

Public sector investment

31. The proposed public investment in water and power development during the Plan period is Rs. 3,140 million. Of this outlay, Rs. 92.7 million is allocated to the Central Government's programme, with the balance of Rs. 3,047.3 million divided almost equally between East and West Pakistan. West Pakistan's allocation includes Rs. 27 million for development in the Frontier Regions, and Rs. 78 million for the Coastal and Desert Streams region. The Central Government's programme includes Rs. 46.5 million for atomic energy development, Rs. 20 million for Special Regions, and the balance for the Survey of Pakistan, the Meteorological Service, and on a network analyser.

32. Table 4 shows the proposed allocations to the major sub-sectors in the two Provinces and to the Centre.

TABLE 4

*Programme of public expenditure on water and power development,
1960-61 to 1964-65*

	East Pakistan		West Pakistan		Total	
	(Million Rupees)	(Per cent)	(Million Rupees)	(Per cent)	(Million Rupees)	(Per cent)
Investigations and surveys	66.1	4.4	76.6	5.0	142.7	4.5
Multipurpose development	784.4	51.6	6.1	0.4	790.5	25.2
Irrigation	87.7	5.8	349.6	22.9	437.3	13.9
Drainage, reclamation and tubewells.	(a)	..	228.8	14.9	228.8	7.3
Flood regulation ..	245.5	16.2	64.7	4.3	310.2	9.8
Open canals .. ..	..	..	110.0	7.2	110.0	3.5
Power	288.1	18.9	662.4	43.3	950.5	30.3
Miscellaneous ..	47.3	3.1	30.0	2.0	77.3	2.5
Total ..	1,519.1	100.0	1,528.2	100.0	3,047.3	97.0
Central Government programme.	..	..	..	..	92.7	3.0
			Grand Total ..		3,140.0	100.0

(a) Included under multipurpose development, irrigation and flood regulation.

33. Of the total allocation for water and power development, Rs. 1,042 million will be spent on schemes already in progress, Rs. 325 million in East Pakistan, and the balance in West Pakistan, and Rs. 2,098 million on new schemes. Broadly speaking, allocations to the various sub-sectors in the Second Plan, as compared with provisions in the First Plan, show an increase of 32 per cent for general investigations and surveys ; 8 per cent for multi-purpose schemes ; 67 per cent for drainage, reclamation, and tubewells ; nearly 57 per cent for flood regulations ; and 47 per cent for power. There is a decrease in the allocation for irrigation, because the major schemes in the programme are nearing completion. Expenditure on open canals, which was not included in the First Plan in accordance with the definition of development expenditure applicable at that time, is covered in the Second Plan under the new definition.

Private and semi-public sector investment

34. Private and semi-public investment in water and power includes Rs. 45 million by landowners in the various irrigation project areas on water courses ; Rs. 15 million on tubewells and percolation wells, for which a subsidy is provided in the Plan ; and Rs. 190 million by the Karachi Electric Supply Corporation—a semi-public concern—on power generation and distribution.

Investigations and surveys

35. Investigations, surveys, and research are the keys to effective and coordinated planning, and they must be continued over a long period of time. Inadequacy of data in the First Plan was one of the major obstacles to preparation and proper implementation of schemes. Collection of basic data, such as temperatures, rainfall, ground water levels, and stream flows deserves high priority. Knowledge of grain size distribution, porosity, field permeability, yielding ability of the soil formations, and direction of ground water flow is necessary for sound development of the underground water potential. Soil properties must be known to solve the problems of salinity, canal seepage, waterlogging, and rationalization of water applications for optimum agricultural production. Sound drainage design and layout is not possible without adequate information on soil structure and properties.

36. Detailed soil classification and surveys are needed to determine soil fertility, crop rotations, and suitable kinds of fertilizers, and the amount and manner of their use to suit the particular soil conditions. Each type of soil has its own characteristics and properties, physical and chemical, and requires its own special treatment and use ; most soils, if well managed, can produce good yields. Soil classification and surveys have hitherto covered only a small portion of the arable lands of the country. Provision has been made for them in the agriculture programme. Detailed surveys, which may supplement the agriculture soil surveys, are envisaged also under the drainage and reclamation Schemes. All the lands must be classified and surveyed as rapidly as possible. Research is necessary in soil, water, and plant relationships ; the agriculture sector includes a suitable provision. Provision

has also been made in a number of irrigation and multipurpose projects—Ganges-Kobadak (Kushtia unit), Teesta barrage and Kotri barrage—for agricultural experiment and demonstration farms to determine these relationships and to educate the farmer in water application and crop-raising.

