MULTI HAZARD VULNERABILITY RISK ASSESSMENT (MHVRA)

and DISASTER MANAGEMENT INFORMATION SYSTEM (DMIS)

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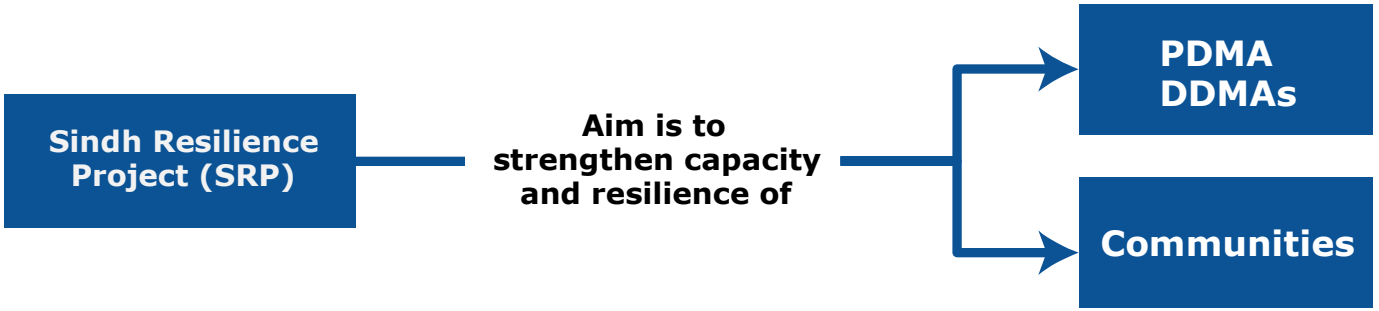
SUPARCO

PAKISTAN SPACE AND UPPER ATMOSPHERE RESEARCH COMMISSION

BACKGROUND

Government of Sindh with the financial support of the World Bank is implementing a five years project, titled "Sindh Resilience Project (SRP)"



- **As a vital component in efficient disaster management, SRP (PDMA Component) planned to conduct a Multi Hazard Vulnerability Risk Assessment Study in the Province of Sindh**

- **A contract was signed with SUPARCO on 27th June, 2019**

OBJECTIVE

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Conduct of Multi Hazard Vulnerability Risk Assessment (MHVRA) study

Preparation of MHVRA Informed Disaster Management Plans for all districts under study and provincial level plan

Development and operationalization of Disaster Management Information System (DMIS)

OBJECTIVE

Sindh Province up to UC level Covering following hazards:

- Flood
- Drought
- Heat wave
- Cyclone and Storm
- Earthquake
- Tsunami

SCOPE

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Cataloguing of historical / past hazardous events

Hazard Assessment

Exposure and Vulnerability Assessment with respect to socio-economic dimensions including:

Livelihood	Agriculture	Population	Buildings	Communication	Transportation	Infrastructure	Strategic assets

Adaptive and Coping Capacity Assessment

Risk Assessment

Atlas Designing

SCOPE

SUPARCO

Development of web based integrated Disaster Management Information System (DMIS) containing various modules

- MHVRA Maps and Databases
- Inventory Store and Relief Distribution
- Rapid Response and Rescue Coordination
- Rapid Damage Assessment
- Vehicle and Pumping Machine Tracking
- Video Conferencing
- National and International Disaster Warning and Information Integration
- Live Streaming and Imagery by Mapping Drones
- Mobile Applications for Crowd Sourcing and Warning Dissemination
- GIS Data Collection and Visualization

OUTPUT

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Provincial and District wise MHVRA Atlases

Provincial and District wise MHVRA Informed Disaster Management Plans

Online Disaster Management Information System

GENERAL METHODOLOGY

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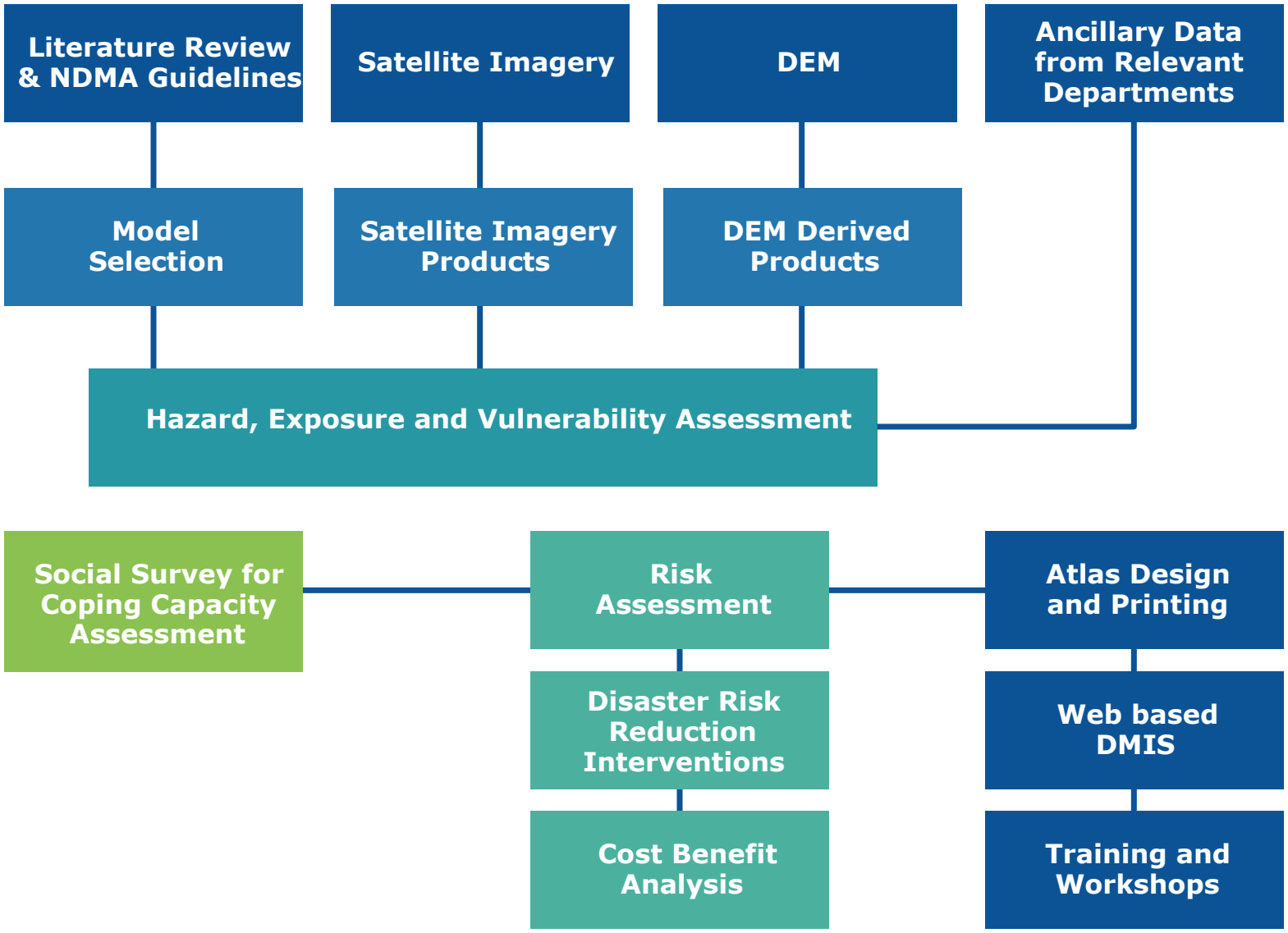

MULTI HAZARD VULNERABILITY RISK ASSESSMENT (MHVRA)

MHVRA METHODOLOGY FLOW CHART

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REMOTE SENSING AND GIS

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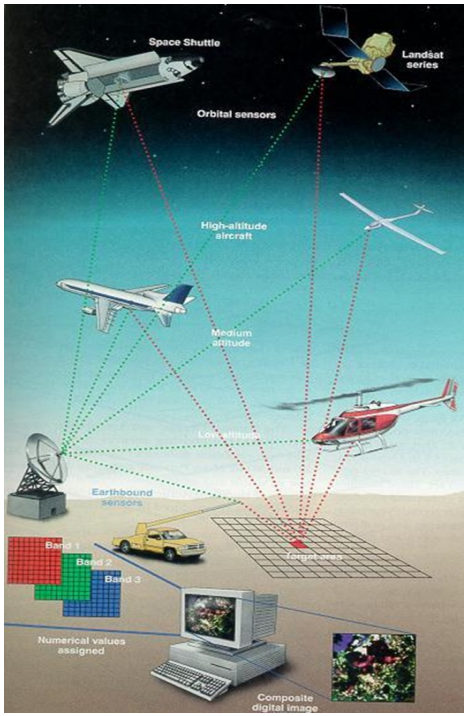
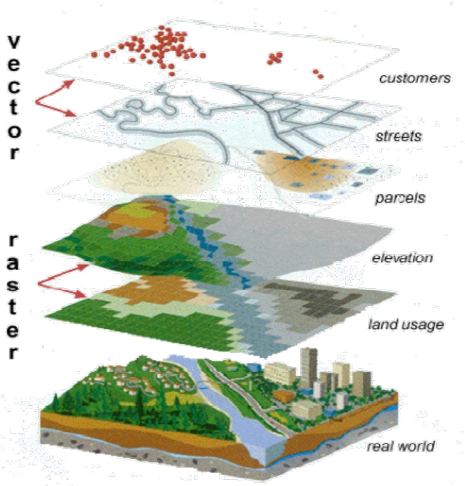
REMOTE SENSING

Remote Sensing is the measurement or acquisition of information of some property of an object by a sensor that is not in physical contact with the object under consideration.



GIS

A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data



HAZARD ASSESSMENT

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Mapping of hazard occurrences

Preparation and mapping of ancillary parameters for each hazard

Execution of model for generating hazard maps for each hazard

Calculation of return periods (10, 20, 50, 100, 250)

EXPOSURE, VULNERABILITY & RISK ASSESSMENT

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EXPOSURE

The interaction of elements at risk and hazard defines the exposure. The Elements at Risk are linked to physical, economic, social and environmental vulnerability of the area.

VULNERABILITY

Vulnerability is the condition determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards

EXPOSURE, VULNERABILITY & RISK ASSESSMENT

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CAPACITY

Capacity of a community is categorized as "Coping & Adaptive Capacity". The coping capacity refers to the ability of people, organizations, and systems, using available skills and resources, to face and manage adverse conditions, emergencies, or disasters. The adaptive capacity refers to the ability of a system or individual to adapt to climate change and is characterized as capacity to reduce the disaster risks.

RISK ASSESSMENT

Risk can be defined as the probability of harmful consequences, or expected losses resulting from interactions between natural hazards and vulnerable conditions in a given area and defined time period.

DATA COLLECTION & SPATIAL DATA PREPARATION

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DATA TYPE	SOURCE
Satellite imagery	SPOT 6/7 1.5 meter resolution – 2019/2020
Digital Elevation Model (DEM)	SPOT stereo 5 meters
Land use / Land cover	Satellite imagery
Elements at risk (road, irrigation, railways, petrol pumps, power plants, education, health, industries, and other features)	Satellite imagery and concerned departments
Boundaries	Survey of Pakistan (SoP) and Election Commission of Pakistan (ECP)
Geological map	Geological Survey of Pakistan (GSP)
Historical cyclone tracks	World Meteorological Organization and National Oceanic and Atmospheric Administration (NOAA)
Bathymetery	Pakistan Navy Hydrographic Department and The General Bathymetric Chart of the Oceans (GEBCO)
River discharge data	Indus River System Authority (IRSA)
Temperature and Rainfall Data	Tropical Rainfall Measuring Mission (TRMM)
Demographic Data	Pakistan Bureau of Statistics (PBS) and Bureau of Statistics, Government of Sindh
Historical Earthquake and Flood Data	National Disaster Management Authority (NDMA)
Irrigation Network	Sindh Irrigation Department

DISTRICT PROFILE - THATTA

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GEOGRAPHY

District area in Sq Km	8,200
Coordinates	23° 43' N to 25° 26' N 67° 05' E to 68° 45' E
Surrounding districts	**Jamshoro** in North **Hyderabad** in North East **Sujawal** in East **Malir** in West
Climate conditions	**Moderate**
Coldest and hottest months	**January** **May**

Seasonal temperature	Max. Mean Temp. (°C)	Min. Mean Temp. (°C)
Spring (March and April)	33.54	21.16
Dry Summer (May and June)	38.32	27.21
Wet Summer (July to September)	35.17	26.54
Autumn (October and November)	34.24	20.79
Winter (December to February)	27.54	13.90

Average annual rainfall	151.85 mm/yr
Physiographic features	**Indus River** in East **Indus Delta** in South West **Arabian Sea** in South **Rann of Kutch** in South East

DEMOGRAPHY

1998	Urban	Rural
599,492*	91,278	508,214

2017	Urban	Rural
979,817	176,058	803,759

Average annual growth rate 1998 - 2017: **2.61 %**

No. of household (2017): **184,868**

Male to Female ratio as on 2017 (%): **108.68**

**Including newly formed Sujawal District*

LOCATION OF DISTRICT THATTA

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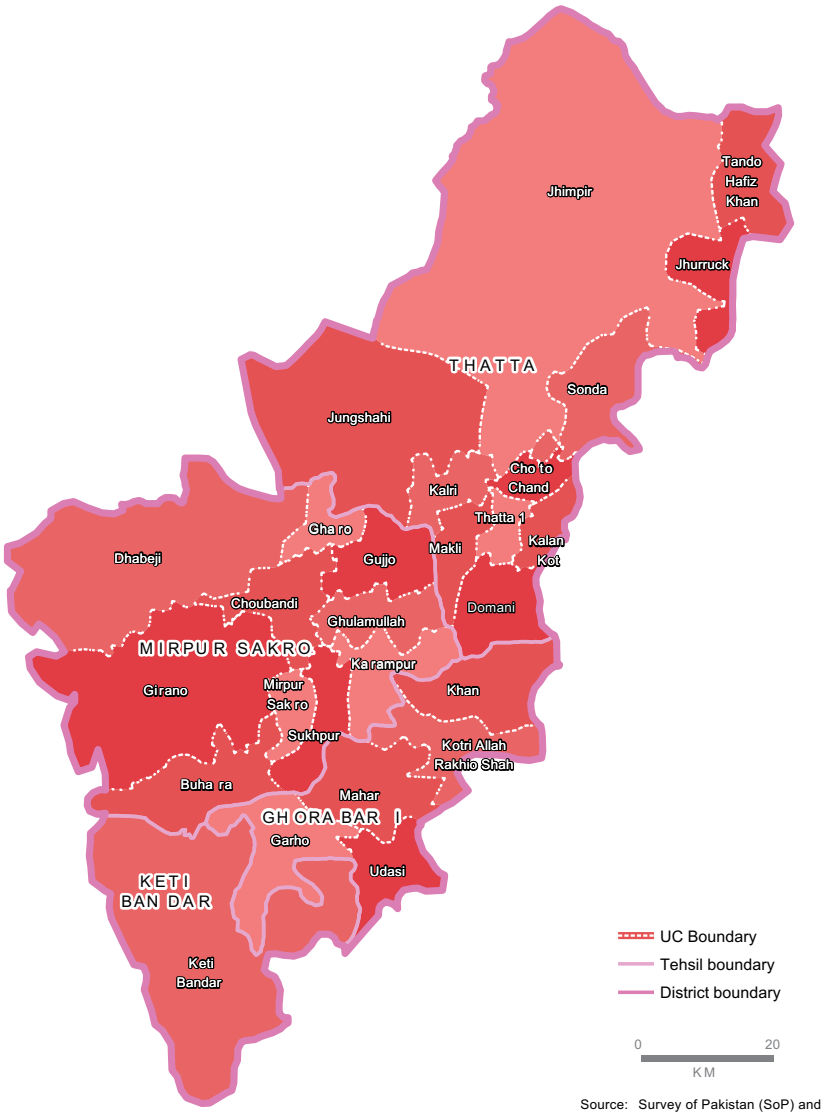

Source: Survey of Pakistan (SoP) and Election Commission of Pakistan (ECP)

DISTRICT PROFILE - THATTA

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ECONOMY:

Main employment sources:

- Fisheries
- Agriculture

Major Crops
Production in M.tons (2016-17)

Wheat	Cotton	Rice	Sugercane
233,979	54,185	2,002,364	23,608

Minor Crops
Production in M.tons (2016-17)

Barley	Bajra	Jowar	Maize
1,279	56	123	1,108

ADMINISTRATIVE SYSTEM

DISTRICT

THATTA

979,817*

TALUKA

1. THATTA — 406,063*
2. MIRPUR SAKRO — 340,834*
3. GHORA BARI — 174,088*
4. KETI BANDAR — 58,832*

UNION COUNCILS

THATTA

1. Domani
2. Choto Chand
3. Kalan Kot
4. Kalri
5. Makli
6. Jungshahi
7. Jhurruck
8. Jhimpir
9. Tando Hafiz Khan
10. Thatta 1
11. Sonda
12.

MIRPUR SAKRO

13. Buhara
14. Choubandi
15. Dhabeji
16. Girano
17. Ghullamullah
18. Gharo
19. Gujjo
20. Mirpur Sakro
21. Karampur
22. Sukhpur

GHORA BARI

23. Garho
24. Mahar
25. Khan
26. Kotri Allah Rakhio Shah
27. Udasi

KETI BANDAR

28. Keti Bandar

* POPULATION (2017)

GIS LAYERS - THATTA

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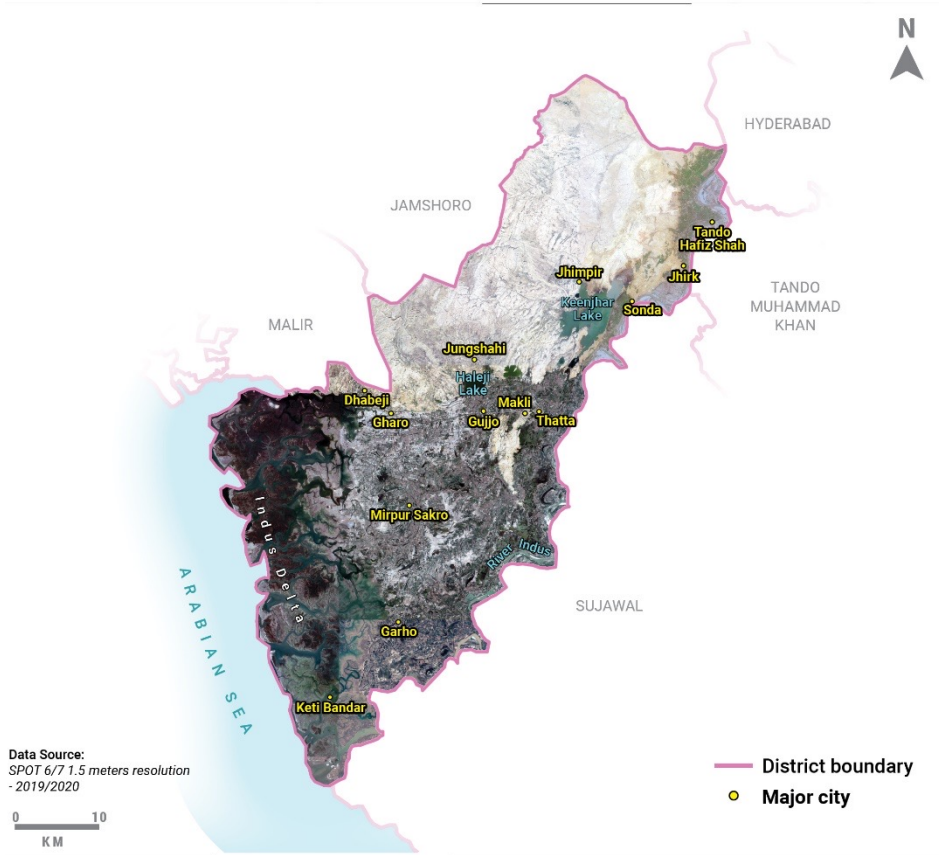
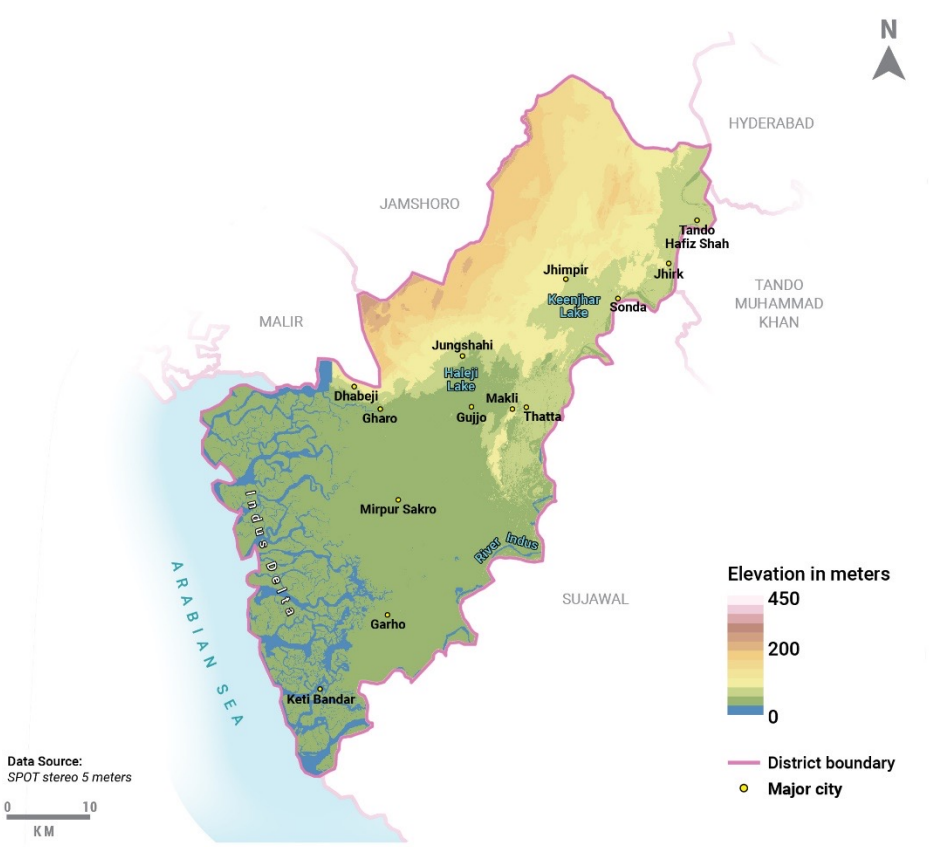
SATELLITE IMAGERY



