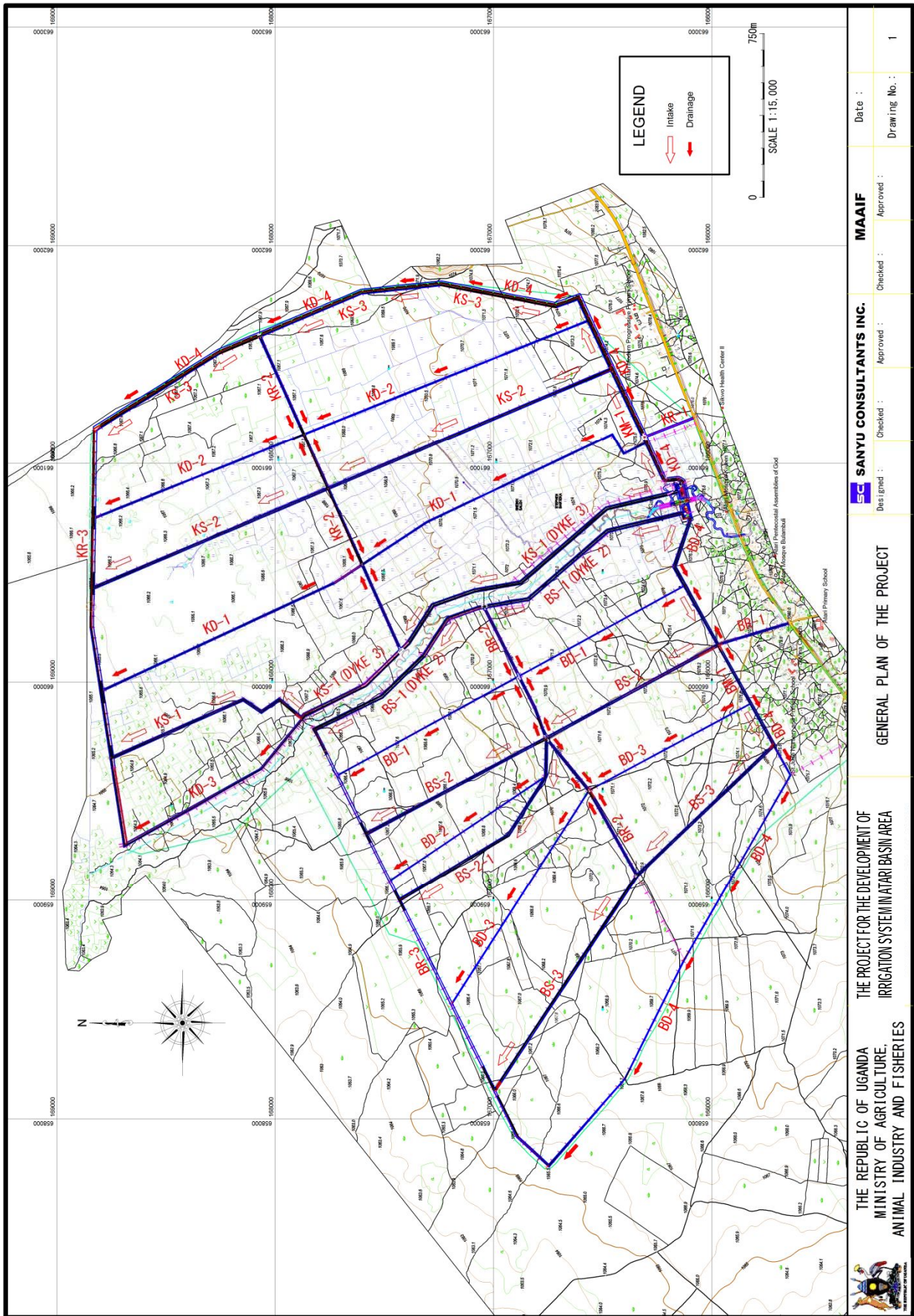


2-2-3**Outline Design Drawings****Table 2-2-3-1 Drawing List**

Figure No.	Title	Nos
2-2-3-1	General Plan of the Project	1
2-2-3-2	Location of Headworks	1
2-2-3-3	General Plan of Headworks (1/3), (2/3), (3/3)	3
2-2-3-4	Plan of De-silting Basin on Bulambuli	1
2-2-3-5	Plan of De-silting Basin on Kween	1
2-2-3-6	Typical Cross Section of Canal, Road and Dyke(1/2), (2/2)	2
2-2-3-7	Longitudinal Profile of BM (1/2), (2/2)	2
2-2-3-8	Longitudinal Profile of BS-1 and Protection Dyke-2 (1/3), (2/3), (3/3)	3
2-2-3-9	Longitudinal Profile of BD-1 (1/3), (2/3), (3/3)	3
2-2-3-10	Diversion Structure (Main Canal) (1/2), (2/2)	2
Total		19

Source: JICA OD Team



THE REPUBLIC OF UGANDA
 MINISTRY OF AGRICULTURE,
 ANIMAL INDUSTRY AND FISHERIES

THE PROJECT FOR THE DEVELOPMENT OF
 IRRIGATION SYSTEM IN MATARI BASIN AREA

GENERAL PLAN OF THE PROJECT

SC SANYU CONSULTANTS INC.
 Designed :
 Checked :
 Approved :
 Checked :
 Approved :

MAAIF
 Date :
 Approved :
 Drawing No. : 1

Fig. 2-2-3-1. General Plan of the Project

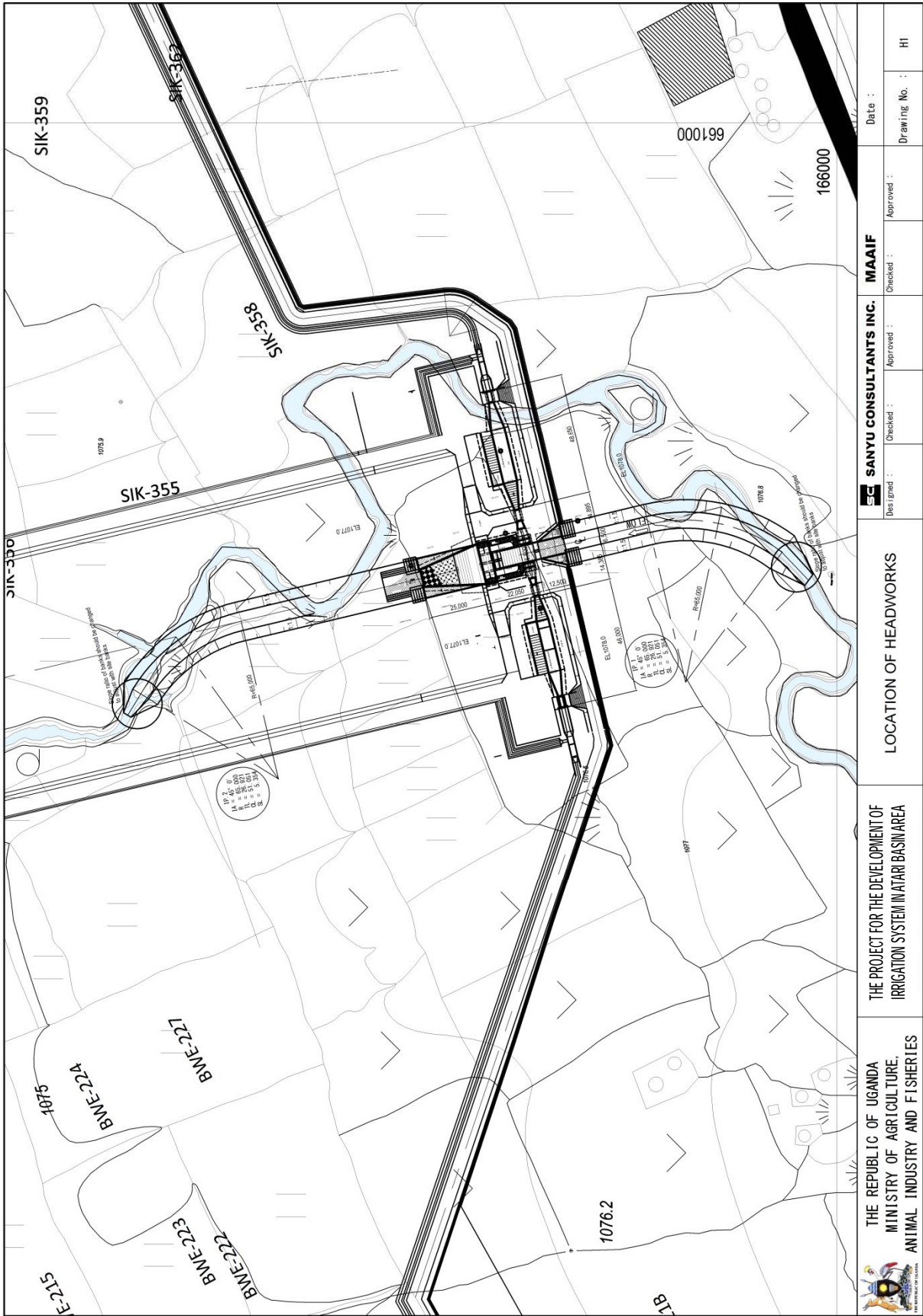


Fig. 2-2-3-2. Location of Headworks

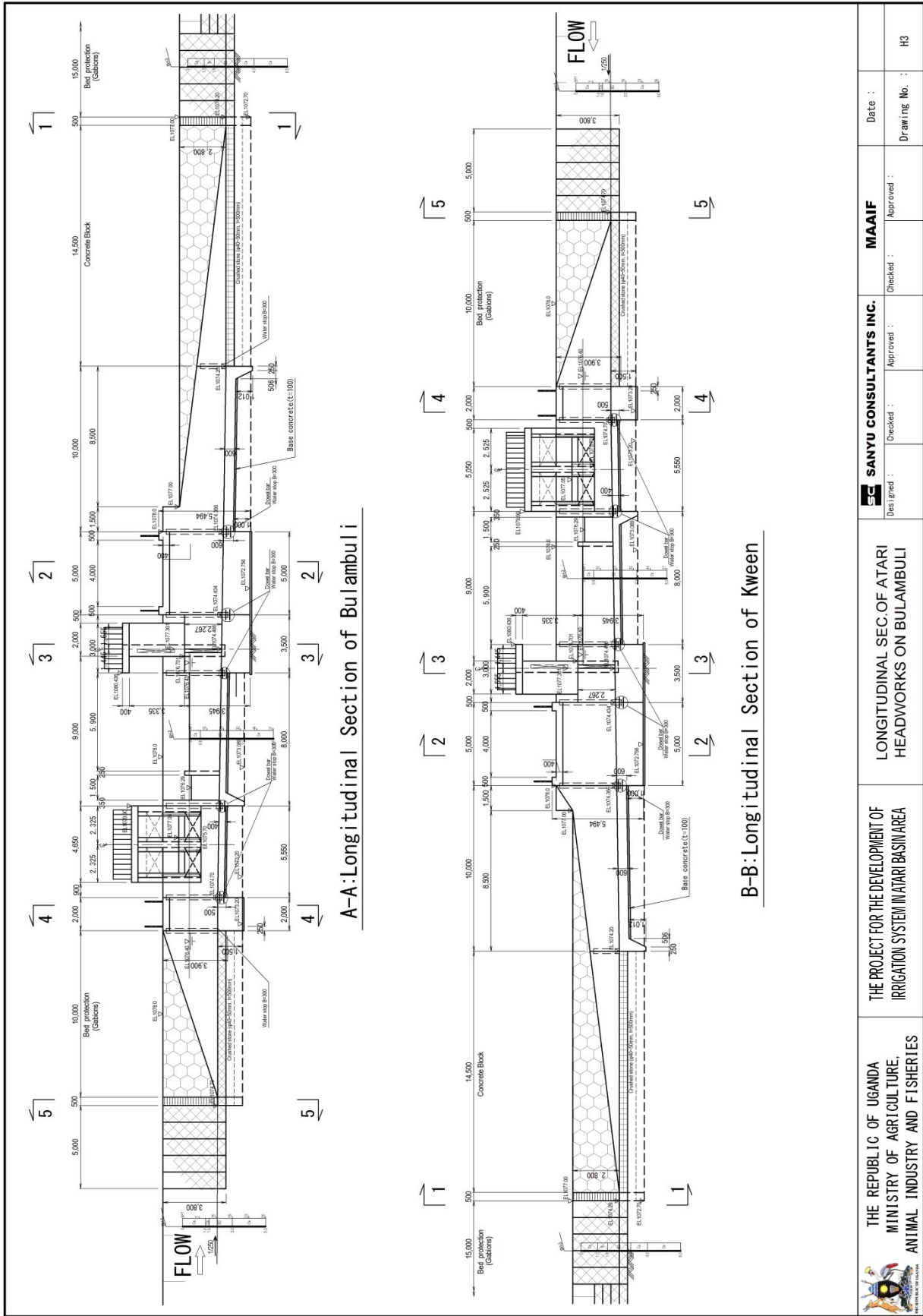


Fig. 2-2-3-3-2. General Plan of Headworks (2/3)

<p>THE REPUBLIC OF UGANDA MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES</p>	<p>THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN ATARI BASIN AREA</p>		<p>LONGITUDINAL SEC. OF ATARI HEADWORKS ON BULAMBULI</p>		<p>Des. by: [] Checked: [] Approved: []</p>	<p>MAAIF</p>	Date: []
	<p>Checked: [] Approved: []</p>		<p>Checked: [] Approved: []</p>				<p>Drawing No.: H3</p>

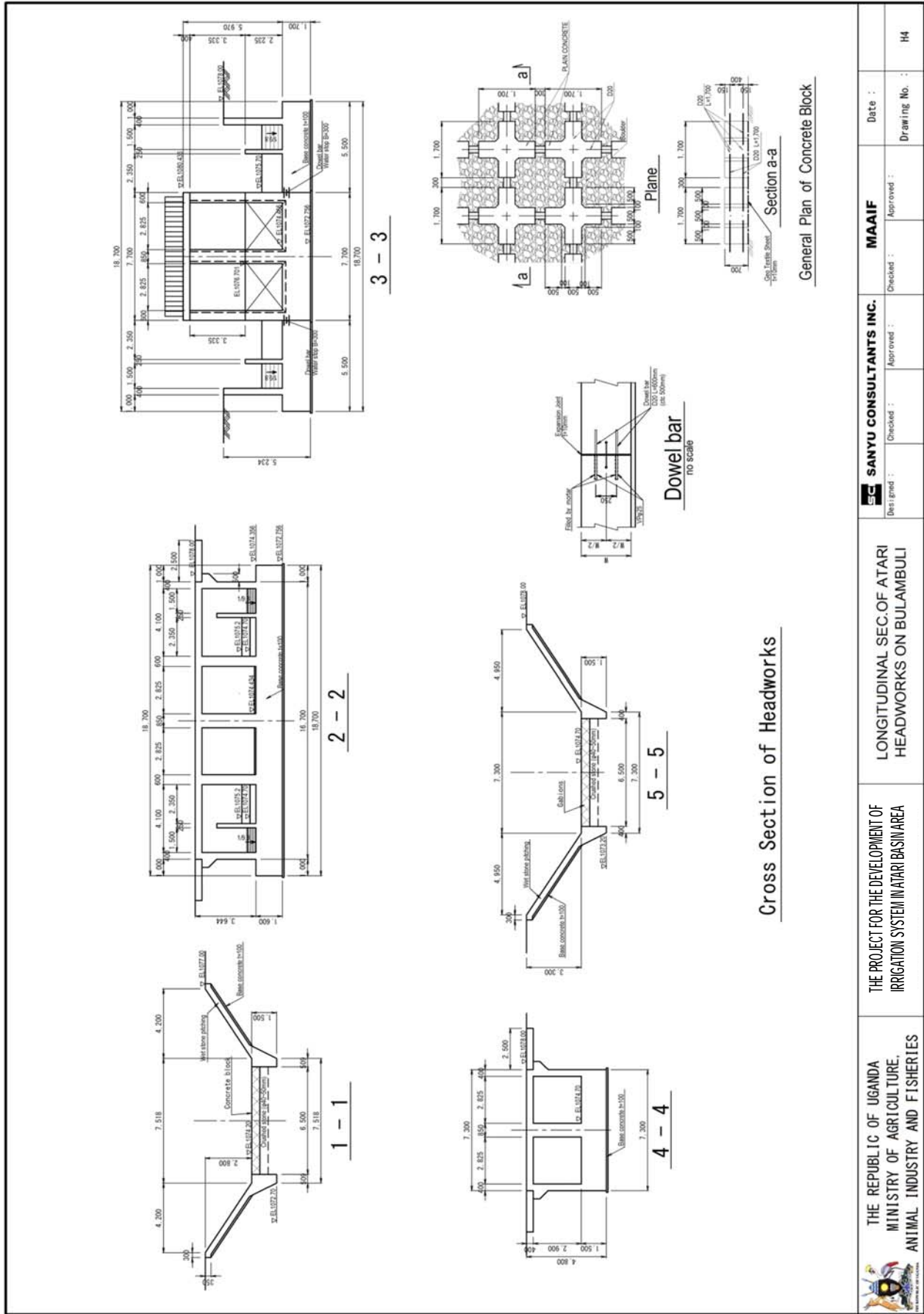


Fig. 2-2-3-3.3. General Plan of Headworks (3/3)

 <p>THE REPUBLIC OF UGANDA MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES</p>	<p>THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN ATARI BASIN AREA</p>	<p>LONGITUDINAL SEC. OF ATARI HEADWORKS ON BULAMBULI</p>	<p>EC SANYU CONSULTANTS INC.</p>	<p>MAAIF</p>	<p>Date :</p>
			<p>Designed :</p>	<p>Checked :</p>	<p>Approved :</p>

