

Final Report on

Development of Digital Elevation Model and delineation of Catchment boundaries (DEM) for 2 polders (55/2A and 55/2C) of Blue Gold Program

November 2015

Dhaka



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Table of contents

Table of contents	I
List of figures	II
List of tables	II
List of Photograph	III
Acknowledgement	iv
Executive Summary	v
1. Introduction	1
1.1 Study area.....	1
1.2 Scope of works	1
1.3 Deliverables and outcomes.....	3
2. Activities	4
2.1 Initial consultation meeting	4
2.2 Inception Report	4
2.3 Data collection.....	4
2.4 Digital Elevation Model (DEM) development	5
2.4.1 Scanning and geo-referencing	5
2.4.2 Data capturing.....	5
2.4.3 Data editing and accuracy assessment.....	6
2.4.4 Develop Digital Elevation Map (DEM).....	6
2.5 Field Investigation	9
2.6 Hydrological boundary and drainage pattern assessment	11
2.6.1 Catchment area and tidal dynamics assessment.....	11
2.6.2 Catchment of Polder 55/2A	11
2.6.3 Catchment of Polder 55/2C	24
2.7 Tidal dynamics assessment	32
2.7.1 BWDB gauge data.....	36
3. Conclusion	39
Appendix A: Area Elevation CurveOf Polder 55-2A	
Appendix B: Area Elevation CurveOf Polder 55-2C	
Appendix C: CEGIS Water Level Gauge data	

List of figures

Figure 1.1: The study area	2
Figure 2.1: Overall methodology of the activities.....	4
Figure 2.2 : Sample of BIWTA FINNMAP	5
Figure 2.3: Digital Elevation Model (DEM) of Polder 55/2A.....	7
Figure 2.4: Digital Elevation Model (DEM) of Polder 55/2C.....	8
Figure 2.5: Intervention and catchment Map of Polder 55/2A.....	11
Figure 2.6: Intervention and catchment Map of Polder 55/2C	25
Figure 2.7: Drainage Pattern Map of Polder 55/2A.....	31
Figure 2.8: Drainage pattern Map of Polder 55/2C	32
Figure 2.9: Area Elevation and Storage curve of Chadpura Catchment.....	32
Figure 2.10: BWDB and CEGIS installed gauge location map.....	33
Figure 2.11: Surface water level at R/S of Sutarmal Khal.....	35
Figure 2.12: Surface water level at R/S of Dhorandi Khal.....	35
Figure 2.13: Surface water level at R/S of Chadpura khal	36
Figure 2.14: Surface water level at D/S of Chiknikandi Bridge	36
Figure 2.15: surface water level at Galachipa (Lohalia River).....	37
Figure 2.16: surface water level at Patuakhali (Lohalia River)	37
Figure 2.17: Flood depth map at high tide (30 Oct – 01 Nov, 2015).....	38

List of tables

Table 2.1: Drainage outlet/ hydraulic structure wise drainage catchment for Polder 55/2A.	12
Table 2.2: Drainage outlet/ hydraulic structure wise drainage catchment for Polder 55/2C.	25
Table 2.3: Water level gauge data from 30/10/2015 to 1/11/2015	

List of Photograph

Picture 2.1:Meeting with Mr. Dewlar Hossain, Project Engineer, Blue Gold Program.....	9
Picture 2.2:Meeting with Mr. Shafiqul Islam, Executive Engineer, Patuakhali O&M Division, BWDB.....	9
Picture 2.3:Water level gauge at R/S of Sutarmal DS	9
Picture 2.4 :Water level gauge at R/S of Chadpura DS.....	9
Picture 2.5:Water level gauge at D/S of Chiknikandi Bridge	10
Picture 2.6:Water level gauge at R/S of Dhorandi DS	10
Picture 2.7:Water level gauge connection with Ckhinikandi Bridge TBM using Level machine	10
Picture 2.8:Typical Cross section survey of Road and Embankment using Total Station....	10
Picture 2.9: Chadpura Drainage Sluice of Polder 55/2C	10
Picture 2.10:Sutarmala Drainage Sluice of Polder 55/2A.....	10

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Under the Blue Gold project the consultant Euroconsult Mott MacDonald assigned CEGIS to prepare the Digital Elevation Model (DEM) and catchment boundaries for two polders.

CEGIS acknowledge the Mr. Guy Jones, Team Leader, Blue Gold Project, for selecting CEGIS for this work.

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CEGIS deeply acknowledge supports of all above to conduct this study.

Executive Summary

The coastal region of Bangladesh is regarded as a zone of multiple vulnerabilities. About 38% of the population in this region live below the poverty line and face high vulnerabilities in terms of insecurity of food, income, water and health. Management of water resource is very crucial for achieving wellbeing of the coastal population.

The objective of Blue Gold is to reduce poverty of the people in the coastal areas by enhanced productivity of crops, fisheries and livestock in an integrated way and to increase the income by improved processing and marketing of agricultural commodities with value chain development. Under the Blue Gold project the consultant Euroconsult Mott MacDonald assigned CEGIS to prepare Digital Elevation Model (DEM) and catchment boundaries for two polders.

The DEM was prepared using FINNMAP (points and contour lines) considering all physical features (khals, roads etc.). Catchments were developed using Soil and Water Assessment Tool (SWAT) model. Polder 55/2A consist 13 catchments and Polder 55/2C consist 7 catchments. The catchments were identified based on drainage outlets.

Area-Elevation of each catchment has been delineated and presented in charts/figures. Due to lack of water level data nearby the polder CEGIS installed four gauges around the study area and collected tidal data for three days (30 Oct – 01 Nov, 2015) to realize the high tide and low tide inundation considering gate open or no polder condition.

It observed that during high tide most of the area is subjected to inundation by F2 (0.9-1.8m) land class which could be made flood free by implementing the polder functionality.

1. Introduction

The coastal region of Bangladesh is regarded as a zone of multiple vulnerabilities. About 38% of the population in this region live below the poverty line and face high vulnerabilities in terms of insecurity of food, income, water and health. Water is the blessings as well as curse for the coastal population. Management of this natural resource is very crucial for achieving wellbeing of the coastal population. Participatory water resources management is successfully operating in coastal area of Bangladesh by BWDB, where Government of the Netherlands (GoN) participates as a development partner.

Blue gold is such a project of GoN and GoB which emphasizes active involvement of rural communities. The explicit objective of Blue Gold is to reduce poverty of the people in the coastal areas by enhanced productivity of crops, fisheries and livestock in an integrated way and to increase the income by improved processing and marketing of agricultural commodities with value chain development. Under the Blue Gold project the consultant Euroconsult Mott MacDonald assigned CEGIS to prepare Digital Elevation Model (DEM) and catchment boundaries for two polders. This report presents the description of conducted activities as per contract.

1.1 Study area

The study area comprises two polder 55/2A and 55/2C of Patuakhali district (Figure 1.1). The administrative and management control of these polders lies with Patuakhali BWDB O&M Division under southern zone. The Polder 55/2A consist part of three Upazilas namely, Patuakhali Sadar, Bauphal and Dashmina Upazila under Patuakhali District and covers about 79.51sq km. This polder is within around 45 km aerial distance from the coast of the Bay of Bengal, undergoing diurnal tidal influence. The polder is surrounded by tidal rivers namely, the Lohalia River on the West, the Baliakati khal on the South portion and the Chihergudi khal on the East.

The 55/2C consist part of two Upazila namely Dashmina and Galachipa under Patuakhali District and covers about 63.17sqkm. It is surrounded by Gopaldi river on the East, Baliakatikhal on the North and Kamalakanta on the West (See Figure 1.1).

1.2 Scope of works

The scope of works as per the ToR are as follows:

- Digital Elevation Model development based on contour and point data from FINNMAP/BWDB Maps.
- Catchment area delineation including updated water management infrastructure layout along with roads and culverts/bridges.
- Tidal dynamics assessment around the polders and suggest drainage plans.

