

GEODETIC ENGINEERS OF THE PHILIPPINES REGIONAL DIVISION III 45th ANNUAL REGIONAL CONVENTION

Land Sector Modernization Cadastral Survey Records Reconstruction (LandS Mode: CadSRR)

D.L.M. Bool, V.L.DL. Azucena, L.P. Balicanta & J.L.D. Fabila

Deane Leonard M. Bool

Research Associate Training Center for Applied Geodesy and Photogrammetry University of the Philippines dmbool@up.edu.ph



GeoSurvLAV





GEP R3 – 45TH ANNUAL REGIONAL CONVENTION

LandS Mode







CADSRR: Objectives



- Come up with processes and methodologies in the Cadastral data reconstruction activities
- Use GIS-Based software in handling and processing lot data

CADSRR: REx

NAIROBI City LIS (Kenya)

- QGIS was employed to process data and create the digital map.
- Output were stored into a database created using PostgreSQL and PostGIS. The database provides tools for data updating and visualization.
- The system contained information on parcel ownership, land use, taxation, location boundary, land value, encumbrance, etc.

CADSRR: REx

Cadastral Survey Reconstruction (Kosovo)

- The graphical cadastral data was compared with the alpha-numeric data in relation to the presence or completeness of the documents based on the:
 - No. of parcels in the graphical evidences
 - No. of parcels in the textual evidences
 - No. of parcels that are not recorded or documented in the registries (but exists in the locality).
- The georeferencing and vectorization of scanned cadastral maps were done using a GIS software.

CADSRR: REx

National Land Records Modernization Programme (India)

- Includes automation/resurvey of cadastral maps using modern cadastral techniques.
- Land records data are available as (a) textual data, and (b) spatial data (cadastral maps).
- Existing paper maps converted into GIS-ready digital format and then integrated with corresponding textual data.
- Cadastral Survey/Resurvey were carried out using modern surveying technologies namely GPS/ETS, high-resolution satellite imagery and aerial photogrammetric approach depending up land terrain and existing map.

CADSRR: Methodology

- Familiarize and review the current practices in the survey records reconstruction of the selected Regional Offices.
- DENR Regional Offices: III, NCR, CALABARZON & MIMAROPA

Consultation with LMB-LAMS

RECONSTRUCTION ACTIVITIES PER REGION							
	Ш	NCR					
Data	Bearing-distance data, Coordinates	Bearing-distance data, Coordinates, Cadastral and Projection Maps	Coordinates from LMB and Private GEs	Bearing-distance data, Coordinates of Cadastral Lots			
Encoding/Plotting	Excel \rightarrow AutoCAD	AutoCAD	AutoCAD	AutoCAD (GE Survey)			
Error of Closure	Adjustments with the aid of Excel	Graphical Adjustment (allowable area difference must not exceed 1m ² /ha)	-	Graphical Adjustment (allowable linear error of closure must not exceed 0.01m)			
Edge Matching	Area Solver, TD Matcher Adjustments in Excel	Adjustments in Manifold (CMs, PMs and DCDB as basis)	-	Adjustments in AutoCAD (Approved isolated surveys as basis)			

Disclaimer: Data was collected during the months of March, April and May of 2018

RECONSTRUCTION ACTIVITIES PER REGION							
	III CALABARZON MIMAROPA			III CALABARZON MIMAROPA		NCR	
	Systematic way of reconstructing lots	Fast-paced work for reconstruction of lots	Local GEs providing	Old Cadastral Maps contain distances and bearings for lot lines			
Strengths	Always aim to return the same technical description with respect to its source	Utilizes Manifold for observation of Cadastral Maps overlaid by the lot data	them with data containing coordinates	Use of database for linkage of reconstructed lots			
Weakness	Tedious and lengthy procedure	Technical description does not always match from its sources	Reconstruction is still limited to data obtained from Lot Data Computation Sheets	Limited data			

Disclaimer: Data was collected during the months of March, April and May of 2018

CADSRR: GIS Based Solutions

Coordinate Data (Lot Data Computation Sheet)

Bearing-Distance Data (Technical Description)

NAM IDENSIGNATION FOR

Scanned Maps (Cadastral Maps, Projection Maps, etc.)

