

PROJECT INFORMATION DOCUMENT (PID) CONCEPT STAGE

Report No.: PIDC3319

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| Project Name | PK-Sindh Barrages Improvement Phase I Project (P131324) |
| Region | SOUTH ASIA |
| Country | Pakistan |
| Sector(s) | Irrigation and drainage (70%), General water, sanitation and flood protection sector (30%) |
| Theme(s) | Water resource management (60%), Rural services and infrastructure (20%), Social risk mitigation (10%), Climate change (5%), Other environment and natural resources management (5%) |
| Lending Instrument | Specific Investment Loan |
| Project ID | P131324 |
| Borrower(s) | Economics Affairs Division, Government of Pakistan |
| Implementing Agency | Sindh Irrigation and Power Department |
| Environmental Category | A-Full Assessment |
| Date PID Prepared/ Updated | 05-Feb-2014 |
| Date PID Approved/ Disclosed | 06-Feb-2014 |
| Estimated Date of Appraisal Completion | 25-Jul-2014 |
| Estimated Date of Board Approval | 16-Dec-2014 |
| Concept Review Decision | |

I. Introduction and Context

Country Context

1. Pakistan's economy has experienced recent declines in economic growth rates, falling from a high of 8% in 2007 to a recent estimation for 2013 of 3%. Much of the economic slowdown can be attributed to deteriorating and increasingly unpredictable macroeconomic and security conditions, as well as recent catastrophic natural disasters. Predictions of continued economic slowdown combined with growing concerns over debt, external financing, and fiscal weaknesses will continue to challenge the country.

2. Agriculture remains a mainstay of the national economy. Over recent decades Pakistan's agriculture has made major gains, playing an important role in the achievement of national objectives related to economic growth, food security, poverty reduction, social stability, and trade.

The sector accounts for about 23% of Gross Domestic Product (GDP) and employs about 44% of the labor force. Around a quarter of Pakistan's land area is under cultivation and is watered by the largest contiguous irrigation and canal system in the world, the Indus Basin Irrigation System (IBIS). IBIS accounts for approximately US\$300 billion of investment (at current rates), 22% of the country's Gross Domestic Product (GDP), 65% of its employment, and 70% of its export earnings.

3. Annually 120 billion cubic meters of the Indus water (out of 176 billion m³) is diverted through IBIS dams, barrages and canals to feed the irrigation sector. The hydrograph of the river is strongly seasonal with a long low-water season between October and March and a high-water season between April and September, driven primarily by snowmelt in the upper catchment and monsoon rainfall. The river usually peaks in mid-August or early September. The river carries large sediment loads due to widespread and rapid erosion in its upper catchment. It is estimated that about one billion m³ of sediment is deposited in its floodplain each year.

4. Sindh Province is home to over 52 million people. Over 60% of the population lives in rural areas where poverty is pervasive. A large number of the rural population of Sindh lives below the poverty line. The Indus river water is especially important to agriculture and the livelihoods of the population. It is estimated that the poor derive 56% of their income from agriculture. In addition, Sindh makes up a large portion (26%) of Pakistan's cultivated area and produces about a quarter (24%) of major irrigated crops, such as cotton, rice, sugarcane, and wheat. The water management areas i.e. the cultivable command area is of order of 5.1 million ha. The actual irrigated area varies from year to year depending on availability of canal water.

Sectoral and Institutional Context

5. Pakistan's agricultural sector is almost wholly dependent on irrigation: irrigated land supplies more than 90 percent of agricultural production. Agriculture in most areas is not possible without irrigation because the climate of Pakistan is arid to semi-arid with low and variable rainfall. Annual rainfall over much of the area is not more than 150 mm per annum with high evaporation rates, ranging from 1,250 mm to 2,800 mm per annum.

6. Given climate change and high population growth rates, current forms of water resources management are widely recognized as being unsustainable and inadequate to ensure future water availability for food security, economic growth, and the needs of the environment.

7. Barrages are strategic hydraulic assets. Barrages are used to raise the water level in the river so that irrigation water can be diverted to the main and link canals by gravity for various uses. Barrages are also used for river control and flood management, act as a source of water supply for all sectors of the economy, function as bridges over rivers, and are often used for utility crossings such as gas pipelines. Therefore, the condition and the safe and reliable operation of a barrage have far-reaching implications for the livelihood and economic growth of all segments of society.

8. Priorities for Improvement of Barrages in Sindh. Three large barrages were built between 1932 and 1962 on the Indus River in Sindh province. The northern one, Guddu Barrage, has developed major safety issues. The second one, Sukkur barrage, is one of the oldest and serves about 3 million hectares of agricultural lands. Over the decades, it has also developed safety issues. Repairs on the Sukkur Barrage are being carried out regularly. The last one (most southerly), the Kotri Barrage, was rehabilitated in 2000.

9. The project area is dry with a mean annual rainfall of less than 88 mm. There are two wet seasons: the first with low rainfall in February and March and second with higher rainfall in the monsoon period of July, August, and September. About 80% of the mean annual rainfall occurs in the two wet seasons.