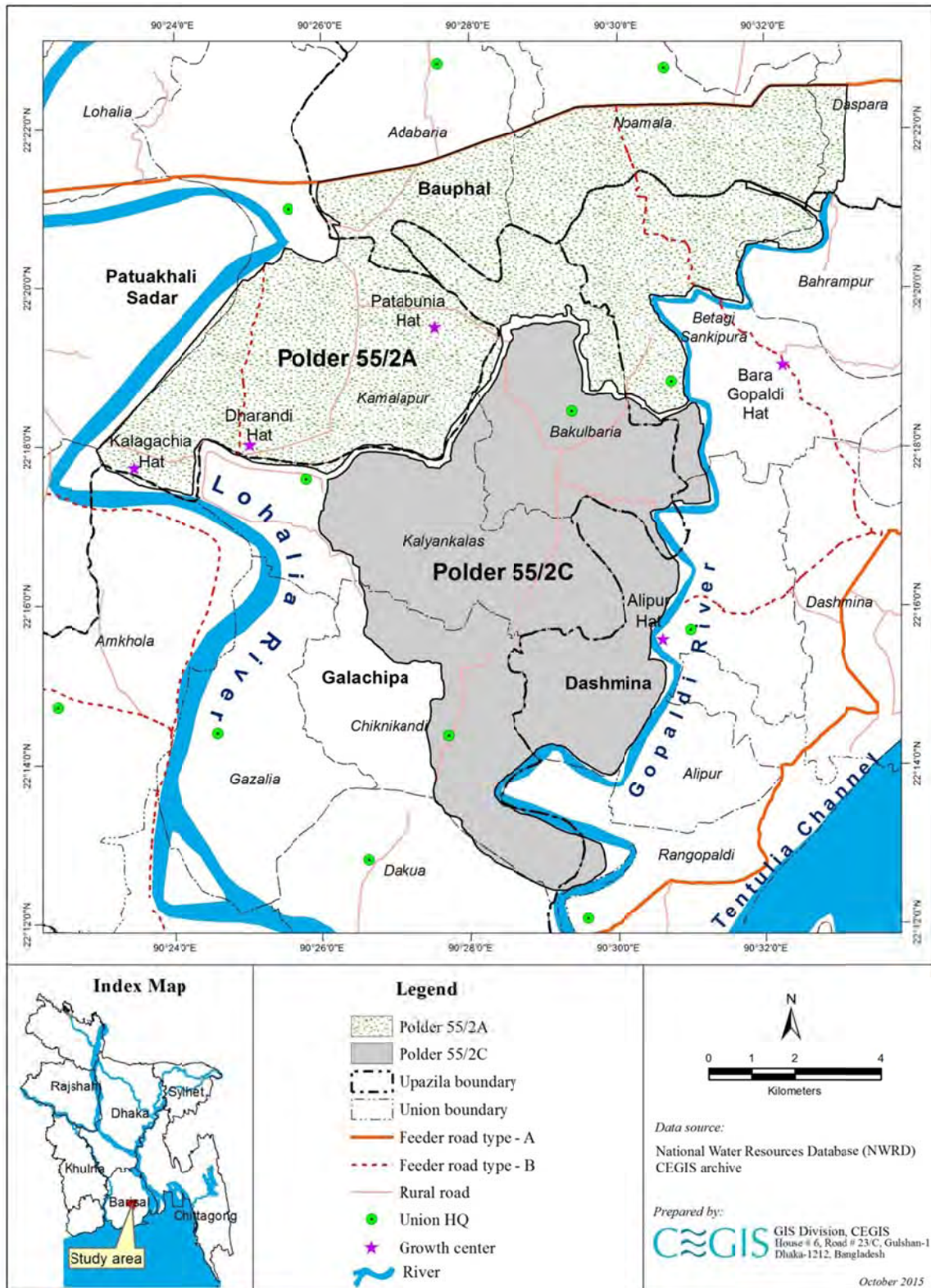


Figure 1.1: The study area

1.3 Deliverables and outcomes

Followings are the deliverables and outcomes of this study.

- Inception Report
- DEM preparation & Elevation Mapping
- Catchment area delineation and detail mapping.
- Drainage pattern/direction maps
- Technical Report

2. Activities

At the inception phase all works have been identified and a step-by-step approach and methodology has been developed. The major activities are presented in Figure 1.2 and described in the following sections.

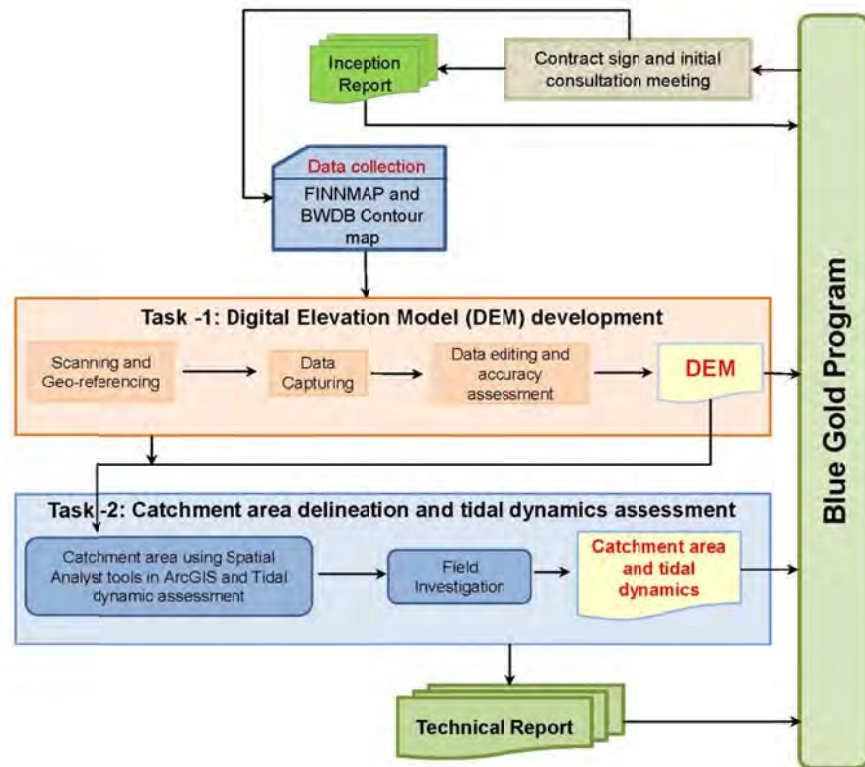


Figure 2.1: Overall methodology of the activities

2.1 Initial consultation meeting

After signing of the contract an initial consultation meeting was done with the officials and relevant professionals of the client on 13 August 2015 to finalize the understanding of the requirements, identify the data sources, data format, spatial resolution, coordinate system, probable outcomes and priorities.

2.2 Inception Report

The Inception Report consisted detail activities, methodology, deliverables, and work plan for performing the project activities and was submitted to the client.

2.3 Data collection

The contours and spot elevations were collected from FINNMAP. The FINNMAPs were published by Bangladesh Inland Water Transport Authority (BIWTA) in 1998 at 1:10000 scale. Fourteen (14) numbers sheets have been collected under this study. The collected FINNMAPs are 2470-540 to 2470-555 (04 sheets), 2465-535 to 2465-550 (04 sheets), 2460-

535 to 2460-550 (04 sheets) and 2455-545 to 2455-550 (02 sheets). The contour intervals of FINNMAP is 0.25 m. East-west spacing of spot elevation is about 300 m and spacing in north-south direction is about 100m. Sample of a FINNMAP is shown in figure 2.1. Rivers and khal networks were digitized from these maps.

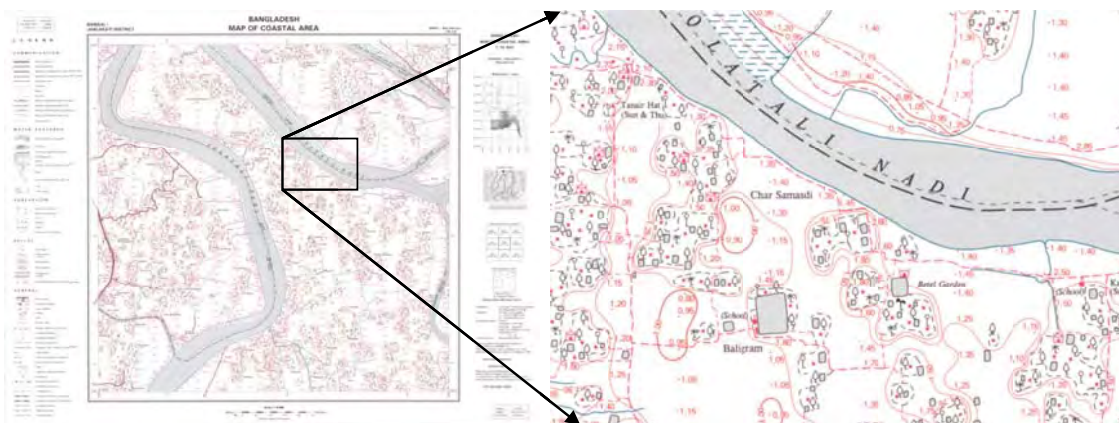


Figure 2.2 : Sample of BIWTA FINNMAP

2.4 Digital Elevation Model (DEM) development

2.4.1 Scanning and geo-referencing

All the collected FINNMAP sheets were scanned using a high precision scanner at 200 dpi in JPG file format. The maps were scanned in such a way, that all the features are clearly visible and digitization can be done accurately. Geo-referencing has been done using ArcGIS software. Bangladesh Transverse Mercator (BTM) projection has been preferred by the client has been used to geo-reference those images.

