

Improve performance of drip irrigation in OSSF systems in Texas - Updates

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TEXAS A&M
AGRILIFE
EXTENSION

Onsite Wastewater Mega-Conference, Hampton, VA
National Onsite Wastewater Recycling Association (NOWRA)

Presentation Outline

- I. Texas On-Site Sewage Facility Grant Program (TOGP)
- II. Drip in Texas (permitting)
- III. Project updates
 - A. Survey, literature review, and site visits
 - B. Bench scale research at TAMU OSSF Center

**Materials being presented represent the author opinions,
and do NOT reflect the opinions of NOWRA**

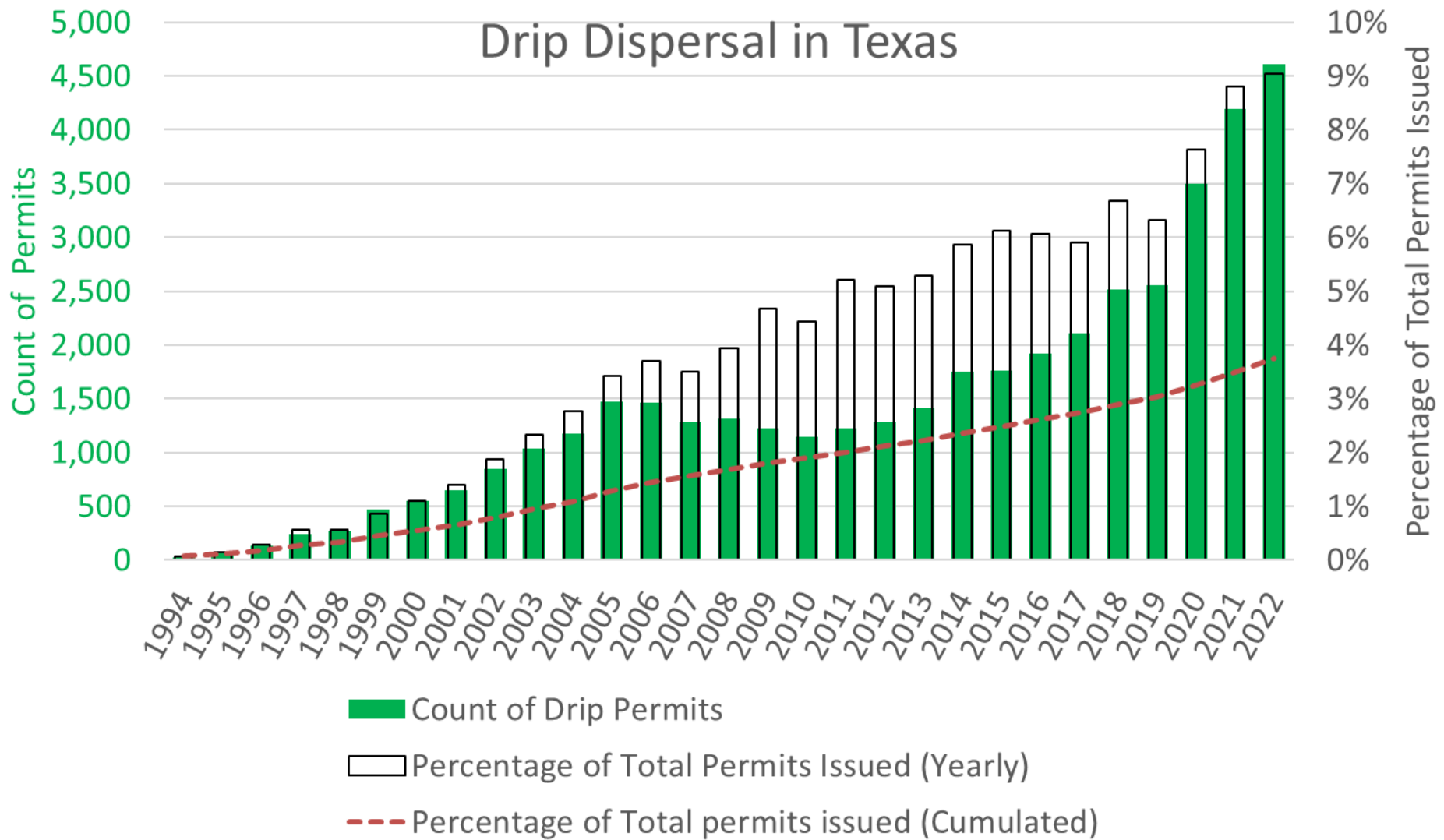
I. Texas On-Site Sewage Facility Grant Program (TOGP)