DIGITAL ELEVATION MODEL



GIS LAYERS - THATTA

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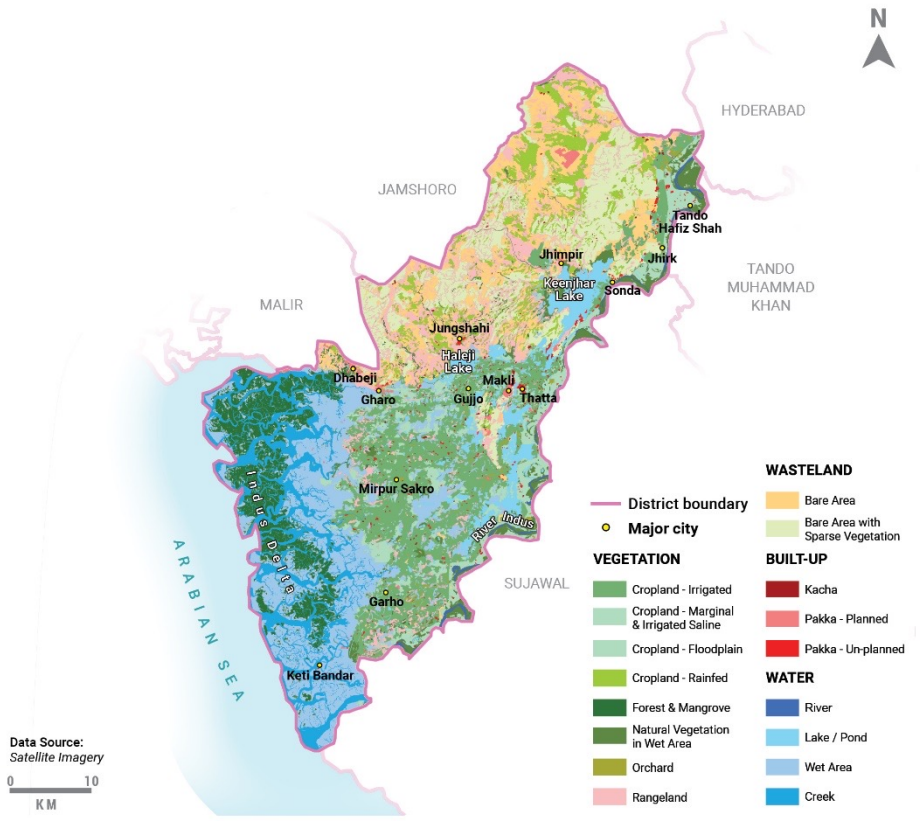
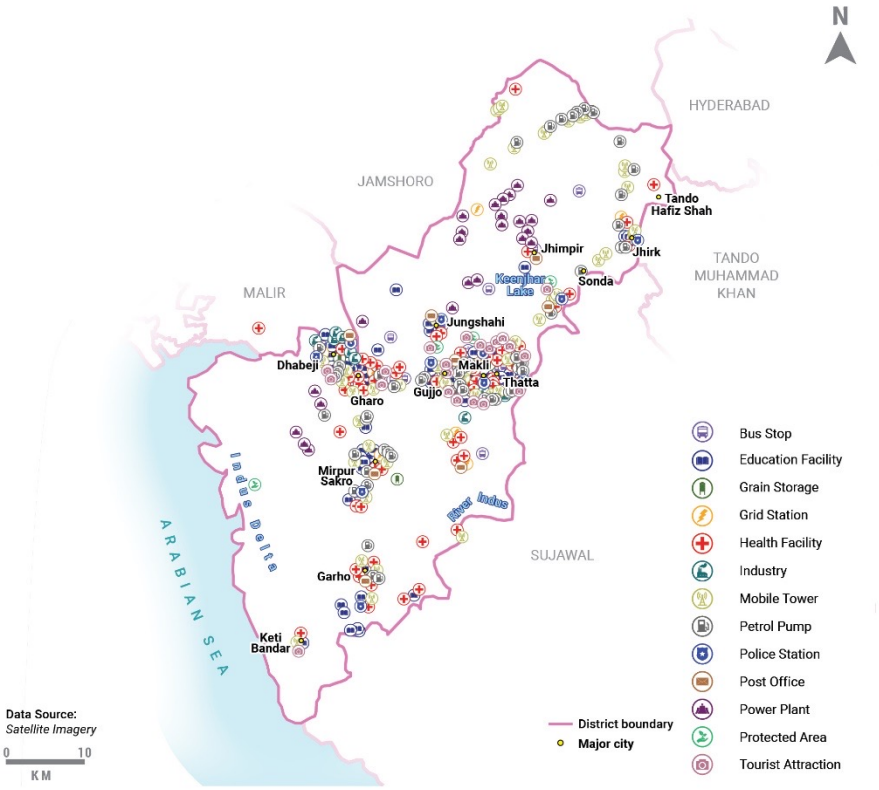
LAND USE / LAND COVER



CIRITICAL INFRASTRUCTURE



GIS LAYERS - THATTA

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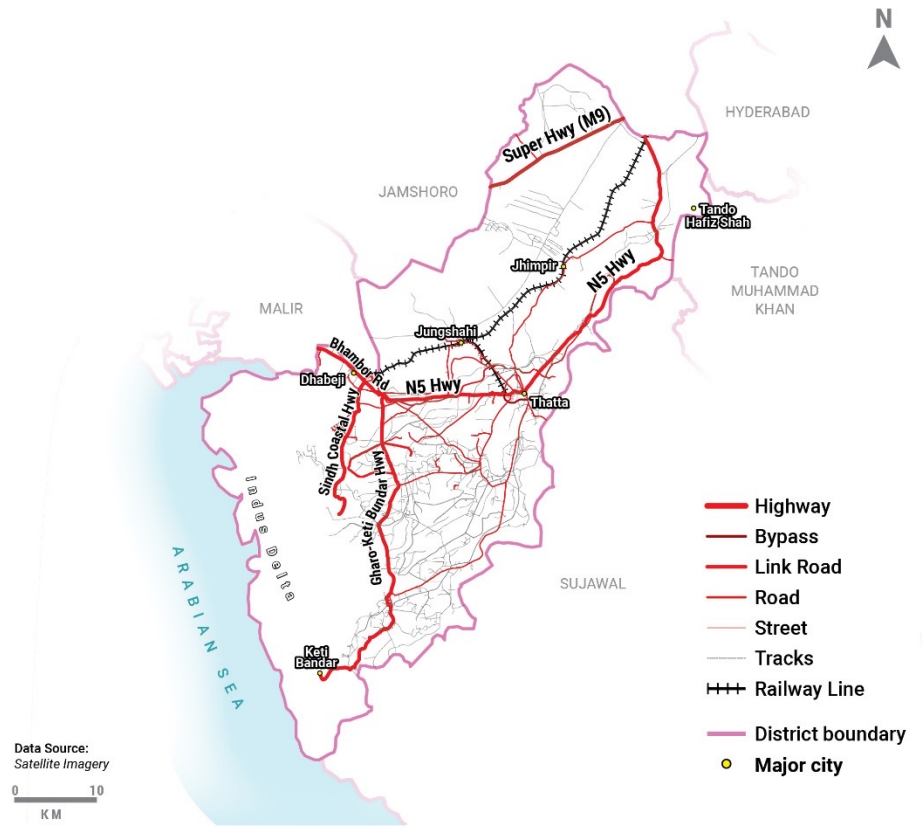
TRANSPORTATION NETWORK

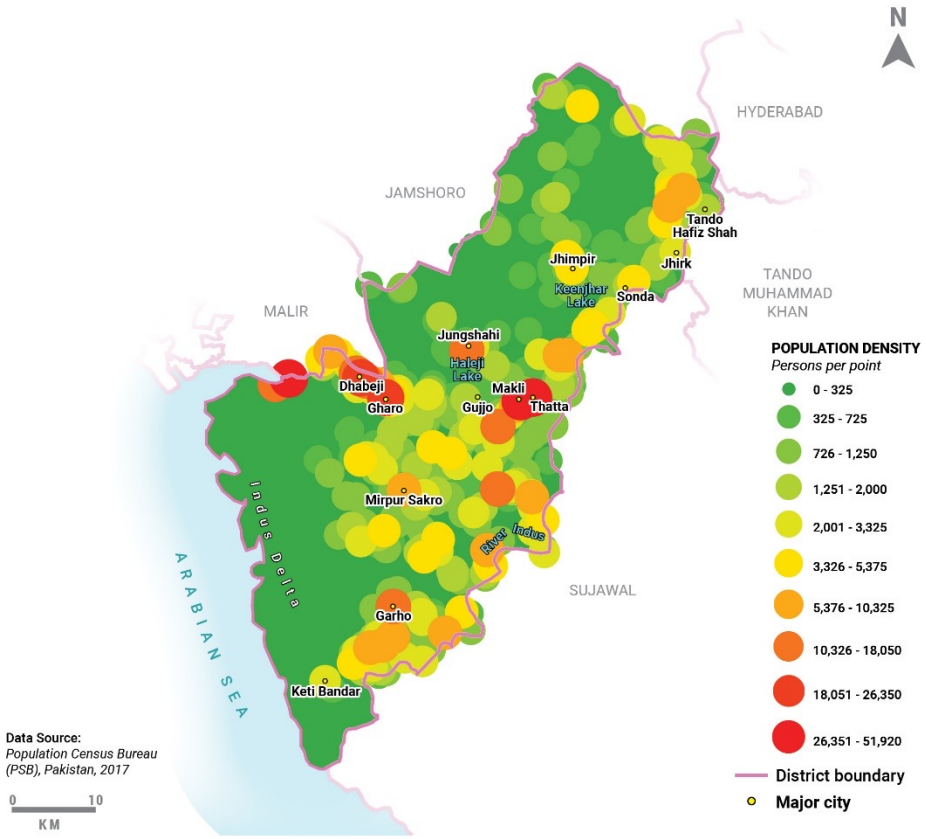


IRRIGATION AND DRAINAGE

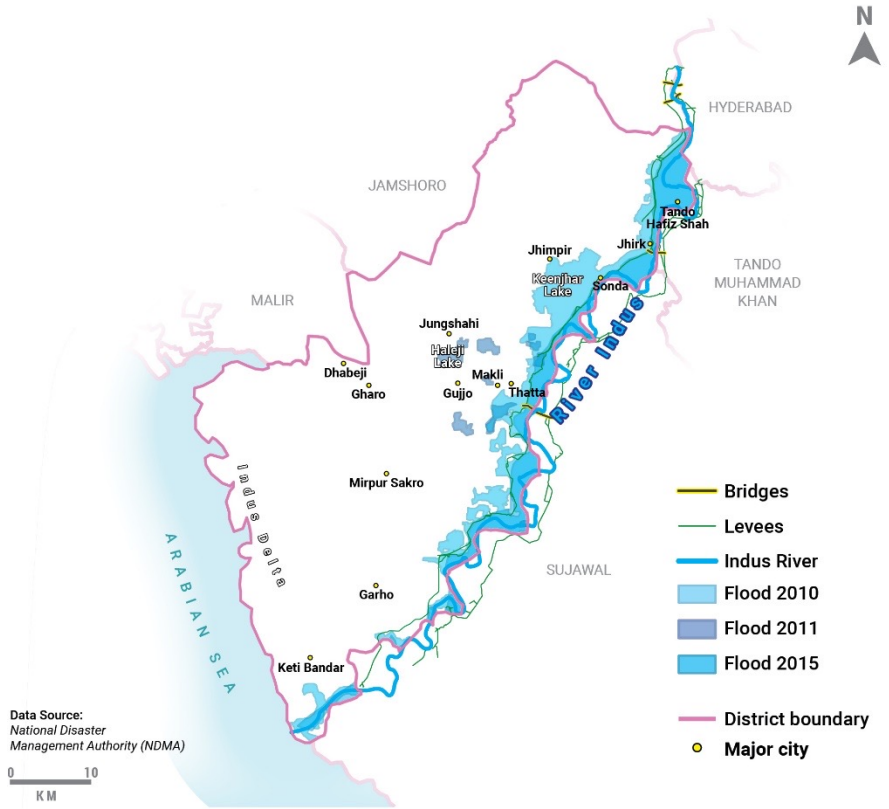
GIS LAYERS - THATTA

SUPARCO

POPULATION DENSITY



PAST FLOOD EXTENTS



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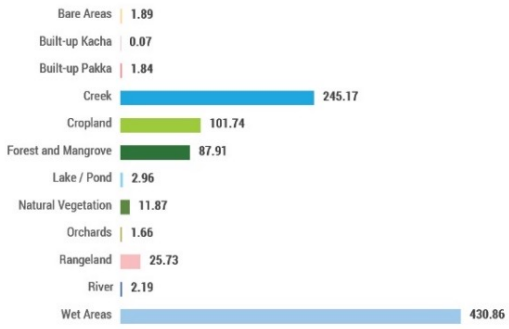
UC - KETI BANDAR

UC PROFILE

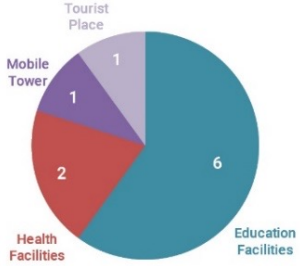
Union Council area in sq. km	914
Surrounding UCs / Features	**Buhara** in North **Garho** in North East **Udasi** in East **Sujawal District** in South East **Arabian Sea** in West
Population	2017 approx. 58,833
No. of household	2017 approx. 11,630

Land Use Land Cover

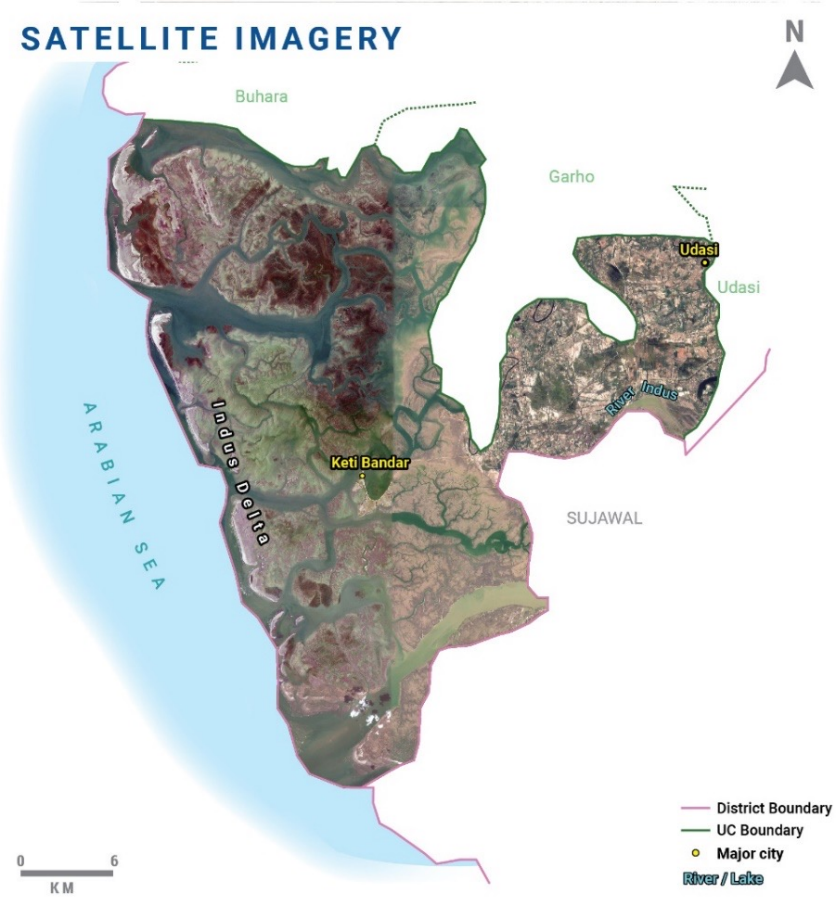
coverage area in sq.km



Critical Infrastructure



SATELLITE IMAGERY



MHVRA AT UC LEVEL

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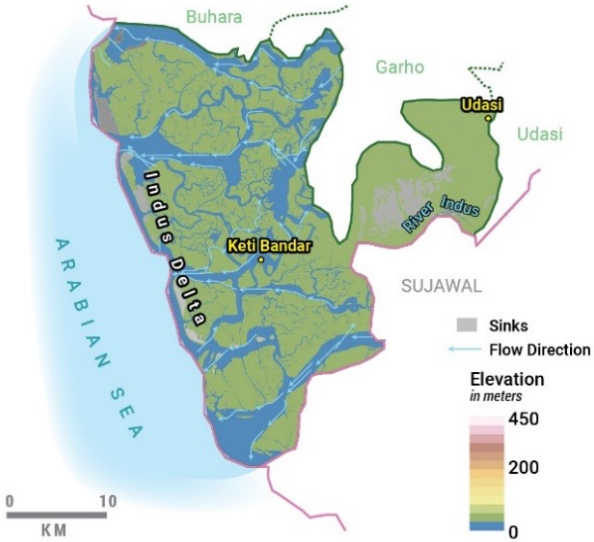
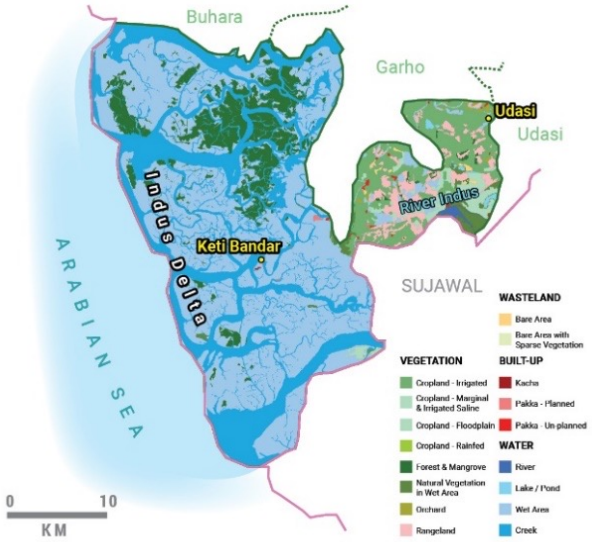
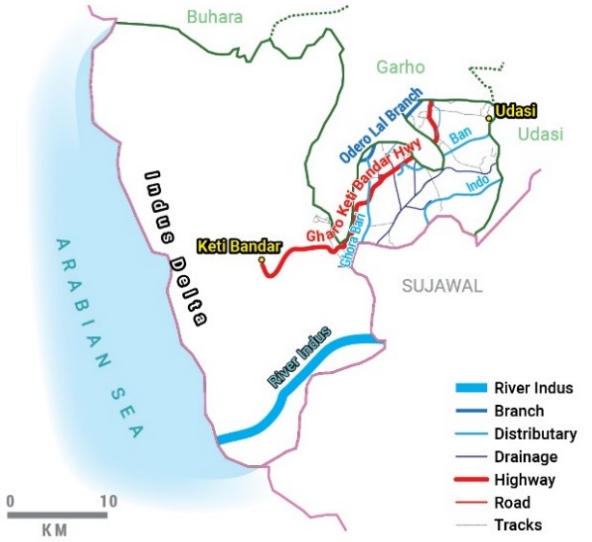
DEM AND FLOW DIRECTION