CADSRR: GIS Based Solutions

-H

Scanned Maps

How does the "digitized maps" fare against the reconstructed lots from TD/LDCS? Layers of shapefiles

CADSRR: Analysis GEOREFERENCING

Points	Lot Data Computation Sheet					
i onito	N	E				
BBM2	1476608.930	589882.670				
BBM4	1477033.020	589745.120				
293-c1	1477206.530	589882.110				
276-c1	1477110.590	590193.910				
236-c2	1477299.590	589495.710				
258-c5	1476744.990	589844.570				
379-c3	1477165.700	590076.940				
289-c7	1477176.440	589886.520				
270-c12	1477034.490	590081.490				
271-c2	1476889.370	589793.880				
238-c5	1476471.52	589469.42				

Analysis of Georeferencing Techniques available in QGIS

Transformation Model	Po	Error < 1 m		
	Highest Value	Lowest Value	Mean	
HELMERT	5.912	0.255	2.374	10
LINEAR	4.775	0.092	1.321	62
1ST POLYNOMIAL	4.693	0.082	0.795	84

Analysis of Georeferencing Techniques available in QGIS

CADSRR: Analysis DIGITIZATION

Area	Gasan, Marinduque	Manila
lmages Provider	DENR-R4B	DENR-NCR
No. of Images	3	2
No. of Features	128 Features	266 Features
Scale	1:1000 and 1:2000	1:500

Accuracy check of Digitized Lots from Cadastral Maps

CADSRR: Analysis

DIGITIZATION Accuracy check of Digitized Lots from Cadastral Maps

Table for the Digitized Features in Gasan Cadastre

% Error Range Frequency						
0.00%	-	0.01%	1			
< 0.01%	-	0.05%	1			
< 0.05%	-	0.10%	2			
< 0.10%	-	0.25%	8			
< 0.25%	-	0.50%	12			
< 0.50%	-	1.00%	23			
< 1.00%	-	2.50%	30			
< 2.50%	-	3.00%	8			
< 3.00%	-	3.50%	10			
< 3.50%	-	4.00%	4			
< 4.00%	-	4.50%	4			
< 4.50%	-	5.00%	3			
< 5.00%	-	7.50%	11			
< 7.50%	-	10.00%	7			
<10.00%	-	12.50%	0			
<12.50%	-	15.00%	1			
<15.00%	-	17.50%	2			
<17.50%	-	100.00%	0			

- As per DAO 2007-29, the 1 square meter per 1 hectare error corresponds to 0.01% error.
- 2 out of 128 lots near the allowable error.
- Average of 2.69% for 1:1000 and 1:2000
 Scaled Cadastral Maps

*Comparison of error is between the computed area per reference system and the declared area **Although some lots' declared area were changed to their computed area from the coordinates of the lot

CADSRR: GIS Based Solutions

DIGITIZATION Accuracy check of Digitized Lots from Cadastral Maps

Table for the Digitized Features in San Lazaro Estate

° E		2222	Enomionau
9 ELT	OL R	ange	requency
0.00%	-	0.01%	1
< 0.01%	-	0.05%	8
< 0.05%	-	0.10%	5
< 0.10%	-	0.25%	23
< 0.25%	-	0.50%	31
< 0.50%	-	1.00%	69
< 1.00%	-	2.50%	100
< 2.50%	-	3.00%	10
< 3.00%	-	3.50%	10
< 3.50%	-	4.00%	3
< 4.00%	-	4.50%	2
< 4.50%	-	5.00%	2
< 5.00%	-	7.50%	1
< 7.50%	-	10.00%	0
<10.00%	-	12.50%	0
<12.50%	-	15.00%	0
<15.00%	-	17.50%	1
<17.50%	-	100.00%	0

- As per DAO 2007-29, the 1 square meter per 1 hectare error corresponds to 0.01% error.
- 9 out of 266 lots to be near the allowable error.
- With an average of 1.28% for 1:500
 Scaled Cadastral Map

Although, Manila Cadastre has no LDCS, areas are indicated on the Cadastral Map, therefore, comparison was still provided.

*Comparison of error is between the computed area per reference system and the declared area **Although some lots' declared area were changed to their computed area from the coordinates of the lot

- Data Templates
- GIS Procedures in Reconstruction
- Plugins
- Training Modules

Data Templates

- Regional offices encode two kinds of textual data as part of their survey reconstruction activities
 - coordinates from lot data computation sheets
 - bearing-distance data from technical descriptions
- Developed two spreadsheet templates for these data which can also perform accuracy checks.
 - Bearing-Distance Template
 - Coordinates Template

Data Templates: Bearing-Distance

- If the Linear Error of Closure is greater than the user-defined tolerance, an error message will appear and corrections should be done to close the lot.
- The template will produce a new technical description with adjusted values and also some suggested corrections in the directions.

