	
		DS	6-8	88	16	88x16	1408	2480 / 165
		Agri.	-	-	-	-		
		Settl/Roads	0-2	2	11	2x11	22	
		River		-		-		
		TOTAL		**165**			**2480**	15.03
7	Intensity of Soil Cons. Works	MD Forest	Mod	75	14	75x14	1050	
		DS	Slight	88	16	88x16	1408	2486 / 165
		Agri.		-		-		
		Settl/Roads	Mod	2	14	2x14	28	
		River		-		-		
		TOTAL		**165**			**2486**	15.07

Calculation of Silt Yield Index of Mapping Units 1C1B3k2-Upper
Geographical area = 270 ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	15-30%	107	14	107x14	1498	
		DS	15-30%	149	14	149x14	2086	3738 / 270
		Agri.	2-7%	9	11	9x11	99	
		Settl/Roads	2-7%	5	11	5x11	55	
		River		-		-	-	
		TOTAL		**270**			**3738**	13.84
2	Land Use	MD Forest	MD Forest	107	14	107x14	1498	
		DS	DS	149	16	149x16	2384	4041 / 270
		Agri.	Agri.	9	11	9x11	99	
		Settl/Roads	Settl/Roads	5	12	5x12	60	
		River	River	-		-	-	
		TOTAL		**270**			**4041**	14.96
3	Soil Type	MD Forest	Sandy Loam	107	12	107x12	1284	
		DS	Sandy Loam	149	12	149x12	1788	3240 /270
		Agri.	Sandy Loam	9	12	9x12	108	
		Settl/Roads	Sandy Loam	5	12	5x12	60	
		River		-	-	-	-	
		TOTAL		**270**			**3240**	12.0
4	Drainage Density	MD Forest	3-5	107	14	107x14	1498	
		DS	3-5	149	14	149x14	2086	3738 / 270
		Agri.	0-1	9	11	9x11	99	
		Settl/Roads	0-1	5	11	5x11	55	
		River		-		-		
		TOTAL		**270**			**3738**	13.84
5	Erosion Intensity	MD Forest	1-5 t/ha	107	12	107x12	1284	
		DS	1-5 t/ha	149	12	149x12	1788	3235 / 270
		Agri.	1-5 t/ha	9	12	9x12	108	
		Settl/Roads	<1 t/ha	5	11	5x11	55	
		River		-		-	-	
		TOTAL		**270**			**3235**	11.98
6	Land slide	MD Forest	0-2/km^2	107	11	107x11	1177	
		DS	2-4/km^2	149	12	149x12	1788	3119 / 270
		Agri.	0-2/km^2	9	11	9x11	99	
		Settl/Roads	0-2/km^2	5	11	5x11	55	
		River		-		-		
		TOTAL		**270**			**3119**	11.55
7	Intensity of Soil Cons. Works	MD Forest	Good	107	12	107x12	1284	
		DS	Good	149	12	149x12	1788	3226 / 270
		Agri.	V.Good	9	11	9x11	99	
		Settl/Roads	Good	5	12	5x11	55	
		River		-		-		
		TOTAL		**270**			**3226**	11.95