10. Guddu barrage. The primary function of the gated Guddu barrage is to provide irrigation water to over one million hectares of agricultural lands in the Jacobabad, Larkana and Sukkur districts of Sindh and the Naseerabad district of Balochistan, by feeding the Ghotki Feeder and Rainee canals on the left (east) side and the Begari Sindh (BS) Feeder and Desert Pat Feeder canals on the right (west) side. The barrage incorporates two fish ladders. The barrage is also used for river control and flood management. It has been designed to pass a super-flood discharge of up to 33,980 cubic meters per seconds (m³/sec). The barrage is also an important transport link across the River Indus and provides cooling water for the thermal power station at Guddu. Two major gas lines cross the barrage. The barrage was commissioned in 1962 and has now seen over fifty years of active service. It consists of 64 gates of 18 meters each and one navigation lock with a span of 15 meters. The gates weighing 55 to 100 tons are “fixed wheel” type and operate without counterweights.

11. Rehabilitation and modernization of Guddu barrage is needed. A recently completed feasibility study by an international engineering consulting firm, which was commissioned by the Government of Sindh, indicates that there are serious operational difficulties and safety issues, the most severe problems being: i) up to 60% of the steel of the 65 gates on the main barrage is badly corroded; ii) the lifting mechanisms are badly corroded, with a strong possibility of failure; iii) the switch panels and power distribution network are in extremely poor condition; and iv) there is no backup power supply system in case of power failures. Currently stress levels within the gates are already in excess of the allowable design stresses during normal operation. Since the rate of corrosion cannot be slowed it is considered likely that the gates will fail during normal operation within 5 years. There is already at risk now that the gates may fail in case of a flood event that necessitates opening and closing. Such a failure is likely to be catastrophic, affecting water supplies to all the irrigated areas supplied by the barrage. Due to the recent flood events upstream embankments were breached. The embankments around the Guddu barrage require upgrading to meet the new criteria: they must be able to withstand 1:100 year floods.

12. Pakistan is already one of the most climate-vulnerable countries in the world due to its complex geography (e.g. high evaporation rate, monsoon influence, and glacier dynamics). Climate change is expected to increase the occurrence of extreme climatic events (such as floods), and the temporal and spatial availability of water. The expected changes in river discharge rate will alter the physical forces exerted on the barrage and pose risks to its operation, safety, and structural integrity. With the possibility of higher future flows due to climate change and increased retrogression, project interventions are even more vital to ensure the safety of the barrage. Recently the government has started to explore the combination of “hard” interventions (to protect high-value infrastructure such as barrages) and “soft” interventions (smart adaptation to living with floods), which have been used to considerable effect in countries as diverse as the United States and the Netherlands and are a globally-accepted best practice.

13. Institutional challenges and reform. Pakistan has a long- and well-established tradition of water entitlements. The 1991 Provincial Water Accord established clear entitlements for each province to surface waters. Implicit in the Water Accord is a set of water entitlements at the canal command level. In large areas of the system these entitlements serve as the basis for allocation of water among

canal commands. There are also well-established rules for further distributing water to the distributary canals and canal outlets. The water economy of Pakistan depends fundamentally on a gigantic hydraulic infrastructure system. The major challenge which has to be addressed is how to maintain what has been built. Many elements of the vast hydraulic system are now reaching the end of their design lives such as the Guddu barrage, and have to be rebuilt. The barrages are classic “public goods”, and as strategic assets would remain under public management even after the transformation of the irrigation system under the current reform program.

Relationship to CAS

14. The Bank’s Country Partnership Strategy (CPS) for 2010-14 emphasizes among other things the need for improving infrastructure to support growth (Pillar 3). Under Pillar 3, improved sustainability of water and irrigation systems contributes to the “sub-pillar” of strengthened irrigation infrastructure and agricultural competitiveness.

II. Proposed Development Objective(s)

Proposed Development Objective(s) (From PCN)

The development objective is to safeguard the reliable supply of water to about 1 million hectares through the rehabilitation of the Guddu barrage and the improvement of O&M capacity of the Irrigation and Power Department.

Key Results (From PCN)

The success of the project will be measured using the following main indicators:

- 244,480 farmers’ households provided with reliable irrigation water.
- 1 million ha provided with reliable irrigation water
- Improved operation and maintenance

Intermediate indicators are:

- 65 barrage gates and mechanical lifting equipment replaced.
- 25 main canal head regulator gates replaced
- 40 km of embankments rehabilitated.
- Barrage management organization established within IPD.

III. Preliminary Description

Concept Description

17. The project is confined to a single site and involves works that have been designed in detail based on a well-prepared detailed Feasibility Study (FS) of an international standard. The project involves mechanical and civil works on the existing barrage structure (rehabilitation), and no new works are included. By far the largest and most complex element of these works is the removal and replacement of the 65 barrage gates and 25 head regulator gates. A detailed inspection of each gate shows that wear and tear on the gates, rollers and hoists is considerable and that the probability of failure is evident. There is considerable risk of failure of the main barrage gates within the next five years. Considering that it will take about four years for the project to be completed and for all the gates and mechanical equipment to be replaced, the proposed project needs to proceed, so that the gates are replaced before any failure occur.