37. It is necessary to measure precipitation, rates of evaporation, canal losses, stream stages and flows, and the silt and mineral content of streams at key points in order to solve the complicated problems of flood control, navigation, irrigation and drainage. It is also necessary to collect data relative to the location, nature and magnitude of flood losses in order both to assess the need and to appraise the means of flood control. The number of existing rain-gauge stations in charge of the Meteorological Service will therefore be increased, and facilities will be installed for the collection of all relevant information over a larger field. A sum of Rs. 61.82 million has been provided for this purpose.

38. The Irrigation Research Institute, Lahore, needs reorganization and expansion ; the provision made in the First Plan for that purpose was not utilized. A similar research institute, established in East Pakistan in 1948, also needs considerable expansion and strengthening. The facilities of the Central Hydraulics and Soil Mechanics Laboratory at Karachi have remained largely unused. A programme for expansion should be prepared. There is also need for the planned use of the existing facilities, and their enlargements as a means of determining the basic principles of river management. Great savings in costs could be effected as a result of research. A sum of Rs. 9.4 million is provided for these expansions and improvements at Dacca and Lahore.

39. For economy and coordinated planning, it is necessary to prepare detailed projects and estimates well in advance of construction. Promising specific projects must therefore be investigated and surveyed in detail so as to build up a portfolio of well-prepared schemes, and permit construction to be started on such schemes as are found feasible later in the Plan period. Detailed investigations, up to the feasibility report stage, are to be completed on the Teesta barrage project, the Tangon irrigation project and the Ganges-Kobadak project in East Pakistan. In West Pakistan, the Kunhar valley hydro-electric scheme is to be investigated in detail. Storage sites, alternative to Gomal Zam, in the Zhob-Gomal basin will be investigated for determining the feasibility of exploitation of the water resources of these streams. . On the result of these investigations will depend the priorities to be assigned to any projects that may emerge. A number of other small schemes will also be investigated. A sum of Rs. 35 million has been provided for this purpose. To expedite the preparation of sound projects and a programme of resource development designed to meet the growing needs of the country, provision has been made for engaging, in addition to Pakistani specialists, the services of foreign management and consulting engineering firms with requisite experience to evaluate existing data and reports, undertake comprehensive investigations and surveys, and prepare specific projects as well as long-range integrated plans for

the development of water and power resources. Such services will also include training of Pakistani personnel, and help in evolving sound managerial and administrative procedures.

40. Altogether Rs. 142.7 million has been provided in the Plan for general investigations and surveys, an increase of almost two-and-a-half times the actual amount spent during the First Plan period.

Multipurpose development

41. For the development of multipurpose projects, the Plan provides a sum of Rs. 790.5 million, the bulk to be spent in East Pakistan. In this Province, multipurpose projects must aim at relieving drainage congestion, providing irrigation supplies, protecting land against unregulated stream and tidal flows, improving navigation, and where feasible, developing hydro-electric power. Of the total allocation made in the Plan, Rs. 224.1 million will be spent on schemes already in progress, namely the Karnafuli, Ganges-Kobadak (Kushtia unit), and Warsak projects. It is expected that by the end of the Plan period an additional 100,000 acres will be irrigated and production from 250,000 acres increased through flood protection, drainage and improved water supply. The ultimate benefits will be much larger. The completion of the Karnafuli project, with the possible addition of a third unit, will increase its electric generating capacity to 120,000 kw. The Karnafuli and Ganges-Kobadak (Kushtia unit) schemes will be completed, with an expenditure of Rs. 218.0 million, during the Plan period. Subject to proven feasibility, work will be started on the second unit of the Ganges-Kobadak project, which is estimated to cost about Rs. 490 million, and of which Rs. 120 million will be spent by 1965. The proposed Khulna multipurpose project is, in effect, the third unit of the Ganges-Kobadak Project. It provides for impoldering about one million acres of land in the southern part of the Khulna District, and for a supply of fresh water for irrigation within the polders from the Ganges through a canal taking off below the Hardinge Bridge. Definitive plans and an assessment of economic feasibility have not been completed and construction is scheduled in the later years of the Plan, subject to a favourable report. The Khulna multipurpose project is estimated to cost Rs. 329 million, of which Rs. 161 million may be spent by 1965.

