Integrated Stormwater Management (iSWM) Subcommittee Meeting

Staff Planner: Casey Cannon

July 12, 2023

iSWM

North Central Texas Council of Governments
Environment & Development

Agenda

I. Welcome and Introductions

II. Presentation and Action Items
1. Approval of April 12, 2023, Meeting Summary.
2. Approval of FY24 Work Plan
3. Presentation on Bio-Swale Media

III. Discussion Items
I. FY23 Work Program Update

IV. Information Items
1. Regional Public Works Program Update
2. Total Maximum Daily Load Program Update

V. Other Business and Roundtable Discussion
1. Upcoming Events and Conferences
2. Future Agenda Items and Roundtable Discussion
3. Schedule for the Next Meeting

Adjournment

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Welcome & Introductions

Welcome and Introductions

- The meeting agenda, presentation and handouts are located on the iSWM subcommittee webpage
- Please use the chat function to add your name and organization for attendance

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Approval of April 12, 2023, Meeting Summary

- The meeting summary is posted online for Subcommittee approval.

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Approval of FY24 Work Plan

- The FY24 Draft Work Program for the Public Works Council (PWC) is posted online.
- The iSWM Task List is up for approval for inclusion in the Work Program.
- The Public Works Council (PWC) will vote on the Work Program at the August 17, 2023, Meeting.

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Approval of FY24 Work Plan

4. **integrated Stormwater Management (iSWM) Program:**
   - Conduct quarterly meetings of iSWM Implementation Subcommittee (IIS)
   - Conduct educational trainings and workshops to promote the implementation of iSWM
   - Monitor the iSWM certification process including continued support of the IIS Review Board
   - Assist local governments in the application of the iSWM program
   - Oversee the contract and iSWM consultant
   - See Attachment A for anticipated FY2024 subcommittee tasks

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Approval of FY24 Work Plan

	Task	Category
1	**Review and Compile iSWM Manual Changes** – NCTCOG staff will review and compile all recent revisions of the iSWM Criteria Manual (2013) and iSWM Technical Manual (2015). This will be an official update of the documents.	Revised Technical Content
2	**iSWM BMP Training (1-2 Hour) -** Training communities on engineering design or maintenance of BMPs	Outreach
3	**iSWM Implementation guidance for communities in the region** - Continued outreach and workshops for iSWM Implementation and/or technical implementation guidance.	Outreach
4	**iSWM Promotional Presentation for Partnering Organizations -** Host event/training promoting iSWM and BMPs through industry and interest groups (i.e., ULI, TREC, AIA, APA, ASLA, USGBC, GDPC, CNU, DBA) and additional developer training/outreach.	Outreach
5	**Stormwater Quality Monitoring of Existing iSWM BMPs** - Establish an annual iSWM BMP monitoring program for determining pollutant removal efficiency of existing local N. Texas structural BMPs installed according to the iSWM design criteria. Select a limited number of existing BMPs in the region and confirm that the device(s) were constructed to iSWM criteria. Then monitor stormwater runoff into the device and the resulting outflow from the device to determine the removal efficiency of selected pollutants.	New/Revised Technial Content
6	**Develop Technical Case Studies** - Case study for the engineering or the design and construction of selected BMP devices to be used as a demonstration project. Similar to SARA LID Training Program https://www.sariverauthority.org/public-services/low-impact-development/lid-training-program.	
7	**Research "cumulative impacts" on small footprint developments.** – With developments of <1 acres, research the impervious cover threshold that creates an impact on drainage systems so that the cumulative effects should be considered.	
8	**Website updates** - Add images and visual cues to help people navigate the website certification guidance page or other quality of life updates.	Website update
9	**Guidance or training on temporary sediment basins.**	Outreach New/Revised Technical Content
10	**Guidance on Pipe Utility Crossing** - Create general guidance describing BMPs and recommendations for pipe utility crossings.	New/Revised Technical Content
11	**Expanded use of trees in detention ponds for dual purposes; water quality and carbon sequestration.**	New/Revised Technical Content
12	**Engineering Best Practices for iSWM Submittals During City Development Review**	New/Revised Technical Content

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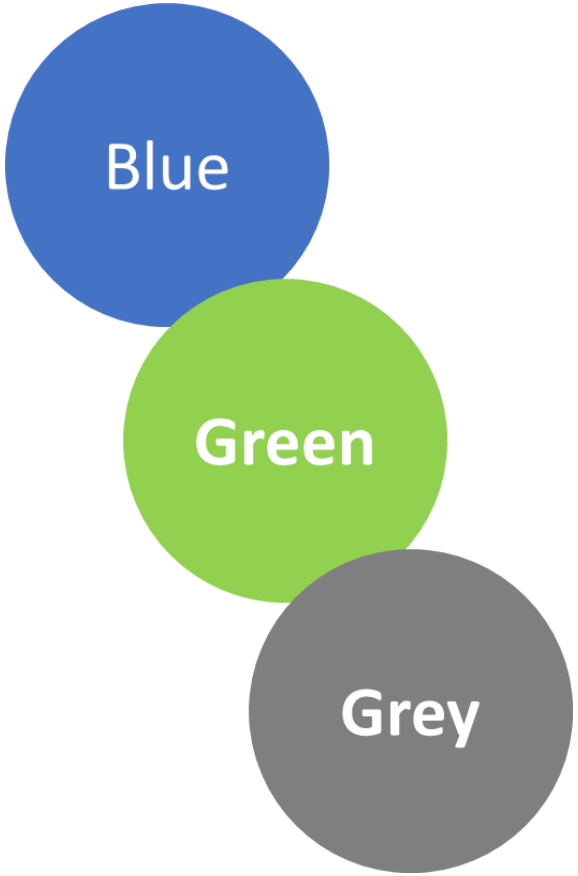


Laboratory Testing of Engineered Media for Biofiltration Swales to Improve Water Quality

Habib Ahmari, Ph.D., P.E.