Projection parameters

Bangladesh Transverse Mercator (BTM) projection parameters were used to geo-reference those images. The parameters of BTM projection are:

Projection Type	Transverse Mercator
Datum Name	Everest
Scale Factor at central meridian	0.99960000
Longitude of central meridian	90:00:00.000000E
Latitude of origin of projection	0:00:00.000000N
False easting	500000.000000 meters
False northing	-2000000.000000 meters

2.4.2 Data capturing

Contour lines, spot height were captured from geo-referenced FINNMAP Maps. Settlement, detail roads network, rivers, khals, water bodies and water management infrastructure

(Drainage and flushing regulators) were captured from these maps. The features have been identified considering size, shape, pattern, texture and description available in the map.

2.4.3 Data editing and accuracy assessment

Data editing and accuracy assessment was also carried out for quality output. The accuracy assessment was done through visual inspection and interpretation by comparing with the original FINNMAP maps. The contour values for each digitized map sheet was checked visually. GIS Expert and Quality Control Specialist were involved in accuracy assessment.

2.4.4 Develop Digital Elevation Map (DEM)

Original elevation of FINNMAP is in SOB datum, which is in Mean Sea Level (MSL). After capturing, the MSL values have been transferred to PWD datum. Roads and embankments have been elevated based on the surrounding elevations and survey. The rivers, khals and other water bodies have been lowered considering lowest elevation. Road has been considered as dominant factor where khal was closed. Digital Terrain Model (DTM) was prepared using Spatial Analyst tool of ArcGIS. The DEM was prepared with 50m X 50m spatial resolution. Figure 2.3 and 2.4 shows the Digital Elevation Model of Polders 55/2A and 55/2C respectively. The DEM has been revised and improved after field investigation.

Figure 2.3: Digital Elevation Model (DEM) of Polder 55/2A

Figure 2.4: Digital Elevation Model (DEM) of Polder 55/2C

2.5 Field Investigation

After data capturing and initial assessment based on secondary data (FINNMAPs, Topo Sheet, Google Images and development of initial DEM) a field investigation was done to verify the collected ground information of flow pattern and structure with parameters. The field office of Blue Gold and BWDB executive engineer office were consulted to identify the available information and location of features in the field.



Picture 2.1: Meeting with Mr. Dewlar Hossain, Project Engineer, Blue Gold Program



Picture 2.2: Meeting with Mr. Shafiqul Islam, Executive Engineer, Patuakhali O&M Division, BWDB

Following information were collected from the field visit.

1. During the field visit from 27th October to 3rd November 2015, CEGIS has installed 04 water level gauges (R/S of Sutarmala drainage sluice, Dhorandi drainage Sluice, Chadpurakhal drainage sluice and D/S of Chiknikandi Bridge) were installed in the rivers and khals as shown in Picture 2.3 – 2.8.



Picture 2.3: Water level gauge at R/S of Sutarmal DS



Picture 2.4 : Water level gauge at R/S of Chadpura DS



Picture 2.5:Water level gauge at D/S of Chiknikandi Bridge



Picture 2.6:Water level gauge at R/S of Dhorandi DS



Picture 2.7:Water level gauge connection with Ckhinikandi Bridge TBM using Level machine



Picture 2.8:Typical Cross section survey of Road and Embankment using Total Station

2. Collection of detail information on Hydraulic structures (Drainage sluices, Outlets, Bridge and Culvert). Twenty (20) numbers of drainage Sluice, 05 numbers of drainage outlets was found in the study area.



Picture 2.9: Chadpura Drainage Sluice of Polder 55/2C



Picture 2.10:Sutarmala Drainage Sluice of Polder 55/2A

3. Flow direction and pattern assessment through visual inspection in stream and public consultation with local people for overland flow.
4. Identify man made obstruction/barrier on the khal through visual inspection and satellite image
5. Identify the location name, hat-bazars etc. through physical visit and public consultation.

Considering all these collected information and knowledge gained from the BWDB officials, Blue Gold professionals, local people and direct field inspection were incorporated. These parameters were considered in DEM and catchment delineation.

2.6 Hydrological boundary and drainage pattern assessment

2.6.1 Catchment area and tidal dynamics assessment



Catchment/watershed delineation is one of the most commonly performed activities in hydrologic analysis. A catchment of an outlet or pour point is the upslope area which drains its accumulated runoff through that point. Watershed delineation was performed with the Spatial Analyst Tools of ArcGIS using the Developed Digital Elevation Model (DEM) and rivers/khals network as inputs. All the watershed delineation steps such as filling sink, defining flow direction and accumulation has been done in ArcGIS using SWAT (Soil and Water Assessment Tool) hydrological model. Catchment wise drainage pattern and area elevation curves were derived from the DEM and watersheds.

2.6.2 Catchment of Polder 55/2A



In this study, for polder 55/2A, catchments has been delineated for thirteen (13) drainage outlets. The drainage outlets were selected at thirteen (13) hydraulic structure locations. Figure 2.5 shows the seventeen catchment boundaries of Polder 55/2A with structures. Area of each catchment boundary has been presented in Table 2.1. From the Figure 2.5 and Table 2.1 shows that catchment of Nobil Hossain sluice DS-10 (Ch. 26.00 km) is the largest catchment which is about 1270 ha.

Table 2.1: Drainage outlet/ hydraulic structure wise drainage catchment for Polder 55/2A



Description of Catchment 01

Catchment name	Cat-1 (Hazirhat catchment)
Location	Mahasradhi, western part of Kashipur and southern part of Atashkhali mauza of Adabaria union
Catchment area (ha)	864 ha
Drainage Outlet	Hazirhat Sluice DS-1 at Ch. 1.00 km. (2V- 1.5 m X 1.8 m)
Main Drainage Canal	Naptanir Khal (Average Top width: about 20m to 25 m)
Land elevation of Catchment (m PWD)	Max: 3.47 Min: 0.95
Length of Stream within catchment (km)	19.12 km
Drainage Density (m/ha)	22.14 ha
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Bhuria khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: Moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Minor (usually takes 2-3 days to properly drain out rainwater) ○ Crop damage: Minor ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: R/S of Hazirhat Sluice</p> <p>Figure: Outfall of Cat – 01</p> </div>	



Description on Catchment 02

Catchment name	Cat-2 (Dhoniapur catchment)
Location	Part of Uttar Dharandi and Dakshin Dharandi mauza of Kamalapur union
Catchment area (ha)	304 ha
Drainage Outlet	Dhoniapur Sluice, DS-2 at Ch. 2.20Km (1V- 1.5 m X 1.8 m)
Main Drainage Canal	Dhoniapur khal (Average Top width: about 10m to 15 m)
Land elevation of Catchment (m PWD)	Max: 3.50 Min: 0.95
Length of Stream within catchment (km)	10.90
Drainage Density (m/ha)	35.91
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Bhuria khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: <i>Choddobhuria khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <p>Figure: C/S of Dhoniapur Sluice</p> <p>Figure: Outfall of Cat-2</p> </div>	



Description on Catchment 03

Catchment name	Cat-3 (sutarmala catchment)
Location	Chandipur, Southern part of Uttar Dharandi and Northern part of Dakshin Dharandi mauza of Kamalapur union
Catchment area (ha)	295 ha
Drainage Outlet	Sutarmala Sluice DS-3 at Ch. 4.50 Km (1V- 1.2 m X 1.5 m)
Main Drainage Canal	Sutarmala khal (Average Top width: about 10m to 12 m)
Land elevation of Catchment (m PWD)	Max: 3.01 Min: 0.95
Length of Stream within catchment (km)	10.06
Drainage Density (m/ha)	34.12
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Galachipa River ○ Condition: Partially active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Betakbunia khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Structure condition is functional.
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: C/S of Sutarmala Sluice</p> <p>Figure: Outfall of Cat-03 (Sutarmala khal)</p> </div>	

