7 1
I E I 8 5

108/1285

N
O
V
E
M
B
E
R

24-25, 1985

★★
★

LUCKNOW

ALL INDIA SEMINAR
ON
RURAL WATER SUPPLY SYSTEMS- EXECUTION, MAINTENANCE & MANAGEMENT

Souvenir

Organised by :

THE INSTITUTION OF ENGINEERS (INDIA)
U. P. STATE CENTRE

Co-sponsored by :

U. P. JAL NIGAM
COUNCIL OF SCIENCE & TECHNOLOGY, U. P.

71-IEI85-1286

★★
★

NOVEMBER

24-25, 1985

★★
★

LUCKNOW

ALL INDIA SEMINAR
ON
RURAL WATER SUPPLY SYSTEMS- EXECUTION, MAINTENANCE & MANAGEMENT

Souvenir

LIBRARY, INTERNATIONAL REFERENCE CENTRE FOR COMMUNITY WATER SUPPLY
P.O. Box 93190, 2509 AD The Hague
Tel. (070) 814911 ext. 141/142
RN: 6143 LO 1286
LO: 71 HENI 05
IEI

Organised by :

THE INSTITUTION OF ENGINEERS (INDIA)
U. P. STATE CENTRE

Co-sponsored by :

U. P. JAL NIGAM
COUNCIL OF SCIENCE & TECHNOLOGY U. P.

CONTENTS

The Institution of Engineers (India)
U. P. State Centre Lucknow.

(Environmental Engineering Division)

All India Seminar on Rural Water supply Systems-Execution, Maintenance & Management, 24-25 November, 1985.

Venue :—Institution of Engineers (India) Auditorium, River Bank Colony, Lucknow.

PROGRAMME DETAILS

24.11.1985, Sunday :

08.30—10.30 A. M. Registration

10.00—11.15 A. M. Inaugural Session

11.15—11.45 A. M. Tea Break

11.45—01.30 P. M.

SESSION 1—WATER ABSTRACTION

1. Saline acquifer management in alluvial sediments of Uttar Pradesh : Dr. A. L. Kidwai
   a Key to successful ground water Development in Problematic areas : Sri S. Mukherjee
2. Importance of Geophysical logging for proper designing of water wells. : Sri Hira Singh
3. Planning water supply schemes Remote sensingapproach. : Sri Om Prakash Dubey
4. Exploitation of ground water in rocky/ bouldary formation of Punjab State : Sri K. L. Gandhi : Sri D. Saini
5. Drilling & Developing Techniques of tube wells for water supply in rocky formation. : Sri Ajit Singh.
6. Rural water supply project in the tribal areas of chnota Nagpur by Indian copper complex-An unit of Hindustan copper Ltd. : D. K. Sen : G. S. Ghose Hazara

01.30 to 2.00 P. M. Lunch break

02.00 to 3.30 P. M.

SESSION 2—WATER ABSTRACTION (Continued)

1. New Trends in Drilling and Design of tube wells for abstraction of ground water : Sri P. S. Rajvansi : Sri G. D. Singh
2. Drilling & Development of tube wells in rocky formation of Chhotanagpur Plateau of Bihar Case studies : Sri Ramvilas P. Singh : Sri N. C. Misra
3. Drilling & Development of Tube wells for Rural water supplies in Hilly areas of Bihar. : Sri J. K. Verma
4. A Solution to the Rural water Supply Problem in the Snow Covered Hangrang Sub Division Kinnaur Distt. (H. P.) : Sri D. S. Pandey
5. Successful drilling & strainer design of Tube wells in Tarai area of Nainital (U. P.) : Dr. Dhaneshwar Rai
6. Rehabilitation of damaged defunct and Sick tube wells Case Study : Sri G. L. Malik

3.30—3.45 P. M. Tea break

3.45—5.15 P. M.

SESSION 3—WATER PURIFICATION

1. Fluoride hazards in the drinking water supply of Nachar sub Division Kinnaur, Distt. (H. P.) Alarming problem. : Sri D. S. Pandey : Sri Kamal Mahmood
2. Pebbel bed floculator a low cost treatment technology for rural areas—a review. : Sri V. P. Deshpandey : Sri S. D. Badrinath : Sri S. K. Gadkari : Sri S. N. Kaul
3. Nitrates in ground water—a recent problem for rural water supplies : Sri M. Z Hasan : Sri S. P. Pande : Sri K. L. Saxena

4. Sujala Sutram in the Combat of Fluorosis. : Sri D. L. N. Sinha
5. New concept in water filteration—valve less auto wash gravity filters. : Sri Santosh Gupta
: Sri Milind Chaudhari
: Sri Rohil Dutt
6. An economic design of Treatment Plant with circular slow sand filters : Sri N. P. Govindankutty

25.11.1985 Monday :

10.00—11.30 A. M.

SESSION 4—WATER QUALITY

1, Cross Connection and control Programme in Water Supply Schemes. : Sri S. D. Badrinath
: Sri V. P. Deshpande
: Sri S. N. Kaul
: Sri S. K. Gadkari
: Sri B. Chakradhar
2. Disinfection of Rural Water Supply. : Sri Jagdish M. Barot
3. Fixed bed chlorinator for Rural water treatment. : Sri R. Mehrotra
4. Constant Discharge chlorinator for gravity feed system. : Sri Gyan Sagar
: Sri V. K. Verma
5. Disinfection of water for Rural water supply system. : Sri S. C. Kudesia
6. Polluted ground water supp.y in Rural urban Areas. : Dr. Dhaneshwar Rai

11.30—11.30 A. M. Tea break

11.45—01.30 P. M.

SESSION 5—MAINTENANCE & MANAGEMENT

1. Rural Water Supply Strategy in 80's : Sri A. C. Chaturvedi
2. Evaluation of Selected Rural Water Supply Schemes in West Bengal. : Sri R. S. Dhaneshwar
: Sri A. K. Basu
: Sri A. K. Biswas
: Sri A. K. Ga guly
: Sri P. B. Sanyal
3. Performance & Maintenance of India Mark II Hand Pumps, : Sri C. Kaivalliam
4. Maintenance & Management of Rural Water Supply Schemes with Special reference to West Bengal. : Sri D. Guin
5. Performance of India mark II hand pumps in Rural areas : Sri Mansoor M. Ali
6. Maintenance & Management of Rural Water Supply Schemes : Sri Lallan Prasad
7. Maintenance & Management of Rural Water Supply Schemes : Sri Rajeshwar Nath Arora

01.30—02.00 P. M. Lunch break

02.00 0.3.30 P. M.

SESSION 6—MAINTENANCE & MANAGEMENT CONTINUED

1. Evaluation of Rural Water Supply Schemes in U. P. : Sri P. S. Kolkar
: Sri V. A. Maisalkar
: Sri R. Paramasivam
2. Rural Water Supply Policy : Sri S. H. Jaffer
3. Maintenance of rural drinking water supply scheme in the hill zone of Uttar Pradesh India, : Sri P. K. Chopra
4. Rural water supply schemes in Gujrat—Maintenancc & Management. : Sri P. Nema
: Sri S. K. Srivastava
: Sri N. C. Kankal
: Sri C. G. Mehta
: Sri B. H. Gokhe
5. Management of human Elements in hand Tubewells maintenance : Sri P. K. Chakraborty
6. Maintenance & Management of Rural Water Supply Schemes in Bihar : Sri Nagesh Chandra Misra

03.30—04.00 P. M. Tea break

04.00—05.00 P. M. CONCLUDING SESSION
Discussions and drafting of recommedations.

With Best Compliments From :

Gram : VARSHCO

Phone : 8-42228

VARSHNEY

ENGINEERING INDUSTRIES

Office & Works :

D-1, Industrial Area, Meerut Road,

GHAZIABAD-201 003 (U. P.)

VARSHCO TRADERS

H-5, PATEL NAGAR-III

GHAZIABAD-201001, U. P.

Manufacturers of :

F. R. C. & Ferrocement Manhole Covers, Chlorinators, Chloroscope,

F. R. P. Lined P. V. C. Strainers, F. R. P. & Ferrocement Storage Tanks,

F. R. P. Corrugated Sheets, Pipe Fittings, Valves, T. & P, ETC.

Message
For
A True Beginning

Who says my country is poor ? No, it's not so. There are imbalances that we have to heal As and when I approach people to donate generously for the causes of poors of the poorest, I am always responded in a rightful manner. It's the missionary zeal-the purpose of one's mission, the motive-that counts

I have come here in connection with Leprosy Eradication Programme. People suffering from the disease are afraid to come up openly-they fear, by doing so they would endear only hate of their own people, most of them would lose their livelihood as well. Such fears in their minds turn even curable diseases into complicated ones. On the other hands, the implementing agencies of such Programme have some unknown kinds of fear and they prefer to turn their faces against the stark realities. Rather, they opt for pleasing the higher authorities with suitable data not based on Truth.

If untruthful attitudes, fear and concealment of facts continue, how the extent and magnitude of the malady can be diagonosed and cured ?

When I am told that the disease has been cured-it hurts me. And wherever it is found that the cases are coming up in large numbers-it's a great satisfaction.

LOVE OTHERS AS GOD LOVES YOU

—MOTHER TERSA

मंत्री
शहरी विकास
भारत सरकार
नई दिल्ली-110011

MINISTER OF
URBAN DEVELOPMENT
GOVT. OF INDIA
NEW DELHI-110011

Message

Dear Shri Chaturvedi,

Thank you for your letter of 28th September, 1985 inviting me to preside over the inaugural function of All India Seminar on Rural Water Supply Systems on 24th November, 1985 organised by the Institution of Engineers (India).

I regret, owing to my other pre-occupations, I will not be able to participate in the function. I wish your function all success.

With regards,

Yours sincerely,

(ABDUL GHAFOOR)

K. C. Kapoor

स्वास्थ्य एवं परिवार कल्याण मंत्री
के निजी सचिव
भारत
नई दिल्ली-110011

Addl. PRIVATE SECRETARY TO
MINISTER OF
HEALTH AND FAMILY WELFARE
INDIA
NEW DELHI-110011

October 11, 1985.