- ⦿ Funded by the Texas Commission on Environmental Quality (TCEQ) from permitting fees
- ⦿ Support “applied research and demonstration projects”
- ⦿ Round 1 (2019-21): ATU, LPD, Reuse
- ⦿ Round 2 (2021-23): RV Parks, **Drip**, Effluent Reduction
- ⦿ Round 3 (2023-25): RV Parks, Research the Research, Flow Equalization

II. Drip in Texas

- ⊙ Increasing in response to issues such as limited space and challenging site conditions: 40,000+ since 1994 (3.6% of total), >9% in year 2022
- ⊙ Lack of standard procedures needed by designers, installers, and maintenance providers
- ⊙ Quite common in Central-East Texas

Drip Dispersal in Texas

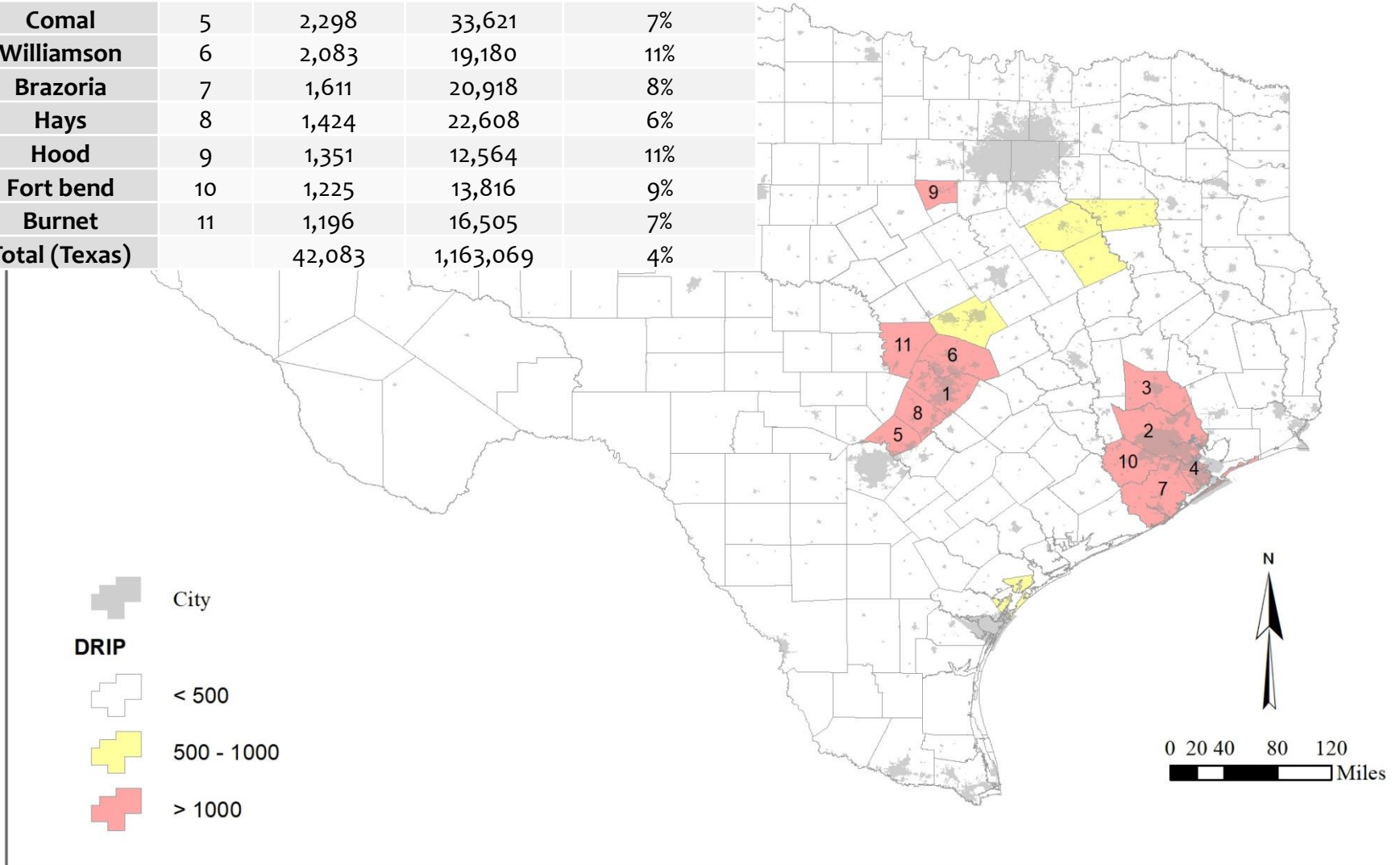


Drip irrigation permits (Aerobic Treatment Unit followed by Drip) issued as of 2022 in Texas. Data is compiled from TCEQ's annual permit dataset by TAMU OSSF Team

