

## Appendix4-2. Minutes of Discussions

**Minutes of Discussions  
on  
the Preparatory Survey  
for  
the Project for the Installation of Weather Surveillance Radar at Sukkur  
in  
the Islamic Republic of Pakistan  
(Explanation on Draft Preparatory Survey Report)**

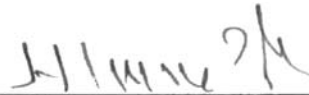
With reference to the minutes of discussions signed between Pakistan Meteorological Department (hereinafter referred to as "PMD") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on June 21, 2019 and in response to the request from the Government of the Islamic Republic of Pakistan (hereinafter referred to as "Pakistan") dated 31<sup>st</sup> December 2019, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for the Installation of Weather Surveillance Radar at Sukkur in the Islamic Republic of Pakistan (hereinafter referred to as "the Project").

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Islamabad, January 29, 2020



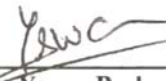
**Mr. Kunio Akatsu**  
Team Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



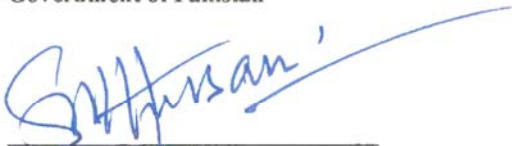
**Mr. Muhammad Riaz**  
Director General  
Pakistan Meteorological Department  
Aviation Division  
Government of Pakistan



**Mr. Muhammad Idrees Mahsud**  
Member  
Disaster Risk Reduction  
National Disaster Management Authority  
Government of Pakistan



**Mr. Yawar Rasheed**  
Assistant Engineer (Floods)  
Federal Flood Commission, Ministry of Water  
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**Syed Mujtaba Hussian**  
Joint Secretary  
Economic Affairs Division  
Government of Pakistan



## ATTACHMENTS

1. Objective of the Project  
The objective of the Project is to improve the PMD's capabilities in meteorological observation, weather forecasting and dissemination of forecast/warnings through the installation of a Weather Surveillance Radar System at Sukkur in the Islamic Republic of Pakistan. This will largely contribute to the mitigation of damages caused by natural/hydro-meteorological disasters in Pakistan which are predicted to increase due to climate change.
2. Title of the Preparatory Survey  
Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for the Installation of Weather Surveillance Radar at Sukkur in the Islamic Republic of Pakistan".
3. Project Site  
Both sides confirmed that the site of the Project is Sukkur (PMD Meteorological Observatory, Rohri-Sukkur in Sindh) which is shown in **Annex 1**.
4. Responsible/ Sponsoring Agency and Implementing Agency  
Both sides confirmed the responsible/ sponsoring agency and implementing agency as follows:
  - 4-1. The Responsible/ Sponsoring Agency: Aviation Division, Cabinet Secretariat.
  - 4-2. The Implementing Agency: Pakistan Meteorological Department (hereinafter referred to as "PMD"). The organization chart of PMD is shown in **Annex 2**.
  - 4-3. The Coordinating Agencies: Economic Affairs Division (EAD), National Disaster Management Authority (NDMA, under the domain of NDMP) and Federal Flood Commission (FFC for contributing in improvements of flood forecasting and warning on countrywide basis including NFPP-IV).
5. Contents of the Draft Report  
After the explanation of the contents of the Draft Report by the Team, the Pakistan side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Pakistan side around June 2020.
6. Cost estimate  
Both sides confirmed that the cost estimate including the contingency explained by the Team is provisional and will be examined further by the Government of Japan for its approval. The contingency under Japanese Grant would cover the additional cost against natural disaster, unexpected natural conditions, etc.
7. Confidentiality of the cost estimate and technical specifications  
Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.
8. Procedures and Basic Principles of Japanese Grant  
The Pakistan side agreed that the procedures and basic principles of Japanese Grant as described in **Annex 3** shall be applied to the Project. In addition, the Pakistan side agreed to take necessary measures according to the procedures.

9. Timeline for the project implementation

The Team explained to the Pakistan side that the expected timeline for the project implementation is as attached in **Annex 4**.

10. Expected outcomes and indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Pakistan side will be responsible for the achievement of agreed key indicators targeted in year 2026 and shall monitor the progress based on those indicators.

[Quantitative indicators]

Table: Achievement Indicators

Indicators	Present (Baseline in 2020)	Target (2026) (3 years after the Project Completion)
Improvement in the observation density of meteorological information (rainfall, wind direction & speed) provided to organizations related to Disaster Risk Reduction (DRR)	Spatial resolution of the latest 45 automatic observation systems in Punjab and Sindh Provinces: 88 km mesh on average	<ul style="list-style-type: none"> <li>Spatial resolution for precipitation data calibrated with Synoptic Meteorological Observation data within the maximum radar detection range between 450 km: approx. 1 km mesh.</li> <li>Spatial resolution for wind speed &amp; direction data calibrated with Synoptic Meteorological Observation data within the maximum radar detection range within 200 km: approx. 1 km mesh.</li> </ul>
Improvement in the temporal observation ability of meteorological information (rainfall, wind direction & speed) provided to organizations related to Disaster Risk Reduction (DRR)	Time interval of meteorological information (rainfall, wind direction & speed) obtained in the area <ul style="list-style-type: none"> <li>Meteorological Satellite: 30-minute.</li> <li>Synoptic Meteorological Observation: 1hour.</li> </ul>	Time intervals of radar observation data calibrated with Synoptic Meteorological Observation data: 10-minutes.

[Qualitative indicators]

- a) To enable DRR-related organizations (NDMA and its allied DRR authorities in provinces and districts) and mass-media to timely response and commence necessary countermeasures against disasters in order to reduce the number of potential disaster victims.
- b) To ensure aviation safety connecting to contribute to the improvement of social infrastructures through the provision of timely and accurate information to the international airports in Pakistan.
- c) To promote the implementation of DRR measures in order to reduce economic losses, through the provision of accurate weather information to users engaged in industries such as transportation, tourism and agriculture.

11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, and Sustainability). The result of the evaluation will be publicized. Pakistan side is required to provide necessary support for the data collection.

#### 12. Technical assistance (“Soft Component” of the Project)

Considering the sustainable operation and maintenance (O & M) of the products and services granted through the Project, following technical assistance is planned under the Project. The Pakistan side confirmed to deploy necessary number of counterparts who are appropriate and competent in terms of its purpose of the technical assistance as described in the Draft Report.

#### 13. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in **Annex 5**. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in No.2 of “2)During the Project” of **Annex 5**, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by PMD during the implementation stage of the Project.

The Pakistan side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

Both sides also confirmed that the **Annex 5** will be used as an attachment of G/A.

##### 13.1 Necessary Clearance/ Permit for the Project and Approval of PC-I

Both sides confirmed the timetable of the following key actions for the Project;

- 1) In order to submit the Project to the Japanese Cabinet, PMD shall make effort for seeking approval of PC-I by Central Development Working Party (CDWP)/ Executive Committee of the National Economic Council (ECNEC) by the end of May, 2020. The Team will provide necessary information for preparation of the PC-I by end of February 2020.
- 2) Initial Environmental Examination (IEE) on the Project shall be completed for the approval of PC-I (by the end of February 2020).
- 3) The height clearance (No Objection Certificate) from the relevant authorities such as the Civil Aviation Authority and Pakistan Air Force for construction of a new Meteorological Radar Tower shall be obtained for the approval of PC-I (by mid May 2020).
- 4) The required procedures to obtain regulatory compliance and necessary permissions from the relevant agencies/authorities such as SDA (Sukkur Development Authority) or the Deputy Commissioner office for the construction of the Radar Tower Building in the project site in Sukkur shall be commenced immediately after signing of the Exchange of Notes and Grant Agreement of the Project and shall be completed before the commencement of the tendering procedures.
- 5) The frequencies of the proposed S-Band radar system in Sukkur shall be allocated and allowed by the Pakistan Telecommunication Authority (PTA)/ Frequency Allocation Board (FAB) to the PMD before the commencement of the tendering procedures.
- 6) The Team recommended PMD that the Government of Pakistan shall establish Height Restriction to avoid construction of any building/facility higher than the new Radar Tower Building within 10km radius from the Sukkur Radar site to ensure appropriate Radar observation. PMD agreed to request the relevant authorities

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- to restrict the height limitations set by the Sukkur City Government.
- 7) PMD agreed to make arrangements to provide commercial power supply from the main supply line to the Sukkur Radar site.
  - 8) PMD agreed to make arrangements to provide VPN with the required transmission speed to the Sukkur Radar site in order to connect main network system on PMD.
  - 9) PC-IV shall be submitted right after the completion of the Project.
14. Monitoring during the implementation  
The Project will be monitored by PMD and reported to JICA by using the form of Project Monitoring Report (PMR) attached as **Annex 6**. The timing of submission of the PMR is described in **Annex 5**.
15. Project completion  
Both sides confirmed that the project completes when all the facilities constructed and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly, but in any event not later than six months after completion of the Project.
16. Environmental and Social Considerations
- 16-1 General Issues
- 16-1-1 Environmental Guidelines and Environmental Category  
The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as C because the Project is likely to have minimal adverse impact on the environment under the Guidelines.
- 16-2 Environmental Issues
- 16-2-1 Environmental Impact Assessment (EIA)  
Both sides confirmed the EIA report is not required for the Project in the country's legal system. Initial Environmental Examination (IEE) shall be completed by the end of February 2020.
17. Other Relevant Issues
- 17-1. Security Arrangements  
The Government of Pakistan shall take all possible and necessary measures to ensure the safety of the concerned Japanese and other foreign persons during the implementation of the Project at the Project site and movement to the Project site from their accommodations, whenever Japanese side requests in advance.
- 17-2. Dissemination of Weather Radar Data  
Both sides confirmed: 1) near real-time radar data/products will be provided to the public through PMD web site and also provided to other related organizations through data servers in PMD, and 2) radar data will be archived and be available to other disaster risk reduction related organizations for disaster survey.
- 17-3. Visibility of the Project  
The Pakistan side affirmed the following measures to be taken in order to enhance publicity of the Project:
- (a) Mass media sources
  - (b) Brochures
  - (c) Commemoration panels

#### 17-4. Adaptation to Climate Change

In recent years, the number of tropical cyclones approaching/ landing in Pakistan has increased. To mitigate the impacts of climate change, it is absolutely necessary to monitor activities of the monsoon through the Sukkur meteorological radar system. Therefore, the Project is expected to contribute to climate change adaptation.

#### 17-5. Contribution for Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030:

In March 2015, the Third UN World Conference on Disaster Risk Reduction was held in Sendai, Japan and the Sendai Framework for Disaster Risk Reduction 2015-2030 (hereinafter referred to as "SFDRR 2015-2030") was adopted. The concept of the Project is in line with SFDRR 2015-2030 and priorities for action. Particularly, the Project contributes to implement "**Priority 1: Understanding disaster risk**" through an improved meteorological observation capability, and "**Priority 4: Enhancing disaster preparedness for effective response**" through an improved accuracy of forecasts and warnings.