Ashish Bhurtyal

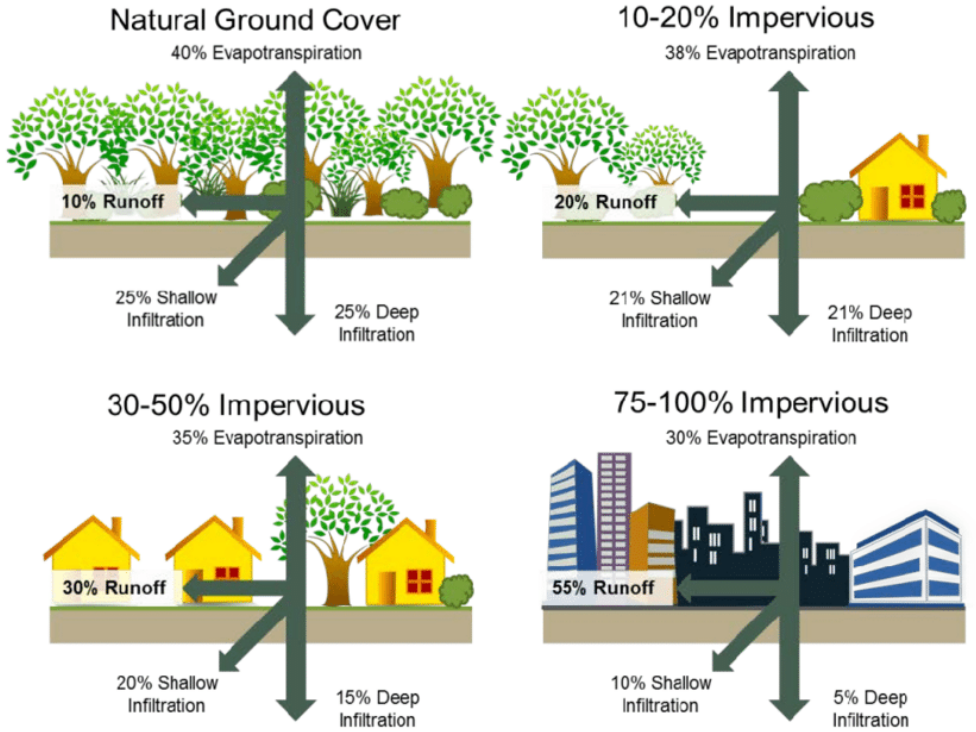
July 10, 2023

Outline

- Background
- Objective & Approach
- Experimental Setup and Procedure
- Results
- Conclusions
- Works Underway
- Acknowledgment

Background

- Urbanization alters watershed runoff, impacting receiving water's physical characteristics and water quality.
- Urban stormwater runoff carries pollutants including nitrogen, phosphorus, sediments, heavy metals, BOD, pesticides, and herbicides. Increased runoff from urban areas alters receiving waters and threatens aquatic ecosystems.
- Stormwater management programs aim to minimize impacts on receiving waters by using on-site BMPs.
- Examples of BMPs include stormwater harvesting to prevent flooding, and infiltration, biofiltration, or bioretention systems to reduce volume, retain pollutants, enhance water quality, and mitigate impacts on receiving waters.
- Linear BMPs are commonly utilized for flow control and runoff treatment. Bioswales, infiltration ditches, and vegetation land strips are examples of linear BMPs.



(Holt et al., 2018)

A bioswale along the side of a roadway in Orange County (www.sccwrp.org/news/regional-monitoring-network-being-built-to-evaluate-bmp-performance/)

Bioswales

- Water treatment by bioswales is a combined effect of filtration, uptake by plants (if any), sedimentation, adsorption, and infiltration process
- Swales are considered filtration BMPs if an underdrain system is employed and infiltration practices when an underdrain is not installed.
- Swales may be covered with dense vegetation, typically grass, to slow down water flows, trap suspended particles, and remove pollutants.
- There are two types of vegetated swales: dry swales (or grassed swales), and wet swales (or water quality swales).
- The dry swale is a vegetated, conveyance channel to treat and filter stormwater runoff for a given water quality and volume.

Tarrant County College (South Campus)

Texas Health Clearfork Center
(5400 Clearfork Main St., Fort Worth)

Fire Dep. Training Academy
(505 W Felix St., Fort Worth)

Bioswales

- As a linear BMP, bioswales have been commonly used for the treatment and conveyance of highway stormwater runoff.
- They are constructed near the edges of parking lots or integrated into road medians, curb cutouts, and sidewalks to collect and treat stormwater runoff before releasing it to streams or storm drainage systems.
- Pollutants can be effectively removed by bioswales created on-site, but similar to other infiltration BMPs, bioswales are prone to clogging.
- A field survey of 207 stormwater infiltration systems in Maryland showed that 1/3 of the swales were not functioning due to clogging despite being operating only for 2 years (Lindsey et al., 1992).
- Soil properties, such as infiltration rate and grain size, greatly impact the pollutant removal efficiency of bioswales. In low permeability areas, bioswales may be less effective at removing pollutants.
- Gravel and sand/gravel mix that are commonly used to minimize clogging of infiltration BMPs have very low hydraulic conductivity (0.2-0.8 cm/hr).
- Larger materials like crushed stones and gravel are used as filter media in bioswales due to their high hydraulic conductivity (2.5-1500 cm/hr). However, they have low water retention and are not suitable as plant-growing media. To improve bioswale infiltration, **expanded shale** can be used to amend the soil.

Treatment and conveyance of highway stormwater (Allen et al., 2015)

Serving a parking lot (Auckland Regional Council, 2003)

Objective and Approach

"Evaluate the potential application of expanded shale as a filter medium in bioswales to treat roadway stormwater runoff".

- Install and monitor a "scaled" *expanded shale-engineered* filtration media in a controlled laboratory setting at the UTA-Hydraulics Lab.

- Test the performance of the expanded shale under a variety of swale geometry, filter thickness and gradation, hydraulic loading, and sediment concentration.

- Measure water quality parameters including total suspended solids (TSS), turbidity (Tu), nitrates and phosphates.

- Examine the distribution of water movement by visualization techniques, including the non-toxic dye injection-tracing method and PIV (Particle Image Velocimetry).

- Use the results to assess the performance of expanded shale in pollutant removal and optimize the swale's geometry.

