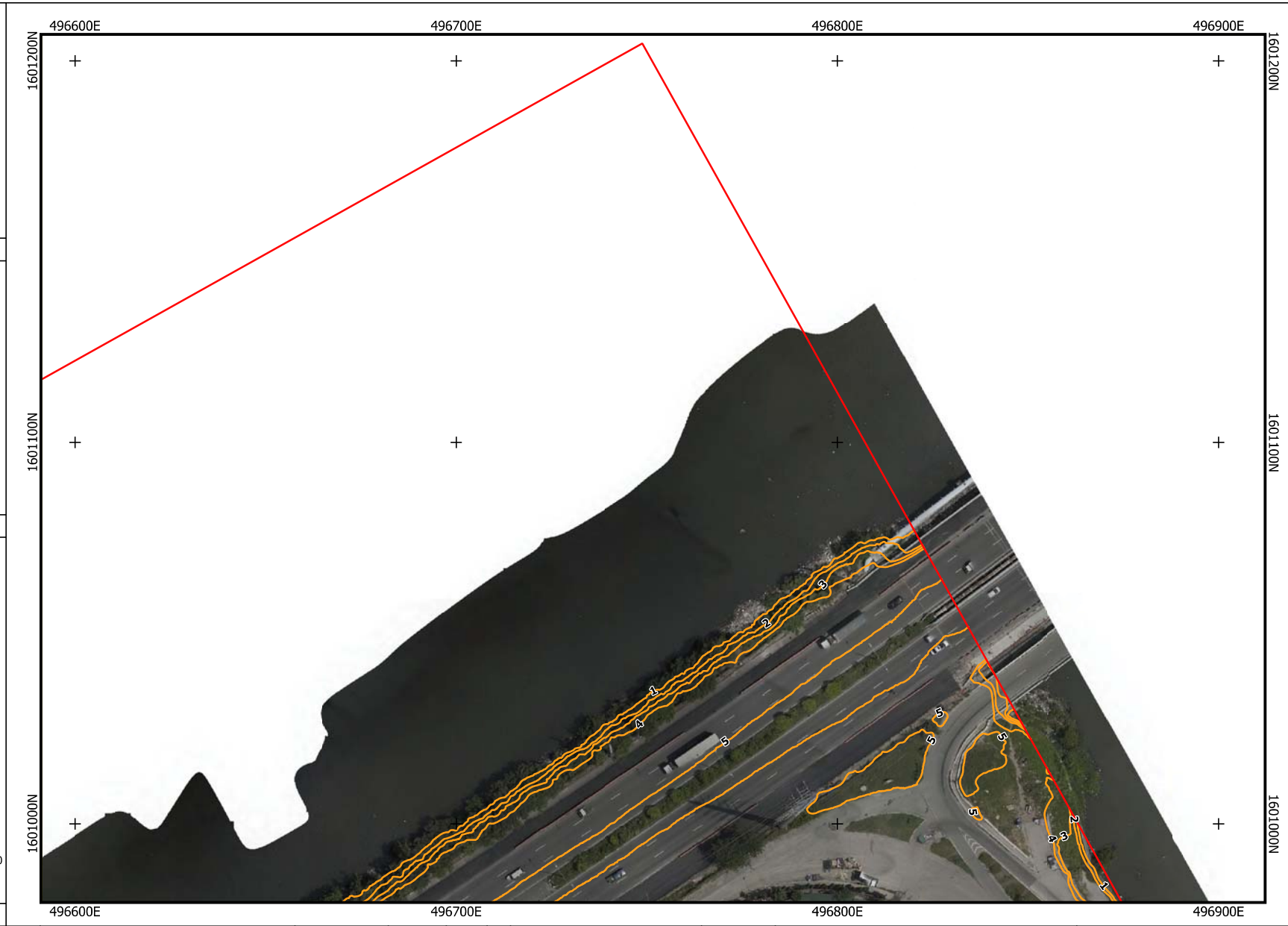
Orthomosaic



MAP INDEX

LEGEND

Area of Interest

1m Contour

MAP PROJECTION
PHILIPPINE REFERENCE SYSTEM ZONE III
PHILIPPINE REFERENCE SYSTEM 1992

SURVEY DATE
AUGUST 2020

Meters
0 25 50
1:1000

NOTES

CLIENT: CTI Engineering Co., Ltd.

SURVEYOR: AERO 360 INTERNATIONAL

I hereby certify that this is a correct plan of the survey made by me personally, or under my direct supervision in conformity with the provisions of applicable laws of the Republic of the Philippines and the rules and regulations of the Department of Environment and Natural Resources.

ENGINEER ON RECORD

PRC NO:	8849
PTR NO:	-
DATE OF ISSUE:	09-19-11
PLACE OF ISSUE:	

SORVI GENALEON R. ILDEFONSO
GEODETIC ENGINEER

SURVEY TEAM

	NAME	DATE
PROJECT MANAGER		
LIDAR OPERATOR		
DRONE PILOT		
SURVEY TECH		
DATA ANALYST		

REVISION			DESIGNER	
REV	DATE	DETAILS	GIS	ENGR
A				

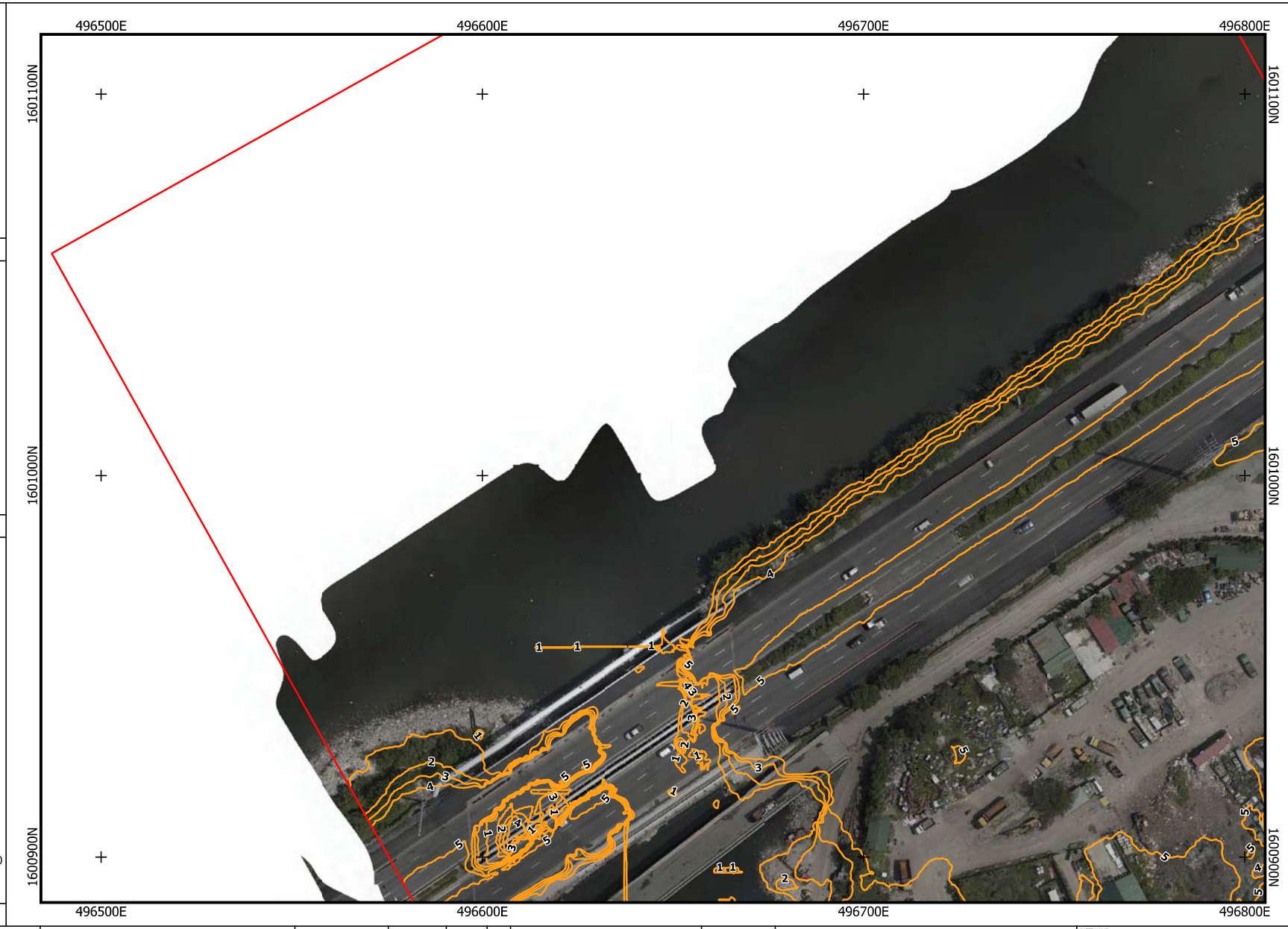
LiDAR Topographic Survey and Mapping under Follow-up Study on Parañaque Spillway

A3 | AS INDICATED

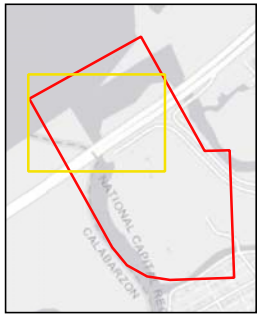
SHEET NAME: Survey Area 4 - Orthomosaic

SHEET NUMBER: 1/5

Orthomosaic



MAP INDEX



LEGEND

- Area of Interest
- 1m Contour

MAP PROJECTION
PHILIPPINE REFERENCE SYSTEM ZONE III
PHILIPPINE REFERENCE SYSTEM 1992

SURVEY DATE
AUGUST 2020

Meters
0 25 50
1:1000

NOTES

CLIENT: CTI Engineering Co., Ltd.

