



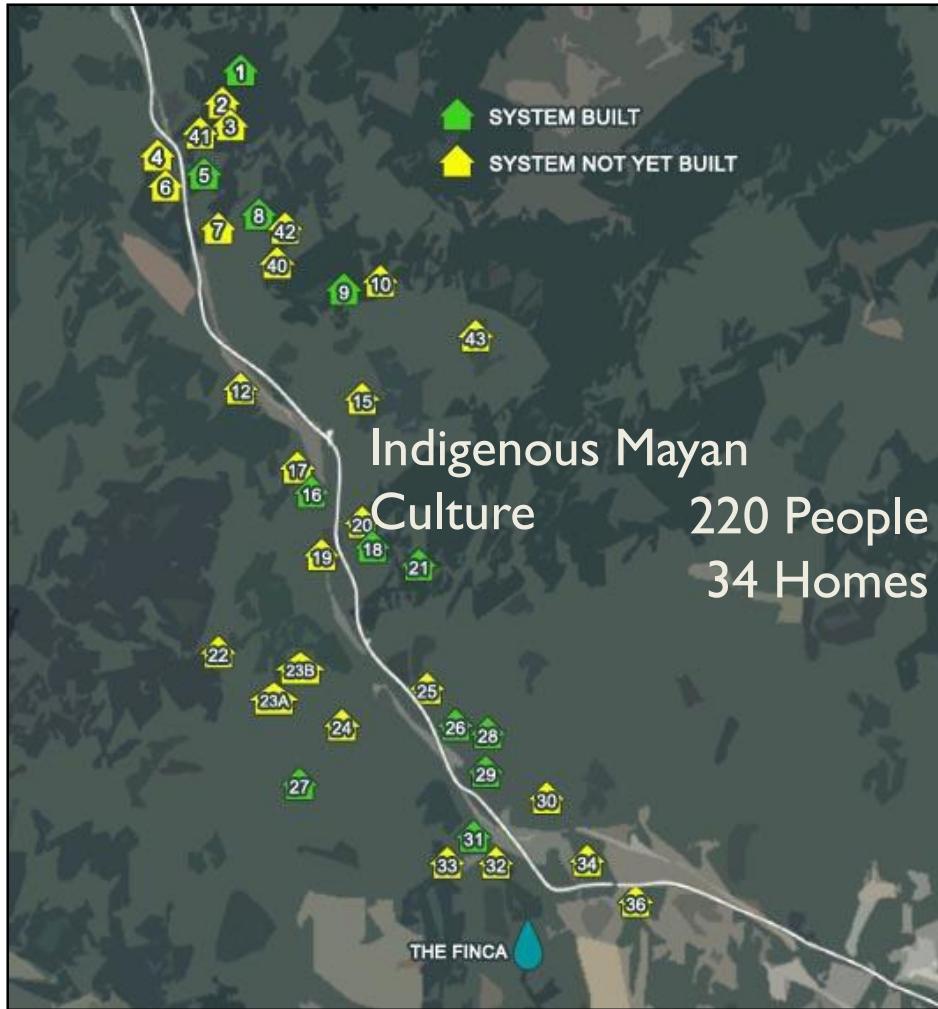
ENGINEERS WITHOUT BORDERS USA
WORCESTER POLYTECHNIC INSTITUTE CHAPTER

May 2015 525 TAC Review

2/25/15

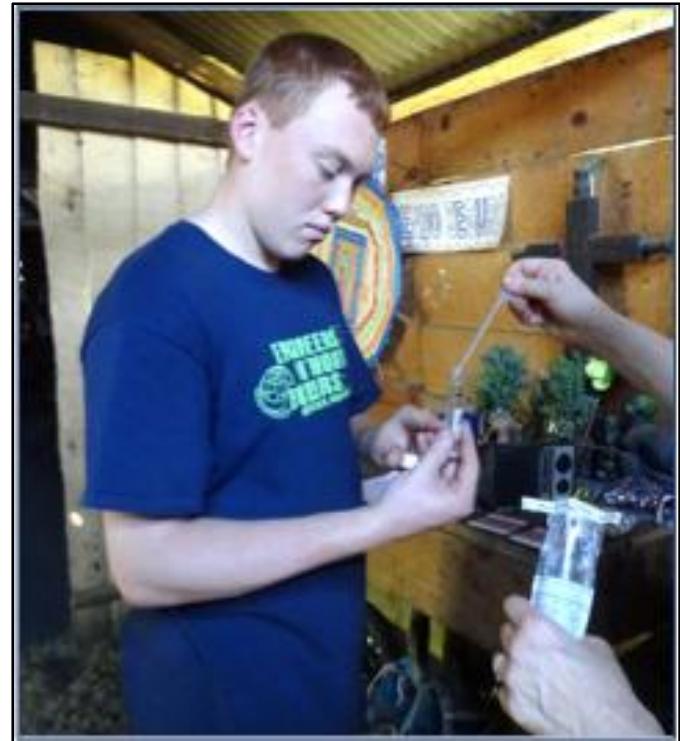


Guachtuq, Guatemala



Program Background

- ▶ July 2010 Assessment
- ▶ July 2011 Assessment
- ▶ January 2013 Pilot Implementation
- ▶ May 2013 Assessment
 - ▶ Assessment of pilot implementation
 - ▶ Health survey and census
 - ▶ Home assessments for 10 homes
- ▶ January 2014 Pilot Implementation
 - ▶ Funded by an EPA grant
 - ▶ Implemented at 2 homes and assessed 8 homes for May 2014
 - ▶ Interviews and monitoring



Program Background (cont.)

- ▶ May 2014 Implementation
 - ▶ 8 home implementation
 - ▶ Conducted family interviews and system monitoring
 - ▶ Assessed the remaining homes for implementation



Program Background (cont.)

- ▶ January 2015 Assessment
 - ▶ Verified home designs and MOUs
 - ▶ Got materials quotes from construction stores
 - ▶ Prepared logistics for May 2015



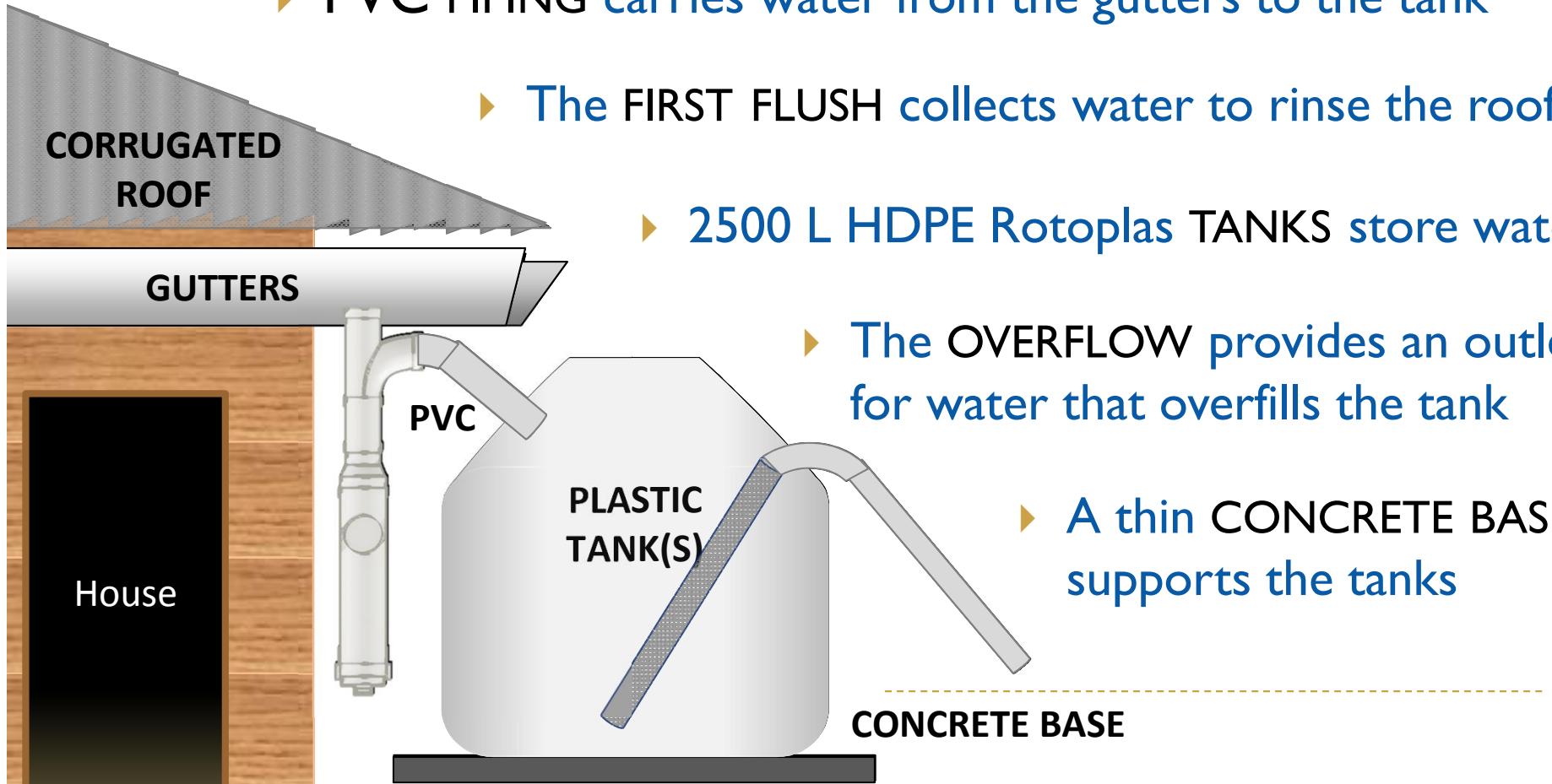


Home Designs



Basic System Components

- ▶ Colonial Style GUTTERS are mounted on the sides of the house
 - ▶ PVC PIPING carries water from the gutters to the tank
 - ▶ The FIRST FLUSH collects water to rinse the roof
 - ▶ 2500 L HDPE Rotoplas TANKS store water
 - ▶ The OVERFLOW provides an outlet for water that overfills the tank
 - ▶ A thin CONCRETE BASE supports the tanks



Excel Model

- ▶ Calculates specific requirements necessary for each home
- ▶ Inputs:
 - ▶ Roof area
 - ▶ # of family members
 - ▶ Total storage capacity
 - ▶ Daily consumption rate
- ▶ Provides outputs on:
 - ▶ First flush length
 - ▶ Required height of overflow pipe

Calculating Flow In:				
Width, Length, and Surface Area				
length of roof 1	5	m	0	m
width of roof 1	5.6	m	0	m
length of roof 2	8.8	m	0	m
width of roof 2	6.6	m	0	m
length of roof 3	0	m	0	m
width of roof 3	0	m	0	m
Total Surface Area	86.08	m ²	0	m ²

Total Storage Volume				
Tank Volume & Flush Volume				
Volume of Tank 1	1700	L	0	L
Volume of Tank 2	1700	L	0	L
Volume of Tank 3	2500	L	0	L
Volume of Tank 4	0	L	0	L
Flush Volume (5 gal)	17.216	L	0	L
Total Storage Volume	5900	L	0	L

First Flush Length				
First Flush length (5 gal) 4"	212.351	cm	0.000	cm
First Flush length (5 gal) 3"	377.513	cm	0.000	cm
First Flush Volume Constant	0.2	L/m ²		

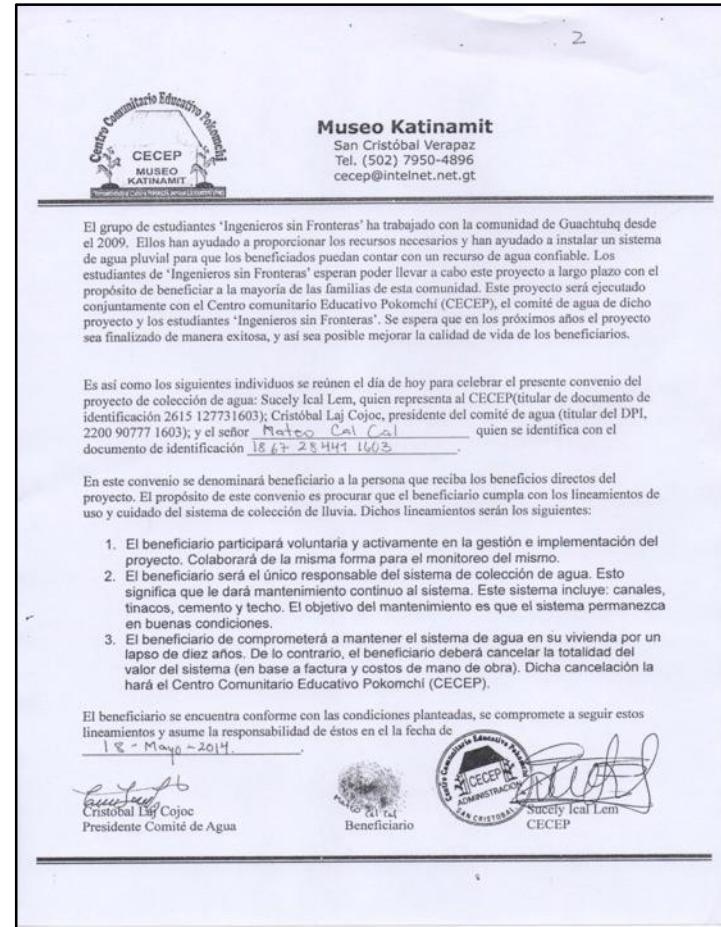
Calculating Flow Out				
Other Information				
Number of People	8			
Regular Consumption Rate	96	L/Day	0	L/Day
Consumption Rate on Rations	24	L/Day	0	L/Day
Efficiency Rate	80%		80%	

Overflow				
Pipe Diameter	0.0381	m		
Roof Area	86.08	m ²		
Maximum Rainfall: Final Height	4.22606	m		
	12.62355	cm		
	4.96991	in		

Operation and Maintenance

► Memorandum of Understanding (MOU)

- ▶ Families pay 5%
- ▶ Preparations
- ▶ Repairs and upkeep
- ▶ Cleaning the System
 - ▶ First flush
 - ▶ Gutters
 - ▶ Tanks
 - ▶ Filter
- ▶ Mosquito Netting





Home Profiles



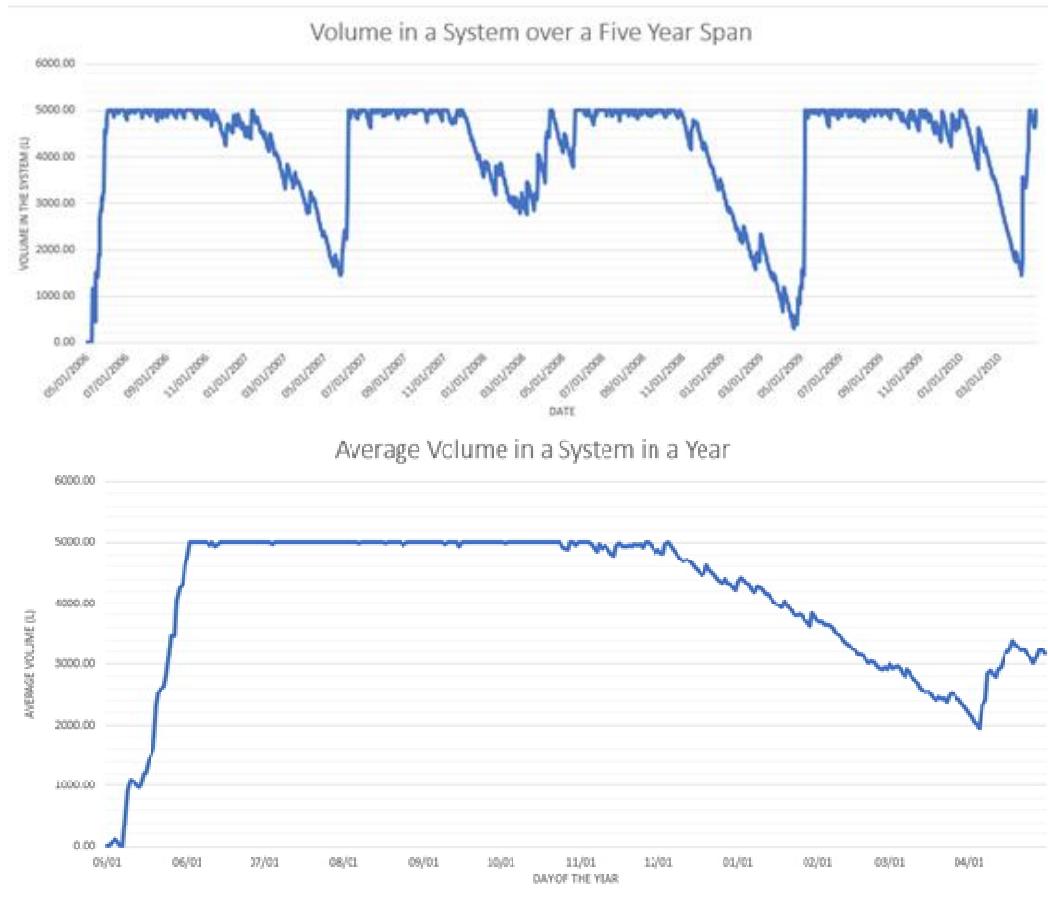
House Profiles – House 7

- ▶ House 7 – Jose Sis Xuc and Graciela Cardona Valezquez
- ▶ Existing Storage
 - ▶ 1 2500 L Tank (Government)
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base
 - ▶ Empty and clean the existing tank



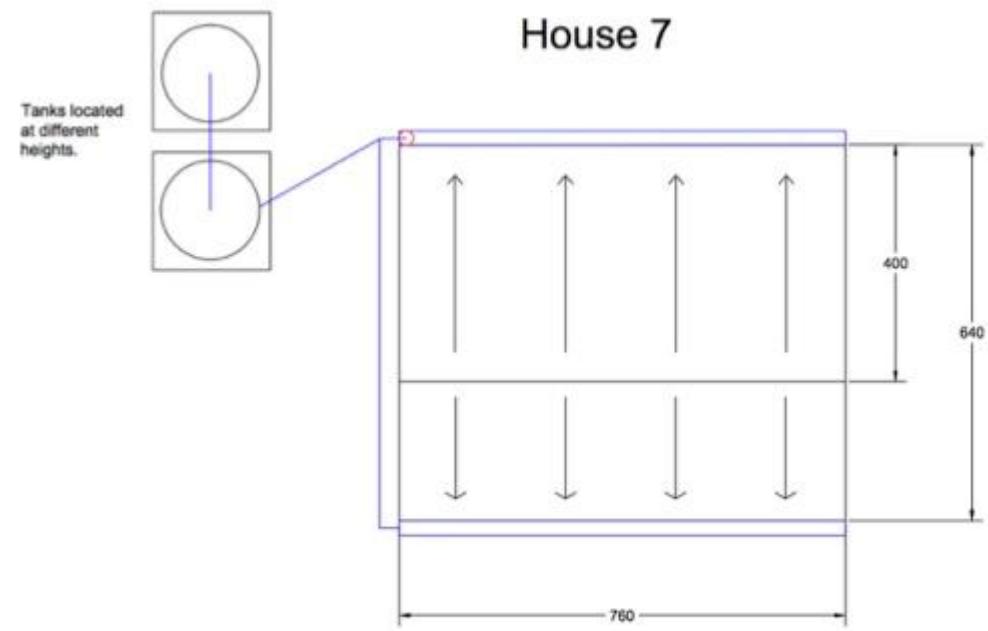
House Profiles – House 7

► House 7 – Jose Sis Xuc and Graciela Cardona Valezquez



House Profiles – House 7

- ▶ House 7 – Jose Sis Xuc and Graciela Cardona Valezquez
- ▶ Construction Plan
 - ▶ 2 Gutters of length 760 cm
 - ▶ First flush length of 120 cm
 - ▶ Overflow height of 4 cm
 - ▶ 1 tank is being added
 - ▶ 1 single tank base is being added



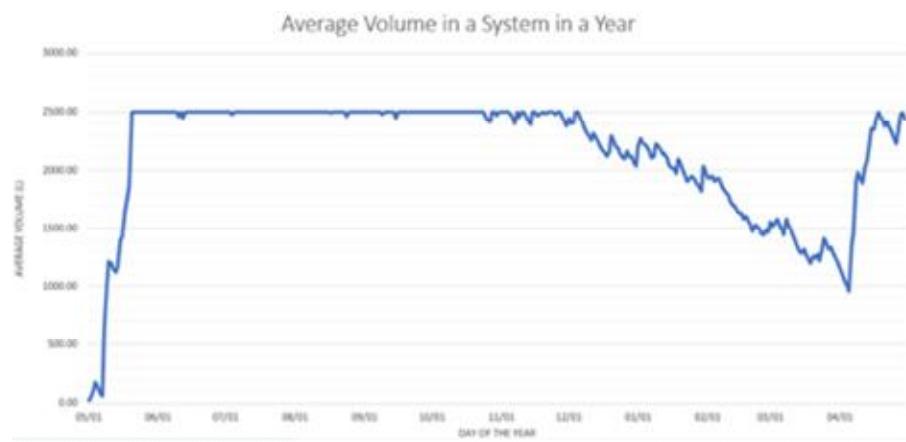
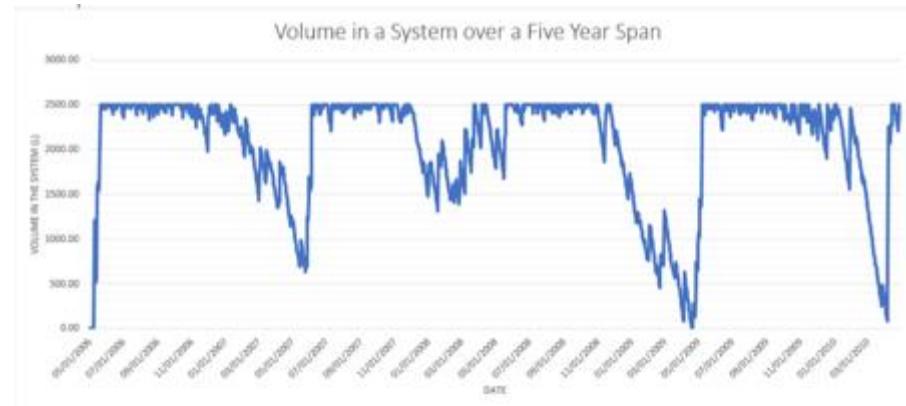
House Profiles – House 20

- ▶ House 20 – Mario Enrique Chul Laj and Clara Caj Cu
- ▶ Existing Storage
 - ▶ No existing Storage
- ▶ Preparations
 - ▶ Prepare the roof and remove extension from the roof near the base.
 - ▶ Prepare the spot for the Concrete Base
 - ▶ Collect rocks for the concrete base