Expanded Shale

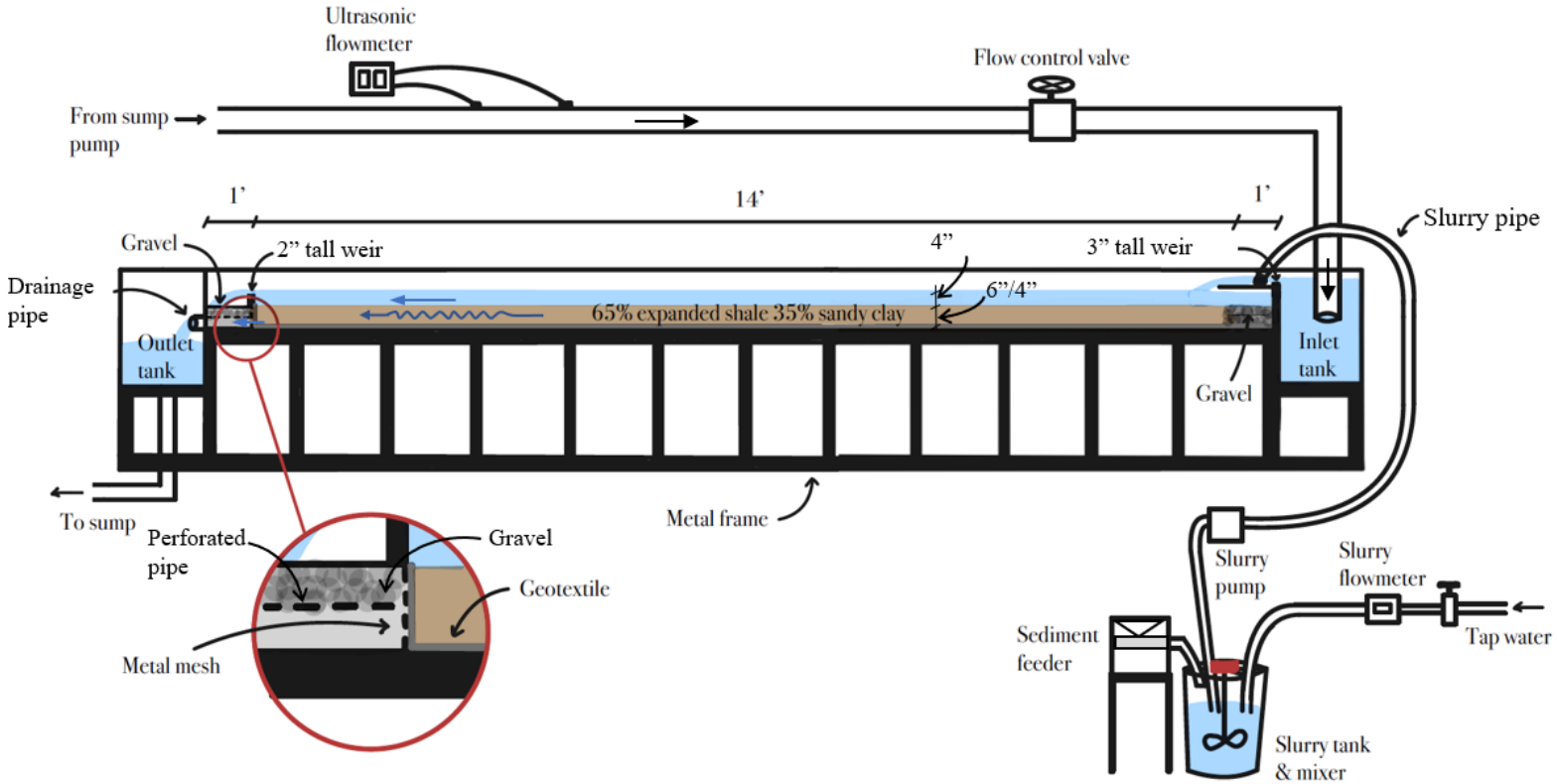
- Expanded shale is a lightweight, porous aggregate made from clay or shale heated in a rotary kiln until it becomes a light, porous aggregate.
- It can be used as an amendment with clay soils, to improve its drainage properties or as filtering media.
- Examples of the applications of expanded shale:
  - Wastewater treatment (sand filter, constructed wetlands for re-use/release, industrial fluid)
  - Stormwater treatment (sand filter, bioretention)

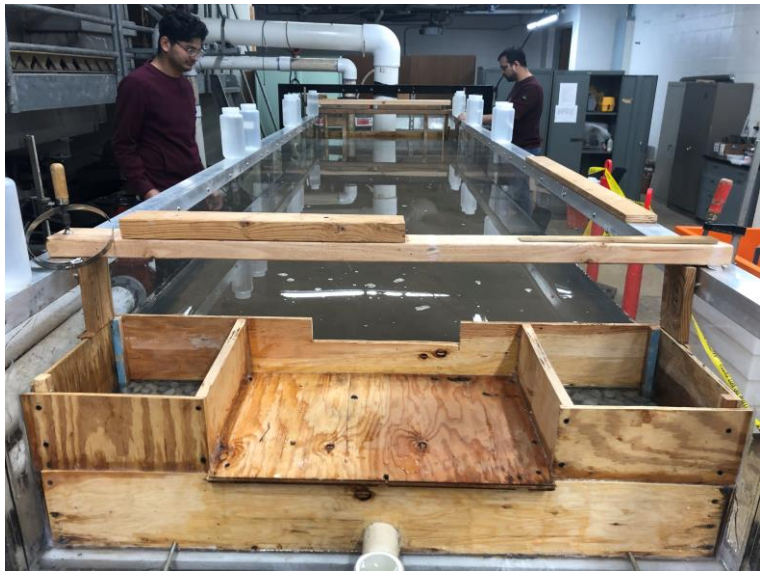
(www.americanbonsai.com/Articles.asp?ID=276)

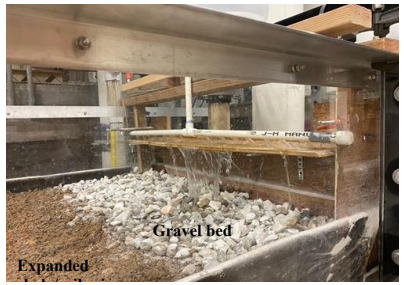
- Sample properties of expanded shale and sand used in filtration applications (ESCSI, 2018) :
  - Specific gravity: 1.25-1.85 (sand: 2.65-2.75)
  - Loose dry density: 480-960 kg/m^3 (1440-1760 kg/m^3)
  - Permeability: 1.27-33 m/hr (sand: 0.025-15 m/hr)

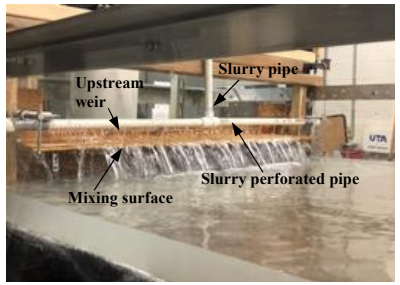
(Photos Courtesy of ARCOSAT LightWeight)