Message

Dear Shri Chaturvedi,

Kindly refer to your letter dated the 28th September, 1985 addressed to my Minister inviting her to inaugurate the seminar of the U. P. State Centre of the Institution of Engineers (India) to be held on 24th November at 10 AM at Lucknow. Due to my Minister's other pressing engagements it will not be possible for my Minister to attend the seminar.

With regards,

Yours sincerely,
(K. C. KAPOOR)

Dr. SANJAY SINH
Minister For Transport, U. P.

PHONES : OFF. 44918
32811—8369
RES. 47721/33550

VIDHAN BHAWAN
LUCKNOW

Dated 11th October, 1985

Message

I am pleased to know that a two-day All India Seminar on RURAL WATER SUPPLY SYSTEMS-EXECUTION, MAINTENANCE AND MANAGEMENT-is being organised by the Institution of Engineers, U. P. Centre at Lucknow.

Basic human needs being water, air followed by food should be adequately catered for. None could servive without water. It was therefore imperative that water supply was ensured even in remotest corners. Nature has bestowed all the areas with ground water which if properly explored could meet the drinking water requirements.

In post-independence period ambitious schemes were chalked out and executed in rural areas after tapping all the sources available but due to the system lacking somewhere, complaints are received against irregular and improper water supply resulting in public criticism and resentment. Schemes already executed for the rural areas are reported to be either stopped functioning or lying idle for want of minor repairs.

So, the seminar, in which distinguished engineers from all over the country are participating, should evolve a fool-proof system for surveying, formulating, executing and maintaining regular water supply in the rural areas. I do hope that it will conclude with some constructive and concrete recommendations.

My best wishes for the success of seminar and souvenir.

(DR. SANJAY SINH)

सुनील शास्त्री

एनेक्सी भवन
लखनऊ

दिनांक १८ अक्तूबर, ८५

ऊर्जा मंत्री
उत्तर प्रदेश

संदेश

मुझे यह जानकर प्रसन्नता है कि इंस्टीटयूट आफ इंजीनियर्स (इण्डिया) की उत्तर प्रदेश शाखा द्वारा आगामी २४ एवं २५ नवम्बर को लखनऊ में "ग्रामीण जल आपूर्ति प्रणाली के क्रियान्वयन और रख रखाव एवं प्रबन्ध" के संबंध में अखिल भारतीय स्तर पर एक विचार गोष्ठी का आयोजन किया गया है और इस अवसर पर एक स्मारिका भी प्रकाशित की जा रही है।

भारत का विकास करने के लिए गांवों का विकास करना अत्यन्त आवश्यक है क्योंकि यह कृषि प्रधान एवं गावों का देश है। ग्रामीण अंचलों में शुद्ध पेयजल की व्यवस्था करके ग्राम वासियों के स्वास्थ्य की रक्षा करना और कृषि के लिए जल की पर्याप्त व्यवस्था करना नितान्त आवश्यक है। आशा है कि स्मारिका में ऐसी बहुमूल्य सामग्री का समावेश होगा जिससे पाठकों का ज्ञानवर्द्धन होगा।

मैं विचार गोष्ठी के आयोजकों को हार्दिक बधाई देता हुआ स्मारिका के सफल प्रकाशन की कामना करता हूं।

सुनील शास्त्री

ORGANISING COMMITTEE

1. Sri A. C. Chaturvedi, FIE. Chairman, I E. (I), U. P. Centre
2. Sri D. C Chaturvedi, FIE, Council Member
3. Sri Rajendra Dayal, Chief Engineer, U. P. Jal Nigam, Lucknow
4. Sri D P. Singhal, Chief Engineer, U. P. Jal Nigam, Lucknow
5. Sri D. M. Gupta, FIE, Honorary Secretary' IE (I), U. P: Centre
6. Sri S. M. Hammad, FIE, Convener & Superintending Engineer, U. P. Jal Nigam, Almora

TECHNICAL PAPERS AND SOUVENIR COMMITTEE

1. Sri R. S. Singh, Chief Engineer, U. P. Jal Nigam, Lucknow
2. Sri Y. N. Chaturvedi, Superintending Engineer, U. P. Jal Nigam, Varanasi
3. Sri S M Hammad, Superintending Engineer, U. P. Jal Nigam, Almora
4. Sri S. K. Srivastava, Executive Engineer, Temp. Project Dn., U. P. Jal Nigam, Almora
5. Sri S. K. Nigam, Registrar, IE, (I) U. P. State Centre

ACCOMMODATION AND RESERVATION COMMITTEE

1. Sri S. M. Hammad, Superintending Engineer, U. P. Jal Nigam, Almora
2. Sri V. K. Kathuria, Executive Engineer, U P. Jal Nigam, Ramnagar
3. Sri S P. Chaturvedi, Executive Engineer. U. P Jal Nigam, Almora
4. Sri S. K. Nigam, Registrar, IE (I), U. P. State Centre, Lucknow

INTRODUCTORY NOTE ON SEMINAR

By

Sri Syed Md. Hammad*, ME (PH), CE (I), FIE (I), FIPHE, FIWWA, MAWWA, MIIPA, MIIPE.

From the very begining of the existence of human being on this planet, water has been recognised as a vital element in man's life. For this reason only, from time immemorial human settlement started on the bank of rivers or near perennial sources of water. Due to passage of time and growth in population, these settlements scattered here and there in search of livelihood and to meet demand of other necessities of life. India, primarlly being an agriculture base country had a Rural population of 76 percent spread in 5,66,878 villages according to 1981 Census. Previously water supply services were concentrated in urban areas only and prior to 1960 very little work was done for Rural population.

During various deliberations in the 1970's practically all the countries of the globe evinced serious concern about the water supply and sanitation problem of "forgotten", Rural people. Since then it received increasing emphasis by its inclusion in the United Nations second Development Decade. At the U. N. Conference on human settlement in 1976 it was assigned a high priority followed by a possitive resolution at the Mar Del Plata U. N. Water Conference in 1977 and finally by a proclamation of the International Drinking Water Supply and Sanitation Decade of 1981-90 by the United Nations General assembly in 1980. India being signatury to all these conferences, also adopted this resolution and fixed a goal of 100 percent coverage in Rural Water Supply by the year 1990. This proclamation was not only a sudden recognition of the necessity to meet the needs of the unserviced or underserviced rural population but the decision was to move forward more rapidly for the accomplishment of the goal for which 10 years were earmarked.

The Institution of Engineers (India) has always rendered its services not only for the advancement of Science, Technology and Engineering but also for the development and promotion of Engineering information services, Formulation and implementation of Norms, Standards for technical activities, continuous vigilance on Science, Technology Policies of the Nation, Coordination of Technical Education with Research and Industrial Development and coordination of Interdisciplinary work. Thus with these aims in view, at mid point in International Drinking Water Supply and Sanitation Decade, U. P. State Centre of the Institution of Engineers (India) resolved in the beginning of this year to hold an All India Seminar on Rural Water Supply Systems on 24-25, Nov, 1985. This National Seminar has been therefore aimed to present a state of the art review of rural water supplies in different regions of the country and also to review the progress and constraints on this unprecedented National public service programme. During two days deliberations various aspects of project planning, formulation, execution, operation, running and management of Rural Water Supplies along with low cost water treatment technologies, water quality, new R & D works, and case studies will be discussed.

*Convenor and Superintending Engineer, U.P. Jal Nigam, Almora-263 601.

The first five year of the International Decade will be over shortly. Therefore, it has become imperative to review the gap between targets and achievements vis-a-vis resources and performances. The various questions that have cropped up at this juncture could be listed as :—

(i) Has the enthusiasm which was generated in early 80's declined ?

(ii) Are we getting competitive high priority of this programme which it requires and deserves ?

(iii) What are the obstacles and constraints in the launching of this programme ?

(iv) Can we make better progress ?

(v) Can we learn from past ?

(vi) Can we learn from each other ?

(vii) What corrective actions need to be taken ?

I hope during deliberations at this Seminar we shall be able to cast light on these questions. In the concluding session, tomorrow recommendations shall be drafted for the new strategies to be adopted for the fulfilment of decade goal.

This proposal of holding this Seminar was welcomed by all State Govts. and their Public Health Engineering organisations, other concerned organisations, Research Intitutions and Industries. I am grateful for this active support by not only deputing delegates for participation but also by way of contributing useful technical papers, case studies and status information on Rural Water Supplies. I am grateful that U.P. Jal Nigam and Council of Science and Technology U. P. have cosponsored this seminar. I am also grateful to the advertisers who have contributed advertisement for the Souvenir which has been issued to mark this Seminar.

The two days deliberations have been divided into six sessions of which five shall be devoted in presentation and discussions of technical papers on water abstraction, water purification and conveyance, water quality and maintenance, management of Rural Water Supplies. The last and concluding session shall be exclusively devoted for drafting of various recommendations. I welcome and extend sincere thanks on my own behalf and on behalf of the Institution of Engineers (India) U. P. State centre to all the delegates who have come from various parts of this country and also from this state to participate in this National Seminar. I am thankful to Sri S. K. Sharma, Managing Director, U P. Jal Nigam who has taken keen interest in this Seminar and has consented to deliver a key-note address for this Seminar. I am also thankful to the Chief Guest who inspite of his busy schedule has been kind enough to be amongst us, here and presided this inaugural session.

Once again I thank you all for your kind cooperation in making this Seminar useful and successful.

Dated : 24th November, 1985.

S. M. HAMMAD

SALINE AQUIFER MANAGEMENT IN ALLUVIAL SEDIMENTS OF UTTAR PRADESH—A KEY TO SUCCESSFUL GROUNDWATER DEVELOPMENT IN PROBLEMATIC AREAS

By

Sri A. L. Kidwai* and Sri S. Mukherjee**

Enriched mineralized waters at various depth spans in certain tracts of Uttar Pradesh, within the domain of Gangetic alluvium, have become an established fact. Responsible chemical processes and active sources in the thick realm of the unconsolidated Quaternary sediments hitherto remain a problem of investigation. Because of density variation, the fresh and saline waters have been identified to exist separtely in respective aquifer systems and their interfaces precisely established.