County	Rank	Drip Irrigation	ATC	Percentage of Texas ATC
Travis	1	6,045	23,143	26%
Harris	2	5,209	30,310	17%
Montgomery	3	3,969	55,865	7%
Galveston	4	3,947	10,691	37%
Comal	5	2,298	33,621	7%
Williamson	6	2,083	19,180	11%
Brazoria	7	1,611	20,918	8%
Hays	8	1,424	22,608	6%
Hood	9	1,351	12,564	11%
Fort bend	10	1,225	13,816	9%
Burnet	11	1,196	16,505	7%
Total (Texas)		42,083	1,163,069	4%

Drip Irrigation Systems

Count as of 2022



III. Project updates

Goal

- ⦿ Develop guidance to
 - ⦿ assist Texas on-site sewage professionals regarding proper
 - ⦿ design,
 - ⦿ installation,
 - ⦿ operation, and
 - ⦿ maintenance, and
 - ⦿ to aid TCEQ identifying gaps in current regulations

Research questions

- 1) Dosing techniques and application rates relative to structure and texture of soil (native vs import fill or disturbed, depth)
- 2) Installation configurations on flat terrain, slopes, and depressions
- 3) Continuous flushing vs periodic field flushing
- 4) Screened filters vs disc filters, and auto-backflushing
- 5) Techniques for cleaning and unclogging drip tubing

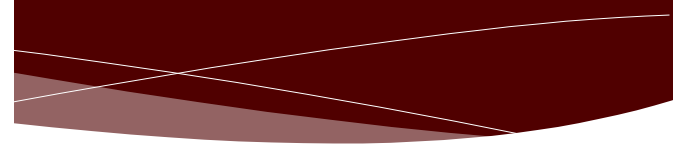
Plan

- ⊙ Survey to interview regulators and license holders, literature review of scientific articles and existing local, state, and federal publications, site visits to see operating conditions
- ⊙ Field experiments at the Texas A&M RELLIS Campus OSSF center, Bryan Texas (Questions 3-5)
- ⊙ Summarize gathered information into a Guidance document for Texas license holders and regulators

A) SURVEY...

- ⦿ Experience (# systems), issues, and suggestions
- ⦿ Distribution:
 - ⦿ Presented at NOWRA (Nov. 2022)
 - ⦿ Approved by TCEQ (Dec. 2022)
 - ⦿ TOWA (Mar. 2023) and e-mails
 - ⦿ Follow-up interviews

Survey to get your feedback for improving DRIP design in terms of effluent distribution uniformity, and ability to maintain the system



Please complete the following questions to the best of your ability.

About you

Indicate if you are a:

- Owner Designer Installer Maintenance Provider Regulator

Estimate number of DRIP systems designed/installed/maintained/inspected

(INCLUDING IN WHICH STATE): _____



Observed problems

- No problems
- Dosing (on and off times) and application rates
- Drip installed in imported soil or fill material
- Drip installed too deep (specify the depth)
- Drip installed in slopes, and depressions
- Mechanism to flush the drip tubing
- Emitter plugging
- Filter clogging
- Not uniform distribution
- Excessive water usage / undersized dispersal area
- Drip system maintenance
- Other _____

Please describe the type and frequency of problem/s you are observing in your area:



About you*

Indicate if you are a:

Owner

Designer

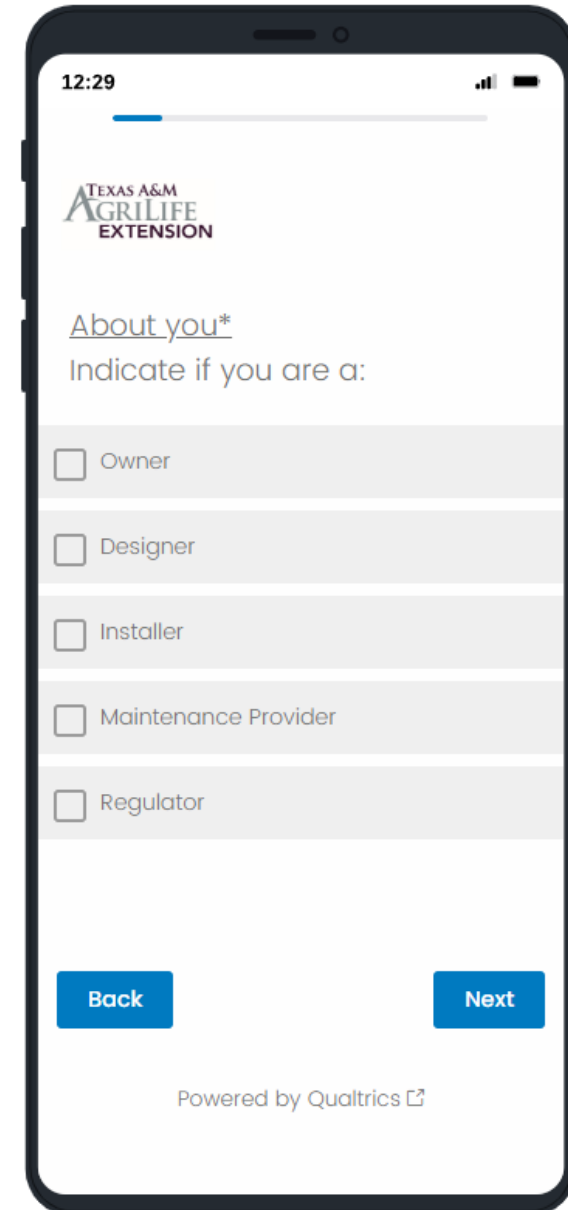
Installer

Maintenance Provider

Regulator

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About you*

Indicate if you are a:

Owner

Designer

Installer

Maintenance Provider

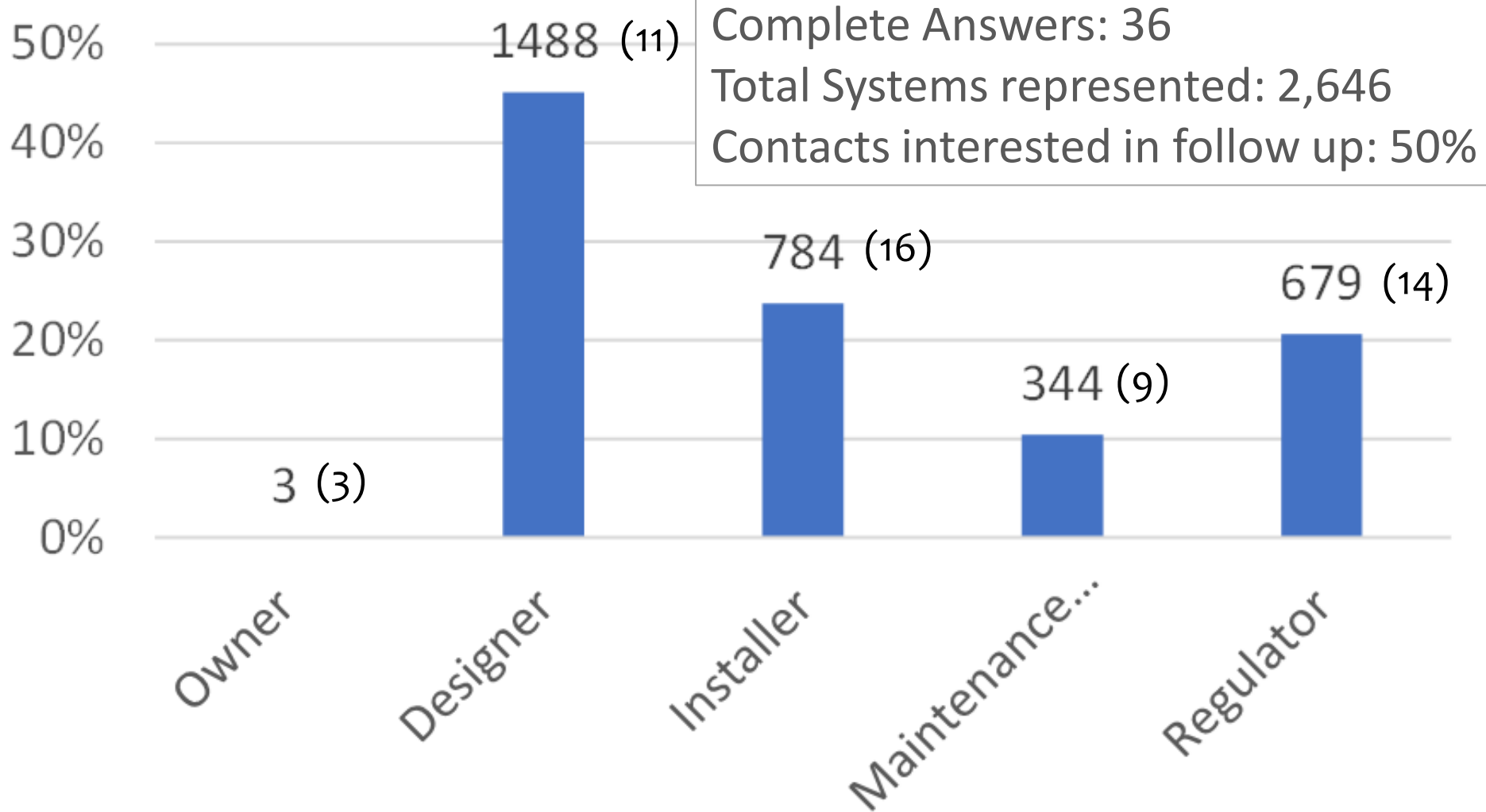
Regulator

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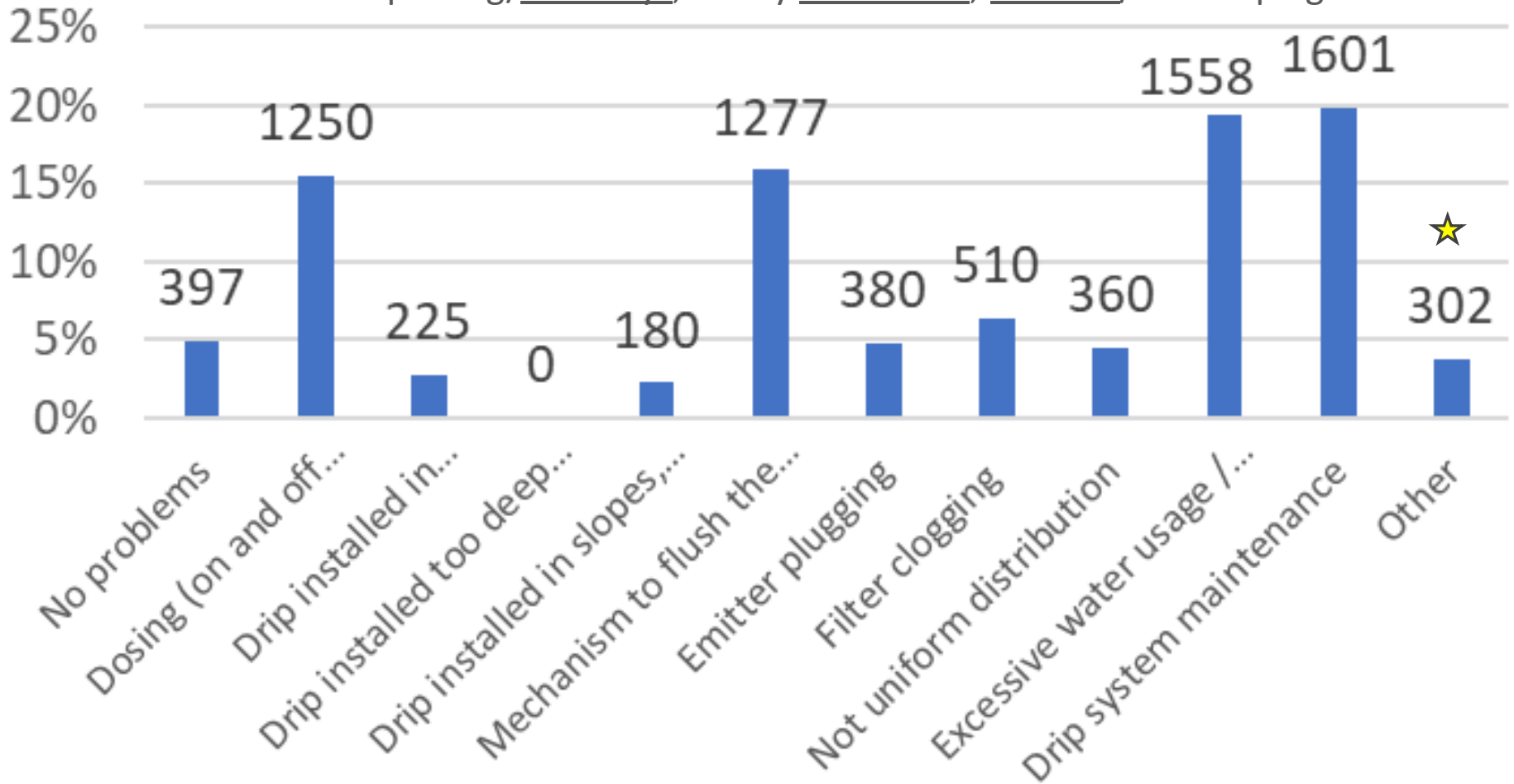
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Indicate if you are a:



Observed problems

★ **Other:** Ponding in a new installation, lift station, education (regulators/designer/homeowner), soil, engineering, filter not cleaned, compacting/chimneys, clarify definitions, mowers/landscaping over field



Problems (please describe)

- X 11: Hydraulic overload (e.g., main problem, suck toilet, occupancy going up, season, holiday use, poor soil flows goes up, sprinklers x3)
- X 7: Maintenance (e.g., biggest issue, maintenance provider blaming installer and vice versa, convince owner is needed, new owner cancels contract “not needed”, fittings)
- X 6: Filter clogging (e.g., cellulose, try to fix by pumping)
- X 5: Education (e.g., installer, installer not educating owner, all involved), class 4, timer x2 (e.g., dose time reduced)
- X 1: 50% fail, damages, no testing by regulator

Suggestions

- X 9: Design (e.g., larger tube openings and filters, deeper trenches, standard manual, simpler control → less to maintain and to go wrong, valves to isolate zones ≤ 600 ft, continuous flush/automated backflush, flushing tool, equalization, high resolution timers)
- X 7: Education (e.g., drip is new, DR to test flow and to inspect, DR/designer, design/implementation, owner)
- X 3: Vegetation (e.g., proper vegetation on mounds, Remove tree canopy, good grass/sod cover for ET)
- X 2: Soil (e.g., no import, cover soil)
- X 1: Maintenance, Simpler regulation/definitions, Installation

Other comments

- **X 12: Maintenance**: (e.g., not proper use ... nobody flush! ... 90%! ... 3 times/yr ... filters service and flushing ... Clean disc filters (home or 10 min soak) or replace ... provider work not well defined (check alarms and go) ... pump maintenance ... providers ...demo maintenance to owner ... discontinuing contract “not good” ... no maintenance until failure)
- **X 5: Design**: (e.g., design, same loading rates for all in rules, design, Tennessee rules, Arkansas not clear directions)
- **X 4: Texas**: (e.g., converting, continuous flush; usual issues, just new!)
- **X 2: Education** (e.g., ... customer education ... people do not know what continuous flush means)
- **X 1: ... grass ... improve soil ...**

...LITERATURE REVIEW

- ⦿ Rules: Texas, North Carolina, Virginia, ...
- ⦿ Private sector (e.g., American Manufacturing, JNM, ...)
- ⦿ NOWRA: Recommended Guidance for the Design of Wastewater Drip Dispersal Systems:
 - ⦿ Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT): Residential Onsite Wastewater Treatment Systems: An Operation and Maintenance Service Provider Program
 - ⦿ Electric Power Research Institute (EPRI) & Tennessee Valley Authority (TVA), Wastewater Subsurface Drip Distribution - Peer Reviewed Guidelines for Design, Operation, and Maintenance
- ⦿ Texas AgriLife OSSF Program & other documents
- ⦿ ...

...SITES VISITS (OPERATING CONDITIONS)

- ⦿ Hood County, May 3-4, 2023, health department staff
- ⦿ Understand problems based on real-world experience by regulators, designers, and installer → recommendations

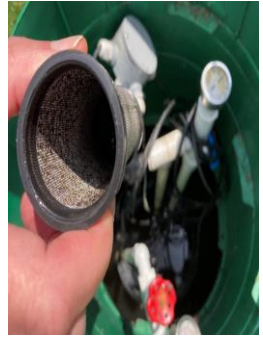
- ⦿ Frequent issues:

- ⦿ Wrong timer settings/models,
- ⦿ Surfacing on first year,
- ⦿ External runoff on drain field
- ⦿ Intermitted use (e.g., B&B).