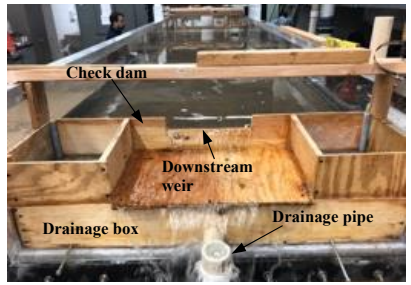
Experimental Setup and Procedure

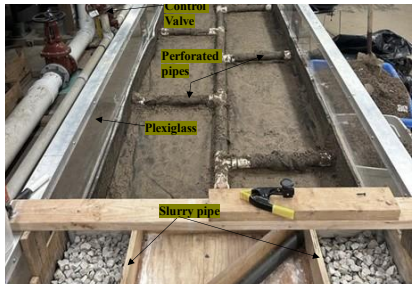


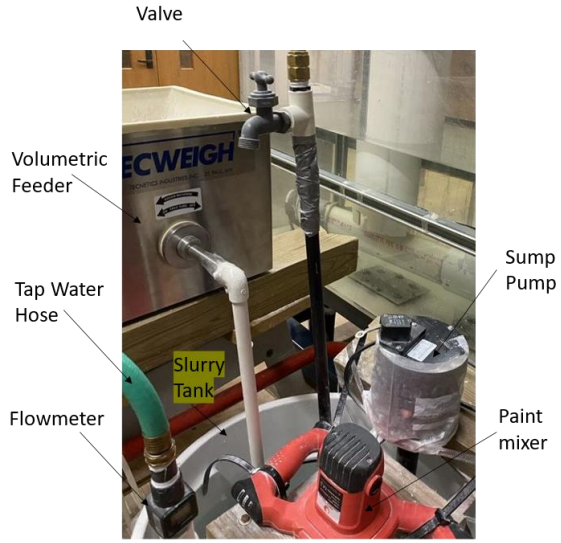








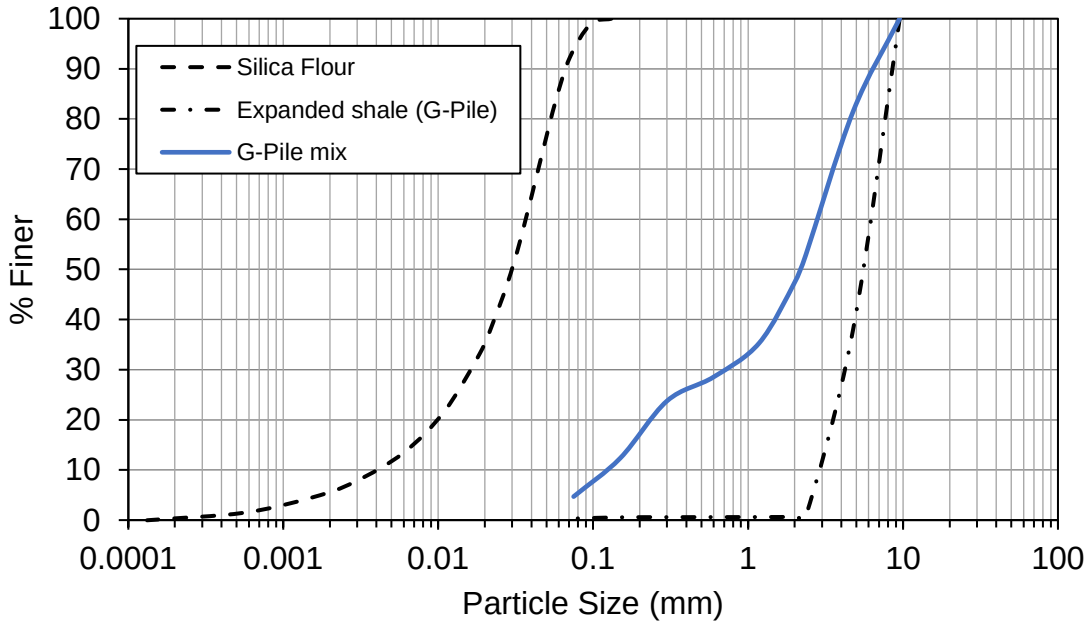


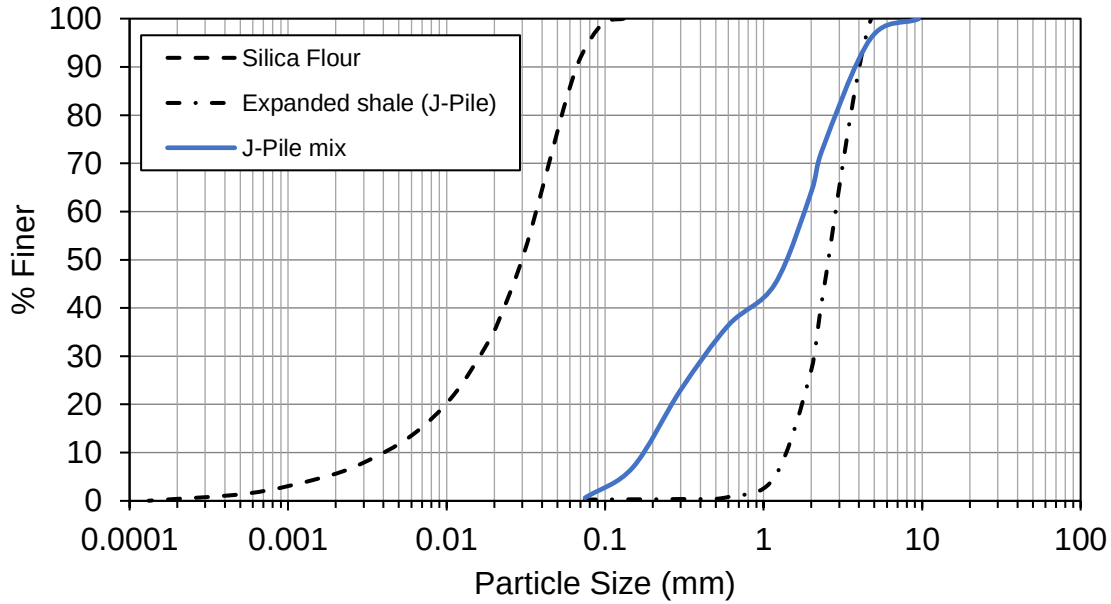


Experimental Setup and Procedure

- Slurry with high sediment concentration was prepared in a 100-liter tank using fine sediment (silica flour #140/106u with d_{50}= 0.03 mm)

- The flume was filled with two infiltration media comprised of 35% sandy-clay soil and 65% expanded shale: Type 1: coarse expanded shale (**G-pile**), and Type 2: fine expended shale (**J-pile**)





Test Scenarios

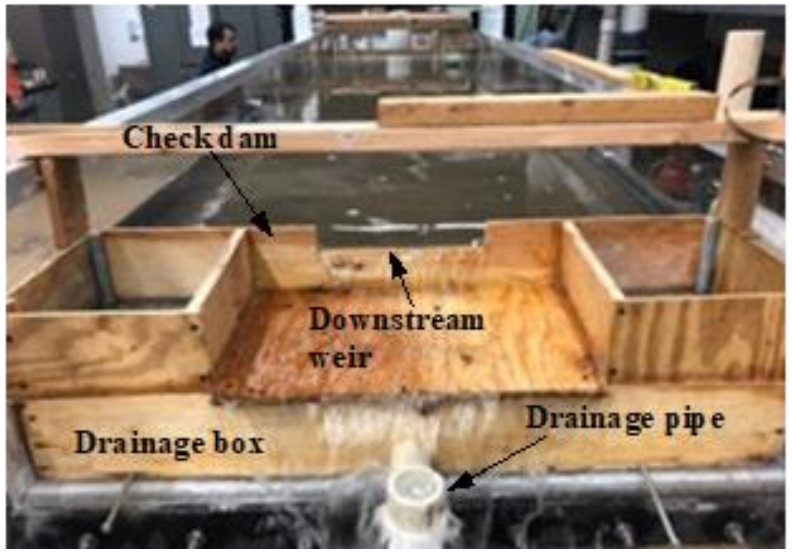
Experiment No.	Infiltration Media	Media Thickness (inches)	Drainage condition	Inflow (L/min)	Influent Sediment Concentrations (mg/Lit)
1	Coarse media (G-Pile)	6	Open	60	100
2				120	
3				180	
4				60	200
5				120	
6				180	
7			Closed	60	100
8				120	
9				180	
10				60	200
11				120	
12				180	
13		4	Closed	60	100
14				120	
15				180	
16				60	200
17				120	
18				180	
19	Finer media (J- Pile)	6	Open	60	100
20				120	
21				180	
22				60	200
23				120	
24				180	
25			Closed	60	100
26				120	
27				180	
28				60	200
29				120	
30				180	