42. Development of the Halda, Sangua, and Mathamuhuri basins of the Chittagong Hill Tracts, the Ganges-Brahmaputra doab, and the Brahmaputra multipurpose scheme are in the initial stages of consideration. The Brahmaputra project envisages diversion of 475 thousand cusecs of flood flow from the main Brahmaputra river into the Old Brahmaputra course. The latter will be dredged, and the flood water will be let into the Meghna through the three arms leading to Bhairab Bazar, Narsingdhi and Kalagachia. It is also proposed to revive the various dead spill channels, such as Sangshi, Banar and other Lakhya system rivers, by diverting part of the flood water into them. The project is expected to reduce the intensity of flood in the main river and irrigate 1.2 million acres during the dry

season. The hydro-electric potential of the project may be of the order of 87,000 kw. Navigation facilities will be improved by keeping open the waterways along various routes, now dead, to important centres of trade and commerce.

43. A sum of Rs. 30 million is provided for continuation of investigations and study of feasibility, and for starting construction on schemes for which economic and technical feasibility can be established.

44. The reclamation of *haor* areas is estimated to cost Rs. 150 million, of which Rs. 50 million will be spent during the Plan period. The Tipperah-Chittagong multipurpose scheme aims at serving navigation and irrigation, at an estimated cost of about Rs. 200 million. A sum of Rs. 10 million is provided for general investigations, and for starting construction late in the Plan period, if investigations establish the need and feasibility of the proposal.

45. In contrast to the humid East Pakistan, dependable flow supplies are always at a premium in the predominantly arid West Pakistan. In the Indus Basin, on completion of the Gudu Barrage, the unregulated river flows will have been fully committed, so that in the multipurpose pattern of West Pakistan, dams and storages must be built and operated for irrigation, reclamation and hydro-electric power. The development might help to mitigate flood damage until the river channels have deteriorated and need has arisen for corrective works. West Pakistan is faced with many difficulties and uncertainties. It will have to find alternative sources of supply for its irrigation now dependent on the eastern rivers—the Sutlej, the Beas, and the Ravi. Irrigation and reclamation requirements indicate the urgent need for new storage. Feasible sites are available, but the immediate resources do not permit exploitation of storage capacity beyond what is contemplated in the Indus Basin replacement works. A number of possibilities of multipurpose development exist in some of the less-developed parts of West Pakistan. Provision was made in the First Plan for investigations, surveys, and the preparation of detailed projects, but no projects have yet been formulated. Provision is made for such studies in the Second Plan. Provision has been made for the completion of the Warsak project.

Irrigation

46. The total amount allocated to single-purpose irrigation works in the Plan is Rs. 437 million, of which Rs. 274 million will be spent on schemes already in progress—the Kotri, Gudu, Taunsa, Thal and Warsak canals. The total amount to be invested on irrigation is larger, because it includes substantial investment on multipurpose, drainage, reclamation and tubewell schemes, and because of the inclusion of Rs. 110 million for open canals as a part of this programme. The implementation of the Rs. 437 million programme will make available by 1965 an additional irrigated area of 1.88 million acres of which 1.14 million acres will be covered by schemes already under way, and 740,000 acres by new schemes. This should make further increases possible later.

47. In East Pakistan, the Tangon project, on which investigations were started in the First Plan period, is scheduled for completion by 1965. It is designed to utilize the low heads of the Tangon and Koratoya rivers by means of three barrages and canals, ultimately irrigating about 154,000 acres in the Dinajpur district. A scheme comprising 300 tubewells and 80 small low-lift pumps for pumping surface water from local streams, all to be energized from a central diesel power station, is proposed for such high areas in the districts of Dinajpur, Rangpur, Pabna and Rajshahi as cannot be irrigated from the Tangon or Teesta scheme. The scheme, which is estimated to cost Rs. 36.2 million, will irrigate an area of about 100,000 acres, and will be completed by 1965. Provision has also been made for about 16 small irrigation schemes throughout the Province. A large number of low-lift pumps to be operated by private persons will also be commissioned.