Calculation of Silt Yield Index of Mapping Unit 1C1B3k2-Middle
Geographical area = 456ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	15-30%	171	14	171x14	2394	
		DS	30-45%	283	16	283x16	4528	
		Agri.	2-7%	1	11	1x11	11	6924 / 456
		Settl/Roads	2-7%	1	11	1x11	11	
		River		-	11	-	-	
		TOTAL		**456**			**6924**	15.18
2	Land Use	MD Forest		171	14	171x14	2394	
		DS		283	18	283x18	5094	
		Agri.		1	11	1x	11	7511 / 456
		Settl/Roads		1	12	1x	12	
		River		-		-		
		TOTAL		**456**				16.47
3	Soil Type	MD Forest	Loam	171	14	171x14	2394	
		DS	Loam	283	14	283x14	3962	
		Agri.	Sandy Loam	1	12	1x12	12	6380 / 456
		Settl/Roads	Sandy Loam	1	12	1x12	12	
		River	-	-				
		TOTAL		**456**			**6380**	13.99
4	Drainage Density	MD Forest	3-5 Km/km^2	171	14	171x14	2394	
		DS	5-7 Km/km^2	283	16	283x16	4528	
		Agri.	0-1 Km/km^2	1	11	1x11	11	6944 / 456
		Settl/Roads	0-1 Km/km^2	1	11	1x11	11	
		River	=	-		-		
		TOTAL		**456**			**6944**	15.22
5	Erosion Intensity	MD Forest	5-10 t/ha	171	14	171x14	2394	
		DS	10-20 t/ha	283	16	283x16	4528	
		Agri.	1-5 t/ha	1	12	1x12	12	6946 / 456
		Settl/Roads	1-5 t/ha	1	12	1x12	12	
		River		-		-	-	
		TOTAL		**456**			**6946**	15.32
6	Land slide	MD Forest	4-6/km^2	171	14	171x14	2394	
		DS	6-8/km^2	283	16	283x16	4528	
		Agri.	0-2/km^2	1	11	1x11	11	6944 / 456
		Settl/Roads	0-2/km^2	1	11	1x11	11	
				-		-		
		TOTAL		**456**		**456**	**6944**	15.22
7	Intensity of Soil Cons. Works	MD Forest	Moderate	171	14	171x14	2394	
		DS	Moderate	283	14	283x14	3962	6380 / 456
		Agri.	Good	1	12	1x12	12	
		Settl/Roads	Good	1	12	1x12	12	
				-		-		
		TOTAL		**456**			**6380**	13.99

Calculation of Silt Yield Index of Mapping Unit 1C1B3 k2 Lower
Geographical area = 132ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	15-30	30	14	30x14	420	
		DS	30-45	93	16	93x16	1488	2005 / 132
		Agri.	2-7	5	11	5x11	55	
		Settl/Roads	<2	4	10.5	4x10.50	42	
		River		-		-	-	
		TOTAL		**132**			**2005**	15.20
2	Land Use	MD Forest	MD Forest	30	14	30x14	420	
		DS	DS	93	18	93x18	1674	2197 / 132
		Agri.	Agri.	5	11	5x11	55	
		Settl/Roads	Settl/Roads	4	12	4x12	48	
		River	River	-		-	-	
		TOTAL		**132**			**2197**	16.64
3	Soil Type	MD Forest	Sandy Loam	30	12	30x12	420	
		DS	Loam	93	14	93x14	1302	1820 / 132
		Agri.	Loam	5	14	5x14	50	
		Settl/Roads	Sandy Loam	4	12	4x12	48	
		River		-		-	-	
		TOTAL		**132**			**1820**	13.79
4	Drainage Density	MD Forest	3-5 km/km^2	30	14	30x14	420	
		DS	5-7 km/km^2	93	16	93x16	1488	2011 / 132
		Agri.	0-1 km/km^2	5	11	5x11	55	
		Settl/Roads	1-3 km//km^2	4	12	4x12	48	
		River		-		-	-	
		TOTAL		**132**		132	**2011**	15.23
5	Erosion Intensity	MD Forest	10-20 t/ha	30	16	30x16	480	
		DS	20-40 t/ha	93	18	93x18	1674	2258 / 132
		Agri.	1-5 t/ha	5	12	5x12	60	
		Settl/Roads	<1 t/ha	4	11	4x11	44	
		River		-		-	-	
		TOTAL		**132**			**2258**	17.11
6	Land slide	MD Forest	4-6 No/km^2	30	14	30x14	420	
		DS	6-8 No/km^2	93	16	93x16	1488	2011 / 132
		Agri.	0-2 No/km^2	5	11	5x11	55	
		Settl/Roads	0-2 No/km^2	4	11	4x11	48	
		River		-		-	-	
		TOTAL		**132**			**2011**	15.23
7	Intensity of Soil Cons. Works	MD Forest	Moderate	30	14	30x14	420	
		DS	Slight	93	16	93x16	1488	2016 / 132
		Agri.	Good	5	12	5x12	60	
		Settl/Roads	Good	4	12	4x12	48	
		River		-		-	-	
		TOTAL		**132**			**2016**	15.27