Results: Drainage Test

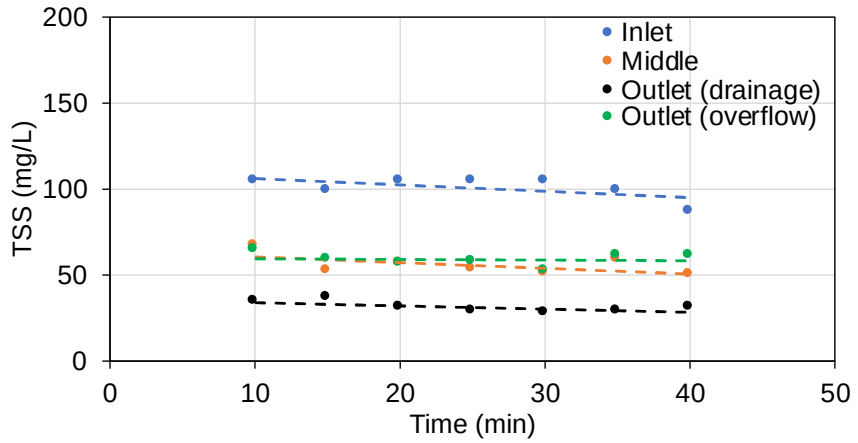
Test No.	Target Inflow (L/min)	Measured Inflow (L/min)	Drainage Rate (L/min)	Overflow (L/min)	Water Depth (cm)
A	-	12.1	12.1	0.0	10.8*
B	60	60.4	14.4	46.0	11.4
C	120	121.5	14.0	107.5	12.1
D	180	184.0	15.0	169.0	12.7

*No flow over the weir was observed at this flow depth even though the depth of water over the weir crest was 0.8 cm

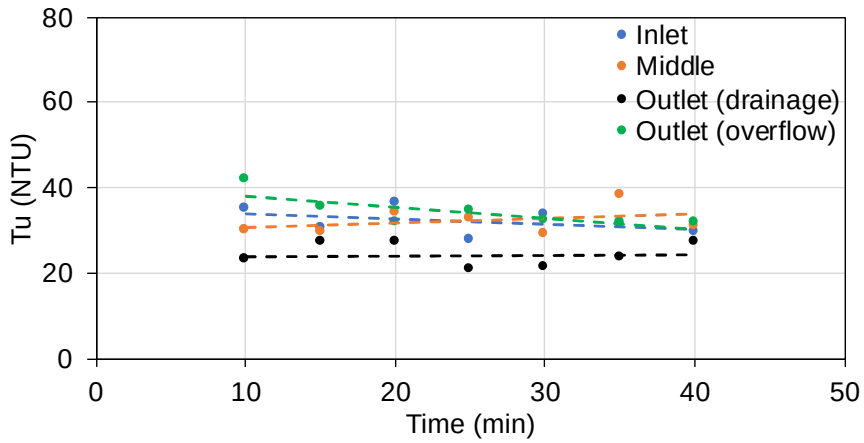
Measured inflow, drainage, and outflow during drainage capacity experiments (Type 1 & 6-inch)



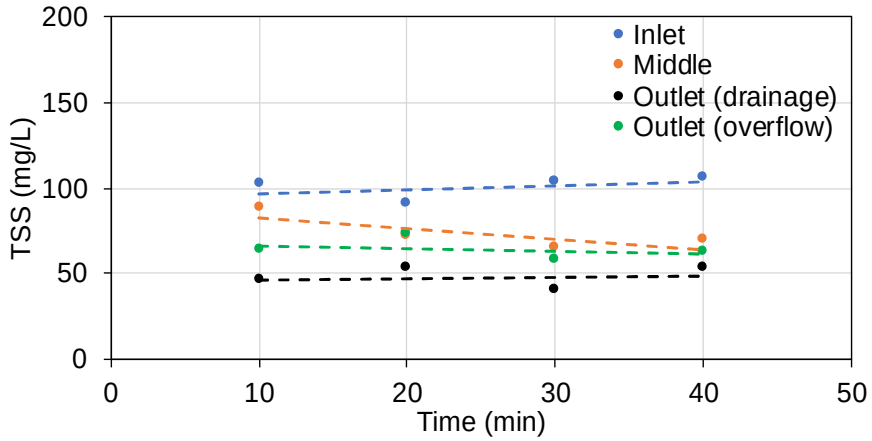
Variation of TSS and Tu in the flume with time



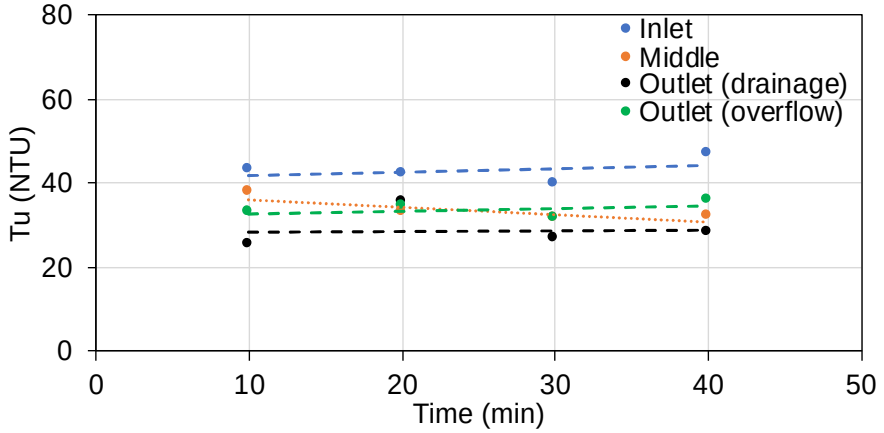
(a)



(b)



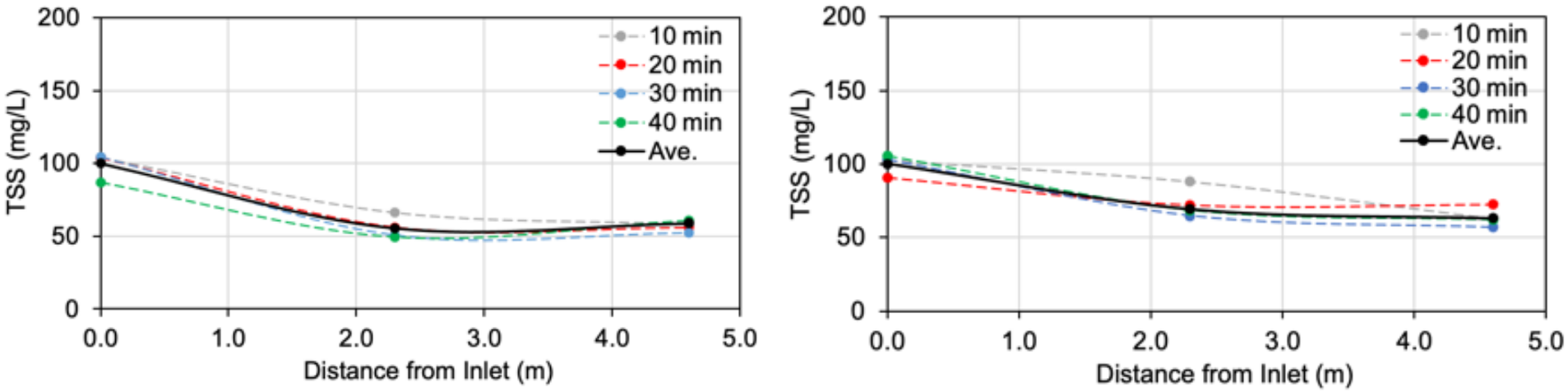
(c)