SURVEYOR: AERO 360 INTERNATIONAL

I hereby certify that this is a correct plan of the survey made by me personally, or under my direct supervision in conformity with the provisions of applicable laws of the Republic of the Philippines and the rules and regulations of the Department of Environment and Natural Resources.

ENGINEER ON RECORD

PRC NO:	8849
PTR NO:	-
DATE OF ISSUE:	09-19-11
PLACE OF ISSUE:	

SORVI GENALEON R. ILDEFONSO
GEODETIC ENGINEER

SURVEY TEAM

	NAME	DATE
PROJECT MANAGER		
LIDAR OPERATOR		
DRONE PILOT		
SURVEY TECH		
DATA ANALYST		

REV	DATE	DETAILS	DESIGNER GIS	DESIGNER ENGR
A				

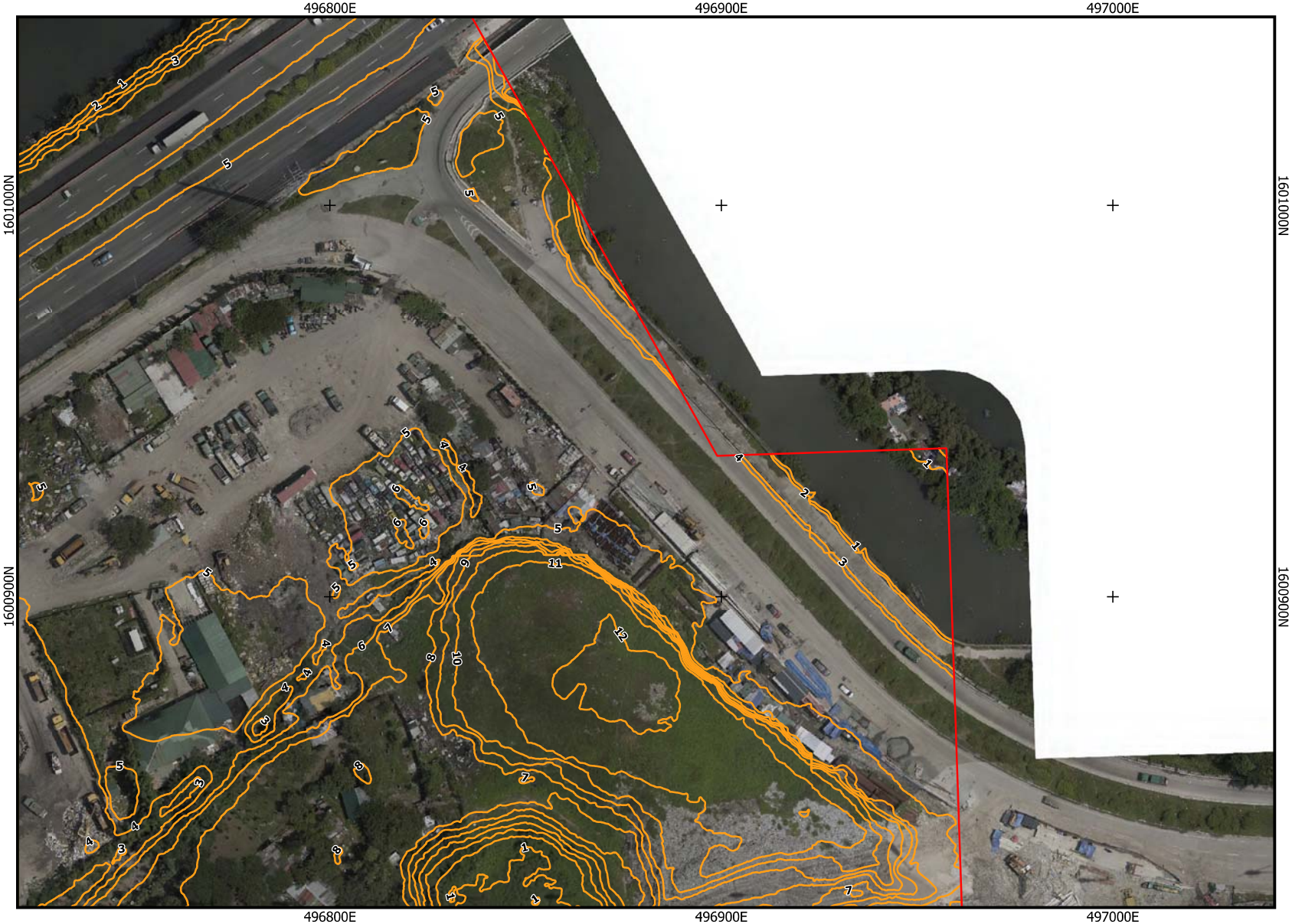
LiDAR Topographic Survey and Mapping under Follow-up Study on Parañaque Spillway

A3 | AS INDICATED

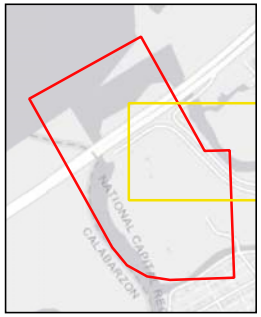
SHEET NAME: Survey Area 4 - Orthomosaic

SHEET NUMBER: 2/5

Orthomosaic



MAP INDEX



LEGEND

- Area of Interest
- 1m Contour

MAP PROJECTION
PHILIPPINE REFERENCE SYSTEM ZONE III
PHILIPPINE REFERENCE SYSTEM 1992

SURVEY DATE
AUGUST 2020

Meters
0 25 50
1:1000

NOTES

CLIENT: CTI Engineering Co., Ltd.

SURVEYOR: AERO 360 INTERNATIONAL

I hereby certify that this is a correct plan of the survey made by me personally, or under my direct supervision in conformity with the provisions of applicable laws of the Republic of the Philippines and the rules and regulations of the Department of Environment and Natural Resources.

ENGINEER ON RECORD

PRC NO:	8849
PTR NO:	-
DATE OF ISSUE:	09-19-11
PLACE OF ISSUE:	

SORVI GENALEON R. ILDEFONSO
GEODETIC ENGINEER

SURVEY TEAM

	NAME	DATE
PROJECT MANAGER		
LIDAR OPERATOR		
DRONE PILOT		
SURVEY TECH		
DATA ANALYST		

REVISION			DESIGNER	
REV	DATE	DETAILS	GIS	ENGR
A				

LiDAR Topographic Survey and Mapping under Follow-up Study on Parañaque Spillway

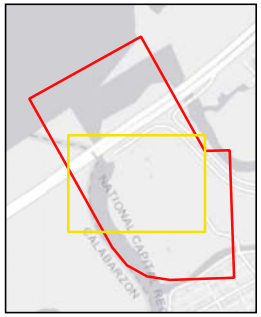
A3 | AS INDICATED

SHEET NAME: Survey Area 4 - Orthomosaic

SHEET NUMBER: 3/5

Orthomosaic

MAP INDEX



LEGEND

- Area of Interest
- 1m Contour

MAP PROJECTION
PHILIPPINE REFERENCE SYSTEM ZONE III
PHILIPPINE REFERENCE SYSTEM 1992

SURVEY DATE
AUGUST 2020

Meters
0 25 50
1:1000

NOTES

CLIENT: CTI Engineering Co., Ltd.

SURVEYOR: AERO 360 INTERNATIONAL

I hereby certify that this is a correct plan of the survey made by me personally, or under my direct supervision in conformity with the provisions of applicable laws of the Republic of the Philippines and the rules and regulations of the Department of Environment and Natural Resources.