Description on Catchment 04

Catchment name	Cat-4 (Lalar khal catchment)
Location	Northern part of Char Maishadi, western part of Dakshin Dharandi and southern part of Chandipur mauza of Kamalapur union
Catchment area (ha)	174.5 ha
Drainage Outlet	Lalar Sluice DS-4 at Ch.5.70 km (1V- 1.2 m X 1.5 m)
Main Drainage Canal	Lalar khal (Average Top width: about 10m to 12 m)
Land elevation of Catchment (m PWD)	Max: 3.48 Min: 0.97
Length of Stream within catchment (km)	4.45
Drainage Density (m/ha)	25.5
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Galachipa River ○ Condition: Partially active (slightly silted up) ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Sardarbari khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
	
Figure: C/S of Lalar Sluice	Figure: Outfall of Cat-04

Description on Catchment 05

Catchment name	Cat-5 (Mirer khal catchment)
Location	Char Maishadi, western part of Dakshin Dharandi mauza of Kamalapur union
Catchment area (ha)	406.6 ha
Drainage Outlet	Mirer Khal Sluice, DS-5 at Ch. 11.4 km (1V- 1.2 m X 1.5 m)
Main Drainage Canal	Mirer khal (Average Top width: about 15m to 18 m)
Land elevation of Catchment (m PWD)	Max: 3.84 Min: 0.97
Length of Stream within catchment (km)	9.11
Drainage Density (m/ha)	23.16
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Galachipa River ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: <i>Kuania khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Minor (usually takes 2-3 days to properly drain out rainwater) ○ Crop damage: Minor ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<p>Figure: C/S of Mirer Khal Sluice Figure: Outfall of Cat-05</p>	

Description on Catchment 06

Catchment name	Cat-6 (Dhorandi catchment)
Location	Dakshin Dharandi, Balaikati and part of Krokmahal mauza of Kamalapur union
Catchment area (ha)	997.9 ha
Drainage Outlet	Dhorandi Sluice DS-6 at Ch. 15.20 Km (3V- 1.5 m X 1.8 m)
Main Drainage Canal	Gobinda khal (Average Top width: about 60m to 70 m)
Land elevation of Catchment (m PWD)	Max: 3.31 Min: 0.95
Length of Stream within catchment (km)	32.18
Drainage Density (m/ha)	37.10
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Patabunia khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Harinbaria khal, Harikhali khal and Bakhar khan khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-6 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: About 12 ha area at Dakshin Dharandi is water logged. ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional





Figure: C/S of Dhorandi Sluice




Figure: Outfall of Cat-06



Description on Catchment 07

Catchment name	Cat-7 (Hashkhali catchment)
Location	Char Balaikati, Akhibaria, Bahermauza, Dakshin Chaudhaburia, Uttar Chaudhaburia part of Kamalapur, Krokmahal mauza of Kamalapur union
Catchment area (ha)	954.9 ha
Drainage Outlet	Hashkhali Sluice DS-7 at Ch. 22.80 Km (3V- 1.5 m X 1.8 m)
Main Drainage Canal	Hashkhali Khal (Average Top width: about 12m to 16 m)
Land elevation of Catchment (m PWD)	Max: 3.71 Min: 0.94
Length of Stream within catchment (km)	41.09
Drainage Density (m/ha)	44.35
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Patabunia khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Krokmahal khal, Akbaria khal and Chaudhaburia khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: About 10 ha area at Char Balaikati is water logged. ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: R/S of Hashkhali Sluice</p> <p>Figure: Outfall of Cat-7</p> </div>	



Description on Catchment 08

Catchment name	Cat-8 (Patabunia catchment)
Location	Part of Patabunia mauza of Bakulbaria union
Catchment area (ha)	365.9 ha
Drainage Outlet	Patabunia Sluice DS-8 at Ch. 17.70 Km (1V- 1.2 m X 1.5 m)
Main Drainage Canal	Dunger Khal (Average Top width: about 8m to 10 m)
Land elevation of Catchment (m PWD)	Max: 3.68 Min: 0.95
Length of Stream within catchment (km)	14.33
Drainage Density (m/ha)	39.17
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Patabunia khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: <i>Dariy khal is moderately silted up.</i> ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Minor (usually takes 2-3 days to properly drain out rainwater) ○ Crop damage: Minor ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
	
Figure: C/S of Patabunia Sluice	


Description on Catchment 09

Catchment name	Cat-9 (Nabin Hossain catchment)
Location	Nijbat Kajal and Bhangora mauza of Noamala union, Chankhola and Northern part of Patabunia mauza of Bakulbaria union and western part of Chinguria and Betagi Ramballah mauza of Betagi Sankipura union.
Catchment area (ha)	1270.4 ha
Drainage Outlet	Nobin Hossain Sluice DS-09 at Ch. 26.0 Km (3V- 1.5 m X 1.8 m)
Main Drainage Canal	Chhonkhola Khal (Average Top width: about 15 m to 18 m)
Land elevation of Catchment (m PWD)	Max: 3.38 Min: 0.92
Length of Stream within catchment (km)	29.95
Drainage Density (m/ha)	23.57
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Patabunia khal is highly silted up in this location ○ Condition: Non-functional ○ ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Bhangra khal and Nobil Hossain khal</i> is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Severe (usually takes 7-10 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Major ○ Permanent Waterlogging: About 8 ha area at Ramballah near Nobin Hossain Sluice and 10 ha area at Vangra in Nijbat Kajal mauza is water logged. ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: R/S of Nobin Hossain Sluice</p> <p>Figure: Outfall of Cat-9</p> </div>	



Description on Catchment 10

Catchment name	Cat-10 (Zamiruddin catchment)
Location	Southern part of Chankhola mauza of Bakulbaria union, western part of Kharija Betagi, Tafalbaria mauza and southern part of Betagi Ramballabh mauza of Betagi Sankipura union
Catchment area (ha)	434.8 ha
Drainage Outlet	Zamiruddin Sluice DS-10 at Ch.32.4 Km (1V- 1.5 m X 1.8 m)
Main Drainage Canal	Kharajuma Betagi khal (Average Top width: about 12 m to 15 m)
Land elevation of Catchment (m PWD)	Max: 3.82 Min: 0.95
Length of Stream within catchment (km)	20.02
Drainage Density (m/ha)	46.05
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Guabaria khal (Sutabaria Nadi) ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: Moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Minor (usually takes 2-3 days to properly drain out rainwater) ○ Crop damage: Minor ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: C/S of Zamiruddin Sluice</p> <p>Figure: R/S of Zamiruddin Sluice</p> </div>	



Description on Catchment 11

Catchment name	Cat-11(Chear catchment)
Location	Betagi Sankipura, Shertaluk Betagi, Jafrabad and eastern part of Betagi Ramballabh mauza of Betagi Sankipura union
Catchment area (ha)	463.2 ha
Drainage Outlet	Chear Sluice DS-11 at Ch.34.4 Km (1V- 1.8 m X 1.95m)
Main Drainage Canal	Chear khal (Average Top width: about 15 m to 18 m)
Land elevation of Catchment (m PWD)	Max: 2.50 Min: 0.95
Length of Stream within catchment (km)	13.78
Drainage Density (m/ha)	29.76
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Guabaria khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: Partially silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Minor (usually takes 2-3 days to properly drain out rainwater) ○ Crop damage: Minor ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
	
<p>Figure: C/S of Chear Sluice</p> <p>Figure: Outfall of Cat-11</p>	

Description on Catchment 12

Catchment name	Cat-12 (Thakurerhat catchment)
Location	Betagi Sankipura mauza of Betagi Sankipura union
Catchment area (ha)	274.1 ha
Drainage Outlet	Thakurerhat Sluice DS-12 at Ch.36.10 Km (1V- 1.2 m X 1.5 m)
Main Drainage Canal	Radaseteram khal (Average Top width: about 6 m to 8 m)
Land elevation of Catchment (m PWD)	Max: 3.66 Min: 0.97
Length of Stream within catchment (km)	0.455
Drainage Density (m/ha)	1.66
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Guabaria khal ○ Condition: Non-functional and moderately silted up. ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: Moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 5-6 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Major ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: C/S of Thakurerhat Sluice</p> <p>Figure: Outfall of Cat-12</p> </div>	

Description on Catchment 13

Catchment name	Cat-13 (Maishadi Catchment)
Location	Noamala and Maoshadi mauza of Noamala union and northern part of Betagi Sankipura mauza of Betagi Sankipura union
Catchment area (ha)	1239.8 ha
Drainage Outlet	Maishadi Sluice DS-13 at Ch.41.20 Km (2V- 1.5 m X 1.8 m)
Main Drainage Canal	Maishadi Nawmala khal (Average Top width: about 20 m to 25 m)
Land elevation of Catchment (m PWD)	Max: 3.61 Min: 0.91
Length of Stream within catchment (km)	20.33
Drainage Density (m/ha)	16.40
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Maishadi khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>katakhal</i> khal is moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: R/S of Maishadi Sluice</p> <p>Figure: C/S of Maishadi Sluice</p> </div>	



2.6.3 Catchment of Polder 55/2C

In this study, for polder 55/2C, catchments has been delineated for seven (07) drainage outlets. The drainage outlets were selected at seven hydraulic structure locations. Figure 2.6 shows the seven catchment boundaries of Polder 55/2C with structures. Area of each catchment boundary has been presented in Table 2.2. From the Figure 2.6 and Table 2.2



shows that catchment of Chadpurakhal sluice DS-6 (Ch. 35.43 km) is the largest and catchment of Sutabariakhal DS-1 (Ch. 1.80 km) is the smallest.