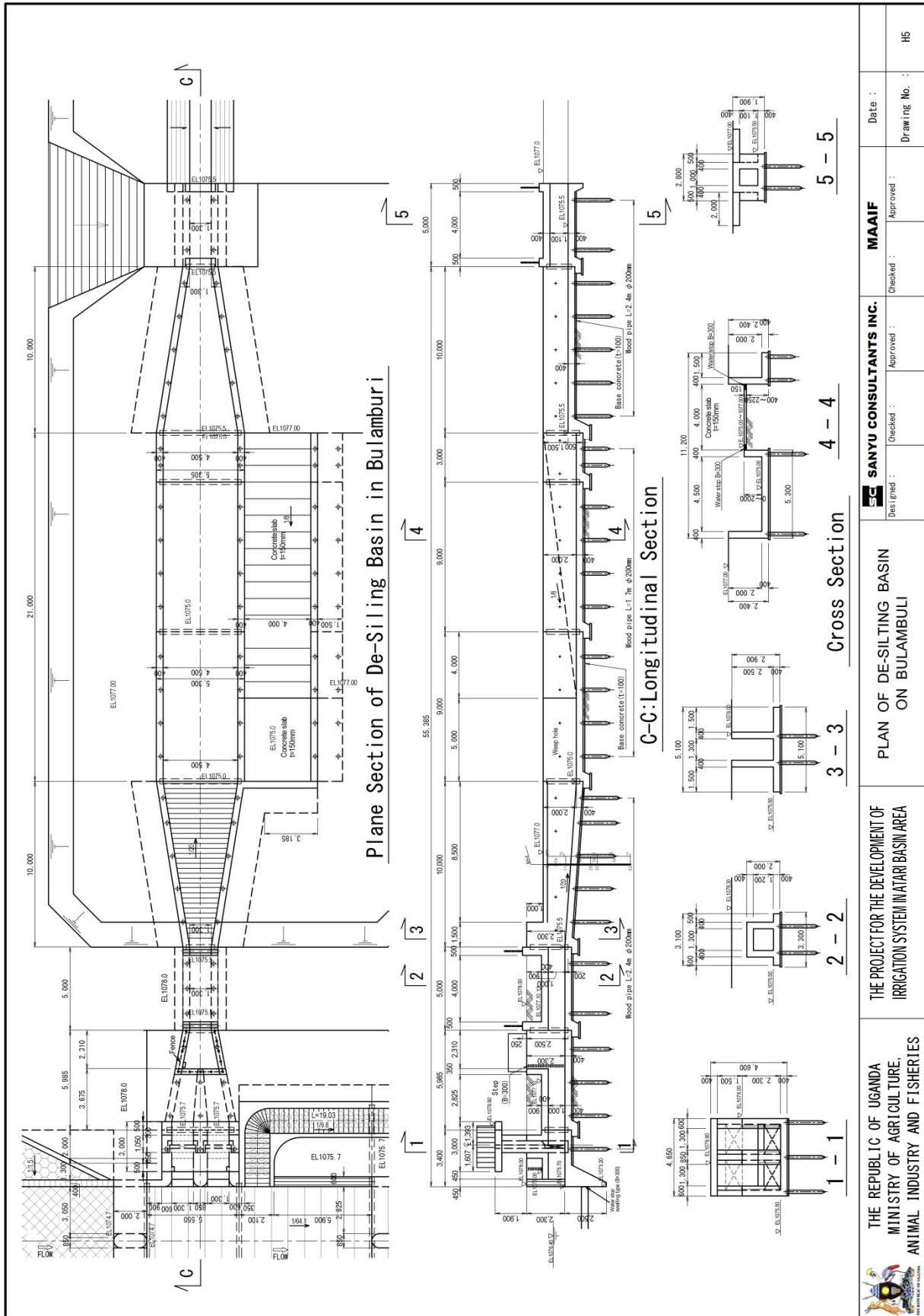
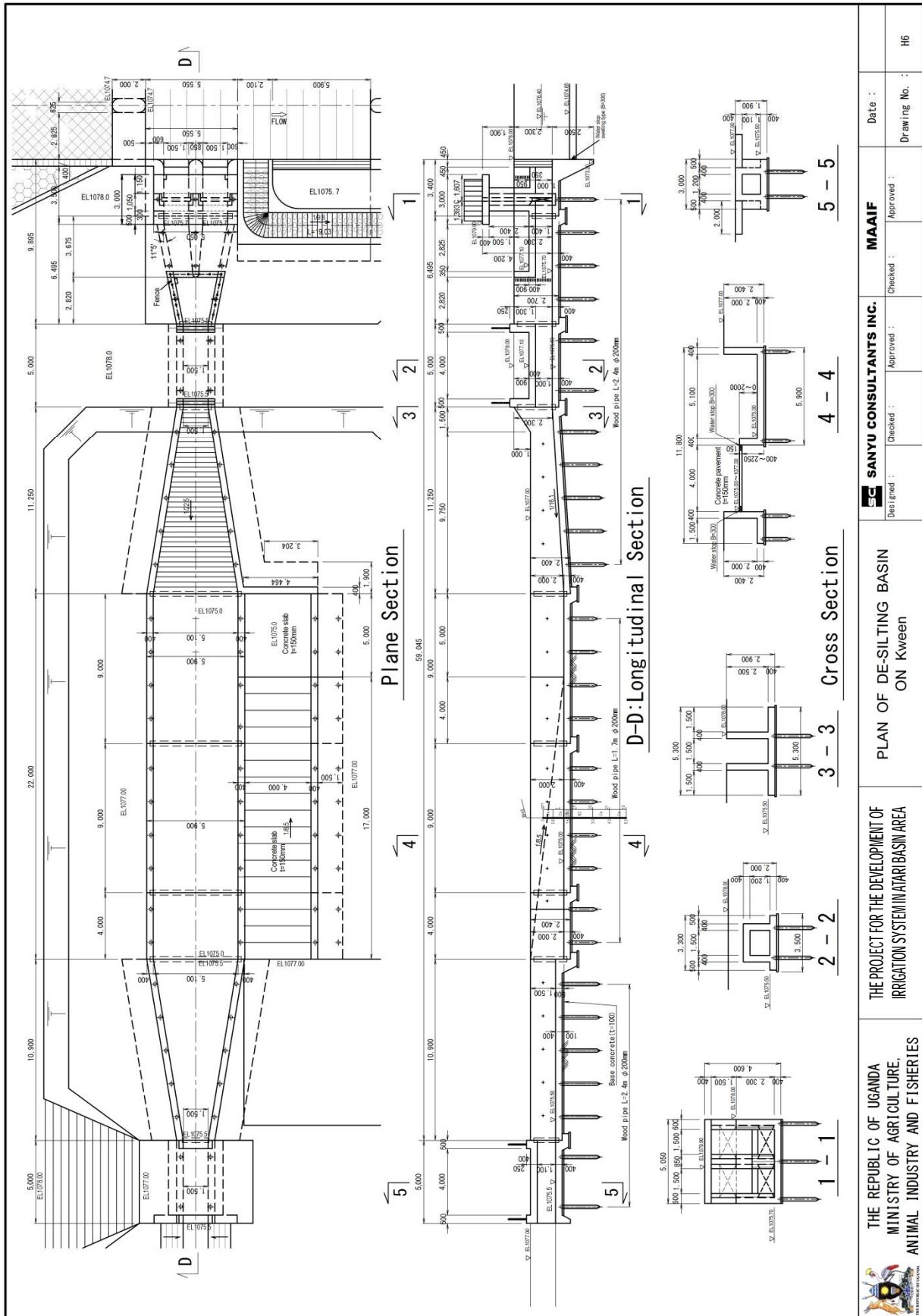


Fig. 2-2-3-4. Plan of De-silting Basin on Bulambuli

 <p style="text-align: center; font-size: small;">THE REPUBLIC OF UGANDA MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES</p>	<p style="font-size: small;">THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN WATARI BASIN AREA</p>	<p style="font-size: small;">PLAN OF DE-SILTING BASIN ON BULAMBURI</p>	<p style="font-size: small;">Designed: Checked: Approved: </p> <p style="font-size: small;">MAAIF SANYU CONSULTANTS INC.</p>
			<p style="font-size: small;">Date: Drawing No.: H5</p>

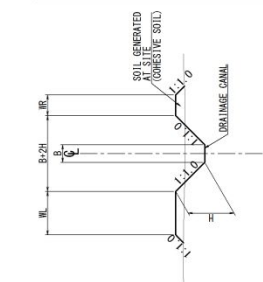


<p>THE REPUBLIC OF UGANDA MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES</p>	<p>THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN NATARI BASIN AREA</p>		<p>MAAIF</p>		Date :
	<p>Best grid :</p>	<p>Checked :</p>	<p>Approved :</p>	<p>Checked :</p>	<p>Approved :</p>

Fig. 2-2-3-5. Plan of De-silting Basin on Kween

TYPICAL CROSS SECTION OF CANAL, ROAD AND DYKE (1/2)
Scale 1:50

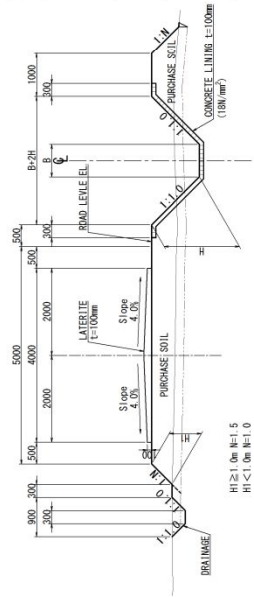
DRAINAGE CANAL



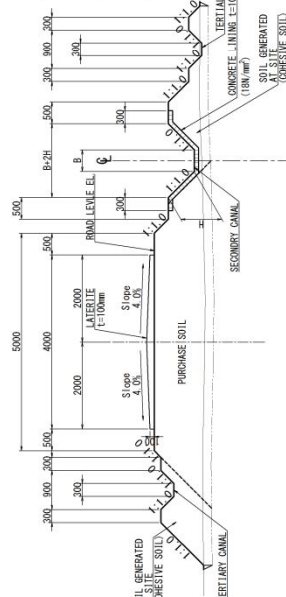
Dimension of Canal structure

Canal Name	Station Number	B (mm)	H (mm)	VR (mm)	VL (mm)
BM	No.0+063~No.0+080	1000	1100		
	No.0+080~No.0+716	750	750		
	No.0+716~No.1+250	750	750		
	No.1+250~No.1+400	400	640		
BS-1 [DYKE-2]	No.0+010~No.0+100	400	500		
	No.0+100~No.0+450	400	450		
BS-2	No.0+010~No.0+100	400	350		
	No.0+100~No.0+450	500	600		
BS-2-1	No.0+450~No.0+900	400	550		
	No.0+900~No.1+827	400	400		
BS-3	No.0+010~No.0+470	400	400		
	No.0+470~No.0+450	500	650		
KM	No.0+060~No.0+046	900	1050		
	No.0+046~No.0+587	600	800		
KS-1 [DYKE-3]	No.0+050~No.0+700	400	650		
	No.0+700~No.1+000	400	650		
KS-2	No.1+000~No.2+250	400	550		
	No.2+250~No.3+106	400	550		
KS-3	No.0+010~No.1+000	400	500		
	No.1+000~No.1+400	400	550		
KD-1	No.0+010~No.0+300	500	1170		
	No.0+300~No.1+465	500	1100		
KD-2	No.1+465~No.1+800	700	1270		
	No.1+800~No.2+871	800	1450		
KD-3	No.0+010~No.1+415	500	1080		
	No.1+415~No.2+400	700	1410		
KD-4	No.2+400~No.2+500	300	740		
	No.2+500~No.2+750	300	770		
KRR-3	No.0+010~No.0+450	2000	1150		
	No.0+450~No.1+150	2000	1340		
MAAIF	No.1+150~No.1+850	2000	1510		
	No.1+850~No.1+912	2000	1530		

MAIN CANAL

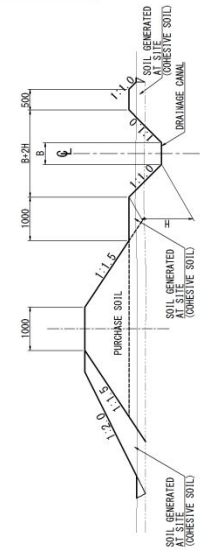


SECONDRY CANAL AND TERTIAL CANAL



DRAINAGE CANAL

KD-3 (NO. 2+100~NO. 3+100)



Dimension of KD-4 Drainage structure

Canal Name	Station Number	B (mm)	H (mm)	VR (mm)	VL (mm)
KM	No.0+010~No.0+210	300	400		
	No.0+210~No.0+939	1000	1100		
KS-3	No.0+000~No.1+500	1000	1100		
	No.1+500~No.2+384	1800	1090		
KRR-3	No.0+000~No.0+350	1800	1090		
	No.0+350~No.0+650	2000	1150		
MAAIF	No.0+650~No.1+150	2000	1340		
	No.1+150~No.1+850	2000	1510		
MAAIF	No.1+850~No.1+912	2000	1530		

Dimension of Drainage structure

Canal Name	Station Number	B (mm)	H (mm)	VR (mm)	VL (mm)
BD-1	No.0+010~No.0+350	400	890		
	No.0+350~No.0+650	400	860		
	No.0+650~No.0+850	400	870		
	No.0+850~No.1+813	500	980		
BD-2	No.0+010~No.0+250	400	570		
	No.0+250~No.0+450	400	500		
BD-3	No.0+010~No.0+450	400	550		
	No.0+450~No.0+550	400	700		
BD-4	No.0+010~No.1+700	500	870		
	No.1+700~No.2+005	600	890		
KD-1	No.0+010~No.0+300	500	1170		
	No.0+300~No.1+465	500	1100		
KD-2	No.1+465~No.1+800	700	1270		
	No.1+800~No.2+871	800	1450		
KD-3	No.0+010~No.1+415	500	1080		
	No.1+415~No.2+400	700	1410		
KRR-3	No.2+400~No.2+500	300	740		
	No.2+500~No.2+750	300	770		
MAAIF	No.0+010~No.0+450	2000	1150		
	No.0+450~No.1+150	2000	1340		
MAAIF	No.1+150~No.1+850	2000	1510		
	No.1+850~No.1+912	2000	1530		



THE REPUBLIC OF UGANDA
MINISTRY OF AGRICULTURE,
ANIMAL INDUSTRY AND FISHERIES

THE PROJECT FOR THE DEVELOPMENT OF
IRRIGATION SYSTEM IN ARIAS BASIN AREA

TYPICAL CROSS SECTION OF CANAL,
ROAD AND DYKE (1/2)

SC SANYU CONSULTANTS INC.
Design grad :
Checked :
Approved :

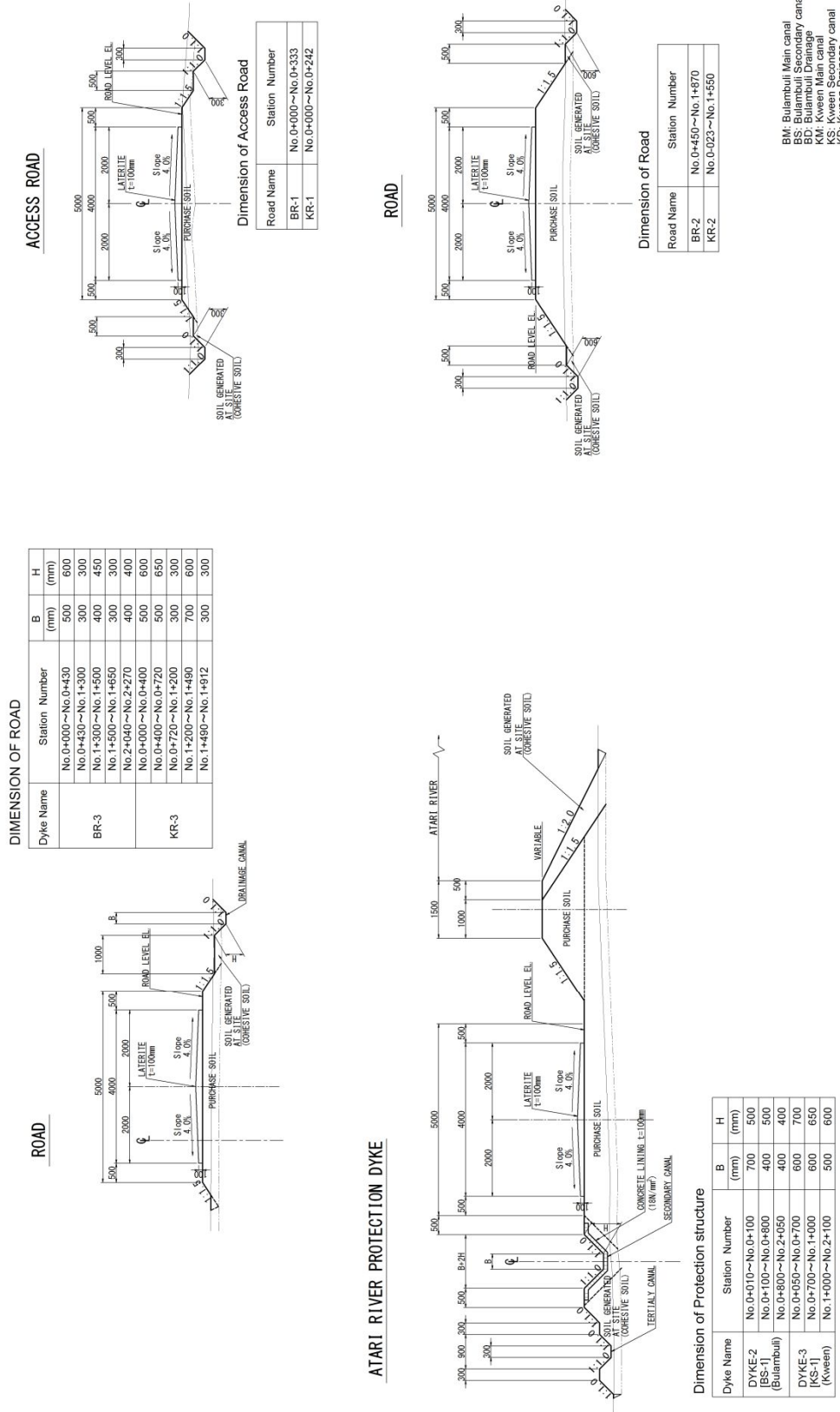
MAAIF
Checked :
Approved :
Date :
Drawing No. : 2 - 1