ENGINEER ON RECORD

PRC NO:	8849
PTR NO:	-
DATE OF ISSUE:	09-19-11
PLACE OF ISSUE:	

SORVI GENALEON R. ILDEFONSO
GEODETIC ENGINEER

SURVEY TEAM

	NAME	DATE
PROJECT MANAGER		
LIDAR OPERATOR		
DRONE PILOT		
SURVEY TECH		
DATA ANALYST		

REVISION			DESIGNER	
REV	DATE	DETAILS	GIS	ENGR
A				

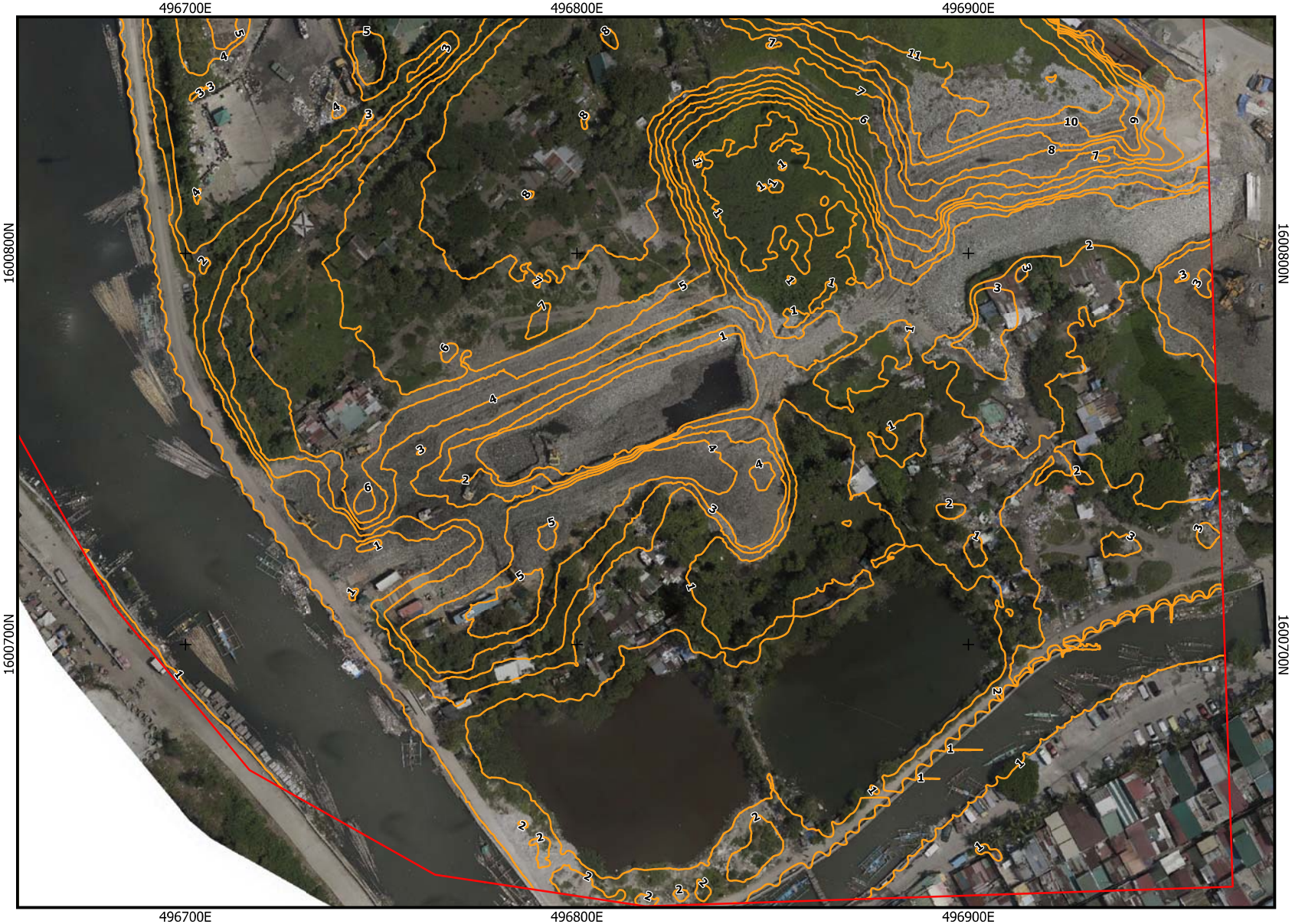
LiDAR Topographic Survey and Mapping under Follow-up Study on Parañaque Spillway

A3 | AS INDICATED

SHEET NAME: Survey Area 4 - Orthomosaic

SHEET NUMBER: 4/5

Orthomosaic



MAP INDEX

LEGEND

- Area of Interest
- 1m Contour

MAP PROJECTION
PHILIPPINE REFERENCE SYSTEM ZONE III
PHILIPPINE REFERENCE SYSTEM 1992

SURVEY DATE
AUGUST 2020

Meters
0 25 50
1:1000

NOTES

CLIENT: CTI Engineering Co., Ltd.

SURVEYOR: AERO 360 INTERNATIONAL

I hereby certify that this is a correct plan of the survey made by me personally, or under my direct supervision in conformity with the provisions of applicable laws of the Republic of the Philippines and the rules and regulations of the Department of Environment and Natural Resources.

ENGINEER ON RECORD

PRC NO:	8849
PTR NO:	-
DATE OF ISSUE:	09-19-11
PLACE OF ISSUE:	

SORVI GENALEON R. ILDEFONSO
GEODETIC ENGINEER

SURVEY TEAM

	NAME	DATE
PROJECT MANAGER		
LIDAR OPERATOR		
DRONE PILOT		
SURVEY TECH		
DATA ANALYST		

REVISION			DESIGNER	
REV	DATE	DETAILS	GIS	ENGR
A				

LiDAR Topographic Survey and Mapping under Follow-up Study on Parañaque Spillway

A3 | AS INDICATED

SHEET NAME: Survey Area 4 - Orthomosaic

SHEET NUMBER: 5/5

Appendix 2

Terms of Reference (ToR) for subcontractor

TERMS OF REFERENCE

FOR

LIDAR TOPOGRAPHIC SURVEY AND MAPPING

UNDER

FOLLOW-UP STUDY ON PARANAQUE SPILLWAY

1. FOLLOW-UP STUDY ON PARANAQUE SPILLWAY

1.1 Background

For over 40 years since the 1970's, Japan has been providing and implementing wide ranging support and technical assistance as well as ODA loan projects to the Philippines, including the preparation of flood control plans, targeting mainly Metro Manila and the major rivers. Regarding river floods, after the completion of the Manggahan Floodway in 1988, JICA implemented the "Study on Flood Control and Drainage Project in Metro Manila" from 1988 to 1991, and the "Pasig Marikina River Channel Improvement Project" was selected as a highly urgent project for flood management of the Pasig Marikina River. Through the feasibility study (F/S) and JICA's Special Assistance for Project Formation (SAPROF), the project was decided to be implemented in four phases, namely; Phase I, Phase II, Phase III and Phase IV. Currently, additional works in Phase III (Supplemental Agreement No. 6) and the permanent works of Phase IV (L/A signed in 2018) are in progress.

Regarding measures against drainage and inland inundation, JICA has been supporting the implementation of river dredging and the construction/installation of pumping facilities, water gates, drainage channels and others through various projects, including the ODA loan project called "Metro Manila Flood Control and Drainage Project" in 1973, the grant aid project named as "Project for Retrieval of Flood Prone Areas in Metro Manila (Phases I and II)" from 1989 to 1994, and the ODA loan project called "The KAMANAVA Area Flood Control and Drainage System Improvement Project" from 2000 to 2008.

In addition, as measures against floods causing inland inundation and lake water level rise in the western Manggahan District and the area surrounding the Laguna de Bay (Basin Area: 2,920 km2; Lake Surface Area: 900 km2), JICA had provided support on the detailed design work for the Eastern and Western Manggahan districts through the ODA loan project entitled "North Laguna Lakeshore Urgent Flood Control and Drainage Project (L/A signed in 1989)" and also supported the construction of lakeshore dikes, the construction of drainage facilities and the installation of drain gates in the western Manggahan District through the ODA loan project known as "Metro Manila Flood Control Project – West of Manggahan Floodway (1997~2007)."

However, Typhoon Ondoy, in September 2009, had brought an unprecedented daily rainfall recorded at 453 mm which caused massive flood damage in areas along the Marikina River and the surrounding Laguna de Bay lakeshore areas in Metro Manila. The Laguna de Bay lakeshore

area where low lying areas without flood management measures are widespread had experienced inundation for more than one month. Flood control measures in the Laguna de Bay lakeshore areas had lagged behind those implemented in the center of Manila and hence flood management measures in the whole Metro Manila are urgent matters to be addressed.

Furthermore, as a countermeasure for flooding in the Laguna de Bay lakeshore areas, in addition to the construction of lakeshore dikes, drainage channels and pumping stations, the construction of a spillway (hereinafter referred to as the "Parañaque Spillway") for draining lake water from Laguna de Bay through Parañaque City to the Manila Bay to control the water level of Laguna de Bay is under consideration. Since it is difficult to acquire land in Parañaque City which is an urbanized area, underground channeling is being considered instead of the open cut method.

In view of the necessity of flood countermeasures for the Laguna de Bay lakeshore areas, JICA conducted the "Data Collection Survey on Parañaque Spillway in Metro Manila (hereinafter referred to as Parañaque Survey 2018)" from 2017 to 2018. In this project, additional studies on the integrated flood control plan for the Pasig Marikina River basin and the Laguna de Bay basin were conducted, including the effects of the Parañaque Spillway, based on the previous survey results, as well as the collection and confirmation of information to evaluate the feasibility of JICA's ODA loan projects and the direction of the Preparatory Survey.