Table 2.2: Drainage outlet/ hydraulic structure wise drainage catchment for Polder 55/2C



Description on Catchment 1

Catchment name	Cat-1(Sutabaria catchment)
Location	Sutabaria, Chiknikandi, eastern part of Majhgram mauza of Chiknikandi union
Catchment area (ha)	782.0 ha
Drainage Outlet	Sutabaria Sluice DS-1 at Ch. 1.80 km (1V- 1.5 m X 1.8 m)
Main Drainage Canal	Sutabaria khal (Average Top width: about 8 m to 10 m)
Land elevation of Catchment (m PWD)	Max: 3.86 Min: 1.31
Length of Stream within catchment (km)	12.26
Drainage Density (m/ha)	27.43
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Kamalakanta khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Chiknikandi Beel khal, Majhgram khal, Kotkhali khal</i> are moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-6 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Major ○ Permanent Waterlogging: About 37 ha area at the eastern side of the Sutabaria khal is water logged due to the Jangal Dungar khal was closed for embankment construction. ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
	 
	<p>Figure: R/S of Sutabaria Sluice</p> <p>Figure: Outfall of Cat-1</p>



Description on Catchment 2

Catchment name	Cat-2 (Kachua catchment)
Location	Kachua, Kalaraja and Kotkhali mauza of Chiknikandi union and southern part of Kalyankalas, western part of Bansbaria Dariabad mauza of Bakulbaria union.
Catchment area (ha)	739.4 ha
Drainage Outlet	Kachua Sluice, DS-2 at Ch. 7.35 Km (2V- 1.5 m X 1.8 m)
Main Drainage Canal	Kamlakanta branch khal (Average Top width: about 16 m to 20 m)
Land elevation of Catchment (m PWD)	Max: 3.86 Min: 1.01
Length of Stream within catchment (km)	27.77
Drainage Density (m/ha)	37.56
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Kamalakanta khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Ramananda khal, Kalaraja khal, Mahisdangar khal and Chhilar khal</i> are moderately silted up. ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: About 12 ha area at northern part of <i>Mohisdangar khal</i> in Kotkhali mauza is water logged. ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: C/S of Kachua Sluice</p> <p>Figure: Outfall of Cat-2</p> </div>	



Description on Catchment 3

Catchment name	Cat-3 (Jatibaria catchment)
Location	Kharijjama, western part of Kalyankalas and eastern part of Kalagachhia mauza of Bakulbaria union.
Catchment area (ha)	673.2 ha
Drainage Outlet	Jatibaria Sluice DS-3 at Ch. 10.72 Km (1V- 1.5 m X 1.8 m)
Main Drainage Canal	Jatibaria khal (Average Top width: about 12 m to 15 m)
Land elevation of Catchment (m PWD)	Max: 3.56 Min: 1.11
Length of Stream within catchment (km)	23.28
Drainage Density (m/ha)	34.59
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Kamalakanta khal ○ Condition: Partially functional ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: Moderately silted up ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-6 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<p>Figure: Outfall of Cat-1 (Jatibaria khal) Figure: Collapse flap gate of Jatibaria sluice</p>	



Description on Catchment 4

Catchment name	Cat-4 (Kalyankalas catchment)
Location	Saikkati, eastern part of Kalyankalas, southern part of Lamna and western part of Guabaria mauza of Bakulbaria union.
Catchment area (ha)	942.5 ha
Drainage Outlet	Kalyankalas Sluice DS-4 at Ch. 15.61 km (3V - 1.5 m X 1.8 m)
Main Drainage Canal	Kalyankalas khal (Average Top width: about 20 m to 25 m)
Land elevation of Catchment (m PWD)	Max: 3.91 Min: 1.08
Length of Stream within catchment (km)	40.69
Drainage Density (m/ha)	43.17
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Patabunia khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Ulasir khal, Taltali khal, Bansbaria khal and Saiyedkati khal</i> are moderately silted up ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<p>Figure: C/S of Kallan Kalash Sluice Figure: Collapse flap gate of Kallan Kalash sluice</p>	

Description on Catchment 5

Catchment name	Cat-5 (Saonomia catchment)
Location	Bakulbaria, Doani Patuakhali, eastern part of Lamna of Bakulbaria union, southern part of Kharija Betagi of Betagi Sankipura union and northern part of Mirmadan of Alipur union.
Catchment area (ha)	629.4 ha
Drainage Outlet	Sonamia Sluice, DS-5 at Ch. 25.38 km (1V- 1.5 m X 1.8 m)
Main Drainage Canal	Sonamia khal (Average Top width: about 12 m to 15 m)
Land elevation of Catchment (m PWD)	Max: 3.81 Min: 1.02
Length of Stream within catchment (km)	22.45
Drainage Density (m/ha)	35.66
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Patabunia khal is moderately silted up in this location ○ Condition: Partially functional ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Moderately silted up ○ Branch khal: <i>Maitbhangar khal</i> is moderately silted up ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-6 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: C/S of Sonamia Sluice</p> <p>Figure: Outfall of Cat-5 (Sonamia khal)</p> </div>	

Description on Catchment 6

Catchment name	Cat-6 (Chandpura catchment)
Location	Paschim Alipur and western part of Chandpur mauza of Alipur union, Banshbaria Dariabad and southern part of Guabaria mauza of Bakulbaria union and eastern part of Kotkhali of Chiknikandi union.
Catchment area (ha)	2045.4 ha
Drainage Outlet	Chandpura Sluice DS-6 at Ch. 33.91 Km (4V- 1.5 m X 1.8 m)
Main Drainage Canal	Varanir khal (Average Top width: about 22 m to 25 m)
Land elevation of Catchment (m PWD)	Max: 3.44 Min: 1.01
Length of Stream within catchment (km)	82.39
Drainage Density (m/ha)	40.28
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Guabaria khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Partially silted up ○ Branch khal: <i>Bashbaria Alipur khal, Kalibarir khal, Budharam khal, Madarbunia khal & Bashbaria Chandpur khal</i> are moderately silted up ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Moderate (usually takes 4-5 days to properly drain out rainwater as the drainage capacity of khal is low) ○ Crop damage: Moderate ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Partially functional
<div style="display: flex; justify-content: space-around;">   </div>	
<div style="display: flex; justify-content: space-around;"> <p>Figure: C/S gate of Chadpura Sluice</p> <p>Figure: Outfall of Cat-6 (Varanir khal)</p> </div>	

Description on Catchment 7

Catchment name	Cat-7 (Katakahli catchment)
Location	Eastern part of Chandpur mauza of Alipur union
Catchment area (ha)	490.3 ha
Drainage Outlet	Katakahli Sluice DS-7 at Ch. 36.75 Km (2V- 1.5 m X 1.8 m)
Main Drainage Canal	Katakahli Chandpur khal (Average Top width: about 15 m to 20 m)
Land elevation of Catchment (m PWD)	Max: 3.81 Min: 1.26
Length of Stream within catchment (km)	15.28
Drainage Density (m/ha)	31.16
Catchment description	<ul style="list-style-type: none"> ➤ <i>Outfall</i> <ul style="list-style-type: none"> ○ Outfall khal: Guabaria khal ○ Condition: Active ➤ <i>Condition of drainage khal</i> <ul style="list-style-type: none"> ○ Main drainage khal: Functional ○ Branch khal: Functional ➤ <i>Drainage congestion</i> <ul style="list-style-type: none"> ○ Drainage congestion problem: Not found ○ Permanent Waterlogging: Not found ➤ <i>Structure condition</i> <ul style="list-style-type: none"> ○ Functional

Area Elevation Curve

Chadpura Sluice (DS-6)

Area elevation curve of Chadpura Sluice DS-6 at Ch. 33.91 Km (4V-1.5 m X 1.8 m) shows that the land elevation varies from 1.01 to 3.44 mPWD. The topography of this area is mostly flat and about 96.16 % (1966 ha) land lies between 1.0 to 2.0 mPWD.