Recent exploratory efforts by Central Ground Water Board in Unnao, Rae Bareli, Sultanpur and Pratapgarh districts, down to the maximum depth of abont 600 metres in the Gangetic plain, revealed a complex situation in freshsaline ground waters interrelationship Geo-electrical logging down to 450 m depth revealed the nature of geochemical frame-work across the tract. The translated hydrodynamic balance in the prevailing systems depicts that top aquifer (depth span varying between 60 m and 125 m. from land surface) is fresh followed sequentially downward by a saline groundwater system (salinity profile range : 60 m. to 360 m. b. g. l.). Phenomenonal occurrance of a second regionally extensive fresh aquifer system has been identified below this saline body,

The generated informations have brought to fore that these dissimilar (qualitatively) complex aquifer systems are separated by variable thickness of impervious transition zones, Exploratory tnbewell structures of C.G, W. B. (depth span : 295 m. to '433 m. below land surface) tapped mainly the deeper fresh confined aquifiers. These structures, on tapping 43 m. to 87 m. of granular materials, yield 0-022 to 0.071 cumec at 6 m. drawdown.

Groundwater development is at a low key and, so far, interfacial boundaries of fresh-saline aquifers appear to remain in a state of equilibrium. The level of salinity in the discharged tubewell water (from bottom fresh zone) remains within the permissible limit of prescription for irrigation.

In order to avert an imbalance in the saline water system, regulated withdrawals from the shallow and deeper fresh aquifers are warranted. Such management may lead to a significant headway of degrading influence of the sandwitched denser saline groundwater and eventually upcoming of the same to pumping wells (which tap top shallowaquifer) and avoid danger of its entrainment to the underlaying confined fresher counterpart.

Synchronised monitoring on the quality of tapped groundwater in relation to time and its progressive development would be the cardinal index of assertion. Proper management, effectively by sealing off the saline zones, appear to be the realistic approach for optimal exploitation and assured supply of groudwater of required quality.

---

*Director, Central Ground Water Board, Lucknow.

**Senior Hydrogeologist in the same organisation.

IMPORTANCE OF GEOPHYSICAL LOGGING FOR PROPER DESIGNING OF WATER-WELLS

By

Hira Singh*

SYNOPSIS

Full available potential of groundwater is not exploited in most of the water wells drilled for Rural water supplies and other purposes due to their faulty design and construction due to lack of subsurface data. This can be overcome if geophysical logging of borewells is conducted before the assembly is lowered. Geophysical logging is the systematic study of physical parameters in relation to depth in boreholes drilled during exploration, exploitation and development of subsurface natural resources. Although well logging is in extensive use in our country in case of oil and gas exploration but this important tool is yet to find its full application in ground water developent.

It is not fully realised that rotary drilling methods, which are normally employed for ground water, prevent an accurate understanding of the penetrated strata. The sampling carried out by percussion coring device or by taking side wall sampling method, apart from being expensive, seldom gives an accurate lithological sequence and the nature of formation water.

Geophysical logging techniques, which include electrical, radiotion, thermal, caliper, sonic devices and borehole televiewer, are useful for location and delineation of water bearing zones, delineation of clay, shale and other lithological units, correlation of different formations, evaluation of formation parameteres and for understanding of the occurrence and movement of ground water. Geophysical well logging, undertaken after the borehole has been drilled, helps in accurate assessment of the in-situ lithological and hydroiogical conditions. The correlation between geophysical logs and lithological and drill time logs helps in suitable designing of well assembly.

*Hira Singh is with Remote Sensing Application Centre U. P., B-19, Sector A, Mahanagar, Lucknow-226 006.

NEW TRENDS IN DRILLING AND DESIGN OF TUBE WELLS FOR ABSTRACTION OF GROUND WATER

By

Sri P. S. Rajvanshy* and Sri G. D. Singh**

The paper deals with some recent developments that have taken place in the drilling equipment. The drilling equipment being suggested in the paper is a versatile rig which can carry out the work of Rotary as well as down the hammerhole drilling to suit different

*Chairman, Rajasthan State Board for the Prevention and control of Water Pollution, Jaipur.

**Executive Engineer in the same organisation.

conditions prevailing at the site. It has arrangements to case the well simultaneously as the drilling proceeds and to slot or perforate the blank casing pipe while in position in the well.

It deals with the change over to organic polymer drilling fluid additives which takes place of native clay or bentonite use of Stainless Steel Screens, fibre glass reinforced plastics P. V. C. etc. in place of conventional mild steel slotted pipes and use of various techniques for the development of wells. It also deals with proper design of the tube well with a view to maintain the water level as high as possible during pumping so as to make the well as efficient as possible. This well increase the capacity of the well and reduce the cost of pumping. It will be easier on the well and it will make a greater volume of water available from the well.

In the paper two live examples of the field have been taken up to give a proper design of the tube so as to extract more quantity of water than being drawn from the conventional wells.

EXPLOITATION OF GROUND WATER IN ROCKY/BOULDARY FORMATIONS OF PUNJAB STATE.

By

K. L. Gandhi* D. S. Saini**

ABSTRACT

This papers deals with the problems faced in drilling of tubewells in the hard rocky areas of Punjab State. The hard rocky areas of the State are confined to the Kandi belt and Intermontane valleys covering parts of Gurdaspur, Hoshiarpur and Ropar Districts. Construction of tubewells in these areas is inescapable due to lack of surface water sources. Studies reveal that in general, three types of subsurface geological conditions prevail in the said areas, viz.

1) Existence of bouldary formations through-out.
2) Existence of soft formations upto about 60m depth, underlain by bouldary/rocky formations.
3) Existence of bouldary/rocky formations upto about 40 m depth underlain by soft clayey formations.

Pre-knowledge of the prevailing subsurface lithological conditions indifferent areas help in deplovment of appropriate type ofdrilling Rig. It has been concluded that deployment of percussion, Rotary-cum-Percussion types of drilling rigs should be done under the aforesaid type of sub-surface lithological situations.

*K. L. Gandhi, Superintending Engineer, Pb. State Tubewell Corporation, Hoshiarpur.

**D. S. Saini, Senior Hydrogeologist, Hydro. Wing, Pb. State Tubewell Corporation. Chandigarh.

Further since the bouldary formations are associated with finer sediments, the corresponding slot size should not be larger than 1/.6" (1.6mm) for speedy development of the tubewells. It has been found necessary to over-develop the tubewells with over development pumps, and this has resulte in improving the performance of tubewells.

In bouldary/rocky formations of Punjab State, tubewells of 0.75 Cs. to 1.5 Cs. capacity at a draw-down of 10m to 24 metres have been constructed successfully down to a depth of 130 metres. The performance of the tubewells so far constructed in rocky/bouldary formations is satisfactory. As the water is low mineralised, so the quality of ground water is fit both for drinking and irrigational purposes.

A SOLUTION TO THE RURAL WATER SUPPLY PROBLEM IN THE SNOW COVERED HANGRANG SUBDIVISION OF KINNAUR DISTRICT, HIMANCHAL PRADESH

By

D. S. Panday*

ABSTRACT

Snow cover on the hill tops is one of the potential sources of good quality fresh water. Still, acute drinking water problem is felt in such areas where the thick snow cover persists round the year. During the investigation, Hangrang subdivision of Kinnaur district was found to be one of such areas in Himachal Pradesh, facing this problem.

The altitude of the subdivision ranges between 3078 and 6690 metres above the mean sea level within the study area. During the ephemeral summer period that extends from May to June, the snow line recedes slightly and touches the elevation of 4 72 m amsl. As a result, discharge in the springs and the glacial *khuds* appreciably increases in the lower reaches of the area below 4872 m. amsl. During this short period, the inhabitants of the lower reaches do get the opportunity of having sufficient drinking water supply from these springs and *khuds*. Besides these, the Spiti river flowing in the valley is a perennial source of water in the area. Spring and *khud* water is available in the area with meagre discharge.

During the investigation, a number of terraces have been demarcated on the eastern side of the river which may prove to be a repository of ground water. Suitable ground water withdrawal structures at the terraces can extract sufficient quantity of water and a continuous supply of water can be made available to the entire Hangrang subdivision through a battery of tubewells by way of multiple pumping stage system. The aim of the paper is to prove the viability of large scale development of ground water in the manner suggested above to provide sustained drinking water supply to the rural population of the area round the year.

"Throughout time, water has been recognised as avital element in man's Survival. As a part of water supply industry, the public Health Engineers Contribute to the longevity of civilization. They have to face the challenge of Supplying safe, clean drinking water to the population".—American Water Works Association.

*Hydrogeologist, Kasai-Subarnrekha (U. N.) Project, Central Ground Water Board, Jameshedpur (Bihar)

REHABILITATION OF DAMAGED, DEFUNCT AND SICK TUBEWELLS CASE STUDY

By

Sri G. L. Malik*
M. E. E , F. I. E., M. Cons. E. (I), F. I. P. H. E.

Author has explained the causes of demaged, defunct and sick tubewells. Defects to be avoided during the process of construction. He has stressed the need for quality control on the material and proper designing of the tubewell. He has also explained the use of proper equipment for different underground strata conditions and different types of screens to be used.

He has also suggested the remedies and methods of rehabilitation of such tubewells. Prevention is always betten than cure so his paper has dealt with preventive measures based on 35 years of his research and development experience.

The case study of tubewells have been given in the main paper and most important points are covered therein explaining steps taken for rectification.

The author has dealt with this paper with the sprit of service to the nation by disclosing most of the trade secret and malpractices being adopted by unscruplous drilling agencies. The author is controlling an organisation of All India repute and well-known for code of ethics equipped with most sophisticated equipment of every type.

*Managing Director, Drillexperts Private Limited, 18/4, West Patel Nagar, New Delhi—110 008.

DRILLING AND DEVELOPING TUBEWELLS IN CHHOTANAGPUR PLATEAU OF BIHAR :

(Case studies)

By

Er. R. B. P. Singh*, M. E., MIE & Er. N. C. Mishra*, MIE.