#### 17-6. Contribution to the National Disaster Management Plan (NDMP)

Both sides confirmed that the Project is in lined with the priority areas identified in the National Disaster Management Plan (NDMP) which has been approved by the National Disaster Management Commission (NDMC), Government of Pakistan in 2012.

#### 17-7. Contribution to the National Flood Protection Plan of Federal Flood Commission (FFC)

Both sides confirmed that the Project is in lined with the priority non-structural interventions identified in Fourth National Flood Protection Plan (NFPP-IV) approved by the Council of Common Interests (CCI), Government of Pakistan in 2017. Being the main coordinating agency of the Government of Pakistan for integrated flood management, FFC will coordinate with other stakeholders to harness the benefits of this Project.

**Annex 1** Project Site

**Annex 2** Organization Chart of PMD

**Annex 3-1** Japanese Grant

**Annex 3-2** Flow Chart of Japanese Grant Procedures

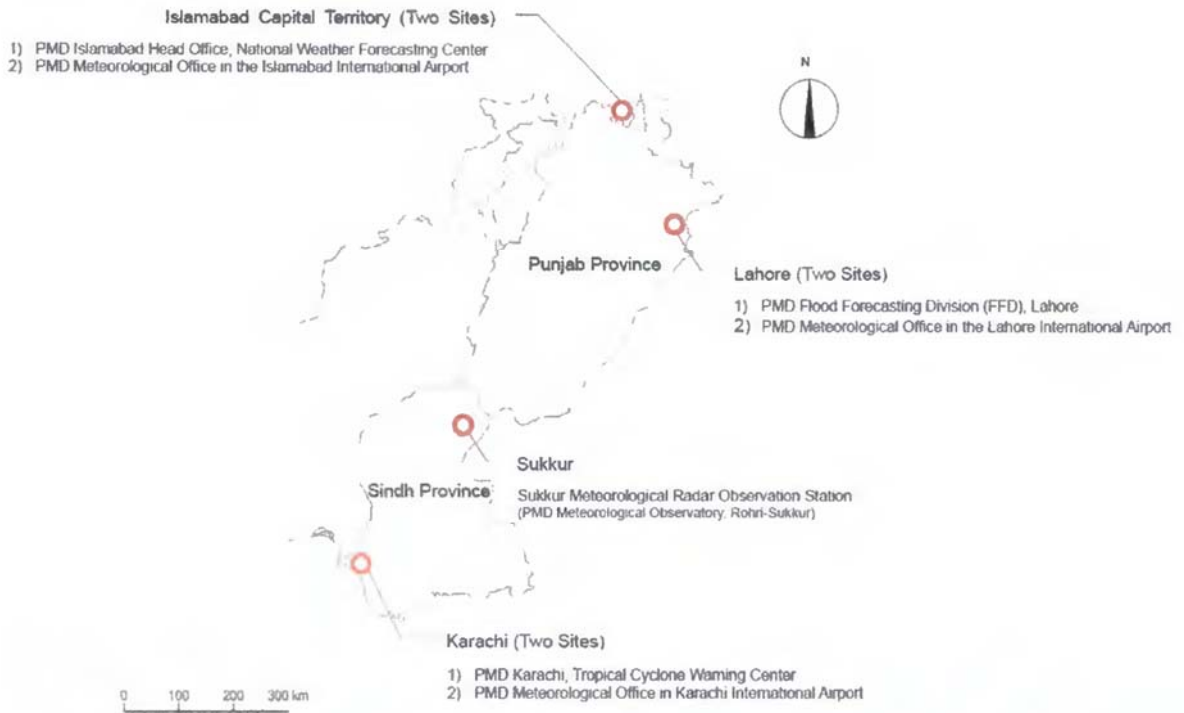
**Annex 3-3** Financial Flow of Japanese Grant

**Annex 4** Project Implementation Schedule

**Annex 5** Major Undertakings to be taken by Recipient Government

**Annex 6** Project Monitoring Report (template)

**■ Islamic Republic of Pakistan**



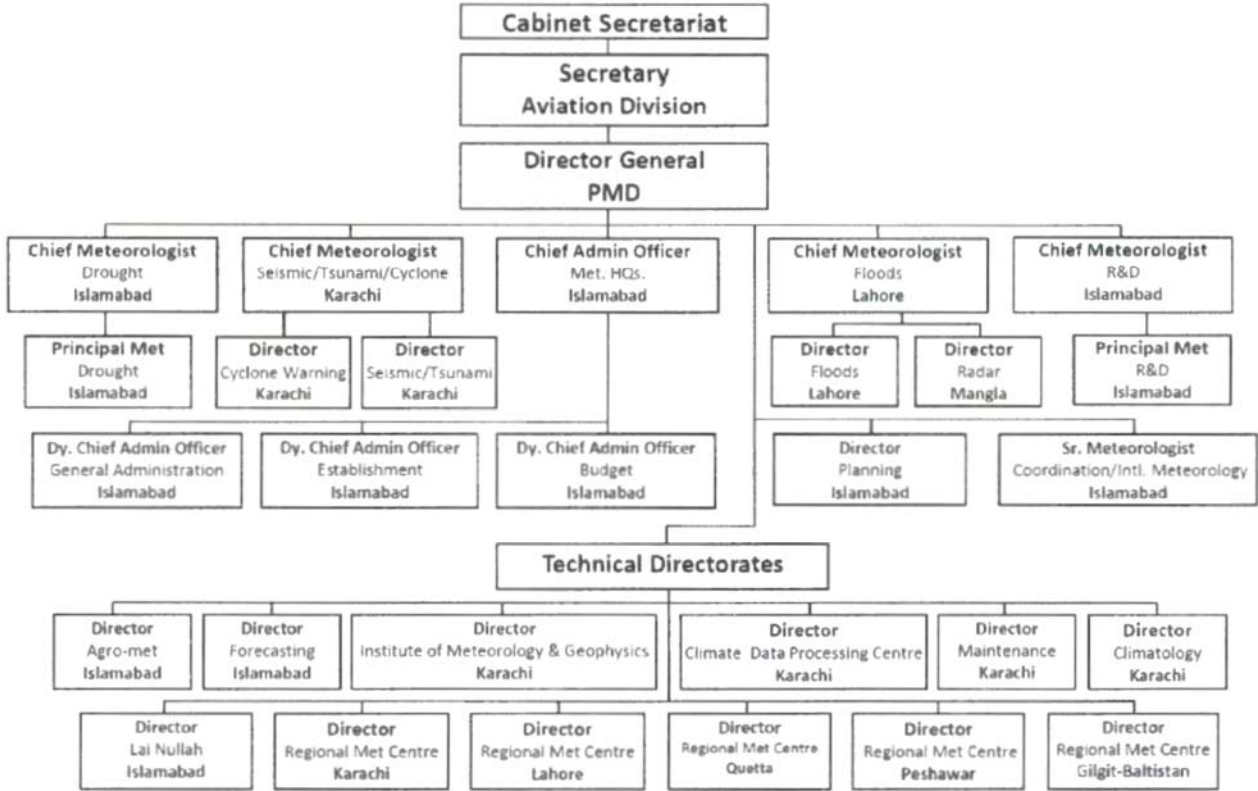
**Project Sites**

**The depiction and use of boundaries, geographic names and related data shown on the map do not necessarily imply official endorsement or acceptance by JICA.**

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**Annex 2**

**ORGANIZATIONAL CHART OF PAKISTAN METEOROLOGICAL DEPARTMENT (PMD)**



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**JAPANESE GRANT**

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

**1. Procedures of Project Grants**

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details)

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

- Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

- Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

- Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage

**2. Preparatory Survey**

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.

- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

**3. Basic Principles of Project Grants**

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the

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Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

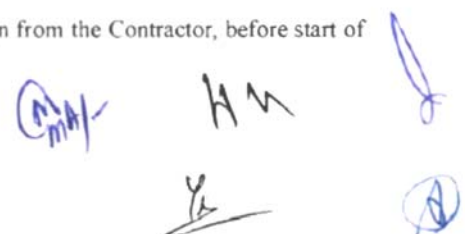
8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.



- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

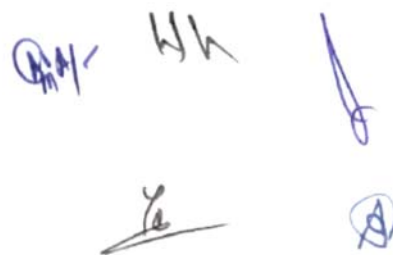
For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

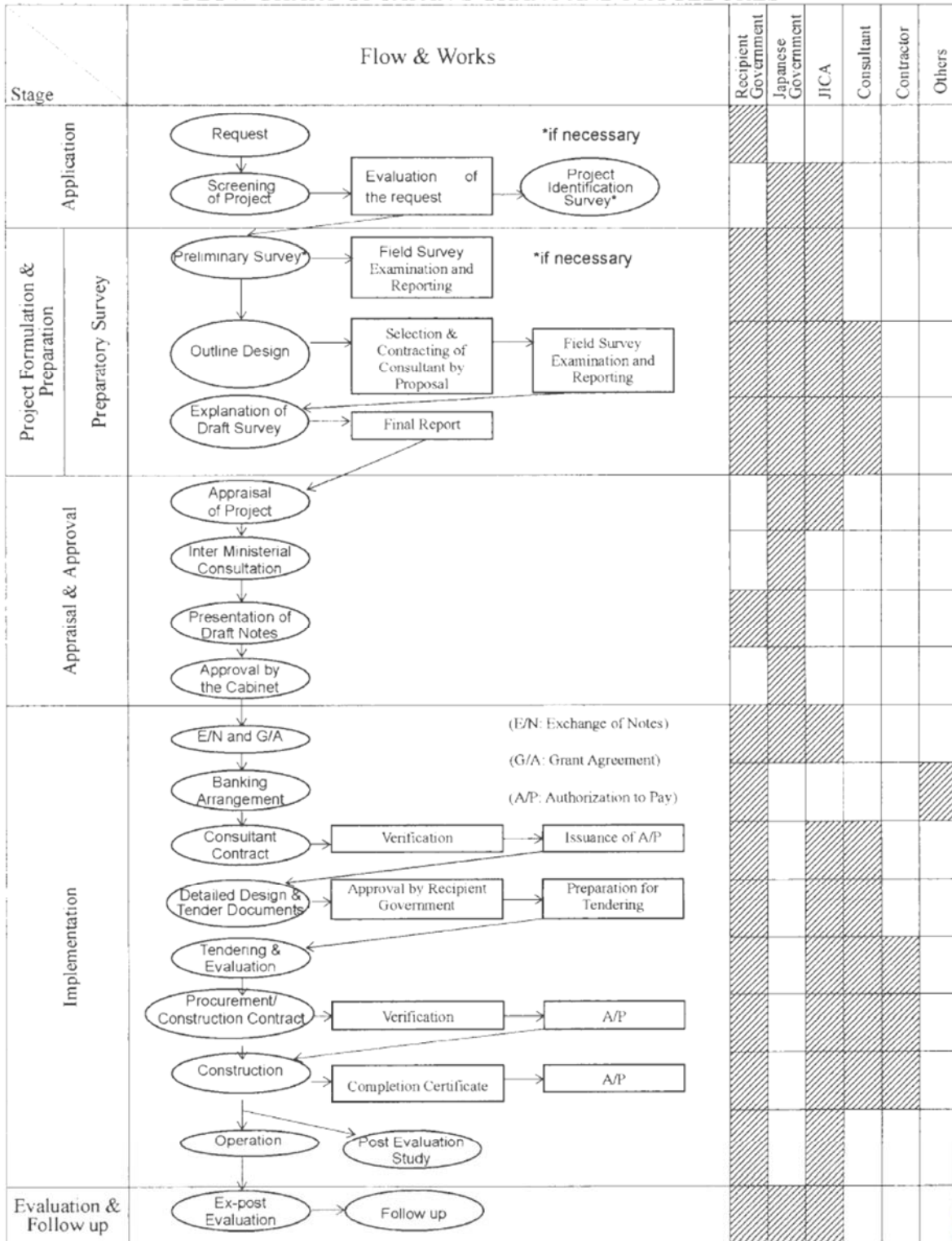
The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