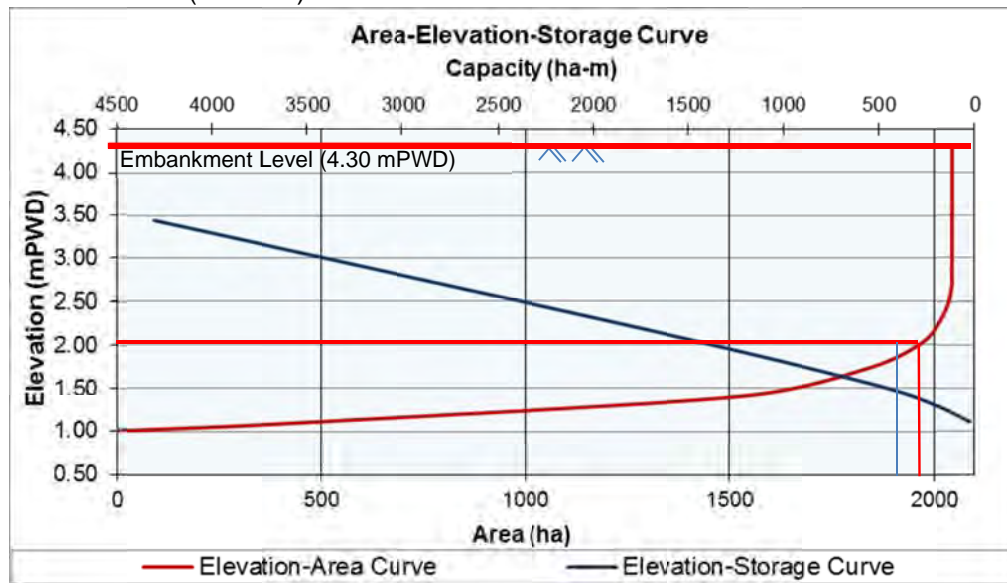


Figure 2.9: Area Elevation and Storage curve of Chadpura Catchment

The Embankment Elevation is at 4.30 mPWD

Catchment maps and area elevation curve for each catchment is presented in Appendix A.

2.7 Tidal dynamics assessment

CEGIS team installed four (04) water level gauge stations (shown in Figure 2.8) to understand the tidal water level variations. Daily Water level data (6:00 AM to 6:00 PM) has been collected from 30th October 2015 to 01st November 2015 and presented in Figures 2.9 – 2.12.

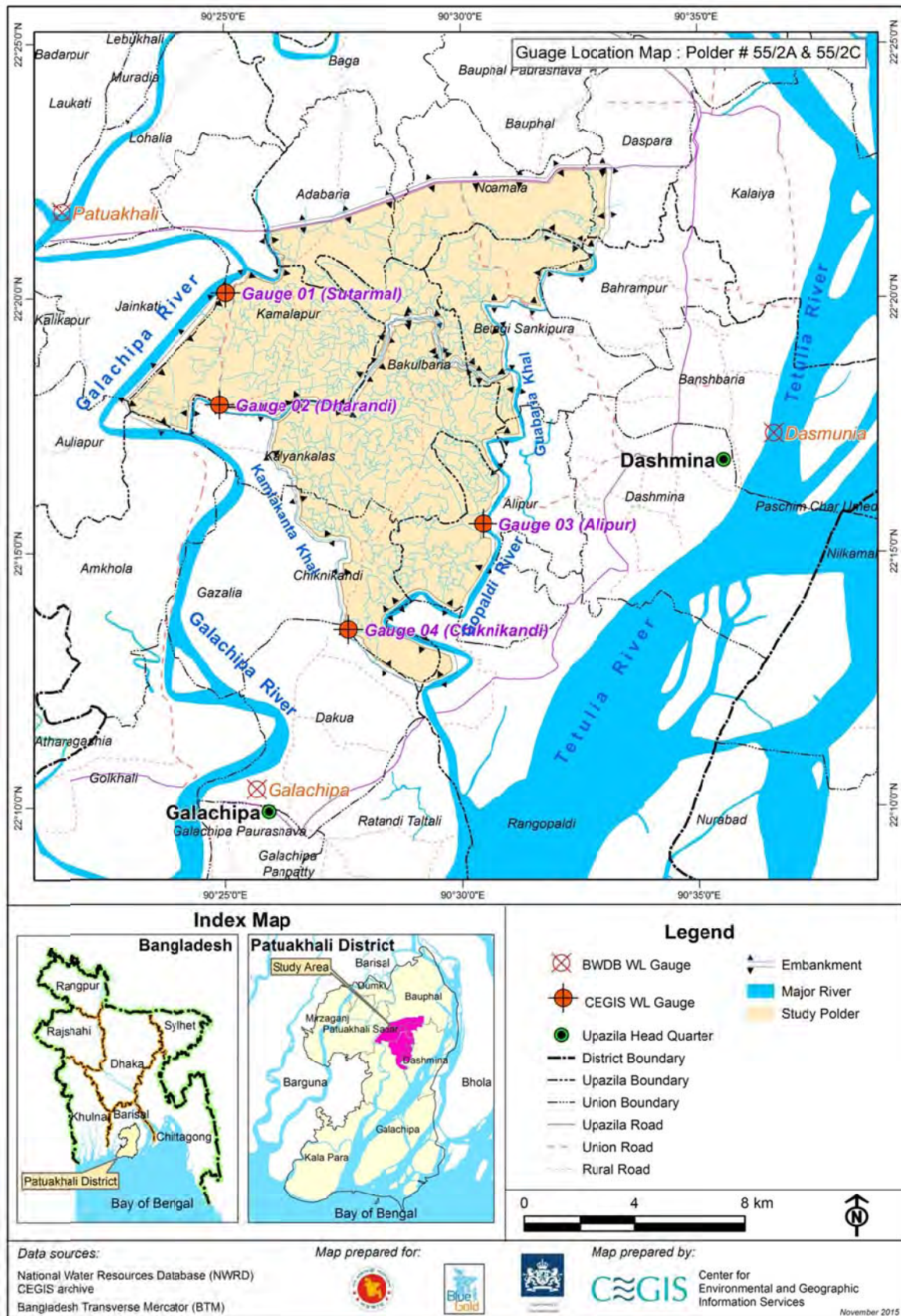


Figure 2.10: BWDB and CEGIS installed gauge location map

Table 2.3: Water level gauge data from 30/10/2015 to 1/11/2015

Date	Time	Gauge 01	Gauge 02	Gauge 03	Gauge 04
30/10/2015	6:00:00 AM	1.53	1.3	2.2	1.96
	7:00:00 AM	1.24	1.04	1.89	1.55
	8:00:00 AM	0.99	0.82	1.61	1.24
	9:00:00 AM	0.68	0.75	1.37	1.05
	10:00:00 AM	0.6	0.63	1.21	0.93
	11:00:00 AM	0.54 (LTL)	0.54 (LTL)	1.09 (LTL)	0.87 (LTL)
	12:00:00 PM	1.47	1.7	1.47	1.29
	1:00:00 PM	2.12	2.32	1.99	1.99
	2:00:00 PM	2.32	2.56	2.61	2.42
	3:00:00 PM	2.52 (HTL)	2.63 (HTL)	2.7 (HTL)	2.59
	4:00:00 PM	2.29	2.33	2.53	2.67 (HTL)
	5:00:00 PM	2.12	1.66	2.2	2.19
	6:00:00 PM	1.58	1.13	1.85	1.99