Data Templates: Coordinates

 This template is from the lot data computation used by the DENR Regional Offices, which is an input for one of the plugins

	A	В	С	D	E	М	R	S	Т	U	V	AA	AB A	C AM	AN	AO	AP	AQ
1	LOT DATA	co	MPUTATION	1														
2	INSTRUCTIONS																	
3																		
4	1 Enter required c	lata	in the vellow colore	d calle														
6	2. Compare dealer		in the year colore	area far arrar abaal	ina													
6	 Compare decial 	eu a	rea with computed	area for error criece	ung.													
7	Lot No	=	37	20														
8	Owner	=	Salazar	Gregorio														
9	Cad Survey No.	=	CAD-44	8-D C-1														
10	CM Quadrangle	=	13-15 N	121-49 E														
11	Barrio	=	Mas	iga														
12	Mun / City	=	Gas	san														
13	Province	=	Marino	duque														
14	Island	=	Marino	duque														
15	Geodetic Engr.	=	Almar Sur	veying Co														
16	Date Surveyed	=	4/25/	1972														
17	Surv. Sym. & No.	=	CAD-44	8-D C-1														
18	L.R.C. No.	=																
19	Declared Area	=	3598	8.43														
20																		
21	TIE POINT DATA:	-	1 170 705 100															
22	BLLM 1	=	1,4/3,/35.420	N														
23			391,390.030	C														
24	NO OF CODNEDS		5															
25	NO.OF CORNERS		,															
27	ERROR CHECKIN	G-																
28	DOUBLE AREA		2 043 99															
29	AREA		1021,99615															
30																		
31	ACCURACY STAN	DAF	RDS:															
32	L.E.C.		0.002451267															
33	R.E.C.		67,862															
34	ACC		1:68000															
36																		
37																		
38	STATIONS	\square	COORD	INATES		TE	CHNICA	L DESCRI	PTION		REMARKS	LAT	DEP	AR	A COMPUT	ATION	For Plotting	
39			NORTHINGS	EASTINGS	DIS	TANCES		BEAR	NGS			0.00		LINE	DMD	DPA	-	
40	PU M 4		1 472 725 400	501 500 050	1	4007 77	N/S	DEG	MIN	E/W	area diaranar	2742.00	1511.00	PLLM 4	1		200	
41	DLLM I		1,473,735,420	591,590,850		4007.77	N	40	09	VV E	area dicrepañcy	21.70	26.52	0LLIVI 1	21.60	1 157 64	520	7447.62
42	2		1 477 479 310	590,000.200		40.30	N	45	46	F		5.98	18 15	2.3	-51.09	1,157.04	590116 81 147	7479 31
44	3		1 477 485 290	590 134 960		2 63	S	41	-+0	F		-1.96	1 76	3-4	-73.38	129 15	590134 96 147	7485 29
45	4		1 477 483 330	590 136 720		73.38	S	39	41	w		-56.47	-46.86	4 - 5	-14 95	-700 56	590136 72 147	7483 33
46	5		1 477 426 860	590 089 860		22.86	N	24	46	w		20.76	-9.58	5 - 1	20.76	198 88	590089 86 147	7426 86
F	4 32	0	321 322	323 324	325	326	327	328	329 3	330	331 332	333	334 3	35 33	6 337	338	339 340	341 3

GIS Procedures in Reconstruction: Filling Shapefile

Manual on filling a missing feature on a shapefile using built-in tools in QGIS.

GIS Procedures in Reconstruction: Filling Shapefile

- Disclaimer:
 - There should be **no gaps** in between adjoining features, unless, it is the missing lot.
 - The filled lot is the cluster of the missing lots. If identified to be one missing lot, the filled lot is the missing lot.

Developed Plugins

- Cadastral Plot Plugin
- TD Generator Plugin
- Lot Raster Clipper

Plugin: Cadastral Plot

💋 Cadastral Plot		? X
Select Input File		
]
O Technical Description		
Coordinates		
Select PTM Zone	Zone I	-
Select Output File		
]]
	ОК	Cancel

Plugins: Cadastral Plot

 CadastralPlot is a QGIS plugin that plots cadastral data (technical descriptions and lot data computation) into a shapefile. Accepts spreadsheet files (.xls/.xlsx) with specialized format.

Plugins: Cadastral Plot

 The output shapefile of this plugin has the capacity to store the geographic location, shape, and other associated attributes of the lot such as lot number, claimant, area, date surveyed, GE who performed the survey, barangay, province, etc.