48. The irrigation programme in the Indus Basin comprises mostly schemes already in progress. On the Thal project the work on colonization is behind schedule but is expected to be completed by 1965. In the Kotri project, work on colonization and the construction and remodelling of the canal network is under way, and is scheduled for completion by 1963. The Taunsa project was formally opened in March 1959, and the work on the distribution system will be completed during the Plan period. The Gudu project was to be completed in 1958, but has been delayed for various reasons. The headworks are now expected to be completed by 1962. Work on the canals and distributaries is already in hand. The Warsak canal system is now scheduled for completion in 1961. On completion of Warsak canals which will utilize the regulated waters of the Kabul river, the Bara Nala water supplies will become surplus. The Bara canal scheme will use this surplus for the perennial irrigation of about 20,000 acres, and intermittent irrigation of an additional 40,000 acres. In addition to the flow irrigation projects, pump irrigation from streams and canals holds promise of opening up new areas. The Plan makes provision for a pilot pumping scheme on the Nara canal of the Sukkur barrage to irrigate 5,000 acres. Provision has been made for small irrigation schemes throughout the Province. These will comprise diversion bunds, electric and diesel pumping sets and tubewells. Provision has also been made for subsidizing, through the Department of Agriculture, some 700 tubewells and 2,000 percolation wells to help promote intensive regional development where water conservation needs are more pressing. The Isplingi valley in Kalat division, having additional untapped ground water resources, offers opportunities for intensive development of crops and livestock through irrigation. Special attention will also be given to the development of the Porali Basin.

49. The Frontier Regions, apart from benefiting from other irrigation and tubewell schemes undertaken in the Province, are allocated an additional Rs. 10 million to be spent on irrigation works suitable for their special conditions and requirements.

50. The Coastal and Desert Streams region suffers from lack of adequate information on local hydrology. Planned development in the area must

therefore await detailed investigations and collection of requisite data, for which a provision is made in the Plan. In addition, a provision of Rs. 14 million has been made for minor schemes, including tubewells, on the assumption that feasible schemes will be formulated.

Drainage, reclamation, and tubewells

51. Considerable increments in agricultural production can be achieved through drainage, reclamation, and tubewells. This programme is concerned with West Pakistan only ; East Pakistan's needs are covered by multipurpose development, irrigation, and flood regulation. In the Indus basin especially, lands have gradually deteriorated, and production has decreased, because of maladjustment of land and water resources, lack of adequate drainage, inadequate and unsound water applications, continuous mining of natural fertility, defective agricultural practices, and similar factors. Above all, the deterioration is attributable to the lack of adequate drainage, the consequent rise of the water table and the salinization of land. Salinity and waterlogging pose a serious threat to the national economy. It is estimated that over 50 per cent of the irrigated land is affected, an area of some 12 million acres. Control of salinity and waterlogging presents a gigantic problem ; the cost of drainage, creation of additional water supplies through storage, and revamping of the canal systems needed to deal with the problem effectively has been calculated to be as high as Rs. 25,000 million. Expenditures on this scale are clearly well beyond the resources of the country. In the circumstances, measures to control and depress the water table, and to reclaim the land, will have to be spread over several Plan periods. This is an unfortunate position, since the great urgency of counteracting the menace of salinity and waterlogging is incontestable.

52. Progress in implementation of the drainage programme in the First Plan period was slow. Detailed investigations and surveys have now, however, been undertaken over almost the whole of the basin. The Plan provides Rs. 103.2 million for drainage to be developed in practically every irrigation scheme area. About 1,000 miles of open drains are to be constructed —insufficient to meet total requirements, but large in comparison with achievements in the First Plan. The programme is given a high priority, and additional funds will be allocated if this is warranted by the rate of progress. Drainage of irrigated lands will need much sustained effort. Public cooperation and participation are indispensable in such ventures. Neither the resources of the Government nor those of the land-users are, by themselves, adequate to implement an effective drainage programme, but their combined efforts can succeed. The main and secondary drains should be provided by the Government ; the field drains, on the analogy of water courses, should be constructed, operated and maintained by the farmers and land-owners themselves. The Government will provide the requisite technical guidance. In the drainage of irrigated lands, group action is essential ; this can be mobilized through the Village AID Organization, or by creating semi-public organizations under Provincial laws.