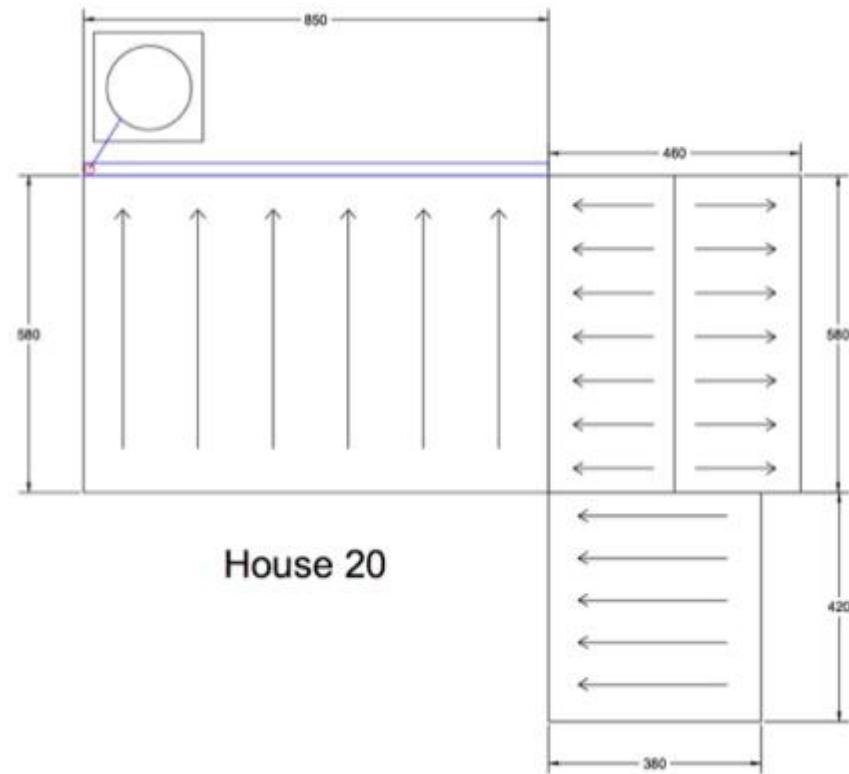
House Profiles – House 20

► House 20 – Mario Enrique Chul Laj and Clara Caj Cu



House Profiles – House 20

- ▶ House 20 – Mario Enrique Chul Laj and Clara Caj Cu
- ▶ Construction Plan
 - ▶ I Gutter of length 850 cm
 - ▶ First flush length of 217 cm
 - ▶ Overflow height of 4.4 cm
 - ▶ I tank is being added
 - ▶ I single tank base is being added





Construction Plan



Key Players in Implementation

- ▶ CeCEP
 - ▶ Sucely Ical Lem
 - ▶ Abelino Cal
 - ▶ Alvaro Cal Lopez
- ▶ Construction Stores
- ▶ Municipality
- ▶ Construction Teams of Men
 - ▶ 12 experienced community members
 - ▶ 22 new beneficiaries
- ▶ EWB Travelers



Phases of the Trip

- ▶ Pre-Trip Preparations
 - ▶ Includes everything that will be completed before travel in May of 2015
- ▶ Phase I: Preliminary Data and Preparations
 - ▶ Includes multiple meetings with various involved parties and confirming that everything we expected to be completed was
- ▶ Phase II: Concrete Base Construction
 - ▶ Concrete bases are constructed at every site where they will be needed
- ▶ Phase III: Materials Transport for Systems
 - ▶ All materials necessary will be delivered, and gutters will be installed
- ▶ Phase IV: System Construction and Education
 - ▶ All systems will be implemented and each family will be educated on how to use and care for their system
- ▶ Phase V: Wrap-up
 - ▶ Meetings and Data collection to wrap up the trip



Pre-Trip

**Confirmation from
Guachtuq Men
(by March 1st)**

- Alvaro will meet with each household and get the name of a representative to participate in construction

**Ordering of Materials from
Venders
(by April 1st)**

- Concrete base material, wood, PVC, and Rotoplas tanks will all be ordered

**Pay for Materials
(by April 25th)**

- Materials excluding wood will be paid for or a plan to pay for them will be made so they are paid for before EWB-USA WPI arrives in country

**Check Homes for
Completion of Preparations
(by May 1st)**

- Confirmation from the community that they are prepared in all ways for implementation



Phase I: Preliminary Data and Preperations

Meeting with CeCEP

Community Meeting

Verify home preparations

Meet with Construction Teams

Meet with the Municipality

Take water quality samples

Monitoring Existing Systems

Distribute existing materials



Phase II: Concrete Bases

Wood delivery and distribution

Water Delivery by the Municipality

Concrete materials delivery and distribution

Meeting with CeCEP

Spreading stone, making wood frames and laying rebar

Mix & pour concrete

Concrete cure time



Phase III: Materials Transport

Delivery and distribution of
PVC, gutters

Sort and Cut PVC, gutters

Gutter clips cut and gutters
hung

Meet with construction teams



Phase IV: System Construction & Education

Tank Delivery and distribution

Assembly of system

Repair and Integrate Existing Tanks

Inspect completed systems

MOUs for Payment Plans

Educate Families at each Home



Phase V: Wrap Up

Water Quality Test

- Final water tests collected at RWH systems implemented on previous trips

Community Meeting

- Celebrate the completion of the project
- Reiterate the importance of cleaning and maintaining the tanks

Inventory

- Count and create records of remaining materials and tools

Meeting with CeCEP

- Discuss any final information regarding payments for homestays, translators
- Discuss monitoring phase of project



Project Scaling



Plan for Project Scaling

- ▶ **Project Scope**
 - ▶ Not all systems require bases & new tanks
 - ▶ Experience working with material providers & transportation
- ▶ **Phased Construction**
 - ▶ Systematic, each stage completed at each home
 - ▶ Keep materials organized, set goals for construction teams
 - ▶ Improved organization, planning, management than previous implementation trip



Plan for Project Scaling (cont.)

- ▶ **Materials Acquisition**
 - ▶ Team has recently visited suppliers
 - ▶ Quotes obtained and advance notice given to suppliers
- ▶ **Materials Transportation**
 - ▶ Pay Macsams and Construfacil for delivery
 - ▶ January confirmed transportation assistance from Municipality of San Cristobal



Plan for Project Scaling (cont.)

▶ Knowledge Transfer

- ▶ Going from 4 → 12 knowledgeable community members about constructing RWH systems
- ▶ Increase rate of teaching with at least 2 experienced community members in each group
- ▶ Teaching can be done in Pokomchi



Proactive Contingency Planning

► Materials

- ▶ Staggered deliveries leave enough time to compensate for any delivery delays
- ▶ The team has quotes from multiple stores as backup in case Construfacil does not have proper quantities
- ▶ Materials transportation will be paid for, ensuring prompt service

► Labor

- ▶ Pre-trip verification of names for construction teams
- ▶ Phase I check-ins with families to ensure Labor commitment

► Sunday May 24th

- ▶ Extra day that can be used for an additional construction day if needed



Contingency Plans

- ▶ If the Municipality is unable to provide services...
- ▶ If there is not enough materials for construction...
- ▶ If home preparations can not be completed...
- ▶ If the construction is not completed before the team needs to leave...



Questions



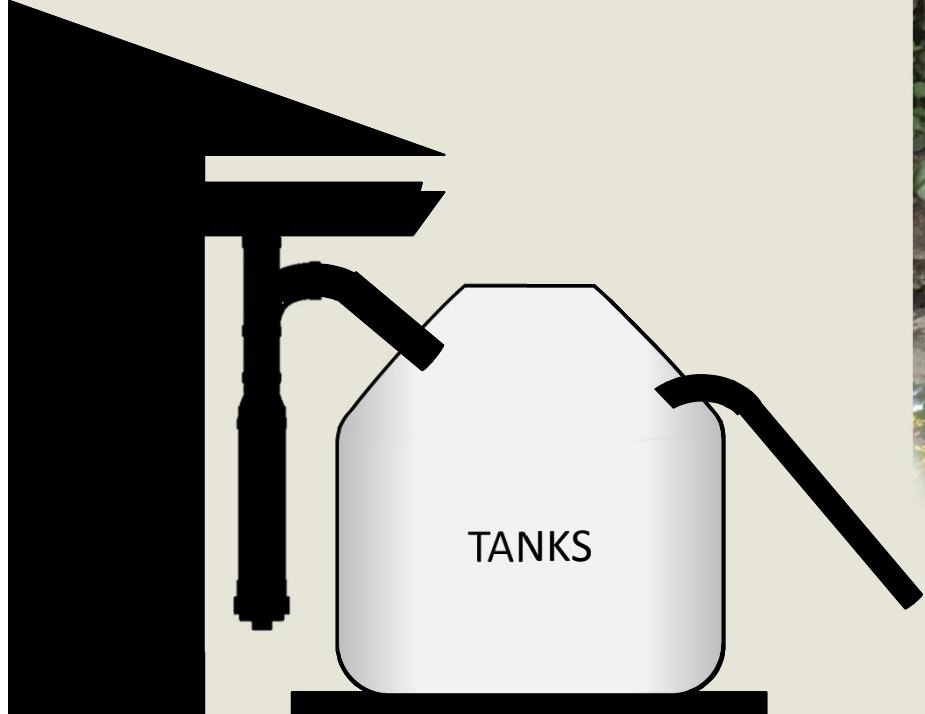
An innovative community member designed wooden gutter clips that are used in every system



The *first flush* system reduces contamination from initial rainfall that washes debris off the roof



Storage tanks are
2500L HDPE vessels
manufactured
in-country and
locally supplied



Thin, stable bases are designed to elevate and support the tanks

8 single tank bases
8 two tank bases
5 three tank bases



Overflow



- ▶ The overflow reaches inside the tank to pull out the dirtiest water first

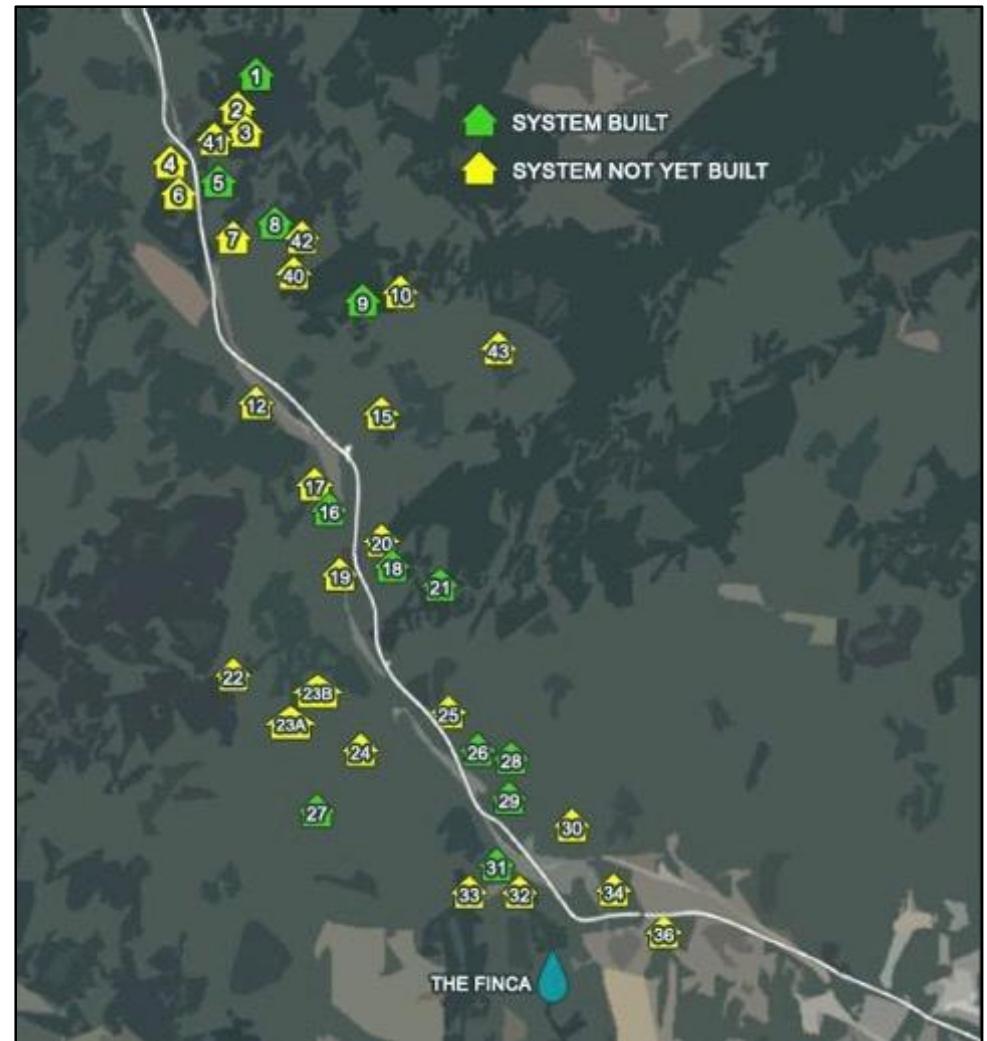


- ▶ The overflow expels excess water in the system, and is covered at the end with mosquito netting.



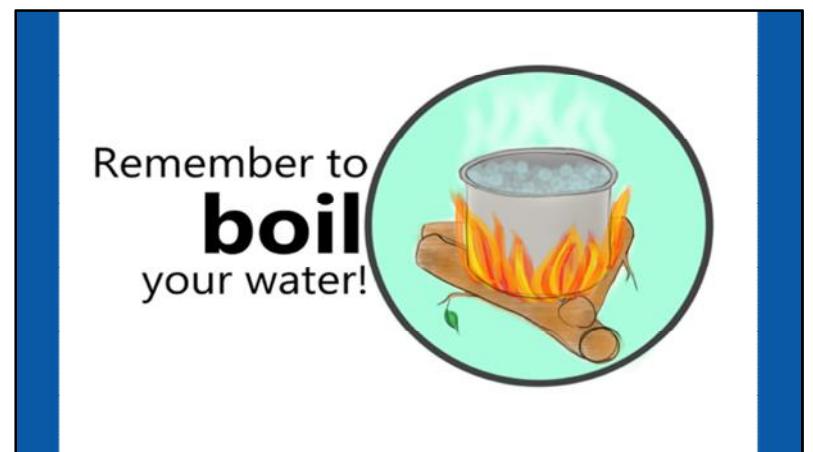
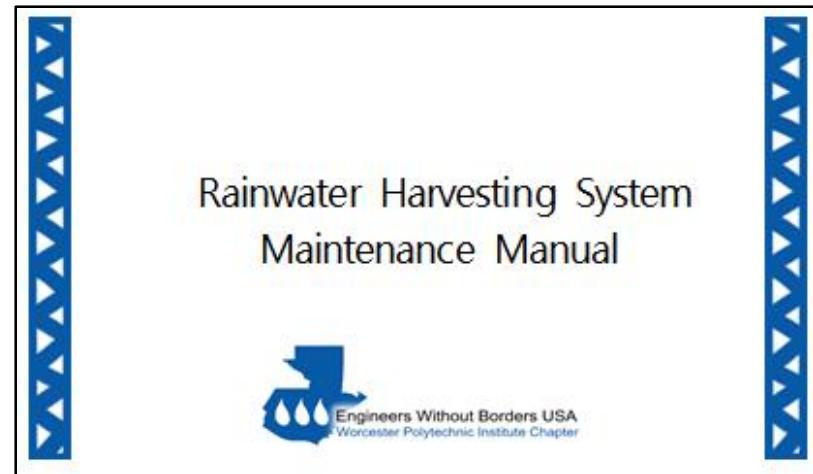
Houses to be Implemented on

- ▶ Indigenous Mayan Culture
- ▶ 22 Remaining Homes
 - ▶ 131 people
- ▶ Less than \$2/person per day

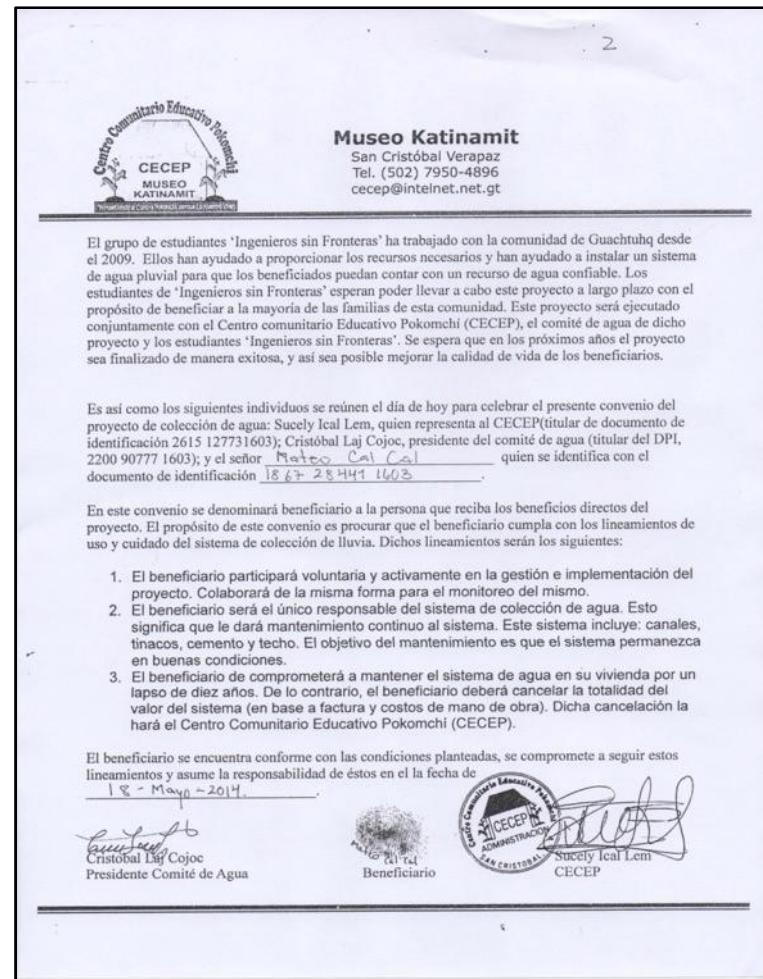
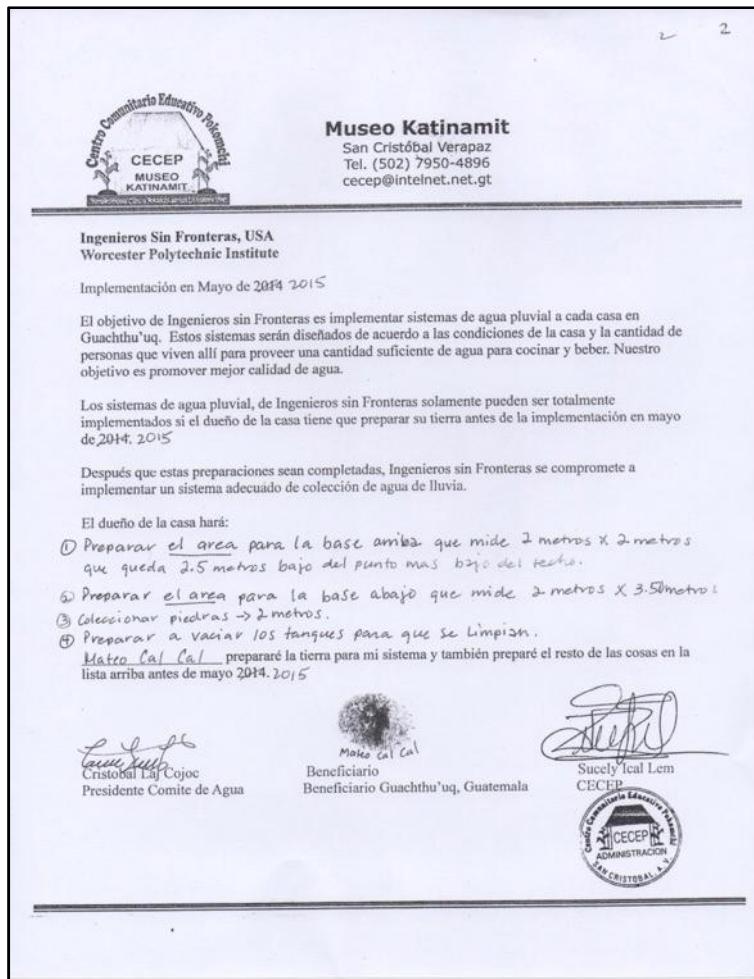


Operation and Maintenance (cont.)

- ▶ Separation of Containers
- ▶ Boiling Water
- ▶ Education
 - ▶ Learning Sessions
 - ▶ Operation Manual



Appendix B: MOUs



Appendix C: House 27 Reconstruction



Original System Implementation by
EWB-USA WPI

System reconstruction at the new home location by the community



Appendix E: Materials Quotes

DESCRIPCION	U/M	P.U.	TOTAL
NYLON NEGRO	MTS	Q11.50	Q2,334.50
ALAMBRE DE AMARRE	LBS	Q6.50	Q409.50
VARILLAS DE HIERRO 1/4 7/32 COMERCIAL	VARILLA	Q7.80	Q624.00
CODO PVC DE 2" PARA AGUA POTABLE	UNIDAD	Q15.00	Q840.00
TEE PVC DE 2" PARA AGUA POTABLE	UNIDAD	Q12.50	Q462.50
TUBO PVC DE 2" PARA AGUA POTABLE	UNIDAD	Q69.00	Q2,070.00
REDUCIDOR PVC DE 2X 1 1/2	UNIDAD	Q10.00	Q290.00
TUBO PVC DE 1 1/2 PARA AGUA POTABLE	UNIDAD	Q52.00	Q988.00
ADAPTADOR PVC 1 1/2 MACHO A.P	UNIDAD	Q3.75	Q618.75
CEDAZO MOSQUITERO GALV. METALICO	MTS	Q14.50	Q14.50
UNION PVC DE 2" PARA DRENAGE	UNIDAD	Q5.00	Q40.00
CODO PVC DE 1 1/2 PARA AGUA POTABLE	UNIDAD	Q5.80	Q313.20
TEE PVC DE 1 1/2 PARA AGUA POTABLE	UNIDAD	Q11.00	Q143.00
REDUCIDOR PVC DE 2X3 PARA DRENAGE	UNIDAD	Q8.25	Q16.50
TUBO PVC DE 3" PARA DRENAGE	UNIDAD	Q70.00	Q70.00
TUBO PVC DE 4" PARA DRENAGE	UNIDAD	Q105.00	Q630.00
CODO PVC DE 1 1/2 G45'	UNIDAD	Q5.00	Q640.00
TUBO PVC DE 1 1/4 PARA AGUA POTABLE	UNIDAD	Q38.00	Q570.00
ADAPTADOR PVC 1 1/2 HEMBRA A.P	UNIDAD	Q6.00	Q90.00
CHORRO DE 1/2 CAIMAN	UNIDAD	Q24.00	Q576.00
SERVICIO DE FLETE	VIAJE	Q150.00	Q150.00



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División DMC Guatemala, S.A.
1a.Calle 16-97 zona 1 Coban A.V