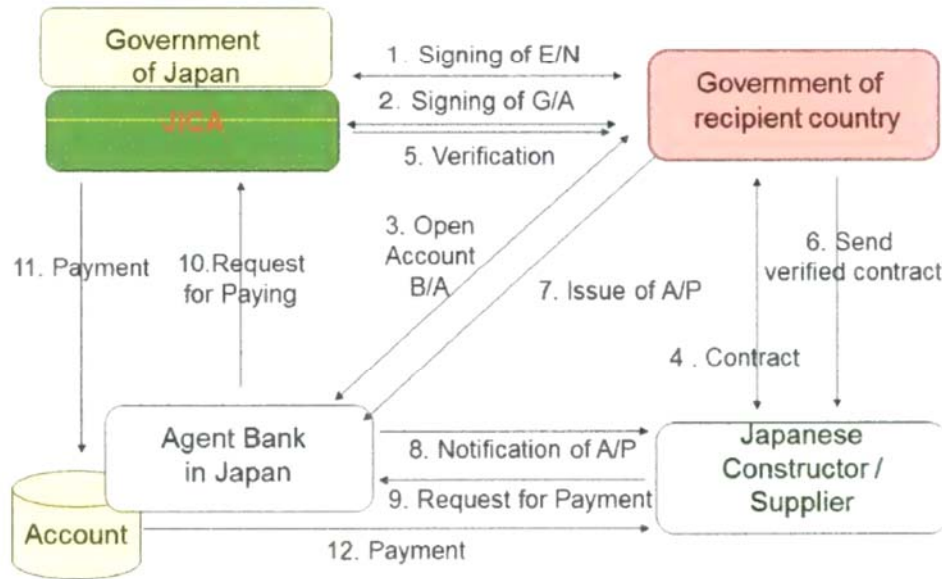
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FLOW CHART OF JAPAN'S GRANT AND PROCEDURES



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Financial Flow of Grant Aid



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**Annex 4**

**Table: Implementation Schedule**

	Month	1	2	3	4	5	6	7	8
Detailed Design & Tendering Procedure									
Detailed Design		█	█						
Tendering Procedure				█	█	█	█	█	█
		Total: 8.0 months							

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
<b>Sukkur Meteorological Radar Observation Station</b>																																									
Construction Work		Total: 22.5 months																																							
Preparation Work/Boundary Wall/Soil Filling		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	
Temporary/Foundation Works																																									
Structure Work																																									
Finishing Work																																									
Building Equipment Work																																									
Equipment Work		Total: 17.3 months																																							
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Islamabad Headquarter Office National Weather Forecasting Centre</b>																																									
Equipment Work		Total: 13.3 months																																							
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Karachi Tropical Cyclone Warning Centre</b>																																									
Equipment Work		Total: 13.3 months																																							
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Lahore Flood Forecasting Centre</b>																																									
Equipment Work		Total: 13.3 months																																							
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Meteorological Office in the International Airports, Karachi, Islamabad, and Lahore</b>																																									
Equipment Work		Total: 13.3 months																																							
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>Soft Component</b>																																									
Soft Component (Activity 1)																																									
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Soft Component (Activity 4)																																									
Soft Component (Activity 5)																																									

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## Annex 5

### Major Undertakings to be taken by Recipient Government

#### 1) Before the Tender

NO	Items	Deadline	Responsible Agency	Cost	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 3 months after G/A	PMD	-	
2	To secure sufficient spaces at the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur) for temporary facilities such as a consultant's site office, contractor's office, workshop, building materials storage, etc. needed for the construction work.	before notice of of the Tender	PMD	-	
3	To obtain all prior regulatory compliance and necessary permissions from the relevant agencies/authorities for the construction of the Radar Tower Building in the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur).	before preparation of PC-I	PMD	-	
4	To undertake the Initial Environmental Examination (IEE) procedures in Pakistan.	before preparation of PC-I	PMD	-	
5	To obtain the required frequencies for the Sukkur Meteorological Radar System, and Polarimetric Test Horn Devices.	before notice of the Tender	PMD	-	
6	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	PMD	-	

#### 2) During the Project

NO	Items	Deadline	Responsible Agency	Cost (PKR)	Ref.
1	To pay bank charge (commission) for the issuance of the Authorization to Pay (A/P) and amendments of A/P, if required, for the Consultant and the Contractor.	every payment	PMD	11,000,000	
2	To undertake all necessary institutional and juridical procedures in Pakistan.	every payment	PMD	-	
3	To handle duty (tax) exemption procedures and to take necessary measures as well as provide requisite legal and/or administrative documentations for import permit and customs clearance to the customs broker/forwarder to be employed by the Contractor at the port of disembarkation for the materials and equipment to be imported for the Project as well as the sending back of any defective equipment and/or spare parts to the manufacturer for repair at the factory or replacement and re-importation thereof into Pakistan during the implementation and warranty periods of the Project.	during the Project	EAD PMD	-	
4	1) To take responsibility for arranging the maximum countermeasures and ensure the appropriate security of the whole Project site/s and of the Japanese and other foreign nationals assigned to the Project prior to the commencement of and during the implementation of the Project. 2) To arrange security around the proposed Project Site in Sukkur with the police. 3) To arrange security around the accommodation(s) of the Consultant & the Contractor with the police. 4) To arrange escort guard with the police during movements between the accommodation(s) of the Consultant & the Contractor and the proposed Project Site in Sukkur.	during the Project	PMD	-	
5	To provide necessary working spaces with Internet Connection at the PMD Islamabad Head Office and the PMD Karachi for the Consultant and the Contractor during the implementation of the Project.	during the Project	PMD	-	
6	To accord Japanese and other foreign nationals including their dependent/s (if any), whose services may be required in connection with the supply of products and services under the signed contracts, such facilities as may be necessary for their entry into Pakistan and stay therein for the smooth and uninterrupted performance of their work (i.e. to secure the appropriate visa including its extension/s required by the recipient country in connection thereof).	during the Project	EAD PMD	-	



7	To exempt goods of Japanese and other foreign nationals from customs duties, internal taxes and other fiscal levies which may be imposed by the Government of Pakistan with respect to their supply (products) and services under the signed contracts.	during the Project	EAD PMD	-	
8	To bear all the expenses, other than those to be borne by the Japanese Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.	during the Project	PMD	-	
9	To provide temporary facilities for the availability or accessibility of electricity for the construction work.	during the Project	PMD	-	
10	1) To provide the commercial power (400V, 3-phase, 4-wire, 50Hz) supply (capacity: no less than 150kVA) along with electric poles/wires, etc from the main supply line to the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur) for the Radar Tower Building and other facilities to be constructed by the PMD prior to the commencement of construction work.	Before commencement of the radar tower building construction	PMD	3,500,000	
	2) To install the required step-down transformer (capacity: no less than 150kVA) as well as service entrance connections for the commercial power supply at the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur) for the Radar Tower Building (400V, 3-phase, 4-wire, 50Hz) prior to the commencement of construction work.			2,500,000	
11	To relocate the existing power cables and the existing meteorological observation field in the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur)	during the Project	PMD	1,500,000	
12	To provide telephone lines for the Radar Tower Building in the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur)	during the Project	PMD	500,000	
13	To procure and install standard furniture for the Radar Tower Building.	during the Project	PMD	-	
14	To undertake incidental outdoor works such as gardening/landscaping and exterior lighting in and around the proposed Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur), if necessary	during the Project	PMD	1,500,000	
15	To provide free of charge and allocate secure temporary storage area/room for the materials, tools and equipment needed during the installation process.	during the Project	PMD	-	
16	To promptly provide reliable and high-speed Internet environment at the Sukkur Meteorological Radar Observation Station (PMD Meteorological Observatory, Rohri-Sukkur), National Weather Forecasting Centre, PMD Islamabad Head Office and other Project Sites (with each corresponding global/fix IP) for the establishment of a Virtual Private Network.	during the Project	PMD	1,000,000	
17	To set up the required and new assigned IP addresses in the computing equipment supplied under the Project and facilitate any required configuration i.e. firewall settings, etc. of the existing PMD equipment which may be made part of the project network communication system, if any	during the Project	PMD	-	
18	To support the Contractor to obtain relevant and vital information or data i.e. shape file map of Pakistan containing the administrative boundaries (regions, provinces, cities, districts, wards, etc.) as well as the rivers, lakes, and dams in Pakistan to be incorporated into the radar data/products display software.	during the Project	PMD	-	
19	To assign appropriate number of trainees and shoulder their dispatching cost to the training sites, such as daily allowance, transportation fee, accommodation, if any.	during the Project	PMD	1,000,000	
20	To shoulder the miscellaneous expenditures such as library books, petrol, telephone, application fee (obtaining the required frequencies for the meteorological radar system and the construction permissions of a new Radar Tower Building).	during the Project	PMD	1,000,000	
21	To demolish the exiting Rohri-Sukkur observatory building (after handing over the Project from Japan side).	during the Project	PMD	1,500,000	
22	To construct category III house, bachelor hostels (after handing over the Project from Japan side).	during the Project	PMD	45,000,000	
23	To submit Project Monitoring Report	every month	PMD	-	
24	To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of	PMD	-	

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		Certificate of Completion for the works under the contract(s)			
25	To submit a report concerning completion of the Project	within 6 months after completion of the Project	PMD	-	

3) After the Project

NO	Items	Deadline	Responsible Agency	Cost	Ref.
1	To assign the required staff including a responsible personnel of the PMD who has reliable technical skill and ample experience for the smooth operation and maintenance of the Equipment.	after completion of the Project	PMD	-	
2	To procure the required spare parts and consumables for the smooth operation and maintenance (O & M) of the Equipment, and enter into a Preventive Maintenance Service Agreement with the equipment supplier if so desired.	after completion of the Project	PMD	-	
3	To ensure adequate maintenance of the Radar Tower Building constructed under the Project so that they may function effectively for a long time.	after completion of the Project	PMD	-	
4	To properly operate and maintain, and also effectively utilize the facilities constructed and the Equipment procured/installed under the Project.	after completion of the Project	PMD	-	
5	To allocate the necessary budget and personnel for the smooth conduct of meteorological radar observation and forecasting works.	after completion of the Project	PMD	-	
6	To periodically update all the operation/antivirus/application software(s).	after completion of the Project	PMD	-	
7	To procure the appropriate number and capacity of disk media, hard disks, solid state disks, etc., and dutifully conduct the required scheduled archiving of radar observation raw data and products.	after completion of the Project	PMD	-	

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

(Note) Progress of the specific obligations of the Recipient may be confirmed and updated from time to time with written agreement between JICA and the Recipient in the form other than the amendment of the G/A.