(d)

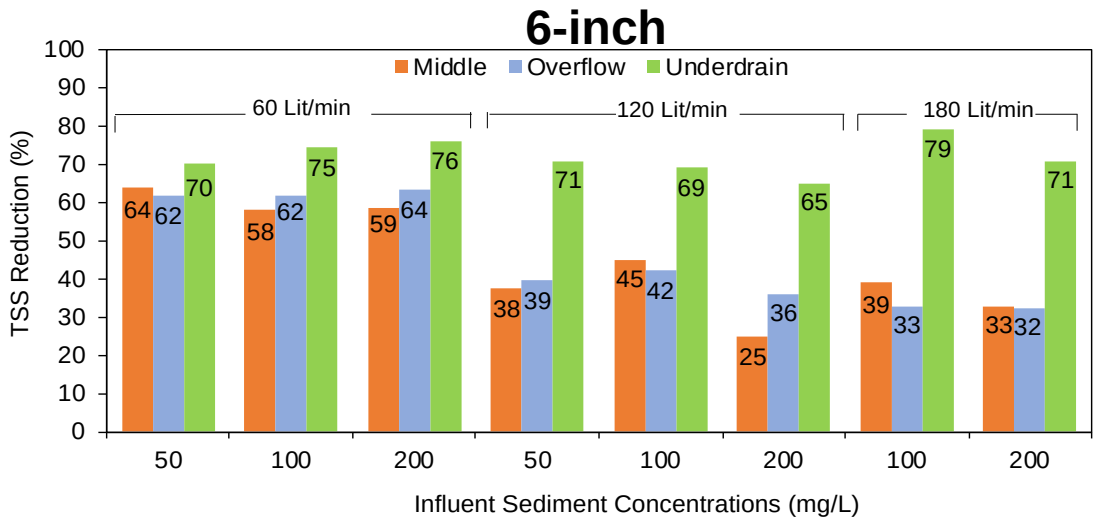
TSS and Tu at the inlet, middle section, drained water, and overflow for experiments with the inflow of 120 L/min, sediment influent of 100 mg/L, and **Type 1** infiltration layer thickness of **6 inches** (a,b) and 4 inches (c,d)

Variation of TSS along the flume

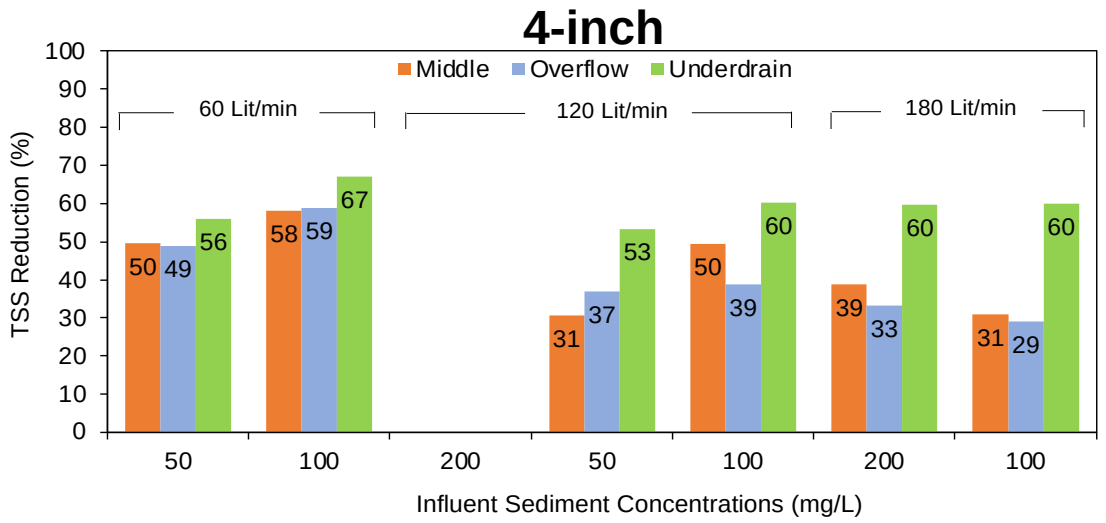


Reduction in total suspended solids (TSS) along the flume in experiments with the inflow of 120 L/min, influent concentration of 100 mg/L, and Type 1 infiltration layer thickness of: (a) 6 inches, and (b) 4 inches

TSS removal efficiency in 4-in and 6-in media



(a)



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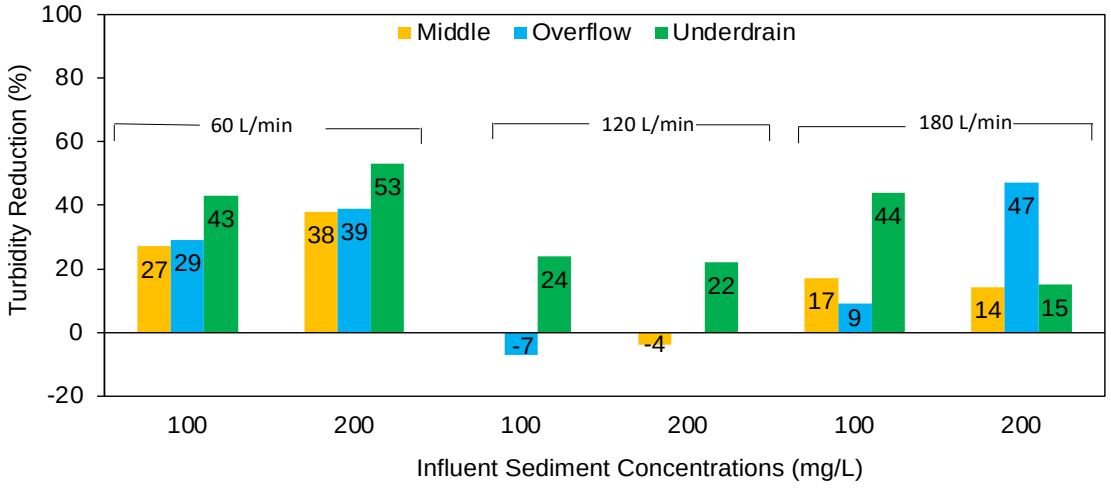