BM: Bulambuli Main canal
BS: Bulambuli Secondary canal
BD: Bulambuli Drainage
KM: Kween Main canal
KS: Kween Secondary canal
KRR: Kween Drainage

Fig. 2-2-3-6-1. Typical Cross Section of Canal, Road and Dyke(1/2)

TYPICAL CROSS SECTION OF CANAL, ROAD AND DYKE (2/2)

Scale 1:50



BM: Bulambuli Main canal
 BS: Bulambuli Secondary canal
 KD: Bulambuli Drainage
 KS: Kween Drainage
 KR: Kween Secondary canal
 KR: Kween Drainage

<p>SANYU CONSULTANTS INC.</p>	Designed : Approved : Checked :	Approved : Checked :	Approved : Checked :	Date : Drawing No. :
	THE REPUBLIC OF UGANDA MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES	THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN ATARI BASIN AREA		

Fig. 2-2-3-6-2. Typical Cross Section of Canal, Road and Dyke(2/2)

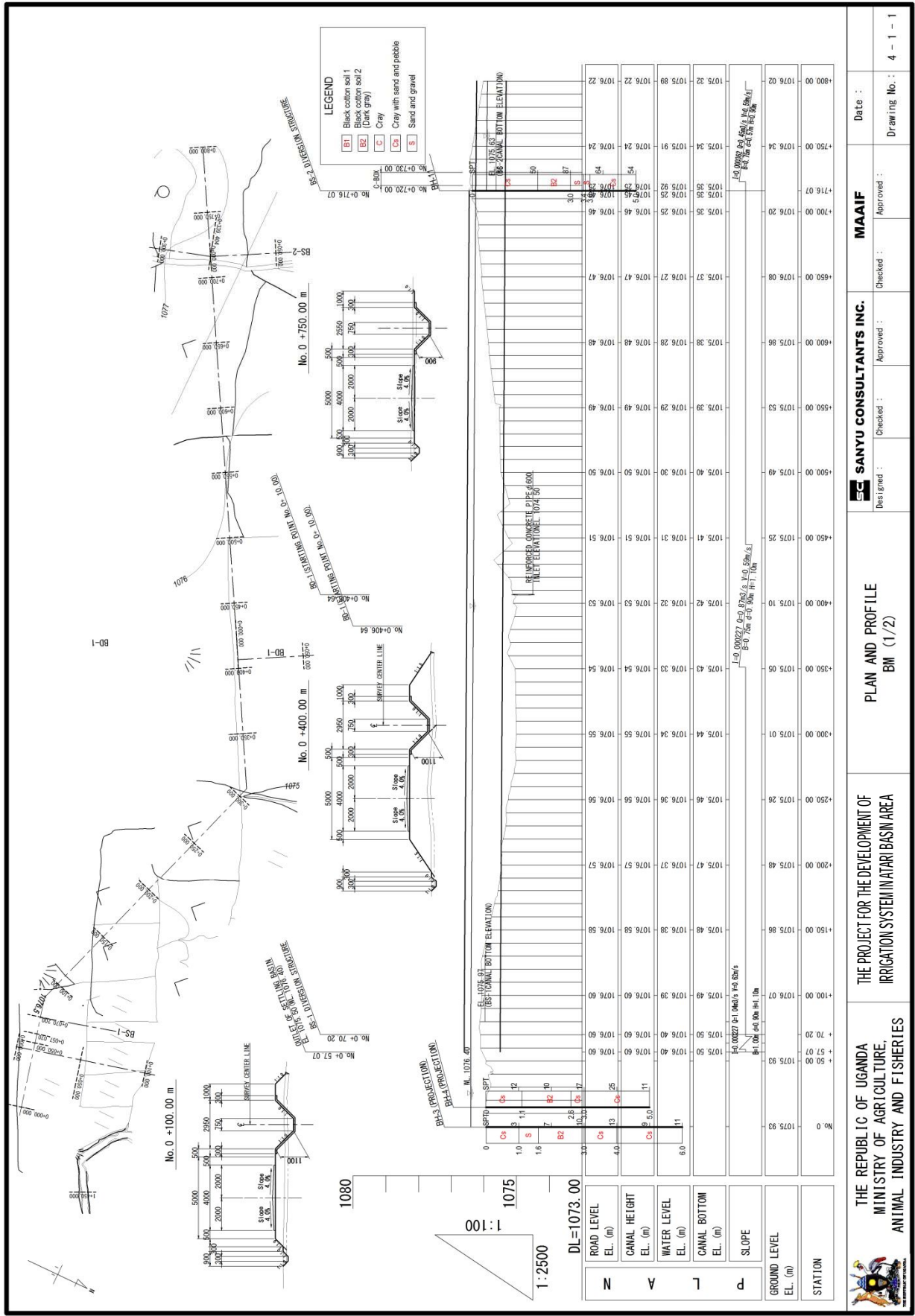


Fig. 2-2-3-7-1. Longitudinal Profile of BM (1/2)



THE REPUBLIC OF UGANDA
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THE PROJECT FOR THE DEVELOPMENT OF
IRRIGATION SYSTEM IN ATARI BASIN AREA

PLAN AND PROFILE
BM (1/2)

SANYU CONSULTANTS INC.
Designed : _____
Checked : _____
Approved : _____

MAAIF
Checked : _____
Approved : _____

Date : _____
Drawing No. : 4 - 1 - 1

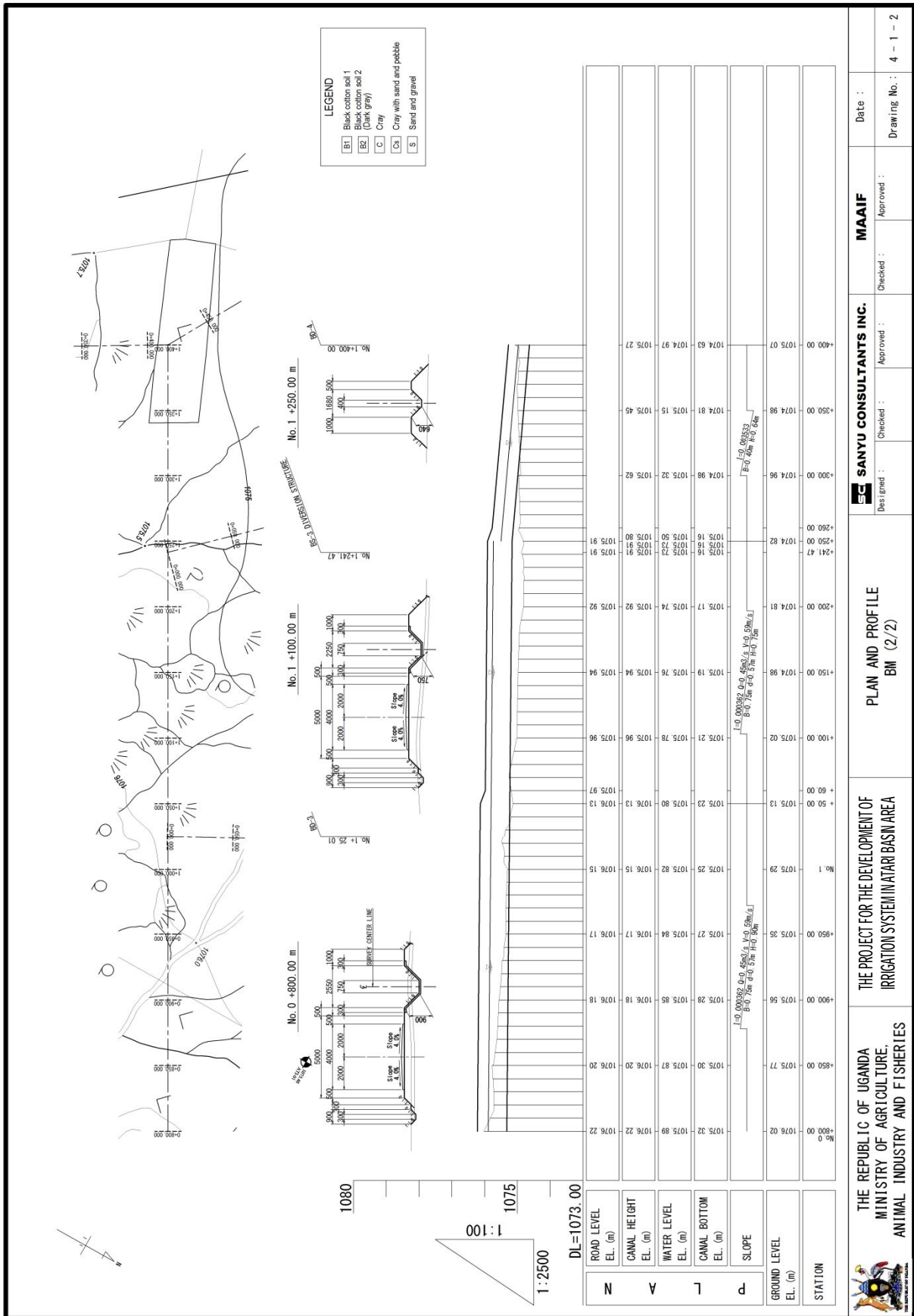


Fig. 2-2-3-7-2. Longitudinal Profile of BM (2/2)

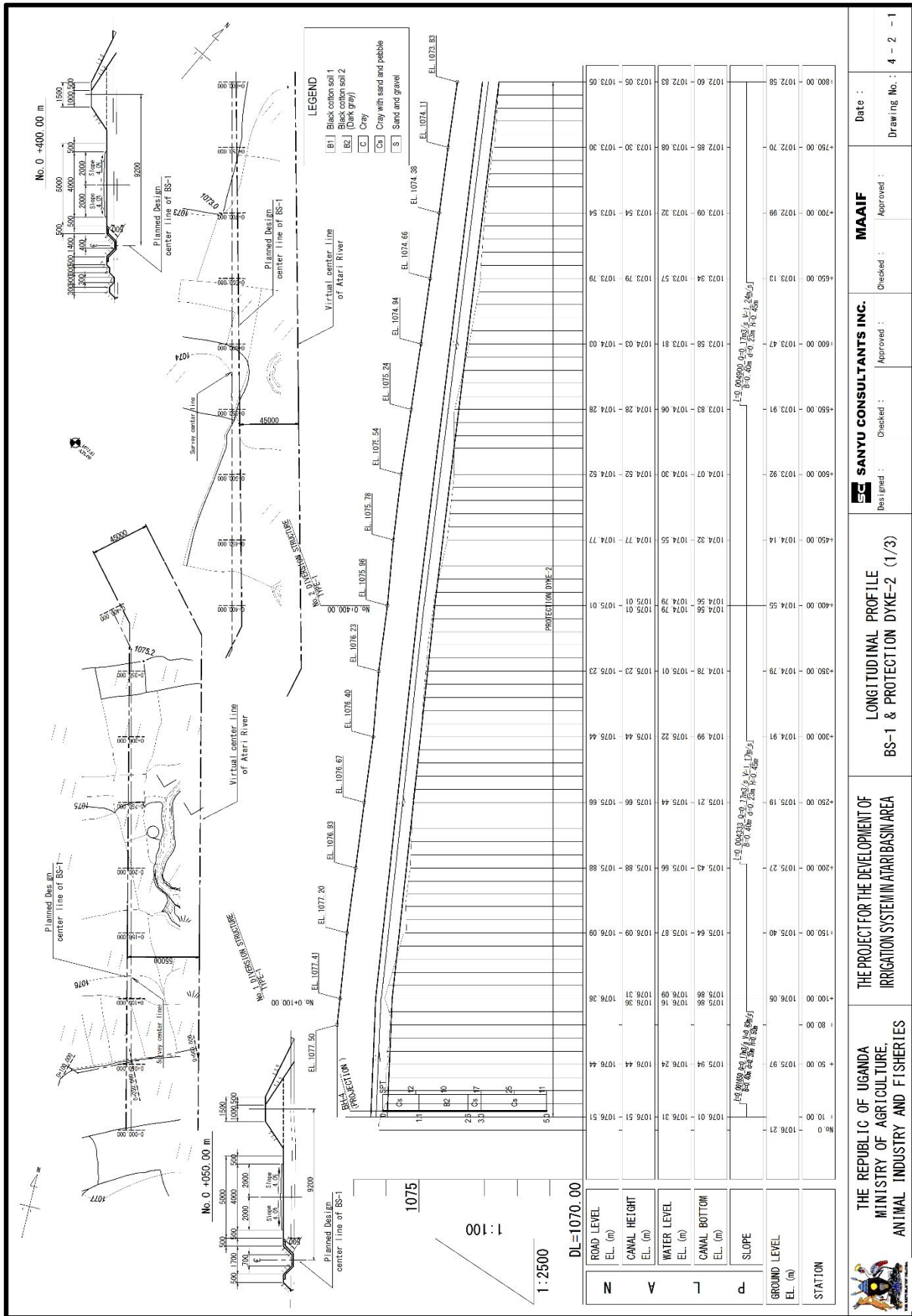


Fig. 2-2-3-8-1. Longitudinal Profile of BS-1 and Protection Dyke-2 (1/3)

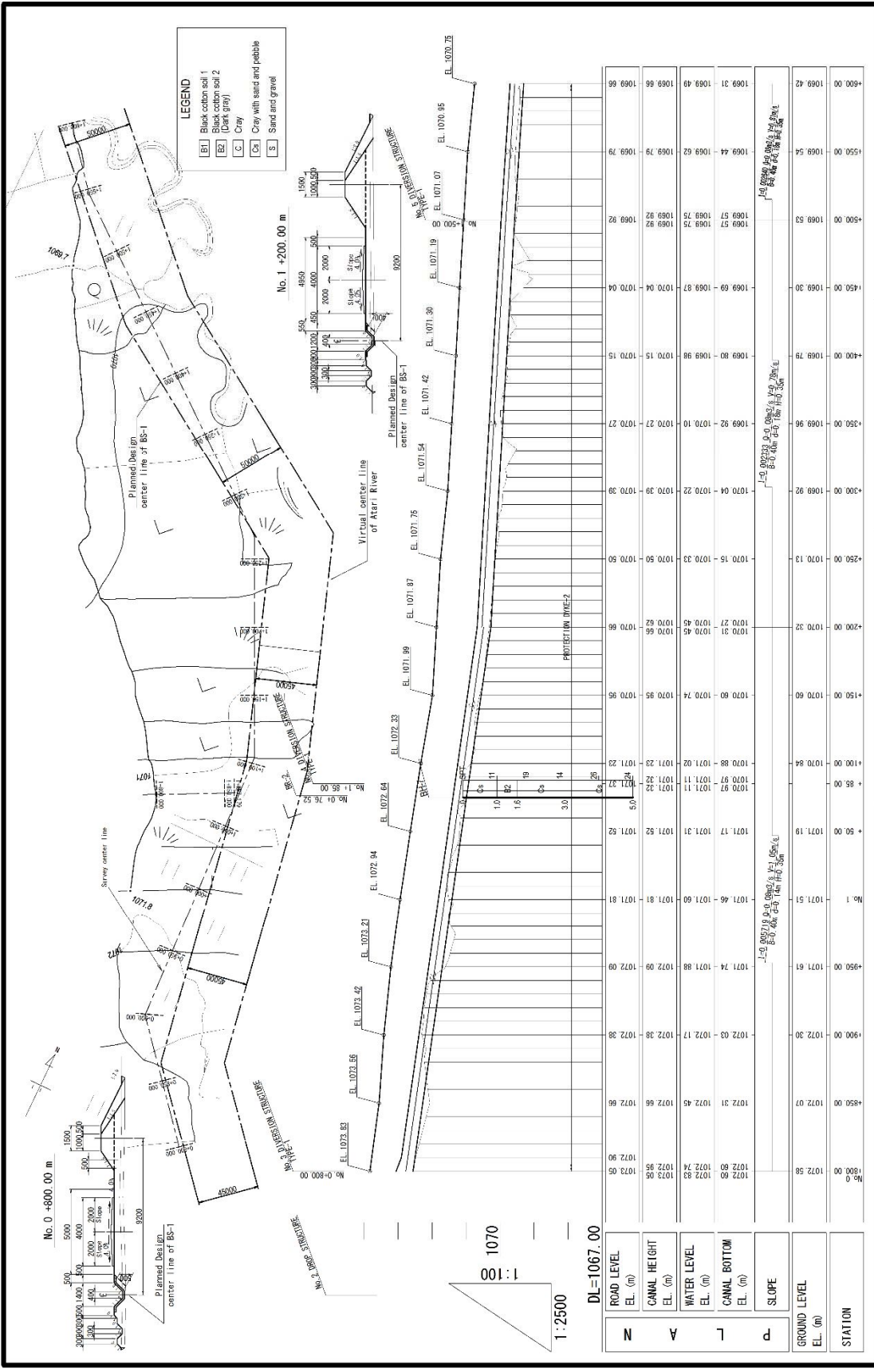


Fig. 2-2-3-8-2. Longitudinal Profile of BS-1 and Protection Dyke-2 (2/3)

SANYU CONSULTANTS INC. Designed: _____ Checked: _____ Approved: _____	MAAIF Approved: _____ Checked: _____	Date: _____ Drawing No.: 4 - 2 - 2
	LONGITUDINAL PROFILE BS-1 & PROTECTION DYKE-2 (2/3)	
THE PROJECT FOR THE DEVELOPMENT OF IRRIGATION SYSTEM IN ATARI BASIN AREA		THE REPUBLIC OF UGANDA MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES

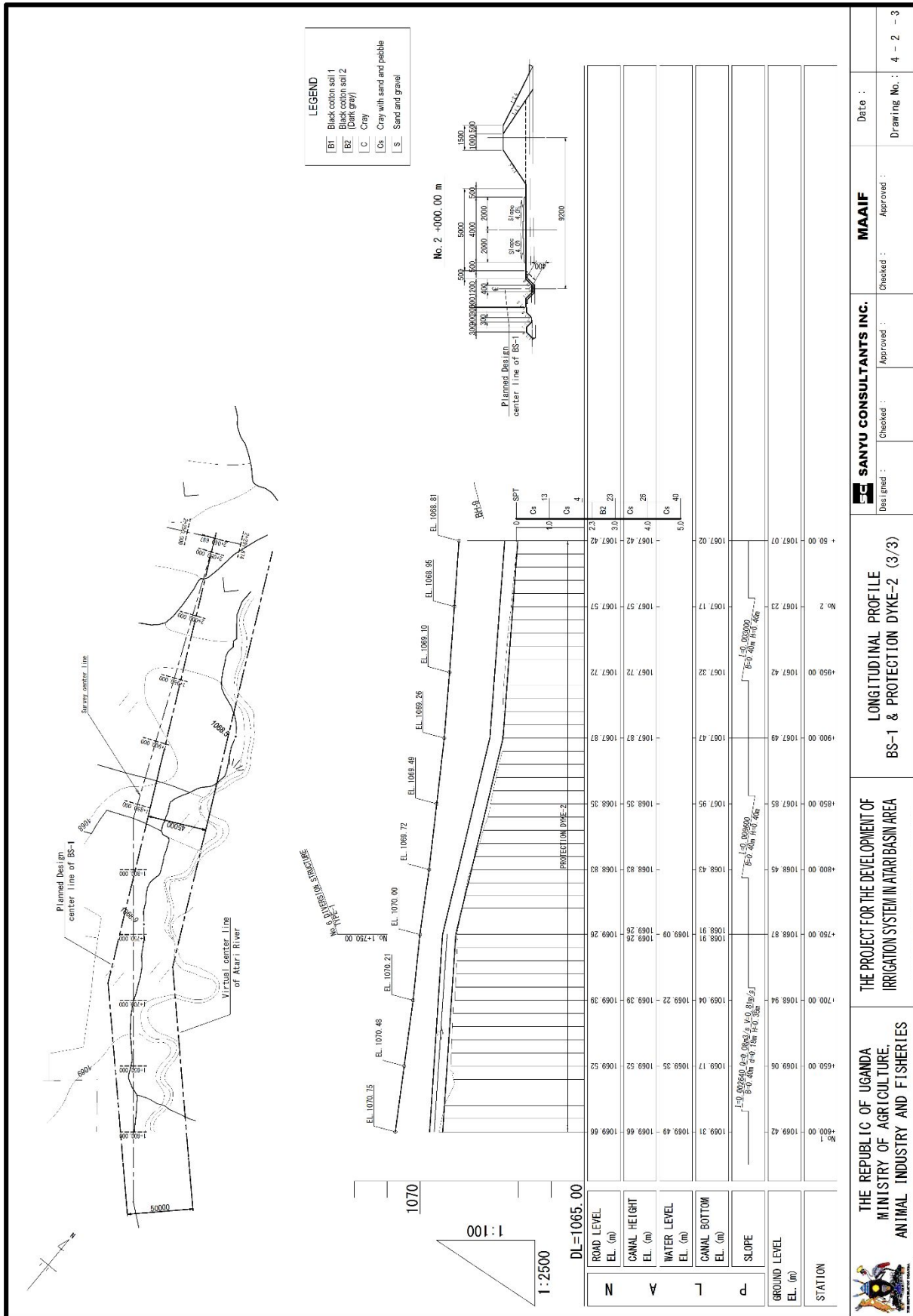


Fig. 2-2-3-8-3. Longitudinal Profile of BS-1 and Protection Dyke-2 (3/3)

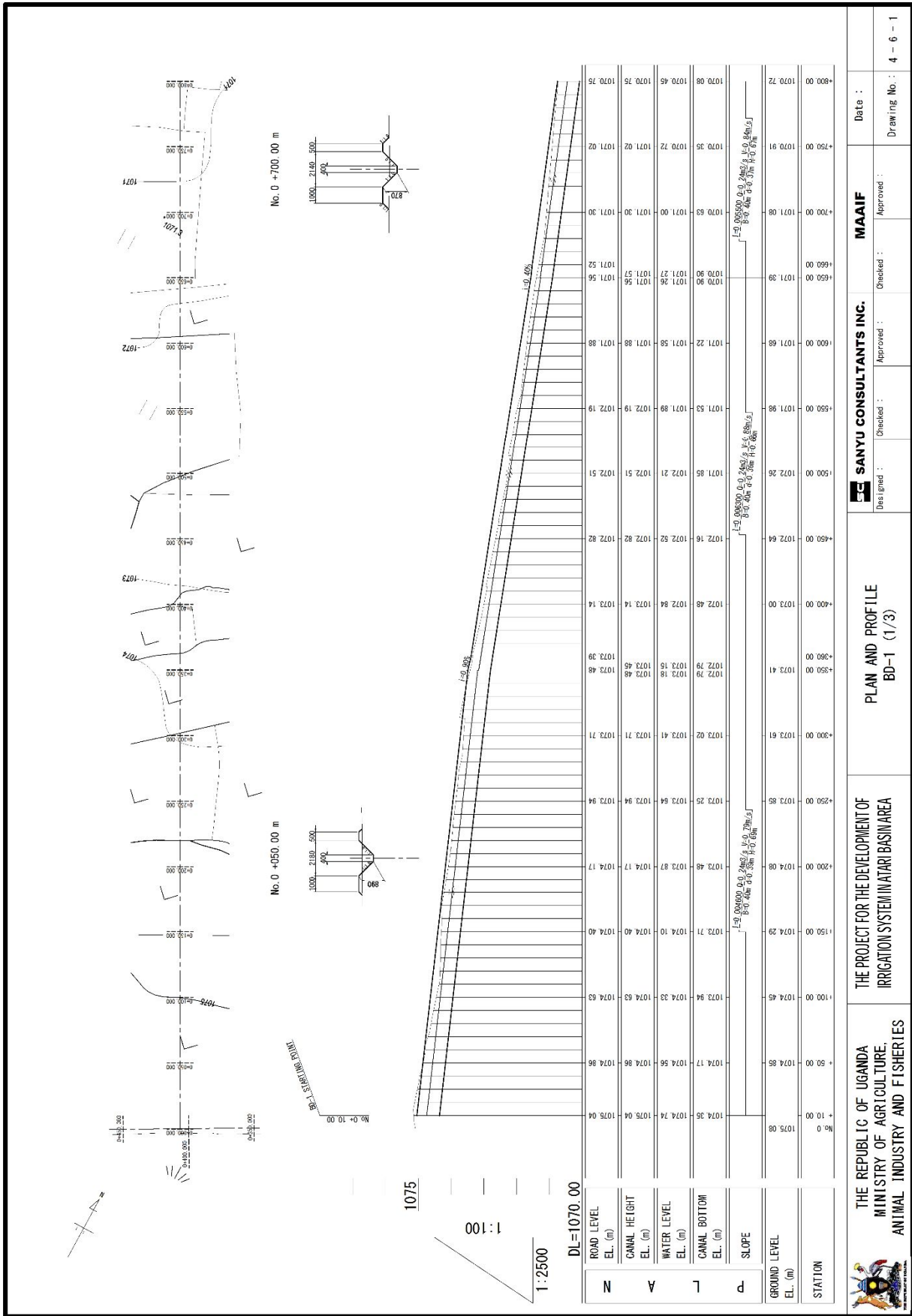


Fig. 2-2-3-9-1. Longitudinal Profile of BD-1 (1/3)

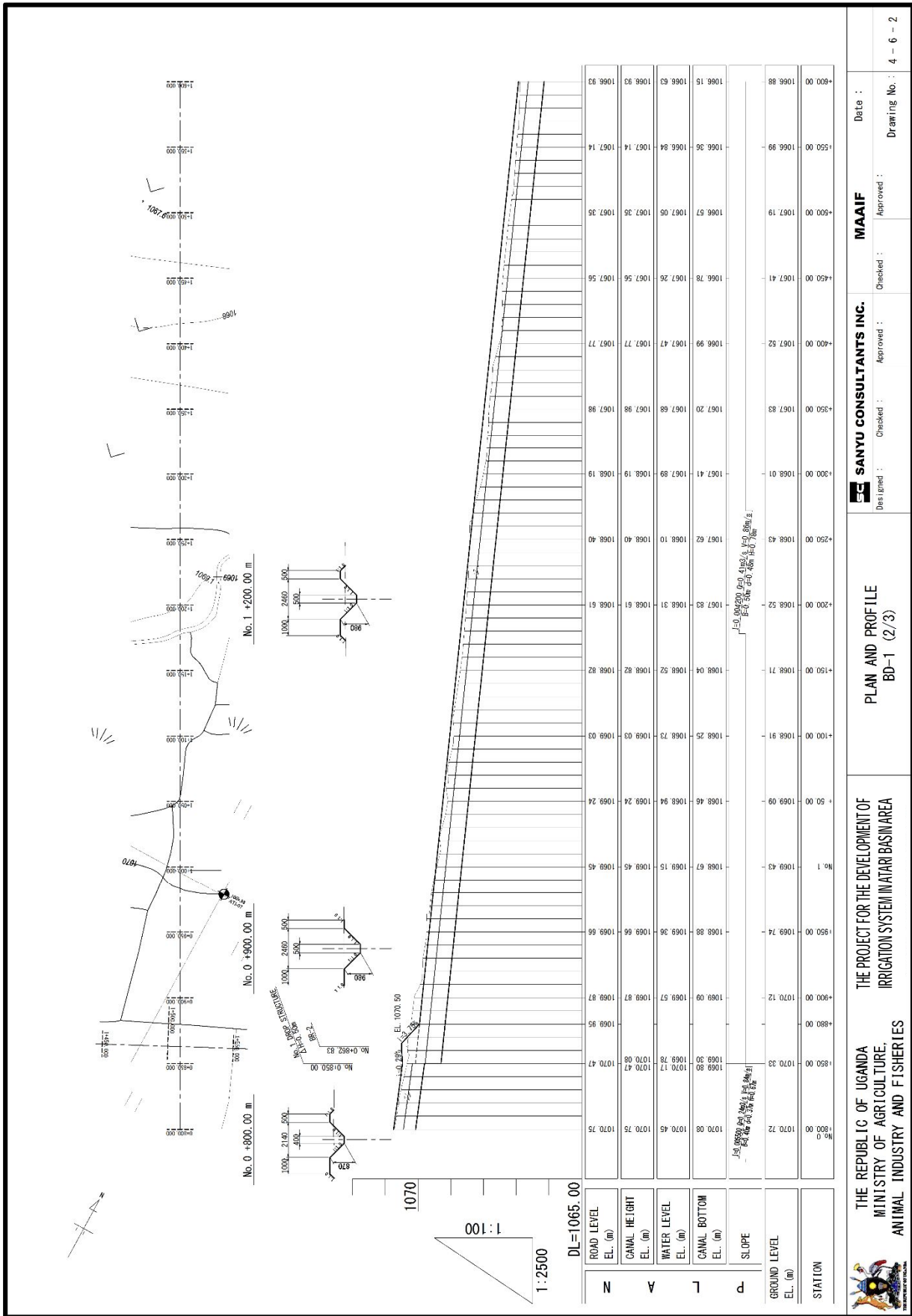


Fig. 2-2-3-9-2. Longitudinal Profile of BD-1 (2/3)

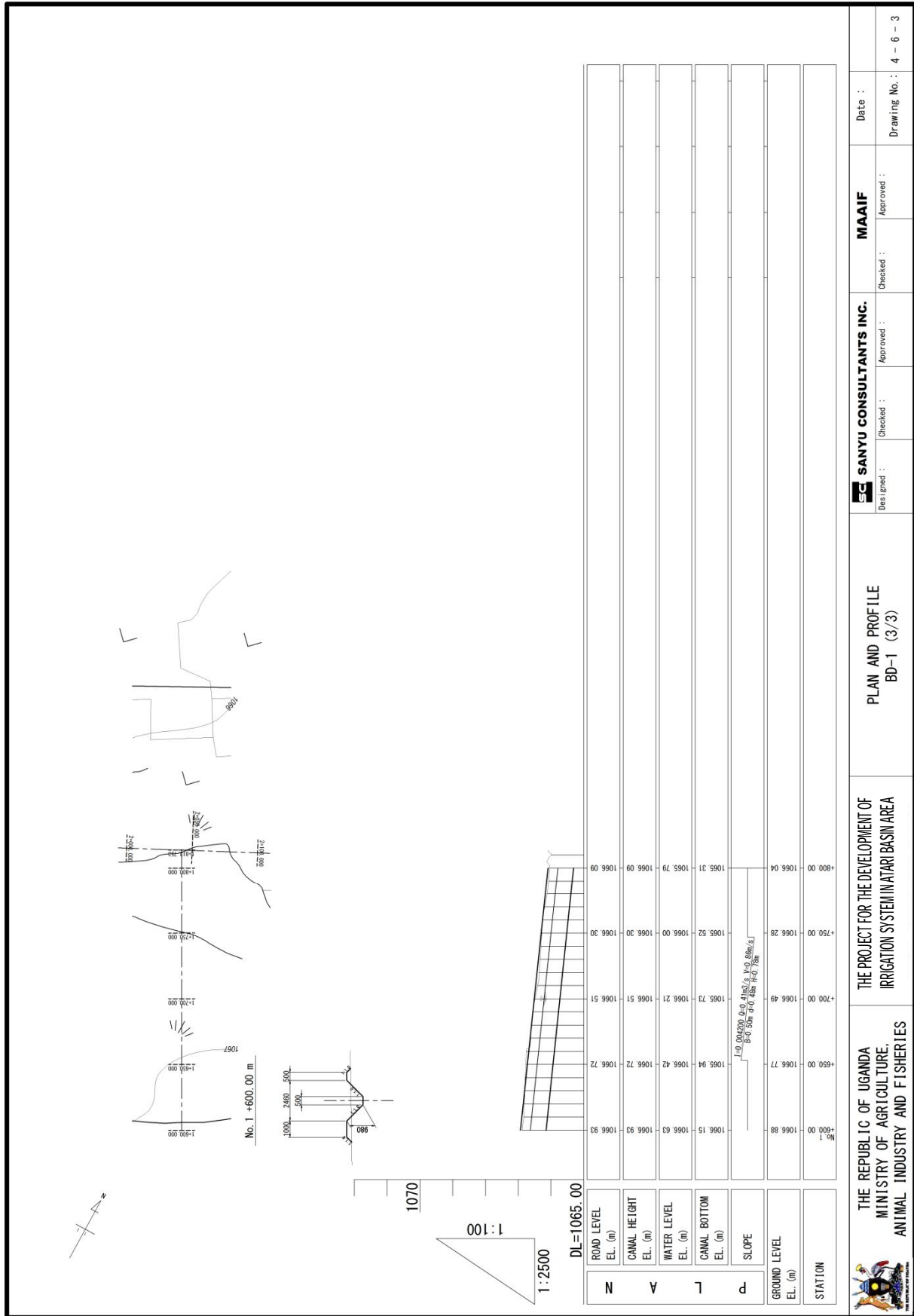


Fig. 2-2-3-9-3. Longitudinal Profile of BD-1 (3/3)

DIVERSION STRUCTURE (MAIN CANAL) (1/2)

Dimension of Diversion Structure (Main Canal)

Canal Name	STA	Div. No.	H (mm)	H1 (mm)	H2 (mm)	H3 (mm)	H4 (mm)	d1 (mm)	d2 (mm)	d3 (mm)	d4 (mm)	d5 (mm)	ELEVATION (D) (E.C.M)
BH	No. 04680	No. 1	1100	500	1100	1000	500	800	800	800	800	800	1015.90
	No. 04681	No. 2	1100	400	1100	800	700	800	800	800	800	800	1015.85
	No. 04682	No. 3	1050	700	1050	800	700	800	800	800	800	800	1015.80
KH	No. 04683	No. 1	1000	400	1000	700	750	500	500	500	500	500	1014.63
	No. 04684	No. 2	1000	400	1000	600	600	500	500	500	500	500	1014.54
	No. 04685	No. 3	1000	400	1000	600	600	500	500	500	500	500	1014.54

MINIMUM INTERNAL DIMENSIONS (ON H = 1.00 m)

Dimension of Diversion Structure (Main Canal)

Canal Name	STA	Div. No.	B (mm)	B1 (mm)	B2 (mm)	B3 (mm)	B4 (mm)	B5 (mm)	B6 (mm)	B7 (mm)	B8 (mm)	L1 (mm)	
BH	No. 04680	No. 1	2200	900	1000	1000	3200	750	2950	700	700	1700	1400
	No. 04716	No. 2	1800	700	750	2950	750	2550	900	800	2200	1200	1200
	No. 14241	No. 3	1400	500	750	2950	400	1680	800	500	1900	1300	1300
KH	No. 04687	No. 1	1200	400	600	2000	600	2000	600	2000	600	2100	1300
	No. 04687	No. 2	1200	400	600	2000	600	2000	600	2000	600	2100	1300
	No. 04640	No. 3	1200	400	600	2000	500	1700	—	—	—	—	

TO PLACE A BOX CULVERT AT KH-NO. 3 ONLY.