Date	Time	Gauge 01	Gauge 02	Gauge 03	Gauge 04
31/10/2015	6:00:00 AM	1.42	1.33	2.15	2.05
	7:00:00 AM	1.17	1.08	1.8	1.85
	8:00:00 AM	0.92	0.78	1.53	1.53
	9:00:00 AM	0.62	0.68	1.3	1.24
	10:00:00 AM	0.52	0.58	1.13	1.04
	11:00:00 AM	0.42 (LTL)	0.53 (LTL)	1.05 (LTL)	0.84 (LTL)
	12:00:00 PM	1.02	1.28	1.4	0.90
	1:00:00 PM	1.42	1.88	1.87	2.13
	2:00:00 PM	1.82	2.28	2.33	2.42
	3:00:00 PM	2.27	2.43 (HTL)	2.51	2.53 (HTL)
	4:00:00 PM	2.32 (HTL)	2.33	2.55 (HTL)	2.43
	5:00:00 PM	1.92	1.88	2.3	1.95
	6:00:00 PM	1.72	1.38	2	1.65

Date	Time	Gauge 01	Gauge 02	Gauge 03	Gauge 04
1/11/2015	6:00:00 AM	1.62	1.58	2.3	2.00
	7:00:00 AM	1.42	1.38	2.03	1.65
	8:00:00 AM	1.22	1.03	1.7	1.33
	9:00:00 AM	0.82	0.83	1.42	1.13
	10:00:00 AM	0.67	0.66	1.2	0.95
	11:00:00 AM	0.52	0.58 (LTL)	1.13 (LTL)	0.63 (LTL)
	12:00:00 PM	0.47 (LTL)	0.8	1.22	1.45
	1:00:00 PM	1.22	1.53	1.63	2.05
	2:00:00 PM	2.02	2.16	2.15	2.40
	3:00:00 PM	2.22	2.43	2.55	2.53
	4:00:00 PM	2.32	2.53 (HTL)	2.65 (HTL)	2.58 (HTL)
	5:00:00 PM	2.42 (HTL)	2.23	2.45	2.25
	6:00:00 PM	2.22	1.78	2.2	1.93

*LTL = Low Tide Level, HTL = High Tide Level

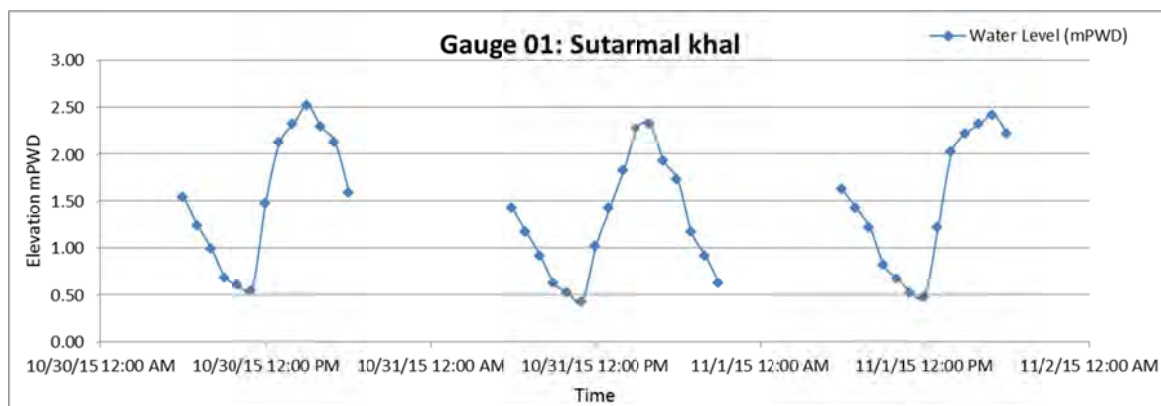


Figure 2.11: Surface water level at R/S of Sutarmal Khal

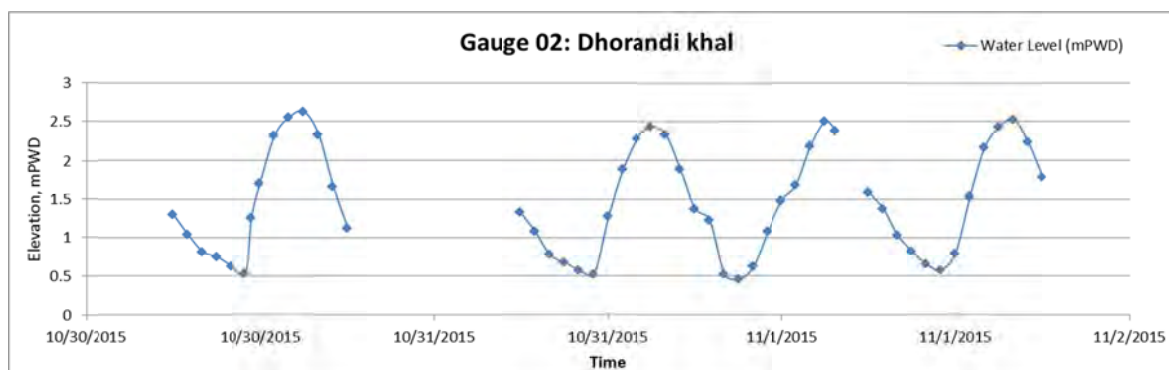


Figure 2.12: Surface water level at R/S of Dhorandi Khal

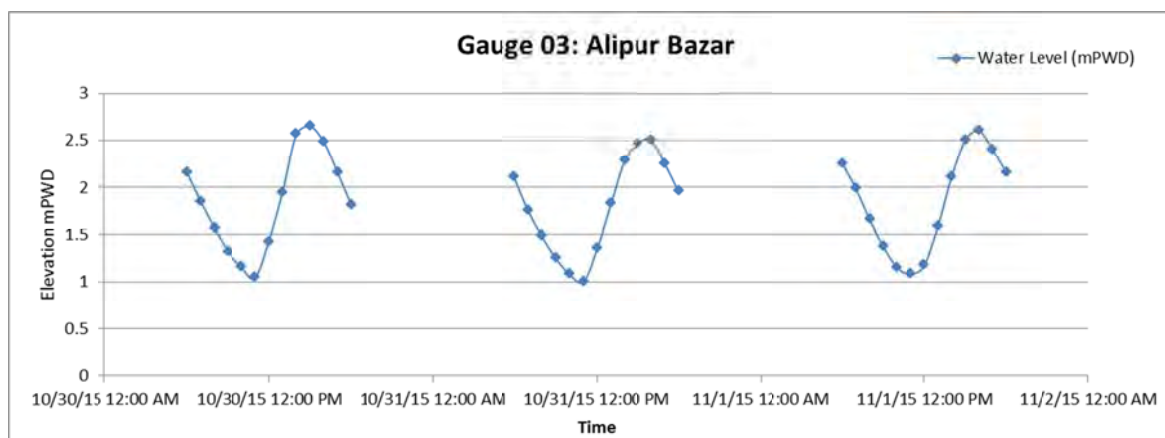


Figure 2.13: Surface water level at R/S of Chadpura khal

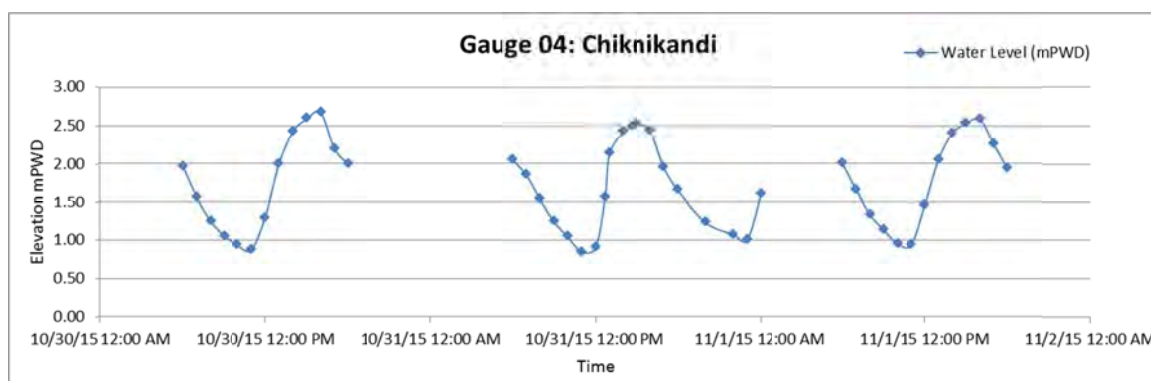


Figure 2.14: Surface water level at D/S of Chiknikandi Bridge

2.7.1 BWDB gauge data

The Patuakhali station (Station ID: 184) is situated at 12 km upstream from polder 55/2A on Lohalia river at Idrakpur mauza of Lohalia union and Galachipa station (Station ID: 185) is situated 15 km downstream from the Polder 55/2C. The locations of these gauges can be seen in Figure 2.8. The water level data of these stations is not available after 1988.