SYNOPSIS

Chhotanagpur Plateau-rich in mines and minerals, flora and fauna-is rather poor in ground water resources. Normally, water acquifer zones are in shape of crevices and fissures of consolidated rock formations. Down-the-hole hammer drilling in this tribal region was introduced during '67 drought for speedy relief operation. Since then, 26,400 nos. of drilled tubewells have been constructed upto March, 1985-80% of which have come up during Sixth Five Year Plan. DTH drilling of 100mm or 125mm dia. boreholes having 38 metres average depth are carried out departmentally without detailed topographical, hydrogeological and geophysical investigations risking failures in large overburdens of collapssible strata.

*Executive Engineer, P. H. Division, Ranchi.

*Sub-Divisional Officer, P. H. Hatia Projects Subdivision No. III, Ranchi.

In such helplessness, combination of Rotary Equipment was the only solution for tapping groundwater to avert crisis at times in Hazaribagh and Ranchi districts.

Top formation of sticky clay, small boulders and fine sand ranging upto 37 meters was drilled with Direct Rotary Mud circulation system before starting DTH drilling if necessary. The strata was provided with suitable casing alongwith slotted pipes and the annular space was duly packed with assorted graveles. Necessary precautions were taken to prevent pollution. These tubewells are yielding sufficient discharge.

A number ot methods and techniques are available for locating suitable acquifers and optimising exploitable groundwater resources. Geophysical surveys using electrical resistivity and seismic methods, radioactive tracers etc. would be immensely helpful for reducing manpower and cost of drilling. Use of foam, acid treatment, blasting etc. would enhance the chances of successful drillings.

It is high time when a suitable result-oriented Methodology for Groundwater Management is effectively evolved by the Department to monitor all drilling operations for minimising the chances of failures, faulty constructions and underutilisation of available resources; otherwise, Rigs would cotinue to run and languish in the dark, eventually, sliding the Decade Plan on a greasy pole.

DRILLING AND DEVELOPMENT OF TUBEWELLS FOR RURAL WATER SUPPLY IN HILLY AREAS OF BIHAR.

By

J. K. Varma

Senior Hydrogeologist, REC Ltd. Patna

ABSTRACT

Prior to the drought of 1967, the Chhotanagpur plateau in Bihar was not at all considered suitable for water well drilling. However during the drought, recourse had to be taken to tubewell drilling and installation of hand pumps. Thus a massive Programme of tubewell drilling in the plateau area was undertaken in 1967 under the Public Health Engineering Department. Later, in order to meet the growing demand for these tubewells and utilize at least some of the available equipment and trained drilling crew, the programme was continued in small measures. Now this has become an important charge of the PHED under the Minimum Needs Programme and Rural Development Programme.

It is surprising that despite the huge size of the programme and long experience, the drilling operations are still based on trial and error. Presently there is no proper collection, documentation, analysis and evaluation of the hydrogeological data of these tubewells. These are neither properly developed nor tasted. There is no norm for categorization of the tubewells excent that tubewells with at least 1.14 m3/hr. discharge are declared successful. Even the discharge measurement is not accurate.

The need of the hour is to adopt standard methods and techniques for site selection based on hydrogeological considerations and for construction, development and testing of

the tubewells. Scientific norms based on sustained yield, draw down and optimum productivity need to be adopted for deciding the success/failure and utility of the tubewells. It is also equally vital to establish and maintain a data collection, recording, analysis, evaluation and retrievel system. There must be continual interaction with the scientific organisations like the Central Ground Water Board and the State Ground Water Investigation Directorate and other user agencies like the Community Development block, DRDA, REC, NABARD etc.

The need for this approach has been emphasized by a case history and steps have been suggested to make the programme more meaningful and useful.

PLANNING WATER SUPPLY SCHEMES-REMOTE SENSING APPROACH

By

Om Prakash Dubey, University of Roorkee, ROORKEE—247667

ABSTRACT

Steady increase in population have continuously increased the demand for food fibre, raw meterials, energy industrial products and various other services. This has led to increase in demand for water in almost all sectors of life. A nation prosperity depends on increased, agricultural, forest and hydropower generation. Thus nation economy depends upon development and conservation of water resources. Larger part of Indian population lives in rural areas. Hence development of country is at all not possible without proper develoment of rural areas. Availability of water is a dynamic phenomena. Hence developmental plans must aim at optional use of water. There are regions where water is not available for drinking what to say of agriculture and other uses. As such every effort has to be made so that atleast drinking water is made available to mankind. Hydrologic parameters are influenced by environmental factor as meterology, pedology, morphology, physiography and botany. Most of these parameters are dynamic as such data has to be collected evenly and continuously, various conventional data collection systems are available but they are costly affair as such every one tries to keep observation sites minimum possible. More over these techniques give information with time lag. Hence planning is generally based on questionable data and leads to ill functioning of schemes. As such some suitable indirect method has to be developed so that optimal planning can be carried out efficiently. Hydrologic phenomena is space time phenomena where as measurement is a point phenomena. Remote Sensing Techniques provide synophic coverage as well as point definition. Remote Sensing provide basic data structure for evaluation of environemental parameters in real time efficiently. As such effort has to be made to promote use of remote sensing techniques for planning of water supply schemes. An approach has been put forth for assesement of water resources in real time so that this vital resource can be efficiently used for meeting the basic need of drinking water.

NEW CONCEPT IN WATER FILTRATION VALVELESS AUTOWASH GRAVITY FILTERS

By

Santosh Gupta*, Milind Chaudhari* And R. D. Dutt*

SYNOPSIS

Water is one of our most important raw material next to air. Water treatment involves many unit processes and operations to make raw water fit for human consumption or industrial use. Water filtration, usually is an important unit operation of any treatment facility. This paper describes the latest equipment available for water filtration without the use of valves, manpower, maintenance, etc, These filters will backwash, of their own, at the precise moment when it is required with predetermined amount of clean backwash water. This backwash water is stored in the unit itself. These units could be installed within a very short period without much civil works and thus, are ideally suited for remote areas.

*M/s OTOKLIN, Plants & Equipment, 8A, Back bay View 4th Floor
3-A Mama Parmanand Marg, Bombay—400004

PEBBLE BED FLOCCULATOR-A LOW COST TREATMENT TECHNOLOGY FOR RURAL AREAS-A REVIEW

By

V. P. Deshpandey* S. D. Badrinath* S. K. Gadkari* S. N. Kaul*

SYNOPSIS

The Internatlonal Water Supply & Sanitation Decade (1981-'990) has been declared by the United Nations with view to provide safe drinking water to the entire Urban & Rural population of the country. The rural population of India being 78% of the total population, highest priority is being given to the problems of rural water supply schemes.

The provision of adequate water supply to meet the requirements of the growing population has been a challenging problem due to paucity of funds for the schemes. The technology which is appropriate in a developed country becomes in appropriate in a developing country due to economic considerations. So, there is a need to develop new appropriate treatment technologies which are economically viable, scientifically sound, technologically feasible and socially acceptable. One of the aims of research in this field has been to indicate methods of bringing about the reduction in the cost of treatment. The use of conventional treatment methods of water purification based on rapid filtration following preliminery sedimentation has not always turned out to be justified either economically or from the health stand point.

*Scientist, National Environmental Engineering Research Institute, Nagpur-20.

New processes at reduced capital costs would be specially valuable in developing countries with limited financial resources. The increasing cost of energy in conventional treatment units, will doubtless have an impact on water utility practice which will probably make better transmission and distribution system requiring low pumping heads. More efficient treatment processes using less energy are to be expected. In many plants, changes in mixing, flocculation and settling have so drastically improved the quality of treated water that substantial plant capacity increases have become feasible without resorting to dual or multi-media filtration.

A pebble bed flocculator is one of the simplest and economical unconventional treatment technology wherein mechanical equipment like rotating paddles are replaced by pebble. It is easy for operation & maintenance by the local population with no need of skilled supervision. The unit can be operated with minimum head of water and hence most suitable for rural areas. In the present paper, an attempt has been to review the existing literature on the feasibility of using pebble bed flocculator for rural water supply schemes.

FLUORIDE HAZARDS IN THE DRINKING WATER SUPPLY OF NACHAR SUBDIVISION, KINNAUR DISTRICT, HIMACHAL PRADESH—AN ALARMING PROBLEM

By

D. S. Pandey & Kamal Mahmood*

ABSTRACT

Hydrogeological investigation carried out in the Nachar subdivision of Kinnaur district has revealed excessive fluoride concentration in ground water (springs). Springs that are sporadically distributed over the area, form the main source of water supply for the rural population of the area. The concentration of fluoride in the spring water varies between 0.00 to 12.25 parts per million (ppm). Since the desirable limits of fluoride in drinking water as per the International Drinking Water Standards range between the critical values of 1·00 and 1.50 ppm, drinking waters with lesser or excessive concessive concentration than the permissible limits pose serious health hazards to the rural community. The fate of the people consuming water with such a terribly high concentration of fluoride as 12.25 ppm may well be imagined.

This pioneering study traced the causes of such an abnormally high concentration of fluoride in spring water to the geological set up of the area. Pegmatite veins traversing the Wangtu granite and gneiss (Algonkian age) are replete with fluoride bearing minerals, namely fluorite and apatite. Water being a good solvent, while moving through the joints, fractures, fissures and cracks of the rock formations, dissolves the minerals and gets enriched with fluoride.

*Hydrogeologists, Kasai-Subarnarekha (U. N.) Project, Central Ground Water Board, Jamshedpur (Bihar).

This paper is aimed at drawing the attention of the concerned authorities by sounding a note of caution and also suggesting suitable remedial measures before the situation worsens beyond control.

REMAINING CHALLENGES

Durtng the second half of thc decade from 1986, the fandamental goal will be to meet the needs of those who are withont safe water and adequate sanitation. If all these people are to be surved then a each day.

* *an additionai 650,000 people need to be supplied with a daily minimum of 20 litres of clean water :*
* *more than 1,000,000 people need to gain access to sanitation facilities.*

—Droplet, IWWA, Bombay

FIXED BED CHLORINATOR FOR RURAL WATER TREATMENT

By

R. Mehrotra & Rajan Chadha*

SYNOPSIS

In a developing country with resource constraints, the primary objective of a rural water supply scheme should be protection against water borne diseases, physical and chemical quality of water being secondary objective.