Calculation of Silt Yield Index of mapping Unit 1C1B3k3 -Upper
Geographical area =122 ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	15-30%	5	14	5x14	70	
		DS	30-45%	86	16	86x16	1376	1787 / 122
		Agri.	2-7	22	11	22x11	242	
		Settl/Roads	2-7	9	11	9x11	99	
		River		-	-	-	-	
		TOTAL		**122**			**1787**	14.65
2	Land Use	MD Forest	MD Forest	5	14	5x14	70	
		DS	DS	86	16	86x16	1376	1796 / 122
		Agri.	Agri.	22	11	22x11	242	
		Settl/Roads	Settl/Roads	9	12	9x12	108	
		River	River	-	-	-		
		TOTAL		**122**			**1796**	14.72
3	Soil Type	MD Forest	Sandy loam	5	12	5x12	60	
		DS	Sandy loam	86	12	86x12	1032	1508 / 122
		Agri.	Loam	22	14	22x14	308	
		Settl/Roads	Sandy loam	9	12	9x12	108	
		River	-	-		-		
		TOTAL		**122**			**1508**	12.36
4	Drainage Density	MD Forest	1-3 km/km^2	5	12	5x12	60	
		DS	3-5 km/km^2	86	14	86x14	1204	1636 / 122
		Agri.	1-3 km/km^2	22	12	22x12	264	
		Settl/Roads	1-3 km/km^2	9	12	9x12	108	
		River	-	-		-		
		TOTAL		**122**			**1636**	13.41
5	Erosion Intensity	MD Forest	5-10 t/ha	5	14	5x14	70	
		DS	10-20 t/ha	86	16	86x16	1376	1818 / 122
		Agri.	1-5 t/ha	22	12	22x12	264	
		Settl/Roads	1-5 t/ha	9	12	9x12	108	
		River		-		-	-	
		TOTAL		**122**			**1818**	14.90
6	Land slide	MD Forest	0-2/km^2	5	11	5x11	55	
		DS	2-4/km^2	86	12	86x12	1032	1428 / 122
		Agri.	0-2/ km^2	22	11	22x11	242	
		Settl/Roads	0-2/km^2	9	11	9x11	99	
		River		-		-		
		TOTAL		**122**			**1428**	11.70
7	Intensity of Soil Cons. Works	MD Forest	Good	5	12	5x12	60	
		DS	Good	86	12	86x12	1032	1482 / 122
		Agri.	Good	22	12	22x12	264	
		Settl/Roads	Mod	9	14	9x14	126	
		River		-		-	-	
		TOTAL		**122**			**1482**	12.15