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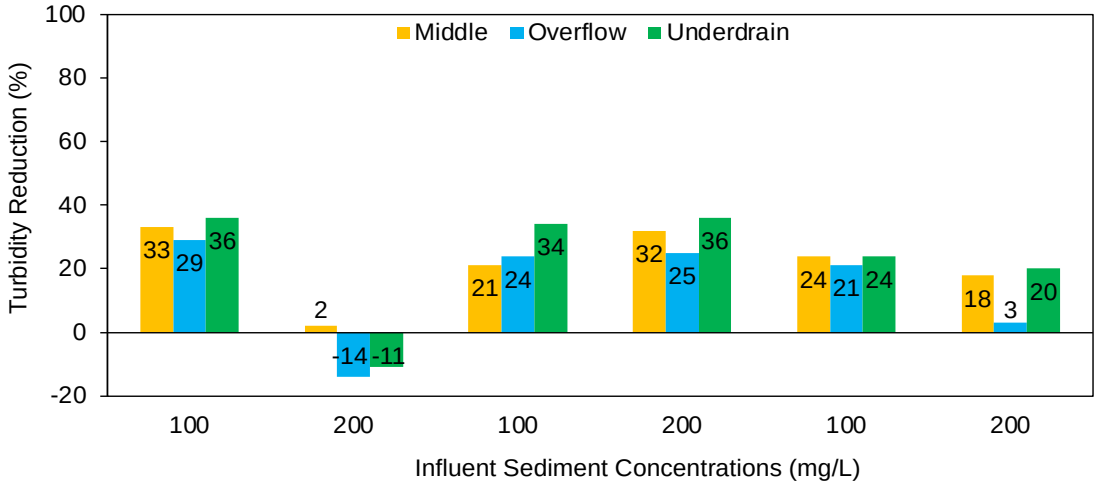
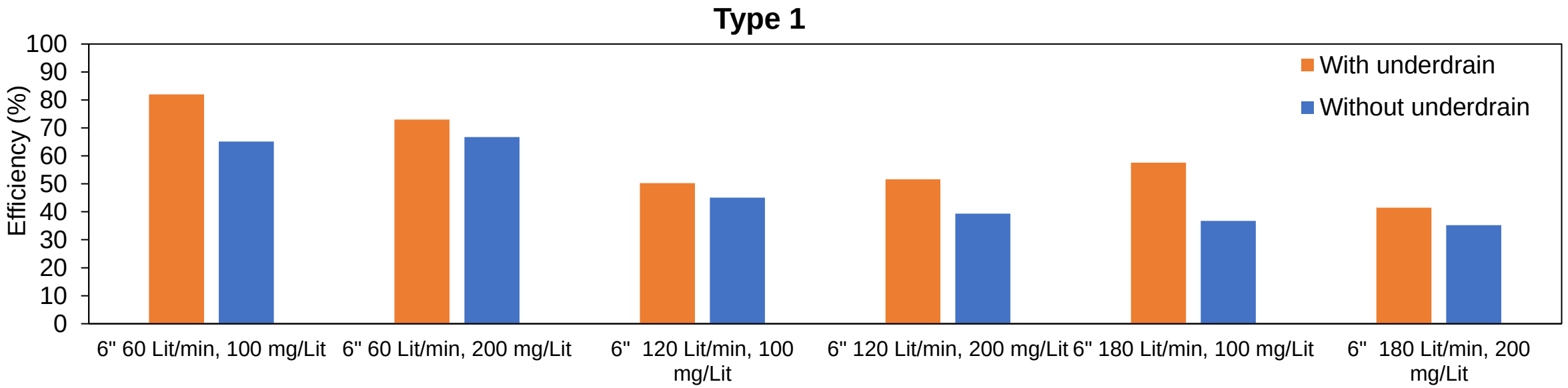
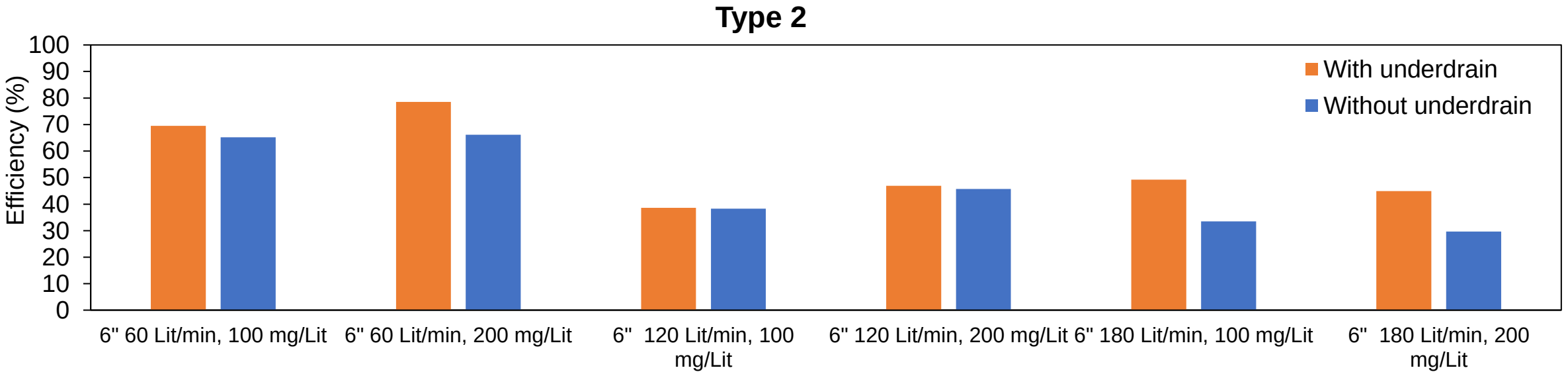


(d)

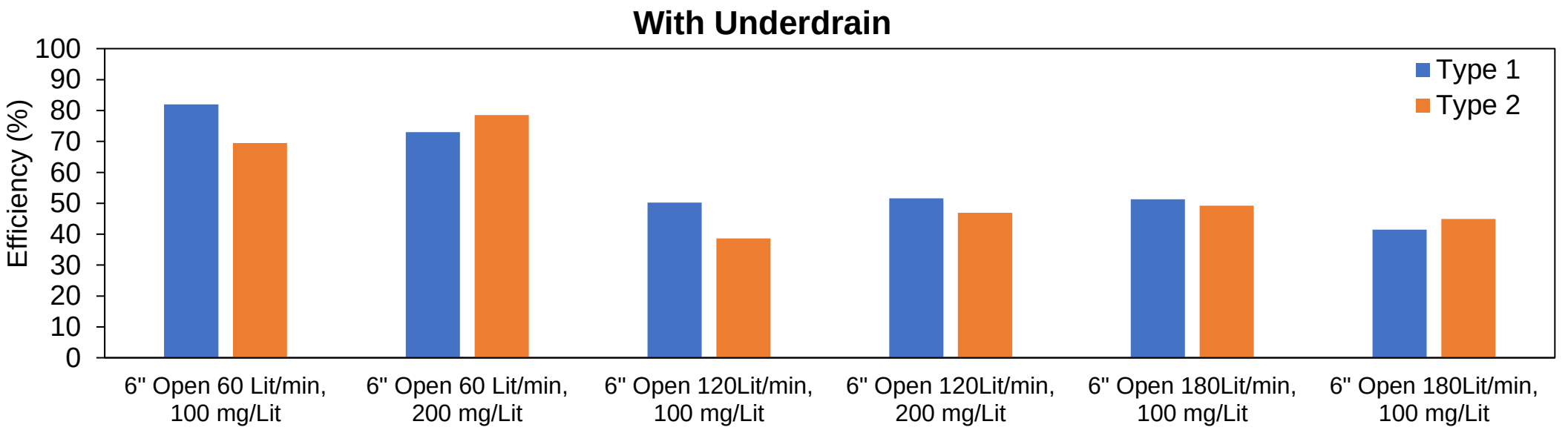
Percentage reduction in TSS (a,b) and Tu (c,d) at the inlet, middle section, drained water, and overflow during experiments with various inflow, sediment influent, and Type 1 infiltration layer thickness