PROFORMA

Orden Comp:
Fecha: 23/01/2015
Proforma: 350820

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<i>Cliente</i>	CENTRO EDUCATIVO COMUNITARIO POQOMCHI				<i>Cuenta:</i>	81827
<i>Dirección</i>	0 calle 0-33, San Cristobal Verapaz.					
<i>Teléfono:</i>	5785 5756 -5 Nit Cliente: 2016401-7				CONDICIONES DE COMPRA	
CODIGO	BODEGA	CANTIDAD	DESCRIPCION DE LA MERCADERIA	U/M	PRECIO UNIT.	TOTAL Q
28647	43	63.00	ALAMBRE DE AMARRE	LIBRA	4.40	277.20
24724	43	975.00	BLOCK (NO ESTRUCTURAL) 14x19x39 25 KGS. PRE	UNIDAD	4.55	4,436.25
34212	43	496.00	BOLSA DE CONCRETO 3001 MAXIPASTA DE 50KG. Coban	UNIDAD	44.00	21,824.00
22236	43	80.00	VARILLA 7/32" X 6.00 MTS	VARILLA	7.40	592.00
24071	43	47.00	BOQUILLA PVC REDONDA 3" PARA CANAL COLONIAL	UNIDAD	30.25	1,421.75
24070	43	47.00	BOQUILLA PVC REDONDA 2" PARA CANAL COLONIAL	UNIDAD	30.25	1,421.75
24068	43	28.00	TAPADERAS PVC PARA CANAL COLONIAL	UNIDAD	16.65	466.20
24081	43	47.00	UNIÓN PVC PARA CANAL COLONIAL	UNIDAD	10.35	486.45
24067	43	11.00	CANAL COLONIAL PVC 6M BLANCO	UNIDAD	278.40	3,062.40
08232	43	56.00	CODO PVC DRENAGE 90 GRADOS 2" PVC	UNIDAD	6.80	380.80
12210	43	37.00	TEE PVC DRENAGE 2" PVC	UNIDAD	9.25	342.25
12454	43	30.00	TUBO PVC BAJADA PLUVIAL 2" PVC	TUBO	46.35	1,390.50
28305	43	29.00	REDUCTOR PVC LISO 2"X1 1/2" PVC	UNIDAD	16.30	472.70
12442	43	19.00	TUBO PVC 160 PSI 1 1/2" PVC	TUBO	67.50	1,282.50
10578	43	76.00	MULTICONECTOR + VALVULA ESFERA ROTOPLAS	UNIDAD	62.70	4,765.20
28198	43	165.00	ADAPTADOR MACHO PVC 1 1/2" PVC	UNIDAD	4.05	668.25
08396	43	8.00	COPLA PVC DRENAGE 2" PVC	UNIDAD	4.80	38.40
08218	43	54.00	CODO PVC 90 GRADOS LISO 1 1/2" PVC	UNIDAD	5.50	297.00
12196	43	13.00	TEE PVC LISO 1 1/2" PVC	UNIDAD	10.85	141.05
11731	43	2.00	REDUCTOR PVC DRENAGE 3"X2" PVC	UNIDAD	7.60	15.20
11733	43	26.00	REDUCTOR PVC DRENAGE 4"X2" PVC	UNIDAD	12.60	327.60
28298	43	17.00	REDUCTOR PVC DRENAGE 3"X1 1/2" PVC	UNIDAD	6.35	107.95
11733	43	11.00	REDUCTOR PVC DRENAGE 4"X2" PVC	UNIDAD	12.60	138.60
28298	43	11.00	REDUCTOR PVC DRENAGE 3"X1 1/2" PVC	UNIDAD	6.35	69.85
12455	43	6.00	TUBO PVC BAJADA PLUVIAL 3" PVC	TUBO	77.40	464.40
12456	43	6.00	TUBO PVC BAJADA PLUVIAL 4" PVC	TUBO	126.00	756.00
17506	43	28.00	LLAVE DE COMPUERTA RED-WHITE 1-1/2" (USA)	UNIDAD	225.00	6,300.00



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1a.Calle 16-97 zona 1 Coban A.V

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					CONDICIONES DE COMPRA	
CODIGO	BODEGA	CANTIDAD	DESCRIPCION DE LA MERCADERIA	U/M	PRECIO UNIT.	TOTAL Q
08204	43	128.00	CODO PVC 45 GRADOS 1 1/2" PVC	UNIDAD	7.90	1,011.20
08393	43	6.00	COPLA PVC DRENAGE 3" PVC	UNIDAD	10.00	60.00
08394	43	50.00	COPLA PVC DRENAGE 4" PVC	UNIDAD	18.30	915.00
12442	43	15.00	TUBO PVC 160 PSI 1 1/2" PVC	TUBO	67.50	1,012.50
06968	43	15.00	ADAPTADOR HEMBRA PVC 1 1/2" PVC	UNIDAD	4.00	60.00
08395	43	1.00	COPLA PVC DRENAGE 1 1/2" PVC	UNIDAD	6.00	6.00
29783	43	24.00	LLAVE CHORRO DE 1/2" PVC BLANCO CASTEL	UNIDAD	26.00	624.00
08481	43	36.00	DEPOSITO AGUA M/AGUA 2500LTS ROTOPLAS	UNIDAD	2,430.00	87,480.00
20421	43	1.00	TAPON PVC MACHO C/ROSCA DE 2"	UNIDAD	19.50	19.50
10642	43	225.00	NYLON 72 X 6 NEGRO	YARDA	10.10	2,272.50
31509	43	1.00	CEDAZO MOSQUITERO FIBRA DE VIDRIO 1/16 VERDE (YARD	YARDA	4.70	4.70
Ultima Linea						



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División DMC Guatemala, S.A.
1a.Calle 16-97 zona 1 Coban A.V

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CODIGO	BODEGA	CANTIDAD	DESCRIPCION DE LA MERCADERIA	U/M	PRECIO UNIT.	TOTAL Q
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08393	43	6.00	COPLA PVC DRENAGE 3" PVC	UNIDAD	10.00	60.00
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12442	43	15.00	TUBO PVC 160 PSI 1 1/2" PVC	TUBO	67.50	1,012.50
06968	43	15.00	ADAPTADOR HEMBRA PVC 1 1/2" PVC	UNIDAD	4.00	60.00
08395	43	1.00	COPLA PVC DRENAGE 1 1/2" PVC	UNIDAD	6.00	6.00
29783	43	24.00	LLAVE CHORRO DE 1/2" PVC BLANCO CASTEL	UNIDAD	26.00	624.00
08481	43	36.00	DEPOSITO AGUA M/AGUA 2500LTS ROTOPLAS	UNIDAD	2,430.00	87,480.00
20421	43	1.00	TAPON PVC MACHO C/ROSCA DE 2"	UNIDAD	19.50	19.50
10642	43	225.00	NYLON 72 X 6 NEGRO	YARDA	10.10	2,272.50
31509	43	1.00	CEDAZO MOSQUITERO FIBRA DE VIDRIO 1/16 VERDE (YARD	YARDA	4.70	4.70
Ultima Linea						



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FERRETERIAS EL TEJAR S.A. TrueValue		CENTRO Tels: 2230 6296 - 2230 6304 2230 6302 - FAX: 2230 0492	ROOSEVELT Teléfonos: 2471 3822 - 2471 1722	COBAN Teléfonos: 7952 9879 - 7952 9880	XELA Teléfonos: 7763 0360 al 62	CHIQUIMULA Teléfonos: 7942 7455 al 56	HUEHUETENANGO Teléfono: 7764 2270	COATEPEQUE Teléfono: 5511 5532
		JUTIAPA Teléfonos: 7844 1951 - 4096 3177	TIVOLI Teléfonos: 2331 5702 - 2331 5719	PROGRES Teléfonos: 2331 5350 - FAX: 2334 3191	CHIMALTENGO Teléfonos: 2367 2701 - 2367 2702	MAZATENANGO Teléfono: 7849 4143 - 7849 1982	ESCUINTLA Teléfono: 7867 9377	7769 9612
LUGAR Y FECHA:		PROFORMA						
31/1/2015		VENDEDOR: <i>Luis Reyes</i>						
NOMBRE: <i>Ingenueros Sin Fronteras</i>		DEPARTAMENTO:						
DIRECCION: <i>Cuidad.</i>		ORDEN DE COMPRA:						
CÓDIGO	CANTIDAD	DESCRIPCIÓN		PRECIO	IMPORTE			
1	1	<i>Tinaco 1,100 litros Durman</i>		1099.00				
1	1	<i>Tinaco 2,500</i>		2,099.00				
<input type="checkbox"/> CENTRO <input type="checkbox"/> PROCERES <input type="checkbox"/> ROOSEVELT <input type="checkbox"/> AGUILAR BATRES <input type="checkbox"/> MAZATENANGO <input type="checkbox"/> CHIQUIMULA <input type="checkbox"/> TIVOLI <input type="checkbox"/> COBAN <input type="checkbox"/> XELA <input type="checkbox"/> CHIMALTENGO <input type="checkbox"/> HUEHUETENANGO		TOTAL						
FABRICA E IMPORTACION DE MATERIALES								

FERRETERIAS EL TEJAR S.A. TrueValue		CENTRO Tels: 2230 6296 - 2230 6304 2230 6302 - FAX: 2230 0492	ROOSEVELT Teléfonos: 2471 3822 - 2471 1722	COBAN Teléfonos: 7952 9879 - 7952 9880	XELA Teléfonos: 7763 0360 al 62	CHIQUIMULA Teléfonos: 7942 7455 al 56	HUEHUETENANGO Teléfono: 7764 2270	COATEPEQUE Teléfono: 5511 5532
		JUTIAPA Teléfonos: 7844 1951 - 4096 3177	TIVOLI Teléfonos: 2331 5702 - 2331 5719	PROGRES Teléfonos: 2331 5350 - FAX: 2334 3191	CHIMALTENGO Teléfonos: 2367 2701 - 2367 2702	MAZATENANGO Teléfono: 7849 4143 - 7849 1982	ESCUINTLA Teléfono: 7867 9377	7889 9612
LUGAR Y FECHA:		PROFORMA						
31/1/2015		VENDEDOR: <i>Luis Reyes</i>						
NOMBRE: <i>Ingenueros Sin Fronteras</i>		DEPARTAMENTO:						
DIRECCION: <i>Cuidad.</i>		ORDEN DE COMPRA:						
CÓDIGO	CANTIDAD	DESCRIPCIÓN		PRECIO	IMPORTE			
1	1	<i>Canal Colonial 2 mts Durman</i>		99.00				
1	1	<i>Canal Colonial 3 mts</i>		115.00				
1	1	<i>1 mts</i>		225.00				
1	1	<i>Pas Tapaderas Para canal</i>		17.00				
1	1	<i>Union para canal colonial</i>		6.50				
1	1	<i>Soporta para canal</i>		8.95				
1	1	<i>bajante para canal colonial</i>		21.00				
<input type="checkbox"/> CENTRO <input type="checkbox"/> PROCERES <input type="checkbox"/> ROOSEVELT <input type="checkbox"/> AGUILAR BATRES <input type="checkbox"/> MAZATENANGO <input type="checkbox"/> CHIQUIMULA <input type="checkbox"/> TIVOLI <input type="checkbox"/> COBAN <input type="checkbox"/> XELA <input type="checkbox"/> CHIMALTENGO <input type="checkbox"/> HUEHUETENANGO		TOTAL						
FABRICA E IMPORTACION DE MATERIALES DE CONSTRUCCION								

Appendix F: Education Materials

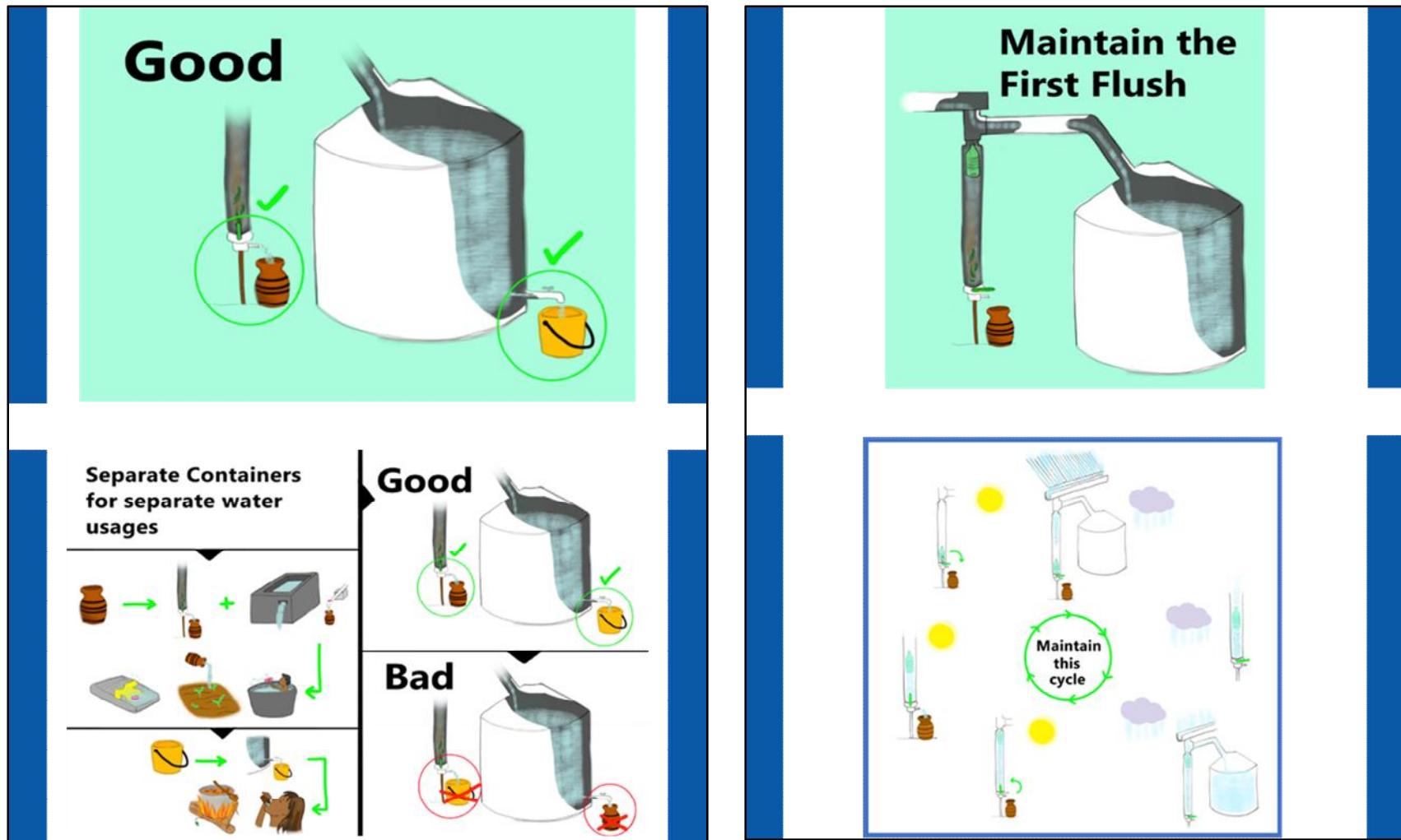
Rainwater Harvesting System
Maintenance Manual

 Engineers Without Borders USA
Worcester Polytechnic Institute Chapter

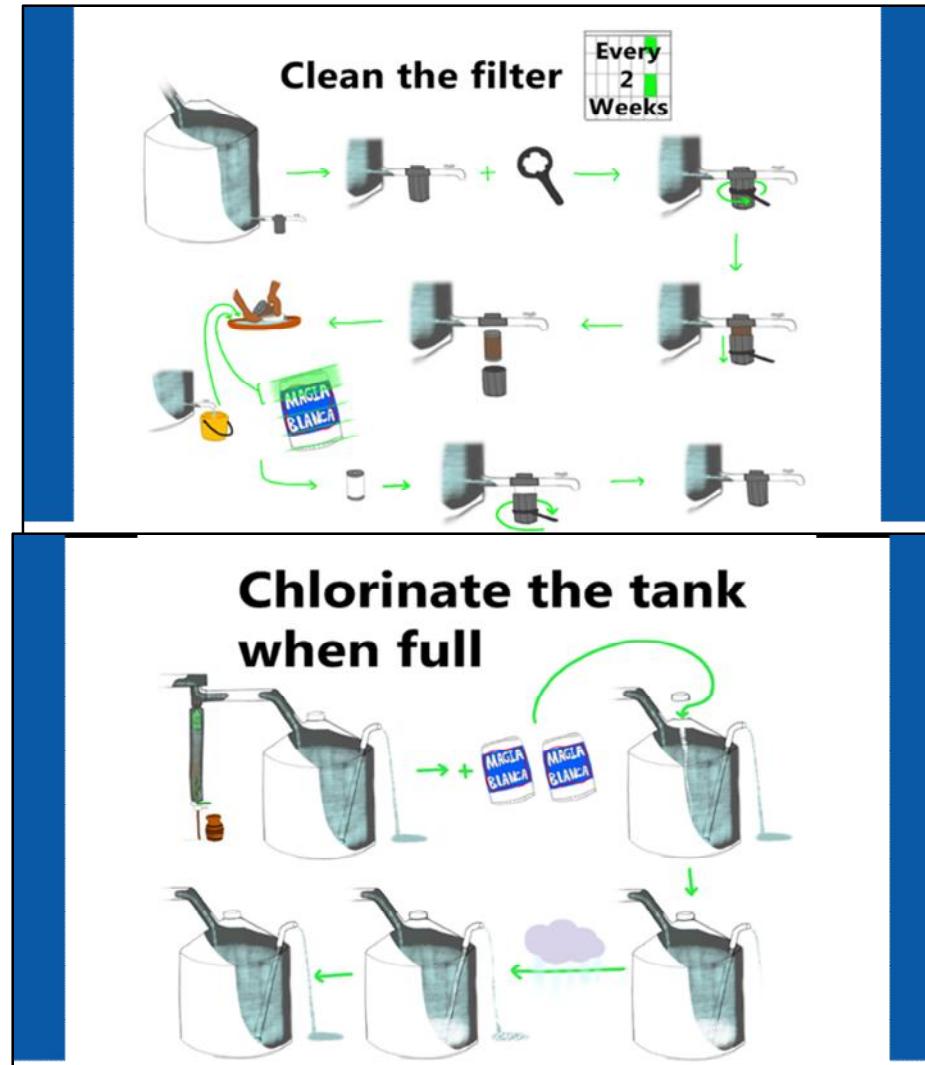
Remember to
boil
your water!



Appendix F: Education Materials

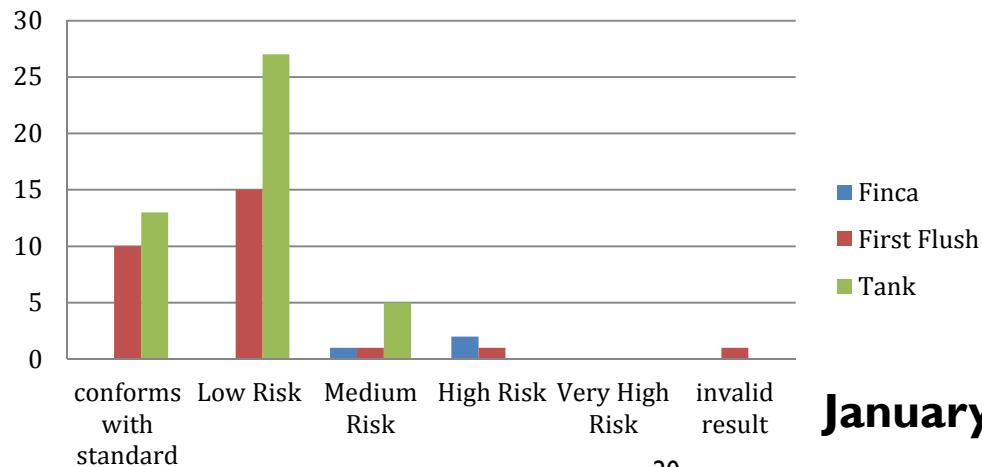


Appendix F: Education Materials

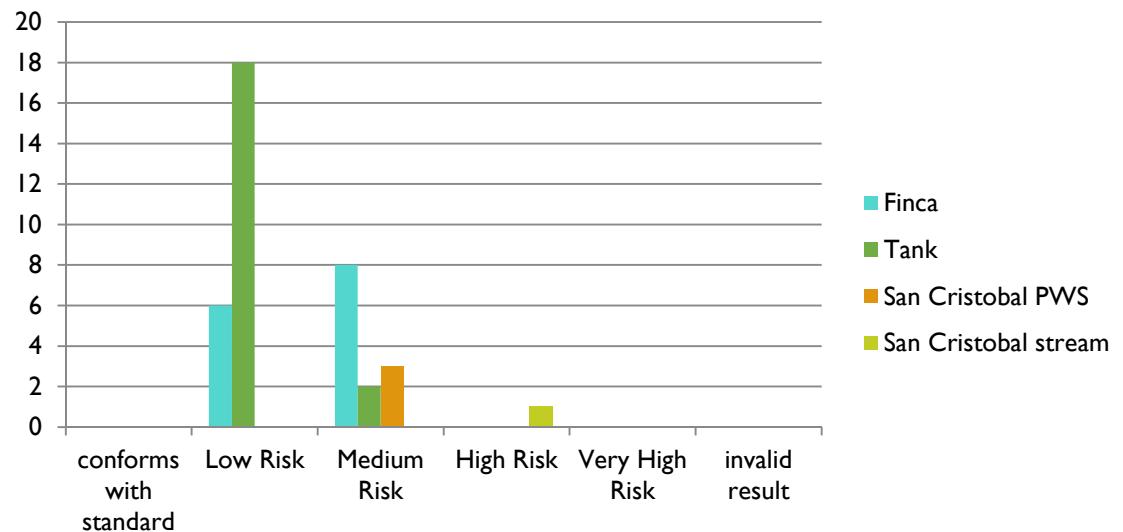


Appendix H: Water Quality Graphs

January 2015 Bacteria Test Results



January 2014 Bacteria Test Results



Appendix I: Planned Water Quality Tests

- ▶ All tests done in triplicate
- ▶ Planned Testing Sites for May 2015
 - ▶ Finca (inorganic as well)
 - ▶ All 12 previously Implemented Systems (tanks and first flush)
 - ▶ House #6 government system (tanks and first flush)
 - ▶ House #12 concrete tank
 - ▶ House #21 government system
 - ▶ House #28 concrete tank



Appendix J: Remaining Materials in Country

	Item	Amount	Measurement	
2" PVC	PVC de 2 pulgadas	9	6 m	
		1	.22 m	
		1	4 m	
		1	3.6 m	
1.5" PVC	PVC de 1.5 pulgadas	1	3.5 m	
		3	6 m	
		1	4 m	
1.25" PVC	PVC de 1.25 pulgadas	1	.282 m	
		1	6 m	
		1	5.5 m	
3" PVC	PVC de 3 pulgados	1	2.6 m	
4" PVC	PVC de 4 pulgados	1	.26 m	
Rebar	Hierro	11	6 m	
PVC glue	Pegamento PVC	3	all open	
Concrete Tool	Herramiento Concreto	7		
Wire Clipper	Cortadores	2		
Pliers	Alicates	3		
Coarse Thread Drywall Screw Box	Tornillo Rosca Ancha para Panel de yeso	1	box	
Silicon Tube	Tubo de Silicon	1	1.25 45 elbow	Codo PVC 1.25" x 45 deg
Can of Spray Paint	Pintura en Spray	1	Gutter Unions	Tapaderas PVC Para Canal Colonial
Pedazos de Lija	Sandpaper	2	Downspouts	Canal Debajada 2"
Teflon Tape	Teflon	2	Gutter Clips	Clips
Saw	Serrucho	3		3 pair
Hammers	Martillos	2		
Hand Saw	Serrucho (de mano)	4		
Brushes	Cepillos	1		
Wheel Barrow	Carretilla	4		
Levels	Niveles	4		
Bulk Heads	Roscas por Rotoplas 1.25"	2		
Male Adaptor (2")	Adaptadores Macho de 2 pulgadas	1		
Male Adaptor (1.5")	Adaptadores Macho de 1.5 pulgadas	14		
Female Adaptors	Adaptadores Hembra	7		
2" Elbows	Codo de 2 pulgadas	33		
1.5" Elbows	Codo de 1.5 pulgadas	15		
4" Elbow	Codo 4"	1		
3" Elbow	Codo 3"	1		
1.5" Cap	Tapon Macho 1.5" con Roscas	4		
2" PVC Union	Union 2"	9		
1.5" PVC Union	Union 1.5"	10		
2" PVC Union	Union 2"	9		
3" PVC Union	Union 3"	6		
2" Tee	Tee PVC 2"	6		
1.5" Tee	Tee PVC 1.5"	2		
2 - 1.5 Reducer	Reductor 2" x 1.5"	2		
3 - 1.5 Reducer	Reductor 3" x 1.5"	2		
1.5" 45 elbow	Codo PVC 1.5" x 45 deg	7		
2" 45 elbow	Codo PVC 2" x 45 deg	1		





System Monitoring Activities



Monitoring of Implemented Systems

- ▶ EWB-USA WPI checks the condition of
 - ▶ Gutters
 - ▶ Tanks
 - ▶ First Flush
 - ▶ Filters
- ▶ Talk to families regarding their tanks and education booklets



Water Quality Tests

Colilert Tests:

check for presence of bacteria

- ▶ 10mL sample is incubated for 22 hours
- ▶ Yellow with presence of bacteria
- ▶ Fluoresce with presence of E. coli

Petrifilm Tests:

quantify bacteria in sample

- ▶ 1mL sample incubated on agar for 22 hours
- ▶ Red colonies = general bacteria presence
- ▶ Blue colonies = presence of E. coli

Conclusion from tests:

84% of implemented tanks are low risk, 16% medium risk vs. the finca where 67% is high risk, 33% is medium risk



Materials List (cont.)