Plugins: TD Generator

🕺 TD Generator	
Select Digitized Layer	
	▼ ◯ Digitized ◯ Records
Only Selected Features	
Output Information	
Chief of Surveys and Mapping Division	e.g. Juan Dela Cruz
Prepared for	e.g. Juan Dela Cruz
Survey Number	Cad-####
Cadastre Name	Area Cadastre
Select Output File	
	OK Cancel

Plugins: TD Generator

2 TD Generator	🕺 TD Generator
Select Digitized Layer	Select Digitized Layer Lot_Zone3 Digitized Constraints Records X Only Selected Features
Output Information Chief of Surveys and Mapping Division Prepared for Survey Number Cadastre Name	Output Information Chief of Surveys and Mapping Division Engr. Juan Dela Cruz e.g. Juan Dela Cruz Prepared for Land Management Bureau e.g. Juan Dela Cruz Survey Number Cad-448 Cad-#####
Select Output File	Cadastre Name Gasan Cadastre Area Cadastre Select Output File C:/Deane/TD_GENERATOR/GasanFeatures_LDCS_Selected.xlsx OK Cancel

This plugin aims **to extract lot data computation sheets from shapefiles** of lot polygons, whether they are digitized data or recorded data. Some details needed for the LDCS are input in the plugin.

Plugins: TD Generator

LMB F	orm ######				Sheet	1/1
			COMPU	MANTON CHER	m	
		LOT DATA	COMPO	TATION SHEE	T	
Lot No	D.	228			Location:	GASAN, MARINDUQU
Owner		VITTO, CRIS	ANTO			Е
Area.		867.57 sq.	m.	Geod	letic Engr:	ALMAR SURVEYING
Surve	y Number	CAD-448-D C	-1			co
Point	Northings	Eastings	Line	Bearing	Distance	Adjoining Lot
R.P.	1,473,735.420	591,590.850				_
			R.P1	N 42d04'W	4,355.39 m	
1	1,476,968.680	588,672.720				
			1-2	N 01d06' E	6.81 m	229
2	1,476,975.490	588,672.850				
			2-3	S 89d55' E	63.41 m	227
3	1,476,975.400	588,736.260				
			3-4	S 00d13' E	5.45 m	227
4	1,476,969.950	588,736.280				
			4-5	S 89d46' E	59.95 m	227
5	1,476,969.710	588,796.230				
			5-6	S 06d04' E	4.25 m	238
6	1,476,965.480	588,796.680				
			6-7	S 89d38' W	104.74 m	230
7	1,476,964.820	588,691.940				
			7-8	N 20d33' E	3.84 m	230
8	1,476,968.420	588,693.290				
			8-1	N 89d17'W	20.57 m	230
1	1,476,968.680	588,672.720				

			8-1	N 89d17'W	20.57 m	230
1	1,476,968.680	588,672.720				
Date E	Prepared	10-29-2018				
Prepar	red for	LMB				
Refere	ence System	PTM Zone II	I			
	_					
		CE	RTIFIC	CATION		
	I hereby cer	tify to the	correc	ctness of th	nis recons	tructed
	lot data co	mputation ba	ased o	n available	data gath	ered.
				FNGP .	TIAN DETA	רווס
			Chi	of Curvous	and Manni	ng Division
			CIII	er, surveys	апа наррі	IIG DIVISION

Plugins: TD Generator

LMB Fo	orm ######				Sheet	1/1		
LOT DATA COMPUTATION SHEET								
Lot No	o.	228			Location:	GASAN, MARINDUQU		
Owner		VITTO, CRIS	ANTO			E		
Area.		867.57 sq.	m.	Geod	letic Engr:	ALMAR SURVEYING		
Survey	y Number	CAD-448-D C	-1			CO		
Point	Northings	Eastings	Line	Bearing	Distance	Adjoining Lot		
R.P.	1,473,735.420	591,590.850						
			R.P1	N 42d04' W	4,355.39 m			
1	1,476,968.680	588,672.720						
			1-2	N 01d06' E	6.81 m	229		
2	1,476,975.490	588,672.850						
			2-3	S 89d55' E	63.41 m	227		
3	1,476,975.400	588,736.260						
			3-4	S 00d13' E	5.45 m	227		
4	1,476,969.950	588,736.280						
			4-5	S 89d46' E	59.95 m	227		
5	1,476,969.710	588,796.230						
			5-6	S 06d04' E	4.25 m	238		
6	1,476,965.480	588,796.680						
			6-7	S 89d38'W	104.74 m	230		
7	1,476,964.820	588,691.940						
			7-8	N 20d33' E	3.84 m	230		
8	1,476,968.420	588,693.290						
			8-1	N 89d17'W	20.57 m	230		
1	1,476,968.680	588,672.720						

Image shows the adjoining feature for each line if existent in the shapefile

238

Plugins: Lot Raster Clipper

💋 Lot Raster Clipper	2 ×
Raster Folder	
Vector Layer	
Buffer Distance (meters)	0.00
Output Folder Path	
ОК	Cancel

CADSRR: Outputs Plugins: Lot Raster Clipper

🕺 Lot Raster Clipper	? ×
Raster Folder	
]
Vector Layer	
]
Buffer Distance (meters)	0.00
Output Folder Path	
]
ОК	Cancel

Plugin for **buffering** multiple features in a single **shapefile**, and **clipping** from **multiple raster data** (DEM, DSM, Orthophotos) obtained from 3D Cadastre.