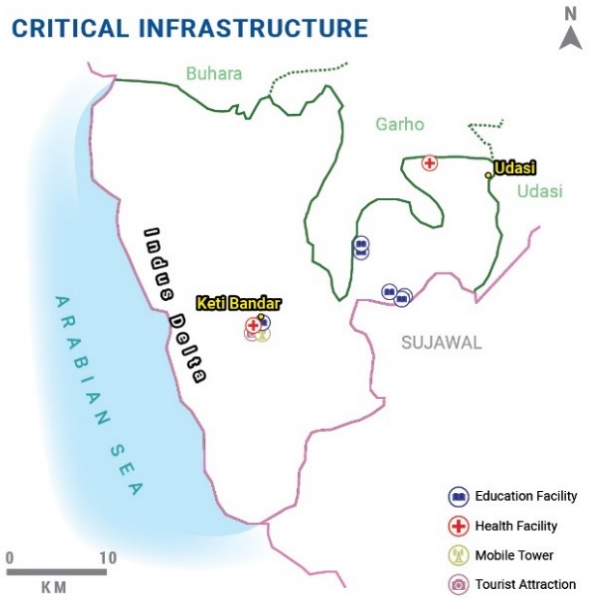
LAND USE / LAND COVER



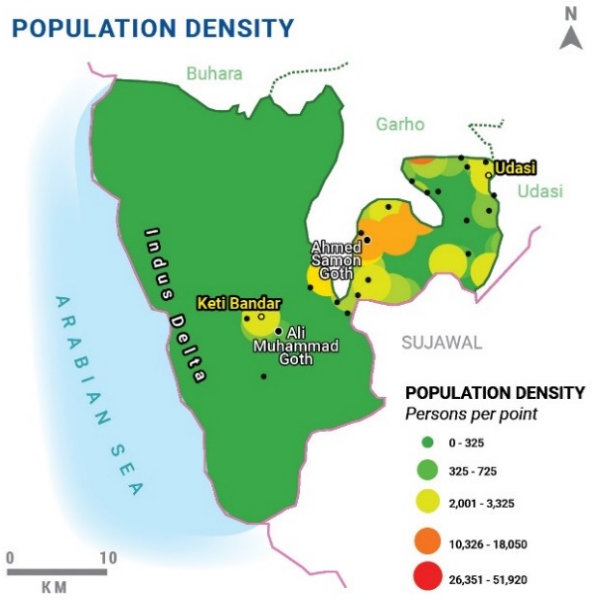
TRANSPORT, IRRIGATION AND DRAINAGE



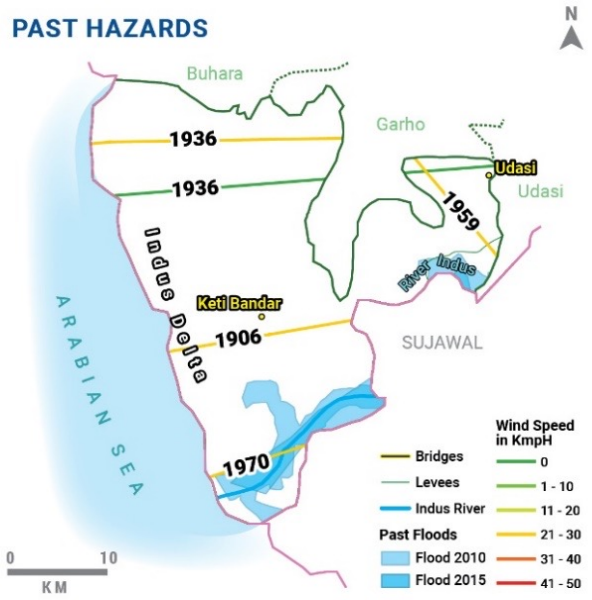
CRITICAL INFRASTRUCTURE



POPULATION DENSITY



PAST HAZARDS



MHVRA AT UC LEVEL

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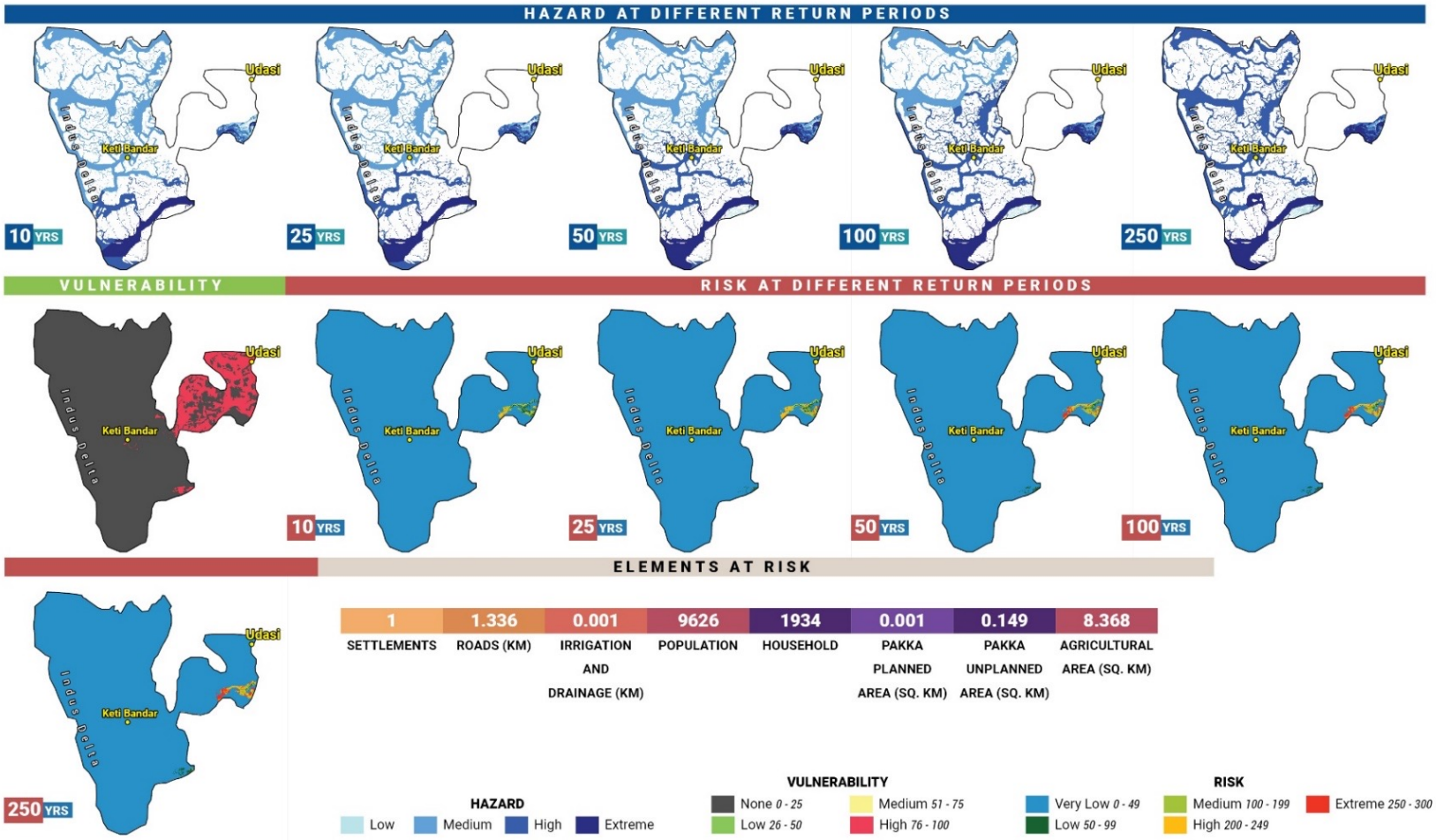
FLOODS



MHVRA AT UC LEVEL

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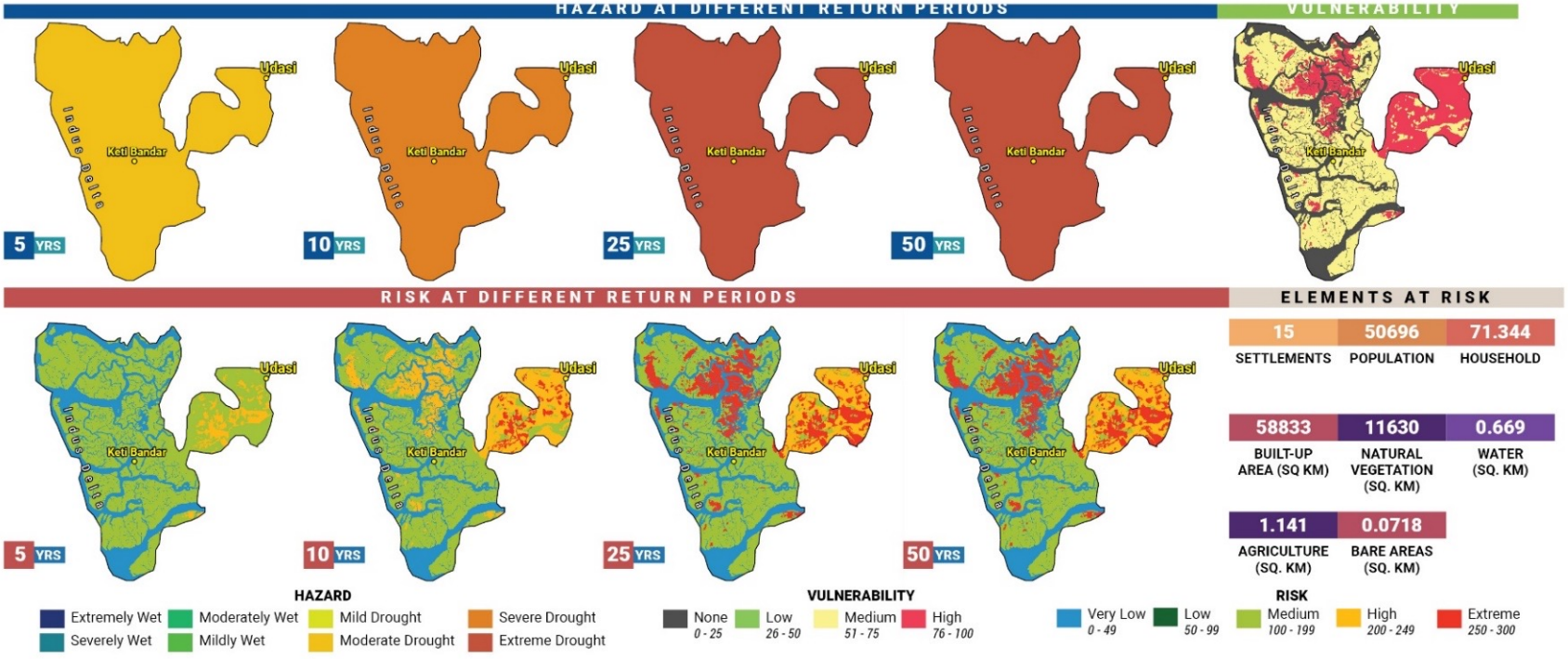
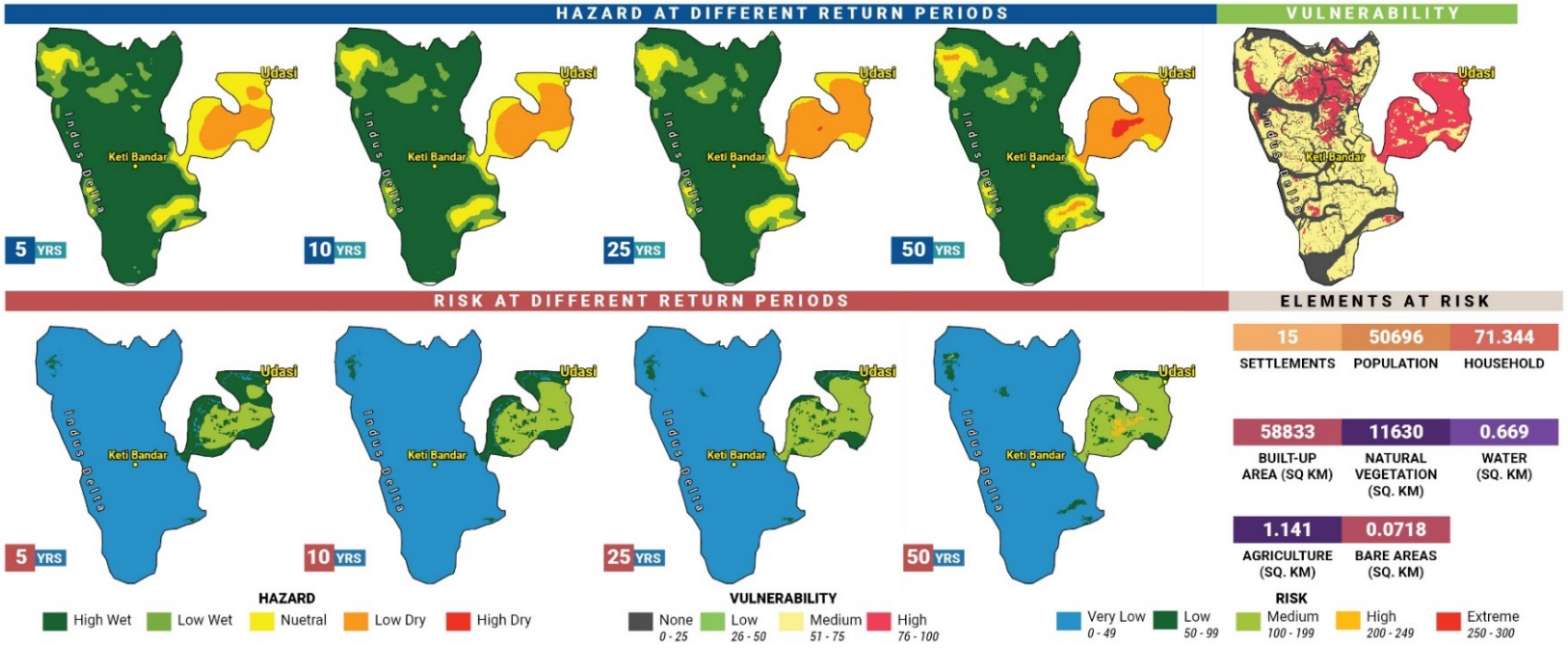
METEOROLOGICAL DROUGHT



MHVRA AT UC LEVEL

AGRICULTURAL DROUGHT



MHVRA AT UC LEVEL

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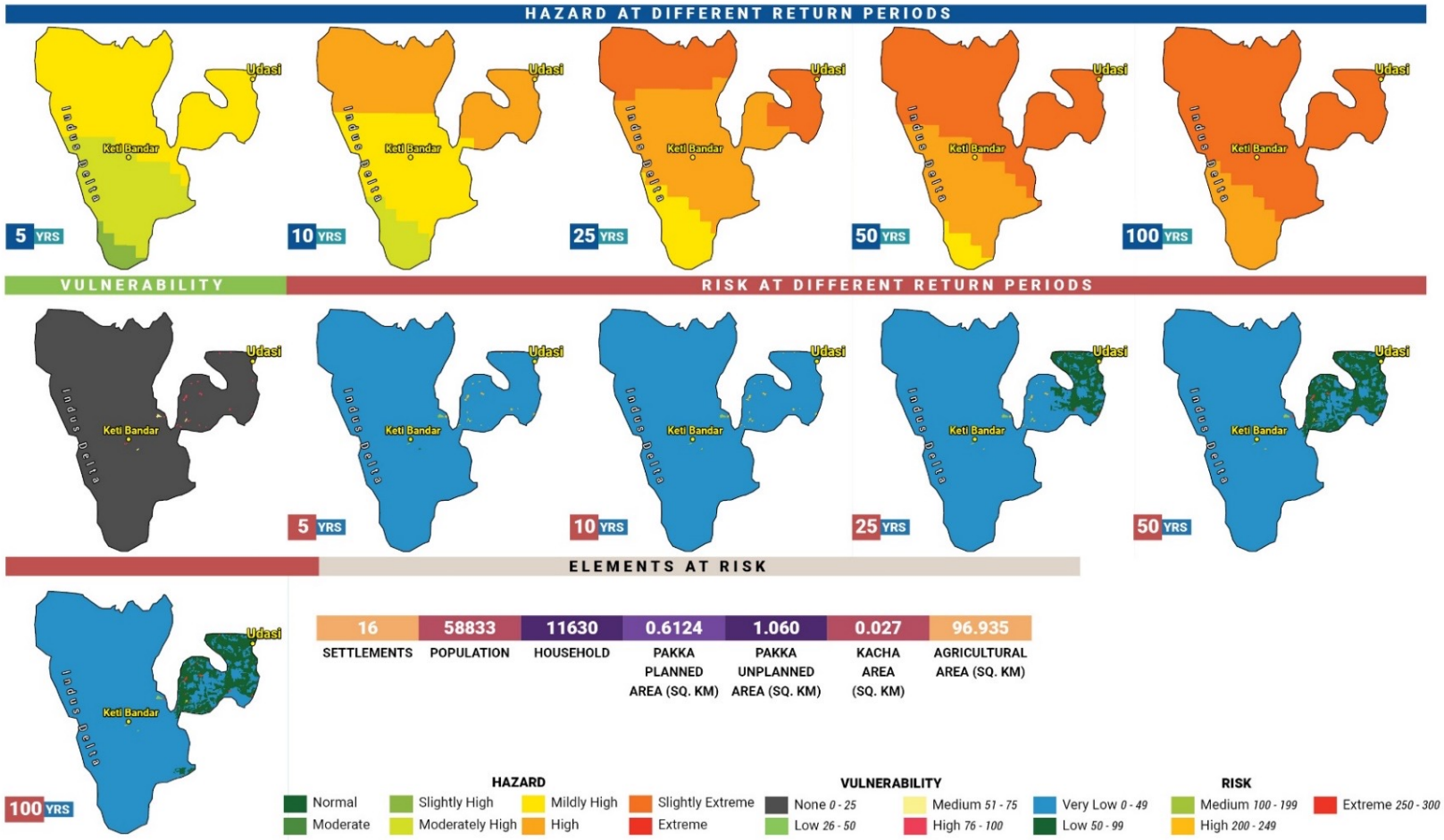
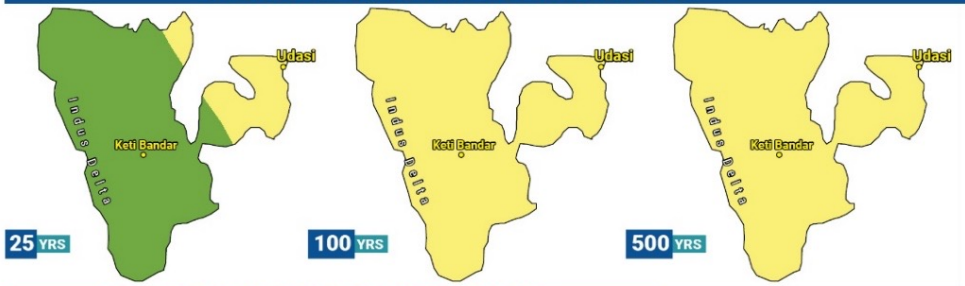
HEATWAVE



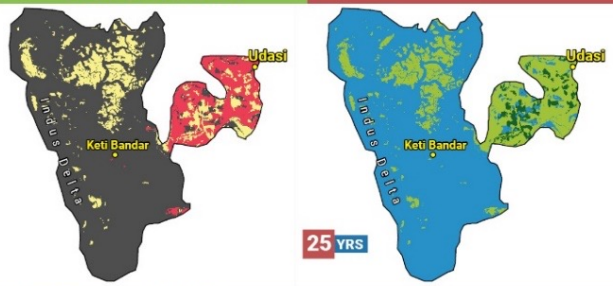
MHVRA AT UC LEVEL

CYCLONE

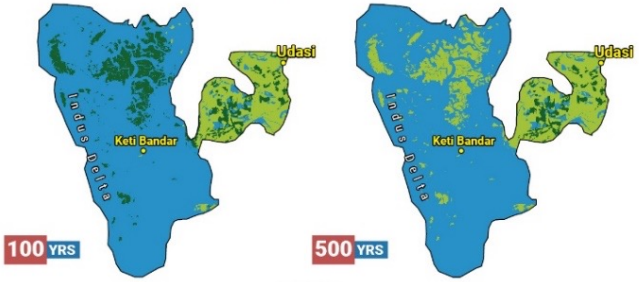
HAZARD AT DIFFERENT RETURN PERIODS



VULNERABILITY



RISK AT DIFFERENT RETURN PERIODS



ELEMENTS AT RISK

1	1	6	2	17	115.025	67.642	58833
TOURIST PLACES	TOWERS	EDUCATION FACILITIES	HEALTH FACILITIES	SETTLEMENTS	ROADS (KM)	IRRIGATION AND DRAINAGE (KM)	POPULATION

11630	0.673	1.158	0.072	103.200
HOUSEHOLD	PAKKA PLANNED AREA (SQ. KM)	PAKKA UNPLANNED AREA (SQ. KM)	KACHA AREA (SQ. KM)	AGRICULTURAL AREA (SQ. KM)

HAZARD

Low | Medium | High | Very High | Extreme

VULNERABILITY

None *0 - 25* | Low *26 - 50* | Medium *51 - 75* | High *76 - 100*

RISK

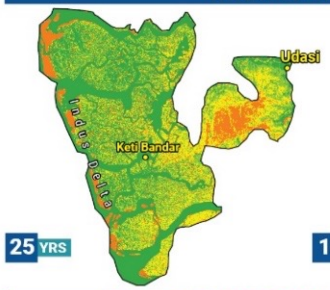
Very Low *0 - 49* | Low *50 - 99* | Medium *100 - 199* | High *200 - 249* | Extreme *250 - 300*

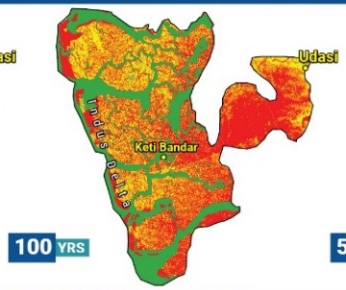
MHVRA AT UC LEVEL

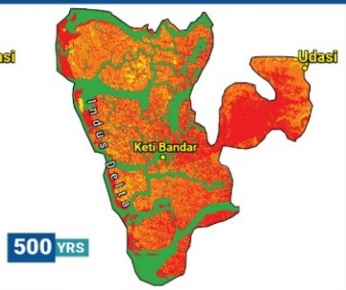
SUPARCO

STORM SURGE

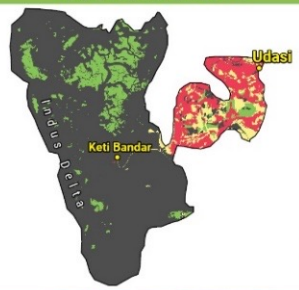
HAZARD AT DIFFERENT RETURN PERIODS

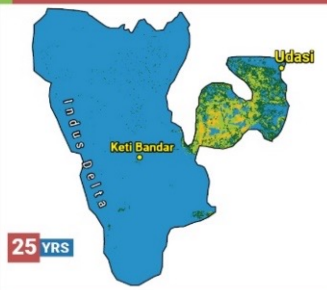




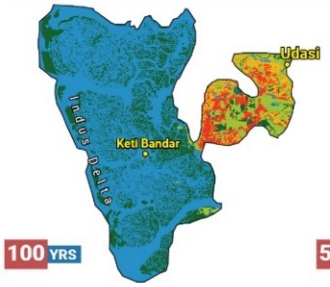


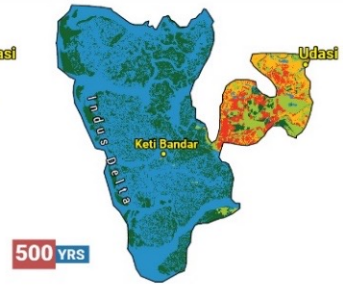
VULNERABILITY





RISK AT DIFFERENT RETURN PERIODS





ELEMENTS AT RISK

1	1	6	2	22	127.013	71.344	58833
TOURIST PLACES	TOWERS	EDUCATION FACILITIES	HEALTH FACILITIES	SETTLEMENTS	ROADS (KM)	IRRIGATION AND DRAINAGE (KM)	POPULATION

11630	0.669	1.141	0.0718	103.305
HOUSEHOLD	PAKKA PLANNED AREA (SQ. KM)	PAKKA UNPLANNED AREA (SQ. KM)	KACHA AREA (SQ. KM)	AGRICULTURAL AREA (SQ. KM)

HAZARD

Low | Medium | High | Very High | Extreme

VULNERABILITY

None *0 - 25* | Low *26 - 50* | Medium *51 - 75* | High *76 - 100*

RISK

Very Low *0 - 49* | Low *50 - 99* | Medium *100 - 199* | High *200 - 249* | Extreme *250 - 300*