- ▶ Uses multiple sheets to break up each section of the system
- ▶ References all of them to a total materials sheet
- ▶ Totals for each part
- ▶ Prices for each part
- ▶ Total Price for the systems
- ▶ To see full materials list see
PAGE XX IN 525

Materials	House 2	House 3	House 4
Plastic Covering for Concrete (ft)	15	10	15
Tie Wire [ft]	3	3	3
Cinder Blocks	75	50	75
Ready Mix Concrete 50kg	32	28	32
2"x4"x12' wood	2	2	2
2"x4"x5' wood	2	2	2
Rocks [m3]	1	0.5	1
2 L Bottles	4	4	4
1/4" Rebar	12	8	12
3/4" Crushed Stone [m^3]	1	0.5	1
Water [L]	225	150	225
2" Downspout	4	4	3
Gutter Caps [Pair]	4	4	3
Gutter Unions	2	0	2
Gutter Clips	20	16	16
Gutters (6m)	5	3	3
2" PVC Elbow	12	6	6
2" PVC Tee	3	3	3
2" PVC Tube (6m)	3210	1810	910
2" x 1.5" Reducer	2	1	1
1.5" PVC Tube (cm)	610	450	610
Rotoplas Tank Inlet	4	3	3
1.5 Male Adaptor	7	7	8
Mosquito Netting	Bulk	Bulk	Bulk
2" PVC Coupling	2	0	0
1.5" Elbow	1	1	2
1.5" Tee	1	1	1
3" x 2" Reducer	0	0	0
4" x 2" Reducer	1	1	1
3" x 1.5" Reducer	0	0	0
4" x 1.5" Reducer	1	1	1
3" PVC Tube (cm)	0	0	0
4" PVC Tube (cm)	140	100	170
1.5" Italy Valve (metal)	1	1	1
1.5" x 45 deg elbow	8	8	5
3" union (coupling)	0	0	0
4" union (coupling)	2	2	2
Water Bottle	1	1	1
Stick	1	1	1
1.25" PVC Tube (cm)	400	400	400
1.5" Female Connector	1	1	1
1.5" union	0	0	0
.5" Faucet	1	1	1
Rotoplas Tank	2	2	2
2 in Threaded Caps	2	2	2
Plastic to Patch Holes	1	1	1



Tools Needed

Tools	Per Team	Total	Own	Needed
Wheelbarrows	2	10	4	6
Shovels	3	15	5	10
Pickaxe	1	5	0	5
Wire Tie Pliers	2	10	2	8
Hand Saws	2	10	4	6
Hammers	3	15	2	13
Machetes	2	10	**	0
Level	2	10	4	6
Line (Use with level)	2	10	0	10
Concrete Tool	2	10	7	3
Tape Measures	2	10	0	10
Scissors	1	5	0	5
Chisel	1	5	0	5
Sand Paper	3	15	2	13
55 Gallon Drums	2	10	3	7
Tarps	5	25	0	25
		** Guachtuq Owned		



Budget

EWB-USA WPI May 2015 TRIP BUDGET

EWB-USA Chapter Name ::

Project Name ::

Worcester Polytechnic
Institute
Guachtuq Water Supply

Type of Trip ::

Trip Type: A= Assessment; I= Implementation; M= Monitoring + Evaluation

NOTE: The fees associated with each trip type will auto-populate the EWB-USA HQ section.

BUDGET (PRE-TRIP)

DIRECT COSTS

Travel + Logistics

Airfare	\$5,590
Flight Insurance	\$400
Homestays	\$2,510
Shuttle to Boston Airport	\$268
Shuttle from Guatemala City to San Cristobal	\$654
Shuttle to Coban	\$118
Overnight stay in Antigua	\$100
Miscellaneous Travel and Taxis	\$50
Food, Beverages, and Homestay Gifts	\$650
Medical Exams	\$100
Sub-Total	\$10,440

Labor

Translators	\$1,882
Monitoring and Logistical Support	\$2,353
Sub-Total	\$4,235

EWB-USA HQ

Program Quality Assurance/Quality Control + Infrastructure	\$4,900
Less EWB-USA HQ Subsidy	\$3,690
Owed by Chapter Sub-Total	\$1,210

Project Materials + Equipment

Water Quality Tests	\$480
Cell Phones for Implementation Teams	\$150
Construction Materials	\$19,000
Sub-Total	\$19,630

Misc.

Printing Education Booklets, Reports, and Photos for Community	\$100
Sub-Total	\$100

TOTAL DIRECT COST **\$35,615**

IN-KIND CONTRIBUTIONS

Community In-Kind Contributions to Project Costs

Labor	\$10,000
Materials and tools	\$100
Logistics and materials transportation	\$100
Sub-Total	\$10,200

TOTAL IN-KIND CONTRIBUTIONS

FUNDS RAISED

Funds Raised for Project + Grants Received



Piping



- ▶ Sealed PVC pipes carry water from the first flush to the tanks themselves.



Bulkhead and Inlet into Tank



▶ This picture shows the bulkhead that connects the PVC tubing to the HDPE Rotoplas tanks. This is a crucial part of the system, since it allows the system to remain closed.



Filter and Spigot



- ▶ This picture shows the connection between the two tanks. The tanks come with a 1.5 inch tapped hole on the bottom of the tank that the tubing is hooked into on either side of the PVC tee outside of the view of this picture. This spigot is where families draw their drinking and cooking water

Waterfall Connection between Tanks



▶ This picture shows the connection between tanks known as a waterfall connection. Once one tank is full, it will flow into the next tank. This allows an old tank to be connected to a new tank without mixing water.





Remaining Home Profiles



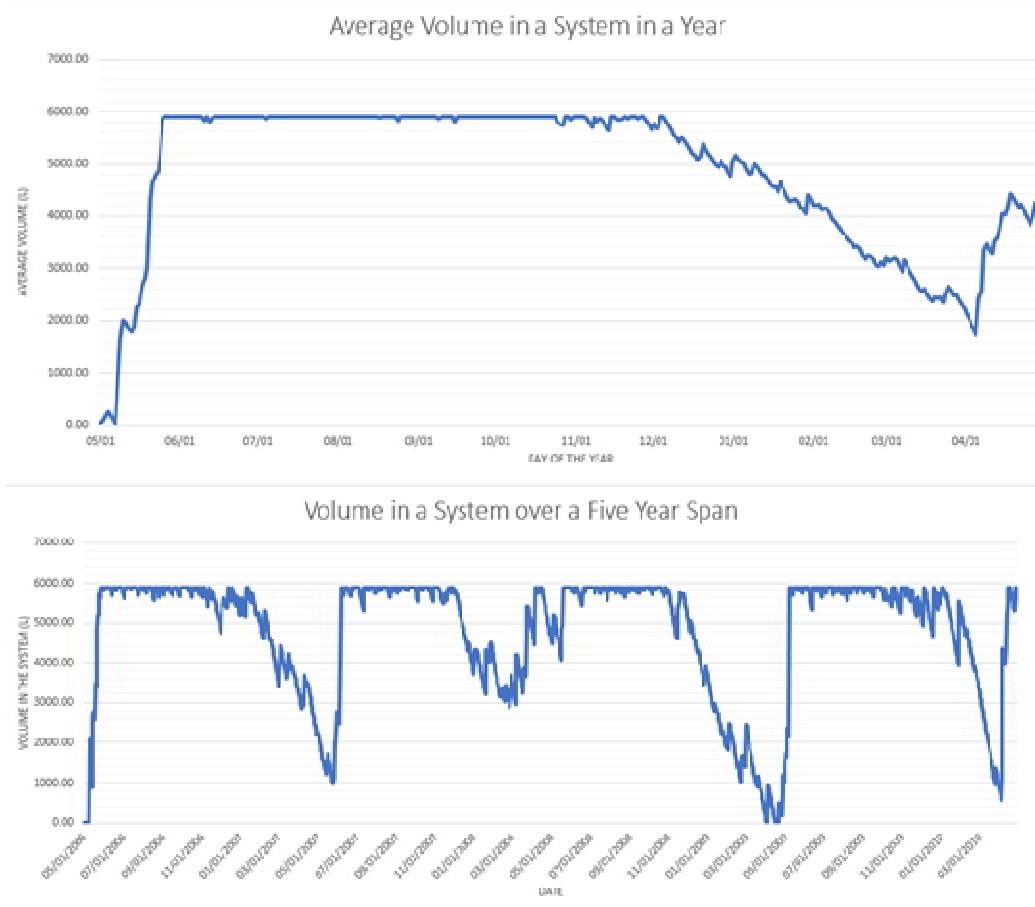
House Profiles – House 2

- ▶ House 2 – Mateo Cal Cal and Isabela Caj Pop
- ▶ Existing Storage
 - ▶ 2 2500 L Tank (Government)
- ▶ Preparations
 - ▶ Prepare the area for the concrete bases
 - ▶ Collect rocks for the concrete bases
 - ▶ Prepare to empty and clean the existing tank



House Profiles – House 2

► House 2 – Mateo Cal Cal and Isabela Caj Pop

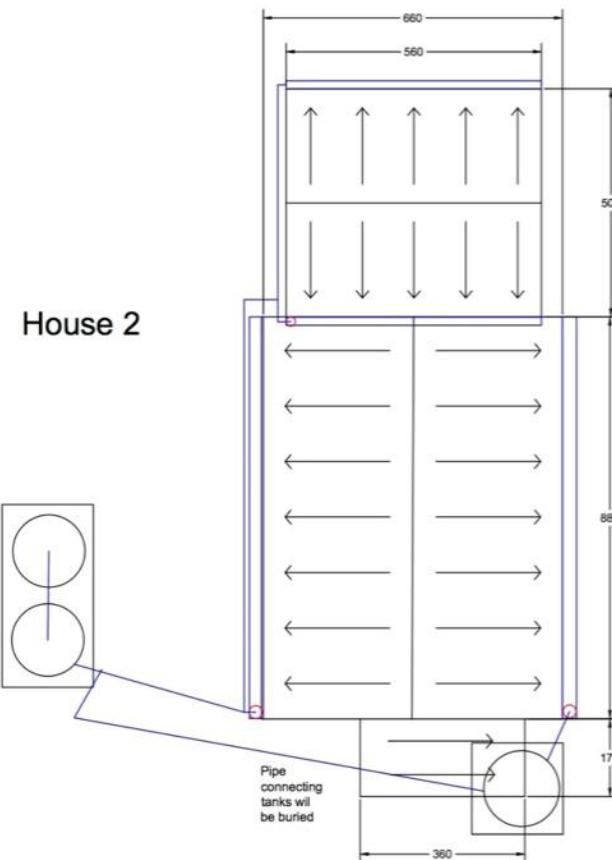


House Profiles – House 2

- ▶ House 2 – Mateo Cal Cal and Isabela Caj Pop

- ▶ Construction Plan

- ▶ 2 Gutters of length 560 cm
- ▶ 2 Gutters of length 880 cm
- ▶ First flush length of 69 cm
- ▶ 2nd first flush length of 72 cm
- ▶ Overflow height of 12.75 cm
- ▶ 1 tank is being added
- ▶ 1 one tank base is being added
- ▶ 1 two tank base is being added



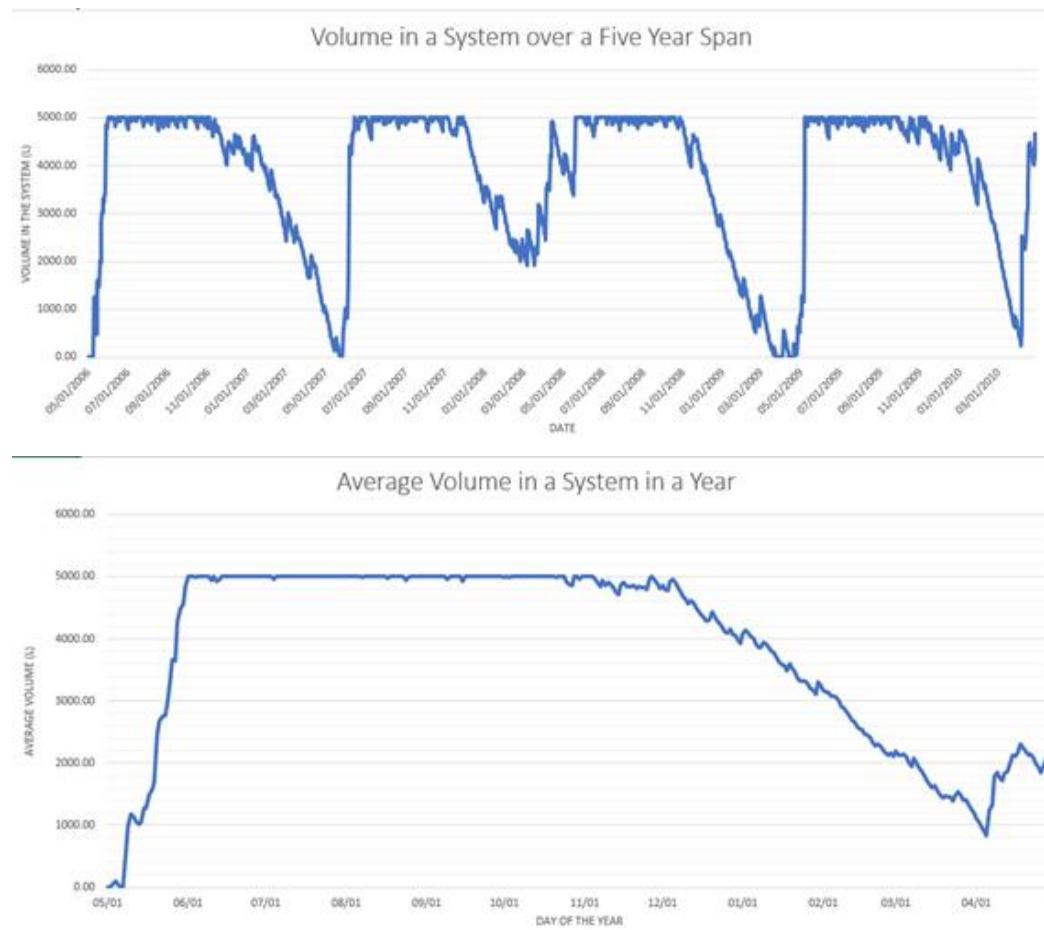
House Profiles – House 3

- ▶ House 3 – Julio Cal Jalal and Celestina Cal Caj
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Increase pitch of the roof
 - ▶ Prepare the area for the concrete bases
 - ▶ Collect rocks for the concrete bases

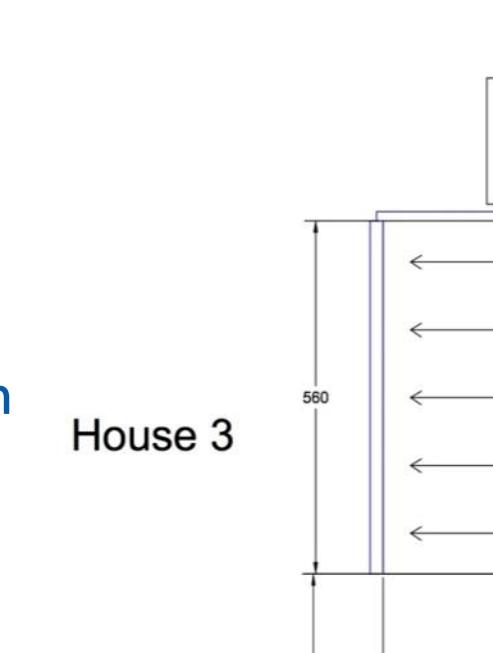


House Profiles – House 3

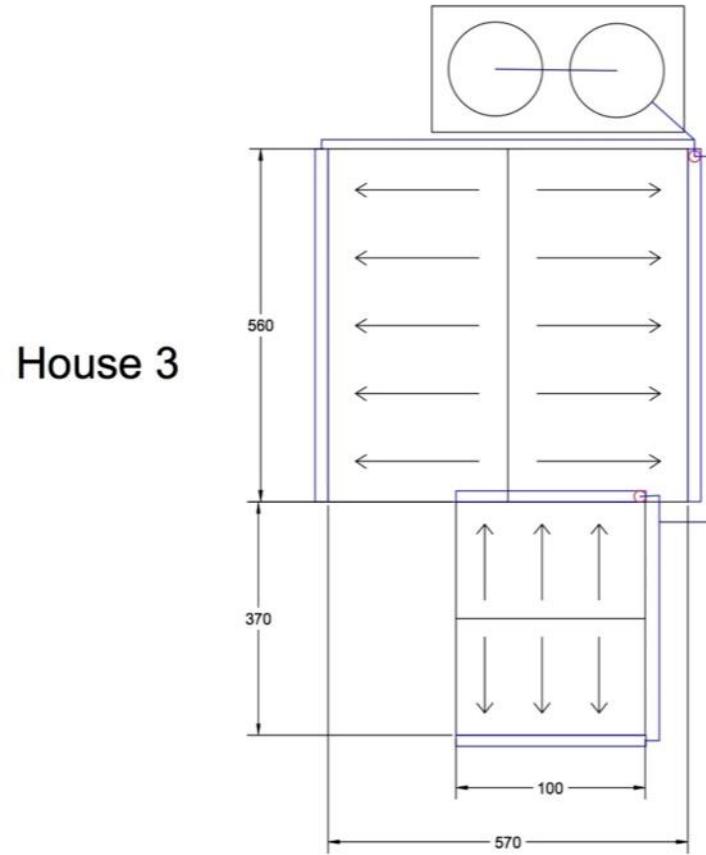
► House 3 – Julio Cal Jalal and Celestina Cal Caj



House Profiles – House 3

- ▶ House 3 – Julio Cal Jalal and Celestina Cal Caj
 - ▶ Construction Plan
 - ▶ 2 Gutters of length 100cm
 - ▶ 2 Gutters of length 560cm
 - ▶ First flush length of 79 cm
 - ▶ 2nd first flush length of 10cm
 - ▶ Overflow height of 5 cm
 - ▶ 2 tanks are being added
 - ▶ 1 two tank base is being added

House 3



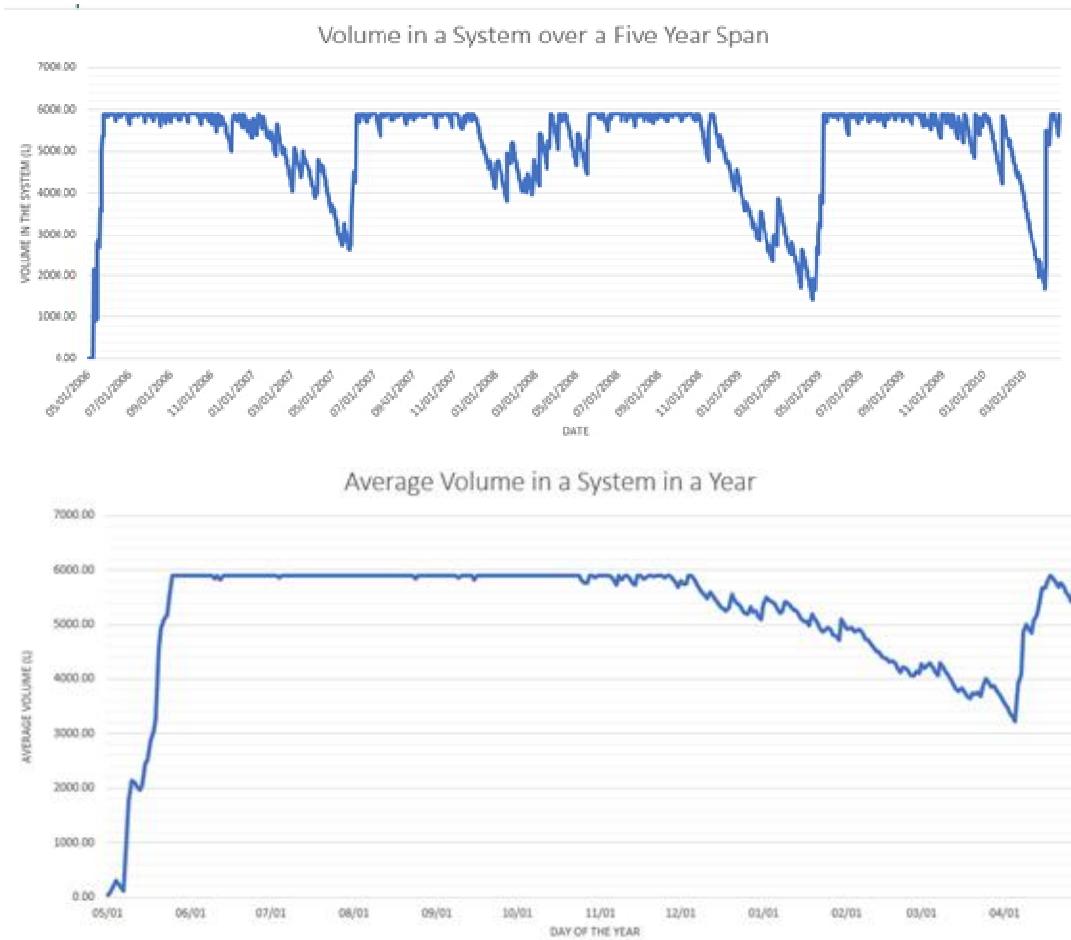
House Profiles – House 4

- ▶ House 4 – Estanislo Caal Mo and Isabel Xona Suc
- ▶ Existing Storage
 - ▶ 1 2500 L tank (government)
- ▶ Preparations
 - ▶ Maintain the roof
 - ▶ Prepare the area for the concrete bases
 - ▶ Collect rocks for the concrete bases
 - ▶ Prepare to empty and clean the existing tank