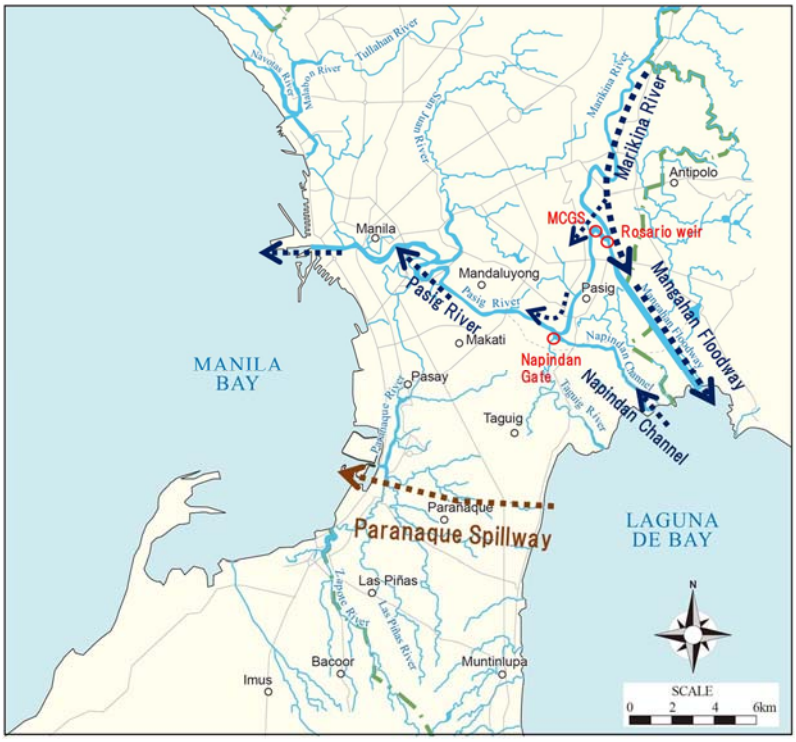


Fig. 1.1 Location Map of Paranaque Spillway

1.2 Objectives

The objectives of this project are to analyze the situation in the Laguna de Bay basin, including the Pasig Marikina River Basin, in a unified manner and in coordination with the existing flood control projects and plans, to prepare the comprehensive flood management plan of the entire Laguna de Bay Lakeshore Area, and to conduct collection and confirmation of information to

examine the feasibility of JICA's ODA loan assistance project and the direction of the preparatory survey.

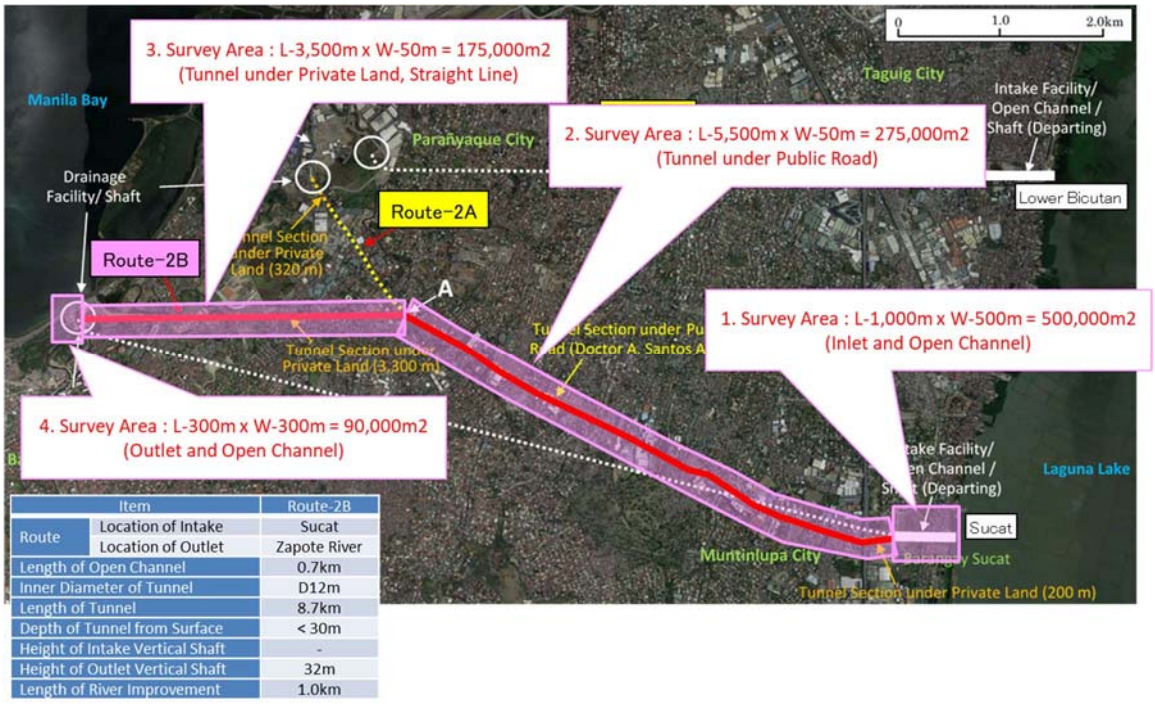
2. LIDAR TOPOGRAPHIC SURVEY AND MAPPING

2.1 Objectives

The objectives of the LiDAR Topographic Survey and Mapping utilizing unmanned airborne platforms are to clarify the contours along the proposed Route 2B of the Paranaque Spillway and the alignment and ROW boundary of the Dr. Santos A. Avenue.

2.2 Target Areas

The target areas of the LiDAR Topographic Survey and Mapping are located along the proposed Route 2B of the Paranaque Spillway, as shown in the figure.



Item		Route-2B
Route	Location of Intake	Sucat
	Location of Outlet	Zapote River
Length of Open Channel		0.7km
Inner Diameter of Tunnel		D12m
Length of Tunnel		8.7km
Depth of Tunnel from Surface		< 30m
Height of Intake Vertical Shaft		-
Height of Outlet Vertical Shaft		32m
Length of River Improvement		1.0km

Fig. 2.1 Target Areas of LiDAR Topographic Survey and Mapping

3. SCOPE OF WORKS

The Consultant will be responsible for executing the LiDAR Topographic Survey and Mapping for areas with a total of 104 hectares.

Details are shown as follows:

1. Survey Area: L-1,000m x W-500m = 500,000m^2 (50 has.) to design the Inlet and Open Channel of the Paranaque Spillway, 1-meter contour, 1:200 scale.
2. Survey Area: L-5,500m x W-50m = 275,000m^2 (27.5 has.) to design the Paranaque Spillway (Underground Tunnel) under a public road (Doctor A. Santos Avenue), 1-meter contour, 1:200 scale; necessary for clarifying the public area (ROW) to fix the alignment of underground tunnel.

3. Survey Area : L-3,500m x W-50m = 175,000m^2 (17.5 has.) to design the Paranaque Spillway (Underground Tunnel) under private lands, straight line, 1-meter contour, 1:200 scale; necessary for clarifying the private area and number of houses to fix the alignment (straight line) of underground tunnel.

4. Survey Area: L-300m x W-300m = 90,000m^2 (9 has.) to design the Outlet and Open Channel, 1-meter contour, 1:200 scale.

4. PROJECT DURATION

The Consultant shall commence the works immediately after the signing of the Contract and shall be completed after two-and-a-half (2.5) calendar months. A proposed time schedule, similar to Table 4.1, shall be submitted one week after the commencement of the work.

Table 4.1 Contract Period

Description	June, 2020	July	August
(1) Field Reconnaissance and Processing Control Point			
(2) Aerial LiDAR Surveying			
(3) Processing of Point Data			
(4) Mapping			
(5) Check and Finalizing			
(6) Submission			Draft Final Results, Final Results

5. OUTPUTS AND DELIVERABLES

The following shall be submitted by the Consultant at the end of the survey works:

- 2 printed copies of the Survey Report, which shall include but is not limited to the following:
    - Photos, location map, control point network diagram
    - General information (purpose, area, period, limits, etc.)
    - Mapping information (origin coordinates, projection, scale factor, etc.)
    - Results (coordinates table, accuracy table, calculation sheets, etc.)
    - Code legend for topographic survey and layer legend for the digital map
    - Instrument calibration certificates for the GNSS, total stations, leveling instruments, etc.
    - CAAP certificates/licenses (i.e., Operator, Controller, Aircraft Unit)
    - NAMRIA control point certificates
    - Copies of permits to conduct the survey as secured from CAAP, DND, LGUs and other related agencies

- Descriptions of newly established control points, with 3 photos: Distant range and middle range photos shall be taken with conspicuous and remarkable landmarks, topographic features such as houses, structures, big trees, hills, creaks, etc. as a background; while short range photos shall be clear enough such that the conditions and inscriptions of the points must be seen.
- 3D topographic map (scale 1:200) showing the planimetric features and contour lines at 1-meter interval

- 2 digital copies of the following:
  - Survey Report (Microsoft Word format)
  - 3D topographic map (1:200 scale) showing the planimetric features and contour lines at 1-meter interval (DWG and SHP formats)
  - Processed/classified Point Cloud data (LAS format)
  - DTM / DSM (TIFF format)
  - Digital Orthophotos (ECW format)
  - Raw/unprocessed images used to produce the Digital Orthophotos
  - Raw/unprocessed Point Cloud data (LAS format)
  - Raw data of ground surveys (e.g., data downloaded from instruments, scanned fieldsheets, etc.)

6. QUALIFICATION OF THE CONSULTANT

6.1 Credentials and Experience

The Consultant can be a registered private firm, academic institution, NGO or a related consortium with proven credentials and with requisite qualified and experience personnel.

6.2 Team Composition

The Consultant shall be composed of, but not limited to, the following:

Team Leader

He/she must have a bachelor's degree in any engineering discipline with 5 years of experience that is related to the project. He/she shall be responsible for the quality and the timely submission of the survey outputs.

Geodetic Engineer

He/she must have a bachelor's degree in Geodetic Engineering with 5 years of experience that is related to the project.