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**Project Monitoring Report**  
**on**  
**Grant Agreement No. XXXXXXXX**  
 20XX, Month

**Organization Information**

<b>Authority (Signer of the G/A)</b>	Person in Charge _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____
<b>Executing Agency</b>	Person in Charge _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____
<b>Line Agency</b>	Person in Charge _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____

**Outline of Grant Agreement:**

<b>Source of Finance</b>	Government of Japan: Not exceeding JPY _____ Government of Pakistan: _____
<b>Project Title</b>	_____
<b>E/N</b>	Signed date: _____ Duration: _____
<b>G/A</b>	Signed date: _____ Duration: _____

## 1: Project Description

### 1-1 Project Objective

### 1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

### 1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr 2017)	Target (Yr 2021)
Qualitative Effect		

## 2: Project Implementation

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**2-1 Project Scope**

Table 2-1-1a: Comparison of Original and Actual Location

<b>Location</b>	<b>Original:</b> <i>(MD)</i>	<b>Actual:</b> <i>(PMR)</i>
	<b>Attachment(s):</b> Map	<b>Attachment(s):</b> Map

Table 2-1-1b: Comparison of Original and Actual Scope

<b>Items</b>	<b>Original</b>	<b>Actual</b>

**2-1-2** Reason(s) for the modification if there have been any.

--

**2-2 Implementation Schedule**

**2-2-1 Implementation Schedule**

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
Cabinet Approval E/N G/A Approval of consultant contract Early Mobilization of consultant Detailed Design Budget Request for FY2016 Tender Process of contractor and supplier Approval of contractor and supplier contract Budget Appropriation and Issuance of A/P Construction Period Shipment Custom Clearance Installation and acceptance Check Soft component Project Completion Date Defect Liability Period		-	-

\*Project Completion was defined as Completion of Soft component at the time of G/A.

**2-2-2** Reasons for any changes of the schedule, and their effects on the project.

**2-3 Undertakings by each Government**

**2-3-1 Major Undertakings**

See Attachment 2.

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**2-3-2 Activities**

See Attachment 3.

**2-3-3 Report on RD**

See Attachment 4.

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2-4 Project Cost

2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan  
(Confidential until the Tender)

	Items		Cost (Million Yen)	
	Original	Actual	Original	Actual
Construction of Facilities				
Equipment				
Soft Component				
Consulting Services				
Contingency				
Total				

Note: 1) Date of estimation:

2) Exchange rate: 1 US Dollar =\*\*Yen

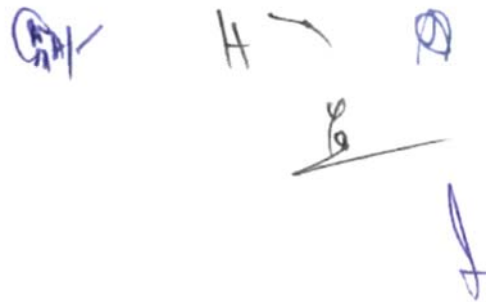


Table 2-4-1b Comparison of Original and Actual Cost by the Government of \*\*

Items			Cost (Thousand MMK)	
	Original	Actual	Original	Actual
				Please state not only the most updated schedule but also other past revisions chronologic ally.

Note: 1) Date of estimation:

2) Exchange rate: 1 US Dollar =(local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

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**2-5 Organizations for Implementation**

**2-5-1 Executing Agency:**

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

<b>Original:</b> (MD)
<b>Actual, if changed:</b> (PMR)

**2-6 Environmental and Social Impacts**

- The environmental monitoring is not required in the Project as this project was categorized as category C in accordance with the GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS of JICA as of April 2010.

**3: Operation and Maintenance (O&M)**

**3-1 O&M and Management**

- Organization chart of O&M
- Operational and maintenance system (structure and the number, qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

<b>Original:</b> (MD)
<b>Actual:</b> (PMR)

**3-2 O&M Cost and Budget**

- The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

<b>Original:</b> (MD)
<b>Actual:</b> (PMR)

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#### 4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): (M/D)	
Potential Project Risks	Assessment
1. Delay of budget appropriation	Probability: H/M/L
	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

#### 5: Evaluation at Project Completion and Monitoring Plan

##### 5-1 Overall evaluation

Please describe your overall evaluation on the project.

*GM*

*HW*

*(D)*

*f*

*YB*

**5-2 Lessons Learnt and Recommendations**

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

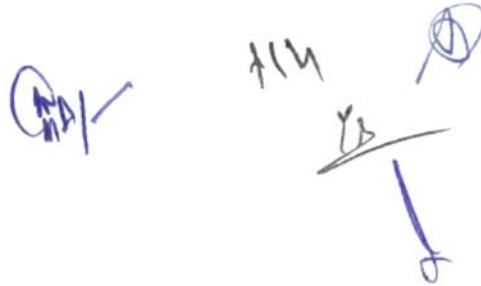
**5-3 Monitoring Plan for the Indicators for Post-Evaluation**

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Yearly disbursement plan
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)  
(Final Report Only)



## Appendix 5. Soft Component Plan

### Soft Component Plan

<Background of the Soft Component Plan>

The Islamic Republic of Pakistan (hereinafter, Pakistan) is devastated by various natural disasters such as heavy rains, torrential rains, flooding, sediment disaster, tropical cyclones and drought because the country's land area extends north and south for 1,500 km with a large difference in the altitude and shape causing meteorological phenomena to vary. Massive flooding occurred consecutively in the recent years of 2010, 2011, and 2012. The Indus River Floods in 2010 (approximately 2,000 killed and lost, over 20 million people affected, 9.5 billion USD total damage), considered to be the worst flooding in the country's history, and the floods in the province of Sindh and its neighbors in 2011 (over 500 killed and lost, approximately 5 million people affected) caused serious damages. Approximately half of the total damages (18,986 million USD) caused by the floods in Pakistan since 1950 (in total, 38,171 million USD) were caused by the floods which occurred in 2010 and onwards triggered by the heavy rains during monsoon seasons. Most of the rain clouds bringing heavy rains during monsoon seasons enter Pakistan from India, and around 80% of them move up to the north and bring heavy rainfalls causing floods. Floods account for about 60% of the number of disasters in Pakistan, about 70% of the number of deaths, and over 90% of the number of victims. It not only causes loss of lives and properties and stagnation of economic activities but also significantly affects the poor, and, thus, it causes a detrimental influence to poverty reduction which is one of the development strategies of the Government of Pakistan.

Most of the heavy rains causing disasters are due to the rain clouds moving from the Indian side into the wide region of Panjab and Sindh provinces. Thus, it is necessary to observe the rain clouds in this region as accurately as possible and use them for the improvement of weather forecasting and warnings.

Currently, S-band meteorological doppler radars are being established in Islamabad (in operation since Jun 2019), Karachi (planned to be in operation by Sep 2020), and Multan (planned to be in operation by Dec 2022). However, it is insufficient to certainly catch the precipitation coming from India because there is a blank area of meteorological radar observation in the middle of Pakistan. Thus, by establishing a new Meteorological Doppler Radar with an observation radius of 450km wide at the existing PMD Rohri-Sukkur Weather Observatory in Sukkur close to the border to cover the blank area, almost all the approach paths of the rain clouds from India to Pakistan can be covered within the observation ranges. In addition, approximately 1km-mesh high resolution observation data of rain intensity and wind speed and direction could be obtained by using the Doppler Mode Observation within 200km radius of the Meteorological Radar, which makes it possible not only to predict the risks of natural disasters but also to take appropriate countermeasures by accumulating and analyzing these observation data in addition to the 450km wide area rain observation data and using them continuously.

Based on the above, this project will establish an S-Band Pulse Compression Solid State Dual Polarization (Polarimetric) Doppler Meteorological Radar System (hereinafter, Dual Polarization Meteorological Radar) in Sukkur in the Sindh Province. The cutting-edge Dual Polarization function will dramatically improve the accuracy of precipitation amount by observing the shape of rain drops and estimating the size of them, compared to a conventional Single Polarization Meteorological Doppler Radar.

In addition, the Meteorological Radar Central Processing System and Meteorological Radar Data Display System will be established under the Project so that the observation data obtained by the Meteorological Radar System will be effectively used for weather forecasting. The Meteorological Radar Central Processing System has the functions of the remote control, operation supervision, and configuration change of the Meteorological Radar System and the operation supervision of the Meteorological Radar Equipment room (monitoring the equipment temperature and the room temperature), thereby, allowing the remote operation, control, maintenance and management of the Sukkur Meteorological Radar Observation Station. It needs to be established in the Islamabad Headquarters Office for the comprehensive operation of all the Meteorological Radars established and planned to be established. The Meteorological Radar Data Display System has the function to receive and display the Meteorological Radar observation data in real time. This will be established in the Sukkur Meteorological Radar Observation Station, PMD National Weather Forecasting Center in the Islamabad Headquarters Office, PMD Karachi Tropical Cyclone Warning Center, PMD Lahore Flood Forecasting Center, and the PMD Meteorological Offices in the Islamabad, Karachi, and Lahore International Airports. The right figure depicts the flow of the Sukkur Meteorological Radar remote operation and control as well as meteorological radar data.