Dimension of Sluice Gate (Main Canal)

Canal Name	STA	Div. No.	NO. 1 GATE (MAIN)			NO. 2 GATE (MAIN)			NO. 3 GATE (LATERAL)			
			Ho (mm)	Bo (mm)	Hs (mm)	Ho (mm)	Bo (mm)	Hs (mm)	Ho (mm)	Bo (mm)	Hs (mm)	
BH	No. 04680	No. 1	800	900	900	700	700	700	700	700	700	—
	No. 04716	No. 2	700	700	700	700	700	700	800	800	800	—
	No. 14241	No. 3	500	500	500	500	500	500	600	600	600	—
KH	No. 04647	No. 1	700	700	700	700	700	700	700	700	700	—
	No. 04687	No. 2	400	400	400	400	400	400	400	400	400	—
	No. 04640	No. 3	—	—	—	—	—	—	—	—	—	—

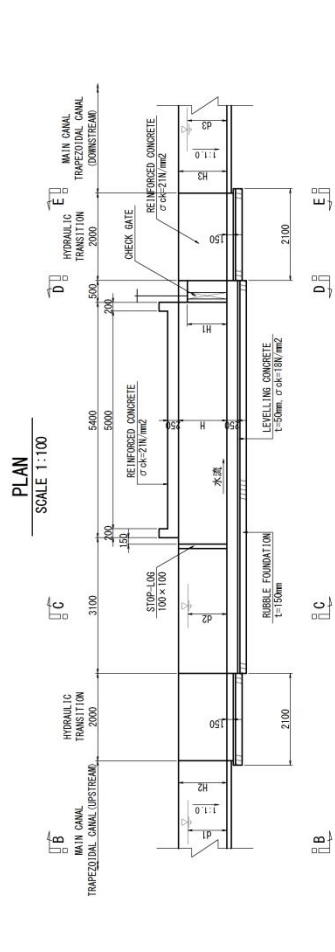
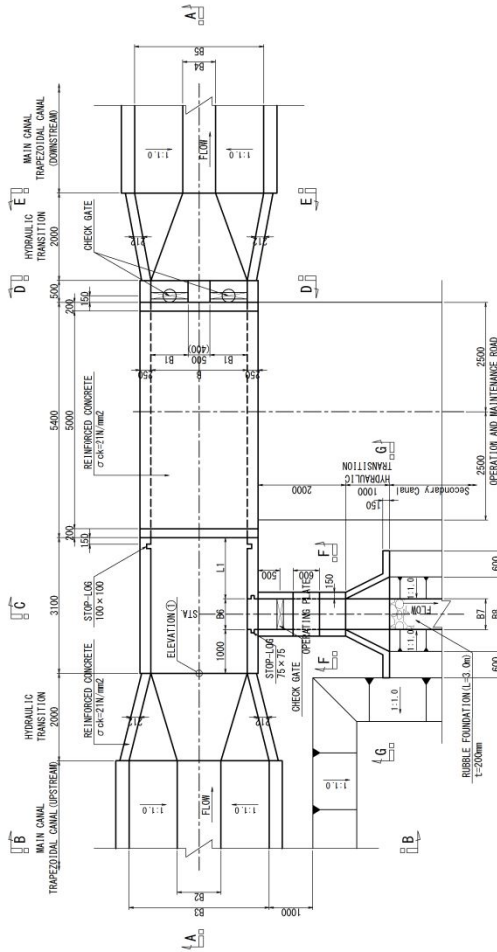


Fig. 2-2-3-10-1. Diversion Structure(Main Canal) (1/2)



THE REPUBLIC OF UGANDA
MINISTRY OF AGRICULTURE,
ANIMAL INDUSTRY AND FISHERIES

THE PROJECT FOR THE DEVELOPMENT OF
IRRIGATION SYSTEM IN ATARI BASIN AREA

DIVERSION STRUCTURE
(MAIN CANAL) (1/2)

SC SANYU CONSULTANTS INC.
Designed: _____ Checked: _____ Approved: _____

MAAIF
Checked: _____ Approved: _____

Date: _____
Drawing No.: 6 - 1 - 1

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Basic Policy

The Project will construct a series of irrigation facilities, namely, headworks, irrigation canals, drainage canals, and agricultural road. Additionally, steel gates such as spillway gates and intake gates, and diversion gates will be procured/installed for the intake and irrigation canals, respectively. MAAIF is the Project implementation agency and its head office in Entebbe is responsible for supervision of the construction. The Project is classified as a civil infrastructure project, and the lump-sum contract system is applied in the construction/consultant contracts.

(2) Policy on Employment of Local Contractors

In Uganda, some dozens of contractors which are classified as Class A+ accede to the Uganda National Association of Construction of Buildings and Civil Engineering Contractors. While some of the contractors seem to have challenges in terms of shortage of manpower and ability, there are several contractors which have experiences to work with Japanese contractors with enough ability. Therefore, it is possible to procure the local contractors as a sub-contractor of Japanese contractors.

(3) Need for Dispatch of Skilled Workers

Dispatch of skilled labors from Japan or third countries is not necessary, since the Project does not require special construction techniques.

(4) Implementation Structure of Uganda Side

As mentioned above, the Implementation Agency of the Project is MAAIF, and its head office will be in charge of the Project management and supervision of the construction/soft component.

2-2-4-2 Implementation Conditions

(1) Road Use Permit

During the construction period, it is planned that construction vehicles such as dump trucks to transport earth-fill materials etc. pass the national road from Mbale to Moroto. Since permit on road traffic for the construction works is required, MAAIF shall obtain the permit from the authorities concerned prior to the commencement of the construction works.

(2) Environmental Countermeasure during Construction

In order to identify environmental impacts on soil, river, etc. by the construction and/or excavation works and to take countermeasures, periodical monitoring of air pollution, noise, emission, water contamination, soil contamination and waste materials shall be conducted by the contractor.

(3) Supports for Project Affected Persons

Land acquisition is required for the construction of headworks, irrigation and drainage canals, etc., and

it is one of obligations of GoU to acquire necessary lands and provide necessary compensation and/or support to the Project Affected Persons (hereinafter referred to as “PAPs”), and such procedures shall be completed prior to the commencement of construction works.

(4) Quarry Site and Disposal Area

Prior to the construction works, GoU shall obtain consents from the relevant private landowners to set the quarry within their lands for mining of earth-fill materials and disposal of materials generated by the construction works.

(5) Procurement of Steel Gates

Large-scale gates are to be procured from Japan. On the one hand, the small-scale gates such as the diversion gate of tertiary canal are to be procured in Uganda. Given that the number of gates to be procured is large, management of the procurement schedule is very important.

2-2-4-3 Scope of Works

Allocation of necessary construction/procurement works between Japanese side and Uganda side is summarized in Table 2-4-3-1.

Table 2-2-4-3-1. Allocation of Construction/Procurement

Item	Japanese side	Uganda side
Construction of irrigation facilities	Construction of headworks, irrigation and drainage canals, etc.	Securing all necessary lands for construction.
Land reorganization	Establishment of model plots	Securing all necessary lands for establishment of model plots.
Buildings	-	Building construction by GoU's own budget or other donor's project.
Equipment	-	Equipment installed by GoU's own budget or other donor's project.
Soft component	<ul style="list-style-type: none"> • Dispatch of specialists of irrigation facility O&M, water management and training planning. • Assistance for preparation of O&M manual of irrigation facilities. 	Participation of the officials from MAAIF, MWE Mbale office, local governments of Bulambuli and Kween Districts Organization of training and arrangement of the participants.

Source: JICA OD Team

2-2-4-4 Consultant Supervision

2-2-4-4-1 Detailed Design and Supervision by Consultant

(1) Detailed Design and Tender Management

Consulting services in the DD and tender arrangement are listed as follows:

- 1) Site survey for the DD including the alignment survey of drainage in Bulambuli side
- 2) Review of estimated cost by the OD
- 3) Preparation of detail drawings and tender document
- 4) Tender arrangement

Following 11 consultants are assigned for the services:

- 1) Chief Consultant
- 2) Civil Engineer A (Gate)
- 3) Civil Engineer B (Intake)
- 4) Civil Engineer C (Irrigation and Drainage Canal)
- 5) Civil Engineer D (Planning of River Channel and Dyke)
- 6) Civil Engineer E (Planning of Road)
- 7) Civil Engineer F (Land Re-organization)
- 8) Civil Engineer G (Construction Schedule and Cost Estimation)
- 9) Environmental and Social Considerations
- 10) Tender Document
- 11) Tender Document (contingency)

(2) Detail design and Tender Arrangement

The construction works include several and wide-range of works such as construction of headworks, intakes, de-silting basin, irrigation and drainage canals, O&M roads, and Land Re-organization of model plots. Therefore, the resident engineer, who has sufficient knowledge and experiences of construction methods and O&M of irrigation facilities, is to be assigned.

Table 2-2-4-4-1. Supervision by Consultant

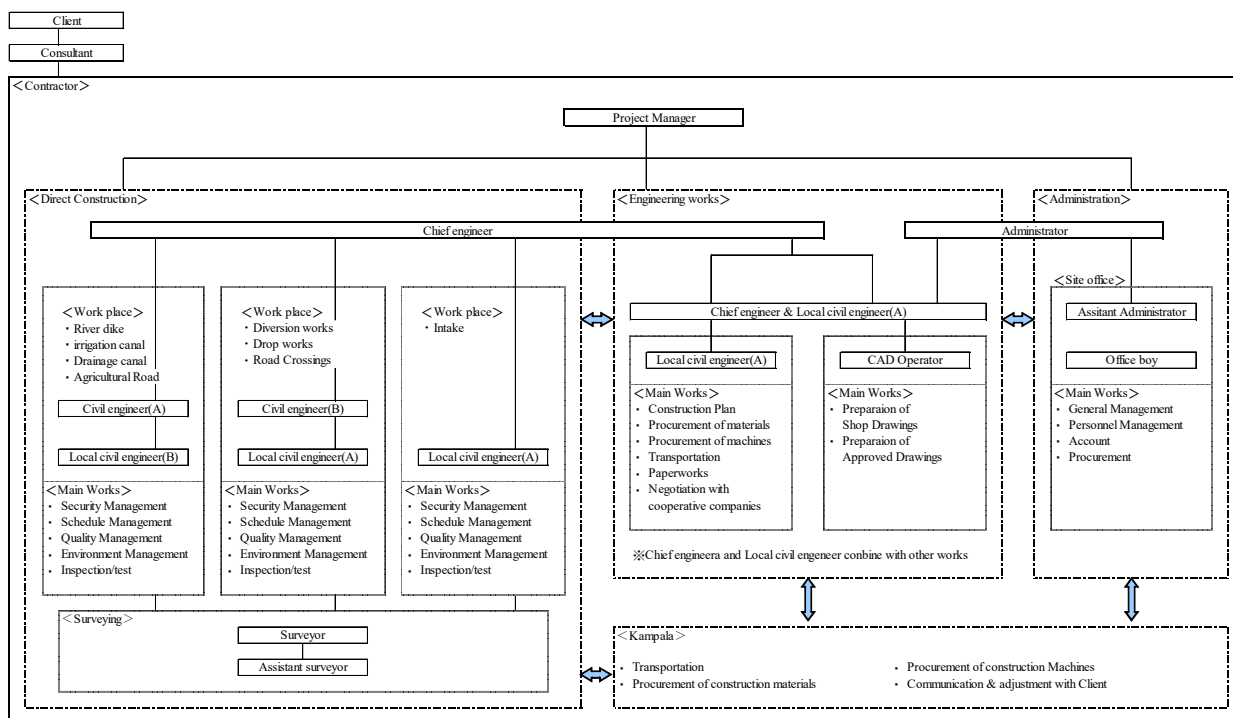
Profession	Period (M/M)	Duty
Chief consultant	1.50	- Inspection at the commencement and completion of the construction, and coordination among related authorities - Support of the resident engineer
Resident engineer	31.00	- Inspection - Advice for construction arrangement, schedule, quality and security to the contractor - Approval of drawings and design change - Provision of advice related to O&M of the facilities
Supervisor (gates)	1.00	- Supervision of the installation of water level regulation gates and intake gates
Inspector	0.27	- Implementation of defect inspection after one (1) year from the completion of construction
Total	33.77	

Source: JICA OD Team

2-2-4-4-2 Construction Management Plan by Contractor

The site office for the contractor is to be built in the Atari area. Five (5) Japanese Supervisor, namely Project manager, Chief engineer, Civil engineer (A), Civil engineer (B) and Administrator manages the construction works assisted by two (2) local civil engineers, local staff and local contractors. Tentative contractor's management structure is shown in Figure 2-2-4-4-1.

Organizational chart of construction office



Source: JICA OD Team

Fig. 2-2-4-4-1. Contractor's Construction Management Structure

2-2-4-5 Quality Control Plan

Form of structures and quality of construction materials are confirmed and recorded to satisfy design requirements such as specifications, structures and functions which designated on the contractor's contract by inspections. Also, countermeasures for delay of construction schedule and problems on the construction shall be discussed in Monthly meeting participated by Ugandan authorities, consultant and contractor and biannual Quality control meeting added by JICA. Items of quality control are tabulated in Table 2-2-4-5-1.

Table 2-2-4-5-1. Contents of Quality Control

Works	Items	Method	Frequency
Leveling of foundation	Soil condition Width and Height Bearing capacity	Visual investigation Measurement of dimensions & height Indentation hardness test	Main part of structures Main part of structures Every main structures
Embankment	Compacted soil	Soil compaction test Site density test	At the start of construction Every soil type Every 500m ³
Concrete	Aggregate (sand, gravel)	Particle size analysis, specific gravity	Every construction term (3 times)
	Cement Concrete casting Concrete strength	Confirmation of quality certification Slump test Compression test	Every construction term (3 times) Every concrete casting Every concrete casting
Steel bar	Strength	Tension test (confirmation of mill sheet)	Every construction term (3 times)
	Arrangement of bars	Bar arrangement inspection	Every concrete casting
Form of structures	Dimension of structures	Measurement of dimensions	Main part of structures
Environment	Soil test	Confirmation of oil contamination, pH, EC	Monthly or so
	Water quality test	Confirmation of pH, EC, DO, TDS, TN, TP	Monthly or so
	Emission gas from construction machines	Measurement of PM10	During machine operation

Works	Items	Method	Frequency
	Noise Observation of river Discharge	Measurement of noise Measurement of discharge	During machine operation Weekly

Source: JICA OD Team

2-2-4-6 Procurement Plan of Construction Materials

2-2-4-6-1 Construction Materials

Construction materials such as earth-fill materials, cement, steel bar, gravel, rock, concrete pipe are available in Uganda. These materials are to be procured from Mbale or Kampala.

Dimension of sluice gates which is planned to procure in this Project varies from (B)300 x (H)300 to (B)2885 x (H)2100. Small-simple gates are made at iron factories in Uganda, however there is no manufacture specialized in gate in Uganda. In the view of securing ability, quality, supply capacity and experience for manufacturing large-scale gates, following gate are planned to procure from Japan.

Table 2-2-4-6-1 shows procurement allocation of main construction materials.

Table 2-2-4-6-1. Procurement Allocation of Main Construction Materials

Classification	Materials	Allocation		Remarks
		Uganda	Japan	
Construction Materials	Wood pile	○		
	Deformed reinforcing bar	○		
	Barbwire	○		
	Cement	○		
	Fine aggregate	○		
	Coarse aggregate	○		
	Water reducing agent	○		
	Earth-fill materials	○		
	Cobble	○		
	Crashed stone	○		
	Timber	○		
	Plywood	○		
	Support	○		
	Gabion	○		
	Scaffolding (steel pipe)	○		
	Diesel	○		
	Gasoline	○		
	Concrete pipe	○		
	Small-size gate	○		(B)300 x (H)300 size sluice gates are procurable in Uganda
	Large-size gate		○	Local procurement is not available.
Water stop		○	Local procurement is not available.	
Expansion joint		○	Local procurement is not available.	
Filter for soil draw-out		○	Local procurement is not available.	
Weep hole		○	Local procurement is not available.	

Source: JICA OD Team

2-2-4-6-2 Construction Machinery

In Uganda, local contractors own construction machinery such as back hoe, bulldozer, dump truck and road roller etc., and lease companies also offer rental machinery. However, procurement of these machinery is difficult in the Atari area, and they are to be provided from Kampala or Mbale.

Main construction machinery is listed in Table 2-2-4-6-2.

Table 2-4-6-2. Procurement Allocation of Main Construction Machinery

Classification	Construction Machinery	Allocation	Remarks
		Uganda	
Construction machinery	Bulldozer(3t)	○	
	Bulldozer (15t)	○	
	Bulldozer(21t)	○	
	Back hoe (0.7m ³)	○	
	Back hoe (0.4m ³)	○	
	Dump truck(10t)	○	Self-propelled transportation
	Truck mount type crane(5t/2.9t)	○	Self-propelled transportation
	Truck(5t)	○	Self-propelled transportation
	Truck crane (25t)	○	Self-propelled transportation
	Vibratory roller (hand guide type 0.8~1.1t)	○	
	Vibratory roller (5t)	○	
	Road roller (10t)	○	
	Pneumatic tire roller (8-20t)	○	
	Generator(10kw)~(20kw)	○	
	Submersible pump (φ150)~(φ200)	○	
	Motor Grader (Blade 3.1m)	○	
	Breaker (Oil pressure 600~800kg)	○	
	Concrete mixer(0.5m ³)	○	
	Tamper (60~80kg)	○	
	Welding machine(Diesel engine 200A)	○	

Source: JICA OD Team

2-2-4-7 Instruction and Training for Facilities Operation and Maintenance

The Project will install spillway gates and water intake gates. In addition, check gates to control water level of canals and turnout gates will be installed at diversions of canals for even water distribution. Techniques for gate operation, repair and maintenance are transferred from the Japanese contractor. On the other hand, gate operation for proper water distribution and flood control will be instructed in soft component activity.