Calculation of Silt Yield Index of Mapping Unit- 1C1B3k3-MIDDLE
Geographical area = 358 ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	MD Forest	7-15%	97	12	97x12	1164	
		DS	15-30%	241	14	241x14	3374	4758 / 358
		Agri.	2-7%	4	11	4x11	44	
		Settl/Roads	2-7%	16	11	16x11	176	
		River	-	-	-	-	-	
		TOTAL		**358**			**4758**	13.29
2	Land Use	MD Forest	MD Forest	97	14	97x14	1358	
		DS	DS	241	16	241x16	3856	5434 / 358
		Agri.	Agri.	4	11	4x11	44	
		Settl/Roads	Settl/Roads	16	11	16x11	176	
		River	River	-	-	-		
		TOTAL		**358**			**5434**	15.17
3	Soil Type	MD Forest	Sandy loam	97	12	97x12	1164	
		DS	Sandy loam	241	12	241x12	2892	4304 / 358
		Agri.	Loam	4	14	4x14	56	
		Settl/Roads	Sany loam	16	12	16x12	192	
		River		-		-		
		TOTAL		**358**			**4304**	12.02
4	Drainage Density	MD Forest	3-5 km/km^2	97	14	97x14	1358	
		DS	5-7 km/km^2	241	16	241x16	3856	5454 / 358
		Agri.	1-3 km/km^2	4	12	4x12	48	
		Settl/Roads	1 -3km/km^2	16	12	16x12	192	
		River	-	-	-	-		
		TOTAL		**358**		358	**5454**	15.23
5	Erosion Intensity	MD Forest	10-20 t/ha	97	16	97x16	1552	
		DS	20-40 t/ha	241	18	241x18	4338	6130 / 358
		Agri.	1-5 t/ha	4	12	4x12	48	
		Settl/Roads	1-5 t/ha	16	12	16x12	192	
		River	-	-	-	-		
		TOTAL		**358**			**6130**	17.12
6	Land slide	MD Forest	0-2/km^2	97	11	97x11	1067	
		DS	2-4/km^2	241	12	241x12	2892	4195 / 358
		Agri.	0-2/km^2	4	11	4x11	44	
		Settl/Roads	2-4	16	12	16x12	192	
		River	-	-	-	-	-	
		TOTAL		**358**			**4195**	11.71
7	Intensity of Soil Cons. Works	MD Forest	Moderate	97	14	97x14	1358	
		DS	Moderate	241	14	241x14	3374	5004 / 358
		Agri.	Good	4	12	4x12	48	
		Settl/Roads	Moderate	16	14	16x14	224	
		River		-		-	-	
		TOTAL		**358**			**5004**	13.98

Calculation of Silt Yield Index of Mapping Unit- 1C1B3k3-Lower
Geographical area = 67 ha

S. No	Parameters	Description of Mini-WS		Area (ha)	Index Value	Calculation	Value	Index Unit
1	Slope	River bed	< 2%	67	10.5	67x10.5	703.3	
								703.5/67
		TOTAL		**67**			**703.5**	10.5
2	Land Use	River bed	River bed	67	10	67x10	670	
								670/67
		TOTAL		**67**			**670**	10.0
3	Soil Type	River bed	Sandy	67	10	67x10	670	
								670 / 67
				67				
		TOTAL		**67**			**670**	10.0
4	Drainage Density	River bed	1-3	67	12	67x12	804	
								804 / 67
				67				
		TOTAL		**277**			**804**	12.0
5	Erosion Intensity	River bed	1-5 t/ha	67	12	67x12	804	
								804 / 67
		TOTAL		**67**			**804**	12.0
6	Land slide	River bed	0-2	67	11	67x11	737	
								737 / 67
		TOTAL		**67**			**737**	11.0
7	Intensity of Soil Cons. Works	River bed	Slight	67	16	67x16	1072	
								1072 / 67
		TOTAL		**67**			**1072**	16.0

Summary Tables

S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
Code = 1C1B3k1-Upper			**Code = 1C1B3k1-Lower**		
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	15.75	1	Slope	15.02
2	Land Use	14.52	2	Land Use	15.03
3	Soil Type	12.25	3	Soil Type	13.98
4	Drainage Density	12.32	4	Drainage Density	15.03
5	Erosion Intensity	11.74	5	Erosion Intensity	14.73
6	Land slide	11.24	6	Land slide	15.03
7	Intensity of Soil Cons. Works	11.43	7	Intensity of Soil Cons. Works	15.05
	Total	**89.25**		**Total**	**103.87**
	89.25 / 7	**12.75**		**107.87 / 7**	**14.83**
SYI	**12.75 x 0.95 x 100**	**1211**	**SYI**	**14.83x 1.0 x 100**	**1483**

S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
Code No. 1C1B3k2-Upper			**Code No. 1C1B3k2-Middle**		
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	13.84	1	Slope	15.18
2	Land Use	14.96	2	Land Use	16.47
3	Soil Type	12.00	3	Soil Type	13.99
4	Drainage Density	13.84	4	Drainage Density	15.22
5	Erosion Intensity	11.98	5	Erosion Intensity	15.32
6	Land slide	11.55	6	Land slide	15.22
7	Intensity of Soil Cons. Works	11.95	7	Intensity of Soil Cons. Works	13.99
	Total	90.12		Total	105.39
	90.12 / 7	12.87		105.39 / 7	15.06
SYI	**12.87 x 0.9 x 100**	**1158**	**SYI**	**15.06 x 0.95 x 100**	**1431**