18. During project preparation a detailed assessment will be carried out aimed at identifying potential adverse impacts of the project such as (a) possible canal closures during implementation, and (b) possible negative impacts on flora and fauna. As the project involves large-scale rehabilitation works on the existing barrage, there is a possibility of interruption of water supplies through canal closures for a short or longer duration. Also, the project may impact on flora and fauna: the Indus River between the Guddu and Sukkur barrages is a very important game reserve and habitat for the Indus or Blind Dolphin (*Platanista gangetica minor*). This part of the river contains almost 60% of the entire population of this river dolphin in Pakistan. Therefore, the project is categorized as an Environmental Category “A” project, requiring thorough environmental and social assessment, development of social impact and environmental management plans, consultations with a wide spectrum of stakeholders, disclosure of mitigation measures, and their diligent implementation and monitoring. The project has the following three components.

19. Component A: Rehabilitation of Barrage (US\$140 million). This component will support rehabilitation and modernization of the barrage and its associated structures. The works have been determined based on (a) detailed diagnostic assessment; (b) hydrological and sediment analysis studies including physical and numerical model studies; and (c) geotechnical, structural, and safety evaluation studies. The component will finance gate replacement works to improve the regulation and the flow of the barrage. This includes replacing all 65 main barrage steel gates (the gates are 18.3 m wide and 6.6 m high and weigh 55 tons each), 25 main canal head regulator gates (the gates are 7.3 wide and 3.8 high and weigh 25 tons each) and hoist gears. It also includes providing new standby generators, electrical cabling and switch gears, replacement of barrage lighting, repairs to the barrage life-bridge and safety barriers, as well as rehabilitation of the three main canal head regulators. In addition, this component finances the strengthening of embankments to ensure improved flood protection. Minor concrete repairs are needed along some of the upstream gate grooves and both fish ladders require rehabilitation.

20. Component B: Improved Barrage Operation (US\$15 million). This component will support modernization and improvements to the barrage operation and maintenance. This will include necessary upgrades to the instrument monitoring systems such as piezometers, gate positioning and gauging, training and capacity building for staff, replacement of surveillance and maintenance boats and procurement of hydrographic equipment. The project will provide new covered workshops and a stock of spare parts for maintenance activities. The instrument monitoring system for the barrage will be renovated and the operating staff will be equipped with an upgraded operation, maintenance, and surveillance manual. An emergency preparedness plan will be prepared. The emergency plan will specify the actors and actions in relation to the following chain of tasks: (a) detection and classification of any potential problem at the barrage site; (b) decision to notify and warn competent authorities; and (c) mobilization of response units when needed. This component will lead to upgrading of the operating facilities with a higher level of control and improved operation & maintenance.

21. Component C: Project Management and Monitoring and Evaluation (US\$15 million). This component will support the coordination of all project-related activities as well as training and technical assistance in procurement, financial, social and environmental safeguards and communication. This component will also cover the cost of consulting services including construction supervision, contract administration, quality control, preparation of any additional designs, and bidding documents. Activities will include the establishment of an independent Panel of Experts (POEs) to review, monitor, evaluate, and help guide the rehabilitation process with

regard to the safety of the barrage. The component will also support implementation of an information dissemination and communication program, particularly regarding possible canal closures and implementation of the safeguard related action plans.

22. A social development action plan and an environmental management plan will be developed based on detailed surveys, social and environmental studies, and consultations with local communities in the command areas and areas around the barrage. This component will support the implementation of these two plans. If necessary, this component will also support the implementation of a resettlement action plan.

IV. Safeguard Policies that might apply

| Safeguard Policies Triggered by the Project | Yes | No | TBD |
|--|-----|----|-----|
| Environmental Assessment OP/BP 4.01 | x | | |
| Natural Habitats OP/BP 4.04 | x | | |
| Forests OP/BP 4.36 | | | x |
| Pest Management OP 4.09 | | x | |
| Physical Cultural Resources OP/BP 4.11 | | x | |
| Indigenous Peoples OP/BP 4.10 | | x | |
| Involuntary Resettlement OP/BP 4.12 | | | x |
| Safety of Dams OP/BP 4.37 | x | | |
| Projects on International Waterways OP/BP 7.50 | | x | |
| Projects in Disputed Areas OP/BP 7.60 | | x | |

V. Financing (in USD Million)

| | | | |
|---|--------|-----------------------|---------------|
| Total Project Cost: | 170.00 | Total Bank Financing: | 160.00 |
| Financing Gap: | 0.00 | | |
| Financing Source | | | Amount |
| BORROWER/RECIPIENT | | | 10.00 |
| International Development Association (IDA) | | | 160.00 |
| Total | | | 170.00 |

VI. Contact point

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