For achieving protection against water borne diseases the most important treatment that the water should receive is dis-infection. There are physical and chemical disinfactants. Such as UV radiation, Ozone, Iodine, Chlorine, heavy metals and chlorine-dioxide etc. Of these, chlorine and its compunds have received widest application on account of cost-benefit ratio.

There are several methods for chlorination of water, the principal difference being the physical means used to meter the chlorine into the water. Conventional methods of chorination are not very suitable for villages due to high cost dosing equipments, supervision, operation and maintenance. Besides, most methods employ direct addition of disinfactant into the water and the dose to be applied has to assessed separately if correct dosing is to be done.

Consequently, there is a pressing need for developing a simple, cheap and effective device to apply chlorine to water. In the present work attempts have been made to develop a simple device to containing cheap sorbents which take up chlorine when placed in chlorine rich medium and release the sorbed chlorine steadily according to chlorine demand of water in contact.

*Lecturer, Deptt. of Civil Engineering, Delhi College of Engineering.

Attempts have been made by various researchers using Quaternary ammonium anion exchange resins appled with tri iodine, chlorine exchange resins using polymers such as polyamide, melamine, acrylamide, ureaformaldehyde, Phenol formaldehyde, macroprous resins and metal ion impregnated organic resin etc. to develop chlorine disinfactars. All these have reasonable performance but pose operational problems and are in addition very costly for application in rural areas in developing countries.

Some work was attempted using cheaper materials such as activated carbon, activated rice-husk, activated cocoanut shell, bitumenous coal etc. but these systems were found successful with iodine only. Since, Iodine has a very limited application for portable water supply, to fill the gap the present study attempts to evaluate some cheap inorganic materials for developing a fixed bed chlorinator. Two materials viz., Alumina and slica gel have been tried. These materials showed a marked sorption capacity and desorption pattern.

It is observed that in batch operation :

(i) 8g alumina and 8g silca gel at pH-11.5 adsorbs 1.3g chlorine and 0.7g chlorine from chlorine media of concentration, 9g/l made using bleaching powder.

(ii) When the alumina and silca gel loaded with chlorine were desorbed into 20 lit. of distilled water, alumina desorbed 28 percent whereas slica gel desorbed 4 percent of the total chlorine adsorbed earlier.

Columns studies to evaluate the potential of Chlorine laden alumina and silica gel to inactivate E. coli present in test water yielded 91 percent reduction of E. coli for 8g alumina laden with 1.3g chlorine and 78 percent E. coil reduction for 8g silica gel with 0.7g chlorine, all at 2 min contact time.

These results are quite significant. The feasibility for field use in fixed bed chlorinator using alumina could be tried by making a prototype for use in isolated house-holds and small public water supplies using surface or ground waters.

"SUJALA SUTRAM" IN THE COMBAT OF FLUOROSIS

By

D. L. N. Sinha*

SYNOPSIS

Fluorine in traces has profound effect on human metabolism. Total avoidance of the elements intake into the body leads to dental carries. When the fluoride level exceeds one ppm in drinking water, the fluorosis disease sets in. Over 600,000 people, the far greater number of livestock and birds in the States of Gujarat, Andhra Pradeso and Rajasthan are suffering from this dreadful disease. The fluorosis, thus, poses a serious health hazard to the country.

***Natural Resources Development Cooperative Society Ltd., Ongole, Andhra Pradesh.**

Fluoride incidence is common in the waters of Kanigirl, Darsi, Podili and Donakonda Taluks of Prakasam district. In a systematic approach, about 400 water samples have been collected from the endemic areas of the district. The levels of incidence varies upto 24 ppm. In the background of the available methodology, defluoridisation is attempted through thousands of experiments keeping in view the rural individual's lack of education, poor economic condition and the accessibility of the defluoridising agent. The resulted in 'Sujala Sutram', which proved as an effective measure in the defluoridisation of natural waters.

The paper offers not only the simple method "Sujala Sutram" to save the rural Indian from fluorosis but also tenders pertinent precautions and pragmatical preventive measures.

NITRATES IN GROUND WATER—A RECENT PROBLEM FOR RURAL WATER SUPPLIES

By

M. Z. Hasan, S. P. Pande and K. L. Saxena

National Environmental Engineering Research Institute, Nagpur - 440 020

SYNOPSIS

Rural population mainly depends on well water for their drinking and domestic requirements. They are facing now a new health related problem due to alarming increase in the levels of nitrates in ground water. The maximum limit prescribed for nitrates in drinking water is 45 mg/L and nitrate levels of ground water have been observed to exceed this limit in the states of Haryana, Maharashtra, Rajasthan, Tamil Nadu and Uttar Pradesh. Besides this in some of the villages situated at remote places, the level of nitrate may be several folds higher than this prescribed limit.

Nitrates and nitrites are highly soluble in water and consequently all nitrate consumed through food, drinking water and beverages are absorbed in the body. Though, there are several reports regarding higher levels of nitrate in the ground water, yet ill health effects due to nitrate consumption are still not confirmed. Moreover, reports of nitrates levels are based on only sporadic surveys. A study was, therefore conducted to evaluate systematically the levels of nitrate in ground water, to follow up time bound variations and correlate infant methemoglobinemia with nitrate levels. Results revealed that majority of ground water sample had nitrate levels above permissible limit. There was definite increase in nitrate levels in ground water samples of the same sources in a period of six years: Infants exposure to nitrates results in the production of methemoglobinemia. We inspected the medical examination records of infants of the localities which have higher levels of nitrate in ground water. It was observed that cases of methemoglobinemia were not prominant in the localities surveyed. Most of the people residing in these localities were from weaker section of population. Breast feeding to infants was most common among them. Perhaps this practice of feeding was responsible for non-occurrence of this disease.

Rural populations should be provided water containing low levels of nitrates. There are two alternatives to achieve this goal. One is to remove nitrates by proven methods of reverse osmosis, ion exchange, chemical treatment and biological denitrification processes. However, implementation of these processes is not ecconomically feasible in villages. The other alternative is to evaluate nitrate levels of wells and identify wells whose water has low nitrate levels. People should be advised to use water from these wells for their domestic requirements.

CROSS CONNECTION AND CONTROL PROGRAMMES IN WATER SUPPLIES SCHEMES

By

S. D. Badrinath* V. P. Deshpande* S. N. Kaul* S. K. Gadkari* B. Charkradhar*

SYNOPSIS

In public water supply system, various cross-connections are inherent due to improper planning design and maintenance. This results in heavy epidemics causing environmental health problems. Cross connection control programmes are necessary in view of water supply and sanitation decade. Backflow preventers should be installed wherever cross connections exists. Various cross connection control systems and a few case studies have been briefly described. It is felt that suitable legislation will help to reduce the population hazards.

"Just three decades ago some 700 million people of the world lived in cities. Today the number stands at 1.8 thousand million and by the end of century it is expected to be more than three thousands million—which will be about half the worlds estimated population. The flood of "urbanites" is not engulfing the richest countries but the poorest."

—Reader Digest, March 1985.

*Scientist, National Environmental Engineering Research Institute, Nagpur-440 020.

DISINFECTION OF RURAL WATER SUPPLY

By

Mr. Jagdish M. Barot*

Water sustains life and also destroys it when gets contaminated. Numerous diseases are water borne and as per an estimate, nearly 80% of the diseases are related to unsafe water only. This adversely reflects on the socio-economic development of the society. India lives in villages where the sources of water supply are mostly unprotected. The water quality aspect is unfortunately poorly attended to, resulting in heavy losses of child life, man hours and money for medicines.

*Chief Scientific Officer, Public Health Engg. Lab., Race Course Road, Baroda-390007.

Village water supply is dependant on a shallow well Hand pump or an open surface source (pond etc.) which are all subject to contamination. The villagers are unaware of the health and hygienic care. It is, therefore, imperative that the water supply is properly disinfected to prevent illnesses.

The paper describes importance of disinfection, various methods, mechanism, suitability of some simple devices and their operation and maintenance. Considering the non availability of consumable materials and parts for sophisticated equipments in rural areas, pot chlorination and use of bleaching powder etc. are advocated. The simple measurement of residual chlorine and chlorine dose requirement, standards and specifications are explained with guidance for storage and handling of chemicals used

In view of the decade planning, action are accelerated to achieve targets of rural sanitation also. As part of this, low cost, pit latrine schemes are emplemented. This is likely to cause ground water pollution Due to the increasing threat of the ground water pollution and insanitary conditions in the villages, disinfection of water needs more attention and care. The paper reminds about our commitment to health for all by the turn of century emphasing the demand for health education of the rural masses.

Conditions prevailing in Gujarat state are described.

EVALUATION OF SELECTED RURAL WATER SUPPLY SCHEMES IN WEST BENGAL

By

R. S. Dhaneshwar*, A. K. Basu, A. K. Biswas**, A. K. Ganguly** and P. B. Sanyal****

ABSTRACT

West Bengal experience varied climate, topography and hydrogeological conditions. The areas in West Bengal can be designated as Hill area, Coalfield area, Saline ground water area and Drought prone scarcity area. Of these four areas, Hill, coalfield and Saline areas are provided with piped water supply with Public Stand Posts, where as Drought stricken areas of Bankura district is provided with hand pump tubewells sunk by rock drilling machines. India Mark II proved to be useful. Except handpump tubewells, in rest of the villages, the planning, execution, operation and maintenance are carried out by PHED and CMDA where as in case of handpump spot sources, the construction (as per PHED specifications), operation and maintenance are carried out by Panchayat Samities with occasional repairs carried out by PHED. All the water samples showed high bacterial counts and the water from saline zone showed additional saline conditions. Hence the quality of all the water samples tested was found to be unsatisfactory.

*Scientist, NEERI Zonal Laboratory, 6/33, Civil Lines, Kanpur-2.