2-2-4-8 Soft Component Plan

2-2-4-8-1 Basic Concept of Soft Component Plan

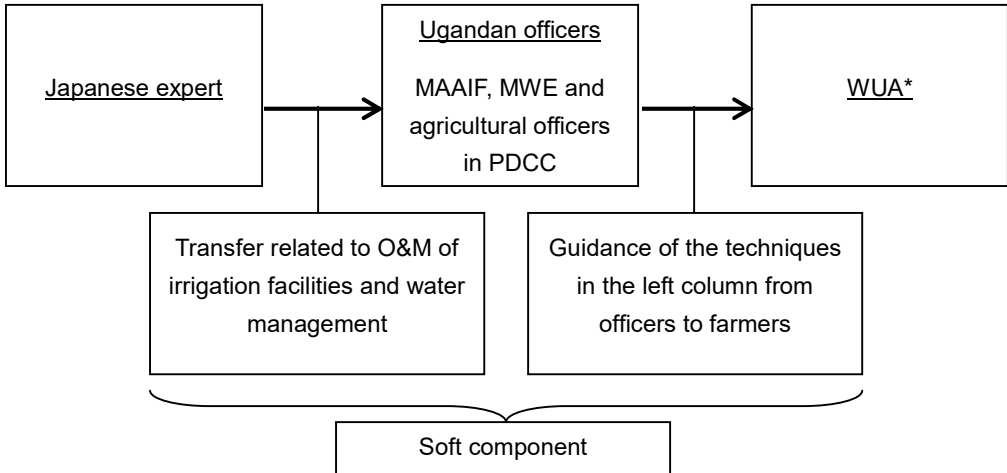
The Project purpose is to increase rice production through construction of the irrigation facilities. Currently, while any institutional activities related to irrigation farming in both Bulambuli and Kween Districts are not observed, facilities management and water management are implemented at individual farmer's level. The farmers of both districts use the same water source, the Atari River, however, they have not discussed water distribution so far. Due to lack of water management rule on the field, the farmers, who cultivate in the downstream of the Project site and/or in the area far from water sources, have faced shortage of irrigation water, and the situation has caused uneven water use among the farmers.

Under the conditions, O & M of irrigation facilities is due to done by WUA in Uganda. MAAIF as the executive agency of the Project, is responsible for supervision of the operation of WUA and technical supports. Currently, however, the administrative procedure for WUA registration and governmental organizations to facilitate O & M are still under development.

Agricultural officers and agricultural extension workers who support famers technically in cooperation

with MAAIF are allocated to the both Bulambuli District and Kween District. In addition, in these districts, PACC which consists of the elected representatives of beneficiary farmers, are established and have cooperated to the Project, since the period of the FS. In the future, PACC is expected to become main body of WUA which responsible for the maintenance of irrigation facilities supported by MAAIF and district agricultural officers. In such a situation, in order to actualize operation of irrigation facilities by PACC and enhance the implementation system of maintenance, capacity development for district agricultural officers, agricultural extension workers, and MAAIF officers in the field of 1) O & M of irrigation facilities, water management techniques, and 2) establishment of farmer's group is necessary in terms of the Project sustainability. Given that only simple irrigation facilities in stalled in the Project area, it has high relevance for the technical transfer of proper O&M including water management method from a Japanese expert to officers.

WUA has been unorganized in the Atari are so far, the target of transfer and guidance from the officers are farmers' organizations in the meantime. Farmers' organizations, here assumed that the organization of representatives of farmers who has concerned the Project since the FS survey. The core members shall be consisted in PDCC.



* The target shall be farmers' organizations which core member is PDCC until WUA in the Atari area is organized.

Fig. 2-2-4-8-1. Flow of Extension related to O&M of irrigation facilities and water management

Proposed activities of soft components are as follows:

Table 2-2-4-8-1. Activities of Soft Component

Component	Target				Activity
	MAAIF	District Agricultural Officers	Farmers group	MWE	
Improvement of O&M techniques	◎	◎	△		(1) Support of irrigation network map preparation
	◎	◎	△		(2) Support of water users list preparation
	◎	◎	△	○	(3) Support of explanation of purpose and meaning of irrigation
	◎	◎	△		(4) Support of preparation of regulation
	○	◎	△	△	(5) Support of presentation of regulation to the farmers
Improvement of water management techniques	○	◎	△		(1) Support of preparation of O&M manual on irrigation facilities
	○	◎	△	△	(2) Support of presentation of the O&M manual to the farmers

Component	Target				Activity
	MAAIF	District Agricultural Officers	Farmers group	MWE	
	◎	◎	△	△	(3) Support of study tour organization to the advanced area (Doho Irrigation Scheme), which targets MAAIF staff, MWE staff, District agricultural officers, board members of the farmers groups and gate keepers (in total 20-30 persons)
	○	◎	○	△	(4) Support of on-site training on O&M of canals, gate operation, tertiary canals, sedimentation ponds and so on
	○	◎	○		(5) Support of on-site training on land reorganization and farm ditch construction
	○				(6) Support of manual modification based on the lessons learned through the on-site training

Note: ◎ : Main target, ○ : Sub-target, △ : Participants

Source: JICA OD Team

One Japanese consultant will be dispatched to Uganda and he/she will work for the soft component activities in collaboration with the Ugandan counterparts. The training will be implemented in local language instead of English, therefore, it is needed to employ one interpreter/facilitator for preparation of O&M manual and for arrangement of training organization.

Table 2-2-4-8-2. Distribution of Personnel for Soft Component

Item	No. of Staff	Remark
Japanese engineer:	1 person	Support for O&M of irrigation facility, water management, and farmers' organization
Ugandan Counterpart:	4 persons	1) MAAIF staff (C/P of the grant aid project) 2) MWR Mbale regional office (irrigation engineer) 3) Bulambuli District office staff (agricultural officer) 4) Kween District office staff (agricultural officer)
Local resource:	1 person	Interpreter/ Facilitator

Source: JICA OD Team

The 1st phase of the soft component activities will be implemented after completion of the construction works of Bulambuli District side, and they will be started with preparation of the irrigation and land use map and the list of the water users in the model area. On-site training and study tour to the advanced area (Doho Irrigation Scheme) in 2nd phase will be organized from 2 months before of completion of whole construction works.

- 1st phase: for 2.14 months from May 2021
- 2nd phase: for 2.60 months from April 2022

2-2-4-8-2 Attention Points of Soft Component

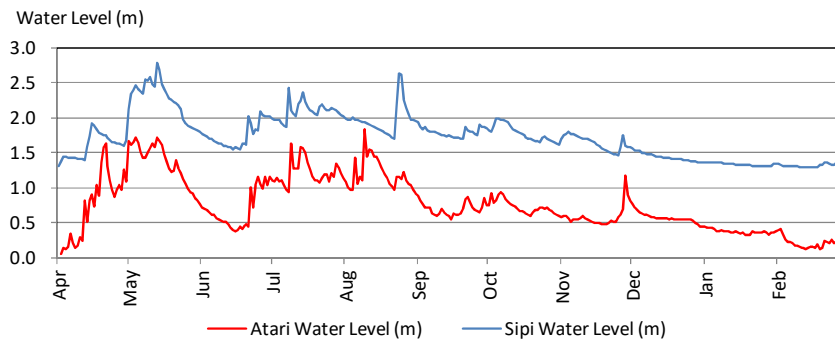
(1) Estimation of the Atari River Discharge

In the 1st term to 2nd term of the FS, discharge of the Atari River was re-estimated. As a result, estimated irrigable area in the 2nd term was decreased to around 70% of that in the 1st term. Since long-term observation of the Atari River discharge has not been implemented, estimated irrigable area can be fluctuated significantly by such change of estimated discharge. Even the OD stage, long-term discharge data to review the estimated irrigable area mentioned above have not been collected. However, it is needed to pay attention to discharge of the Atari River continuously to take flexible measures against fluctuation of the discharge in the future.

The OD examines the irrigable area as reference based on water balance calculation, by using water level of the Atari River which has been measured after the FS completion. In the 2nd term of the FS

(March 2015-August 2015), specific discharge during 15 days ($\text{m}^3/\text{s}/100\text{km}^2$) was estimated to compare correlations of both rivers' discharges based on H-Q curve of the Atari River developed in 2015 ($Q=1.74478(h+0.16419)^2$) and H-Q curve ($Q=1.674(h-0.62)^{2.008}$) of the Sipi River in the same period above. ($y=1.0137x-0.1466$ ($R^2=0.846$)). y: specific discharge of the Atari River, x: specific discharge of the Sipi River).

As well as the FS, the OD re-examines the correlation between discharge of the Sipi River and that of the Atari River (for 15 days) based on the latest water level data of those rivers by using a water level measurement equipment (April 2016 - February 2017, for 9 months).



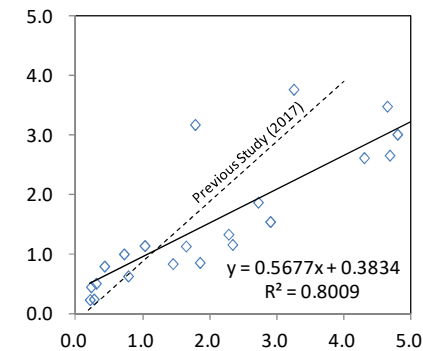
Source: FS Report

Fig. 2-2-4-8-2. Water Level Changes of the Atari River and the Sipi River (April 2016 – February 2017)

In the FS, H-Q curve developed by MWE was applied for the calculation of the Sipi River discharge ($Q=1.674(h-0.62)^{2.008}$). In the calculation, the basic year for water balance calculation was set as 2004 by MWE to avoid influence by sedimentation due to the flood in 2006. In the OD, however, H-Q curve of the Sipi River ($Q=4.2092(h-1.0839)^2$) developed by the JICA FS Team, is applied for correlation estimation, to identify trend of measured discharge of the Sipi River and the Atari River.

Correlation formulas of results gained by the FS and the OD are illustrated in the table below. Correlation factor (R) between the Sipi River discharge and the Atari River discharge in the FS was 0.92, while that in the OD was 0.89, and both results show high correlation. Given that high correlation between both rivers is confirmed as it was done in the FS, the calculation measure for river discharge of the Atari River by using that of the Sipi River is deemed as reasonable. However, when the formula is applied for estimation of river discharge in irrigation period, namely, May-December, the calculated one was smaller than that in the FS.

Atari River Specific Discharge
($\text{m}^3/\text{sec}/100\text{km}^2$)



Sipi River Specific Discharge ($\text{m}^3/\text{sec}/100\text{km}^2$)

Source: JICA OD Team

Fig. 2-2-4-8-3. Comparison of Specific Discharges (average for 15 days)

Table 2-2-4-8-3. Relation of Specific Discharge of the Atari River and the Sipi River

Item	Conversion Formula
F/S (2017): March 2015-August 2015	$y=1.0137x-0.1466$ ($R^2=0.846$) $R=0.92$
Collected data by the OD: April 2016-February 2017	$y=0.5677x+0.3834$ ($R^2=0.8009$) $R=0.89$

y: Specific discharge of Atari Rive, x: Specific discharge of Sipi

Source: JICA OD Team

(2) Evaluation of Irrigable Area based on Water Balance Calculation

In the OD, comparison is done by using only short-term water level data, and sufficient data to re-evaluate the estimated result, which was calculated by the FS, has not been obtained. Therefore, irrigable area, 680ha in net, which was determined in the FS, is applied for the OD. In this time, the irrigable area is calculated as a preliminary examination based on the estimated river discharge considering fluctuation of the irrigable area in the future. Consequently, it will be possible to collect further discharge data during the DD and to prepare a cropping plan and water distribution plan, which can be responded flexibly to change of river discharge after the Project completion.

a) Basic Conditions

Based on the cropping plan, water balance targeting the design year of 2004, which was determined in the FS, is calculated. Coefficients applied for the water balance calculation are shown in the table below. Since the percolation capacity applied in the FS is too small to be applied for the water balance estimation compared to values adopted for cases in other countries. Therefore, under the same condition for estimation as mentioned before, new percolation capacity is applied for irrigable area estimation.

Table 2-2-4-8-4. Basic Conditions for Water Balance Calculation

Specifications	Applied Values	
	FS*	OD (preliminary examination)
Crop coefficient (Kc)	Rice : ·Kc ini =1.05, Kc mid = 1.20, Kc end = 0.90 Maize: ·Kc ini =0.30, Kc mid = 1.20, Kc end = 0.35	same as in the left
Growing period (day)	Rice ·Initial stage (20) ·Crop development stage (30) ·Mid-season stage (40) ·Late season stage (30)	Maize ·Initial stage (20) ·Crop development stage (35) ·Mid-season stage (40) ·Late season stage (30)
Daily crop evapotranspiration (ET ₀)	Average values at Tororo meteorological station	same as in the left
Percolation capacity	1.0mm (Paddy field)	4.0mm (Paddy field)
Water requirement for preparation of paddy field	Land preparation period: 15 days Water requirement for preparation of paddy field:150mm	same as in the left
Effective rainfall	Less than 5mm: 0mm 5mm~less than 80mm: R×80% 80mm and more: 64mm	same as in the left
Irrigation efficiency	60%	same as in the left
Other required water	Water required for domestic use(1,760,000 lit/day)=0.020m ³ /s Water required for livestock(86,000 lit/day)=0.001m ³ /s Environmental maintenance flow (0.166m ³ /s/100km ²)×103km ² =0.171m ³ /s	same as in the left
Discharge of the Atari River	y=1.0137x-0.1466 (y: specific discharge of the Atari River, x: specific discharge of the Sipi River)	y=0.5677x+0.3834 (x and y are same as in the left)

Source: Revised "FS Report"

b) Irrigable area (estimation result)

Irrigable areas estimated by the FS and the OD are compared as illustrated in the table below. According to the table, initial irrigable area for rice (680ha) estimated in the OD is smaller by 20% than that in the FS in the first season, as a result of modification of discharge and partial basic conditions. However, as mentioned before, the OD compares them by using only short-term measured data, and sufficient data to evaluate the estimated result in the FS in detail has not been gained. Therefore, the result is presented just as reference.

Table 2-2-4-8-5. Estimated Irrigable Area in the OD

	First Season		Second Season	
	Paddy	Maize	Paddy	Maize
FS	680ha	-	680ha	-
OD (preliminary examination)	550ha	130ha	680ha	-

Source: JICA OD Team

(3) Attention Points of Water Management

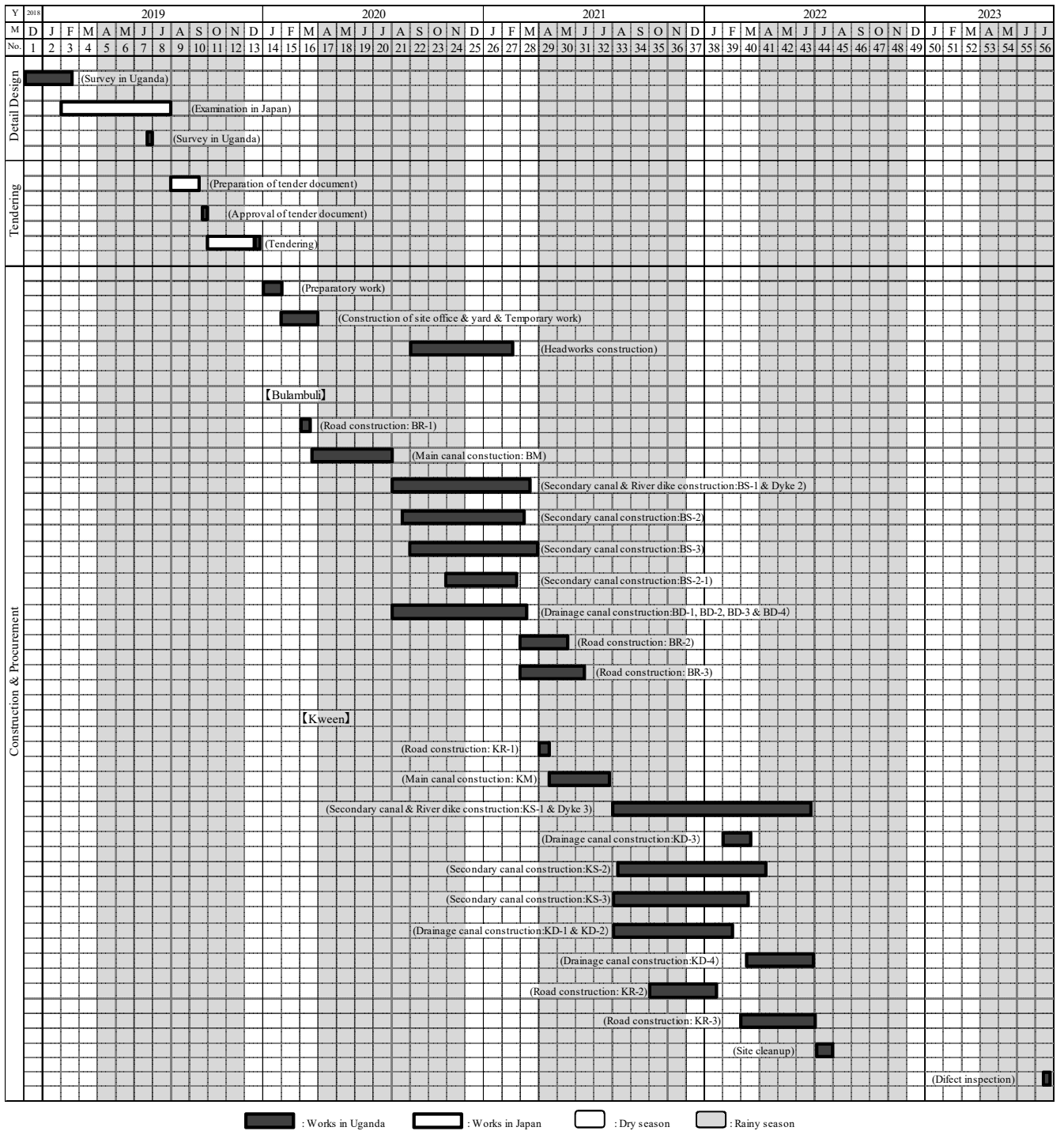
Based on the examination above, some attention points for water management can be raised, they are; flexible cropping plan preparation according to river discharge conditions, and O&M activities for effective irrigation water utilization. Therefore, capacity development of the parties concerned in terms of O&M and water management are to be boosted up through the soft component activities, so that proper cropping plan preparation and smooth O&M of the irrigation facilities would be practiced.

2-2-4-9 Implementation Plan

Annual rainfall in the Project area reaches over 1,000mm and there is clear differentiation between the rainy season, from April to November and the dry season, from December to March. Construction works are mainly implemented in dry season, however, they are done in rainy season also, even though the working efficiency is decreased. It means that construction works are continuously practiced throughout the year.