7. OTHERS

7.1 General Requirement

The Consultant shall exercise great care during the progress of the survey works to avoid any accident and will be responsible for any faults during the project. Accordingly, no claims will be accepted by the Consultant . The Consultant shall acquire all permits or licenses required for the project from appropriate government or private agencies at his own expense.

7.2 Equipment, Material and Labor

All equipment, transportation vehicles, site office, per diem/allowance, materials and labor required for all the above-mentioned works shall be provided by the Consultant . Those costs shall be included in the cost estimate.

7.3 Insurance

The Consultant shall at his expense purchase accident and injury insurance for experts and shall keep the Survey Team free from any claims for the compensation of any accident and/or injury that occurs.

7.4 Tax and Related Charges

All taxes, levies, deductions, charges fees, and similar assessments imposed, assessed, levied, or collected by the Services, or any sub-divisions thereof or any taxing authority therein, upon the Consultant and his staff shall be paid and/or borne by the Consultant .

7.5 Change in Scope of Work

The scope of the Work may be changed if deemed extremely necessary after the discussions during the progress of the project. Additional payment shall be made only for major changes in the scope of works; any such amendments and modifications in the scope of work, task description and work item details and therefore the corresponding change in cost as a result thereof shall be covered by a Supplemental Contract upon mutual agreement between the Survey Team and the Consultant .

8. TECHNICAL SPECIFICATIONS

8.1 Survey Standards

Unless specified, all standards and criteria for all the survey works shall be consistent with the DPWH Design Guidelines, Criteria and Standards (DGCS) 2015, Volume 2B: Engineering Surveys.

8.2 Coordinate System and Datum Level

The coordinate system shall be based on the Philippine Plane Coordinate System (PPCS) – PRS92, the characteristics of which are shown in Table 6.1.

Table 6.1 Philippine Plane Coordinate System (PPCS) – PRS92

Ellipsoid	Clarke's Ellipsoid of 1866	
Projection	Transverse Mercator, in zones of two degrees net width	
Point of origin	Intersection of the equator and the central meridian of each zone, with a northing of 0m and an easting of 500,000 m.	
Scale factor at central meridian	0.99995	
Extents of zones		
Zone	**Central Meridian**	**Limits**
I	117° E	116° 00' to 118° 30'
II	119° E	117° 30' to 120° 30'
III	121° E	119° 30' to 122° 30'
IV	123° E	121° 30' to 124° 30'
V	125° E	123° 30' to 127° 00'

All elevations shall be based on the Manila Bay mean sea level. GNSS-obtained ellipsoidal heights shall be converted to orthometric heights using the latest Philippine Geoid Model published by NAMRIA.

8.3 Installation of Control Points

While the coordinates from the LiDAR-equipped unmanned aircrafts shall be determined by PPK and/or RTK technology, it may be necessary to install control points should there be a need to conduct ground surveys in areas which LiDAR cannot penetrate (e.g., water bodies). In such cases, the points shall be established, defined, and marked on the ground by monuments of permanent nature. The fabrication, marking, and interval requirements of the control monuments shall be consistent with the DPWH DGCS.

8.3 Horizontal and Vertical Control Surveys

Horizontal control surveys shall be conducted using static GNSS, closed-loop traverse using total stations, or a combination thereof. Vertical control surveys meanwhile shall be conducted by direct leveling (using digital levels). The accuracy standards shall be in the Third Order.

8.4 Aerial LiDAR Survey

Aerial LiDAR survey complemented with aerial photography shall be carried out for the target area. Enough width shall be captured for final output to produce a three-dimensional topographic map from the orthophoto, DTM and DSM of the target area.

The Consultant shall use a LiDAR scanner attached to an unmanned aircraft or rotorcraft. The unit must be RTK and/or PPK-compatible and must be equipped with an IMU and other associated control units, and a camera with a resolution of 36 megapixels, or better.

The outputs shall have the following specifications:

- Ground sample distance <= 2.5 cm
- Vertical RMSE (for flat ground) <= 10 cm
- Horizontal RMSE <= 3.5 cm
- Bands: RGB (three-band natural color imagery)
- Radiometric resolution: minimum of 8 bit per band, in accordance with chosen image format
- Cloud free with minimal smoke, smog, fog and dust

8.3 Checkpoints

Checkpoints shall be used to independently assess the accuracy of the survey works. The Consultant shall not, in any way, utilize the points during the processing of the LiDAR data and the aerial photographs to calibrate and improve the accuracies.

Checkpoints may be installed using nails, paints, or any similar markers to facilitate identification. The Consultant shall ensure that the points are clearly recognizable in the aerial photographs (both raw and processed), must be placed in secured locations to guarantee recovery, and must be well-distributed throughout the target area. Their coordinates may be determined using RTK receivers, with the necessary adjustments on the vertical datum properly implemented.

The Consultant may also opt to use existing or newly established control points as checkpoints, provided that these were not utilized as base stations in the processing of the PPK or RTK data.

8.3 Ground Survey

Unless the Consultant has an available water-penetrating LiDAR equipment which can satisfy the required specifications of the outputs, ground survey shall be conducted to determine the underwater terrain.

Total stations and/or GNSS receivers may be used for shallow waters. Backsights for the total station surveys and datum point check for GNSS surveys shall be carried out at appropriate intervals to confirm the stability of the equipment and for the adjustment of ellipsoid and geoid difference.

For areas which can be accessed by boats, the Consultant may use a GNSS-equipped echosounder. Calibrations, such as those related to the speed of sound in water, shall be performed accordingly.

8.3 Office Works

All field observation data shall be submitted in electronic and printed formats, as applicable, as part of the project deliverables. All survey results shall be properly arranged, with brief notes and necessary corrections indicated.

The sheet size of drawings will be in A3 with the texts and other notations unquestionably legible. The title blocks shall be proposed by the Contract and approved by the Client. All control points as well as natural and artificial features, shall be shown and properly labeled on the map. Contours shall be shown at one-meter intervals. Spot elevations shall also be indicated.

Newly established control points shall be documented.

Appendix 3

Contract Agreement between JICA Study Team and subcontractor and Amendment of Contract Agreement

CONTRACT AGREEMENT

FOR

LIDAR TOPOGRAPHIC SURVEY AND MAPPING

UNDER

FOLLOW-UP STUDY ON PARANAQUE SPILLWAY

BETWEEN

JICA Study Team

AND

Aero 360 Solutions, Inc.

This agreement made and entered into this 25th day of June, 2020 in Manila, Republic of the Philippines by and between:

CTI ENGINEERING INTERNATIONAL CO., LTD. (CTII), representative Mr. Takahiro MISHINA, Team Leader having its head office at Tachibana Annex Building, 2-25-14 Kameido, Koto-ku, Tokyo, Japan (hereinafter referred to as the "Client");

- and -

AERO 360 SOLUTIONS, INC., representative MARK VINCENT B. VILLAFLOR, CEO/President having its office at 8 F. Pasco Ave, Santolan, Pasig, Philippines (hereinafter referred to as the "Contractor");

WITNESSETH THAT:

WHEREAS, the Client is awarded by the Japan International Cooperation Agency (JICA) to undertake **FOLLOW-UP STUDY ON PARANAQUE SPILLWAY** (hereinafter referred to as the "Project"):

AND, the Client needs the Contractor to provide the services to execute the LiDAR Topographic Survey and Mapping as specified in the Terms of Reference (TOR) and Bill of Quantities (BOQ) set forth in Annex-A and B attached hereto;

AND, the Contractor represents itself to be the specialist in need and offered the provision of the service to the Client;

AND, the Client has accepted this offer;

NOW, THEREFORE, the Client and the Contractor (hereinafter referred to as the "Parties"), hereby agree as follows:

Article 1. The Services

The Services to be performed by the Contractor is to carry out the Lidar Topographic Survey and Mapping using its own equipment and personnel in accordance with the Term of Reference (TOR) set forth in the Annex-A attached herewith.

Article 2. Assignment and Sub Contracts

The Contractor is not allowed to assign any Third Party(s) to sublet any portion of the work.

Article 3. Obligation of the Contractor

In the conduct of the Services, the Contractor shall cooperate fully with the Client and the concerned Agency(ies) or Department(s), and shall always work in the best interests of the Client and the Government of the Philippines.

Article 4. Work Period

The Services shall be completed by 75th day reckoned from the date of signing of this agreement.

Article 5. Cost of the Services

The cost of the Services, including VAT and other local taxes, is **PHP Two Million One Hundred Sixteen Thousand Four Hundred Sixty-Four (PHP 2,116,464)** only.

Article 6. Payment for the Services

Payments will be made in two (2) installments as detailed below:

Advance Payment

The advance payment of **PHP Eight Hundred Forty-Six Thousand Five Hundred Eighty-Six (PHP 846,586)**, which is equivalent to about 40% of the contract amount, will be paid to the Contractor within one week after the signing of the Contract.

Final Payment

The final payment of **PHP One Million Two Hundred Sixty-Nine Thousand Eight Hundred Seventy-Eight (PHP 1,269,878)** will be paid to the Contractor within ten (10) days after approval of Final Submission by the Client on the completion of the Services.

Banking charge in connection with the transfer of all or part of the Cost shall be at the express of the Contractor.

The Client shall apply a penalty of 1 % of the contract amount for each day of delay beyond the agreed contract period with a maximum of 10% of total amount of the contract. The Client

shall apply a penalty for any reduction of survey items and hours, which will be calculated proportionally to the agreed survey items and hours.