S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
Code No. 1C1B3k2-Lower			**Code No. 1C1B3k3-Upper**		
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	15.20	1	Slope	14.65
2	Land Use	16.64	2	Land Use	14.72
3	Soil Type	13.79	3	Soil Type	12.36
4	Drainage Density	15.23	4	Drainage Density	13.41
5	Erosion Intensity	17.11	5	Erosion Intensity	14.90
6	Land slide	15.23	6	Land slide	11.70
7	Intensity of Soil Cons. Works	15.27	7	Intensity of Soil Cons. Works	12.15
	Total	108.47		Total	93.89
	108.47 / 7	15.50		93.89 / 7	13.41
SYI	**15.50 x 1.0 x 100**	**1550**	**SYI**	**13.41 x 1.0 x 100**	**1341**

	Code; 1C1B3k3-Middle			Code: 1C1B3k3-Lower	
S. No	Parameters	Index Unit	S. No	Parameters	Index Unit
1	Slope	13.29	1	Slope	10.5
2	Land Use	15.17	2	Land Use	10.0
3	Soil Type	12.02	3	Soil Type	10.0
4	Drainage Density	15.23	4	Drainage Density	12.0
5	Erosion Intensity	17.12	5	Erosion Intensity	12.0
6	Land slide	11.71	6	Land slide	11.0
7	Intensity of Soil Cons. Works	13.98	7	Intensity of Soil Cons. Works	16.0
	Total	98.52		Total	81.5
	98.52 / 7	14.07		81.5 / 7	11.64
SYI	14.07 x 1.0 x 100	1407	SYI	11.64 x 1.0 x 100	1164

Priority rating based on silt yield index

Priority Rating	Silt Yield Index
Very High	More than 1500
High	1400-1499
Medium	1300-1399
Low	1200-1299
Very Low	1100-1199

PRIORITY RATING BASED ON SILT YIELD INDEX

| S.NO	MAPPING UNIT	SILT YIELD INDEX	PRIORITY RATING
1	1C1B3k1-Upper	1211	LOW
2	1C1B3k1-Lower	1483	HIGH-1
3	1C1B3k2-Upper	1158	VERY LOW
4	1C1B3k2-Middle	1431	HIGH- 2
5	1C1B3k2-Lower	1550	VERY HIGH-1
6	1C1B3k3-Upper	1341	MODERATE
7	1C1B3k3-Middle	1407	HIGH-3
8	1C1B3k3-Lower	1164	VERY LOW

CONCLUSION

1C1B3k2-Lower carries the highest priority for treatment followed by1C1B3k1-Lower, 1C1B3k2-Middle and1C1B3k3-Middle. The mapping unit 1C1B3k3-Upper carries moderate and1C1B3k1-Upper carries low priority. The mapping unit1C1B3k3-Lower and1C1B3k2-Upper carries very low priority. This priority rating of mapping units is shown in the project area map given below.