- ⦿ Recommendations:

- ⦿ Homeowner education

- ⦿ Adding surface or/and valves to isolate areas
- ⦿ Monitoring
- ⦿ Timer settings
- ⦿ Maintenance
- ⦿ “Feed” system in vacant periods
- ⦿ Managing runoff



B) FIELD EXPERIMENT

- ⊙ Questions: compare flushing, filters, cleaning
- ⊙ Performance: flow, pressure, TSS, filters status, and drip tubing status; after artificially induced clogging
- ⊙ Challenges: set up time (no cost extension, TCEQ)

- A: RELIS Wastewater Treatment Plant (WWTP)
- B: Cleanout
- C: Feed Tank
- D: ATU Septic Tank
- E: ATU 1
- F: ATU 2
- G: LPD Septic Tank
- H: LPD Drainfield (H1-4 = Design Replicates)
- I: ATU
- J: MBR Reuse



Drip Field

OPEN

G.H.

WWTP

- ⊙ RELLIS Campus effluent
- ⊙ Two ATU units, distributed to wetlands' beds (11'x24')
- ⊙ Two 150-ft runs (total 300 ft) of drip tubing in each wetland, less than two inches below the gravel
- ⊙ Pressure compensating dripline: Netafim Bioline ISO 9261; Internal Diameter (I.D.): 0.560 in; Wall Thickness (W.T.): 0.045 in; Flow Rate: 0.61 GPH @ 14.5 PSI (max 58)
- ⊙ Filters:
 - Clearstream screen filter (Open), screen Aztec Dual Spin filter and disc filter (GH)
 - 150 mesh (100-micron filter) cartridges
 - Filters' flush lines to trash tank
- ⊙ Omron timers
- ⊙ Flow meter to ATUs
- ⊙ Flow and pressure meters (in and return dripline)

Starting conditions:

- ⊙ Applied ~100 gallons per day in each system:
 - Through original connections (Oct. 14, 2022)
 - Through drip lines (Apr. 21)
- ⊙ Pressurized drip tubing (Apr. 21):
 - On 4 minutes, Off 56 minutes
 - Inflow ~35 psi, return flow ~30 psi

Monitoring:

- ⊙ Inflow: once/day, started Oct. 14, 2022,
- ⊙ Drip inflow (May 10), drip return flow (Jul. 18): continuous (3 times/week)
- ⊙ Visual filter status (once/week)
- ⊙ Sampling TSS (3 times/week, started Jul. 19)

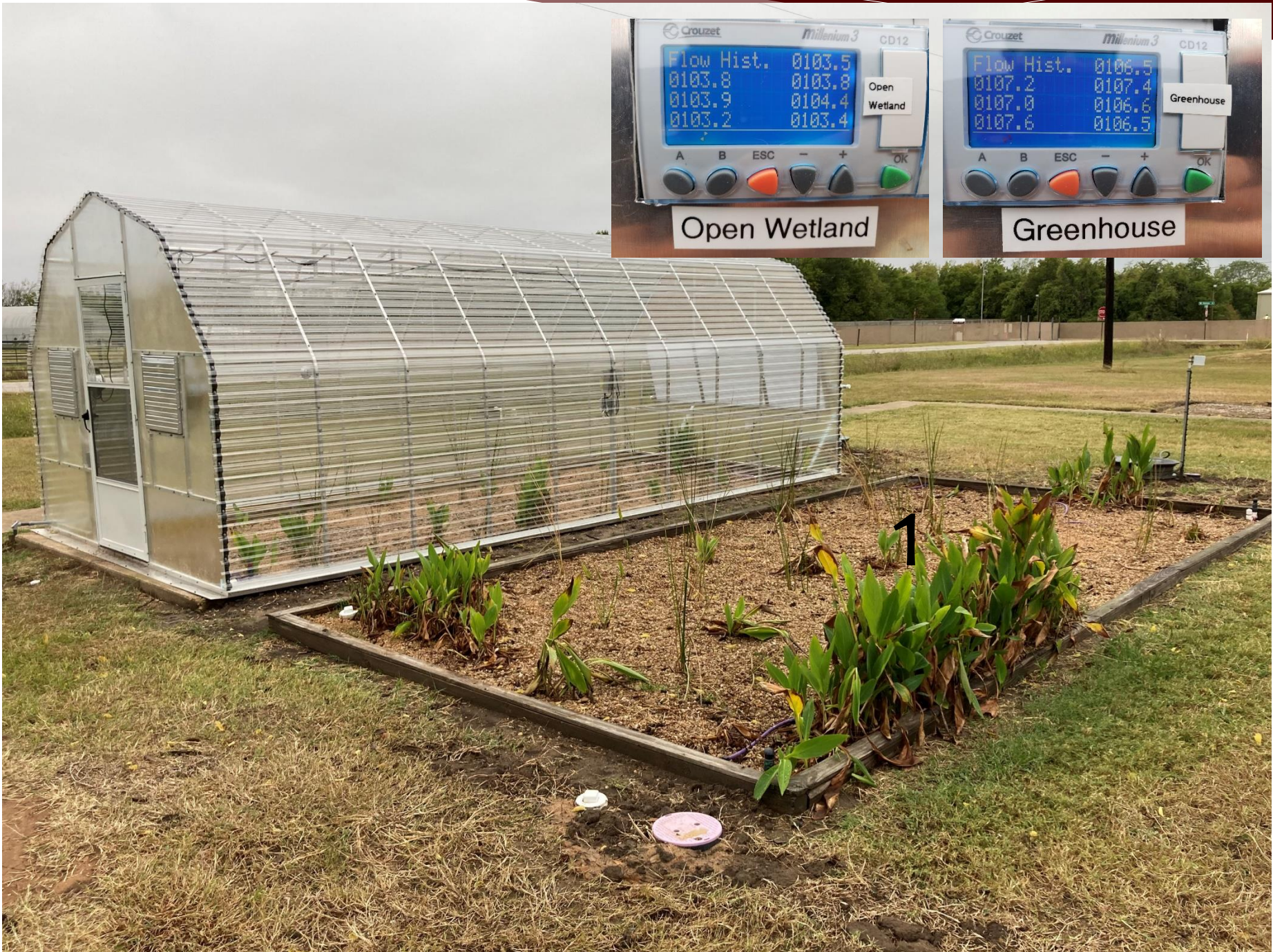
Artificial clogging (started Jul. 12):