MHVRA AT UC LEVEL

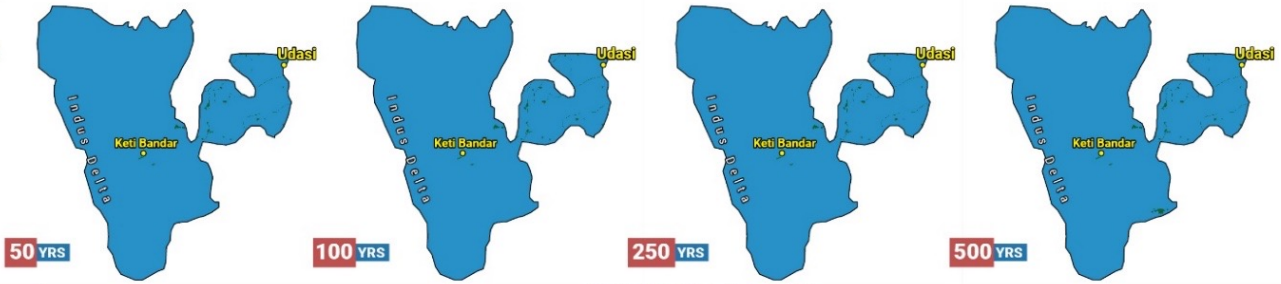
SUPARCO

EARTHQUAKE

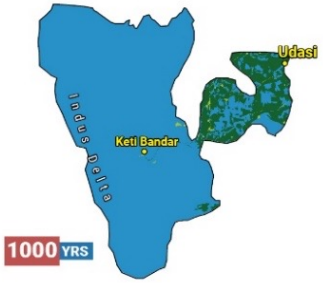
HAZARD AT DIFFERENT RETURN PERIODS

VULNERABILITY

RISK AT DIFFERENT RETURN PERIODS



ELEMENTS AT RISK



1	1	6	2	17	121.41	53.9389	58833	11630	0.680	1.162
TOURIST PLACES	TOWERS	EDUCATION FACILITIES	HEALTH FACILITIES	SETTLEMENTS	ROADS (KM)	IRRIGATION AND DRAINAGE (KM)	POPULATION	HOUSEHOLD	PAKKA PLANNED AREA (SQ. KM)	PAKKA UNPLANNED AREA (SQ. KM)

0.074	123.575
KACHA AREA (SQ. KM)	AGRICULTURAL AREA (SQ. KM)

HAZARD

Weak | Moderate | Very Strong | Violent
Light | Strong | Severe | Extreme

VULNERABILITY

None *0 - 25* | Medium *51 - 75*
Low *26 - 50* | High *76 - 100*

RISK

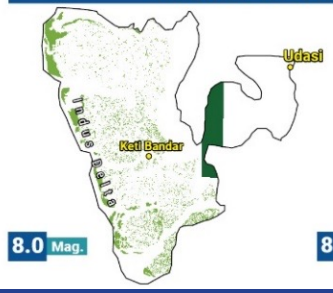
Very Low *0 - 49* | Medium *100 - 199* | Extreme *250 - 300*
Low *50 - 99* | High *200 - 249*

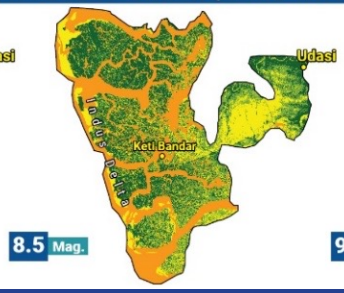
MHVRA AT UC LEVEL

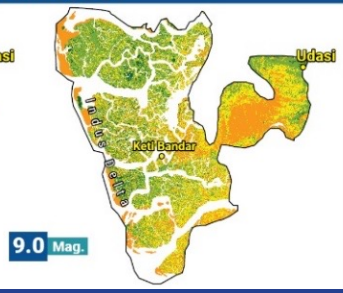
SUPARCO

TSUNAMI

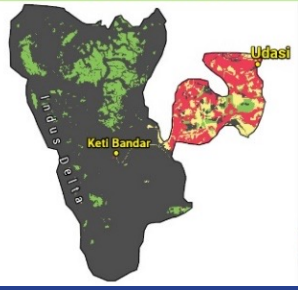
HAZARD AT DIFFERENT EARTHQUAKE MAGNITUDES



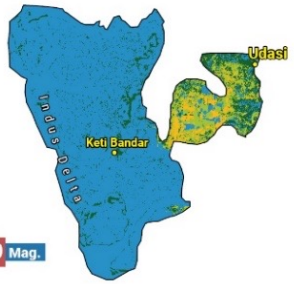




VULNERABILITY



RISK AT DIFFERENT EARTHQUAKE MAGNITUDES



ELEMENTS AT RISK

1	1	5	2	10	112.215	61.055	58136
TOURIST PLACES	TOWERS	EDUCATION FACILITIES	HEALTH FACILITIES	SETTLEMENTS	ROADS (KM)	IRRIGATION AND DRAINAGE (KM)	POPULATION

11482	0.3163	1.036	0.070	99.959
HOUSEHOLD	PAKKA PLANNED AREA (SQ. KM)	PAKKA UNPLANNED AREA (SQ. KM)	KACHA AREA (SQ. KM)	AGRICULTURAL AREA (SQ. KM)

HAZARD

Low | Medium | High | Very High | Extreme

VULNERABILITY

None *0 - 25* | Low *26 - 50* | Medium *51 - 75* | High *76 - 100*

RISK

Very Low *0 - 49* | Low *50 - 99* | Medium *100 - 199* | High *200 - 249* | Extreme *250 - 300*

MHVRA AT UC LEVEL

SUPARCO

RISK MATRIX

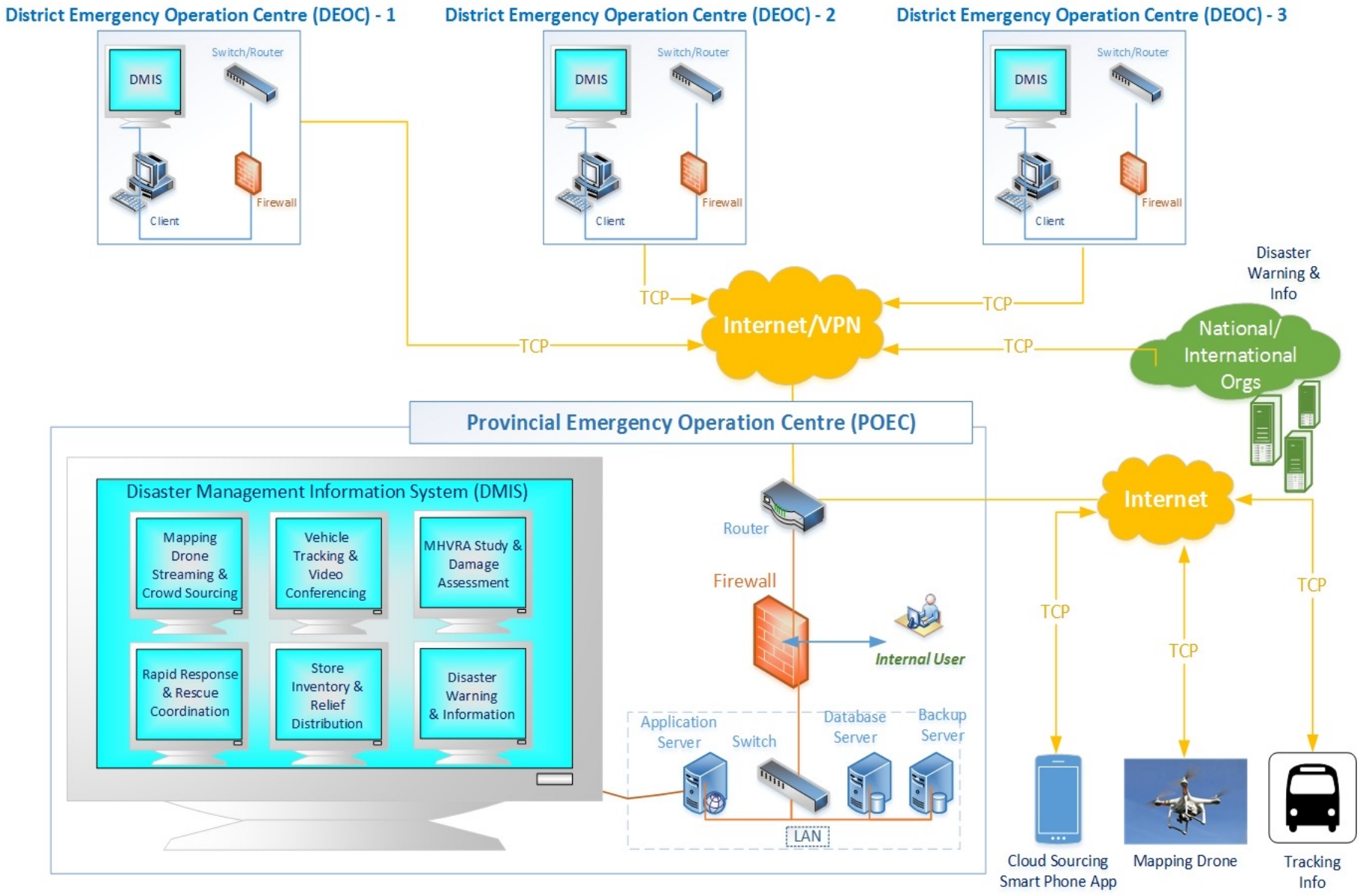
MHVRA AT UC LEVEL

SUPARCO

Disaster Management and Information System (DMIS)

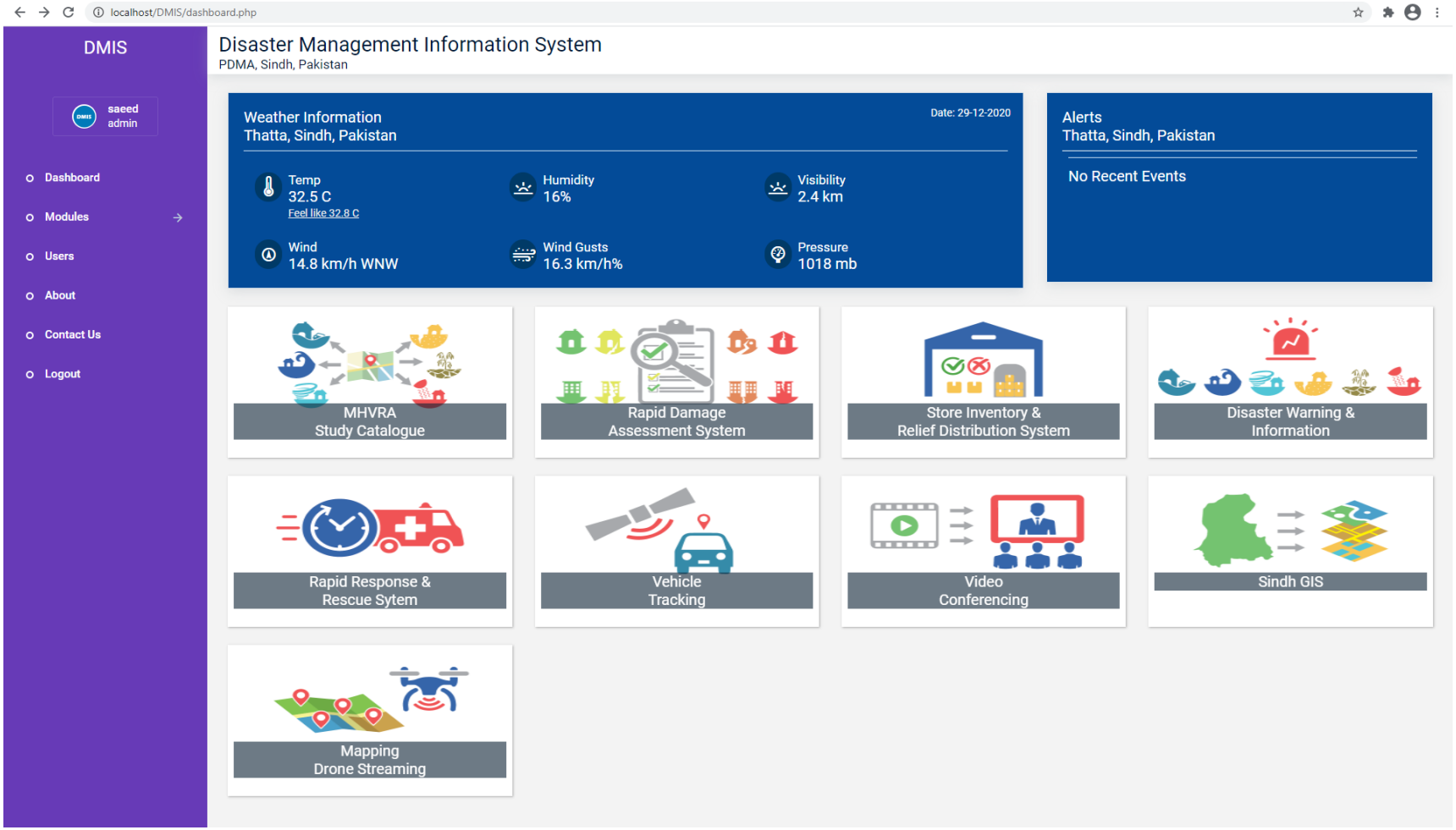
SYSTEM ARCHITECTURE FOR DMIS

SUPARCO

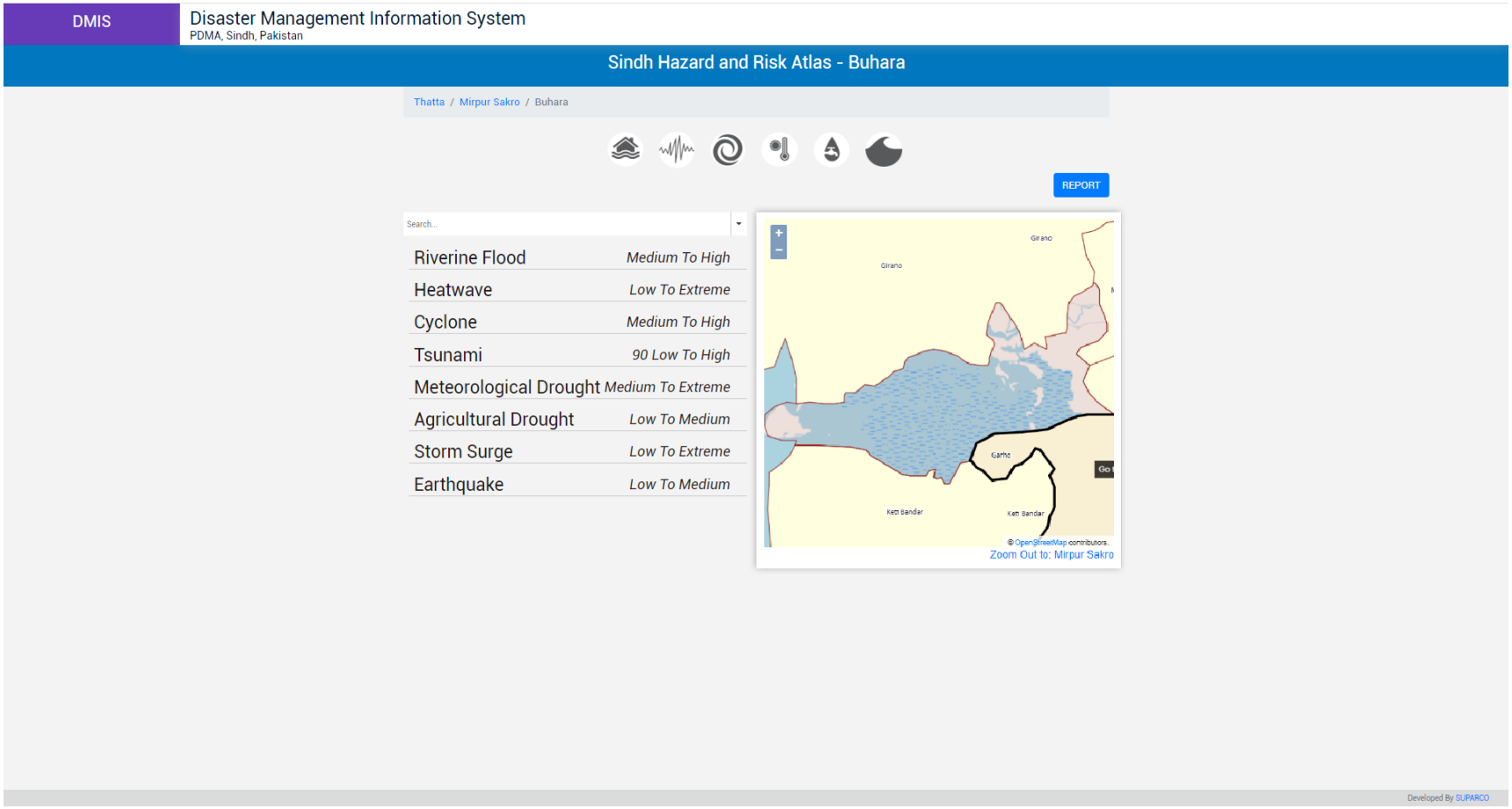


DMIS - DASHBOARD

SUPARCO



DMIS – SINDH HAZARD AND RISK ATLAS



DMIS – SINDH HAZARD AND RISK ATLAS

SUPARCO

DMIS

Disaster Management Information System
PDMA, Sindh, Pakistan

Sindh Hazard and Risk Atlas - Buhara

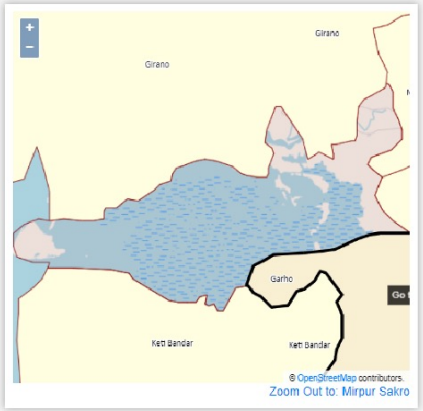
Thatta / Mirpur Sakro / Buhara

REPORT

Search...

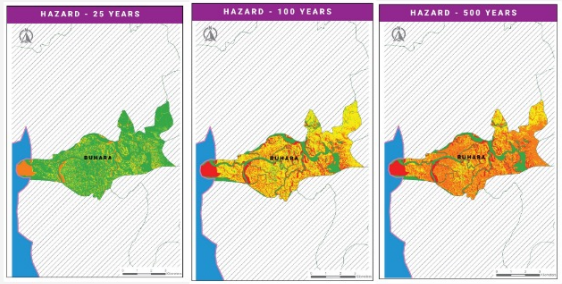
Storm Surge

The UC is affected by storm surges and majority of the area is in "Medium" to "High" risk zones. The creek area present towards the western part of UC is highly affected by storm surge and parts of the land are in "Extreme" zone. However, the vulnerability of these areas is between none to "Medium", with the mangrove area in "Medium" vulnerability. Overall risk of the UC is majority "Very Low" to "Low", due to no population or agriculture being present in these areas. However, the northeastern part of the UC, where the land cover is mostly cropland falls into the "Medium" risk zone for 25 to 100 years and in 500 to 1000 years it is in "Medium" to "High" risk.



Hazard

None-0 Low-1 Medium-2 High-3 Extreme-4



Risk

Very Low 0-49 Low 50-99 Medium 100-199 High 200-249 Extreme 250-300

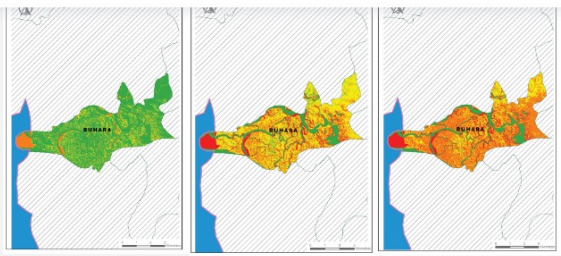
DMIS – SINDH HAZARD AND RISK ATLAS

SUPARCO

DMIS

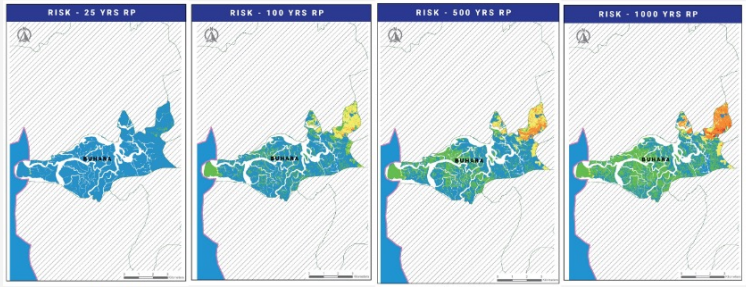
Disaster Management Information System

PDMA, Sindh, Pakistan



Risk

Very Low 0-49 | Low 50-99 | Medium 100-199 | High 200-249 | Extreme 250-300



Vulnerability

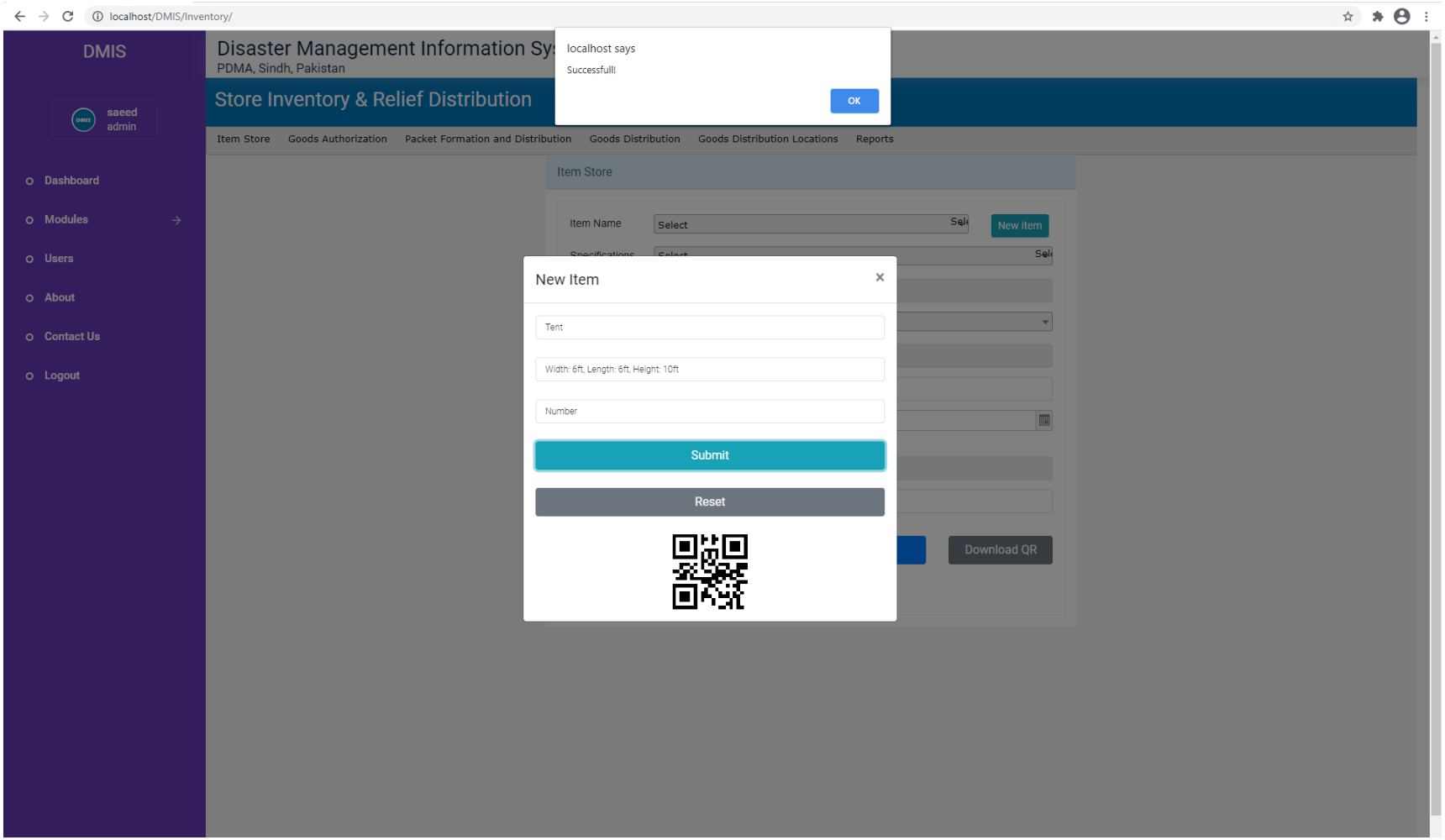
None 0-25 | Low 26-50 | Medium 51-75 | High 76-100