CADSRR: Outputs Plugins: Lot Raster Clipper

CADSRR: Outputs **Plugins: Lot Raster Clipper**

Features buffered by 5 meters

Module 1: QGIS Plugin System

One of the advantage of QGIS from other GIS software is the active community who support it. QGIS offers a library of useful features called plugins. The plugins are created by QGIS developers and other independent users who want to extend the functionality of the software. These extensions are free and available for all users.

Training Modules

Objective

This module covers the basics which includes downloading, installing, and activating plugins. After this module, users will be familiarized with the QGIS plugin system, specifically on how to use the QGIS Plugin Installer and Plugin Manager tool. Users will also learn how to locate the plugin from the QGIS menu once they are installed.

Managing Plugins

There are two kinds of QGIS plugins, "Core Plugins" and "External Plugins". Core plugins are already part of the standard QGIS installation. To use these, users only need to enable it. On the other hand, external plugins must be installed prior to use. These are available in the QGIS Plugins Repository. An easy way to browse and install these plugins is by using the Plugin Manager tool.

Enabling Core Plugins

1. Open QGIS. To open the Plugin Manager, click on Plugins → Manage and Install Plugins.

42

GEP R3 – 45TH ANNUAL REGIONAL CONVENTION

for clues. Here the description says Category Raster. That indicates that the plugin would be found under the Raster menu once enabled.

Training Modules

Module 2. Georeferencing and Digitizing in QGIS

2.1 Georeferencing a Map

Updating the information of a land area is a fairly common task in land management. Analog collection of data, some of which dating several years back, necessitates the shift to digitization of the inventory data.

For instance, users would typically use the information in GIS to compare with later inventories. Thus, the information at hand must be first digitized using the GIS software. However, before the digitization procedure, an important first step must be done – scanning and <u>georeferencing</u> the paper map.

Objective

The goal for this section is for the user to learn how to operate the Georeferencer tool in QGIS.

Scan the map

The first task in georeficiencing is scanning the map. Large maps can be scanned in different parts. Note however, that users need to repeat preprocessing and georeficiencing tasks for each part. Thus, it is recommended to scan the map in as few parts as possible.

Users may use their own maps for the purposes of this manual. Scan the map as an image file with a resolution of at least 300 DPI. For colored maps, scan the image in color for additional information. Color shades in the inventory maps can be used to separate information into different layers (e.g. forest stands, contour lines, roads).

For this module, users may use a previously scanned map, titled sample_map.if and located in the data folder module2_data/georeferencing,

Georeferencing the scanned map

- Open QGIS. The project's CRS must be set to PRS92 in Project → Project Properties → CRS. Note that PRS92 is the CRS currently used in the Philippines.
- Save the QGIS project as map_digitizing.qgs. Since we will be working on data with another CRS, confirm if Enable 'on the fly' CRS transformation is checked.

 The georeferencing plugin from QGIS will be used. Recall that it is already installed in QGIS. Using the plugin manager, activate the plugin similar to the steps in the previous module. The plugin name is <u>Georeference</u>, GDAL.

4. To georeference the map:

- Launch the georeference tool, Raster → Georeferencer, → Georeferencer.
- Add the map image file, sample_map.tif, as the image to georeference, File → Open raster.
- Find and select the Luzon 1911/Philippines zone III CRS when prompted. This is the CRS that was
 used in 1973 when this map was created.
- Click OK.

5. Next, define the transformation settings for georeferencing:

- Open Settings → Transformation settings.
- Click the icon next to the Output raster box, go to the folder and create the folder training_output module2 and name the file as sample_georef.tif.
- Set the rest of parameters the same as below.
- Click OK.

ords 🛛 🖾 English (United States)

Training Modules

Symbology

English (United States)

Symbology, can be define as the visual appearance of a geographic information on the map. One of the core strength of GIS is its ability to represents data in many forms and styles.

To change a layer's symbology, right click on the layer \rightarrow Properties and select the Style tab.