**Scientists, NEERI, Zonal Laboratory, 23 R. N. Mukherji Rd., Calcutta-1.

The health status in 8 study villages did not show anticipated improvement when compared with 4 reference villages having no organised water supply. This was owing to lack in community participation and general health education which was noticed by the prevailing insanitary conditions, exposure to doubtful quality of water sources, such as pouds, rivers and open wells. As per 1977 records, 99127 tubewells were operative, 32,575 were derelict tubewells and 37,720 were open wells Of the 255 piped water supply schemes undertaken by PHED, 170 are located in Darjeeling district and 159 schemes were completed at the time of survey. A criterion for providing one tubewell for 300 persons and one PSP for 300 people for the piped water supply with 40 Lpcd and terminal pressure of 3-5 m at consumers' end was considered.

Planning and implementation for spot sources was observed to be ineffective on account of absence of feedback of information on performance so as to improve upon the future planning. Shortage of funds will obiously hamper the progress. The significance of quality maintenance be accepted by setting up districtwise testing laboratories. Community participation will result in the successful running of water supply schemes. This can be achieved by making use of effective media so as to create awareness. The loss of water at the PSP during supply hours and damages of fixtures can be reduced considerably. By levying water tax will have positive effect on the operation and maintenance of the schemes, resulting in better service and yield.

EVALUATION OF RURAL WATER SUPPLY SCHEMES IN U.P.

By

P. S. Kelkar, V. A. Mhaisalkar & R. Paramasivam Scientists
National Environmental Engineering Research Institute Nagpur–440 020

SYNOPSIS

NEERI undertook a comprehensive evaluation of rural water supply schemes in U. P. and severel other states of India. This paper covers the findings of the survey of five rural water supply schemes from three different regions of the state U. P. The evaluation study covered the following aspects; Design norms as adopted by State Government, Water Supply Sources, Operation & Maintenance, Degree of Service, Water Quality & Communlty Participation.

The study has identified problems & constraints in the implementation of rural water supply programme and has suggested recommendations for future planning, design and effective operation & maintenance of the schemes.

RURAL WATER SUPPLY STRATEGY IN 80's

By

Sri A. C. Chuaturvedi*, FIE, FAE, FIPHE, FIWWA, MIET, MIAWPC.

India has 5,12,000 villages. In over 1,00,000 villages water is more precious than oil, as it has to be transported by rail from area which are already suffering from water scarcity. The crisis of 80's is going to be water as the one of the 70's was energy. Water shortage is a widespread result of pollution just as much as the result of actual use. We can not just let water go to waste. Nature is kicking back. India does not yet have a water management scheme or a water management policy. Rather than working from hand to mouth, we must use water to the best of our ability, whether it be the initiative of Govt. or the people themselves. In many areas, women walk many kilometers and hours (Upto 6 hours a day) every day to get a jar of water. Women are the ones who realise the problem. We have to motivate the people themselves, the actual users, the beneficiaries and not behave like technicians, scientists or coordinatiors and merely talk to the elite in the developing countries at confrences or discussions about the lack of water, about poverty. What ever is said concerning water and locating standard for its protection. The basic message must be provision of safe water.

*Chairman, Institution of Engineers (I) UP State Centre Lokmangaj, Charbagh, Lucknow.

MAINTENANCE AND MANAGEMENT OF RURAL WATER SUPPLY SCHEMES WITH SPECIAL REFERENCE TO WEST BENGAL

By

Sri D. Guin*, B. E., D. T. R. P., M. El (PH.), MIPHE., MIE.

One of the important objectives of the International Drinking Water Supply and Sanitation decade is to provide every citizen of India with safe drinking water during the period. With this provision the transmission of water borne diseases will be controlled; general health of the state and Nation would improve. As a constituent state of India, the State of West Bengal also pledges to fulfil her committment of the decade, as safe drinking water is one of the basic human needs.

Piped water supply system covering cluster of villages, camps or colonies, campus of industrial units, educational, religious or social institutions are becoming more and more popular in West Bengal. The sources of water for these piped water supply systems are either (i) Ground water tapped through large dia tubewells/covered wells and pumped by means of electrical machinery in mostly alluvial regions or (ii) Surface water from the Jhoras in the hilly region and from the rivers, either perennial or impounded.

It is our sad experience that maintenance of water supply schemes in many areas are being neglected. The result is obvious; however, this cannot be allowed to go in case of

*Assistant Professor, Sanitary Engineering, All India Institute of Hygiene & Public Health, Calcutta.

rural water supply schemes during and after this decade. With numerous small water works scattered all over the state, it will be a very difficult task to maintain these works economically and efficiently. Due attention must be given during the constructional stage, particularly the installation of tubewell, laying of pipelines with valves, installation of pumping machineries and other equipments. The correct and appropriate technical and supervisory staff must be engaged for efficient operation and maintenance of the rural water supply schemes, the important national assets.

MAINTENANCE AND MANAGEMENT OF RURAL WATER SUPPLY SCHEME

By

Sri Lallan Prasad*, M.E. (PH) F.I.E. FIWWA.

The rural water supply has become very important subject. As per 20-point programme of the Government, all the problem villages must have atleast one source of drinking water. Also under the International drinking water supply and sanitation decade. ending on 31st March, 1991 all the villages must be provided with safe and dependable source of water supply.

The increased number of rural pipe water supply scheme, Drilled tube wells, Hand tube wells, and Wells in the rural areas are posing great financial problem for its maintenance. In the paper, the problem of Bihar has been narrated. At present Bihar requires atleast Rupees Two crores per annum in the non-plan sector for the maintenance of water supply in the rural areas.

The panchayat are reluctant to levy water tax and collect revenue to meet the cost. The maintenance problem requires immediate solution, so that the potable water sources being created by the Government may be kept in good running condition.

Every dispersed source or any rural water works should be treated as a mini hospital. Potable water is just a preventive medicine. It saves people from water borne desease. The money for maintenance for rural water supply may be collected from the public in the shape of water cess. Ours is a walfare state. This is the duty of the Government to provide good potable water to every citizen.

It is high time that such a national seminar should think over this burning problem of maintenanee of water supply is rural areas.

*Superintendiog Engioeer, P. H. E., Rural water Supply Circle Jamshedpur—831013.

"MANAGEMENT OF HUMEN ELEMENTS IN HAND TUBE WELL MAINTENANCE"

By

P. K. Chakraborty, Executive Engineer Gauhati

SYNOPSIS

In order to provide drinking water facility to all the problem villages within shortest possible time large number of hand tube wells are already installed and more are in the process of installations. Desired level of services from hand tube wells can only be achieved through effective operation and maintenance. Three-tier system are mostly followed for hand tube well maintenance. Whatever may be the system the efficient functioning depends on appropriate management. The emphasise should be towards preventive maintenance rather than break down maintenance.

Humen element is one of the most important imput resource for hand tube maintenance, effective maintenance depends to a large extent on optimum utilization of this resources through sound management process. The process should consist of following important phases viz Planning, Organising, staffing, motivation, Co ordination controlling. Human element which should be our concern in content of hand tube well maintenance include (a) beneficiaries (b) personnel directly associate with management and maintenance of hand tube well (c) Community worker and non-Government Organisation.

The paper deals with certain aspects of management and development of human element which is one of the basic requirement for the attainment of the decade objective in the true sense of the term.

A RATIONAL APPROACH TO INTEGRATED RURAL WATER SUPPLY SYSTEM MANAGEMENT FOR THE 21ST. CENTURY BIHAR (Case studies)

By

Er. Nagesh Chandra Misra* B. Sc. (Eng.); MIE; MIWWA; MIAWPC; MIWSA.

SYNOPSIS

UN's them of 'Clean Water and Sanitation by 1990' is facing paradoxial global realities. In India, an adhoc bureaucratic fragmented approach towards planning has failed to balance Socio-political—ENVIRONMENTAL—techno-economic interactions.

Bihar's Decade Plan for Rural Water Supply Programme rests on concealment of facts. Necessary and sufficient conditions of potable, protected and perennial drinking water is overlooked.

*Subdivisional Officer, P. H. Hatia Project Subdivision No. III, Ranchi.
Qr. No. C-4, New P. H. E. D. Colony, P. O. HINOO (Ranchi) PIN-834 002.

The entire process of planning, organising, leading and controlling has to be scanned and processed through the spectrum 'Nothing succeeds like success that lasts for ever'.

A true Gandhian approach of practical wisdom within the framework of Modern Management techniques should be the core of Rural Water Supply System.

A rational Water Resources Systems Planning based on Watershed Management should be forged with Environment and Gram Swaraj.

Institutional Modernisation with a sound Information and Monitoring System should be developed by growing, expanding, and diversifying the Public Health Engineering Department by imparting continuous and compulsory training facilities to every Man Power for optimising Human Resources Department. Frequent 'Switchover' to different Human Capital's must be stopped henceforth and efficient Technical Managers should head the organisation.

A Mass and Modular Approach to R & D activities for Appropriate Methodology in Installation, Operation and Maintenance of self-sustaining Community Water Supply system should be worked out and accordingly, the Regional Modules of different region of Bihar based on physical and biological characteristics of the environment and economic, demographic and sociocultural aspects of the communities should be executed on mass scale on the basis of longterm planning so that today's every creation may be an integral part of the future deve- lopment with enough compatibility and flexibility to take load of all technical innovations reaching fast by the 21st. century.

RURAL WATER SUPPLY PROJECT IN THE TRIBAL AREAS OF CHOTANAGPUR (SINGHBHUM) BY INDIAN COPPER COMPLEX-AN UNIT OF HINDUSTAN COPPER LTD. (A GOVT. OF INDIA UNDERTAKING)

By

D.K. Sen*, F I.E., M M.G I.

G.S. Ghose Hazra, B.E. (Mining), F.C.C., MMGI**

SYNOPSIS

Catering potable water in remote drought stricken rocky villages of tribal Singhbhum by providing tubewells through in-house facilities of a Public Sector Mining Company is hard to conceive. But this is exactly what could be achieved in Indian Copper Complex of Hindustan Copper Ltd. The basic aim of this paper is a pathfinder to Mining and Construction Companies who are interested in providing potable water in rural inaccessible area of their operation but cannot arrange other agencies to do the job and required to do themselves by reorganising part of their existing production facilities.