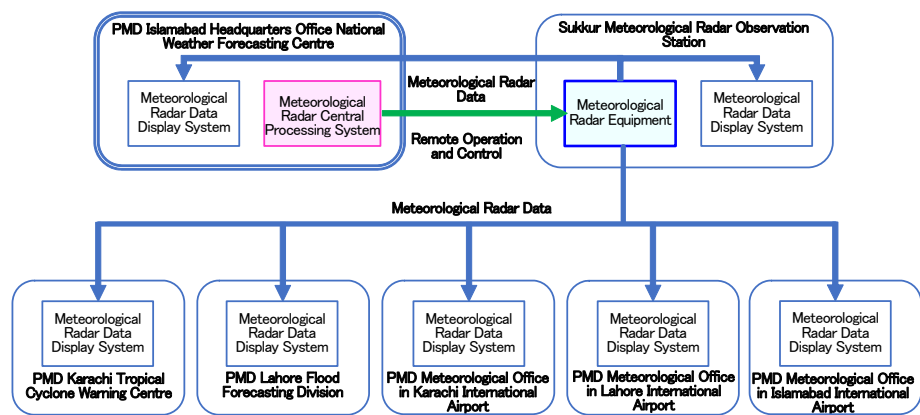


Figure 1: Sukkur Meteorological Radar Remote Operation and Control, and Meteorological Radar Data Flow

In order to operate the systems procured by this project in a good condition for the long term, to improve the accuracy of the weather and flooding information and their forecasts and warnings in Pakistan and to contribute to the reduction of damages caused by natural disasters, it is crucial to optimize and strengthen the PMD's monitoring capability of weather phenomena which can cause disasters through the appropriate use of the Meteorological Radar with the dual polarization function. To achieve this, the staff who has appropriate operation and maintenance skills is required, and, thus, it is necessary to conduct the Soft Component.

As previously mentioned, 3 Meteorological Radars have been or will be established in Pakistan. The Soft Component with regards to the Single Polarization Meteorological Radar established in Islamabad had been conducted from July to Aug 2018 and from Apr to May 2019. It is planned to be conducted in mid-2020 in Karachi where a Single Polarization Radar will be similarly established. The Soft Component items are aimed at establishing the appropriate maintenance and management structure of the equipment procured by the Project and the preparation of the regular inspection and maintenance manuals and learning of the methods by the PMD engineers for the continued use of the project outcome achieved by the Single Polarization Meteorological Radars and the expression of its effect. Furthermore, they will focus on having a deep understanding of the displayed contents of the Meteorological Radar products and how they are generated, and improving their awareness on why it is necessary to confirm the Meteorological Radar products on a daily basis so that PMD forecasters can quickly identify meteorological phenomena necessary for weather forecasting and warning among the products generated by the Meteorological Radars.

Sukkur will be the 2nd case of establishing a Dual Polarization Meteorological Radar in Pakistan. The Soft Component regarding the Dual Polarization Radar in Multan, which will be the first case, will be conducted in late 2022. Considering the antecedent Soft Component, the Soft Component of this project will revise the training materials and manuals that will be created during the Soft Component for the Multan Meteorological Radar to improve the contents more suitable for Pakistan, and will be efficiently conducted by avoiding duplicated training contents with the following important focus points in mind.

- Understanding of the features of the Dual Polarization Meteorological Radar compared to the Single Polarization Radar, its observation principle, and the adjustment items unique to the Dual Polarization Meteorological Radar.
- Explanation of the Dual Polarization Meteorological Radar using the Multan Meteorological Radar observation data and their use in the weather forecasting work.
- Promotion of understanding of the observation mode (PPI, RHI, etc.) and CAPPI that is obtained by processing the observation data, and derived products by composing them.
- Explanation of the non-precipitation echo of Meteorological Radar, methods of automatic removal by the Meteorological Radar and its limitation, and the overview of other quality management methods.
- Explanation of the processing method of the Dual Polarization Meteorological Radar raw data.

<Soft Component Target>

Enabling the PMD to independently and appropriately operate the Dual Polarization (Polarimetric) Meteorological Doppler Radar System being established in Sukkur.

<Soft Component Achievement Indicators>

Soft Component Achievement Indicators are as follows.

Table 1: Soft Component Achievement Indicators

No.	Achievement	Objectively Verifiable Indicators	Means of Verification
1	PMD staff acquires the knowledge on the measurement and confirmation methods of the dual-polarization (vertical and horizontal polarization) function.	Implementation of the measurement and confirmation methods of the dual-polarization (vertical and horizontal polarization) function.	Confirmation of proficiency through visual checks and technical interviews of the measurement and confirmation of the dual-polarization function (vertical and horizontal polarization).
2	PMD staff acquires the knowledge on how to operate and administer the Sukkur Meteorological Radar System.	Prompt and appropriate operation and administration skills using the Sukkur Meteorological Radar System Summary and Maintenance Manual as well as the Maintenance Record Book.	Confirmation of the frequency of using the Sukkur Meteorological Radar System Summary & Maintenance Manual, and entries in the Meteorological Radar System Maintenance Record Book through check of contents and technical interviews
3	PMD staff acquires the knowledge on the maintenance (inspection and adjustment) of the Sukkur Meteorological Radar System.	Inspection, adjustment, minor fault finding, remedy and recovery such as: a. routine maintenance using measuring instruments and tools, b. practice of replacing spare parts into the actual system and the subsequent confirmation of system operation, c. major fault countermeasures: distributing information to the Consultant and the manufacturer and receiving technical advice.	Confirmation of proficiency through visual checks and technical interviews of the followings: 1) routine maintenance using measuring instruments and tools 2) practice of replacing spare parts into the actual system and the subsequent confirmation of system operation 3) practice of minor fault finding, remedy and recovery 4) major fault countermeasures.
4	PMD staff appropriately operate and use the Sukkur Meteorological Radar System and conduct weather observation.	<ul style="list-style-type: none"> <li>• Meteorological Radar Observation according to the observation sequence schedule</li> <li>• Confirmation whether a ground clutter and other non-precipitation echo exist.</li> <li>• Utilization of the weather phenomena identified in the observation for the forecasting work.</li> </ul>	<ul style="list-style-type: none"> <li>• Confirmation of execution of meteorological radar observation in accordance with the sequence schedule from the operation information.</li> <li>• Confirmation whether ground clutters and other non-precipitation echoes exist.</li> <li>• Quiz to assess the skills to find out weather phenomena in the meteorological radar data display system with appropriate operations.</li> </ul>
5	PMD staff acquires radar observation raw data of the Sukkur Meteorological Radar as well as the composite data with the existing other Meteorological Radars and share them with relevant organizations.	<ul style="list-style-type: none"> <li>• Acquisition of radar observation data from radar data display systems.</li> <li>• Conversion of the radar observation data into suitable data for the forecasting work.</li> <li>• Converted data share with is shared with relevant organizations in an appropriate manner and updated regularly</li> </ul>	<ul style="list-style-type: none"> <li>• Confirmation of acquisition of radar observation data from radar data display systems.</li> <li>• Confirmation of conversion of the radar observation data into suitable data for the forecasting work.</li> <li>• Confirmation of regular update of converted data shared with relevant organizations.</li> </ul>

By achieving the 5 targets in the aforementioned Soft Component, the following effects are expected and those effects will contribute to the achievement of the target of this Project.



Table 2: Effects from the Soft Component Achievements

No.	Achievements	Effects from the Soft Component Achievements
1	PMD staff acquires the knowledge on how to measure and confirm the dual-polarization function (vertical and horizontal polarization).	As the PMD engineers acquire the knowledge on the maintenance method of the Sukkur Meteorological Radar System equipment with the dual-polarization function and regularly conduct the adjustment of the equipment relevant to the Meteorological Radar observation and the proper maintenance and management including the regular inspection according to the defined procedures and recording, they will contribute to the operation of the Meteorological Radar established through the Japanese Grant Aid in a good condition for a longer term.
2	PMD staff acquires the knowledge on how to operate and administer the Sukkur Meteorological Radar System.	
3	PMD staff acquires the knowledge of the maintenance method (inspection and adjustment) of the Sukkur Meteorological Radar System.	
4	PMD staff can appropriately operate and use the Sukkur Meteorological Radar System, and can conduct weather observation with high accuracy.	By properly operating the Sukkur Meteorological Radar according to the optimal observation schedule configured during the Soft Component, the PMD can do the Meteorological Radar observation with high accuracy in Sindh and Punjab provinces, and the wider area of the Indian side. Moreover, by applying the analysis method of meteorological phenomena from the meteorological radar products, which the PMD staff learn through the trainings, they will contribute to creation of the weather and flood forecasts and warnings.
5	PMD staff establishes the method to acquire the Meteorological Radar observation raw data as well as its composite data and to share them with the stakeholders.	The Soft Component will contribute to reduction of damages caused by natural disasters that is the Project's target, by acquiring the meteorological radar observation raw data and composite data and converting them into suitable formats to use them for weather forecasting and warning work, and providing these products timely to the disaster management organizations and to the people of Pakistan

<Means of Verification for the Achievement of Outputs >

The means of verification for the achievement of outputs of the Soft Component are also indicated in Table 1 "Soft Component Achievement Indicators".

<Scheduled Activities of the Soft Component>

Scheduled Activities of the Soft Component are as follows: Table 3 describes the contents of each activity, required skills, job categories, and technical skill levels; Table 4 describes the means of implementation, products, and the human resources required by each activity; and, Table 5 describes the target group of each activity.

As a consequence of further scrutiny by the Preparatory Study Team together with the Japan Meteorological Agency and others in connection with the activities of the Soft Component, the necessity was recognized and, therefore, it was concluded to include the training on the "Measurement and Confirmation of the Dual Polarization function (systematic error and standard deviation of the Vertical

and Horizontal Polarization)." Such process is being introduced as a new maintenance management method in Japan for a Dual Polarization Meteorological Radar. Since the Project is for the establishment of a 2nd Dual Polarization Meteorological Radar in Pakistan, the aforementioned training is necessary to include in the Soft Components of the Project. Since it is very difficult to take time for the bird-bath scan during rainfall to be carried out in Activity 1 once the radar continues observation after completion of the Project has been commenced, Activity 1 will be conducted in the time between radar adjustment work and the installation work completion. Activity 2 and 3 on essential items for the operation and maintenance of meteorological radar systems are planned to be provided to the PMD staff who are newly assigned to the Sukkur Radar Observation Station and related staff who is involved in the operation of the meteorological radars. The manuals and other documents prepared by the manufacturer may be significantly different from the ones from the existing radar's since the radar equipment to be introduced under the Project is determined by the tendering. Needless to say, all meteorological radar systems are custom-ordered products manufactured according to the order. Furthermore, if the manufacturers are different, the inspection locations and adjustment procedures will be different due to the different shapes and locations of the units constituting each device of the radar system. Therefore, in fact re-creation of the training materials for Activities 2 & 3 are needed through the revision of most training materials and manuals for the soft component of the Multan Meteorological Radar. Based upon these points, Activity 2 is planned to use the training materials and manuals to be prepared in the Soft Components of Multan Meteorological Radar as much as possible in order to shorten preparation work and to conduct training more efficiently. Activity 3 is planned to focus on training items that are essential for maintenance of meteorological radar system. Regarding the training to be conducted in Activity 4, the same training as the Soft Component conducted at the other existing meteorological radar stations will required for the PMD staff who use Sukkur Meteorological Radar Images after a new meteorological radar has been established owing to topography, altitude, height of meteorological radar tower building and surrounding area conditions (availability of mountains, buildings, bridges, steel towers, etc.), the place of ground clutter occurrence, the direction & distribution of obstruction for observation, the method of complementing observation data in the obstructed range, the radar antenna observation elevation angle, etc. differ greatly from each other. Activity 5 is planned to conduct training to acquire radar raw data and composite data from meteorological radar systems and convert them into data suitable for use in other meteorological works. In addition, implementation of the training on the data share and the regular data updating for timely and appropriate response by disaster management authorities is planned.