Construction schedule of Japanese Grant Aid project is shown in Table 2-2-4-9-1.

Table 2-2-4-9-1. Implementation Schedule



Source: JICA OD Team

2-3 Obligation of Recipient Country

The Project will be implemented as the Japanese Grant Aid Project, and GoU has a responsibility of some works of the Project for sustainable irrigation farming in each stage, namely, DD, preparation stage for commencement of the construction, construction period and after completion of construction works. The obligations of GoU are listed as follows:

2-3-1 Obligations of Construction/Procurement

- 1) Payment of the necessary commission to the bank based on the bank arrangement (B/A), and also Issuance of Authorization to Pay (A/P);
- 2) Prompt procedures such as customs clearance for materials and equipment necessary for the Project;
- 3) Burden and/or treatment for any expenses which are not accounted as the Japanese Grant Aid such as tariff and tax which are imposed in Uganda;
- 4) Provision of necessary convenience for entering Uganda and staying there for the authorized Japanese concerned who provide services for the Project in order to carry out their works smoothly;
- 5) Execution of O&M of the irrigation facilities properly and effectively, and also report of the operation status of the irrigation facilities to Japanese side according to its request;
- 6) Execution of obligations stipulated in "2-2-4-3 Scope of Works";
- 7) Provision of necessary information/data for the Japanese consultant which will conduct the DD, after the implementation of the Project is agreed by GoJ;
- 8) Application and obtaining all necessary permits for the construction works of the Project;
- 9) Application and obtaining water rights related to the Project;
- 10) Logging or transplanting of trees in the construction sites of the Project site;
- 11) Ensuring necessary lands as stockyard of materials and equipment for the Project;
- 12) Installation of electric power lines into the construction office;
- 13) Announcement of existing roads utilization for the Project construction works to the local residents to avoid/minimize probable traffic accidents;
- 14) Ensuring smooth traffic for construction vehicles on the national road, namely, Mbale - Moroto line including repair of the broken bridge;
- 15) Announcement of suspension of irrigation water supply and cultivation during construction works to the related farmers through explanation meeting, and obtaining their understanding; and,
- 16) Construction of drainages in the downstream of Bulambuli District, namely, outside of the Project site, by coordinating with the stakeholders, and connection of those drainages to the newly constructed drainages to be covered by Japan.

2-3-2 Obligations of Environmental and Social Considerations

- 1) Provision of compensation and livelihood support for the affected persons due to the land acquisition and resettlement by the Project prior to the construction works in accordance with the RAP to be approved by the Chief Government Valuer in June, 2018, and provision of those lands for the construction works free of charge;
- 2) Securement of budget to fulfill the conditions indicated in “Certificate of Approval of Environmental Impact Assessment (Certificate No. NEMA/EIA/10475)” dated on 2nd August, 2017;
- 3) Preparation of the environmental checklist and environmental and social monitoring form; and,
- 4) Implementation of the environmental and social monitoring during operation, and periodical report of the monitoring results to JICA.

2-3-3 Obligations of Soft Component Plan

- 1) Assignment of each one counterpart from MAAIF, Mbale office of MWE, local government officials of both Bulambuli and Kween districts (Agronomists), namely, 4 personnel in total;
- 2) Arrangement of the counterpart officials for their smooth participation in the soft component activities, and organization of the training/workshop through adjustment of schedule, participants, implementation procedure, and so on;
- 3) Regular maintenance of irrigation facilities such as dredging and weeding based on the O&M manual;
- 4) Monitoring of progress of O&M and water management;
- 5) Support of establishment and operation of WUA; and
- 5) Burden of the cost for implementation of the soft component activities.

2-3-4 Obligations of Model Sites Activities on Land Re-organization

- 1) Necessary measures for appropriate production activities by using Quality Declared Seed (QDS) in the model sites are taken, for instance, provision of Basic Seed (planned to procure from NaCRRRI) and farming inputs to the farmers, and purchasing QDS to be harvested from the model sites and their expansion to the entire project site, organization of training targeting the beneficiary farmers, and dissemination of knowledge and technology of the rice cultivation, and
- 2) Technical support of the model farmers for the land re-demarcation to divide model site into the small plots (model plots) after the establishment of the model sites (large section) by Japan, and construction of farm ditch and field ridge in the model plots.

2-3-5 Tax Treatment

This project is implemented by Japanese Grant Aid and the fund is contributed by taxpayers in Japan, therefore tax treatment for any duties and taxes related to the project shall be considered.

(1) Custom Duties and Taxes

Taxes and fiscal levies on import and/or re-export of materials and equipment for exclusive use on the Japanese Grant Aid Project are exempted from import duty under the East African Community Customs Management Act 2004.

(2) Value Added Tax (VAT)

Based on the VAT Act, VAT shall be deemed to have been paid if the supply is for use solely and exclusively for the Japanese Grant Aid Project. However, in case a supplier charges VAT to any products and/or any services which are for use solely and exclusively for the Japanese Grant Aid Project, URA shall refund the VAT to the contractors and sub-contractors assigned under the Japanese Grant Aid Project.

(3) Pay as You Earn, Corporate Tax and Withholding Tax

a) Provision of Pay as You Earn (PAYE), Corporate Tax and Withholding Tax

PAYE, Corporate Tax and Withholding Tax will be borne by the designated project executing agency without using Japanese grants. The benefits of the treatment shall only apply to (i) main contractors and sub-contractors that are Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons (herein referred to as “Japanese main contractors and Japanese sub-contractors”) and to (ii) their employees who are not citizens of Uganda.

b) The procedure for payment of PAYE

Japanese main contractors and Japanese sub-contractors shall file PAYE returns with URA and submit a copy of the returns to the executing agency notifying them to pay the taxes.

c) The procedure for Corporate Tax / Withholding Tax

The procedure and tax treatment of Japanese main contractors and Japanese sub-contractors for Japanese Grant Aid Project who are tax resident in Uganda shall file returns with URA and submit a copy of the returns to the Executing Agency notifying them to pay the taxes.

Therefore withholding tax is due in Uganda, the Executing Agency shall pay tax due of Japanese main contractors and Japanese sub-contractors for Japanese Grant Aid Project who are not tax resident in Uganda to URA.

2-4 Project Operation Plan

2-4-1 Implementation Structure for O&M

2-4-1-1 Organizations Responsible for O&M

The irrigation facilities to be constructed by the Project are intake facilities (headworks), main canals, secondary canals, tertiary canals, drainages, O&M roads, river dykes, and de-silting basins installed with the intake incidentally. Concerning O&M of the facilities, it is officially stipulated in Uganda that planning and technical supports are shouldered by MAAIF and MWE, while on-farm level O&M is covered by WUA under the supervision of MAAIF. However, both administrative procedures for WUA establishment and O&M instruction system by the government are still under development. Therefore, technical support for O&M of the facilities and water management will be provided to the farmers' organization by the district governments and the central government.

Especially, agricultural officers of PDCC in Bulambuli District and Kween District and officers in MAAIF and MWE, who have been involved in the Project in the Atari since the FS, will provide PACC consisting of representative of the farmers with technical guidance and support concerning O&M and water management.

Since WUA has unorganized in the Atari area, the target of the technical support shall be farmers' organization which core member is consisted of PACC, involved in the irrigation scheme since FS.

The relationship between central level and district level governments, and institutional structure of PDCC and PACC are described as follows;

2-4-1-2 Relationship between District Governments and Central Government

For smooth project implementation, technical staff, who have connection channel to the ministries concerned, are assigned to each district office. In case of MAAIF, under the Chief Administrative Officer (CAO, governor of district), there is Production Department, which has 7 technical staff dispatched form the main office of MAAIF. At this moment, MAAIF hires technical staff including "Senior Agricultural Engineer (SAE)" as shown in the table below and organizes two-week training in Kampala prior to the dispatch to each district. As of January 2018, around 40 personnel have been newly employed. Moreover, in other ministries such as MWE, technical staff is assigned under the CAO directly.

Table 2-4-1-1. Technical Staff of Bulambuli District Office

Composition Member	No. of Staff	Remarks
District Production Officer (DPO)	1	
District Agricultural Officer (DAO)	1	
Senior Agricultural Engineer (SAE)	1	Under recruitment
District Veterinary Officer	1	
District fisheries Officer	1	
Entomology Officer	1	
Commercial Officer	1	

Source: JICA OD Team

2-4-1-3 PDCC (Project District Coordination Committee)

PDCC has been established for smooth and successful project implementation in each district in 2015, namely, in the FS stage, and the constituent personnel have sufficient technical and professional knowledge of the Project. They belong to the main office of ministries such as MAAIF and MWE officially, however, their current working places and salary payers are the district offices. PDCC of the Project consists of experts of agriculture, irrigation, environment, land, gender and so on.

Table 2-4-1-2. PDCC Constituent Members of Bulambuli District

Post	Category of Personnel	Ministries Concerned	No. of Staff
Chairperson	District Agricultural Officer (DAO)	MAAIF	1
Secretary	Community Development Officer (CDO)	Ministry of Gender, Labour and Social Development	1
Member	District (Engineer) Water Officer (DWO)	MWE	1
	District Natural Resources (DNR)	MWE	1
	District Planner (DP)	Ministry of Finance, Planning & Economic Development	1
	District Land Officer (DLO)	Ministry of Lands, Housing and Urban Development	1
	District Police Commander (DPC)	Ministry of Defense and Veteran Affairs	1
Total			7

Source: JICA OD Team

Table 2-4-1-3. PDCC Constituent Members of Kween District

Post	Category of Personnel	Ministries Concerned	No. of Staff
Chairperson	District (Engineer) Water Officer (DWO)	MWE	1
Secretary	Community Development Officer (CDO)	Ministry of Gender, Labour and Social Development	1
Member	District Production Officer (DPO)	MAAIF	1
	District Agricultural Officer (DAO)	MAAIF	1
	District Natural Resources (DNR)	MWE	1
	District Planner (DP)	Ministry of Finance, Planning & Economic Development	1
	District Land Officer (DLO)	Ministry of Lands, Housing and Urban Development	1
Total			7

Source: JICA OD Team

2-4-1-4 PACC (Project Area Coordination Committee)

PACC, playing as a role of liaison among the target farmers, MAAIF, MWE and the JICA FS Team, was established for smooth project implementation in each district during the FS period. It represents the beneficial farmers and consists of 22 members who have been selected by voting. Main activities of PACC are collection of opinions or requests from the beneficiaries and information sharing among the members about the activities of JICA OD Team.

During the FS period, PACC organized a monthly meeting by itself, and its institutional activities had been implemented for the Project promotion. The agenda of meeting were questions or concerns toward the FS raised by the beneficiaries, activities of the FS, notice of schedule and so on. Bulambuli District and Kween District have 22 PACC members, respectively, even now, 44 members in total in those districts.

Table 2-4-1-4. PACC Members of Both Districts

Position	Bulambuli District	Kween District
Chairperson	1	1
Secretary	1	1
Publicity	1	1
Members	19	19
Total	22	22

Source: JICA OD Team

2-4-1-5 Implementation Structure for O&M

As forth described , WUA has yet been established in the target area till this moment, therefore, O&M of irrigation facilities will be shouldered by the farmers' organization, namely, PACC, until WUA

establishment. PACC has had experiences and abilities to coordinate among the farmers since the FS, therefore, it will be in charge of O&M of the irrigation facilities. Under PACC, gate operators who manage the intake gate and main canal will be assigned. In addition, block leaders who handle water distribution will be assigned in the upstream and the downstream of the secondary canal, respectively, for even water distribution.

Since PACC consists of only farmers, agricultural officers of PDCC, who belong to the district offices, provide the farmers with technical support. The soft component will promote capacity development of the engineers of MAAIF/MWE and the district offices related to O&M and water management, then they will organize technical training for PACC and gate operators consisting of farmers.

Such on-site O&M activities and results are to be reported to MAAIF and MWE Mbale regional office regularly, and necessary advices or instructions for solution of any issues identified at the site will be given.

Even after WUA is established under the support of MAAIF in the near future, it would take at least 10 years until O&M can be done by the WUA consisting of farmers independently. Therefore, the governmental offices concerned, as a responsible organization, should be involved in daily management of irrigation facilities at initial stage of operation.

Table 2-4-1-5. PACC Members of Both Districts

Facilities		Daily O&M	Responsible Organization for O&M (large-scale maintenance)
Intake (Headworks)		Each district office * (WUA (farmers' organization))	MAAIF, MWE Mbale Regional Office
Canal	Main canal	Each district office * (WUA (farmers' organization))	MAAIF
	Diversion st. (diversion to secondary canal) └─ Check gate └─ Turnout gate	Each district office * (WUA (farmers' organization))	MAAIF
	Secondary canal	WUA (farmers' organization)	Each district office
	Diversion st. (diversion to tertiary canal) └─ Check gate └─ Turnout gate	WUA (farmers' organization)	Each district office
	Tertiary canal	WUA (farmers' organization)	WUA (farmers' organization)
	Division box (diversion to farm ditch) └─ Check gate └─ Turnout gate	WUA (farmers' organization)	WUA (farmers' organization)
	Farm ditch	WUA (farmers' organization)	WUA (farmers' organization)
Drainage		WUA (farmers' organization)	Each district office
O&M road		WUA (farmers' organization)	Each district office
River dyke		WUA (farmers' organization)	Each district office
Sedimentation pond		WUA (farmers' organization)	Each district office

Note: Each district office requests daily O&M to the WUA (farmers' organization).

Source: JICA OD Team

2-4-2 O&M Plan

O&M plan consists of activities to be shouldered by MAAIF/ district governments and WUA (farmers' organization), respectively. Former' ones are 1) training of the facility operation and instruction for even water distribution targeting WUA done by MAAIF/ district governments, and 2) monitoring of WUA's activities after such technology transfer. Latter's activities are 1) O&M of gates in the secondary and tertiary canals, 2) dredging and weeding of canals and the de-silting basin, 3) repair of the irrigation facilities and so on.

Table 2-4-2-1. O&M Plan

Activities	Contents	Responsible Organization
Support of WUA (farmers' organization) operation	<ul style="list-style-type: none"> ♦ MAAIF and district office personnel support and strengthen the farmers' organization. 	<ul style="list-style-type: none"> ♦ MAAIF ♦ MWE Mbale Regional office ♦ Each district office
Water management, gate operation and monitoring	<ul style="list-style-type: none"> ♦ MAAIF and district office personnel implement training and monitoring for the facilities O&M. ♦ Soft component targeting MAAIF and district office personnel will be done for their capacity development. ♦ Period of the soft component implementation is set at 10 years after the start of operation 	<ul style="list-style-type: none"> ♦ MAAIF ♦ Each district office
Water diversion at the water intake (headworks), main canals, secondary canals, tertiary canals	<ul style="list-style-type: none"> ♦ 4 gate operators handle the headworks, while 12 block leaders operate the turnout gates. ♦ Assignment of new sub-leader for tertiary canal gate operation is to be considered depending on the size of irrigation area. 	<ul style="list-style-type: none"> ♦ WUA (farmers' organization) ♦ Each district office
Maintenance of gates	<ul style="list-style-type: none"> ♦ Oil filing: lubrication to the gate hoist once per year ♦ Painting: re-painting of gates is done every 5 years ♦ Sealing gum: sealing gum of gates is to be replaced every 10 years. 	<ul style="list-style-type: none"> ♦ MAAIF ♦ Each district office
Maintenance of the de-silting basin	<ul style="list-style-type: none"> ♦ Dredging of sedimentation pond, which is established together with the water intake facilities ♦ Dredging frequency is once per 6 months 	<ul style="list-style-type: none"> ♦ WUA (farmers' organization) ♦ Each district office
Repair of facilities including drainage, O&M roads, protection dyke	<ul style="list-style-type: none"> ♦ Regular inspection by WUA (farmers' organization) ♦ under the support of MAAIF and District office every 6 months ♦ Repair of the facilities according to necessity (minor repair) 	<ul style="list-style-type: none"> ♦ WUA (farmers' organization) ♦ Each district office
Maintenance of the canal, drain, and related facilities	<ul style="list-style-type: none"> ♦ Dredging and weeding of canal, drain, and related infrastructures every half year 	<ul style="list-style-type: none"> ♦ WUA (farmers' organization) ♦
Others	<ul style="list-style-type: none"> ♦ Environmental monitoring ♦ Handling of complaints from the water users or residents ♦ Coordination among the stakeholders 	<ul style="list-style-type: none"> ♦ WUA (farmers' organization) ♦ Each district office

Source: JICA OD Team

2-4-3 Project Target on Management and O&M Structure

The Project mainly aims at the construction of fundamental irrigation facilities and plans the technical support to the related agency through the necessary activity of soft components for the appropriate and sustainable O&M on the facilities. The activity of soft components is targeted at the improvement of the O&M of the facilities and the enhancement of water management to the district officer (PDCC) working at front-line for WUA support, and MAAIF and MWE, since there has not been organized group to use cooperatively the facilities in the Project site.

In addition, PDCC as the primal actor transfers O&M knowledge to WUA together with supporting WUA for the organizational activity and the appropriate water management in order to adequately satisfy entire farmland with water. As mentioned above, WUA has not been organized for now but PACC structured by farmer will expect to be the target of transferee for the time being.

The necessary engineers who properly are able to make the O&M of middle and large irrigation scheme are not almost seen as well as adequate capability, therefore, it is currently important for Uganda to enhance O&M and organization by means of putting WUA at the core.

Accordingly the proper expert who has widely professional knowledges on target field and adequate

experiences in the overseas is imperative for the soft components to realize the effective irrigation facilities constructed in the Project and to develop the deliberated and sustainable irrigation and farming activity. Furthermore, technical supports for the proper O&M, the water management and the enhancement of organization should be trained under the expert as well.