- · Change the symbology of your digitization output into red dotted line with no fill.
- · Select Simple Fill. Set the of parameters the same as below

🔀 General	Single symbol	
Style	Simple fil	
🚥 Labels		L.J.
Fields		
🎸 Rendering	Symbol layer type	Simple fil
🧭 Display	Fil	
Actions	Outine	
	Fill style	•
• 🔫 Joins	Outine style Dot Line	•
🕅 Diagrams	Join style 🔗 Bevel	•
🍘 Metadata	Outline width 1.000000	🖾 🗘 Milmeter 💌
~	Offset X.Y 0.000000	Milmeter •
 Variables 	0.000000	٢
Legend	Layer transparency	
	Layer blending mode Normal	•
	Feature blending mode Normal	
	Draw effects	
	Control feature rendering order	
	Co.t.	
	acyte	Cancel Apply

In the current survey records reconstruction efforts of DENR-LMB, lots reconstructed through digitizing georeferenced maps are categorized as **non-survey data**.

Module 3. Cadastral Survey Records Reconstruction Application

ords

Training Modules

Lastly, select the destination folder of the output file. After running the plugin, the plot will appear in the QGIS Map View window.

Trans, output,	He Festare L	AR 112 Disease	D III MINONI	01										
110	0.411	TIOS	「おこの」	日間に作っ										
LICAN, DA	Canad	CHLIN	(Mguel	8407	8,07	PROF		a	0478,89	519,89	10,36,378	Ones		Over
120	REP OF THE R.	0048100	19-15 W 123-	MASEA	GASHIM	MARCUPS.	MARDOUDS.	ACMINE SCIENC.	24/94/28/2	10046000	- 10	13804.45	BUM 1	12804.An
258	BASA, XOSE	00489205	12-13 W 131-	MADEA	CASIN	and an other	WARRAND'S	ACREA TIME.	65/65/1872	OD-HE9CE	54	3448.58	BLM 1	34488.58
240	MADRONEL R.	0048901	19-19 8 121-	MAUEA	GALIN	sexaendra	NVR36UQ/8	ALMIR SURL.	65/95/1972	0048001	84	2125.04	BUM 1	2512.59
342	SHOP, HER	0048101	D-II & UD -	MALIKA	GASIN	MARCOQ.E.	W490024	APRICE STREET	61451972	0048001	14	1418.99	BUH 1	1418.91
384	HYEIA ERL	0048400	19-19 8 (21) -	MASSIA	GA3388	windon's	manood a	ALMIN SURG.	84/85/1972	0048901	NA.	2115.25	BUNI	1005.34
285	SEVELA, BST.,	0046900	12-15-1121-	MASEA	6434R	B-CODENIE	INVERSION IN	ADMIN SURG.	94/95/1972	0046001	56	8528.75	BUM1	8528.71
266	MADRONED, C.	00489000	12-13 W 131-	MASEA	GA3.84	MARKAGU P.R.	MARKARING R	ACMINE TURIE.	05/05/1072	OD-HE9CL	34	256.86	BUH L	278.54
247	10805081.8.	0040301	13-15 8 123	MALEA	GASHI	BARREN PAR	MARSEND/R	ADMIR SURV.	45/95/1972	0048001	34	294.80	BUH1	282.86
248	MADRONA, JO.	0040101	10-10-0-10-	MAIRA	GA33H	Indpologit	NUMBER	APRIL SURV.	45/95/1972	00448001	86	394.09	MUN 1	336.00
338	ROMIDAL -	0048100	19-18 9-101	MAURA	GA349	www.eoopa	MIRDOUQ.R	Almin Same	40,450,077	00480000	84	12794.04	MINT	12798.00