PRIORITIZATION OF MAPPING UNITS BASED UPON SILT YIELD INDEX

GEOGRAPHICAL AREA = 1760 Ha
SCALE = 1:50000

N

RAVI RIVER
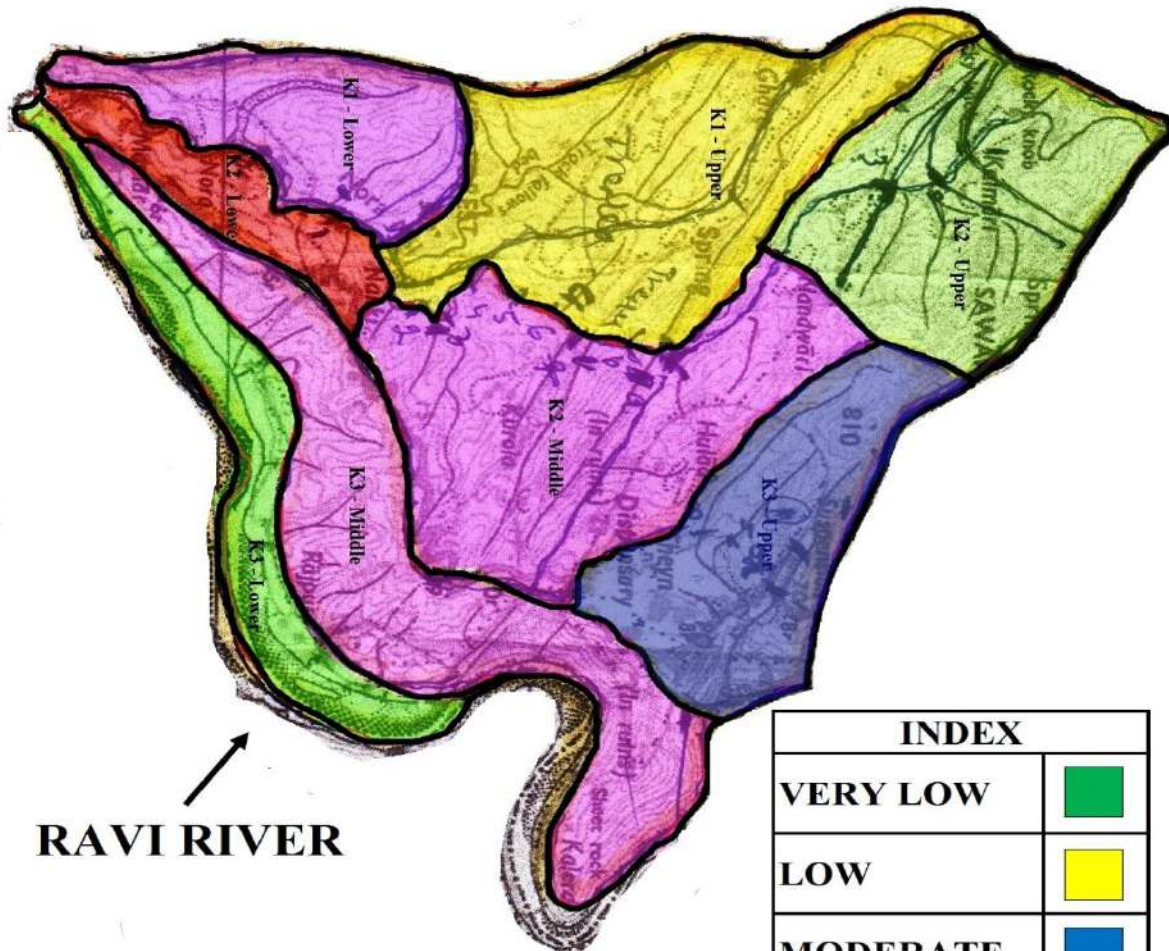
INDEX	
VERY LOW	
LOW	
MODERATE	
HIGH	
VERY HIGH	

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Society for Promotion and Conservation of Environment (SPACE)

SPACE is basically a consortium of experts (registered as NGO) having long and varied experience in the relevant field of participatory natural resources development and management. Most of the members have worked in the watershed development projects funded by the state, the central government and International funding agencies. Under the aegis of SPACE, this professional group attempts to draw attention to the causes, effects and consequences of depleting and degrading natural resources. This society helps, assist and promote suitable mitigation measures, essential for resource conservation and poverty alleviation.

SPACE has a highly qualified and experienced team of professionals having long and varied experience in natural resources conservation and management. It has earned more than forty consultancy services from the state and central government and corporate houses. The team was deeply involved in world Bank funded Integrated Watershed Development Project and Govt. of India, Ministry of Rural Development supported Integrated Watershed Management Program. SPACE has conducted more than two dozen evaluation and impact assessment studies of different projects. More than a dozen projects funded by the National Bank of Agriculture and Rural Development Haryana have been successfully completed in Haryana Shivaliks and drought prone southern districts. It is now engaged in a very comprehensive biodiversity conservation related project in Haryana Shivaliks.

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