**Table 3: Scheduled Activities of the Soft Component**

Achievement No.	Activity	Contents of the Activity	Required Skills and Job Categories	Current Skill Level	Required Skill Level
1	Activity 1	Measurement and confirmation of the Dual Polarization function	An engineer with the knowledge and skills of measurement and confirmation of the Dual Polarization function.	Experience of inspection, adjustment, fault finding, remedy and recovery of analog meteorological radar	Skill to measure and confirm the dual polarization function.

				systems or single polarization meteorological radar systems.	
2	Activity 2	Preparation and utilization of the Summary & Maintenance Manual and the Maintenance & Management Record Book of the Sukkur Meteorological Radar System.	An engineer capable of operation and maintenance of a dual polarization meteorological radar.	Experience of operation and maintenance of analog meteorological radar systems or single polarization meteorological radar systems.	Skill for operation and management of the Dual Polarization Meteorological Doppler Radar System according to the manual summary and the Maintenance & Management Record book
3	Activity 3	Inspection, Adjustment, Minor Fault Finding, Remedy and Recovery, Major Fault Countermeasures of the Sukkur Meteorological Radar System.	An engineer capable of adjustment and minor fault finding of Dual Polarization (Polarimetric) Meteorological Radar System.	Experience of inspection, adjustment, fault finding, remedy and recovery of analog meteorological radar systems or single polarization meteorological radar systems.	Skill to check, adjust, troubleshoot, remedy and recovery of Dual Polarization Meteorological Doppler Radar System
4	Activity 4	Fundamental of the Dual Polarization Meteorological Radar System, Data quality control overview, Meteorological Radar Observation according to the sequence schedule. Explanation for use of Meteorological Radar products for the weather forecasting work.	Staff who can conduct the quality control such as identifying and complementing Clutters and Blind Areas from the meteorological radar observation data, and create the observation sequence schedule which is suited to the weather phenomena in Pakistan	Experience of observation and forecasting based on the observation data of analog meteorological radar systems or single polarization meteorological radar systems.	<ul style="list-style-type: none"> <li>• Understanding of the characteristics of a dual polarization meteorological radar system compared to a single polarization meteorological radar.</li> <li>• Skill to create a sequence schedule and run the observation following the schedule.</li> <li>• Skill to effectively use the observation data of the dual polarization meteorological radar system to the forecasting work.</li> </ul>
5	Activity 5	Establishment of the method to obtain the meteorological radar observation raw data and the composite data and to share them to the stakeholders.	Staff who understand the data flow of the meteorological observation data and has the skills to convert the data format and share them.	Experience of conversion of the observation data format from the existing Islamabad meteorological radar.	<ul style="list-style-type: none"> <li>• Skill to acquire the observation raw data and the composite data.</li> <li>• Understanding how to read the data format of the observation raw data.</li> <li>• Skill to share the PMD meteorological radar products and its continued operation.</li> </ul>

Table 4: Implementation contents of the Soft Component

Activity	Means of Implementation	Products	Human resource for the activity
Activity 1	Technical discussion with the PMD engineers	<ul style="list-style-type: none"> <li>• Operation Procedure to measure and confirm the Dual Polarization Function</li> </ul>	Expert Consultant on Measurement and confirmation of dual polarization function meteorological radar operation and maintenance: 0.83 man-months (Period of Technology Transfer in Pakistan: 25days)  Direct Support
	Preparation of the procedure to measure and confirm the Dual Polarization function through the bird-bath scan		
	Preparation of the procedure to measure and confirm the Dual Polarization function through the Polarimetric Test Horn Device		
	Training to measure and confirm the Dual Polarization function through the bird-bath scan		
	Training to measure and confirm the Dual Polarization function through the Polarimetric Test Horn Device		
Activity 2	Technical discussion with the PMD engineers	<ul style="list-style-type: none"> <li>• Sukkur Meteorological Radar System Maintenance</li> </ul>	Expert Consultant on meteorological radar operation and maintenance: 0.70 man-months
	Explanation of the Sukkur Meteorological Radar System Summary		

	<p>Comparison with the Multan Meteorological Radar System Maintenance Manual and Maintenance &amp; Management Record Book, confirmation of differences and sections requiring improvement, and revision</p> <p>Training on maintenance work according to the Sukkur Meteorological Radar System Maintenance Manual and recording in the Maintenance &amp; Management Record Book by the PMD engineer</p>	<p>Manual</p> <ul style="list-style-type: none"> <li>Sukkur Meteorological Radar System Maintenance &amp; Management Record Book</li> </ul>	<p>(Period of Technology Transfer in Pakistan: 21days)</p> <p>Direct Support</p>
Activity 3	<p>Discussion with the PMD engineers</p> <p>Comparison, confirmation of differences and improvement points from the procedure document for Multan, and revision</p> <p>Practice of routine maintenance using measuring instruments, detector, attenuators and tools</p> <p>Practice of replacing spare parts into the actual system and the subsequent confirmation of system operation</p> <p>Training on Fault Finding, Remedy and Recovery Confirmation assuming failure conditions</p> <p>Practice of major fault countermeasures</p> <p>Preparation of the procedure document</p>	<ul style="list-style-type: none"> <li>Various implementation procedures described in the Sukkur Meteorological Radar System Maintenance Manual for Activity 2</li> </ul>	<p>Expert Consultant on meteorological radar adjustment and fault finding: 0.87 man-months</p> <p>(Period of Technology Transfer in Pakistan: 26days)</p> <p>Direct Support</p>
Activity 4	<p>Technical discussion with the PMD forecasters and engineers</p> <p>Preparation of training materials</p> <p>Explanation of the Sukkur Meteorological Radar products and utilization for forecasting works</p> <p>Training of the data quality control overview of the Dual Polarization Meteorological Radar</p> <p>Explanation of generation procedure of the surface rain intensity product</p> <p>Estimation of ground clutter and blind areas at each antenna elevation angle, and creation of the elevation composite table based on the estimation result</p> <p>Preparation of the observation sequence schedule of the Sukkur Meteorological Radar</p> <p>OJT of the meteorological radar observation according to the created sequence schedule</p>	<ul style="list-style-type: none"> <li>Sukkur Meteorological Radar Product Explanation Material</li> <li>Data Quality Management Overview Training Material</li> <li>Observation Sequence Explanation Material</li> <li>Quiz using Sukkur weather radar observations</li> </ul>	<p>Expert Consultant on meteorological radar observation: 1.07 man-months</p> <p>(Period of Technology Transfer in Pakistan: 32days)</p> <p>Direct Support</p>
Activity 5	<p>Preparation of training materials</p> <p>Training for acquisition of raw data (including the data obtained by the Dual Polarization) and composite data</p> <p>Training on reading observation raw data format</p> <p>Operational Training for publishing and utilizing Sukkur Meteorological Radar products</p>	<ul style="list-style-type: none"> <li>Guidebook for obtaining and sharing weather radar data and products</li> </ul>	<p>Expert Consultant on meteorological radar observation data utilization: 0.63 man-months</p> <p>(Period of Technology Transfer in Pakistan: 19days)</p> <p>Direct Support</p>

Activities 1, 2, and 3 require the Sukkur Meteorological Radar System, and, thus, will take place in the Sukkur Meteorological Radar Tower Building. These trainings are planned to include the Sukkur Meteorological Radar Observation Station technical staff, the PMD Islamabad technical staff who will conduct the remote operation, control, and maintenance and management of the Sukkur Meteorological Radar Observation Station by using the Meteorological Radar Central Processing System, and the technical staff of PMD Karachi, as the district meteorological observatory, who are generally responsible for the operation, maintenance and management of the Sukkur Meteorological Radar Observation Station and are required to take immediate actions in case of major fault of the meteorological radar.

With regards to Activity 1, it is planned to include the Multan Meteorological Radar Observatory technical staff because 1) the maintenance and management method is new; and, 2) the necessity was discussed for

the first time during the Preparatory Survey of the Sukkur Meteorological Radar System Establishment Project (i.e. it was not included in the Multan Meteorological Radar Establishment Project). Activity 4 is intended for the staff who use the products to be obtained from the Sukkur Meteorological Radar System in their weather forecasting and warning work. Specifically, the activity will take place at the Sukkur Meteorological Radar Observatory where the Meteorological Radar Building will be newly established, PMD Islamabad Headquarters Office National Weather Forecasting Center, PMD Karachi Tropical Cyclone Warning Center, PMD Lahore Flood Forecasting Center and the PMD Meteorological Offices in the Islamabad, Karachi, and Lahore international airports, where the Meteorological Radar Data Display System will be setup, for the PMD staff at each site. Activity 5 will take place at the PMD Islamabad Headquarters Office National Weather Forecasting Center and the PMD Karachi Tropical Cyclone Warning Center for the staff who use the products to be obtained from the Meteorological Radar System in their weather forecasting and warning work and, additionally, the R&D Division staff and programmers who use the Meteorological Radar observation raw data and its composite data. Based on the above, the target groups of the Soft Component are according to the table below.

**Table 5: Target Groups of each Activity**

Activity	Designation	Islamabad	Sukkur	Karachi	Multan	Lahore
Activity 1	Principal Engineer	1		1		
	Electronic Engineer	3	2	4	2	
	Electronic Sub-Engineer	1	1	1	1	
	Electric Engineer		2			
	Mechanical Engineer		1			
Activity 2	Principal Engineer	1		1		
	Electronic Engineer	3	2	4		
	Electronic Sub-Engineer	1	1	1		
	Electric Engineer		2			
	Mechanical Engineer		1			
Activity 3	Principal Engineer	1		1		
	Electronic Engineer	3	2	4		
	Electronic Sub-Engineer	1	1	1		
	Electric Engineer		2			
	Mechanical Engineer		1			
Activity 4	Meteorological Staff	15	11	15		10
Activity 5	Meteorological Staff	15		15		
	R&D Division Staff	5				
	Programmer	5		3		

Details of each activity schedule are as follows.