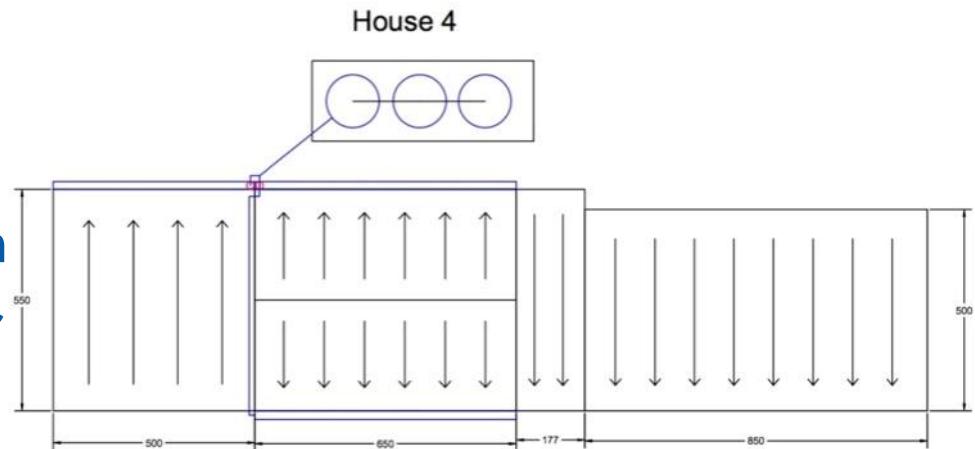
House Profiles – House 4

► House 4 – Estanislo Caal Mo and Isabel Xona Suc



House Profiles – House 4

- ▶ House 4 – Estanislo Caal Mo and Isabel Xona Suc
- ▶ Construction Plan
 - ▶ 2 Gutters of length 650 cm
 - ▶ 2 Gutters of length 500 cm
 - ▶ First flush length of 82 cm
 - ▶ 2nd first flush length of 88cm
 - ▶ Overflow height of 7 cm for the new tanks
 - ▶ Overflow height of 10 cm for the old tanks
 - ▶ 2 tanks are being added
 - ▶ 1 three tank base is being added



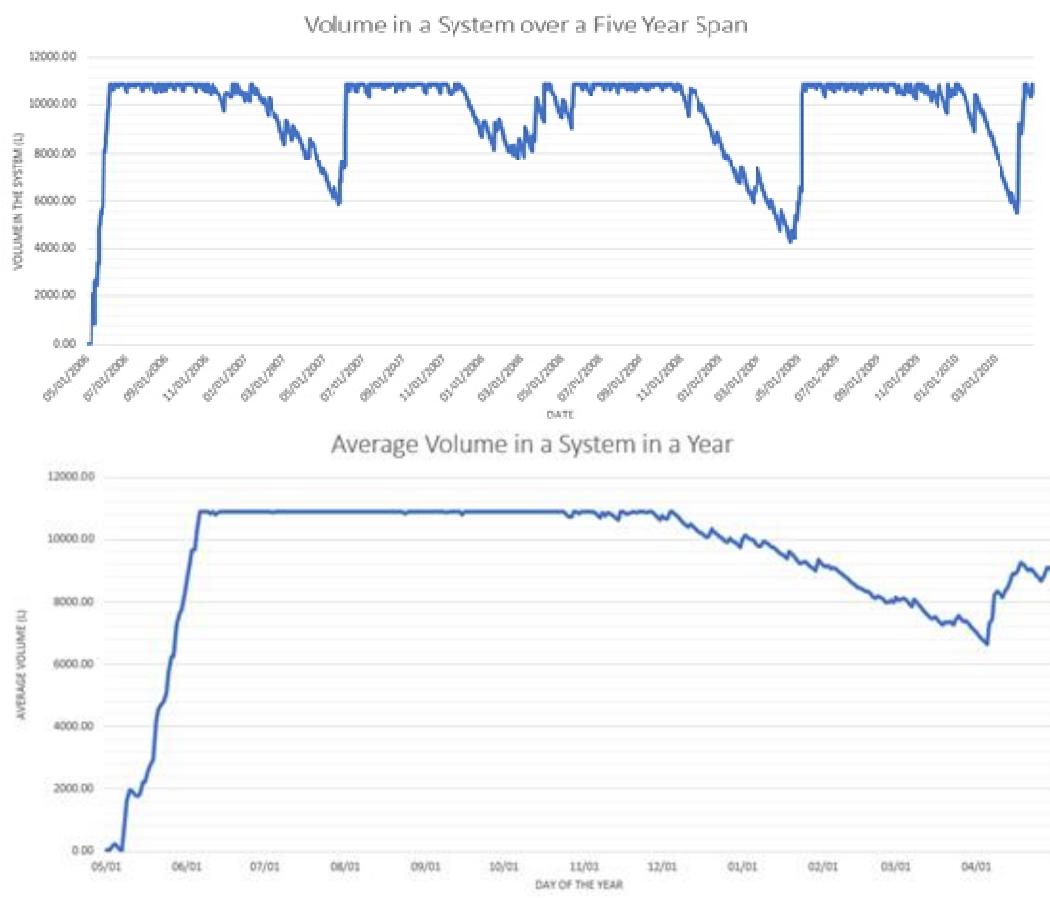
House Profiles – House 6

- ▶ House 6 – Carlos Jom Yuja and Rosa Gualim Cal
- ▶ Existing Storage
 - ▶ 1 2500 L tank (government)
 - ▶ 1 5000 L concrete tank
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base
 - ▶ Prepare to empty and clean the existing tank



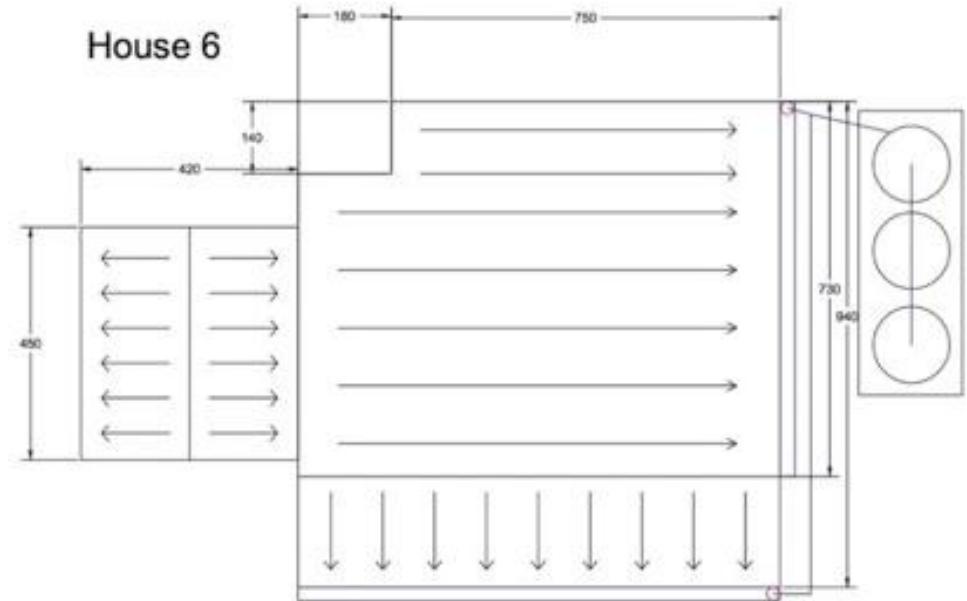
House Profiles – House 6

► House 6 – Carlos Jom Yuja and Rosa Gualim Cal



House Profiles – House 6

- ▶ House 6 – Carlos Jom Yuja and Rosa Gualim Cal
- ▶ Construction Plan
 - ▶ I Gutters of length 930 cm
 - ▶ I Gutters of length 730 cm
 - ▶ First flush length of 372 cm
 - ▶ Overflow height of 12.5 cm
 - I three tank base is being added



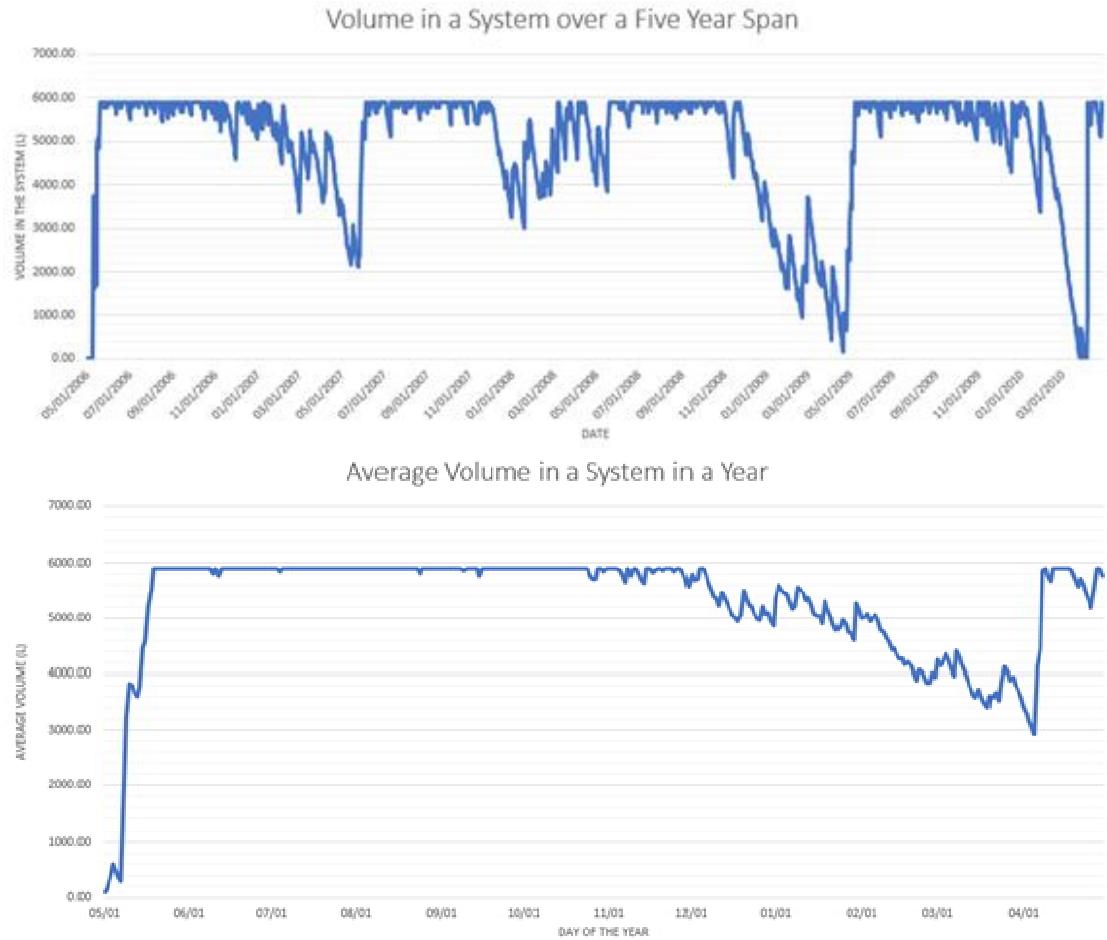
House Profiles – House 10

- ▶ House 10 – Santiago Lem Mo and Magarita Pop Jom
- ▶ Existing Storage
 - ▶ 2 2500 L tanks (government)
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base
 - ▶ Raise the roof in the front of the house



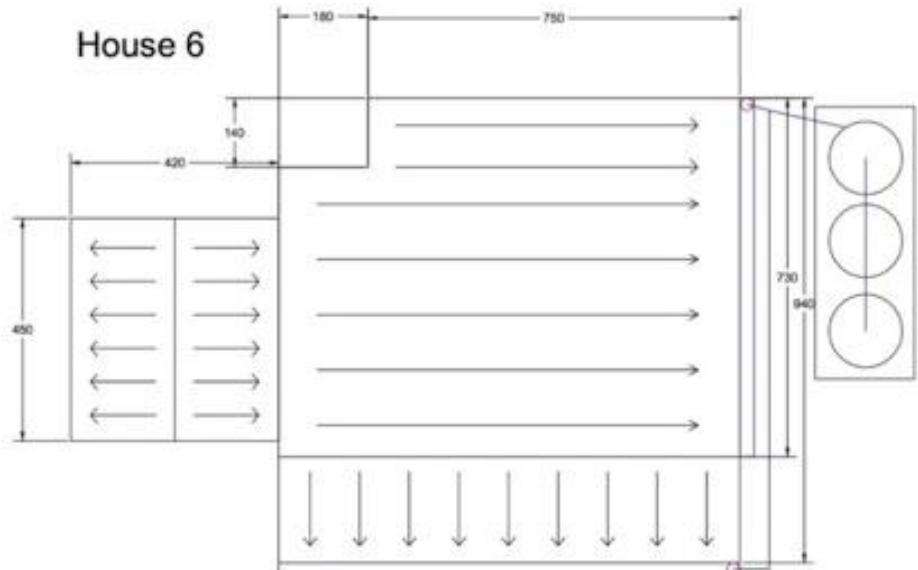
House Profiles – House 10

► House 10 – Santiago Lem Mo and Magarita Pop Jom



House Profiles – House 10

- ▶ House 10 – Santiago Lem Mo and Magarita Pop Jom
- ▶ Construction Plan
 - ▶ 2 Gutters of length 900 cm
 - ▶ 1 Gutter of length 1210 cm
 - ▶ 1 Gutter of length 740 cm
 - ▶ First flush length of 150 cm
 - ▶ 2nd first flush length of 170 cm
 - ▶ Overflow height of 36 cm
 - ▶ 1 three tank base is being added



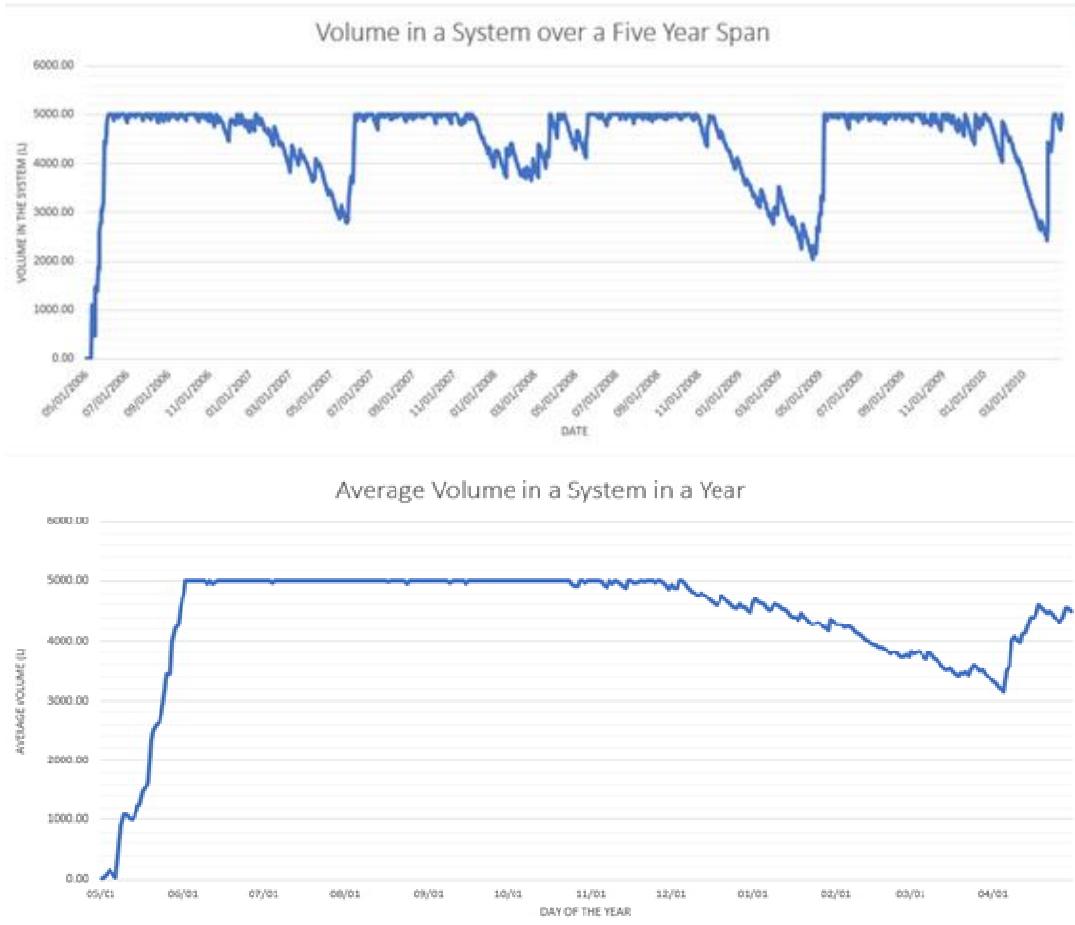
House Profiles – House 12

- ▶ House 12 – Edin Raul Coc Chub and Alejandrina Yuja Lem
- ▶ Existing Storage
 - ▶ 1 5000 L concret tank
- ▶ Preparations
 - ▶ Maintain your home



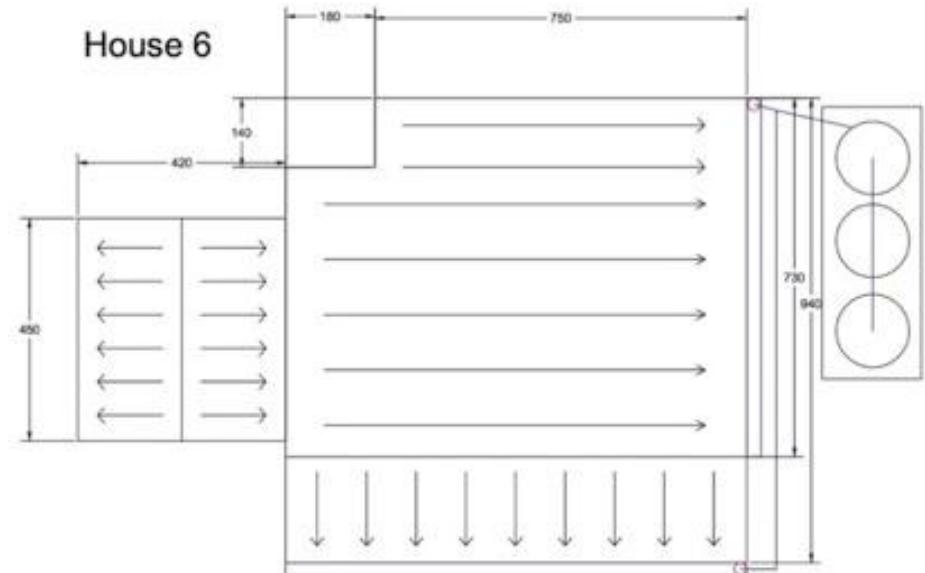
House Profiles – House 12

► House 12 – Edin Raul Coc Chub and Alejandrina Yuja Lem



House Profiles – House 12

- ▶ House 12 – Edin Raul Coc Chub and Alejandrina Yuja Lem
- ▶ Construction Plan
 - ▶ 2 Gutters of length 760 cm
 - ▶ First flush length of 113 cm
 - ▶ Overflow height of 4 cm



House Profiles – House 17

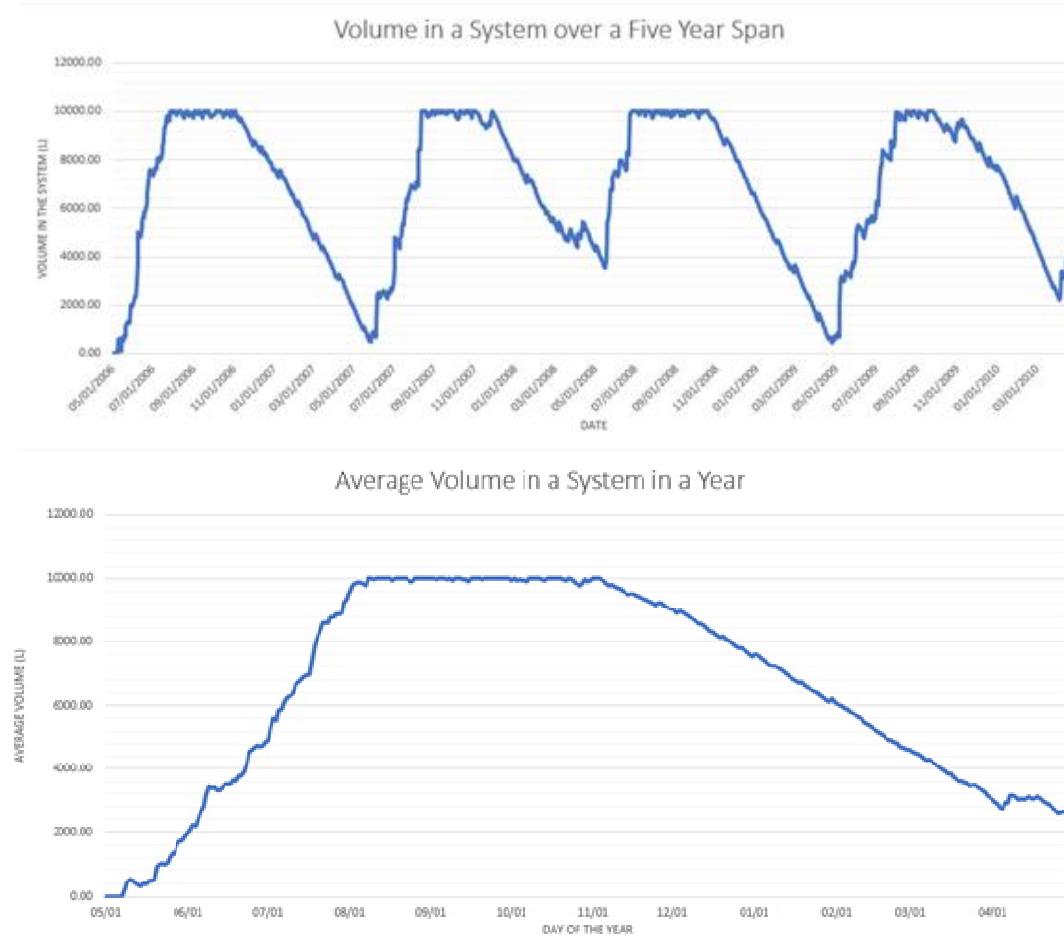
- ▶ House 17 – Edgar Efrain Yuja Cal and Macz Calel
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base



01/07/20

House Profiles – House 17

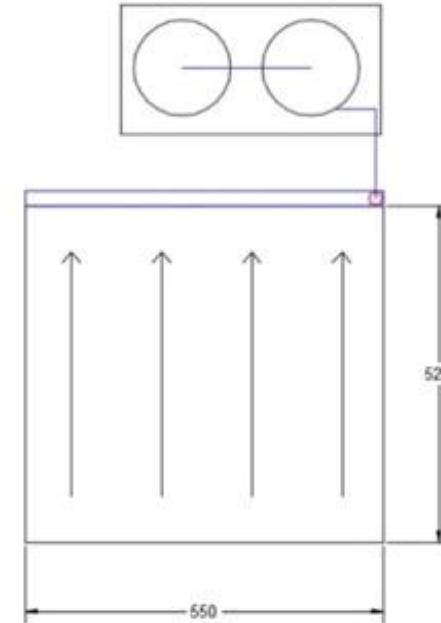
► House 17 – Edgar Efrain Yuja Cal and Macz Calel



House Profiles – House 17

- ▶ House 17 – Edgar Efrain Yuja Cal and Macz Calel
- ▶ Construction Plan
 - ▶ 1 Gutters of length 550 cm
 - ▶ First flush length of 65 cm
 - ▶ Overflow height of 8 cm
 - ▶ 2 tanks being added
 - ▶ 1 two tank base