DMIS – STORE INVENTORY AND RELIEF DISTRIBUTION

QR Code Scanner

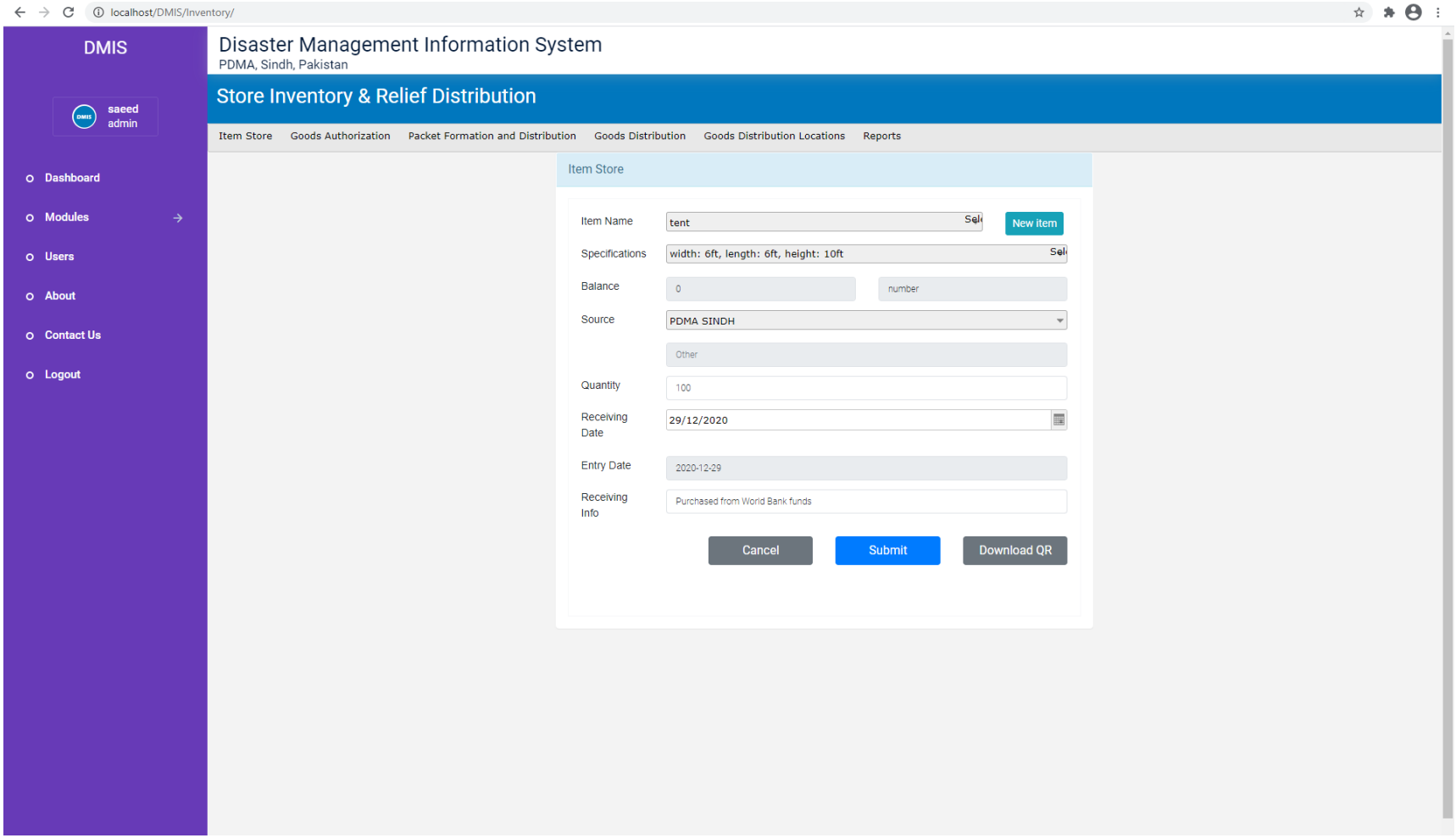
DMIS – INVENTORY STORE AND RELIEF DISTRIBUTION

SUPARCO



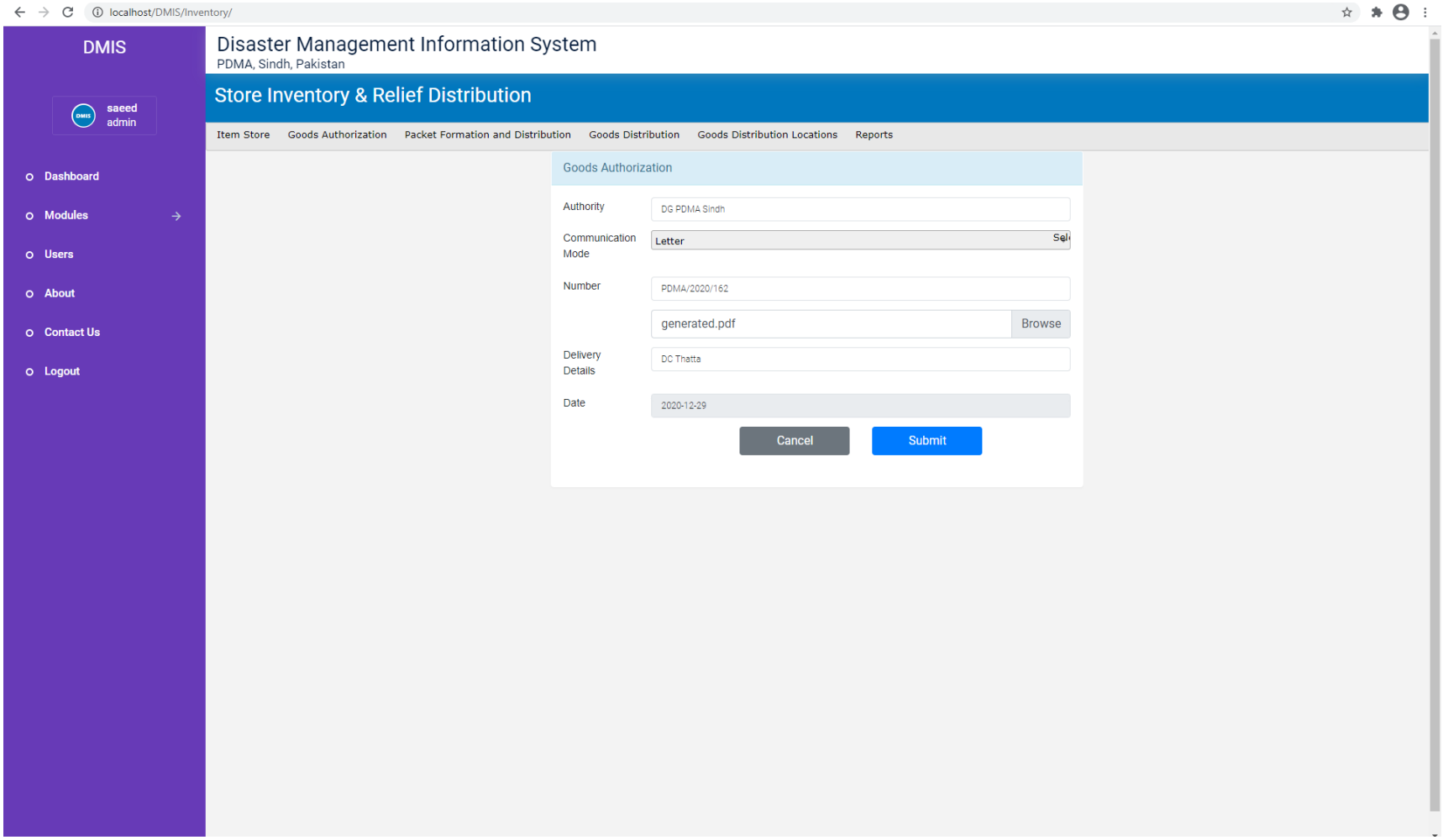
DMIS – INVENTORY STORE AND RELIEF DISTRIBUTION

SUPARCO



DMIS – INVENTORY STORE AND RELIEF DISTRIBUTION

SUPARCO



DMIS – INVENTORY STORE AND RELIEF DISTRIBUTION

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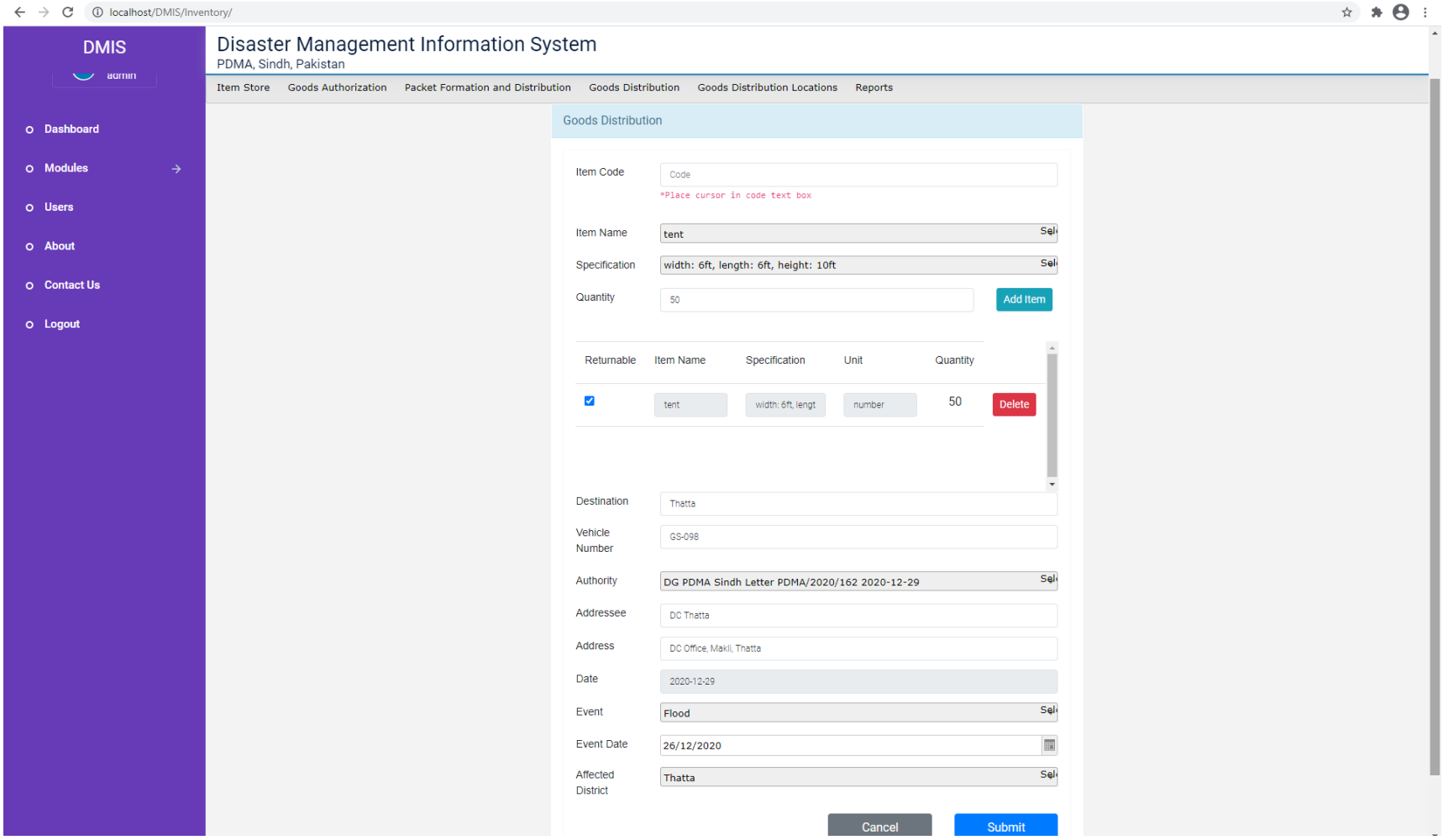

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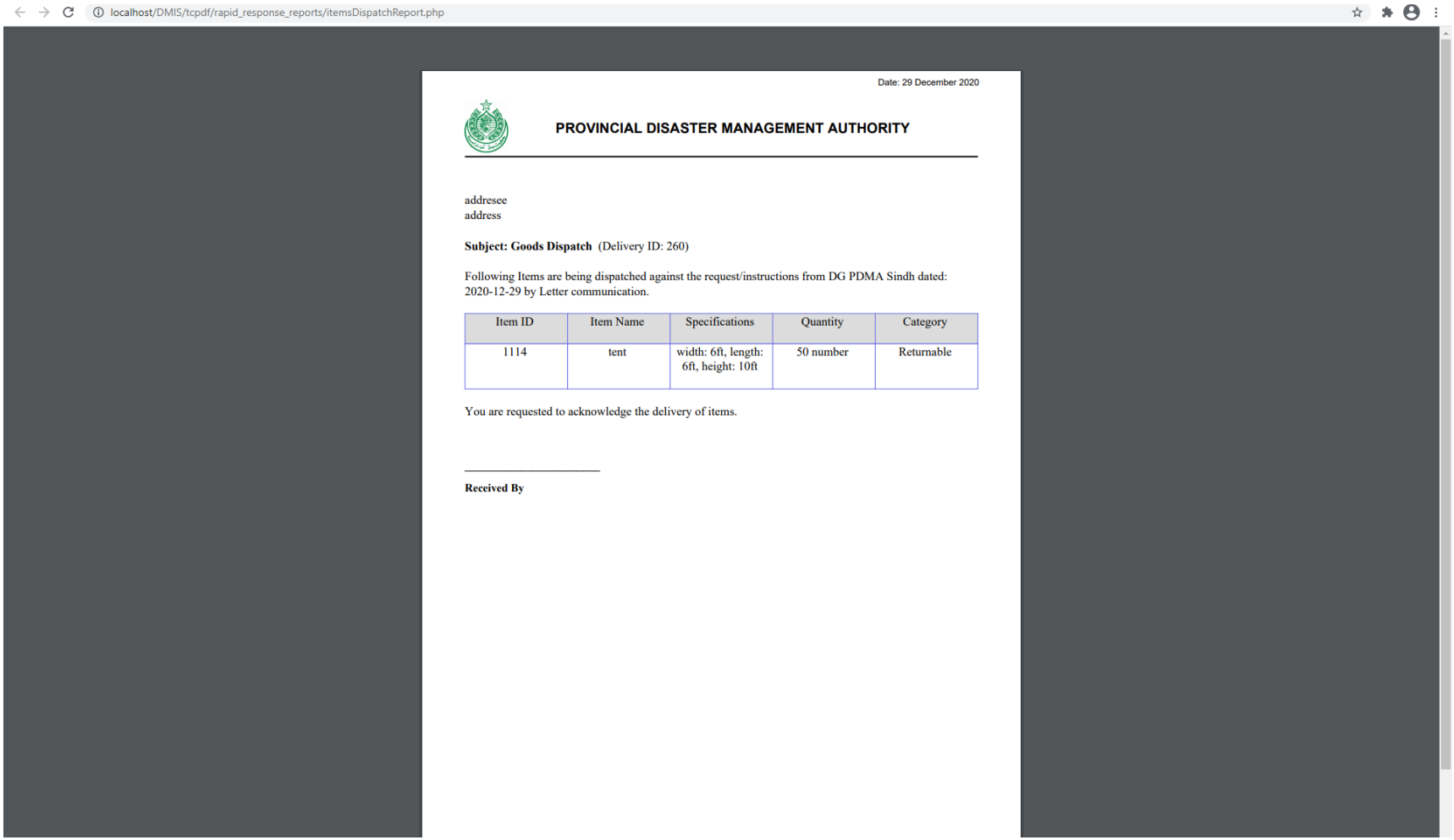

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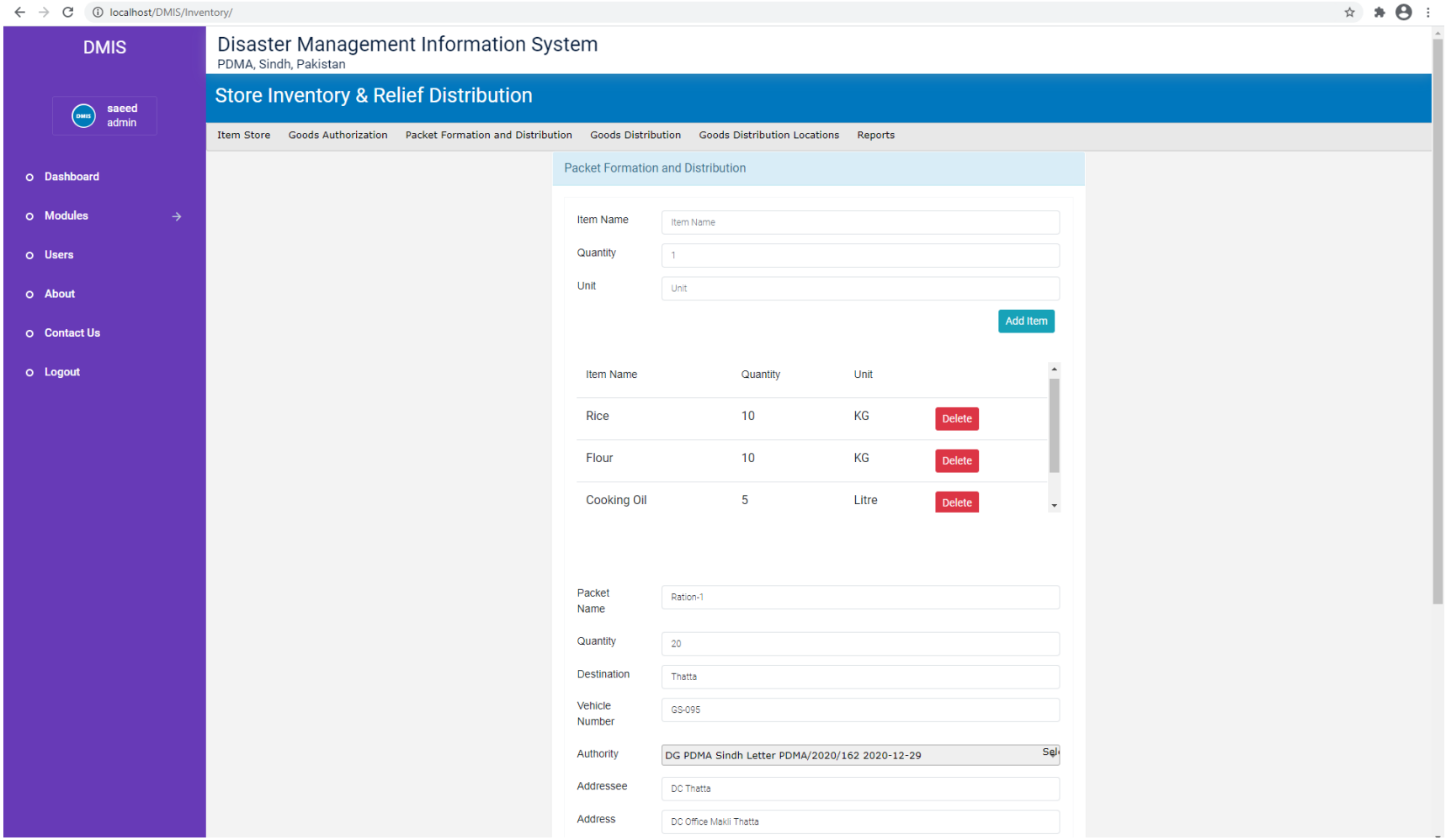