Article 7. Force Majeure

The Contractor shall promptly notify the Client and the Client shall promptly notify the Contractor in writing of the occurrence of any event of Force Majeure. As used herein, the term "Force Majeure" shall mean attributable to the causes specified hereunder;

1. Natural causes, such as earthquakes, epidemics and other similar causes affecting the work, to the extent that would make it impossible or impracticable for the Contractor to carry out, in whole or in part, its obligations under this Agreement.

2. Human causes, such as war, armed invasion, revolution, insurrection, blockades, riots, civil disturbances, strikes or other analogous or similar causes, including the occurrence of a national banking moratorium, to such extent that would make it impossible or impracticable for the Contractor to carry out, in whole or in part, its obligations under this Agreement.

The Contractor as of the day of the giving such notice, shall be relieved from liability for the failure to carry out its obligation due to the occurrence of such events of Force Majeure.

In such event, either party may terminate this Agreement by giving ten (10) days notice in writing to the other; upon the giving or receipt of such notice of termination, the Contractor shall take immediate steps to bring the work to a close in a prompt and orderly manner.

Upon termination of this Agreement pursuant to the foregoing provisions, the Client shall not be liable to make any payment to the Contractor, except for the works performed or expenditures incurred prior to the date of such termination of its work and settlement of its obligations incurred by the Contractor as a result of Force Majeure, which costs and expenses may not have been incurred but for such Force Majeure.

Article 8. Indemnities

Unless otherwise specified hereunder, the Contractor shall indemnify and hold the Client and its engineers, supervisors, officers, agents and employees free and harmless from any and all liability for compensations, claims, suits, costs or charges related to any losses as well as any personal or property injury or damages that may arise out of the performance of the Services or in connection therewith.

Article 9. Insurance

The Contractor shall at its own expense, carry and maintain the necessary insurance in accordance with the terms and conditions necessary for the performance of the Services and in accordance with the provisions of the laws and/or regulations of the Government and with the

prevailing practice in the Philippines, with insurance companies acceptable to the Client for the whole period of the performance of the work, including but not limited to the following;

1. Workmen's compensation insurance for the Contractor's employees engaged in the Services.

2. Comprehensive automobile liability insurance covering owned, non-owned and hired automotive equipment used by the Contractor for damages against itself and injury, death or property damage caused against any third party.

In spite of the aforesaid insurance, the Contractor shall still be fully responsible for the performance of all obligations as specified herein and the Contractor shall assume all risks.

Article 10. Representative

Upon conclusion of the Agreement, the Contractor shall assign a representative satisfactory to the Client. The representative shall be responsible for handling all the important matters on behalf of the Contractor.

The engineers appointed by the Client, whose names shall be notified to the Contractor, shall have powers to control and supervise the Services.

Article 11. Termination of the Services

The Client may terminate the Services of the Contractor under this Agreement for good and sufficient causes by giving written notice to the Contractor five (5) days prior to the termination of this Agreement. The Contractor shall be entitled to receive remuneration for services performed under this Agreement up to the termination.

Should the Contractor fail to comply with its obligations under Article 3 herein, or with any other requirement under this Agreement, this Agreement shall be terminated.

Should the work be stopped under order of any court or other public authority thru no fault or act of the Contractor, or if the Client fails to comply with the provisions of Article 6 herein, then the Contractor may, on giving notice of such occurrence, and unless further Agreement is reached, stop work or terminate this Agreement and recover payment from the Client for all fees earned to date of termination, all costs incurred by the Contractor for services performed, all items procured for the work, and for any or all losses sustained by reason of the work stoppage and termination.

Article 12. Language

The English language shall be used in all written communication between both Parties with respect to this Agreement.

Article 13. Obtaining of Governmental Permission and Approval

The Contractor shall obtain, for itself, all the necessary permissions and approvals of the Government and other competent concerned authorities/agencies required for the work, and shall acquire all the rights and privileges for access to and use of the work site necessary for the execution of the Services.

Article 14. Applicable Laws

This Agreement shall be deemed to be a contract made under, and shall be governed solely and construed in accordance with the laws of the Philippines.

Article 15. Preservation of Peace

The Contractor shall take all reasonable precautions for preventing any unlawful, riotous, or disorderly conduct which may be caused by the Contractor's employees or may occur among them and for the preservation of peace and the protection of persons and property in the work site and in the area adjacent thereto.

Article 16. Income Tax and Other Duties

Under all phases of this Agreement, the Contractor shall be liable for its Corporation Tax, Income Tax, duties, contributions and other taxes or charges which may be levied both on the Contractor and its staff according to the laws and regulations of the Philippines.

Article 17. Alternation of the Services

At any time during execution of the work, the Client shall have the right to make any modification in the work by giving change order to the Contractor. In the event of such a change, the cost of services and/or the date of completion of the work may be adjusted by prior agreement between the Parties.

Article 18. Disputes

In the event of any disputes arising between the Parties with respect to the Agreement and/or the performance of the Services, the Parties shall endeavor to take prompt steps amicably to settle the same.

Article 19. Intellectual Property

The drawings, data and other documents, as instruments of the Services, are the intellectual property of the Client and shall not be used for any work other than the Project without prior written approval of the Client. The copyright of all drawings, data and other documents submitted by the Contractor in connection with Agreement rests with the Client.

Article 20. Contract Amendments

Any amendment or modification of this Contract, other than the variations set forth, may be negotiated between the parties hereto and shall be agreed to by a written document signed by both parties.

Article 21. Safety Measures

The Contractor will take all necessary measures and precautions to ensure safety of all personals and machines to be used for the survey purpose. As such, a person in charge of safety and security of the personal shall be allocated adequately. In case of any accidents, the Second Patty shall take all responsibilities and immediately contact and inform the Contractor.

Article 22. Representation and Warranties

The Contractor hereby represents and warrants to the Client as follows:

1. The Contractor is a corporation duly organized, validity existing and in good standing under the laws of the Philippines, and in full corporate power to conduct the business presently being conducted by it and is duly qualified to transact business with the Client.
2. The execution, delivery and performance of this Agreement by the Contractor have been duly authorized and approved by requisite corporate action of the Contractor.
3. The person signing this Agreement is fully authorized to represent the Contractor. This agreement when signed, shall be binding on the Contractor.

IN WITNESS WHEREOF, the Parties hereto have signed this Agreement in their respective names in duplicate, each party retaining one (1) copy thereof, as of the day and year first above written.

The Client	The Contractor
Takahiro MISHINA	Mark Vincent B. Villaflor
Team Leader	CEO/ President
CTI Engineering International Co., Ltd.	Aero 360 Solutions, Inc.

ANNEX-A

TERMS OF REFERENCE
FOR
LIDAR TOPOGRAPHIC SURVEY AND MAPPING
UNDER
FOLLOW-UP STUDY ON PARANAQUE SPILLWAY

1. FOLLOW-UP STUDY ON PARANAQUE SPILLWAY

1.1 Background

For over 40 years since the 1970's, Japan has been providing and implementing wide ranging support and technical assistance as well as ODA loan projects to the Philippines, including the preparation of flood control plans, targeting mainly Metro Manila and the major rivers. Regarding river floods, after the completion of the Manggahan Floodway in 1988, JICA implemented the "Study on Flood Control and Drainage Project in Metro Manila" from 1988 to 1991, and the "Pasig Marikina River Channel Improvement Project" was selected as a highly urgent project for flood management of the Pasig Marikina River. Through the feasibility study (F/S) and JICA's Special Assistance for Project Formation (SAPROF), the project was decided to be implemented in four phases, namely; Phase I, Phase II, Phase III and Phase IV. Currently, additional works in Phase III (Supplemental Agreement No. 6) and the permanent works of Phase IV (L/A signed in 2018) are in progress.

Regarding measures against drainage and inland inundation, JICA has been supporting the implementation of river dredging and the construction/installation of pumping facilities, water gates, drainage channels and others through various projects, including the ODA loan project called "Metro Manila Flood Control and Drainage Project" in 1973, the grant aid project named as "Project for Retrieval of Flood Prone Areas in Metro Manila (Phases I and II)" from 1989 to 1994, and the ODA loan project called "The KAMANAVA Area Flood Control and Drainage System Improvement Project" from 2000 to 2008.

In addition, as measures against floods causing inland inundation and lake water level rise in the western Manggahan District and the area surrounding the Laguna de Bay (Basin Area: 2,920 km^2; Lake Surface Area: 900 km^2), JICA had provided support on the detailed design work for the Eastern and Western Manggahan districts through the ODA loan project entitled "North Laguna Lakeshore Urgent Flood Control and Drainage Project (L/A signed in 1989)" and also supported the construction of lakeshore dikes, the construction of drainage facilities and the installation of drain gates in the western Manggahan District through the ODA loan project known as "Metro Manila Flood Control Project – West of Manggahan Floodway (1997~2007)."

However, Typhoon Ondoy, in September 2009, had brought an unprecedented daily rainfall recorded at 453 mm which caused massive flood damage in areas along the Marikina River and the surrounding Laguna de Bay lakeshore areas in Metro Manila. The Laguna de Bay lakeshore

area where low lying areas without flood management measures are widespread had experienced inundation for more than one month. Flood control measures in the Laguna de Bay lakeshore areas had lagged behind those implemented in the center of Manila and hence flood management measures in the whole Metro Manila are urgent matters to be addressed.