Inhere, based on the acknowledgment of the target range of grant aid project together with clarifying the issue of maintenance of irrigation facilities, farming technics and farmers' activities on organization, the points and the goals of activities after the Project are shown as follows;

Table 2-4-3-1. Issue of Organization of O&M, Ppurpose and Target Range of the Project

Scopes	Issues	Purposes	Target range of the soft components
Organization	<ul style="list-style-type: none"> ■ Unorganized the procedure for WUA registration in the law ■ Inadequate officer in MAAIF who is able to train the irrigation engineer, and unclear demarcation of water management between MAAIF and MWE ■ To clearly identify the role of PDCC, which is organized for smooth implementation, about O&M after the construction ■ Unclear definition of PACC, which consists of representative of farmers, role in terms of O&M and cooperative activity of farming but the communication between farmers is main role 	<ul style="list-style-type: none"> ■ MAAIF, MWE : To develop irrigation and agricultural engineer and properly be trainable in each project ■ PDCC: To be capable of instruction on agriculture and irrigation to WUA and farmers ■ PACC : To be basic organization for WUA registered as the officially permitted and able to work in terms of organizational irrigation and agriculture. To be capable of collection of water fee for maintenance on irrigation facilities (these activities transfers to WUA after establishment of WUA) 	<ul style="list-style-type: none"> ■ PDCC, MAAIF, MWE: To enhance the capacity of O&M and management on irrigation facilities in the Project. ■ PACC: To be participated by farmers from PACC in training program of capacity for PDCC, MAAIF, MWE
Technical matters	<ul style="list-style-type: none"> ■ PDCC, MAAIF, MWE : Less knowledge on irrigation and site experience of officers ■ PACC : Less knowledge on irrigation and agriculture. Farmers do not have the idea for cooperative operation of irrigation facilities and result in difficulty of intentional water distribution site experience of officers 	<ul style="list-style-type: none"> ■ MAAIF, MWE : To be able to take measure for maintenance with operating facilities and share knowledge on irrigation technics each other as required ■ PDCC : To have basic knowledge of agriculture and irrigation, and be capable of instruction and monitoring for O&M on key facilities such as headworks and main canals. To be able to repair the damage classified the difficulty for WUA. (PDCC possessed maintenance machines) ■ PACC : To have basic knowledge of agriculture and irrigation, and be capable of formulating irrigation plan based on agriculture plan. To be able to work irrigation agricultural activity based on the formulated rule (After establishment of WUA, these works are 	<ul style="list-style-type: none"> ■ PDCC, MAAIF, MWE : To acquire management and O&M knowledge including monitoring on Atari irrigation facilities. To acquire plan and O&M of farm dich in land re-organization. To make O&M manual and explain to WUA. ■ PACC : To be participated by farmers from PACC in above activities.

Scopes	Issues	Purposes	Target range of the soft components
Machine for maintenance works	<ul style="list-style-type: none"> ■ PDCC, MAAIF, MWE : Lack of necessary machines for maintenance works and agricultural activities ■ Lack of knowledge for O&M regardless of possession of necessary machines 	<p>transferred to WUA)</p> <ul style="list-style-type: none"> ■ PDCC, MAAIF, WME possess machines for maintenance and lend them as required. ■ PACC : To be decided necessary machine depending on damage class and purpose for maintenance menu. (After establishment of WUA, these works are transferred to WUA) 	<ul style="list-style-type: none"> ■ Out of target at soft components.
Budgetary circumstance	<ul style="list-style-type: none"> ■ MAAIF : Budget of agricultural sector account for 20%, approx. 1.3 M US\$ (based on Government approved) in entire budget for a few years. Fund to agricultural sector from the other donors trend to increase, but actual spending stood at only half. Budget by donor fund is fluctuated. ■ PDCC : Budget of agricultural sector from local government subsidy accounts for 2% and ordinary expense share 90% of that one. In other words, budget of development is relatively smaller than other expenses. ■ PACC : WUA is not established to collect water fee and other fee. 	<ul style="list-style-type: none"> ■ MAAIF : To be able to acknowledge and request necessary budget for irrigation development ■ ■ PDCC : ditto ■ PACC : To be able to properly manage group of irrigation water abided by collection of water fee and rule. (After establishment of WUA, these works are transferred to WUA) 	<ul style="list-style-type: none"> ■ Out of target at soft components.

Source : JICA OD Team

2-5 Project Cost Estimation

2-5-1 Approximate Cost of Target Cooperative Project

Based on the regulation stipulated on JICA Guideline in April 2015, the Project cost of entirety and Japanese side should be confidential. Inhere, the Project cost of Ugandan side is shown as follows;

2-5-1-1 Approximate Project Cost of Ugandan Side

Approximate project cost to be borne by GoU is 30.116 billion UGX (937 million yen) and its breakdown is shown in Table 2-5-1-1

Table 2-5-1-1. Approximate Project Cost on Ugandan Side

Items	Amount (UGX) Under estimation	Amount (Million Yen)	Remark
To secure the necessary budget and implement land acquisition and compensation with full replacement cost in accordance with the RAP	1,384,072,000	43.04	
Tax	6,367,000,000	198.0	Tax treatment
Bank commission related to Bank Arrangement(BA) and Authorization to Pays(AP)	90,000,000	2.8	
Commission for construction permission	500,000	0.02	
Commission for application of water right	450,000	0.01	
Construction cost of connecting electric wire to site office	36,000,000	1.1	
Construction cost of drainage canals at the downstream side of the Project area in Bulambuli	143,000,000	4.4	
Countermeasure cost of conditions mentioned in EIA Certificate	332,000,000	10.0	
Environmental monitoring cost after completion of the construction	88,628,000	0.27	
Cost for arrangement of counterparts for the soft component activity (4 staff)	85,000,000	0.26	
To commence procurement of the land re-organization for the remaining project area (except the Model Sites)	11,276,527	350.70	
To commence procurement of the machinery for construction and agriculture	6,845,493	212.89	
To commence procurement of the value chain facilities	3,467,492	107.84	
Total	7,905,078,000	240.56	

Source: JICA OD Team

2-5-1-2 Conditions of Cost Estimation

- 1) Timing of the cost estimation: September, 2017 (the end month of field survey)
- 2) Foreign currency exchange rate: 1 US\$ = 112.05 yen
1UGX = 0.0311yen
- 3) Period of construction/ procurement: 31 months (see Section 2-2-4-9)
- 4) Others: The cost estimation is made in accordance with the system of Grant Aid Cooperation of Japan Government

2-5-2 Cost of Management and O&M

Based on “2-4-2 O&M Plan”, calculated annual O&M cost is tabulated below.

Table 2-5-2-1. Breakdown of Annual O&M Cost

Items		Amount (UGX)	Remarks
1)Personnel	Board members of farmers' organization	27,000,000	
2)Maintenance cost	Dredging of de-silting basins	14,636,000	
	Reshaping irregularities/weeding of irrigation canal (main canal, secondary canal)	13,776,000	
	Ditto (tertiary canal)	6821,000	
	Reshaping irregularities/weeding of drainage canal	2,1042,000	
	Repair works of road	4,799,000	
	Repair works of river bank	18,095,000	
	Maintenance of gates (minor repair)	3,216,000	
	Maintenance of gates (replacement of large-scale parts)	2,389,000	
	2)subtotal	84,774,000	
Total 1)+2)		111,774,000	
Total amount per ha		165,000	UGX/ha/year

Source: JICA OD Team

Table 2-5-2-2. Collected Amount of Water Charge

Items	Unit price	Unit	Amount	Remarks
1) Collected amount per ha		Kg/ha/cropping	75	150 kg/year
2) Area for collection		ha	570	
3) Collected amount (based on unhulled rice)		Kg/cropping	42,750	
4) Collected amount (based on milled rice)		Kg/cropping	25,650	Yield rate 60%
5) Selling price of milled rice	2,500	UGX/kg	—	From Interview survey
6) Sales total of milled rice (Collected amount of water charge)		UGX	64,125,000	=4) x 5)
7) Collected amount of water charge per ha per cropping		UGX/ha/cropping	112,500	=6) / 2)
8) Annual collected amount per ha		UGX/ha/year	225,000	=7) x 2

Source: JICA OD Team

O&M cost consists of two items, one is a personnel of board members of farmers' organization and gate keepers, the other is maintenance cost such as dredging of de-silting basins and repair of canal, road and gates. To bear the cost by farmers' organization themselves, total 112 million UGX of water charge shall be collected yearly. Considering planning irrigation area, necessary amount of water charge based on unhulled rice is 150kg/ha/year (75kg/ha/cropping).

Meanwhile, the farmers have no experiences of systematic irrigation farming and have no common understanding of pay-for-use of irrigation water. For conventionalizing of pay-for-use system, it is necessary that implementation of long-term operation/ water management of irrigation facilities, based on timely, adequate and fair water distribution. At this point, technical supports of project management and O&M of irrigation facilities by MAAIF and districts are indispensable, accordingly, successive arrangement of technical staffs and budget allocation for implementation of above activities.

Doho irrigation scheme operated in vicinity of the Project area provides appropriate operation of irrigation scheme and O&M of facilities based on highly collection rate of water charge. In this project, site visit to Doho irrigation scheme is planned in the training program of soft component activities. Acquiring knowledge and experience of operation method of irrigation scheme in Doho including the collection of water charge, proper operation of the Project is expected.

CHAPTER 3 Project Evaluation

3-1 Preconditions

(1) Permission of construction for the Project (Provision of compensation and livelihood support)

The Project components are mainly intake facilities (headworks), canals, drainage canals, the O&M road, river dyke and related facilities. Model Site, in addition to that, is constructed as land re-organization works, which is respectively planned 6ha in Bulambuli and Kween, i.e., 12ha in total. MAAIF has to complete the land acquisition (compensation and livelihood support) based on the RAP prior to commencement of the construction, since any construction yard planned are located in the private land

(2) Obtain necessary permission for construction works

Any kind of permission concerning the construction works have to be applied to the related agency and completed prior to the commencement of construction works. Specifically, construction permit, water permit and the others are applied to MWE, and Road Connection Permit issued by Uganda National Road Authority (hereinafter referred to as "UNRA") are required in the Project.

(3) Performance on terms for ESIA concurrence

The EIA report submitted to NEMA in February 2017 was certified with the approval issued on 2nd August in 2017. MAAIF, however, shall take appropriate measures for the 59 comments from NEMA as the approval is conditional.

(4) Performance on procedure of tax and custom duty

MAAIF shall smoothly perform necessary measures for tax, custom duty and the others imposed concerning the Project, since the Project served by the Grant Aid Project of Japan has to be exempted these duty and charge based on the Exchange of Notes.

(5) Performance on the obligations of recipient country

The obligations of Uganda, except for above, are listed as follows; Banking arrangement, drainage canal works in Bulambuli for treating the tail drainage by means of extending the drainage canals in the Project area up to exiting canals in the out of target area, works of land re-organization, farm ditch constructed by the farmers which is below class of tertiary canal in the Model Site and the monitoring on environmental and social consideration conducted after the construction.

The soft components plan to be participated by C/P from the related agency, also the targeted officer at the training in Bulambuli and Kween, and the representative of the farmers should join to the training as well.

3-2 Necessary Inputs by Recipient Country

To be ensured an sustainable effect of the Project, Uganda is required to undertake as follows;

(1) Technical support of O&M for irrigation facilities

The constructed irrigation facilities conduct a operation and maintenance by WUA under the support by MAAIF. The soft components plan to target the agricultural engineer and officers in Bulambuli and Kween, MAAIF and the farmers in the beneficial area for the purpose of training on the O&M of irrigation facilities and developing the capacity of water management.

WUA has a role for delivery of appropriate water timely to beneficial area by means of proper O&M on irrigation facilities. WUA composed by the farmers, however, has not used and operated the new irrigation facilities such as integrated one ever than before, therefore, proper O&M on irrigation

facilities is assumed to be difficult for WUA and the farmers

The sustainable O&M on irrigation facilities regards as the basic activity to reach out the increasing in rice production aimed at the Project. In terms of sustainable effect of the Project after the completion of the Project including the soft components, MAAIF and Districts continuously provide the support to WUA until they foster a consciousness about the O&M and its activities work regularly. In order to further sustainable effect of the Project, the farmers are required not only the support by MAAIF and District, but also the budget for its realization.

(2) Capacity development of establishment and enhancement of WUA

The key factor for the sustainable and securing the Project impact for the irrigated agriculture is WUA composed by the farmers in the target area. The one of main activities in terms of management is to secure the necessary budget for its management organizationally. The budget comes from water fee which is collected by the member of WUA and paid from income by the agricultural production.

WUA will continue to maintain the irrigation facilities and repair work using water fee though, WUA, namely the farmers, has not been experience of fare for the irrigation water. Hence it is assumed that the consciousness and the system concerning collection of the water fee need to take time

However, there is not any WUA in the Project site presently. The cooperative supports by MAAIF, Districts (PDCC) and representative of the farmers (PACC) are imperative for establishment and enhancement of WUA, and the systematic organization is also required for the sustainable support.

(3) Performance on social and environmental considerations

The constructed facilities in the Project all are the new ones, therefore, compensation and livelihood support to the affected persons who cannot cultivate temporary or forever due to the land acquisition are imperative, and the proper considerations and measures for affected environment and society are indispensable.

In addition above, Uganda side is required to monitor and necessary measures based on the monitoring plans and the check lists on the environmental impact during and after the construction.

3-3 Important Assumptions

The important assumptions to realize the sustainable and effective impact of the Project are as follows;

- ✓ No major change in Ugandans agricultural and irrigation policy
- ✓ To maintain the irrigation and the drainage function with appropriate maintenance works for the facilities, and to secure the stable delivery of irrigation water timely and properly.
- ✓ To continuously collect the water fee stipulated in the regulation
- ✓ No occurrence of long-term extraordinary drought and flood in the Atari river and the beneficial area

3-4 Project Evaluation

The Project relevancy for the implementation of the Japanese Grant Aid Project is shown as follows;

3-4-1 Relevance

(1) Target beneficial persons

The nation of people below poverty line in Uganda is assumed to be 6.7million as of 2012/13, which account for 19.7% of gross population reported by Statistical Abstract, 2017, Uganda Bureau of Statistic. Comparing this statistical vale between in rural and urban areas, those are 7.8 million (22.8%) and 3.2 million (9.3%) respectively. It is appeared that the rural poor reaches about 2.5 times higher than the urban area of that. Furthermore the eastern area where the project is targeted is seen 24.5% of poor ratio in rural area, which is in excess of 22.8% of national average in rural area. Direct beneficial households in the Project are approximately 530 and indirect beneficial persons are approximately 6,530, therefore, the Project contributes poverty reduction through the increasing the rice production and the famers income.

(2) Urgency of Project implementation

NDRS undertaken in Uganda as the member of CARD plans to increase rice production in 680,000ton in 2018 from 177,800ton in 2008. To broaden rice cultivation in dry season by the Project contributes to increase in self-sufficient in national level and to improve productivity in rural area, which is in conformity with the national strategy of food security. Furthermore, increasing in the rice production by the Project leads to realize an income improvement of farmers as well, hence, the Project serves the stable civilian life and the improvement of living conditions. Accordingly, the Project implementation is required with high urgency.

(3) Conformity with national development plan in Uganda

Agriculture in Uganda regards as the one of primary sector in the national development plan, in particular, it addresses to enhance modernization and productivity of agriculture. DSIP in MAAIF puts the priority on improvement of productivity as well and formulates eight programs including improvement of agriculture technics and supports of extension service. Hence, the Project policy is conformity with the national development plan and agriculture sector plan in Uganda. Furthermore, the constructed irrigation facilities and the O&M done by the farmers' organization contribute to integrated irrigation development plans in middle and large scale, which is prioritized to be essential in NDP II and ASSP.

(4) Relation with Japan policy of ODA

According to ODA policy of Japan for Uganda, agricultural development plan is the one of priority filed which is categorized into four filed, i.e. 1)Human resource development (education and job training), 2)Basic life support (health care, water supply, environment etc.), 3)Agricultural development (rice promotion, improvement of added value of agricultural products, etc.), 4)Basic economy infrastructure (road, water supply, power supply). Basic policy of these priorities are not changed and Japanese government keep standing the policy of supporting the CARD frameworks for increasing rice production in Africa. To support modernization of agriculture sector in JICA project program, three of the rural industry promotion programs, i.e. rice promotion, livestock promotion and rural industry promotion, are implemented. In particular, the Project regards as important one because of matching with the rice promotion program policy. Accordingly, the Project policy is in consistency with ODA policy in Japan.

Furthermore, according to ODA policy for Uganda in July 2017, improving the rural income through the rural development project regards as the one of priority filed and the development project and aims at an enhancement of income of rural poverty with improving agricultural productivity and yielding. Hence the Project is in conformity with these policy as well.

3-4-2 Effectiveness

The Project impacts are expected as follows;

(1) Quantitative effectiveness

Expected quantitative effectiveness is as follows. The values of effectiveness are targeted in three years after the completion of the Project.

Table 3-1. Base and Target Value of Quantitative Effectiveness

Items	Base (2014)	Target (2025)
Irrigation area (ha)	330 ha	680 ha
Rice field (ha)	264 ha	570 ha
Rice production (ton/ha)	3.0 ton/ha	5.0 ton/ha

Source : JICA ODTeam

(2) Qualitative effectiveness

- ✓ The series of activities concerning the irrigation facilities project such as survey, planning, designing, construction, and operation and maintenance after the completion, result in impact of effectiveness of the Project and lead to be the model of irrigation development project in Uganda, furthermore, these activities are broaden and developed to other irrigation scheme.
- ✓ The Project is enable to increase the rice production in conjunction with technical assistance project targeted improvement and extension of irrigation rice agriculture technics.
- ✓ The qualified headworks and canals in terms of durability constructed newly together with river dyke, are directly expected to impact on disaster prevention in the beneficial area and the irrigation facilities, and result in the contribution to the stability of facilities, increasing in rice production and improvement of farmers' income in the flood season.
- ✓ The soft components in the Project serve acquisition of technics on the O&M for the facilities to MAAIF, Districts engineer and the farmers (WUA), and realize sustainable water management and the O&M properly concerning the irrigation.