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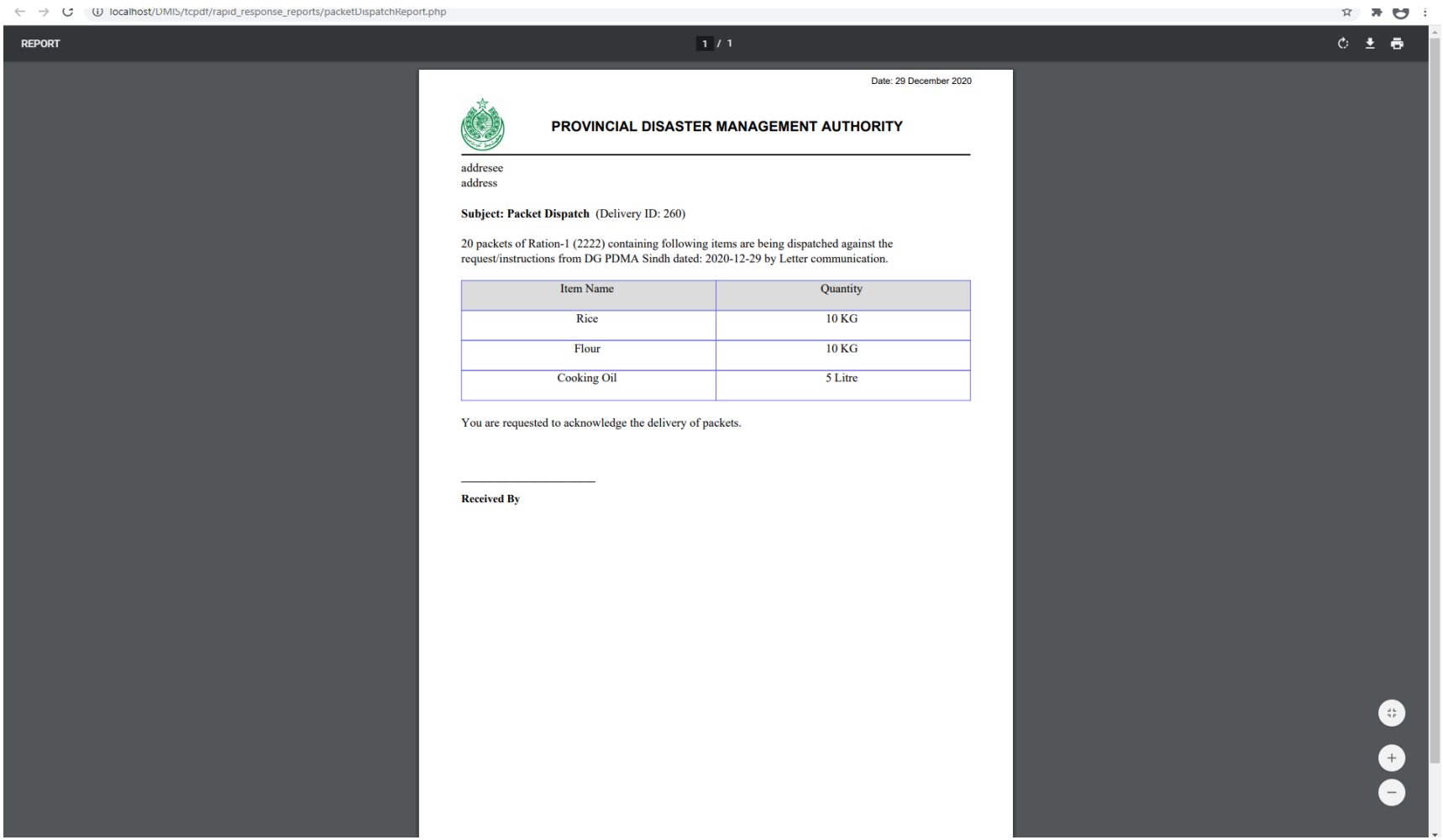
SUPARCO



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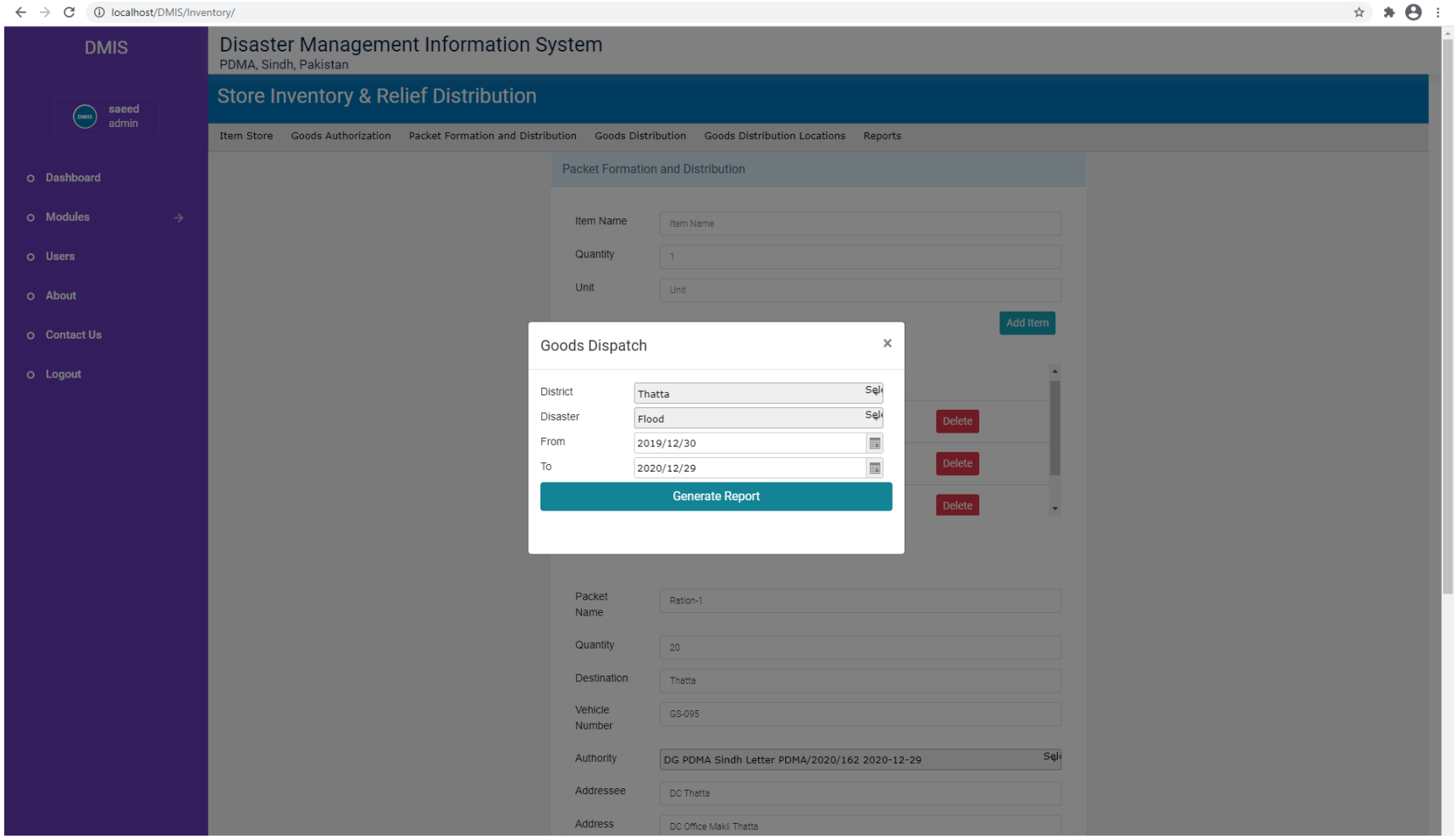

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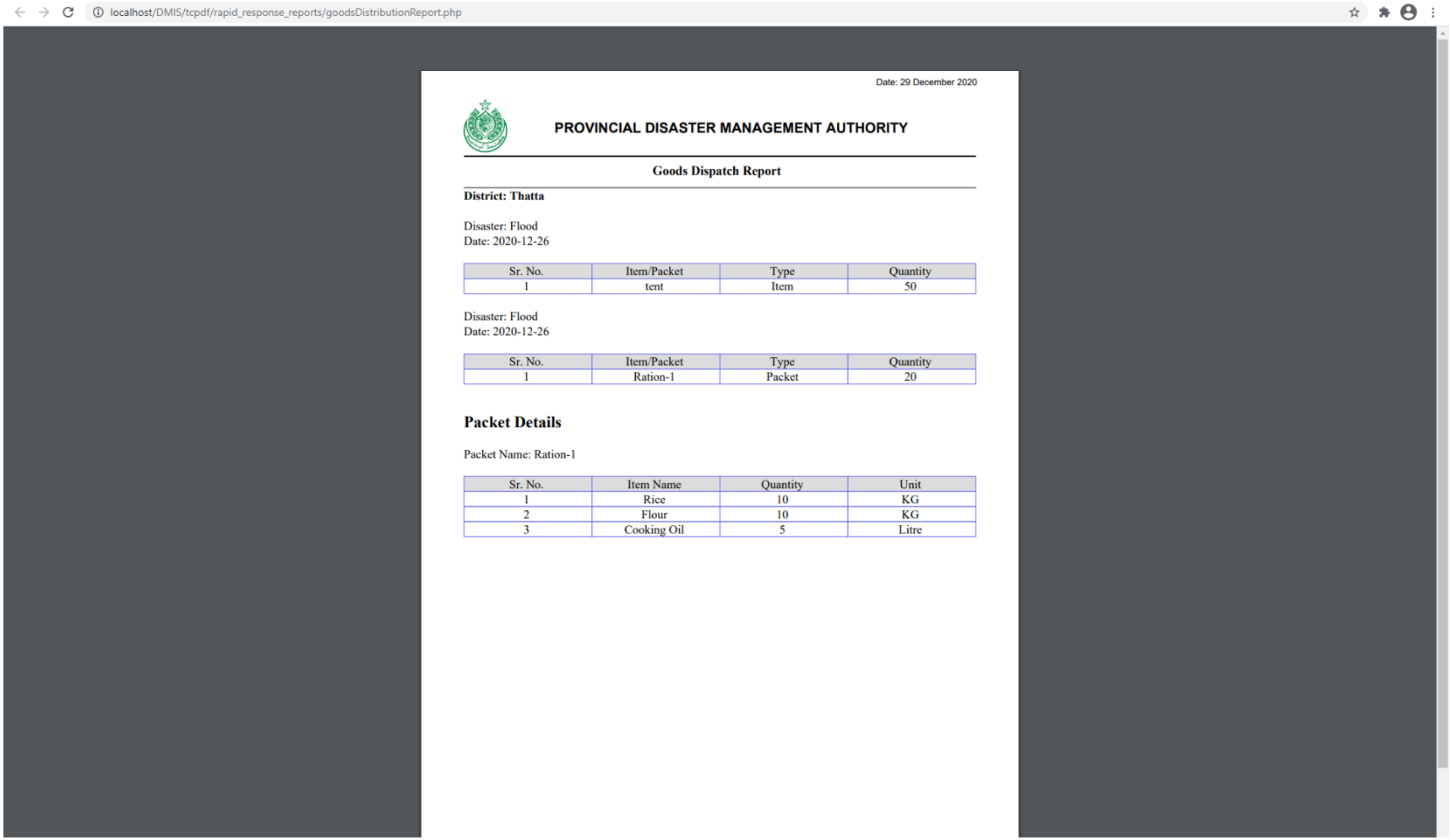

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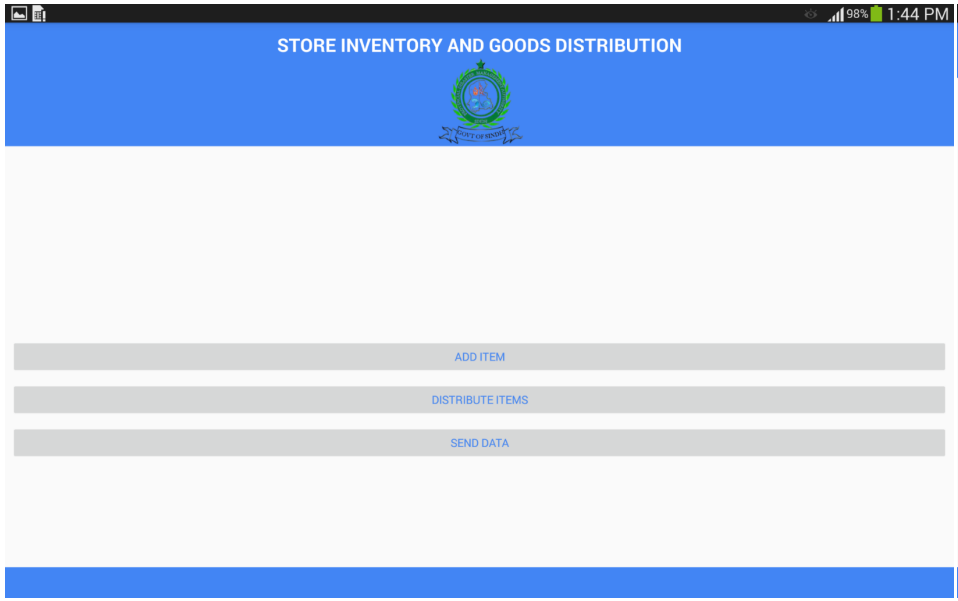
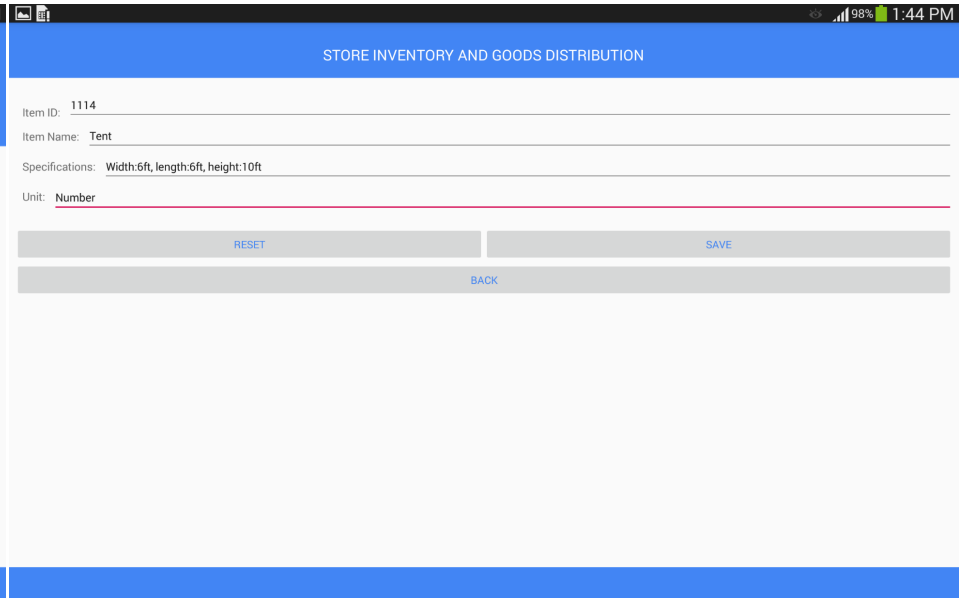
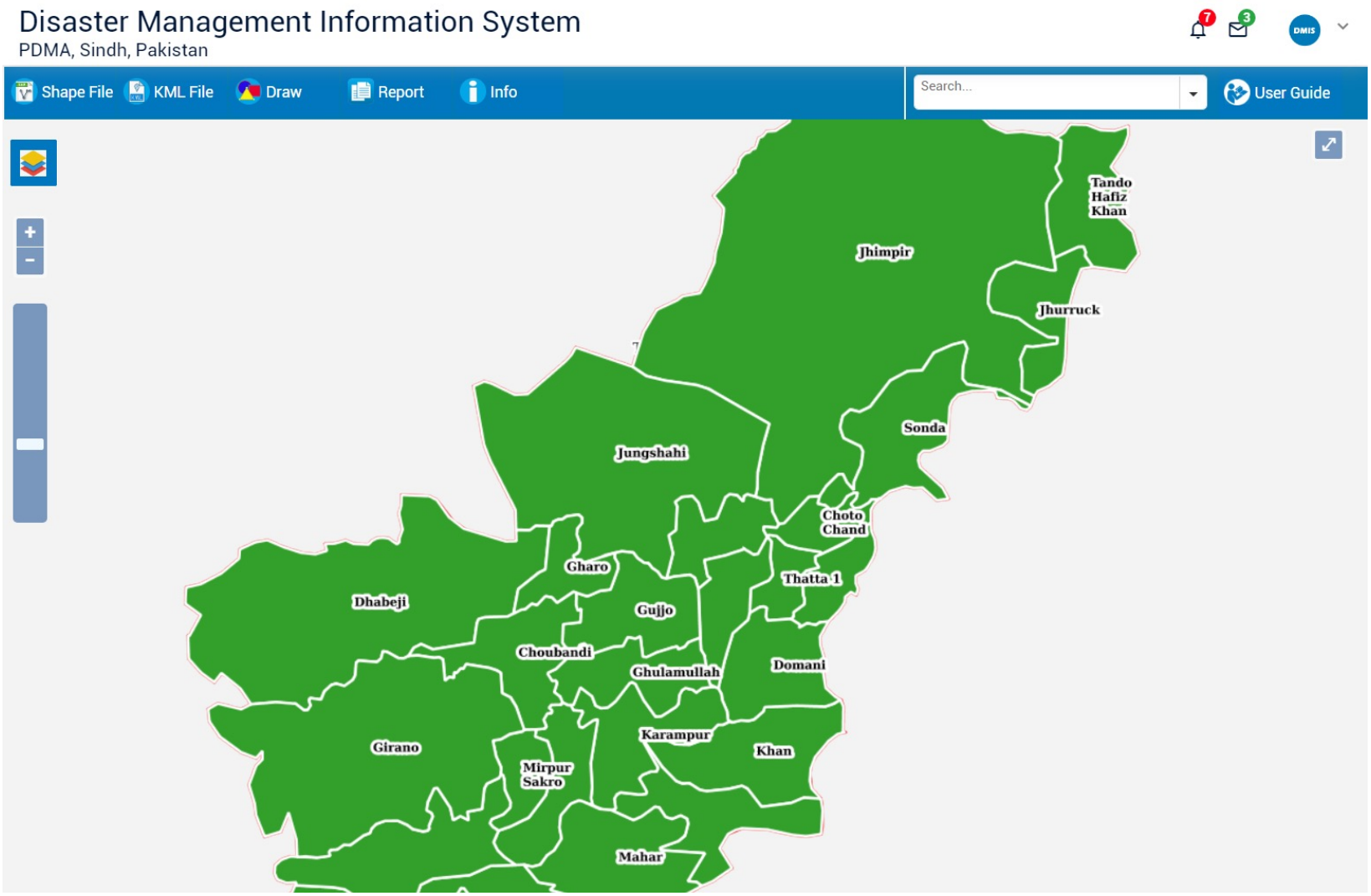




DMIS – RAPID DAMAGE ASSESSMENT

SUPARCO



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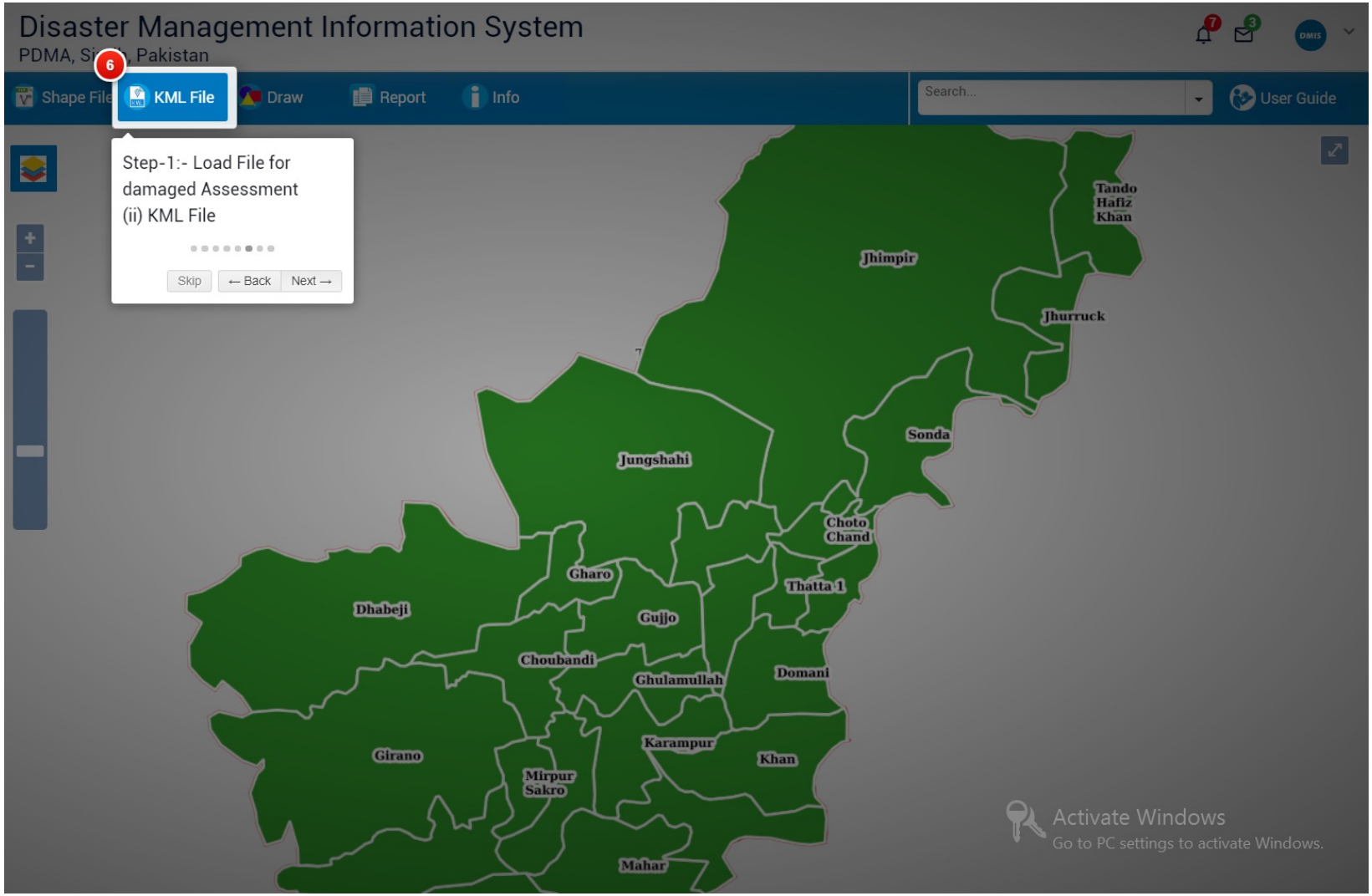