The paper deals with the above idea from inception to completion and even beyond that i.e. rendering service to make those installations run continuously and efficiently.

*Chief Drilling Engineer, Hindustan Copper Ltd., Indian Copper Complex.

**Senior Mining Engineer, Hindustan Copper Ltd., Indian Copper Complex.

These include the steps viz. realising the need, commitment to National 20 Point Programme, Project formulation, Ground Water Survey viz-a-viz Population density and involving Workers' Union for pin-pointing drilling locations, approaching different state authorities for execution and their inability to undertake the job on account of pre-occupation, futile attempts to engage a suitable drilling contractor, decision to take up this challanging job by the mining complex, selection & procurement of a versatile drillings system so that it can take up regular production jobs at Surface and in Underground and can also perform tubwell drilling, creation of infrastructure, drilling a large number of suceessful tubewells of an average depth of 50 metres in hard metamorphic rock in 615 villages spread over an approximate area of about 200 sq kilometres in six blocks. Established enviable track record by keeping all hand pump installation continuously operating by rendering maintenance service. The mobility of the drilling system in most inaccessible villages without vehicular road link and involving villagers for maintaining their precious tubewells are the highlights.

RURAL WATER SUPPLY SCHEMES IN GUJARAT-MAINTENANCE & MANAGEMENT

By

P. Nema. S. K. Shrivastava, Dr. N. C. Kankal, C. G. Mehta, B. H. Gokhe
National Environmental Engineering Research Institute' Ahmedabad

SYNOPSIS

There are 18275 inhabited villages in the Gujarat State. A total of 12038 villages have been identified as problem villages. Out of this 6237 villages have been covered by water supply upto March, 1980 with target plan to cover another 3500 villages by March, 1985.

Gujarat water Supply & Sewerage Board is entrusted with the responsibility of providing safe drinking water to these problem villages. Under a sponsored programme by CPHEEO, Ministry of Housing & Works, Govt. of India, National Environmental Engineering Research Institute (NEERI) carried out a survey of selected number of rural water supply schemes in Gujarat with a view to identify technological, administrative, financial and other constraints in effective implementation, operation and maintenance in order to give the desired benefit to the rural population. The evaluation studies encompassed (1) Interviewing the people on the various aspects of the scheme such as degree of service, financial management, health status etc. (2) Engineering assessment in terms of design, functional efficiency (3) Collection and analysis of water samples for quality assessment.

The findings of the studies concerning mainly management and operation & maintenance aspects have been discussed in this paper.

It was noticed that the main reasons behind the non operation of the schemes to a satisfactory level were due to (1) low revenue receipts from the users (2) non-availability of spare parts of the pump/motor (3) lack of technical services and (4) unawareness of the people regarding health & socio-economic benefites of getting the safe water.

Based on the data collected, various problems & constraints have been identified and recommendation made for effective implementations of the rural water supply schemes.

MAINTENANCE AND MANAGEMENT OF RURAL WATER SUPPLY SCHEMES.

By

Rajeshwar Nath Arora* B. Sc. (Civil Engg.) D.P.A. MIE. Miwwa,

SYNOPSIS

The heart of administration is the management of programmes designed to serve the general welfare.

With the advance of Civilization, the utility of water to man has increased manifolds so much so that the present day Civiclife will be unable to function without a well-maintained public water supply scheme.

Under the existing system the basic responsibility of the maintenance of rural water supply schemes lies with the local bodies which lack the necessary capacity and capability to maintain these water supply schemes.

The various problems in the maintenance of rural water supply schemes and their suggested soluations are as under :—

1. Meagre allocation : —The provision on the maintenance of rural water supply schemes is too meagre and needs revision.

2, Maintenance staff: —Generally part-time fitter cum Chaukidar are employed for the maintenance of scheme who are not able to do full justice to their duties. For this rural infra-structure duly trained by the department could be developed to carryout day to day repairs.

3. Magisterial Power : —To check sabotages pilferage in the rural water supply schemes, magisterial powers could be vested with the Engineers.

4.. Involvment by the Benificiaries : —To inculcate a sense of involvement by the benificiaries, village panchayats could be made responsible for paying electriacl charges and for repairs and maintenance.

5. Adoption of Village :—To overcome the problem of paucity of funds, every unit of the public sector organisation should compulsarily be directed to adopt at least one village in the same district to finance the drinking water supply schemes.

6. Security money :—To check the never ending demand of additional stand posts in piped rural water supply schemes, some amount of money could be charged as token of security from the benificary.

Thus the steps opined above could lead to better maintained and managed rural water supply schemes.

---

*Executive Engineer U. P. Jal Nigam Pithoragarh.

STATE WISE STATUS OF

STATUS OF RURAL WATER SUPPLIES

1.	Name of State/Union Territory	ARUNACHAL PRADESH		MAHARASHTRA	
2.	Rural population (1981 Census)	6,28,050		40.79 million	
3.	Villages (Numbers) and 1981 population.	No. of villages	Pop. 1981	No. of villages	Pop. 1981
	(i) Total	3257	6,28,050	39354	40.79 million
	(ii) Problem villages as per original survey	2973 (1971)	—	14025	16.59 million
	(iii) Additional problem villages after subsequent survey(s)	284	—	—	—
	(iv) Net non-problem villages	Nil		—	—
4.	Coverage upto March 1985 :—				
	(i) Total villages covered with W/S	1899	4,36,560	18956	21.89 million
	(a) Problem villages	1899	4,36,560	13106	15.19 million
	(b) Non problem villages	Nil	—	5850	6.76 million
	(ii) Total villages covered by piped W/S	1847	4,28,560	3407	5.11 million
	(iii) Total villages covered by Hand pumps/Sanitary wells	52	8,000	15549	16.78 million
	(iv) Total Nos. of Rural piped water supply schemes (Commissioned)	—	—	3005	5.11 million
	(v) Total Nos. of India Mark-II Hand pumps (installed)			31098	7.77 million
5.	Average per capita capital cost (1981 population)				
	(i) Rural piped water supply schemes	Rs. 700/- to 800/-		Rs. 300/- to 400/-	
	(ii) India Mark II hand pumps schemes	—		Rs. 100/-	
6.	Average per capita maintenance cost per annum at present :—				
	(i) Rural piped water supply schemes	Rs. 10/- (approx)		Rs. 20/-	
	(ii) India Mark II hand pumps schemes	N. A.		N. A.	
7.	Maintenance agencies :—				
	(i) For rural piped water supplies :	Rural Works Department		Zila Parishads & Village Panchayat	
	(ii) For India Mark II hand pumps :	—		—	

RURAL WATER SUPPLIES

MANIPUR		PUNJAB		RAJASTHAN		WEST BENGAL	
1045 thousand (1981 census)		103.35 lakhs (pop. 1971)		27051354 (1981 census)		4013393 (1981 census)	
No. of vill.	Pop. 1981	No. of vill.	Pop. 1971	No. of vill.	Pop. 1981	No. of vill.	Pop. 1971
2057	1045 (thousand)	12188	103.35 lakhs	34968	27051354	38074	3334497
1280	792 (,,)	3712	40.71 lakhs	24037	21261613	25243	2413255
469	148 (thousand)	5400 (upto 31-3-85) survey work	41.09 lakhs	3398	1814387	9201	679278
308	105 (thousand)	in 3076 villages is in progress		7533	3975354	3630	241955
		2482		22262	20767107		
887	654 (thousand)	2482	27.29 lakhs	20277	1657433	4199 (F.C.) 11429 (P.C.)	258633 285918
15	3 (,,)	—	—	1985	2115674	528 (F.C.)	65286
852	602 (thousand)	2482	27.39 lakhs	7593	13432607	753 (F.C.)	132310
50	55 (,,)	—	—	14669	7334500 (App.)	3974 (F.C.) 11429 (F.C.)	191609 2859.18
357 119 partly commi. Sch.	620 (thousand)	961	27.39 lakhs	—	—	206 (Fully) & 3 (Partly)	132310
170	34 (thousand)	—	—	43797	N.A.	1987	49868
Rs. 700.00/ Per Capita		Rs. 400.00/Per Capita		Rs. 300.00/Per Capita		Rs. 300.00/Per Capita	
Rs. 100.00/Per Capita		—	—	Rs. 52.00 per capita assuming that a hand pumps is provided for every 250.		Rs. 70.00	
Rs. 40.00/head/annume		Rs. 20.00/- Per Capita		Rs. 20.00 Per Capita		Rs. 10.80	
Rs. 0.50 head annume		N.A.		N.A.		Rs. 1.00	
P.H.E. Department		Pb. P.W.D. Public Health R.W.S. (Wing)		PHED Deptt. Raj.		PHE Dte	
		N.A.		—do— & Panchayat Samittee		PHE Dte	

8.	Financial :		
	(i) VIIth Plan outlay for Rural Water Supplies	Rs. 1742 lacs (State Sector) Rs. 400 lacs (Central Sector) Proposed	Rs. 620 Crores Rs. 66.01 Crores
	(ii) Provision for 1985-86 for RWS	Rs. 425 lacs State Sector Rs. 50 lacs Central Sector	Rs. 318.95 Crores (6th plan only)
	(iii) Expenditure on rural water supplies upto end of 6th Five Year Plan	Rs. 1410.92 lacs (State Sector) Rs. 248.27 lacs (Central Sector) Rs. 0 85 lacs Central M & I Unit	
9.	Village coverage target		
	(i) During 1985-86	300 (250 MNP+50 ARP	1163 (Problem)+1652 Non-Prob.
	(ii) During 1986-90	1058 Proposed	17185 (Non-Prob.)
	(iii) Beyond 1990	—	398 (Non-Prob.)
10.	Rural average water tariff/presently enforced :	No tariff is being earned at present	Rs. 1.0 per 1000 litres
	(i) Domestic connection		Nil
	(a) Metered	Nil	
	(b) Un-metered	Nil	Nil
	(ii) Non domestic connection		
	(a) Metered	Nil	Nil
	(b) Un-metered	Nil	Nil
	(iii) Stand Post		Rs. 150/- per house per year
	(iv) Any other charges		No
11.	Financing pattern :		
	(i) For problem villages	From State Sector and	100% Grant in
	(ii) For others	From Central Sector	100% aid from 1-4-85
12.	What percentage (average) of maintenance cost of Rural water supplies is available from beneficiaries	Nil	5% Capital cost
13.	Constraints :		
	(i) In execution of RWS Schemes	Non-availability of material & skilled persons	Non availability of material and non-regular flow of fund.
	(ii) In maintenance of RWS Schemes	Poor finding in accessibility of works	Non-availability of Technical staff.
14.	Recommendations for better maintenance & management of Rural water supplies	Trained personnels to be given additional incentive to work	Govt. should maintained with a provision of plan Fund.