300	MADRONA, RL	00+6101	1915 W125-	MASSIA	64548	mannupa	MARNOUDA	AMM SURE.	05951972	00446001	. 64	245.20	mints	245.25
214	SEVELA, FET.,	0048925	(2-13 W (21)-	MADEA	GA3.84	NOVABOUD R	MARROUPA	ADM DUTL.	03/05/1872	0048901	34	\$726.57	BUM 5	\$725.54
375	SAND PACETY	0040000	13-13-8 121-	MALEA	GASHIE.	NVX80UQ/E	MARGEOUD/R	ADMIR SURV.	45/85/1972	0046001	84	293234	BUM 1	2042.34
116	RES. 3348	0048101	0.04810	MAREA	GASIN	and period.	MIDDUDE	ANR SHE	49450972	00448001	34	2438.09	MUN1	2428.M
277	MAG, ROMAL	0048401	1913.9101-	MAURA	GAMIN	www.eoup.e	www.euga	ALMIA SURG.	85/85/1972	00480001	84	917.09	miH1	without .
119	SEMI, MINIA.,	0046101	10159121-	MASEA	64548	minhoups.	MANUTA	ALMINE SUPEL.	01/05/1972	004469.01	.94	963.67	BUM1	898.34
363	14CZ, 191340	0048405	19-13 W [21]-	MASEA	GA3.66	MARGIQ.E	MARROUP/R	ALMOST TURN.	04/05/1872	0048901	34	796.01	man s.	7968.84
204	LEON ANDA.	0048405	13-15 8 123	MASEA	GADIN	NURSEUQUE	NUCCESSION IN	ACREM SURV.	04/05/1972	00489055	84	4034.82	BLM 1	4234.82
306	OLDING AND	0040101	12-13-6121-	MATERA	GASIN	materia.	MARRINGA	ANR SIRK.	25/44/1972	0048001	M	34071.82	MUN 1	24075.65
287	VARIABLE .	0048401	19189101-	MALIKA	GAMIN	INVADOUR.	MARDOUR.	ADDA SURG.	25/14/2072	00480055	84	341237	MUN 1	2402.87
388	SIL SMIN	00+6101	19-15 9-121-	MASEA	64348	MARKING MARK	manoupd	ADDRESS STREET	25/14/2472	004469.01	.54	4967.54	MUM 1	4962.53
388	PE, PRINCESCA		0.010	MADEA	GA346	INVADUQ.E	MARKING R	-	25/04/0872	0048901	34	01407.75	BUH 5	tjadOs
290	TELES, AMUEL	0040000	13-13 H 123-	MALEA	CAS/RR	NARBOURK	NARROUDA	ADRIR SURV.	25/04/2012	0048001	84	40214.80	BLM 1	40224.97
24	SIMELA AM.		10-13-10-10-	MASEA	CA3M	MARRING R	MIRONA	-	24/14/1972	0048001	84	3145.52	BUH 1	3045.54
280	MMELA CO.	0048401	19-18 9-101-	MALIEA	GAMB	8420024	INVESTIGATION	ALMIA SURV.	24/14/2872	00400000	84	3173.84	BUN 1	2071.44
285	SIMELA ANE.	0040101	19-15 9-10-	MASEA	G4546	manoups.	MANUDA	Alter Satura	24/14/2017	004489.01	.66	1150-49	BUM1	1100.40
204	SEMILA, NM.		19-19-10	MAUEA	GA3.66	MANDOOR	NAMOUNT	ALMIN TURL	25/04/1972	0048001	34	4134.38	BUM 5	6396.36
295	1433, FLD	0040000	13-13 H 133	MARIEA	CALME .	NAMED OF	NARSENDA	ALMER SURV.	2014/2012	0048000	10	374.20	BLM 1	3796.30
204	OLANS, CH.		0-04-00-	MACEA	0388	MARROOM.	MARRIDO	ANNE SURV.	25/44/1972	0048001	84	9425.67	man's	5425.47
207	MINELA PA.	0048101	19-18 W (2)-	MALEA	GAMM	****	101220003	-	25/54/2872	00489055	10	106.73	mint	1799.71
144	dates therein.	Call 400.0.0.0	short with	MACKING.	Cables	and belowing	mandanced	A Real Property	malamete	CH2.448.0.5.1		1442.07	mine a	LANT ST