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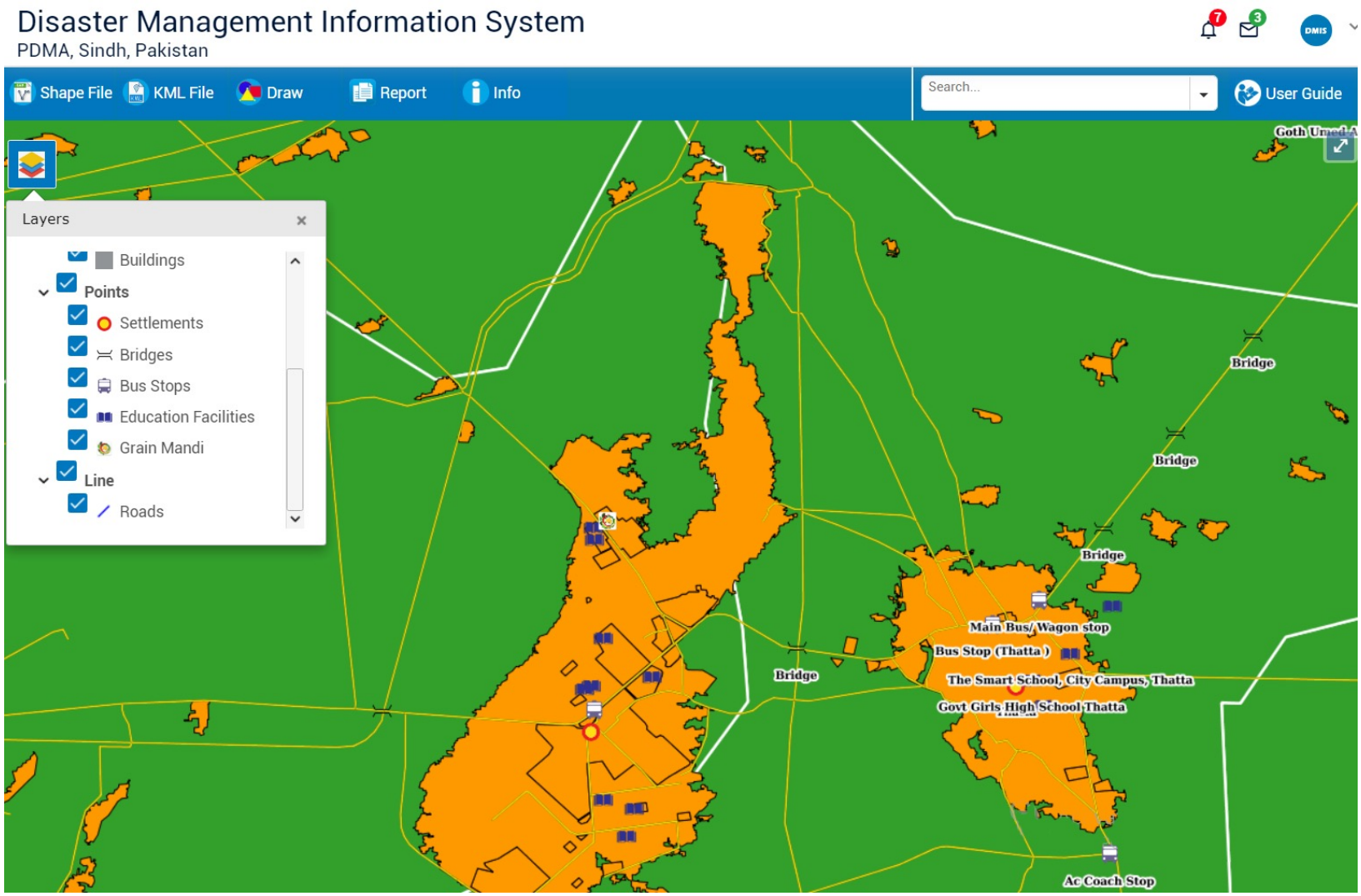

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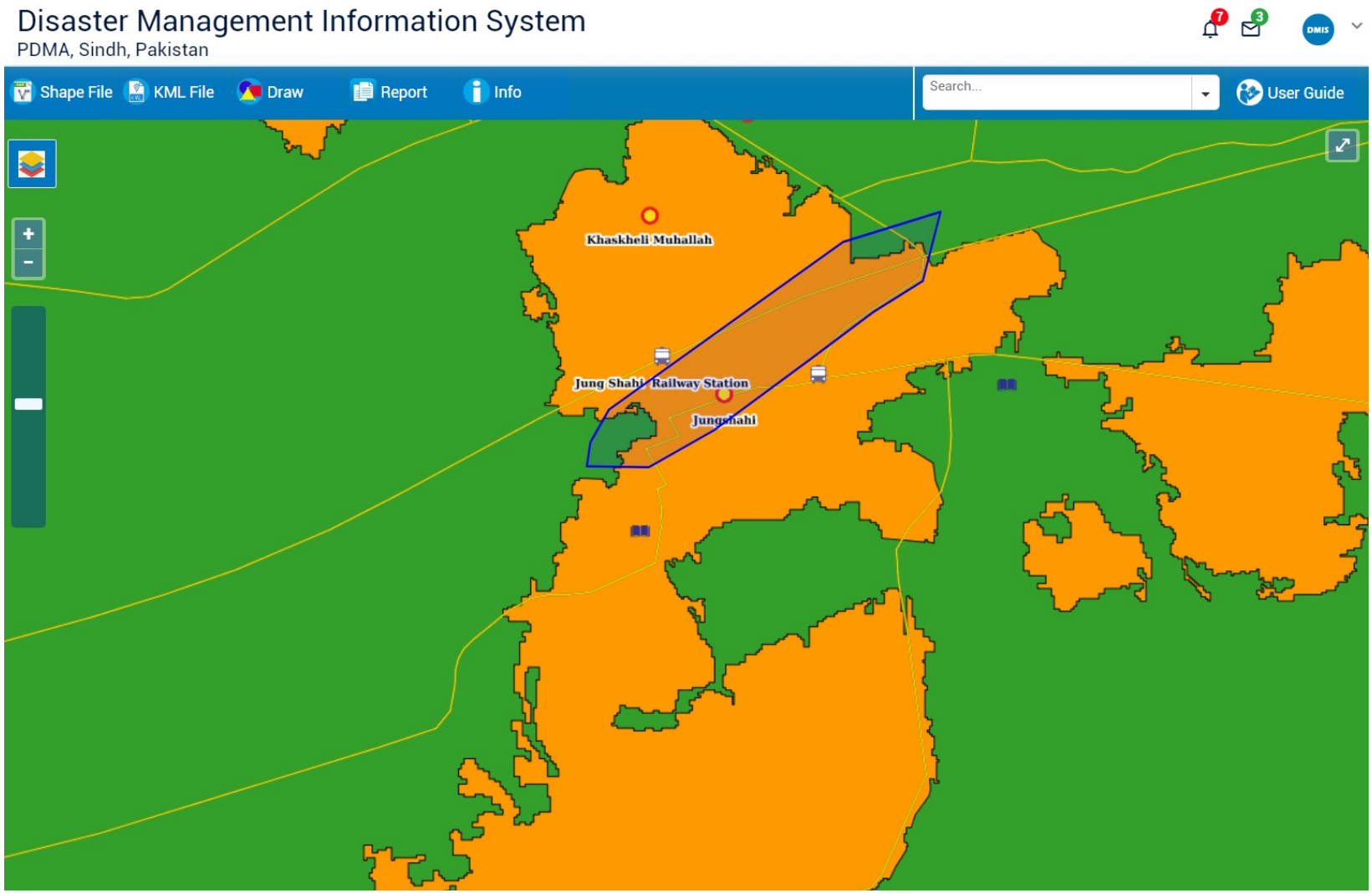

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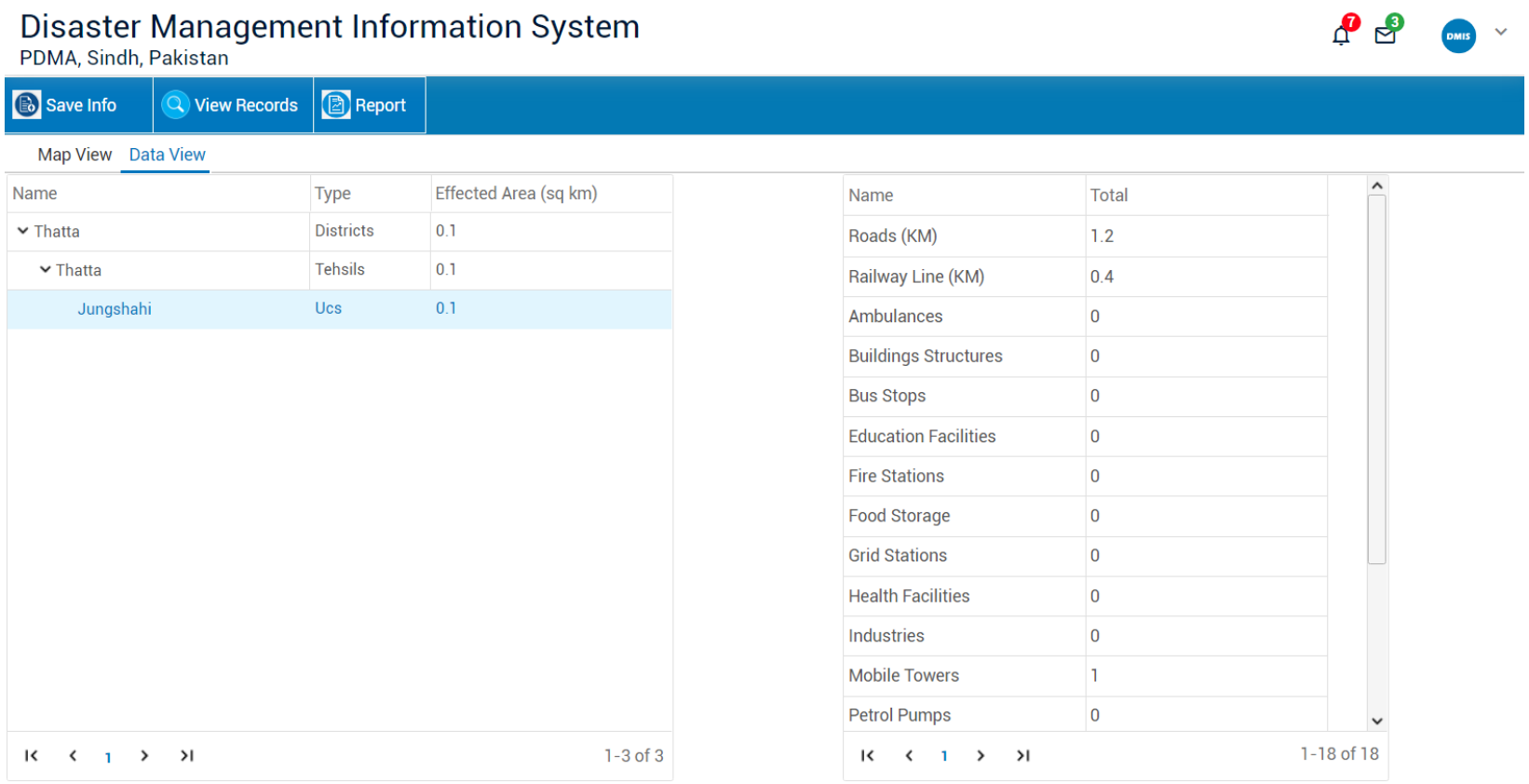


DMIS – RAPID DAMAGE ASSESSMENT

SUPARCO

Provincial Disaster Management Authority
Sindh Pakistan

Rapid Damage Assessment

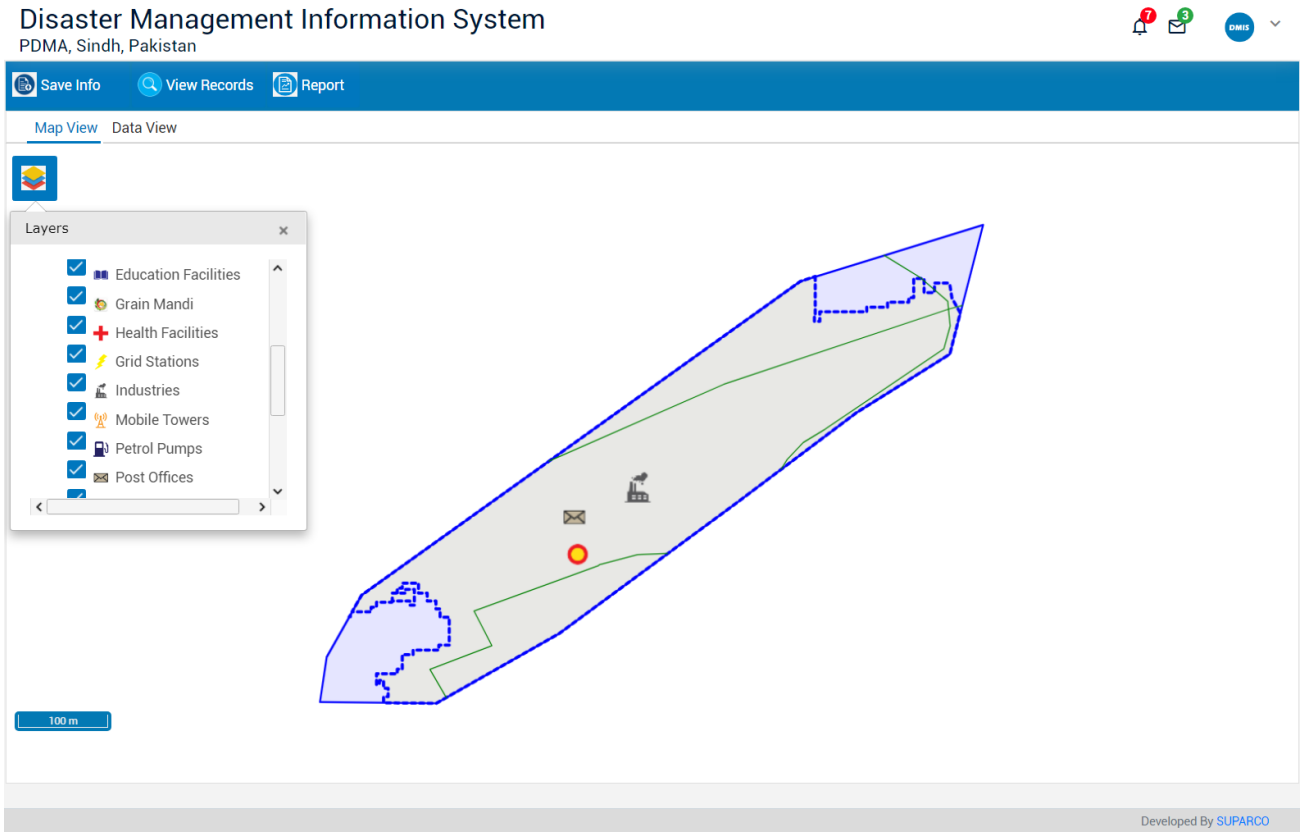
Administrative Boundaries

Name	Type	Effected Area(km^2)
Thatta	Districts	0.1
Thatta	Tehsils	0.1
Jungshahi	Ucs	0.1

Number of Total Effected POI

Name	Value
Roads (KM)	1.2
Railway Line (KM)	0.4
Ambulances	0
Buildings Structures	0
Bus Stops	0
Education Facilities	0
Fire Stations	0
Food Storage	0
Grid Stations	0
Health Facilities	0
Industries	0
Mobile Towers	1
Petrol Pumps	0
Police Stations	0
Post Offices	1
Protected Areas	0
Tourist places	0

DMIS – RAPID DAMAGE ASSESSMENT



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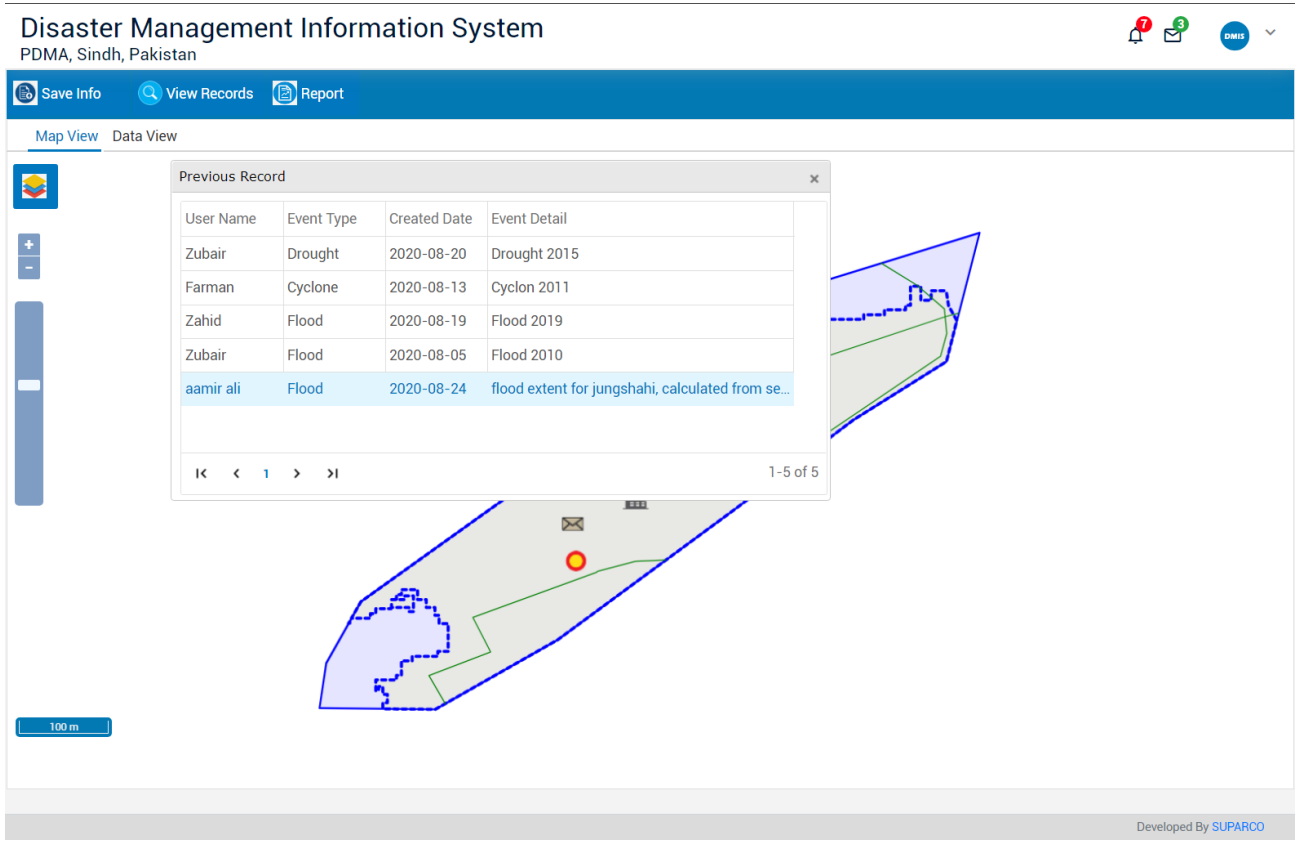

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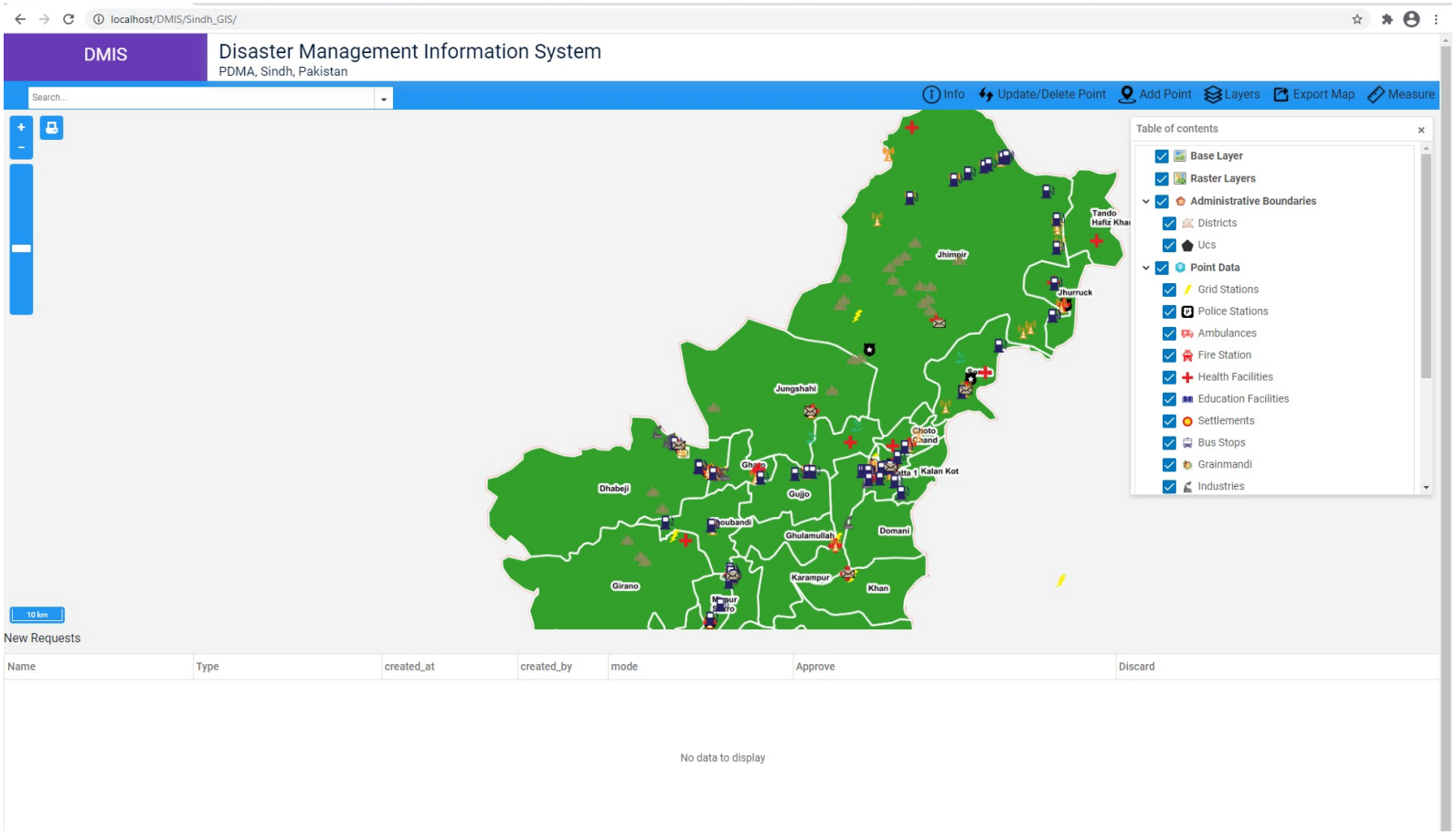