Furthermore, as a countermeasure for flooding in the Laguna de Bay lakeshore areas, in addition to the construction of lakeshore dikes, drainage channels and pumping stations, the construction of a spillway (hereinafter referred to as the "Parañaque Spillway") for draining lake water from Laguna de Bay through Parañaque City to the Manila Bay to control the water level of Laguna de Bay is under consideration. Since it is difficult to acquire land in Parañaque City which is an urbanized area, underground channeling is being considered instead of the open cut method.

In view of the necessity of flood countermeasures for the Laguna de Bay lakeshore areas, JICA conducted the "Data Collection Survey on Parañaque Spillway in Metro Manila (hereinafter referred to as Parañaque Survey 2018)" from 2017 to 2018. In this project, additional studies on the integrated flood control plan for the Pasig Marikina River basin and the Laguna de Bay basin were conducted, including the effects of the Parañaque Spillway, based on the previous survey results, as well as the collection and confirmation of information to evaluate the feasibility of JICA's ODA loan projects and the direction of the Preparatory Survey.

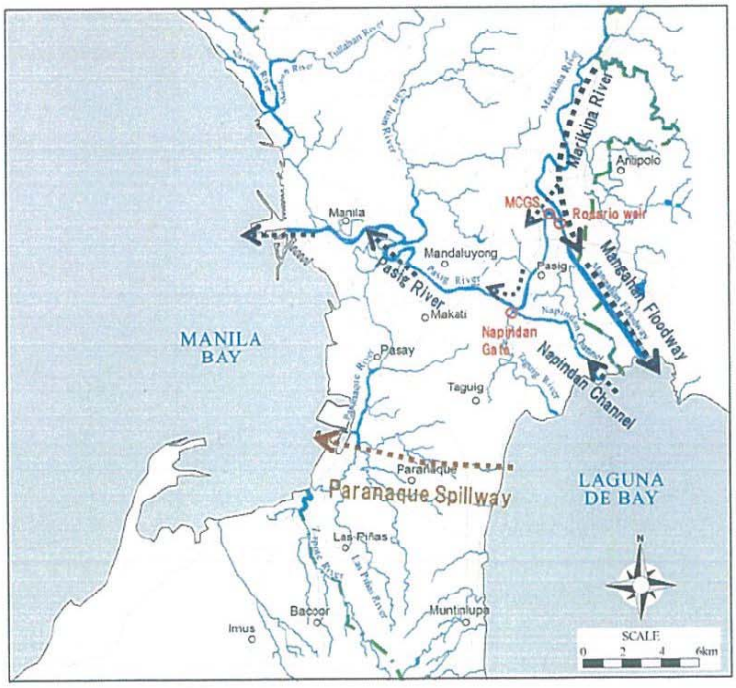


Fig. 1.1 Location Map of Paranaque Spillway

1.2 Objectives

The objectives of this project are to analyze the situation in the Laguna de Bay basin, including the Pasig Marikina River Basin, in a unified manner and in coordination with the existing flood control projects and plans, to prepare the comprehensive flood management plan of the entire Laguna de Bay Lakeshore Area, and to conduct collection and confirmation of information to

examine the feasibility of JICA's ODA loan assistance project and the direction of the preparatory survey.

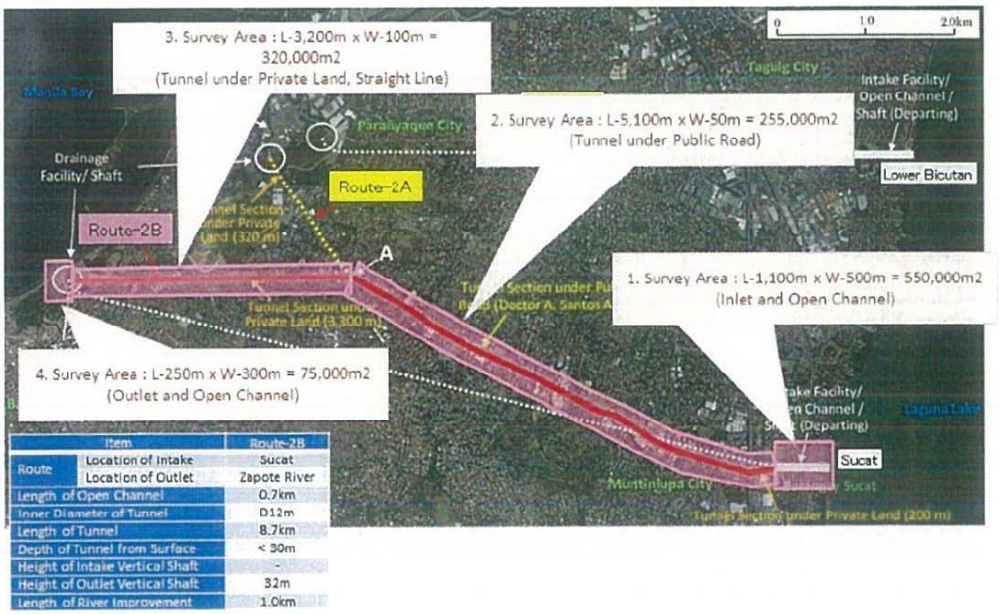
2. LIDAR TOPOGRAPHIC SURVEY AND MAPPING

2.1 Objectives

The objectives of the LiDAR Topographic Survey and Mapping utilizing unmanned airborne platforms are to clarify the contours along the proposed Route 2B of the Paranaque Spillway and the alignment and ROW boundary of the Dr. Santos A. Avenue.

2.2 Target Areas

The target areas of the LiDAR Topographic Survey and Mapping are located along the proposed Route 2B of the Paranaque Spillway, as shown in the figure.



Item		Route-2B
Route	Location of Intake	Sucat
	Location of Outlet	Zapote River
Length of Open Channel		0.7km
Inner Diameter of Tunnel		D12m
Length of Tunnel		8.7km
Depth of Tunnel from Surface		< 30m
Height of Intake Vertical Shaft		-
Height of Outlet Vertical Shaft		32m
Length of River Improvement		1.0km

Fig. 2.1 Target Areas of LiDAR Topographic Survey and Mapping

3. SCOPE OF WORKS

The Consultant will be responsible for executing the LiDAR Topographic Survey and Mapping for areas with a total of 120 hectares.

Details are shown as follows:

1. Survey Area: L-1,100m x W-500m = 550,000m^2 (55 has.) to design the Inlet and Open Channel of the Paranaque Spillway, 1-meter contour, 1:200 scale.
2. Survey Area: L-5,100m x W-50m = 255,000m^2 (25.5 has.) to design the Paranaque Spillway (Underground Tunnel) under a public road (Doctor A. Santos Avenue), 1-meter contour, 1:200 scale; necessary for clarifying the public area (ROW) to fix the alignment of underground tunnel.

3. Survey Area : L-3,200m x W-100m = 320,000m^2 (32 has.) to design the Paranaque Spillway (Underground Tunnel) under private lands, straight line, 1-meter contour, 1:200 scale; necessary for clarifying the private area and number of houses to fix the alignment (straight line) of underground tunnel.

4. Survey Area: L-250m x W-300m = 75,000m^2 (7.5 has.) to design the Outlet and Open Channel, 1-meter contour, 1:200 scale.

4. PROJECT DURATION

The Consultant shall commence the works immediately after the signing of the Contract and shall be completed after two-and-a-half (2.5) calendar months. A proposed time schedule, similar to Table 4.1, shall be submitted one week after the commencement of the work.

Table 4.1 Contract Period

Description	June, 2020	July	August
(1) Field Reconnaissance and Processing Control Point			
(2) Aerial LiDAR Surveying			
(3) Processing of Point Data			
(4) Mapping			
(5) Check and Finalizing			
(6) Submission			Draft Final Results ▼ Final Results ▼

5. OUTPUTS AND DELIVERABLES

The following shall be submitted by the Consultant at the end of the survey works:

- 2 printed copies of the Survey Report, which shall include but is not limited to the following:
    - Photos, location map, control point network diagram
    - General information (purpose, area, period, limits, etc.)
    - Mapping information (origin coordinates, projection, scale factor, etc.)
    - Results (coordinates table, accuracy table, calculation sheets, etc.)
    - Code legend for topographic survey and layer legend for the digital map
    - Instrument calibration certificates for the GNSS, total stations, leveling instruments, etc.
    - CAAP certificates/licenses (i.e., Operator, Controller, Aircraft Unit)
    - NAMRIA control point certificates
    - Copies of permits to conduct the survey as secured from CAAP, DND, LGUs and other related agencies

- Descriptions of newly established control points, with 3 photos: Distant range and middle range photos shall be taken with conspicuous and remarkable landmarks, topographic features such as houses, structures, big trees, hills, creaks, etc. as a background; while short range photos shall be clear enough such that the conditions and inscriptions of the points must be seen.
- 3D topographic map (scale 1:200) showing the planimetric features and contour lines at 1-meter interval

- 2 digital copies of the following:
  - Survey Report (Microsoft Word format)
  - 3D topographic map (1:200 scale) showing the planimetric features and contour lines at 1-meter interval (DWG and SHP formats)
  - Processed/classified Point Cloud data (LAS format)
  - DTM / DSM (TIFF format)
  - Digital Orthophotos (ECW format)
  - Raw/unprocessed images used to produce the Digital Orthophotos
  - Raw/unprocessed Point Cloud data (LAS format)
  - Raw data of ground surveys (e.g., data downloaded from instruments, scanned fieldsheets, etc.)