**Table 6: Planned Detailed Schedule of each Activity**

Activity 1	
Day	Measurement and Confirmation of the Dual Polarization Function of the Sukkur Meteorological Radar System
1	Departure from Japan, Arrival in Islamabad on Monday
2	Final adjustment of the schedule with the Planning section in Islamabad. Transfer to Sukkur
3	Preparation of the procedure to measure and confirm the Dual Polarization function through the bird-bath scan
4	Preparation of the procedure to measure and confirm the Dual Polarization function through the Polarimetric Test Horn Device
5	Preparatory Work for the training Technical Discussion with the PMD engineers in Sukkur (training orientation, grasping technical level, classifying trainees)

6	Sat. (Holiday)
7	Sun. (Holiday)
8	Operation Procedure Training for the Bird-bath Scan
9	Training on Differential Reflectivity (ZDR) Calibration by the Bird-bath Scan
10	Training on Differential Phase Shift ( $\phi$ DP) Calibration by the Bird-bath Scan
11	Examination and determination of the installation location of the Polarimetric Test Horn Device
12	Training on the installation procedure and adjustment method of the Polarimetric Test Horn Device
13	Sat. (Holiday)
14	Sun. (Holiday)
15	Training to prepare an horizontal antenna pattern by using horizontal polarization
16	Training to prepare a vertical antenna pattern by using vertical polarization
17	Training to measure transmitting/receiving power values (horizontal and vertical) using the Polarimetric Test Horn Device
18	Training on Phase Difference between horizontal and vertical calibration using the Polarimetric Test Horn Device
19	Training on reading and calculating antenna characteristics from antenna patterns
20	Sat. (Holiday)
21	Sun. (Holiday)
22	Training on calculating transmitting/receiving loss and entering to the DRSP
23	Support for PMD's review Transfer to Islamabad
24	Preparation of the Soft Component Completion Report Departure from Islamabad
25	Arrival in Japan

Activity 2	
Day	Preparation and utilization of the Summary & Maintenance Manual and the Maintenance & Management Record Book of the Sukkur Meteorological Radar System
1	Departure from Japan, Arrival in Islamabad on Monday
2	Technical Discussion with the PMD engineers and the final adjustment of the schedule with the Planning section in Islamabad Transfer to Sukkur
3	Preparatory Work at the Sukkur Meteorological Radar Tower Building Technical Discussion with the PMD engineers in Sukkur (training orientation, grasping technical level, classifying trainees)
4	Explanation of the Sukkur Meteorological Radar System Summary
5	Comparison with the Multan Meteorological Radar System Maintenance Manual and Maintenance & Management Record Book, confirmation of differences and sections requiring improvement, and revision
6	Sat. (Holiday)
7	Sun. (Holiday)
8	
9	Training on maintenance work according to the Sukkur Meteorological Radar System Maintenance Manual and recording in the Maintenance & Management Record Book by the PMD engineer (Daily, Weekly, Monthly, Semiannual, Annual Inspection and Maintenance)
10	
11	
12	
13	Sat. (Holiday)
14	Sun. (Holiday)
15	
16	Training on maintenance work according to the Sukkur Meteorological Radar System Maintenance Manual and recording in the Maintenance & Management Record Book by the PMD engineer (Daily, Weekly, Monthly, Semiannual, Annual Inspection and Maintenance)
17	
18	
19	Preparation of the Soft Component Completion Report
20	Sat. (Holiday)
21	Sun. (Holiday)

Activity 3	
Day	Inspection, Adjustment, Minor Fault Finding, Remedy and Recovery, and Major Fault Countermeasures of the Sukkur Meteorological Radar System.
1	Preparatory Work for the training Comparison, confirmation of differences and improvement points from the procedure document for Multan, and revision
2	Practice of routine maintenance using measuring instruments, detector, attenuators and tools
3	Practice of routine maintenance using measuring instruments, detector, attenuators and tools
4	Practice of replacing spare parts for the Antenna into the actual system and the subsequent confirmation of system operation.
5	Practice of replacing spare parts for the Antenna Controller into the actual system and the subsequent confirmation of system operation.
6	Sat. (Holiday)
7	Sun. (Holiday)
8	Practice of replacing spare parts for the Transmitter into the actual system and the subsequent confirmation of system operation.
9	Practice of replacing spare parts for the Digital Receiver and Signal Processor (DRSP) into the actual system and the

	subsequent confirmation of system operation.
10	Detailed explanation of how to confirm the status of each equipment using the Antenna Controller Support for PMD's review
11	Detailed explanation of error messages displayed on the Antenna Controller, and training on necessary actions Training on confirming restoration status Support for PMD's review
12	Detailed explanation of the alarm on each equipment, and training on necessary actions Training on confirming restoration status Support for PMD's review
13	Sat. (Holiday)
14	Sun. (Holiday)
15	Training on Minor Fault Finding, Remedy and Recovery Confirmation using Yes/No charts Support for PMD's review
16	Training on Minor Fault Finding, Remedy and Recovery Confirmation using Yes/No charts Initial response training in the event of major fault Support for PMD's review
17	Response training in the event of major fault (Explanation and practice on how to prepare the report format, how to collect
18	data from each device required for reporting, how to use various measuring devices required for data collection, commentary
19	on taking photographs for reporting, etc.) Support for PMD's review
20	Sat. (Holiday)
21	Sun. (Holiday)
22	Introduction of failure cases, Explanation of response and response implementation training Support for PMD's review
23	Preparation of the Soft Component Completion Report
24	Preparation of the Soft Component Completion Report
25	Transfer to Islamabad Departure from Islamabad
26	Arrival in Japan

Activity 4	
Day	Fundamentals of the Dual Polarization Meteorological Radar System, Data Quality Control Overview and Meteorological Radar Observation according to the sequence schedule.
1	Departure from Japan, Arrival in Islamabad on Monday
2	Technical Discussion with the PMD engineers Final adjustment of the schedule with the Planning section in Islamabad. Transfer to Sukkur
3	Preparatory Work for the training Technical Discussion with the PMD forecasters and engineers (training orientation, grasping technical level, classifying trainees) Preparation of the training materials (confirmation of the differences and improvement points from Multan's materials, and revision)
4	Preparation of the observation sequence schedule for the Sukkur Meteorological Radar
5	Explanation of the Sukkur Meteorological Radar products
6	Sat. (Holiday)
7	Sun. (Holiday)
8	Utilization of the Sukkur Meteorological Radar products for forecasting works (training on explanation and operation of each
9	function such as Mouse Point Information, Warning Area Setting, Echo Tracking, Overlay Display, Location Maker Tool, Wind Rose, Display Image Saving/Printing etc.)
10	Explanation of the generation procedure of the surface rain intensity product Estimation of ground clutter and blind areas at each antenna elevation angle, and creation of the elevation composition table based on the estimation result
11	Training of the data quality control overview of the Dual Polarization Meteorological Radar
12	Revision of the observation sequence schedule of the Sukkur Meteorological Radar
13	Sat. (Holiday)
14	Sun. (Holiday)
15	
16	OJT of the meteorological radar observation according to the created sequence schedule
17	
18	Transfer to Karachi Revision of Training Material
19	Technical discussion with the PMD forecasters and engineers
20	Sat. (Holiday)
21	Sun. (Holiday)
22	Explanation of the Sukkur Meteorological Radar products and use for forecasting works
23	Explanation of the generation procedure of the surface rain intensity product

	Estimation of ground clutter and blind areas at each antenna elevation angle, and creation of the elevation composition table based on the estimation result
24	Transfer to Lahore Revision of Training Material Preparation of the Soft Component Completion Report
25	Explanation of the Sukkur Meteorological Radar products and use for forecasting works
26	Explanation of the generation procedure of the surface rain intensity product Estimation of ground clutter and blind areas at each antenna elevation angle, and creation of the elevation composition table based on the estimation result
27	Sat. (Holiday) Transfer to Islamabad
28	Sun. (Holiday)
29	Explanation of the Sukkur Meteorological Radar products and use for forecasting works
30	Explanation of the generation procedure of the surface rain intensity product Estimation of ground clutter and blind areas at each antenna elevation angle, and creation of the elevation composition table based on the estimation result
31	Training of the data quality control overview of the Dual Polarization Meteorological Radar Preparation of the Soft Component Completion Report Departure from Islamabad
32	Arrival in Japan

Activity 5	
Day	Establishment of methods for acquiring and sharing "the raw data from meteorological radar observation" and "composite data"
1	Departure from Japan, Arrival in Islamabad on Monday
2	Preparatory Work for the training Training to acquire the raw data and composite data using Linux commands
3	Study of automating data acquisition and Technical advice for implementing automation
4	Training on reading the raw data format (explanation on binary numerical data transferred between computers with different architectures, training on the operation of software to display binary data, training on reading the raw data format based on the data format definition provided by the manufacturer)
5	Training on PMD Weather Radar Product sharing and publishing (prioritization of the best weather radar products to all stakeholders, consideration of appropriate descriptive information to prevent stakeholders from misinterpreting radar product images, consideration of the appropriate sharing and publishing methods and provide technical advice, etc.)
6	Sat. (Holiday)
7	Sun. (Holiday)
8	Training on PMD Weather Radar Product sharing and publishing (prioritization of the best weather radar products to all stakeholders, consideration of appropriate descriptive information to prevent stakeholders from misinterpreting radar product images, consideration of the appropriate sharing and publishing methods and provide technical advice, etc.)
9	Transfer to Islamabad
10	Training to acquire the raw data and composite data using Linux commands
11	Study of automating data acquisition and Technical advice for implementing automation
12	Training on reading the raw data format (explanation on binary numerical data transferred between computers with different architectures, training on the operation of software to display binary data, training on reading the raw data format based on the data format definition provided by the manufacturer)
13	Sat. (Holiday)
14	Sun. (Holiday)
15	Training on PMD Weather Radar Product sharing and publishing (prioritization of the best weather radar products to all stakeholders, consideration of appropriate descriptive information to prevent stakeholders from misinterpreting radar product images, consideration of the appropriate sharing and publishing methods and provide technical advice, radar image release training on website, etc.)
16	
17	
18	Preparation of the Soft Component Completion Report Departure from Islamabad
19	Arrival in Japan

#### <Procurement Method for Soft Component Implementation Resources>

Implementation resources are procured based on the direct support of the Japanese consultants who are in charge of equipment procurement for the Project. The rationales are presented below.

- Personnel with the advanced technique and knowledge of weather services and dual polarization meteorological radar system is necessary.



- Personnel as indicated above usually belongs to weather organizations which actually conduct weather consultation services.
- Personnel who has similar experience to the proposed technology transfer is required.

<Implementation Schedule>

The implementation schedule of the whole Project and soft component is indicated in the following table. Activity 1-B "Measurement and confirmation of the Dual Polarization function" is planned to be provided by the consultant during the period when the Meteorological Radar Maker conducts their adjustment work. The other activities are planned to be executed during the rainy season, 8 months after the completion of the installation and adjustment work of the meteorological radar system. The schedule of all activities will not overlap so that staff not included in the target group of each training can participate in the training if they have the opportunity.