House 17



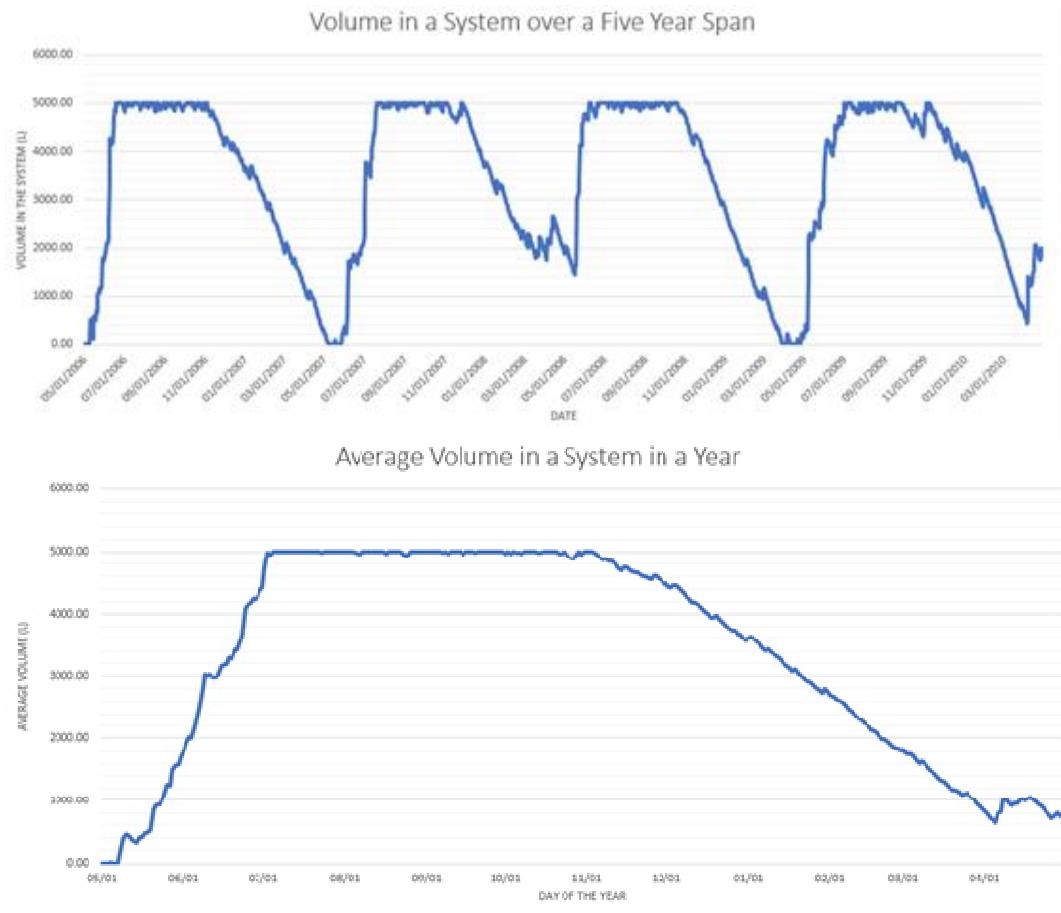
House Profiles – House 19

- ▶ House 19 – Victor Caj Cu and Matilde Jor Yuja
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base
 - ▶ Raise the roof 500 cm for the tank



House Profiles – House 19

► House 19 – Victor Caj Cu and Matilde Jor Yuja

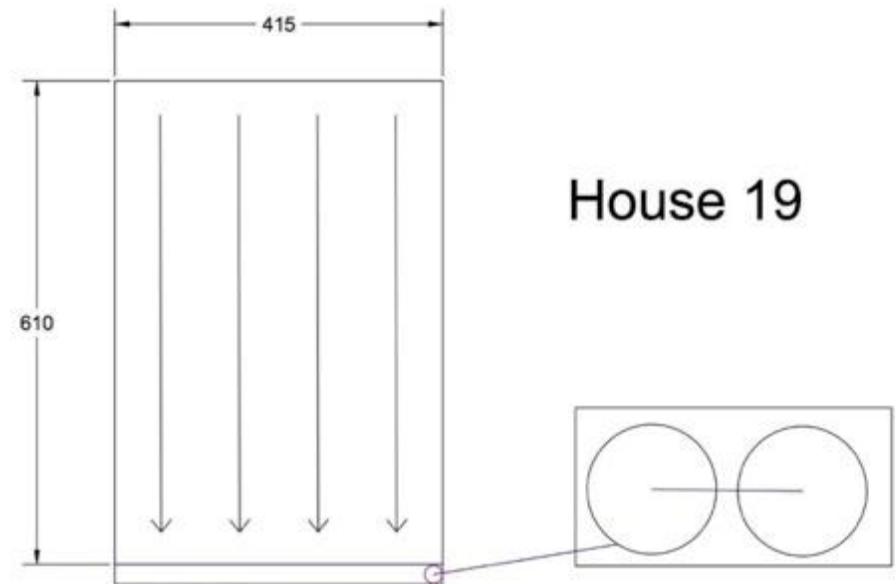


House Profiles – House 19

- ▶ House 19 – Victor Caj Cu and Matilde Jor Yuja

▶ Construction Plan

- ▶ I Gutters of length 415 cm
- ▶ First flush length of 65 cm
- ▶ Overflow height of 8 cm
- ▶ 2 tanks being added
- ▶ I two tank base



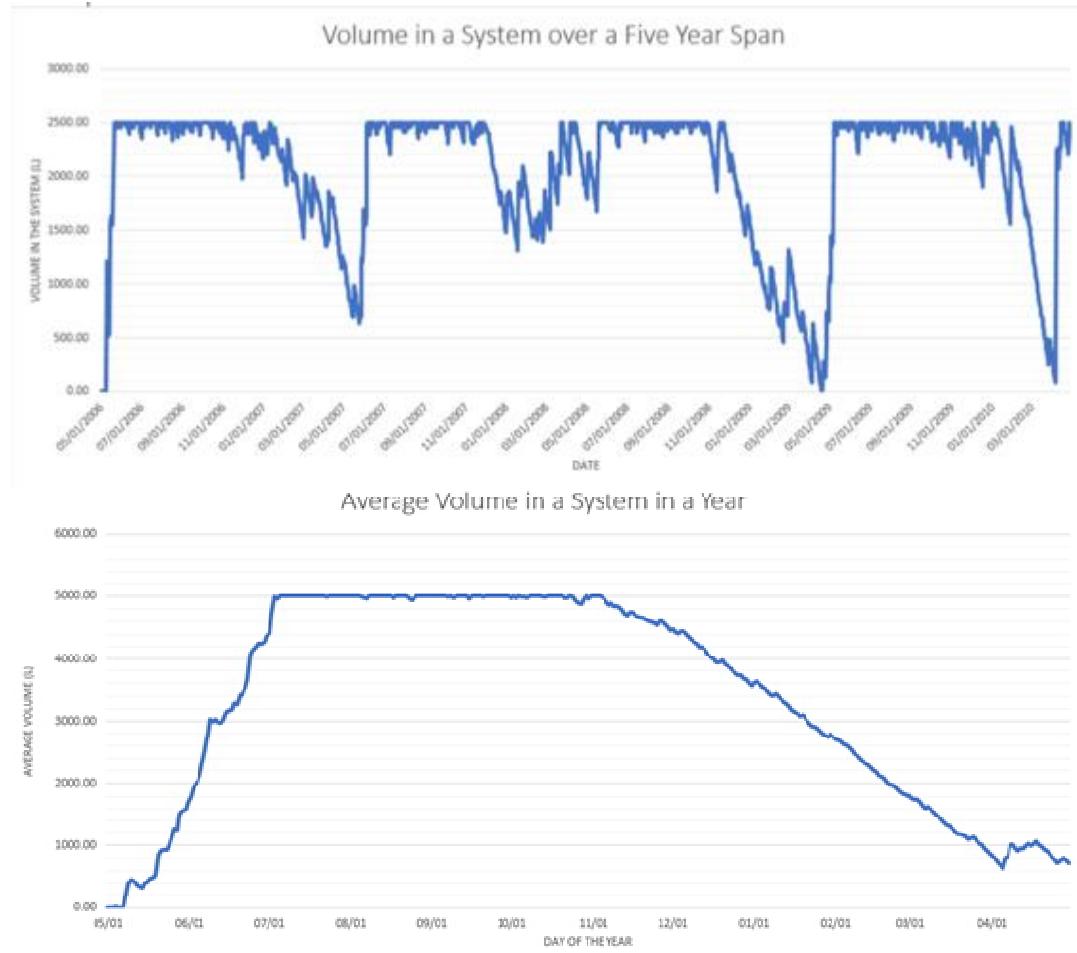
House Profiles – House 20

- ▶ House 20 – Mario Enrique Chul Laj and Clara Caj Cu
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base



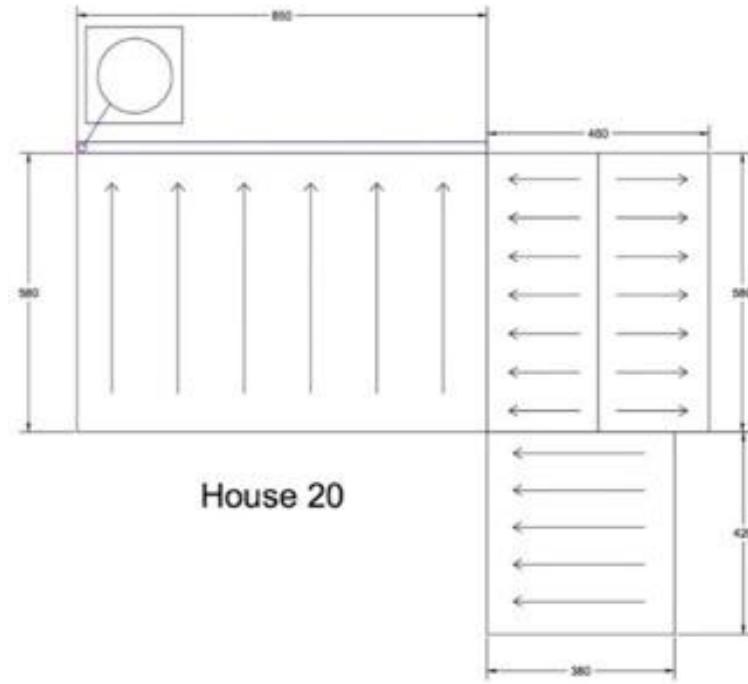
House Profiles – House 20

► House 20 – Mario Enrique Chul Laj and Clara Caj Cu



House Profiles – House 20

- ▶ House 20 – Mario Enrique Chul Laj and Clara Caj Cu
- ▶ Construction Plan
 - ▶ I Gutter of length 850 cm
 - ▶ First flush length of 217 cm
 - ▶ Overflow height of 4.4 cm
 - ▶ I tank being added
 - ▶ I one tank base



House Profiles – House 22

- ▶ House 22 – Teresa Yuja Lopez
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the concrete base
 - ▶ Collect rocks for the concrete base



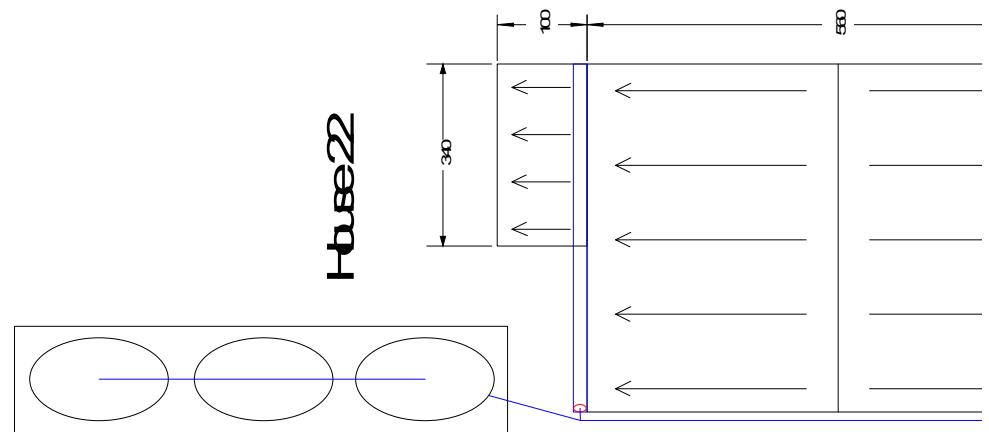
House Profiles – House 22

► House 22 – Teresa Yuja Lopez



House Profiles – House 22

- ▶ House 22 – Teresa Yuja Lopez
- ▶ Construction Plan
 - ▶ 2 Gutters of length 650 cm
 - ▶ First flush length of 98 cm
 - ▶ Overflow height of 10 cm
 - ▶ 3 tanks being added
 - ▶ 1 three tank base



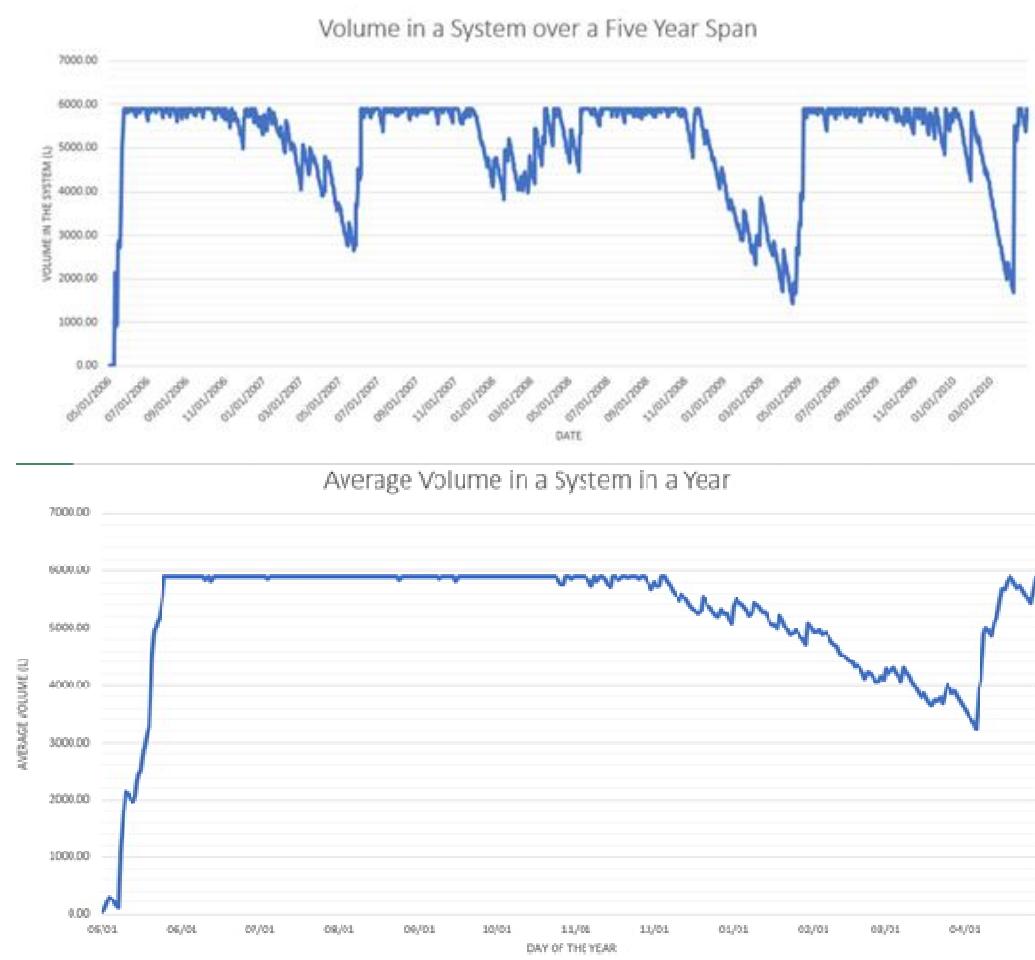
House Profiles – House 23a

- ▶ House 23a – Abelino Caal Ical and Marcela Toc
- ▶ Existing Storage
 - ▶ 3 2500 L tanks (government)
- ▶ Preparations
 - ▶ Level the ground near the government tanks



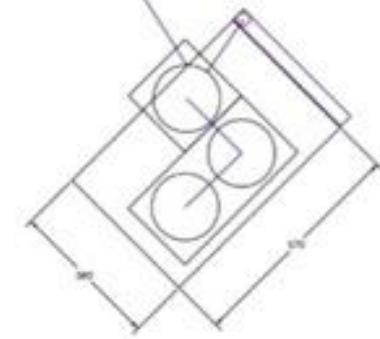
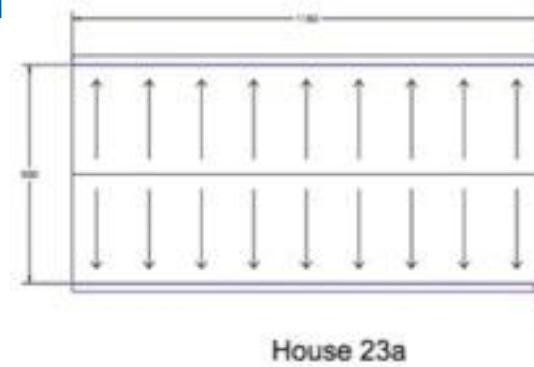
House Profiles – House 23a

► House 22 – Teresa Yuja Lopez



House Profiles – House 23a

- ▶ House 22 – Teresa Yuja Lopez
- ▶ Construction Plan
 - ▶ 2 Gutters of length 1180 cm
 - ▶ 1 Gutter of length 380 cm
 - ▶ First flush length of 380 cm
 - ▶ Overflow height of 12.8 cm
 - ▶ 1 one tank base



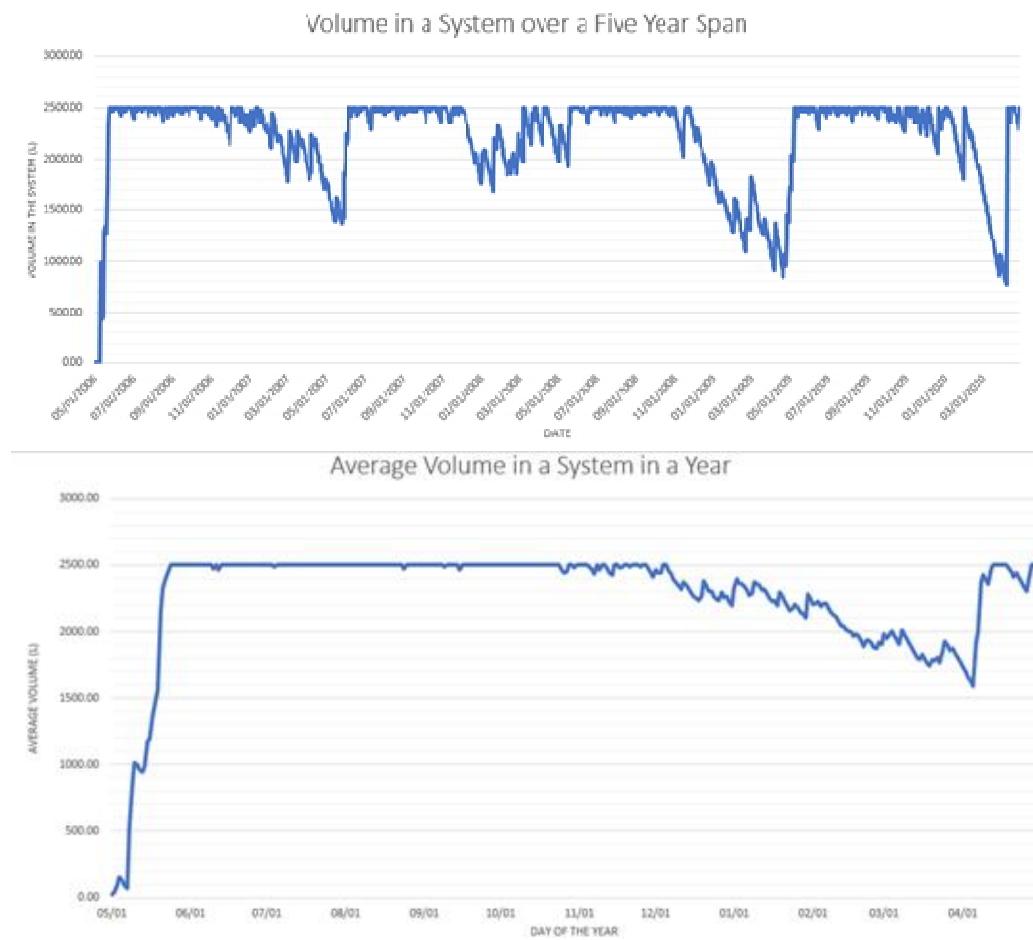
House Profiles – House 23b

- ▶ House 23b – Mario Xim Laj and Chen Toc
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base



House Profiles – House 23b

► House 23b – Mario Xim Laj and Chen Toc

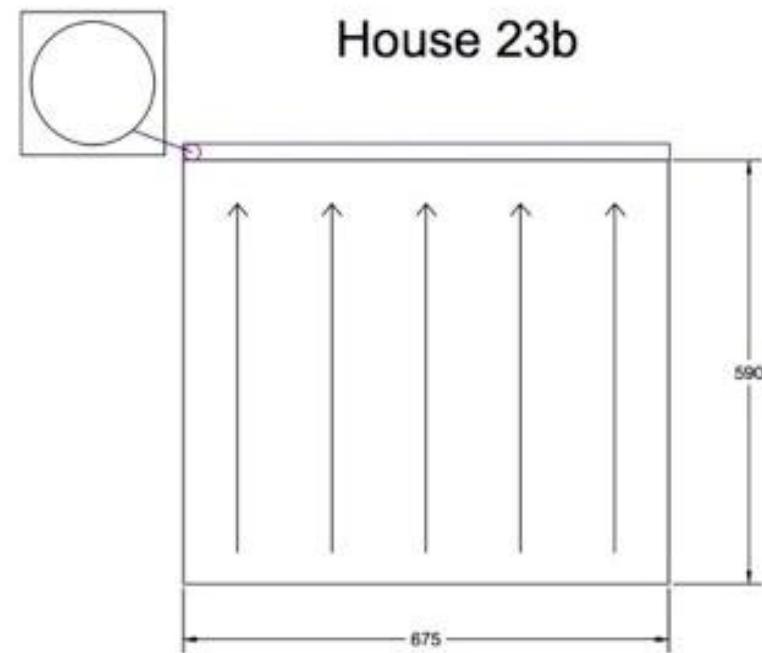


House Profiles – House 23b

▶ House 23b – Mario Xim Laj and Chen Toc

▶ Construction Plan

- ▶ I Gutter of length 675 cm
- ▶ First flush length of 175 cm
- ▶ Overflow height of 3 cm
- ▶ I tank being added
- ▶ I one tank base