6. QUALIFICATION OF THE CONSULTANT

6.1 Credentials and Experience

The Consultant can be a registered private firm, academic institution, NGO or a related consortium with proven credentials and with requisite qualified and experience personnel.

6.2 Team Composition

The Consultant shall be composed of, but not limited to, the following:

Team Leader

He/she must have a bachelor's degree in any engineering discipline with 5 years of experience that is related to the project. He/she shall be responsible for the quality and the timely submission of the survey outputs.

Geodetic Engineer

He/she must have a bachelor's degree in Geodetic Engineering with 5 years of experience that is related to the project.

7. OTHERS

7.1 General Requirement

The Consultant shall exercise great care during the progress of the survey works to avoid any accident and will be responsible for any faults during the project. Accordingly, no claims will be accepted by the Consultant . The Consultant shall acquire all permits or licenses required for the project from appropriate government or private agencies at his own expense.

7.2 Equipment, Material and Labor

All equipment, transportation vehicles, site office, per diem/allowance, materials and labor required for all the above-mentioned works shall be provided by the Consultant . Those costs shall be included in the cost estimate.

7.3 Insurance

The Consultant shall at his expense purchase accident and injury insurance for experts and shall keep the Survey Team free from any claims for the compensation of any accident and/or injury that occurs.

7.4 Tax and Related Charges

All taxes, levies, deductions, charges fees, and similar assessments imposed, assessed, levied, or collected by the Services, or any sub-divisions thereof or any taxing authority therein, upon the Consultant and his staff shall be paid and/or borne by the Consultant .

7.5 Change in Scope of Work

The scope of the Work may be changed if deemed extremely necessary after the discussions during the progress of the project. Additional payment shall be made only for major changes in the scope of works; any such amendments and modifications in the scope of work, task description and work item details and therefore the corresponding change in cost as a result thereof shall be covered by a Supplemental Contract upon mutual agreement between the Survey Team and the Consultant .

8. TECHNICAL SPECIFICATIONS

8.1 Survey Standards

Unless specified, all standards and criteria for all the survey works shall be consistent with the DPWH Design Guidelines, Criteria and Standards (DGCS) 2015, Volume 2B: Engineering Surveys.

8.2 Coordinate System and Datum Level

The coordinate system shall be based on the Philippine Plane Coordinate System (PPCS) – PRS92, the characteristics of which are shown in Table 6.1.

Table 6.1 Philippine Plane Coordinate System (PPCS) – PRS92

Ellipsoid	Clarke's Ellipsoid of 1866	
Projection	Transverse Mercator, in zones of two degrees net width	
Point of origin	Intersection of the equator and the central meridian of each zone, with a northing of 0m and an easting of 500,000 m.	
Scale factor at central meridian	0.99995	
Extents of zones		
Zone	**Central Meridian**	**Limits**
I	117° E	116° 00' to 118° 30'
II	119° E	117° 30' to 120° 30'
III	121° E	119° 30' to 122° 30'
IV	123° E	121° 30' to 124° 30'
V	125° E	123° 30' to 127° 00'

All elevations shall be based on the Manila Bay mean sea level. GNSS-obtained ellipsoidal heights shall be converted to orthometric heights using the latest Philippine Geoid Model published by NAMRIA.

8.3 Installation of Control Points

While the coordinates from the LiDAR-equipped unmanned aircrafts shall be determined by PPK and/or RTK technology, it may be necessary to install control points should there be a need to conduct ground surveys in areas which LiDAR cannot penetrate (e.g., water bodies). In such cases, the points shall be established, defined, and marked on the ground by monuments of permanent nature. The fabrication, marking, and interval requirements of the control monuments shall be consistent with the DPWH DGCS.

8.3 Horizontal and Vertical Control Surveys

Horizontal control surveys shall be conducted using static GNSS, closed-loop traverse using total stations, or a combination thereof. Vertical control surveys meanwhile shall be conducted by direct leveling (using digital levels). The accuracy standards shall be in the Third Order.

8.4 Aerial LiDAR Survey

Aerial LiDAR survey complemented with aerial photography shall be carried out for the target area. Enough width shall be captured for final output to produce a three-dimensional topographic map from the orthophoto, DTM and DSM of the target area.

The Consultant shall use a LiDAR scanner attached to an unmanned aircraft or rotorcraft. The unit must be RTK and/or PPK-compatible and must be equipped with an IMU and other associated control units, and a camera with a resolution of 36 megapixels, or better.

The outputs shall have the following specifications:

- Ground sample distance <= 2.5 cm
- Vertical RMSE (for flat ground) <= 10 cm
- Horizontal RMSE <= 3.5 cm
- Bands: RGB (three-band natural color imagery)
- Radiometric resolution: minimum of 8 bit per band, in accordance with chosen image format
- Cloud free with minimal smoke, smog, fog and dust

8.3 Checkpoints

Checkpoints shall be used to independently assess the accuracy of the survey works. The Consultant shall not, in any way, utilize the points during the processing of the LiDAR data and the aerial photographs to calibrate and improve the accuracies.

Checkpoints may be installed using nails, paints, or any similar markers to facilitate identification. The Consultant shall ensure that the points are clearly recognizable in the aerial photographs (both raw and processed), must be placed in secured locations to guarantee recovery, and must be well-distributed throughout the target area. Their coordinates may be determined using RTK receivers, with the necessary adjustments on the vertical datum properly implemented.

The Consultant may also opt to use existing or newly established control points as checkpoints, provided that these were not utilized as base stations in the processing of the PPK or RTK data.

8.3 Ground Survey

Unless the Consultant has an available water-penetrating LiDAR equipment which can satisfy the required specifications of the outputs, ground survey shall be conducted to determine the underwater terrain.

Total stations and/or GNSS receivers may be used for shallow waters. Backsights for the total station surveys and datum point check for GNSS surveys shall be carried out at appropriate intervals to confirm the stability of the equipment and for the adjustment of ellipsoid and geoid difference.

For areas which can be accessed by boats, the Consultant may use a GNSS-equipped echosounder. Calibrations, such as those related to the speed of sound in water, shall be performed accordingly.

8.3 Office Works

All field observation data shall be submitted in electronic and printed formats, as applicable, as part of the project deliverables. All survey results shall be properly arranged, with brief notes and necessary corrections indicated.

The sheet size of drawings will be in A3 with the texts and other notations unquestionably legible. The title blocks shall be proposed by the Contract and approved by the Client. All control points as well as natural and artificial features, shall be shown and properly labeled on the map. Contours shall be shown at one-meter intervals. Spot elevations shall also be indicated.

Newly established control points shall be documented.

ANNEX-B

Bill of Quantities
For the LiDAR Topographic Survey and Mapping
under
Follow-up Study on Paranaque Spillway

No.	Description	Unit	Quantity	Unit Price (PHP)	Price (PHP)
1	Mobilization and Demobilization	L.S.	1	156,000	156,000
2	Control Point Survey and Installation	LS.	1	234,000	234,000
3	Acquisition of LiDAR Data	has.	120	5,250	630,000
4	Ground survey	has.	3.3	104,000	343,200
5	Checkpoint Survey and Installation	pts.	30	2,600	78,000
6	Data/Feature Extraction, Calculation, Arrangement, Mapping, Reporting	L.S.	1	448,500	448,500
Sub-Tota l		-	-	-	1,889,700
VAT (12%)		-	-	-	226,764
Total		-	-	-	**2,116,464**

AMENDMENT OF

CONTRACT AGREEMENT

FOR

LIDAR TOPOGRAPHIC SURVEY AND MAPPING

UNDER

FOLLOW-UP STUDY ON PARANAQUE SPILLWAY

BETWEEN

JICA Study Team

AND

Aero 360 Solutions, Inc.

This Amendment of Contract Agreement (hereinafter called "the amendment") is to revise the Contract Agreement (hereinafter called "the agreement") exchanged on this 25th day of June, 2020 in Manila, between the CTI ENGINEERING INTERNATIONAL CO., LTD. (CTII), representative Mr. Takahiro MISHINA, Team Leader of JICA Study Team having its head office at Tachibana Annex Building, 2-25-14 Kameido, Koto-ku, Tokyo, Japan (hereinafter referred to as the "Client") of the one part, and AERO 360 SOLUTIONS, INC., representative MARK VINCENT B. VILLAFLOR, CEO/President having its office at 8 F. Pasco Ave, Santolan, Pasig, Philippines (hereinafter referred to as the "Contractor") of the other part. The time schedule were revised in the amendment.

In the Article 4. "Work Period" in the agreement, the original agreement says;

"The Services shall be completed by 75th day reckoned from the date of signing of this agreement."

This Article was revised as;

"The Services shall be completed by 93th day reckoned from the date of signing of this agreement."

This is the end of the revision of the agreement.

Date: September 4, 2020

The Client	The Contractor
三品孝洋	
Takahiro MISHINA Team Leader CTI Engineering International Co., Ltd.	Mark Vincent B. Villaflor CEO/ President Aero 360 Solutions, Inc.