Table 7: Implementation Schedule

Month	1	2	3	4	5	6	7	8
Detailed Design & Tendering Procedure	Total: 8.0 months							
Detailed Design	■							
Tendering Procedure			■					

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
<b>Sukkur Meteorological Radar Observation Station</b>																																									
Construction Work Total: 22.5 months																																									
Preparation Work/Boundary Wall/Soil Filling	■																																								
Temporary/Foundation Works																																									
Structure Work																																									
Finishing Work																																									
Building Equipment Work																																									
Equipment Work Total: 17.3 months																																									
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Islamabad Headquarter Office National Weather Forecasting Centre</b>																																									
Equipment Work Total: 13.3 months																																									
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Karachi Tropical Cyclone Warning Centre</b>																																									
Equipment Work Total: 13.3 months																																									
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Lahore Flood Forecasting Centre</b>																																									
Equipment Work Total: 13.3 months																																									
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>PMD Meteorological Office in the International Airports, Karachi, Islamabad, and Lahore</b>																																									
Equipment Work Total: 13.3 months																																									
Equipment Manufacturing																																									
Equipment Transportation																																									
Equipment Installation/Adjustment																																									
<b>Soft Component</b>																																									
Soft Component (Activity 1)																																									
Soft Component (Activity 2)																																									
Soft Component (Activity 3)																																									
Soft Component (Activity 4)																																									
Soft Component (Activity 5)																																									

<Soft Component Product>

Soft Component Products are as follows.

Table 8: Soft Component Products (Outputs)

Product Name	Contents	Submission Time	No. of Pages
Operation Procedure to measure and confirm the Dual Polarization Function	<ul style="list-style-type: none"> <li>• Procedures to measure and confirm the Dual Polarization function by the bird-bath scan</li> <li>•Procedures for a) reading and b) recording and confirmation of the observation data during the bird-bath scan</li> <li>•a) Setup and Adjustment, b) Transmission and Reception of test signal, and c) Measurement and Confirmation of the Dual Polarization function by the Polarimetric Test Horn Device</li> </ul>	After Technology Transfer	15
Sukkur Meteorological Radar System	•Summary of the Sukkur Meteorological Radar System		20

Maintenance Manual	<ul style="list-style-type: none"> <li>•Procedures for the routine maintenance using measuring instruments and tools.</li> <li>•Procedures for replacing spare parts into the actual system and the subsequent confirmation of system operation (observation situation)</li> <li>•Procedures for fault finding, remedy and recovery confirmation</li> <li>•Procedures for major fault countermeasure/s</li> </ul>		
Sukkur Meteorological Radar System Maintenance & Management Record Book	<ul style="list-style-type: none"> <li>•Date and time of issues encountered</li> <li>•Cause/s of issues (abnormal sound, partial degradation, etc.)</li> <li>•Troubleshooting steps</li> <li>•Name and quantity of the replaced parts</li> <li>•Name of the engineer who executed the trouble shooting and recovery</li> </ul>		10
Observation Sequence Schedule Explanation Material	<ul style="list-style-type: none"> <li>•Observation shadow area chart for each antenna elevation</li> <li>•Beam elevation chart for each antenna elevation</li> <li>•Surface precipitation intensity product chart</li> </ul>		15
Data Quality Management Overview Training Material	<ul style="list-style-type: none"> <li>•Type of non-precipitation echoes</li> <li>•Examples of ground clutters and sea clutters</li> <li>•Examples of bright band observation</li> <li>•Techniques to remove non-precipitation echoes</li> </ul>		10
Sukkur Meteorological Radar Product Explanation Material	<ul style="list-style-type: none"> <li>•Explanation of essential meteorological radar products and their use for weather forecasting</li> </ul>		30
Guidebook for obtaining and sharing weather radar data and products	<ul style="list-style-type: none"> <li>•Methods to acquire the raw observation data in the NetCDF and other formats</li> <li>•How to read the data table of the raw observation data</li> <li>•How to process the composite observation data</li> <li>•Procedures for sharing weather radar observation data</li> <li>•Explanation on folder directory and script</li> <li>•Configuration file description</li> <li>•Maintenance and troubleshooting procedures</li> </ul>		10
Soft Component Completion Report	<ul style="list-style-type: none"> <li>•Scheduled Activities and Actual Achievement</li> <li>•Planned Outputs and Achievement</li> <li>•Factors that have influenced Achievement of Outputs</li> <li>•Recommendations for sustaining the effects of the Soft Component and its further development</li> <li>•Outputs</li> </ul>	Completion of Soft Component	50

<Obligations of the Recipient Country>

Obligations of the PMD for the implementation of Soft Component are as follows.

1) Manpower Development

- a) Continuous recruitment of human resources for the next generation.
- b) Development of more qualified technical personnel through training and other related manpower development programs.

2) Longer Life Span of the Equipment procured under the Project

- a) Regularly secure the necessary budget for the efficient operation and maintenance of the systems and procure requisite spare parts and consumables for all the equipment to be supplied under the Project according to the plan.
- b) Ensure protection of the equipment against theft and vandalism.

The PMD will be able to implement the above obligations through its organizational and personnel

capabilities. Most especially, the “continuous recruitment of human resources for the next generation” is of vital concern. It is imperative for the PMD to become self-reliant in technical areas such as the operation and maintenance of radar systems. Hence, it is essential that it puts forth continued efforts to recruit and fill vacancies, thereby, promoting technology transfer across all staff levels from the assistant personnel to the engineer(s).

## Appendix 6. References

No	Name of References	Original/Copy/ Digital File	Publisher	Date of Publication
1	Annual Flood Report 2010	Digital File	Government of Pakistan Ministry of Water and Power	2011
2	Annual Flood Report 2011	Digital File	Government of Pakistan Ministry of Water and Power	2012
3	Annual Flood Report 2012	Digital File	Government of Pakistan Ministry of Water and Power	2013
4	Annual Flood Report 2013	Digital File	Government of Pakistan Ministry of Water and Power	2014
5	Annual Flood Report 2014	Digital File	Government of Pakistan Ministry of Water and Power	2015
6	Annual Flood Report 2015	Digital File	Government of Pakistan Ministry of Water and Power	2016
7	Annual Flood Report 2016	Digital File	Government of Pakistan Ministry of Water and Power	2017
8	Annual Flood Report 2017	Digital File	Government of Pakistan Ministry of Water and Power	2018
9	Annual Flood Report 2018	Digital File	Government of Pakistan Ministry of Water and Power	2019
10	ANNUAL REPORT 2007 & 2008	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2009
11	ANNUAL REPORT 2009	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2010
12	ANNUAL REPORT 2010	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2011
13	ANNUAL REPORT 2011	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2012

14	ANNUAL REPORT 2012	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2013
15	ANNUAL REPORT 2013	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2014
16	ANNUAL REPORT 2014	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2015
17	ANNUAL REPORT 2015	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2016
18	ANNUAL REPORT 2016	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2017
19	ANNUAL REPORT 2017	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2018
20	ANNUAL REPORT 2018	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2019
21	National Monsoon Contingency Response Directive-2018	Digital File	Government of Pakistan Prime Minister's Office National Disaster Management Authority	2018
22	Pakistan Floods Rapid Response Plan	Digital File	Office for the Coordination of Humanitarian Affairs United Nations	2011
23	A Report on the Implementation of Diagnostic Study for 2010 Flood and Extreme Monsoon Rains 2011 in Pakistan under Sustainable Development through Peace Building, Governance and Economic Recovery in KP and Support Landslide IDPS in Hunza Nagar and Gilgit District When UNDP survey as Implementing Partner	Digital File	Pakistan Meteorological Department	2012
24	Flood Protection Plan-IV (Ten Year Plan)	Digital File	Ministry of Water Resources/NESPAK DELTARES	2018
25	Location of Observatory Stations	Digital File	Pakistan Meteorological Department	-
26	Monsoon Track 2009-2018	Copy	Pakistan Meteorological Department	-

27	Flood Extent - Pakistan	Digital File	National Disaster Management Authority	-
28	Annual Mean Rainfall Pattern	Digital File	Pakistan Meteorological Department	-
29	Station Network	Digital File	Pakistan Meteorological Department	-
30	Flood 2010 Disaster Management Apparatus in Sindh	Digital File	Sindh Provincial Disaster Management Authority	-
31	Breach at Tori Bund in Flood 2010	Digital File	Sindh Provincial Disaster Management Authority	-
32	Presentation on Pakistan Meteorological Department	Digital File	Pakistan Meteorological Department	-
33	Presentation on Climate and Observation Network of Pakistan	Digital File	Pakistan Meteorological Department	-
34	Flood Forecasting Data Exchange & Flood-2010 in Pakistan	Digital File	Flood Forecasting Division, Pakistan Meteorological Department	-
35	Flood Forecasting System of PMD	Digital File	Flood Forecasting Division, Pakistan Meteorological Department	-
36	Rainfall Pattern 2-7 September 2014	Digital File	Pakistan Meteorological Department	2019
37	Rainfall Pattern 10-17 August 2011	Digital File	Pakistan Meteorological Department	2019
38	Daily Rainfall data Jul. 2010	Digital File	Pakistan Meteorological Department	-
39	Daily Rainfall data Aug. 2010	Digital File	Pakistan Meteorological Department	-
40	Daily Rainfall data Sep. 2010	Digital File	Pakistan Meteorological Department	-
41	Daily Rainfall data Jul. 2011	Digital File	Pakistan Meteorological Department	-

42	Daily Rainfall data Aug. 2011	Digital File	Pakistan Meteorological Department	-
43	Daily Rainfall data Sep. 2011	Digital File	Pakistan Meteorological Department	-
44	Daily Rainfall data Jul. 2014	Digital File	Pakistan Meteorological Department	-
45	Daily Rainfall data Aug. 2014	Digital File	Pakistan Meteorological Department	-
46	Daily Rainfall data Sep. 2014	Digital File	Pakistan Meteorological Department	-
47	Daily Rainfall data Jan. 2019	Digital File	Pakistan Meteorological Department	-
48	Daily Rainfall data Feb. 2019	Digital File	Pakistan Meteorological Department	-
49	Daily Rainfall data Mar. 2019	Digital File	Pakistan Meteorological Department	-
50	Hourly Rainfall data Aug. 2016	Digital File	Pakistan Meteorological Department	-
51	Hourly Rainfall data Jul. 2017	Digital File	Pakistan Meteorological Department	-
52	Hourly Rainfall data Sep. 2012	Digital File	Pakistan Meteorological Department	-
53	Hourly Rainfall data 19-21 Feb. 2019, 1-4 Mar. 2019, 11-14 Apr. 2019	Digital File	Pakistan Meteorological Department	-
54	Hydro Data (Monsoon Season) 2010	Digital File	Pakistan Meteorological Department	-
55	Hydro Data (Monsoon Season) 2011	Digital File	Pakistan Meteorological Department	-
56	Hydro Data (Monsoon Season) 2014	Digital File	Pakistan Meteorological Department	-



57	River System & River Routing Model	Digital File	Pakistan Meteorological Department	-
58	Pakistan: Floods in Balochistan	Digital File	World Health Organization	2019