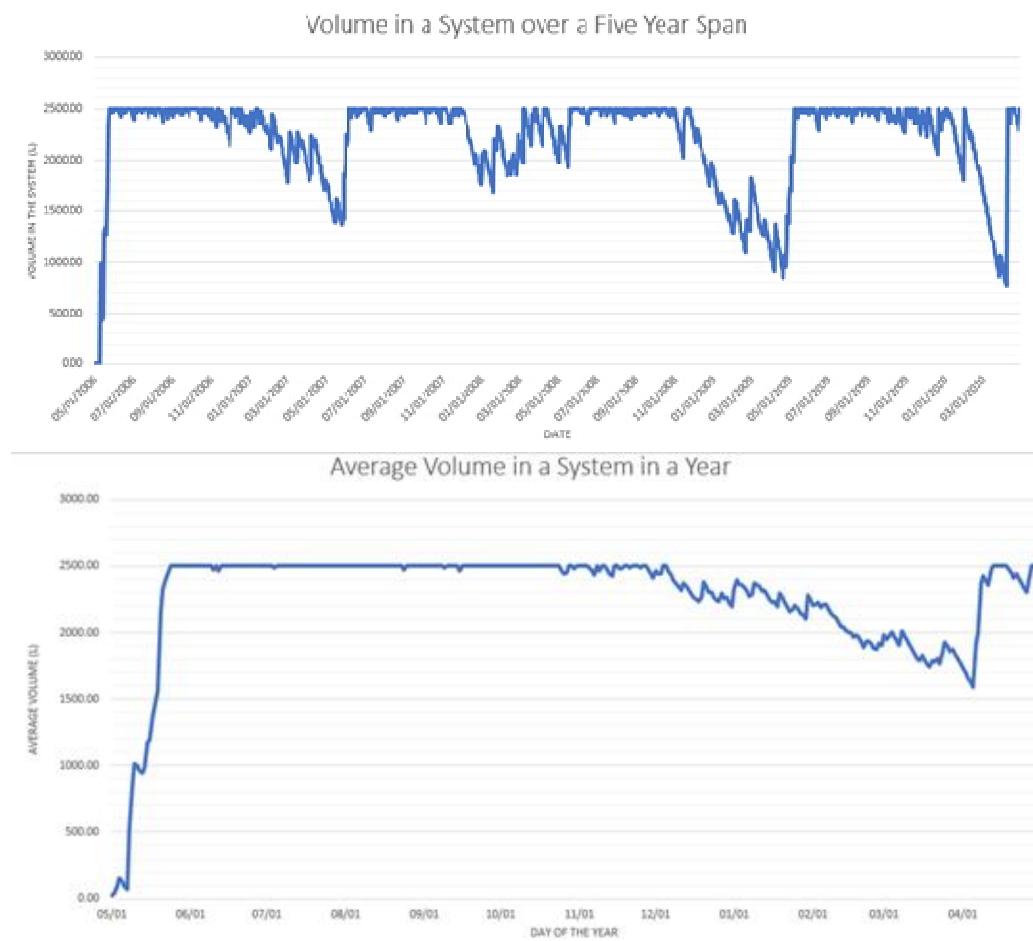
House Profiles – House 24

- ▶ House 24 – Cerapio Caal Caal and Alicia Chen Toc Chub
- ▶ Existing Storage
 - ▶ 1 5000 L tank
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base



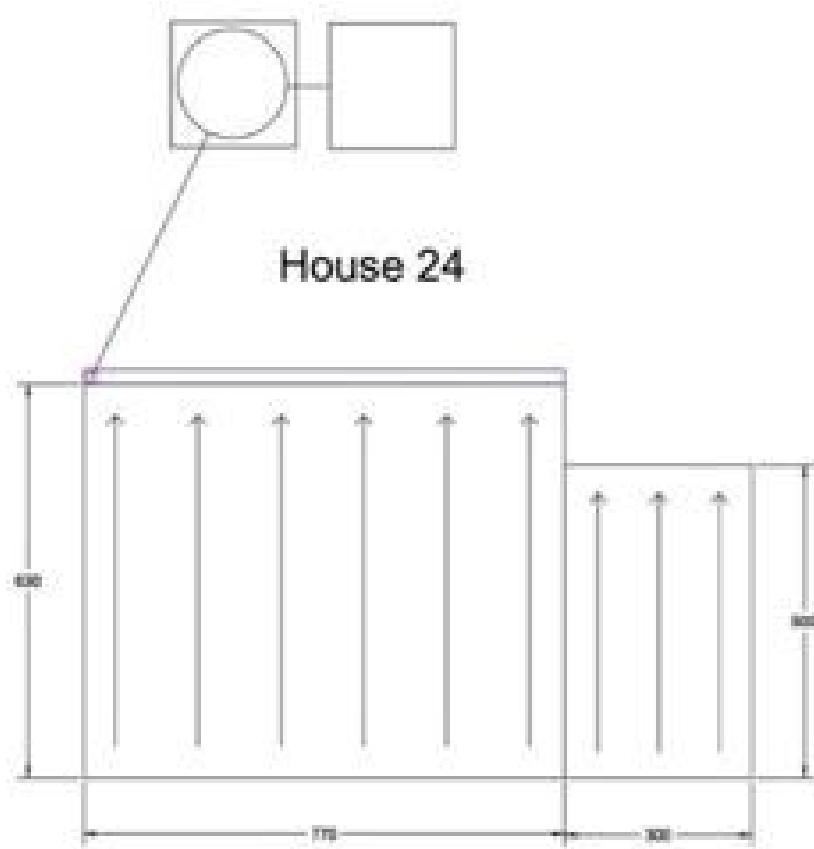
House Profiles – House 23b

► House 24 – Cerapio Caal Caal and Alicia Chen Toc Chub



House Profiles – House 23b

- ▶ House 24 – Cerapio Caal Caal and Alicia Chen Toc Chub
- ▶ Construction Plan
 - ▶ I Gutter of length 770 cm
 - ▶ First flush length of 213 cm
 - ▶ Overflow height of 4.3 cm
 - ▶ I tank being added
 - ▶ I one tank base



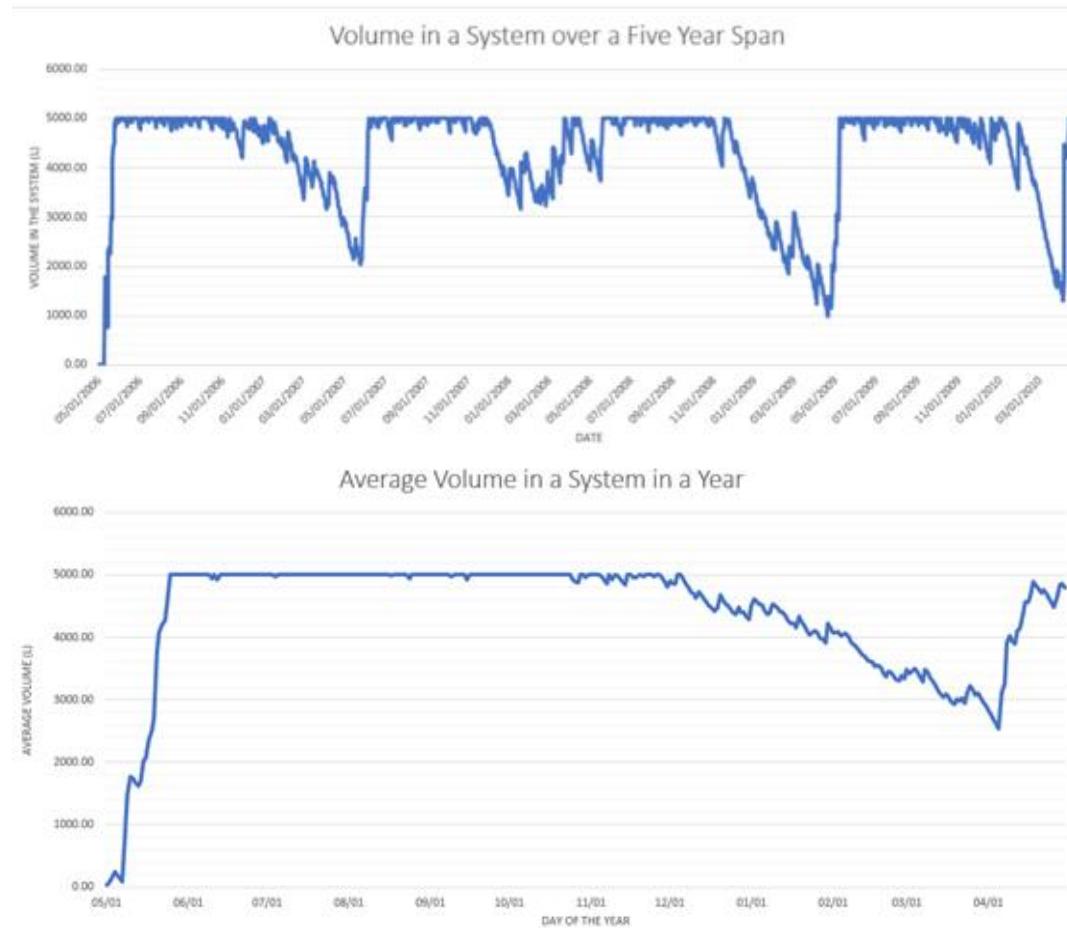
House Profiles – House 25

- ▶ House 25 – Emilio Chen Gualim and Elvira Choc Lem
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base



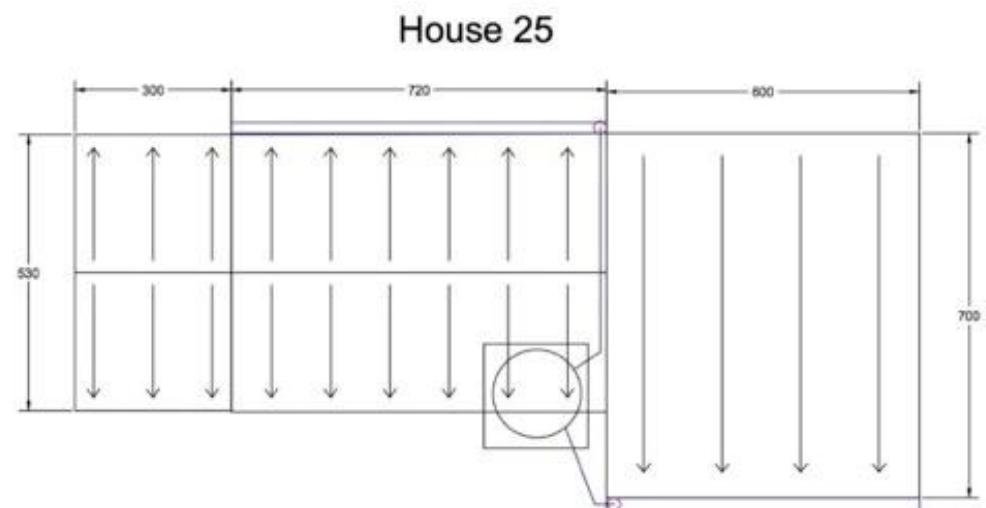
House Profiles – House 25

► House 25 – Emilio Chen Gualim and Elvira Choc Lem



House Profiles – House 25

- ▶ House 25 – Emilio Chen Gualim and Elvira Choc Lem
- ▶ Construction Plan
 - ▶ I Gutter of length 720 cm
 - ▶ I Gutter of length 600 cm
 - ▶ First flush length of 317 cm
 - ▶ Overflow height of 9 cm
 - ▶ I tank being added
 - ▶ I one tank base



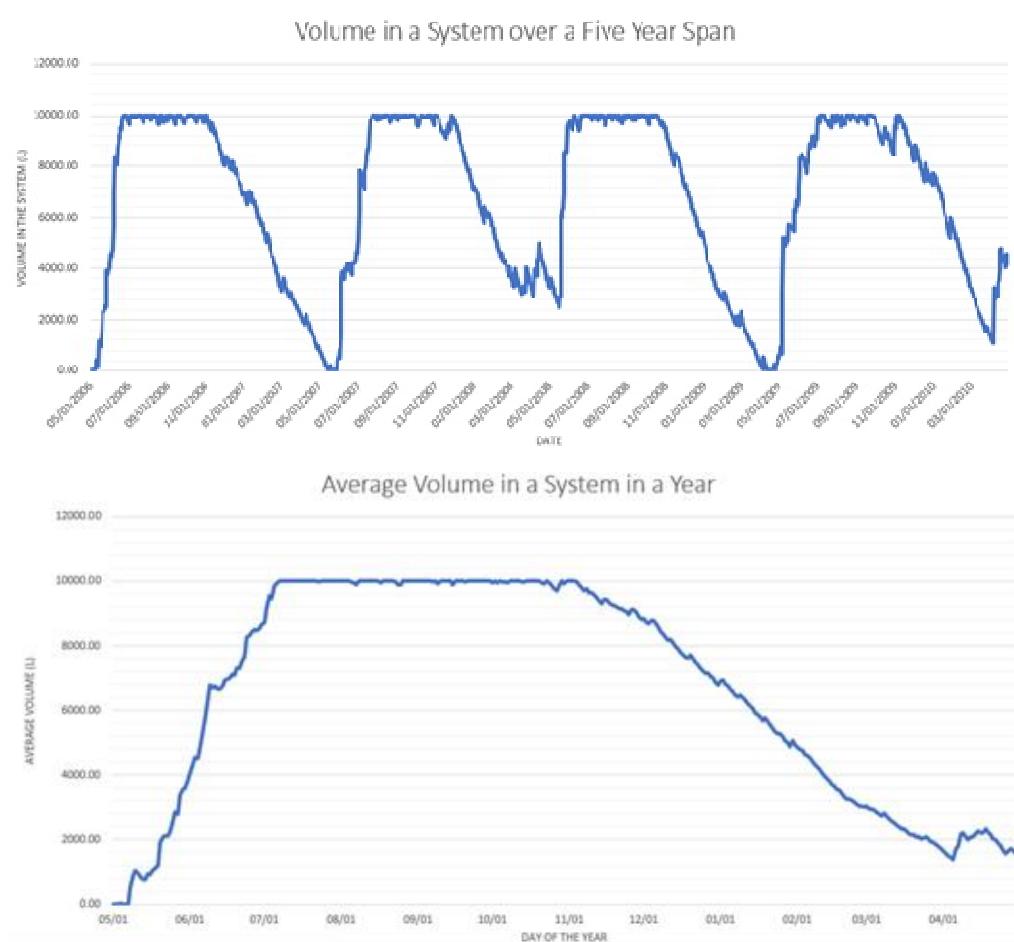
House Profiles – House 30

- ▶ House 30 – Martolo Jom Valesques and Herlinda Valasques Xona
- ▶ Existing Storage
 - ▶ 1 2500 L tank (government)
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base
 - ▶ Prepare to empty existing tanks to be cleaned



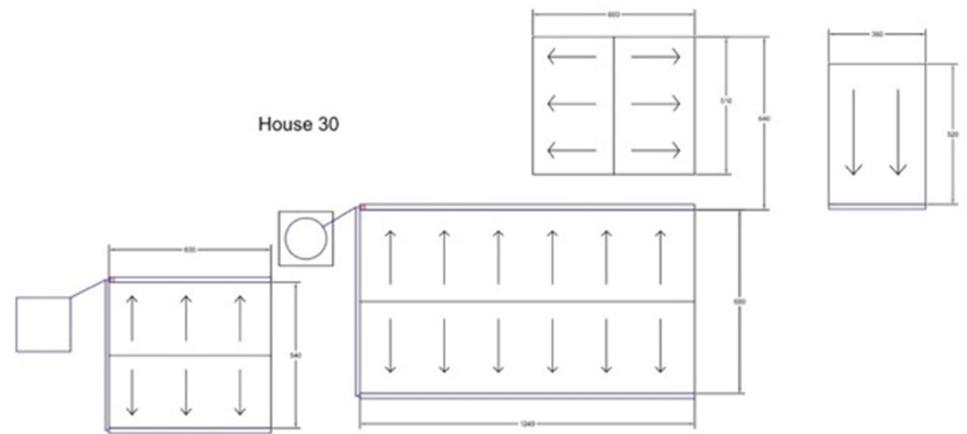
House Profiles – House 30

► House 30 – Martolo Jom Valesques and Herlinda Valasques Xona



House Profiles – House 30

- ▶ House 30 – Martolo Jom Valesques and Herlinda Valasques Xona
- ▶ Construction Plan
 - ▶ 2 Gutters of length 1240 cm
 - ▶ 2 Gutter of length 600 cm
 - ▶ First flush length of 86 cm
 - ▶ Overflow height of 1 cm
 - ▶ 1 tank being added
 - ▶ 1 one tank base



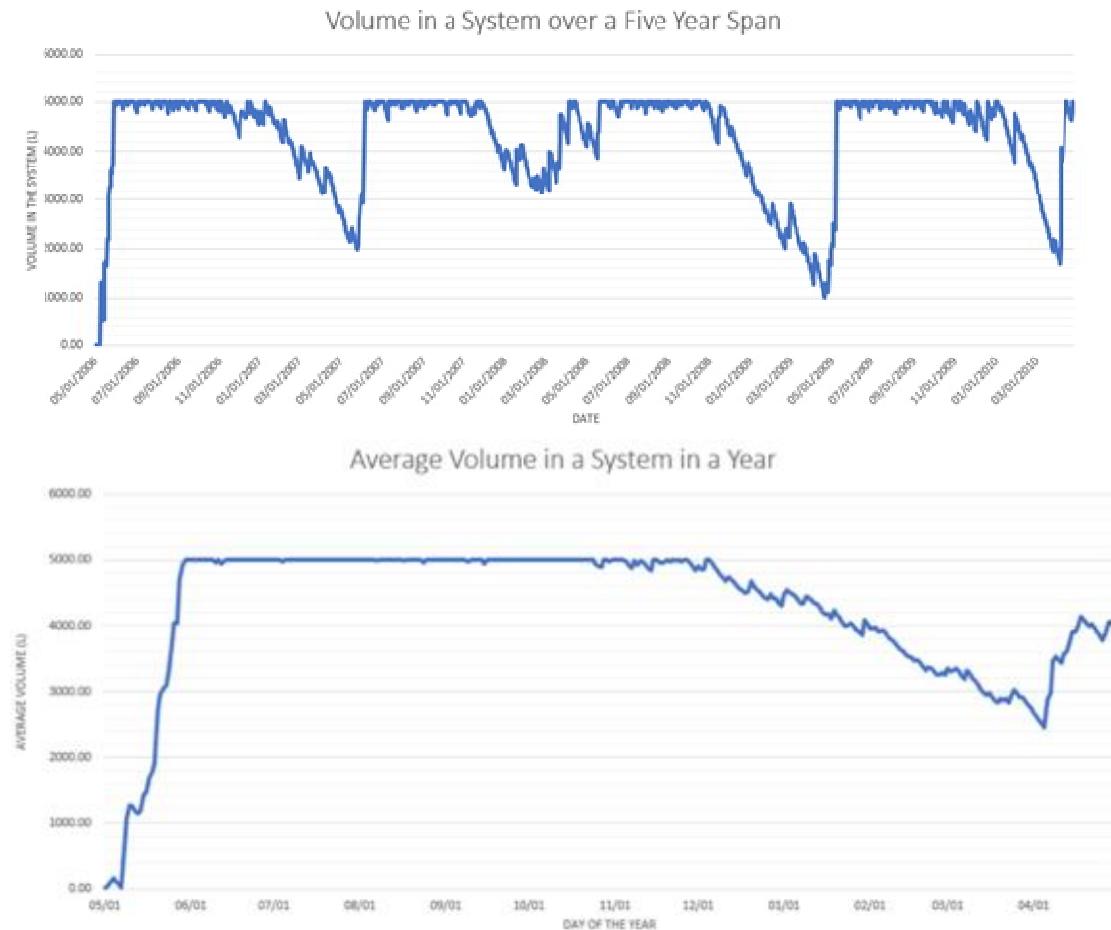
House Profiles – House 32

- ▶ House 32 – Emilio Gualim Cal and Ana Maria Quej Cal
- ▶ Existing Storage
 - ▶ 2 2500 L tanks (government)
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base
 - ▶ Prepare to empty existing tanks to be cleaned



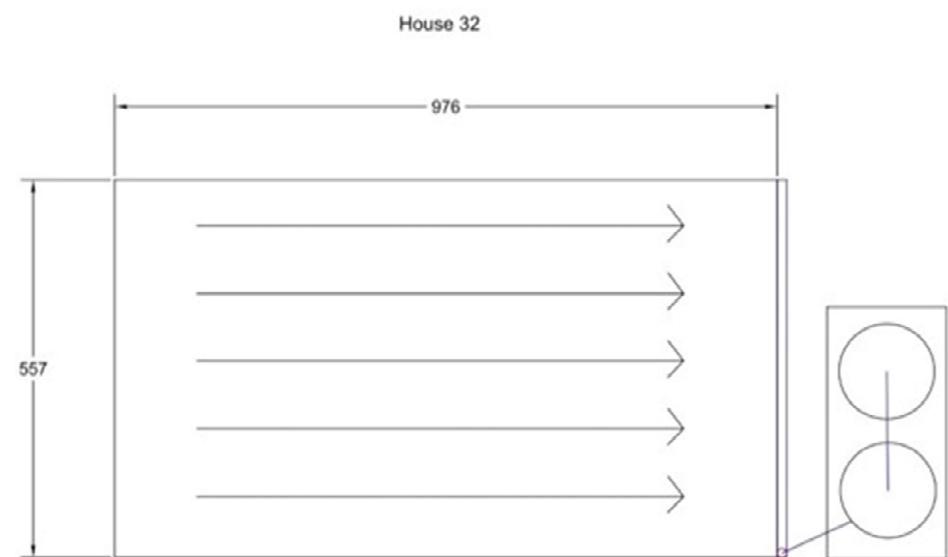
House Profiles – House 32

► House 32 – Emilio Gualim Cal and Ana Maria Quej Cal



House Profiles – House 32

- ▶ House 32 – Emilio Gualim Cal and Ana Maria Quej Cal
- ▶ Construction Plan
 - ▶ I Gutter of length 557 cm
 - ▶ First flush length of 239 cm
 - ▶ Overflow height of 5.3 cm



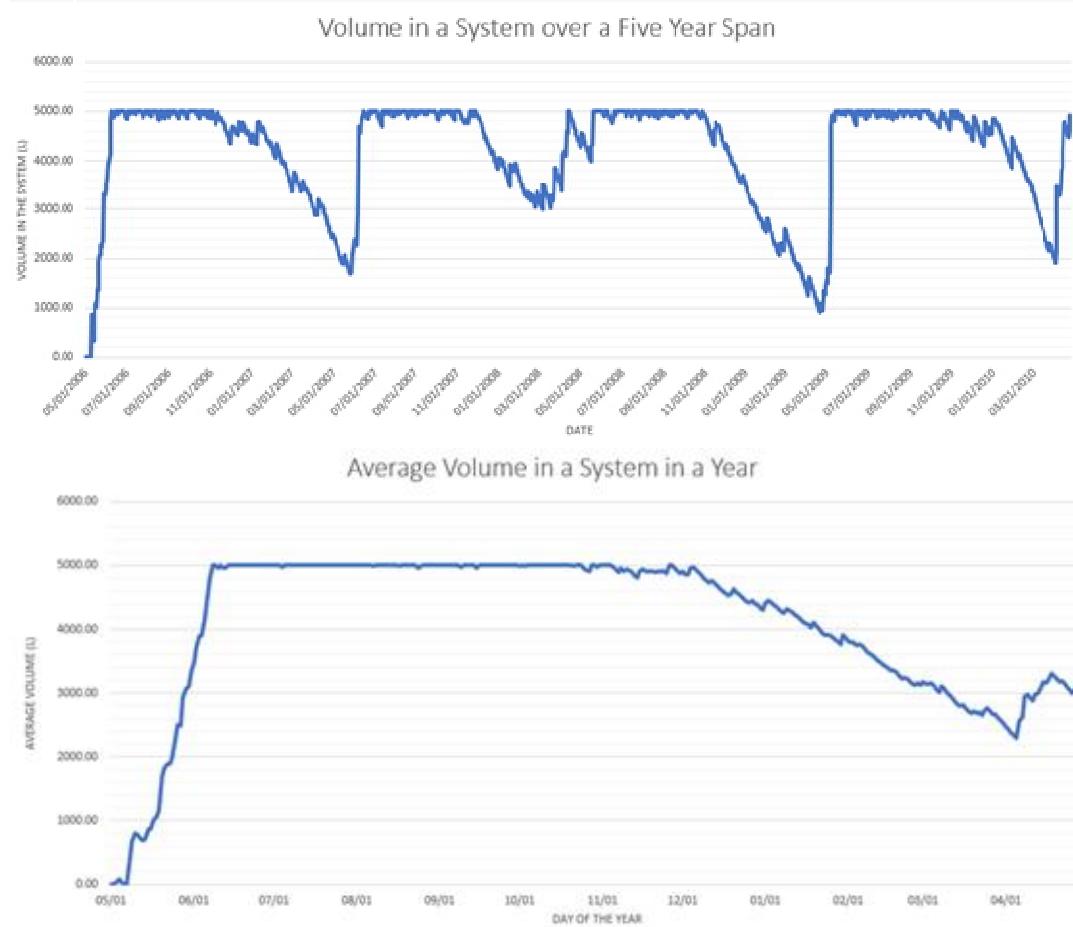
House Profiles – House 33

- ▶ House 33 – Anjelina Quej Ical
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base
 - ▶ Prepare the roof