53. Strategically located tubewells have been advocated as the principal method for solving the drainage and salinity problem. The argument is that through pumping, the water table can be depressed and controlled, and water so obtained can be utilized for leaching the salts below the crop root level and for irrigation. Eight reclamation schemes covering an area of 480,000 acres initiated in the First Plan were later incorporated into a single comprehensive salinity control and reclamation project. The scheme envisages drilling of 2,200 tubewells designed to serve an area of 1.6 million acres in the Rechna and Chaj doabs, to be completed in 1961 at an estimated cost of Rs. 68 million, excluding the cost of an electric distribution system. The Plan provides for completing the project, with an additional Rs. 30 million to be lent to the Soil Reclamation Board for providing physical facilities for the application of new and existing water and reclamation techniques efficiently. Tubewells, however may not provide the complete solution, unless the conditions are ideal, which is rare. The solution of such problems seems to lie in providing both surface and sub-surface drainage, the latter combining in varying degree open drains, closed drains, and pumped well. It is, therefore, necessary that the effectiveness of the programme under execution should be studied by a body of experts, before launching another substantial tubewell programme. Provisionally an additional sum of Rs. 40 million has been provided for similar tubewells in other suitable areas.

Flood regulation

54. Floods have occurred frequently, and with great severity, causing enormous losses and misery. It has been estimated that in East Pakistan alone in the three successive years 1954 to 1956, the rice area partially or totally damaged was of the order of 8.3 million acres. The corresponding loss in agricultural production has been put at 1.717 million tons, valued at Rs. 468 million. Enormous losses have occurred also in West Pakistan from time to time. Here the high embankments of the new link canals, cutting across the natural drainage, have aggravated an already bad situation.

55. A Flood Commission for East Pakistan was established in December 1955, and a Flood Control Board in June 1956. A United Nations Water Control Mission studied the flood control and water resources development problems of East Pakistan in 1956-57. In 1957 the Government of West Pakistan created the West Pakistan Flood Commission to prepare an integrated basin-wide flood control plan. For want of adequate basic data, however, no comprehensive flood control measures have so far been formulated in either Province.

56. The Plan provides a sum of Rs. 310.2 million for flood regulation, of which Rs. 56.37 million will be spent on schemes now under way. Almost four-fifths of this allocation will be spent in East Pakistan, where an area of 800,000 acres is likely to be improved. The work consists primarily of opening up congested channels, thereby decreasing the time of inundation of land, and providing for earlier agricultural activities. The programme includes

protective embankments and channel realignment to reduce damage to health and property from ponded water. East Pakistan's allocation of Rs. 245.5 million includes Rs. 35.27 million for schemes in progress. Five of a total of six large schemes will be completed during the Plan period : the Faridpur drainage scheme ; the Feni sub-division flood reduction scheme; re-excavation of Ghungur, Salda and Buri Nadi in Tippera district ; strengthening of embankments of the Gumti river ; and dredging of the Gumti. East Pakistan will also complete a number of small schemes. It will further undertake new schemes, including the raising, strengthening, and construction of tidal embankments, draining of the Sadar sub-division of Noakhali district, flood regulation in the area between Surma and Kushiya, improvement of the Manu river, resuscitation of the Ichamati river in the Pabna district, and a number of other schemes.

57. West Pakistan will complete the four schemes under execution—the Kot Hafiz Scheme, Bara and Chilla Nallah, rehabilitation of river bunds, and provision of mobile wireless sets to complete a flood warning system on the major rivers. The cost of this programme is Rs. 21.10 million. Another Rs. 43.60 million will be spent on new schemes, including a twenty-mile river bund near Kashmore, remodelling of Balloki barrage, detention dams in Dera Ghazi Khan, and provision for such further measures of flood control as may be recommended by the West Pakistan Flood Commission. In the Coastal and Desert Streams region, the streams are subject to flash floods, with peaks which are sharp but of low total volume. Such floods wash away the *bunds* constructed by cultivators to divert the flow to cultivable lands. Steps will be taken to build permanent structures both to control floods and to provide irrigation.

Open canals

58. West Pakistan has a network of canals, a large number of diversion works, and a growing mileage of embankments and drains. Considerable sums are expended annually on their extension, improvement, and replacement. This expenditure was not included in the First Plan. A sum of Rs. 110 million is provided in the Second Plan.

Power

59. The objectives of the power programme in the Plan are :

- (i) to install additional generating capacity to meet increased power demand during the Plan period ;
- (ii) to provide transmission and distribution facilities to meet the growing and diverse demands over large areas ; and
- (iii) to make a modest beginning with electrification of rural areas.

The Plan provides Rs. 950.5 million for power schemes in the public sector, Rs. 288.1 million to be spent in East Pakistan and the balance in West Pakistan. Of the total, Rs. 320 million will be spent on schemes already in progress. The Karachi Electric Supply Corporation is expected to invest Rs. 190 million during the Plan period.