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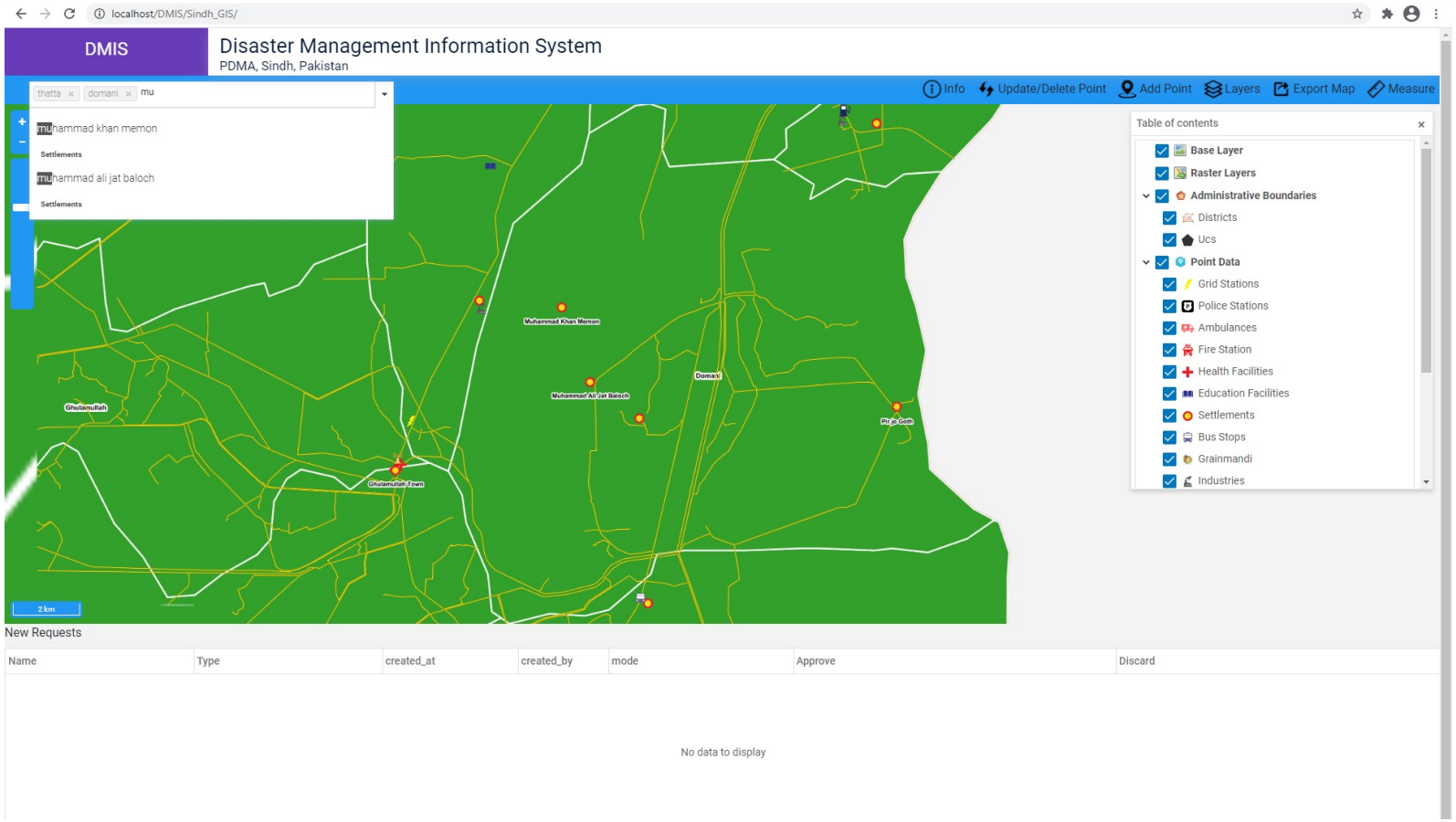

DMIS – SINDH GIS

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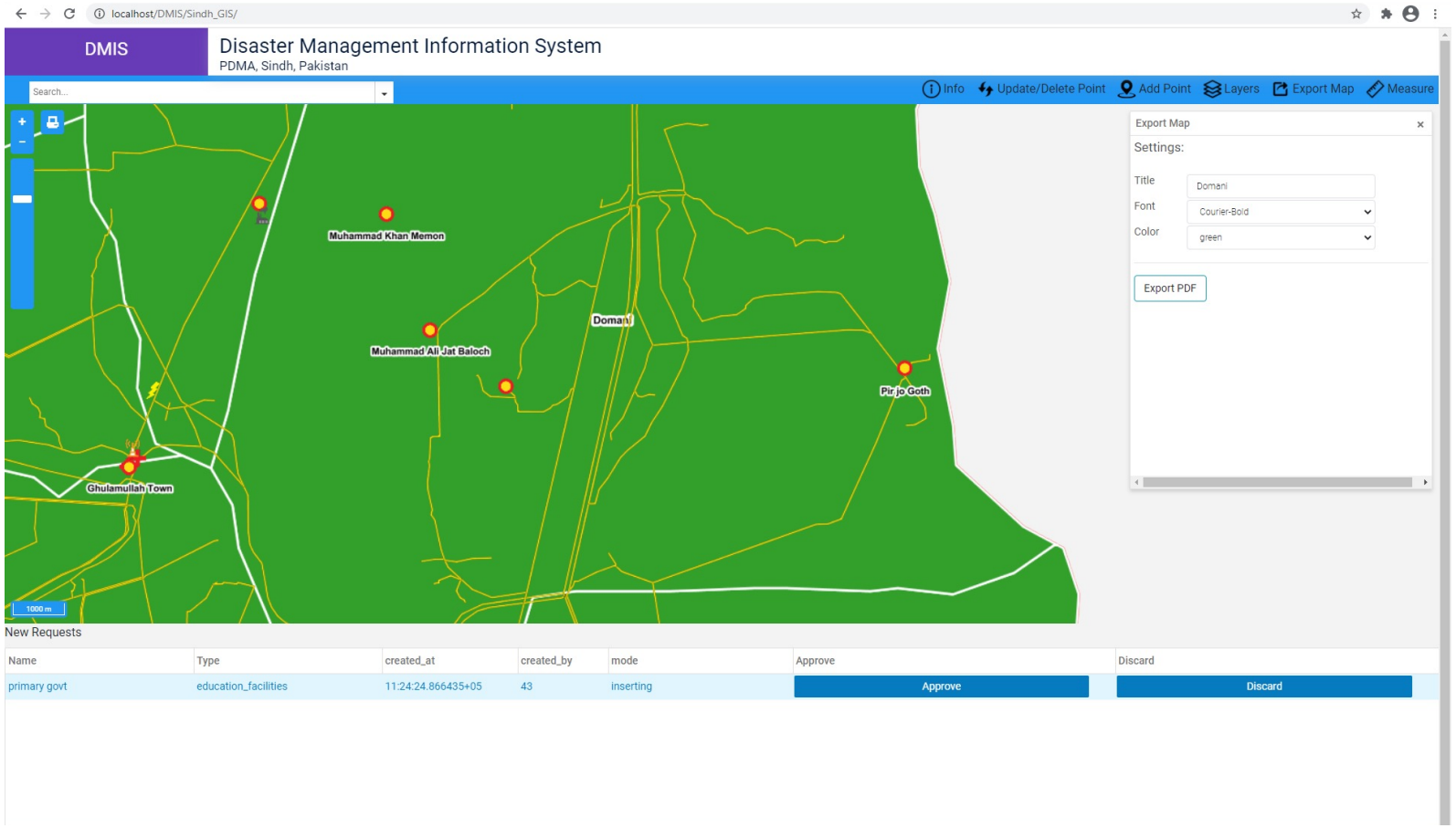

DMIS – SINDH GIS

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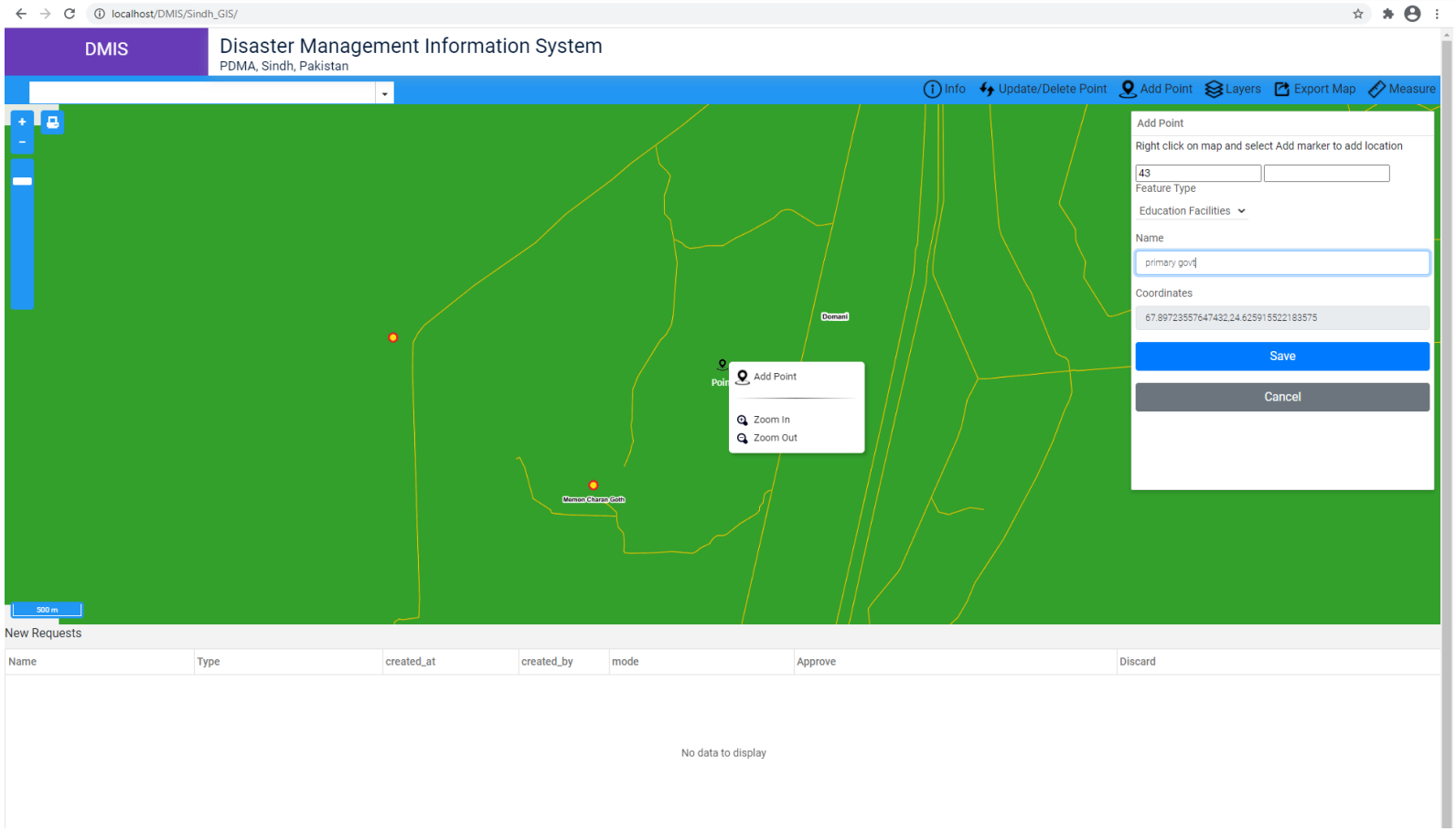

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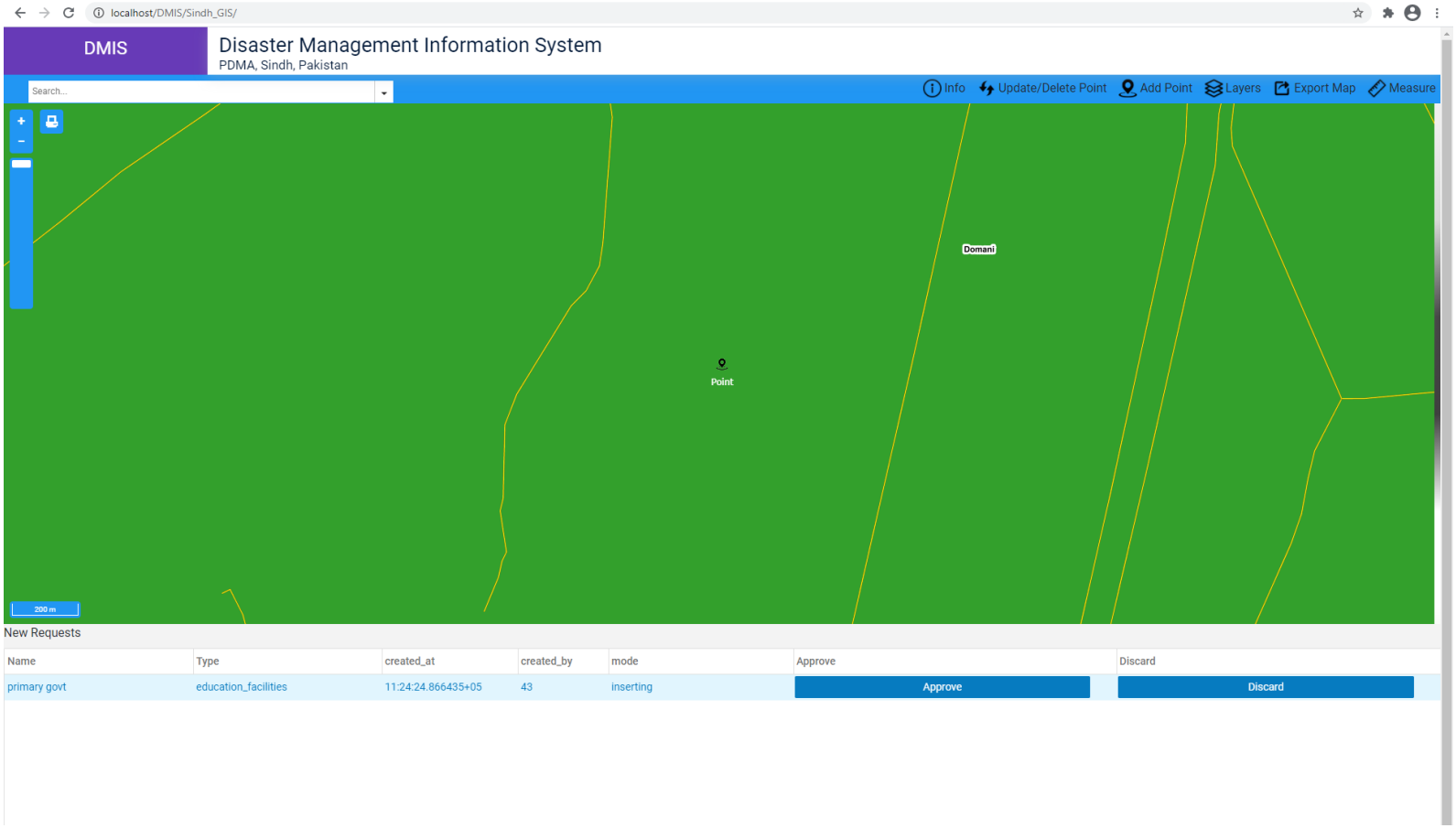

DMIS – DISASTER WARNINGS

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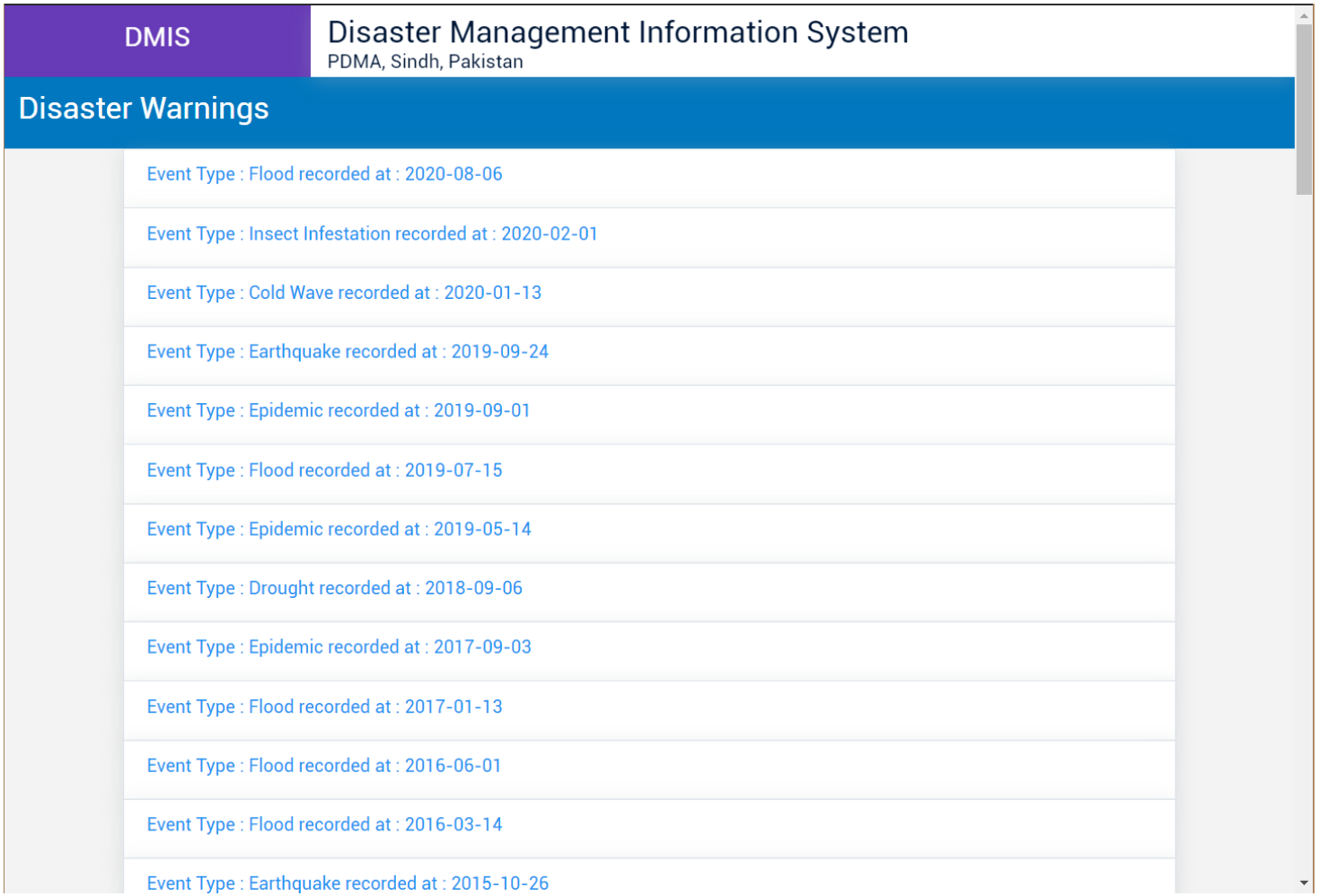

DMIS – DISASTER WARNINGS

SUPARCO

DMIS

Disaster Management Information System

PDMA, Sindh, Pakistan

Disaster Warnings

Event Type : Flood recorded at : 2020-08-06

Heavy rainfall started in Sindh and Baluchistan from the 6 August and continued till the 7 August with intermissions. Continuous rain over a period of 24 hours caused massive flooding in Karachi, Hyderabad, Shaheed Benazirabad and Dadu of Sindh province. However, Tehsil Johi in Dadu district is the area which is greatly affected by flash floods. It has been reported that floods are not only damaging infrastructures and houses but also destroyed crops in Johi Tehsil. Government of Sindh has declared 80 villages in Dadu district as "Calamity Affected Areas". The floods also hit different parts of Baluchistan including Kacchi, Sibbi, Harnai, Naseerabad, Jafferabad and Jhal Magsi districts where Jhal Magsi and Jafferabad districts as the most affected areas according to the rapid needs' assessment report. On 18 August, the Government of Baluchistan also declared emergency in Jhal Magsi district.

Dadu district, located at the border between Baluchistan and Sindh, was the worst hit area in recent monsoon floods. Multiple breaches reported in 'Flood Protection Embankment' on 8 August, which triggered flooding in at least 200 villages in Johi Taluka (Tehsil), Dadu district.According to the data collected form Revenue Department at Taluka Revenue Office Johi by PRCS teams, 109 villages in 84 Dehs (villages) of seven UCs (out of total 14 UCs) of Taluka Johi were hit by flood/flash flood. Total population in these affected UCs is approximately 136,520 which is scattered, and these type of topography makes them more vulnerable and inaccessible.

Torrential rains that lashed 22 districts of Baluchistan province on 7 August caused flooding and damaged bridges and highways, cutting off highways Gwadar-Karachi, Quetta-Jacobabad from main cities. Several parts of the province were inundated with floodwaters and the paramilitary personnel were called in to evacuate people to safer areas. In Bolan area, flash floods swamped and damaged the main Quetta-Sibi highway at various points, cutting off the area with the provincial capital. Initially, it has been reported that Jhal Magsi, Jafferabad, Sibi, Harnai, Naseerabad and Kachi districts areas are badly affected by the floods. In Jhal Magsi district alone, six UC and 40 villages are completely washed away by heavy floods. Apart from damage of infrastructures and destruction to houses, seven persons are reported dead and more than 50 are injured, and the floods washed away standing crops and livestock on its way in district Jhal Magsi and Jafferabad. (IFRC, 20 Aug 2020)

Monsoon rains and associated flooding continue to affect Pakistan, resulting in at least 90 fatalities and injuring 40, according to national authorities. More than 1,080 houses, 5 bridges and 10 roads have been damaged or destroyed. On 24-25 August, rescue operations in Karachi, and Dadu Districts (Sindh Province) saw the evacuation of 1,544 individuals, after flooding and landslides. Media report 3 people killed and hundreds of homes and streets inundated. Additional rain and thunderstorms are forecast over most of Pakistan on 26-27 August. (ECHO, 26 Aug 2020)

SUPARCO

THANK YOU