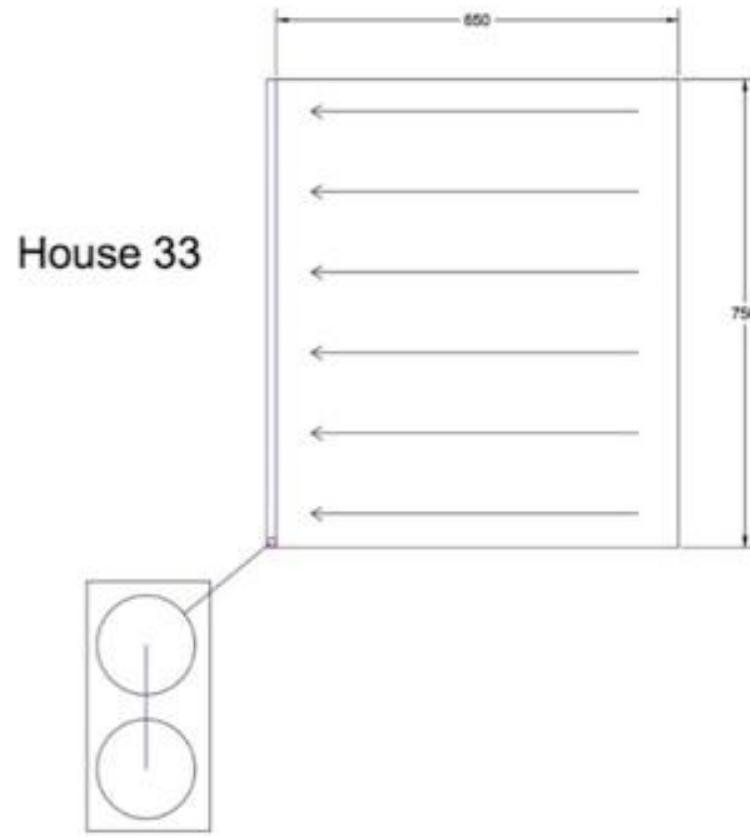
House Profiles – House 33

► House 33 – Anjelina Quej Ical



House Profiles – House 33

- ▶ House 33 – Anjelina Quej Ical
- ▶ Construction Plan
 - ▶ 1 Gutter of length 750 cm
 - ▶ First flush length of 158 cm
 - ▶ Overflow height of 2.5 cm
 - ▶ 2 tanks being added
 - ▶ 1 two tank base



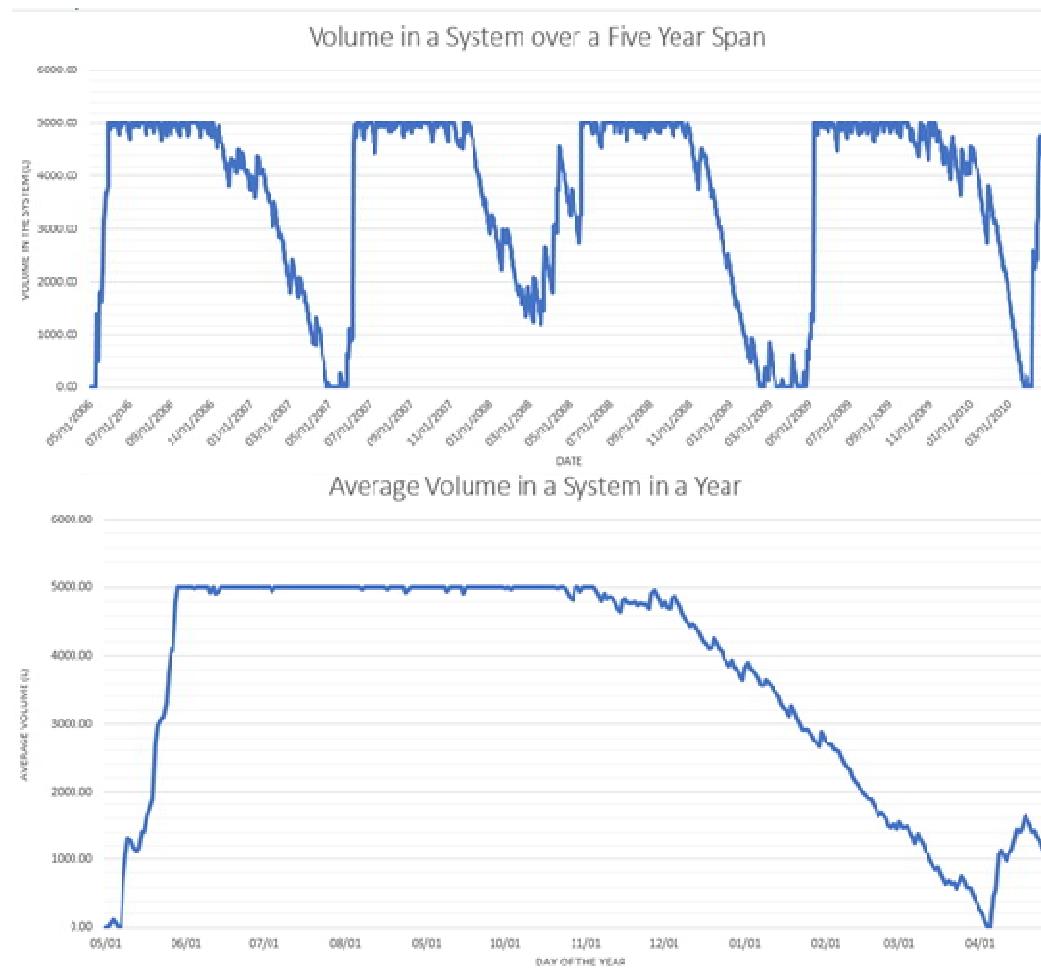
House Profiles – House 34

- ▶ House 34 – Leandro Gualim Cal and Maria Magdelana Jom Yuja
- ▶ Existing Storage
 - ▶ 2 2500 L tanks (government)
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base
 - ▶ Construct their new home as designed



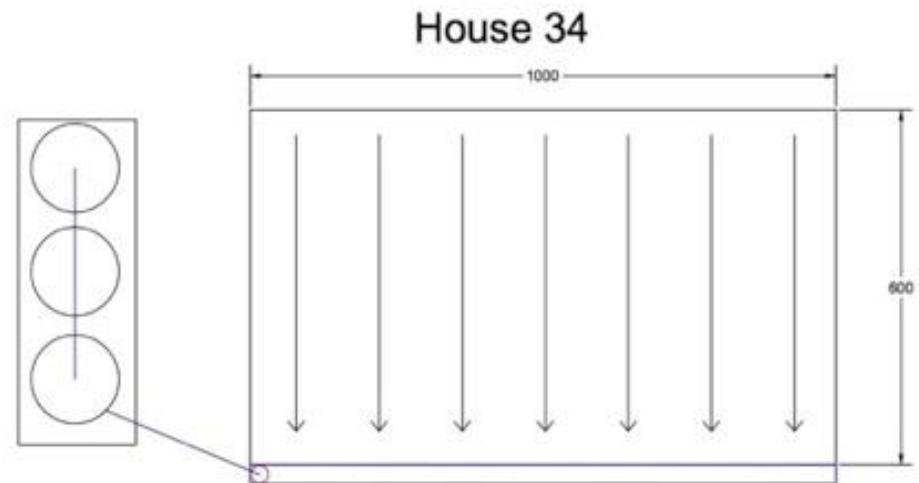
House Profiles – House 34

► House 34 – Leandro Gualim Cal and Maria Magdelana Jom Yuja



House Profiles – House 34

- ▶ House 34 – Leandro Gualim Cal and Maria Magdelana Jom Yuja
- ▶ Construction Plan
 - ▶ I Gutter of length 1000 cm
 - ▶ First flush length of 148 cm
 - ▶ Overflow height of 6.4 cm
 - ▶ I tank being added
 - ▶ I three tank base



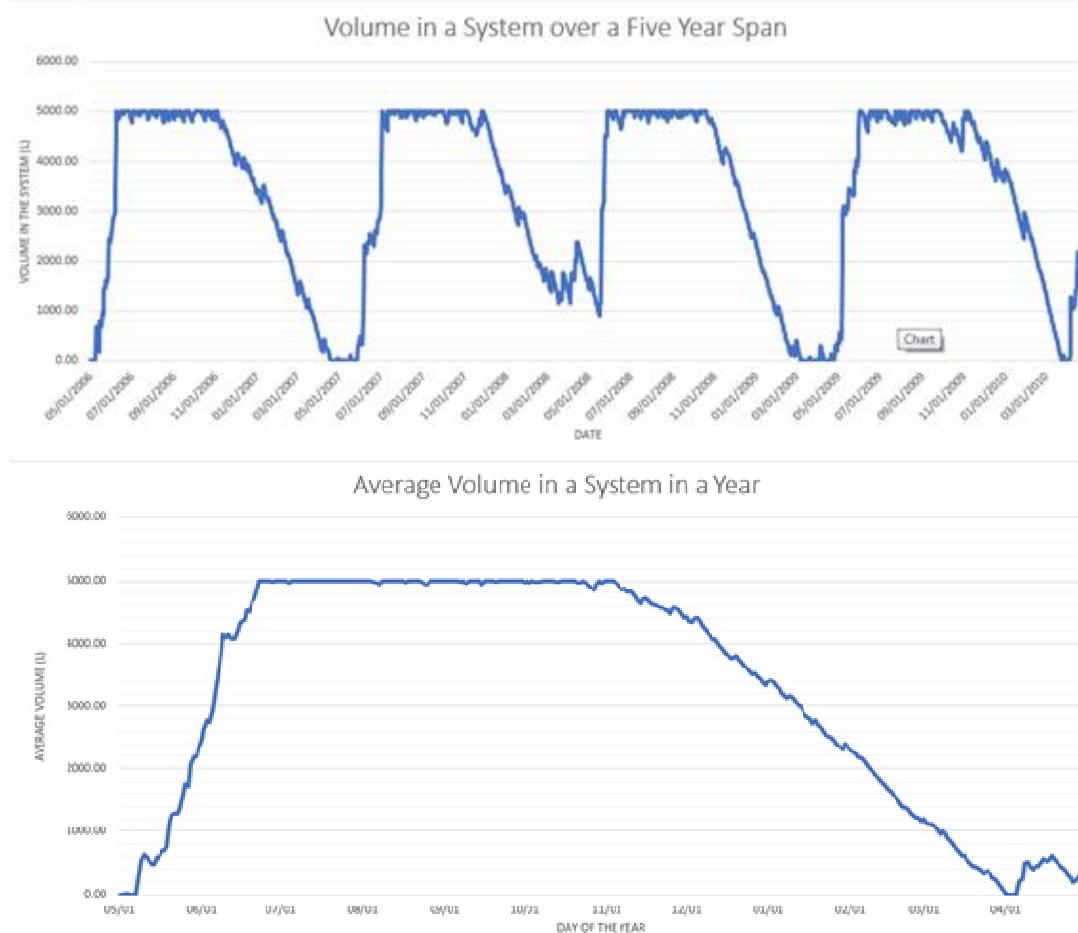
House Profiles – House 36

- ▶ House 36 – Luis Gilberto Cojoc Yuja and Zoila Esperanza Ical Cojoc
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base



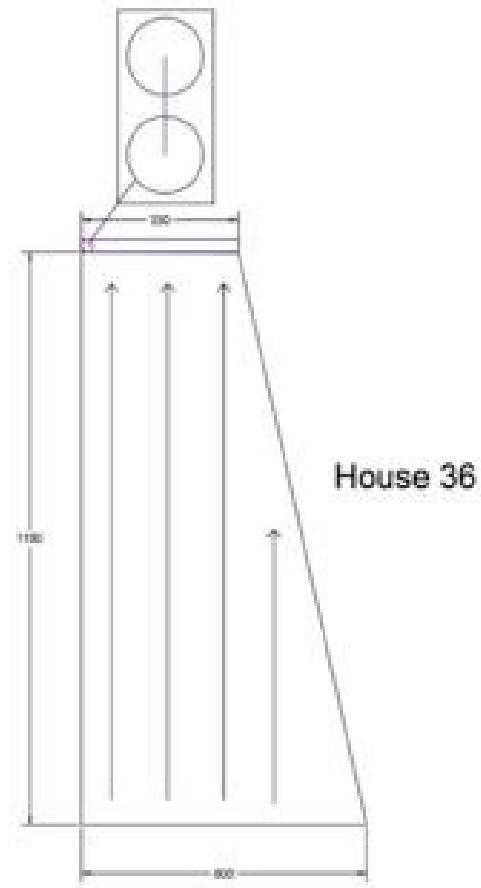
House Profiles – House 36

► House 36 – Luis Gilberto Cojoc Yuja and Zoila Esperanza Ical Cojoc



House Profiles – House 36

- ▶ House 36 – Luis Gilberto Cojoc Yuja and Zoila Esperanza Ical Cojoc
- ▶ Construction Plan
 - ▶ I Gutter of length 330 cm
 - ▶ First flush length of 76 cm
 - ▶ Overflow height of 2.25 cm
 - ▶ 2 tanks being added
 - ▶ I two tank base



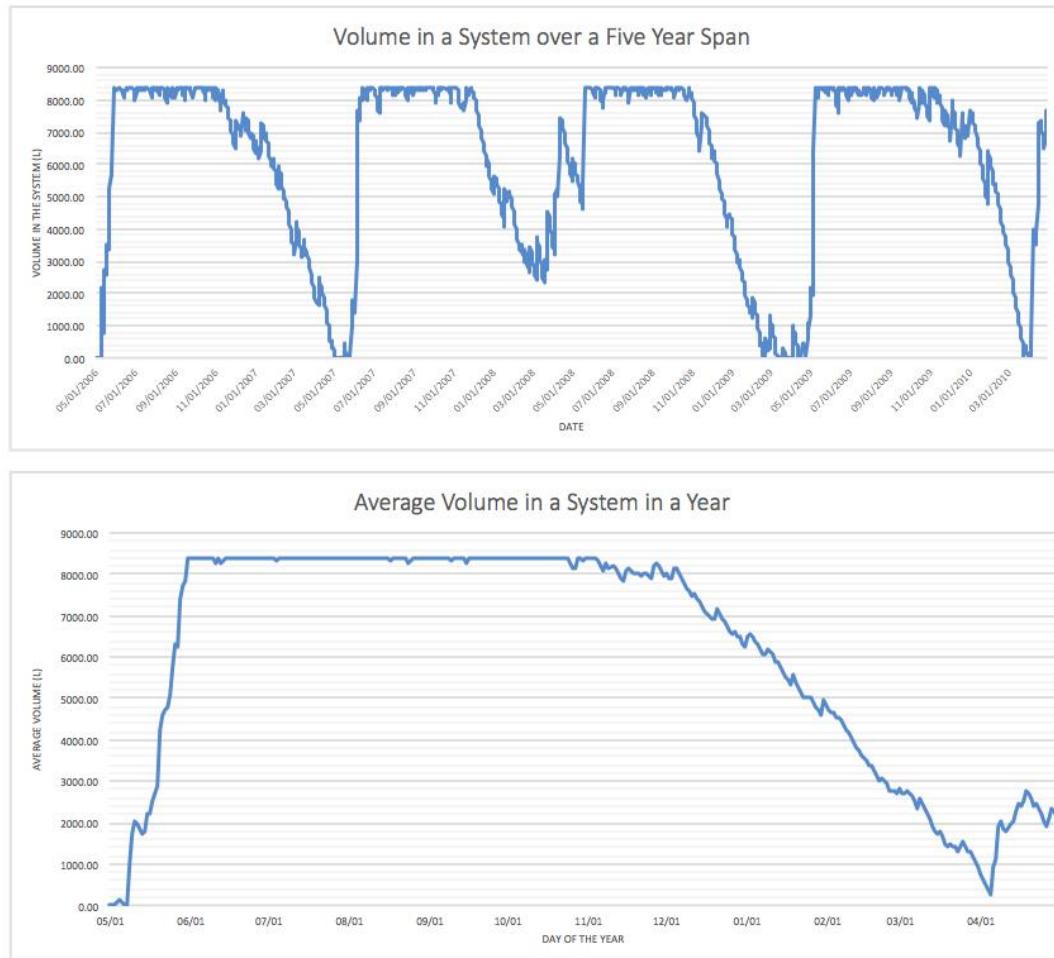
House Profiles – House 40

- ▶ House 40 – Secundino Lem Mo and Lucia Cal Suram
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base
 - ▶ Rearrange the roof so align the corrugations



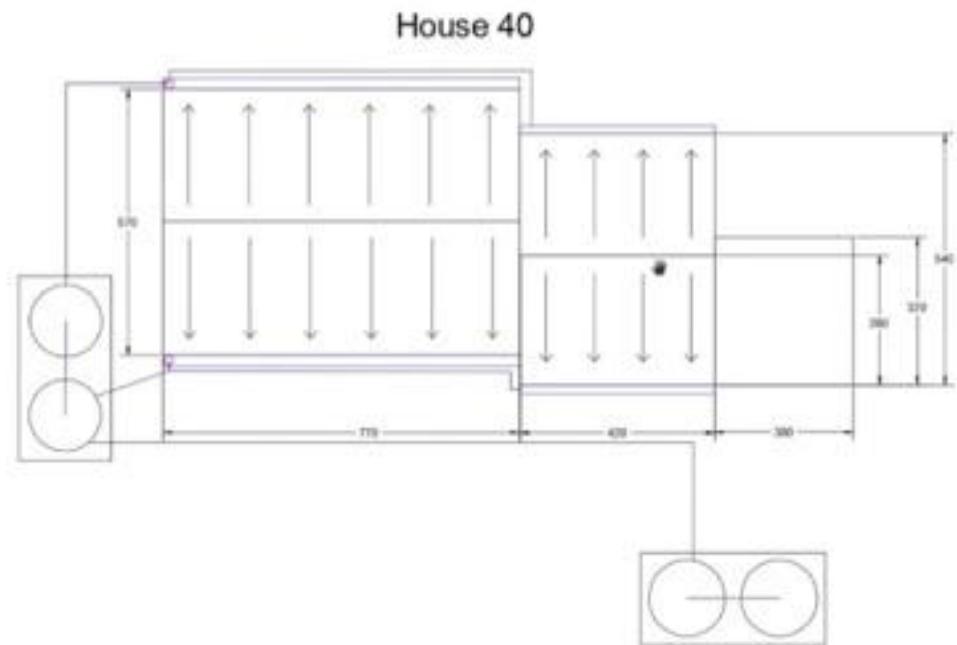
House Profiles – House 40

► House 40 – Secundino Lem Mo and Lucia Cal Suram



House Profiles – House 40

- ▶ House 40 – Secundino Lem Mo and Lucia Cal Suram
- ▶ Construction Plan
 - ▶ 2 Gutters of length 750 cm
 - ▶ First flush length of 84 cm
 - ▶ Overflow height of 2.25 cm
 - ▶ 2 tanks being added
 - ▶ 1 two tank base



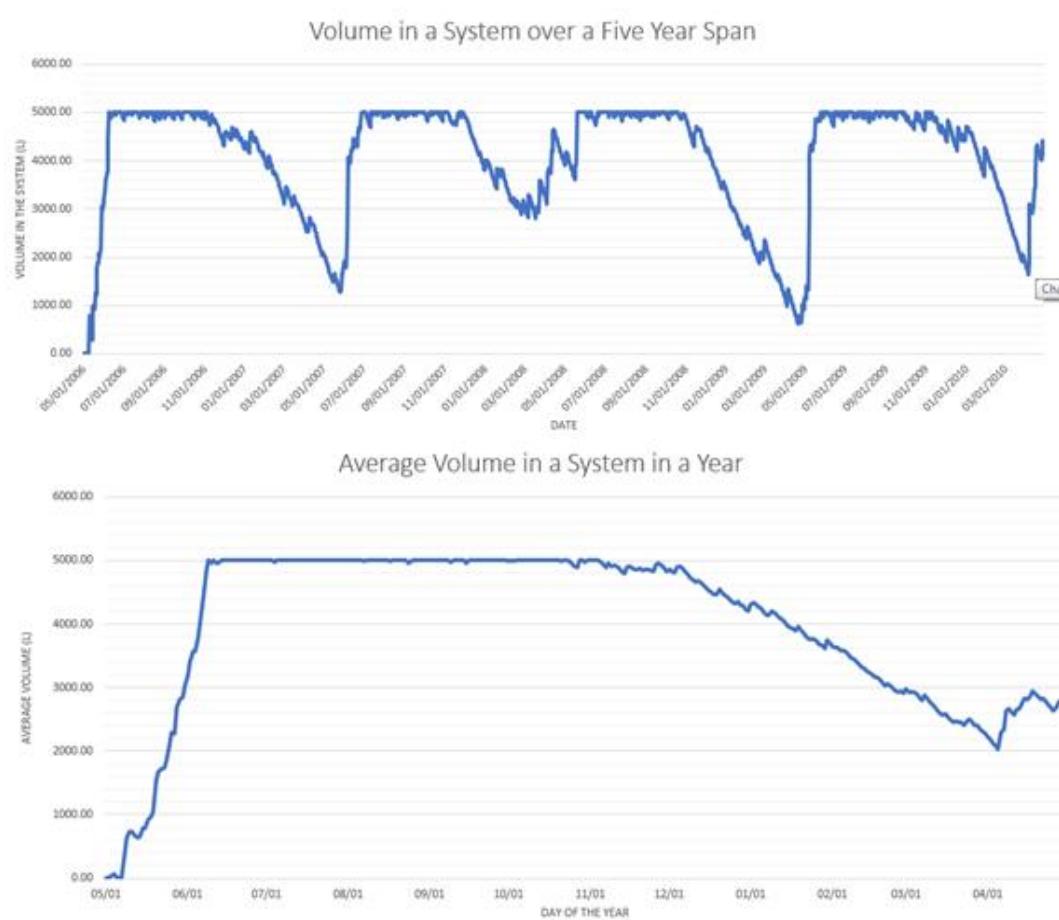
House Profiles – House 43

- ▶ House 40 – Rigoberto Cac Caal and Elsa Marta Yuja Lem
- ▶ Existing Storage
 - ▶ No existing storage
- ▶ Preparations
 - ▶ Prepare the area for the base
 - ▶ Collect small rocks for the base
 - ▶ Rearrange the roof so align the corrugations



House Profiles – House 43

► House 40 – Secundino Lem Mo and Lucia Cal Suram



House Profiles – House 43

- ▶ House 40 – Secundino Lem Mo and Lucia Cal Suram
- ▶ Construction Plan
 - ▶ 2 Gutters of length 750 cm
 - ▶ First flush length of 84 cm
 - ▶ Overflow height of 2.25 cm
 - ▶ 2 tanks being added
 - ▶ 1 two tank base