Rs 1900 lacs	Rs. 7000.00 lacs under MNP (State Plan)	Rs. 4600 lacs (MNP) + Rs. 5460 lacs DDP	Rs. 19523 lacs (outlay) recommended by planning commission.
Rs. 480 lacs	Rs. 1000 lacs under MNP (State Plan)	Rs. 1140 lacs	Rs. 922.00 lacs (ARWP=461.00 lacs) MNP=461.00 „
Rs. 2465.00 lacs (For State Plan) Rs. 1127.00 lacs (For Central Allocation)	Total Rs. 8034.55 lacs	Rs. 24833 lacs	Rs. 9864.59 lacs (During 6th plan period)

Prob. Vill.	Non-prob. Vill.	Prob. Vill.	Non-prob. Vill.	Prob Vill.	Non-prob. Vill.	Prob. Vill.	Non-prob. Vill.
160	3	125 Nos.	—	1600	—	1168	95
702	305	875 Nos.	—	2160	460	Can not be assessed till VIIth plan outlay is finalised.	
—	—	All the remaining problem & non-problem villages		—	8486	—do—	
						No tarriff	
				Rs. 1.50/1000 L		Run entirely on State Govt.	
	Nil	Not applicable		—			
	Nil	Flat Rate of Rs. 10/- PM Per Connection.		Rs 14/-Single Family With Two Tapnnection		Subsidy	
	Nil	Not applicable		—			
	Nil	„		—			
	Nil	Nil		—			
	Nil	Nil		—			
From State plan & From Central Grant From State Plan		Funds are provided by the State Goverrtment under M. N. P. and by the GOI Under Centrally sponcered A. R. P. Programme		50% Central Assistant 50% State Plan 100% State Plan		(i) State plan MNP (ii) Centrally sponsored ARWP State Plan MNP	
Does not arise Since no wetter Tax is levied.		—		Nil		None	
Shortage of Construction Materials and rig wagon shortage of fund		Paucity of Funds		FINANCIAL		Inadequacy of financial resourses.	
		—do—		—do—		Proper Policy and also inadequay of financial resourses.	
Liberal Financial assistance and to seek full Co-operation from public.		—				Constraints is in 13 are to be removed.	

With best compliments from :

INDIAN PLASTIC AND LAMINATES LTD

Manufacturers of :
INJECTION MOULDED & FABRICATED
PVC PIPE FITTINGS

OFFICE & WORKS :
D-44, INDUSTRIAL AREA,
MEERUT ROAD,
GHAZIABAD (U. P.)

Gram : INPLAST

Phones : Office : 8-42228
Resi : 6419085

With best Compliments from :

Gram : RAHUL METER

Phone : 842272
842209

Rajasthan Industrial & Scientific Corpn.

(water meter division)
39, Industrial area Jhotwara, Jaipur-302 012

Manufacturer of :
RAHUL BRAND WATER METERS

dry dial inferential type A singlejet as well as multijet in sizes 15, 20, 25, 40 & 50 mm demestic type with ISI mark.

Suppliers to :
most of public health engineering departments of many states & munincipal corporation of many cities in India including greater Bombay.

With best compliments From :

DRILLEXPERTS PRIVATE LIMITED

EXPLORE UNDERGROUND WATER ANYWHERE

Consult : Vikas Malik, B.Com., LL.B., P.G.D.B.A., Director, Lucknow.
OR
G. K. Malik, M.E.E., F. I. E., M. Cons. E. (I , F. I.P H E. (I)
Managing Director, Drillexperts Private Limited.
Tubewell Construction and Consultant Engineers,
Regd. & H. O. : 18/4, West Patel Nagar,
New Delhi-110 008
Phone : 563871 Gram : RIGEXPERTS

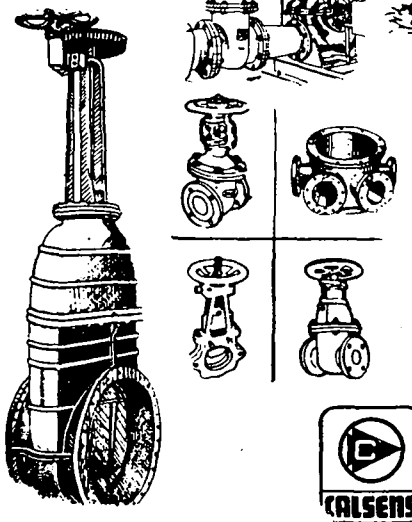
Branch Office : C-318, Nirala Nagar, Lucknow—226 007 (U. P.)
Phone : 74163 Gram : RIGWELLS

We Specialise in :

1. **Construction of Large Diameter Truly Vertical Dependable Durable Tubewells.**
2. **Supply and installation of Pumping Sets of any Type.**
3. **We Manufacturer of :**
   - *(a) Reverse Circulation Drilling Rigs & Accessories.*
   - *(b) Percussion Drilling Rigs & Accessories*
   - *(c) Slotted Pipes & Fittings etc*

CALSENS®
VALVES

Used by leading industries all over the country!



Calsens valves are widely used at Waterworks and Lift Irrigation, Steel Plants, Power Units and Mines, Cooling Towers, Water Treatment Plants, Effluent Treatment, Fertilizer, Chemical, Sugar Factories and other Process Industries.

... available in cast iron, cast steel, stainless and mild steel, in sizes upto 1500 mm.

★ Made from selected raw materials, and subjected to rigorous performance tests.

★ Comes in a wide range — sluice, gate, reflux, globe, check, pulp, pressure release, diaphragm and air-release valves, pen stocks etc.

★ Also graded castings and fabrication

CALSENS

CALSENS PRIVATE LIMITED

6/1A British Indian Street, Calcutta 700 069, Phone 23-6527, 23-2734
Telex 021-2595 CALSIN
Offices at : Madras, Hyderabad, Bangalore, Cochin, Rourkela, Delhi Bombay, Pune

Jetsetters-CPL/3/85

Rural Water Supply

WISHING THE SEMINAR ALL SUCCESS

From : **The Indian Hume Pipe Co. Ltd., Construction House, Ballard Estate, BOMBAY-400 038**

A WALCHAND GROUP INDUSTRY

★

Manufacturers :

(1) Prestressed Concrete Pipes for Water Supply, Drainage, Sewerage & Heavy Duty Culverts for diameter of over 300 mm and for pressures 30 Metres and above.

(2) R.C.C. Hume Pipes of NP2, P1, P2, P3, NP3 & NP4 for various applications like Water Supply, Sewerage, Drainage Irrigation and for Heavy Duty Culverts

(3) Hume Water Tank, Septic Tank, Water Trough, Sentry Cabins—Movable, Non Corrosive, No Intra-structural Leakage, No Maintenance, More Economical—More durable.

(4) Hume Steel Pipes, Specials, Welded Steel Pipes & Penstock Pipes

(5) Prestressed Concrete Sleepers

★

Branches in U. P. **The Indian Hume Pipe Co. Ltd., Karari-Jhansi-284003**

The Indian Hume Pipe Co. Ltd., Aishbagh Mill Road, Industrial Area, Lucknow-226 004

The Indian Hume Pipe Co. Ltd., 115, Mahatma Gandhi Marg, Allahabad-211 002

With best compliments from :—

KSB PUMPS LIMITED

Registered Office : **126, Maker Chambers III Nariman Point**
Bombay 400021

Head Office & Works : **Bombay Pune Road, P. O. Pimpri**
Pune - 411018 (India)

Telex : 145228 KSBH IN
Telephone : 82006-9/83684/5
Telegram : KAYESBE

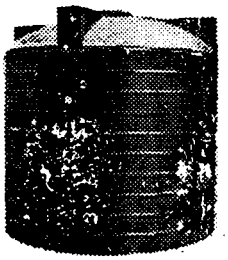
Regional Offices : Ahmedabad, Bombay, Calcutta, Delhi, Madras.

Now you can complete water supply projects in remote and problem villages

....quickly and efficiently with Sintex

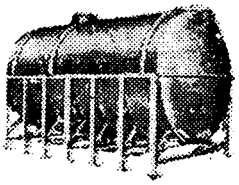
SINTEX Water Storage Tanks are moulded to seamless perfection from FDA approved grades of polyethylene and offer you a range of unmatched properties that make them the ideal water storage tanks for remote and problem villages.

* Readily available
* Easy to transport and install
* 100% Rust and Leak proof
* 100% Maintenance free
* Hygienically the safest
* Strong and Durable
* Versatile
* Wide range of capacities upto 20,000 lits.



For further information, contact

SINTER PLAST CONTAINERS
Plastics Division
The Bharat Vijay Mills Ltd.
KALOL (N-GUJARAT) 382721 Gram: SINTEX,
PHONE: 2687-2244 Telex: 0121-296 BVM IN



Sintex The Readymade Water Storage Tanks

A Quality Product of the BVM Group

OFFICES AT

Bidhan SP-92

Ahmedabad : 179,New Cloth Market, Ahmedabad 380 002. Ph: 365157, 361045.
Bombay : 18, World Trade Centre Cuffe Parade, Colaba, Bombay 400 005 Ph: 211653, 217869.
Calcutta : 10, Middleton Street, Calcutta 700 071, Ph: 214028
Madras : 123, Angappa Naiken Street, (3rd floor) Madras 600 001.
New Delhi : GF-3 Osian Building, 12,Nehru Place New Delhi 110 019,Ph: 681188

Printed at : TRIVENI PRESS, 28 Vidhan Sabha Marg, Lucknow. Phone : 42648