- ⊙ ~ 15 gall of sludge in each pump tank (once/week, + chicken feed on Jul. 12)
- ⊙ Toilet paper in each clean before aeration tank (2 times/week)
- ⊙ Capping filter back flow



OPEN

G.H.



OPEN:
Screen
filter



G.H.:
Screen
Dual
Spin
Filter/
Disc



July-October 2023

	FILTER TYPE open	FILTER TYPE GH	return flow set at about	ADD (sludge/c hicken feed/toil et paper)	CLEAN pump filter	CLEAN drip filter	CAP back flow	FLUSH lines	ON/OFF pump trash	ON/OFF pump drip	! power outage	! high water	! drip filter plugged	other
Wed 7/12/23	screen	screen alt.	20%	sl./ch.f.			no		on	on				
Thu 7/13/23				sl./ch.f./t.p.	both									
Fri 7/14/23					both									
Sat 7/15/23											x			
Sun 7/16/23								off GH	off GH					reprogrammed
Mon 7/17/23					both			on GH	on GH					added aeration pipe GH
Tue 7/18/23								off GH						
Wed 7/19/23					Open GH			on GH						
Thu 7/20/23														
Fri 7/28/23				sl./t.p.										
Mon 7/31/23				sl./t.p.										
Fri 8/4/23				t.p.										
Wed 8/9/23											x			
Mon 8/14/23				t.p.		yes Open					x			
Fri 8/18/23				sl./t.p.										
Tue 8/22/23				t.p.										
Mon 8/28/23						Open	no Open					Open	Open	
Tue 8/29/23				t.p.										
Thu 8/31/23														
Tue 9/5/23				t.p.										
Thu 9/7/23				sl.				both						
Fri 9/8/23				t.p.										
Mon 9/11/23						yes Open								
Tue 9/12/23				t.p.										
Wed 9/13/23											x			
Fri 9/15/23				sl./t.p.										sludge is from aeration tanks from now on
Mon 9/18/23						Open	no Open	off Open				Open	Open	
Tue 9/19/23								on Open						
Wed 9/20/23				t.p.										
Fri 9/22/23		disc			both									reset pressure GH, reset return pressure Open (air bubbles)
Wed 9/27/23				sl./t.p.										GH: teflon outside discs
Fri 9/29/23				t.p.										
Mon 10/2/23				t.p.										
Thu 10/5/23				t.p.										
Fri 10/6/23				t.p.										
Mon 10/9/23				sl.			yes both							
Fri 10/10/23				t.p.		both	no both						both	filter plugged 100% disc, almost 100% screen
Thu 10/12/23				t.p.			yes both							
Sun 10/15/23				t.p.										
Tue 10/17/23			0%				no both							

Clogging the filter was hard... but we managed to do it...



V. Questions?

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