Shapefile Format

CadastralPlot plugin converts the information inside the text file into a shapefile format. The shapefile format is consists of 3 primary files with the same name, but the following file extensions:

- shp.- contains the spatial information, namely, x, coordinate pairs which describes the point, line or polygon features contained in the file.
- b) .dbf contains the attribute information, or the descriptive characteristics of the features.
- c) shx links the shp and .dbf file. It matches up the correct row in the .shp file with the correct record in the .dbf file. The shapefile will not work properly without these 3 files.

The output shapefile of the plugin also contains a prj. gpj and gpg file. The prj and gpg contains the coordinate system and projection information. These file are necessary for correct positioning of data with respect to other spatial data, and for measuring and calculating distance. The gpg file is an optional plain text files that describes the encoding applied to create the shapefile.

ords

English (United States)

5

Cadastral Survey Reconstruction

The step and approach in reconstruction of records shall depend on the source data or records identified during the research process.

Condition	Numerical	Graphical (CM, PM)
Case 1	\checkmark	\checkmark
Case 2	\checkmark	-
Case 3	-	\checkmark

- The output can be categorized into 2: survey-accurate and non-surveyaccurate data.
- Survey Accurate reconstructed from numerical data
- Non-Survey Accurate extracted from maps

*CM – Cadastral Map *PM – Projection Map

Cadastral Survey Reconstruction

Case 1: Both Numerical and Graphical Data are available

 Numerical data will be used for reconstruction while graphical data will serve as basis for cleansing (identification and correction of erroneous, gaps and overlaps).

Condition	Recommendations
Error of Closure	• The maximum allowable error of closure is 2.50% of the area <i>(for reconstruction purposes only)</i> . Once the data of its adjoining lots becomes available, the lot can be reconstructed by extracting its corners from its surrounding lots .
Erroneous/Missing Tie Line Description	 Using adjoining lots. Overlaying a georeferenced map where the map will guide the translation of the displaced lot.

CADSRR: Recommendations Cadastral Survey Reconstruction

Table for the Digitized Features

Basis for 2.50%

Area	Gasan, Marinduque	Manila
Images Provider	DENR-R4B	DENR-NCR
No. of Images	3	2
No. of Features	128 Features	266 Features
Scale	1:1000 and 1:2000	1:500

in Gasan Cadastre								
<pre>% Error Range Frequency</pre>								
0.00%	-	0.01%	1					
< 0.01%	-	0.05%	1					
< 0.05%	-	0.10%	2					
< 0.10%	-	0.25%	8					
< 0.25%	-	0.50%	12					
< 0.50%	-	1.00%	23					
< 1.00%	-	2.50%	30					
< 2.50%	-	3.00%	8					
< 3.00%	-	3.50%	10					
< 3.50%	-	4.00%	4					
< 4.00%	-	4.50%	4					
< 4.50%	-	5.00%	3					
< 5.00%	-	7.50%	11					
< 7.50%	-	10.00%	7					
<10.00%	-	12.50%	0					
<12.50%	-	15.00%	1					
<15.00%	-	17.50%	2					
<17.50%	-	100.00%	0					

Table for the Digitized Features in San Lazaro Estate

8 Err	or F	lange	Frequency
0.00%	-	0.01%	1
< 0.01%	-	0.05%	8
< 0.05%	-	0.10%	5
< 0.10%	-	0.25%	23
< 0.25%	-	0.50%	31
< 0.50%	-	1.00%	69
< 1.00%	-	2.50%	100
< 2.50%	-	3.00%	10
< 3.00%	-	3.50%	10
< 3.50%	-	4.00%	3
< 4.00%	-	4.50%	2
< 4.50%	-	5.00%	2
< 5.00%	-	7.50%	1
< 7.50%	-	10.00%	0
<10.00%	-	12.50%	0
<12.50%	-	15.00%	0
<15.00%	-	17.50%	1
<17.50%	-	100.00%	0

Cadastral Survey Reconstruction

Case 2: Only Numerical Data are available

- For lots with missing or erroneous tie lie description, place it in a separate layer for cleansing.
- Cluster the lots by block and according to number to easily translate them all at once. Use **adjoining lots** for edge matching.

Cadastral Survey Reconstruction

Case 3: Only Graphical Data are available

- In case there are no numerical data present, georeferenced map can be digitized to extract lot data. These reconstructed lots will fall under the non-survey accurate category and will be stored in a separate layer.
- Digitized data cannot be used as substitute for re-survey and will only be used for the completion of DCDB.
- Digitized data will be connected to a reference point nearest to the lot cluster.
- Digitized data can be extracted from High Definition Orthophotos, where possible boundaries can be extracted.

Cadastral Survey Reconstruction

Case 3: Only Graphical Data are available

Condition	Recommendations
Georefencing	 Use the map corners as GCPs and apply the given map projection. For the sampling method and transformation algorithm, use Cubic and 1st Order Polynomial respectively.
Establishment of Base Project	 If two adjacent maps have different scales, the large scale map will be the basis of adjustments for adjacent smaller scale maps. If two adjacent maps have the same scale, the map with a lower RMSE, in terms of Georeferencing, will be the basis of adjustment.
Manner of Digitization	 Add vertices on the center of corner's circle and follow the corner numbers (always start at corner 1). Another layer to indicate assumed boundary lines that is subject for further validation and amendments.

CADSRR: Possible Future

- Extend the plugins' input and output to several type of files, making it compatible to various format such as variations of spreadsheet files for input and output of the Cadastral Plot and TD Generator Plugins, respectively. (dbf format, LAMS Spreadsheet)
- TD Generator plugin for multiple shapefiles consisting of varying survey numbers, beneficial for filling the adjoining lot column.

"The application of GIS is limited only by the imagination of those who use it." - Jack Dangermond