The available surface water levels of two BWDB stations at Galachipa (Station ID: 185) and at Patuakhali (Station ID: 184) were collected from 1968 to 1988. Monthly average water level (for both high tide and low tides) were calculated and presented in **Figures 2.9 - 2.12**

Water levels during high tide range from 1.35 to 2.37 mPWD at Galachipa, and 0.97 to 1.86 mPWD at Patuakhali. On the other hand, the low tidal water levels range from -0.59 to -0.17 mPWD at Galachipa and -0.68 to -0.47 mPWD at Patuakhali.

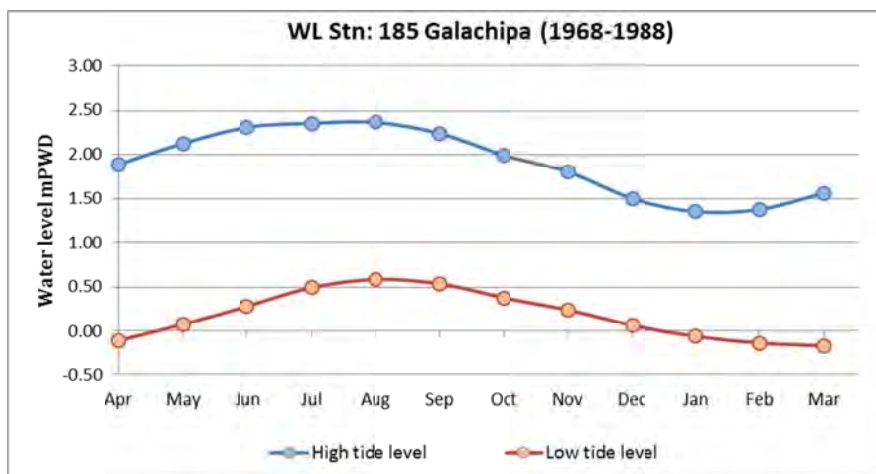


Figure 2.15: surface water level at Galachipa (Lohalia River)

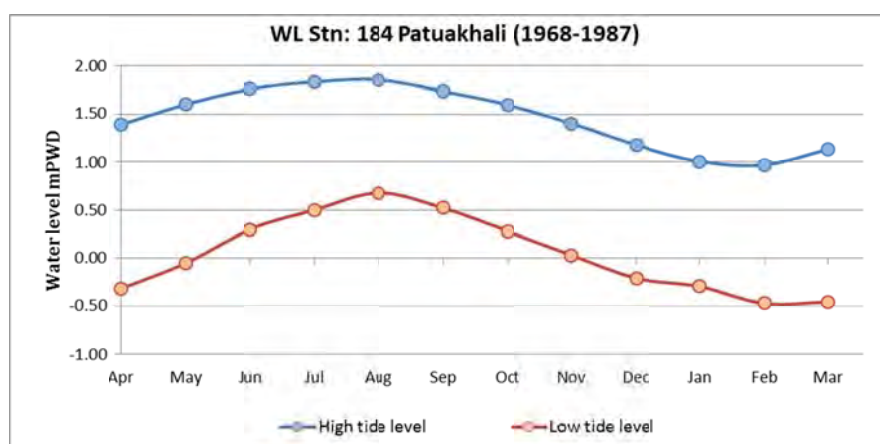


Figure 2.16: surface water level at Patuakhali (Lohalia River)

Comparing the DEM (Figure 2.3 & 2.4), and water surface generated from the four locations observed water levels, it is found that during high tide the inundation could occupy almost entire polder with varying depths. The flood depth map at high tide is presented in Figure 2.15. The analysis of the tidal inundation has been done considering gate open or no polder condition. Khals are only inundated during low tide period.

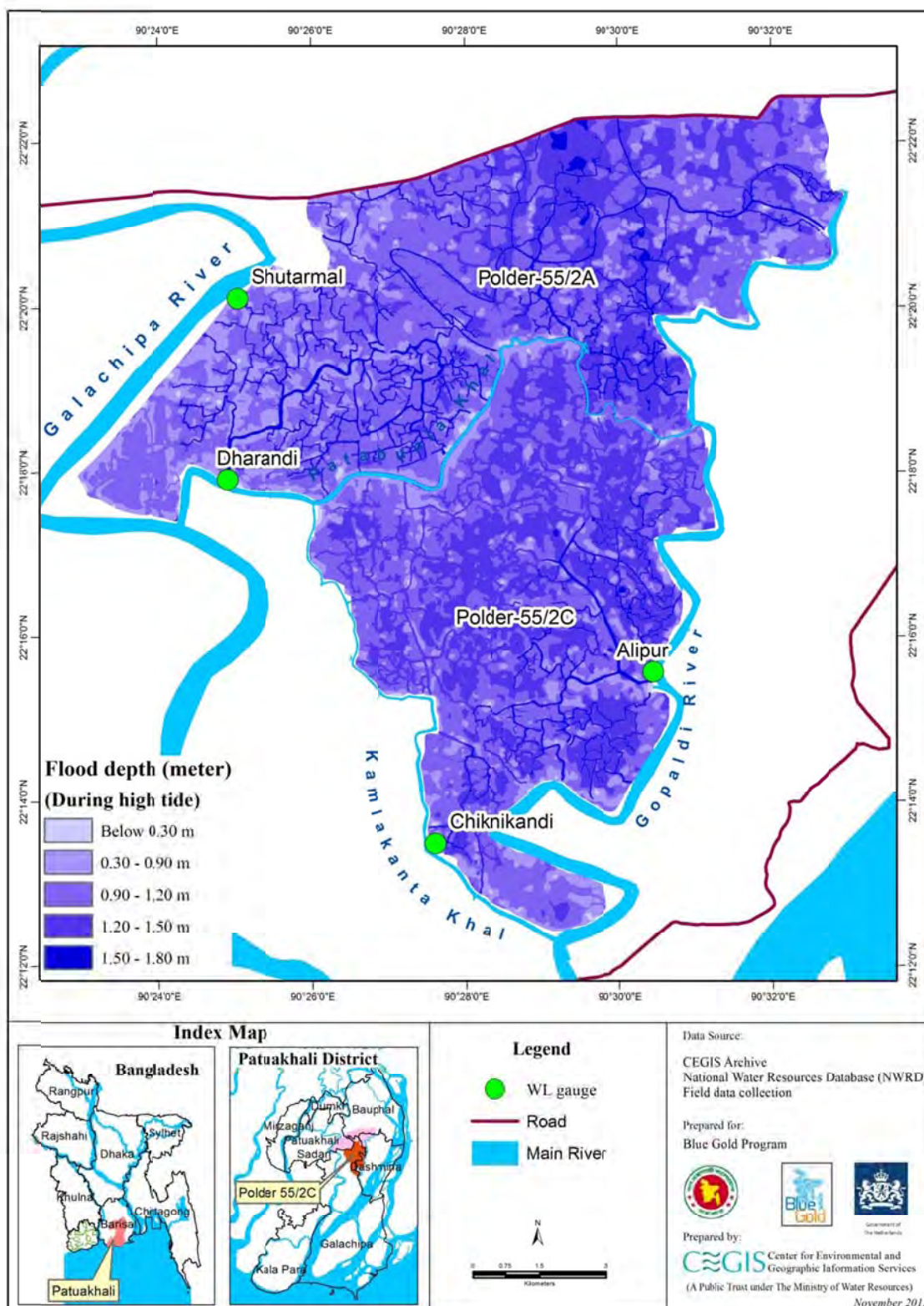


Figure 2.17: Flood depth map at high tide (30 Oct – 01 Nov, 2015)

3. Conclusion

The DEM was prepared using FINNMAP (points and contour lines) considering all physical features (khals, roads etc). Catchments were developed using Soil and Water Assessment Tool (SWAT) hydrological model. Polder 55/2A consist 13 catchments and Polder 55/2C consist 07 catchments. The catchments were identified based on drainage outlets.

Area-Elevation of each catchment has been delineated and presented in charts/figures. Due to lack of water level data nearby the polder CEGIS installed four gauges around the study area and collected tidal data for three days (30 Oct – 01 Nov, 2015) to realize the high tide and low tide inundation considering gate open or no polder condition.

It observed that during high tide most of the area is subjected to inundation by F2 (0.9-1.8m) land class which could be made flood free by implementing the polder functionality.

Appendix A: Area Elevation Curve Of Polder 55-2A

Appendix B: Area Elevation Curve Of Polder 55-2C