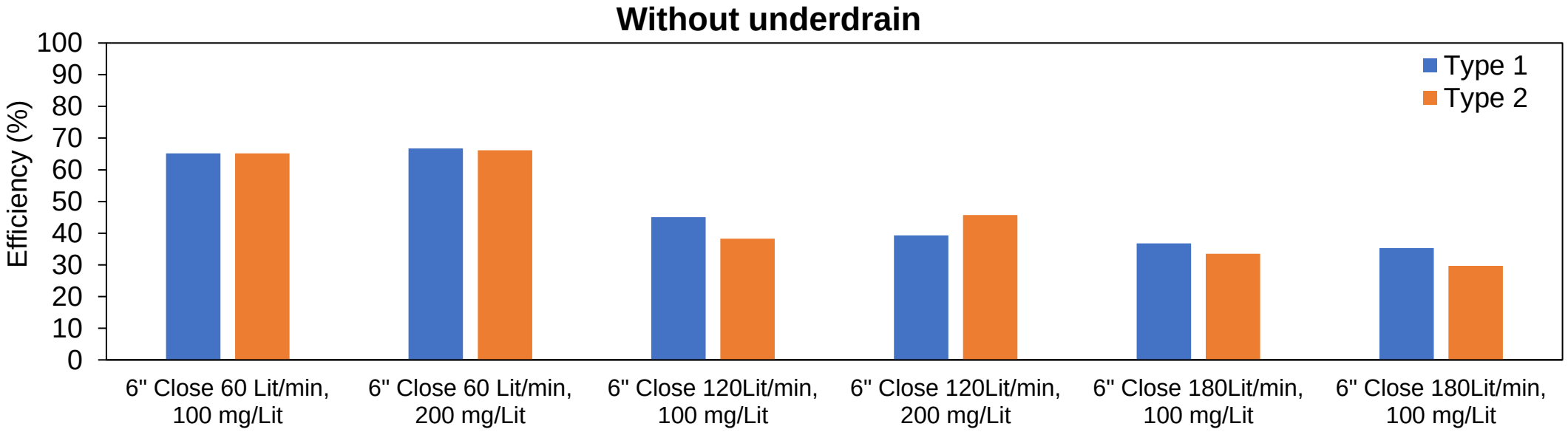
Effect of underdrain on TSS removal efficiency



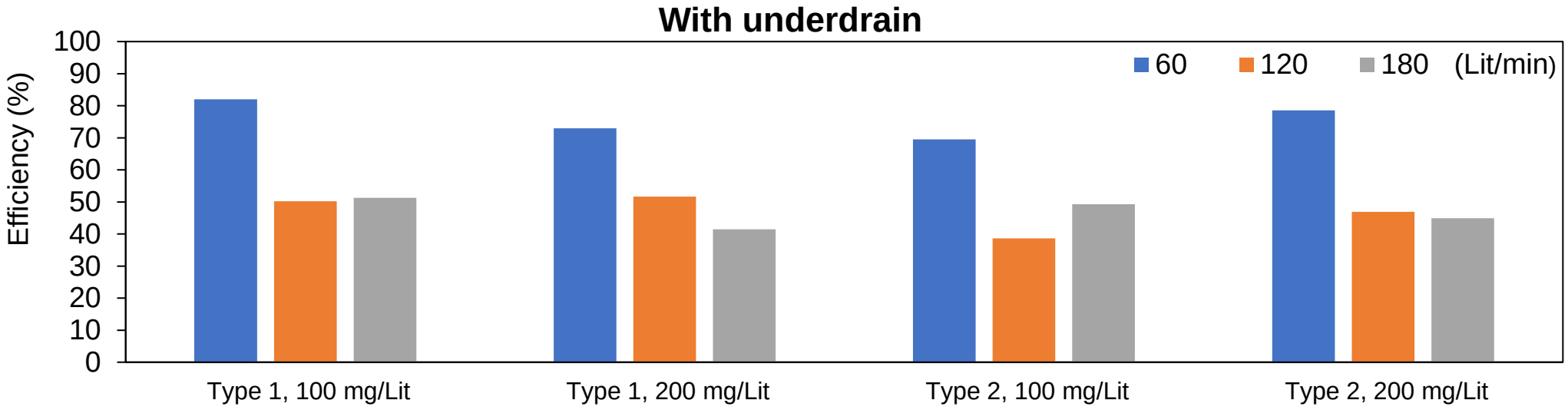


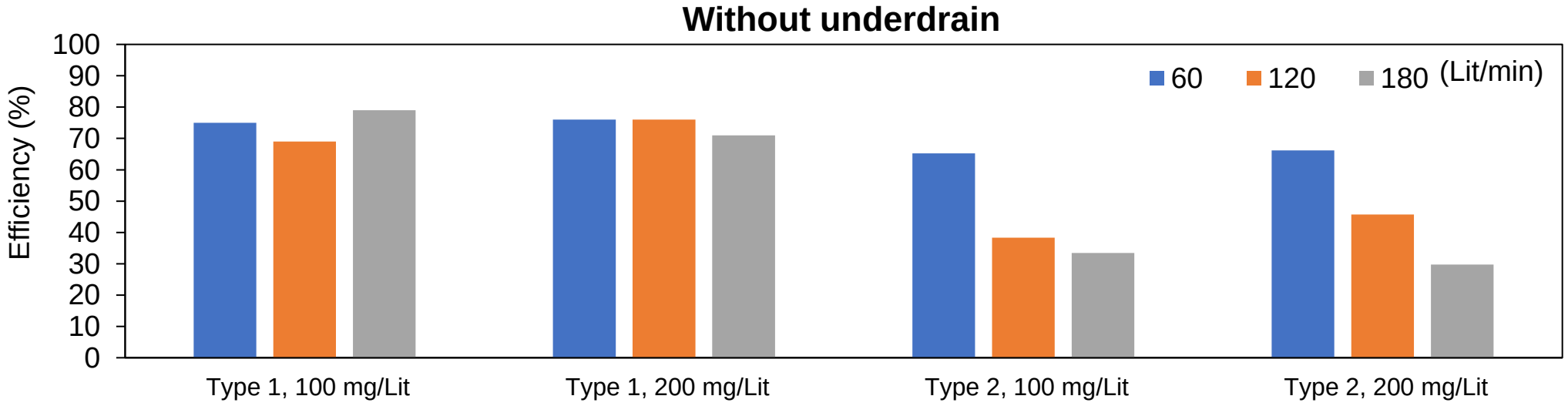
Effect of type of expanded shale on TSS removal efficiency



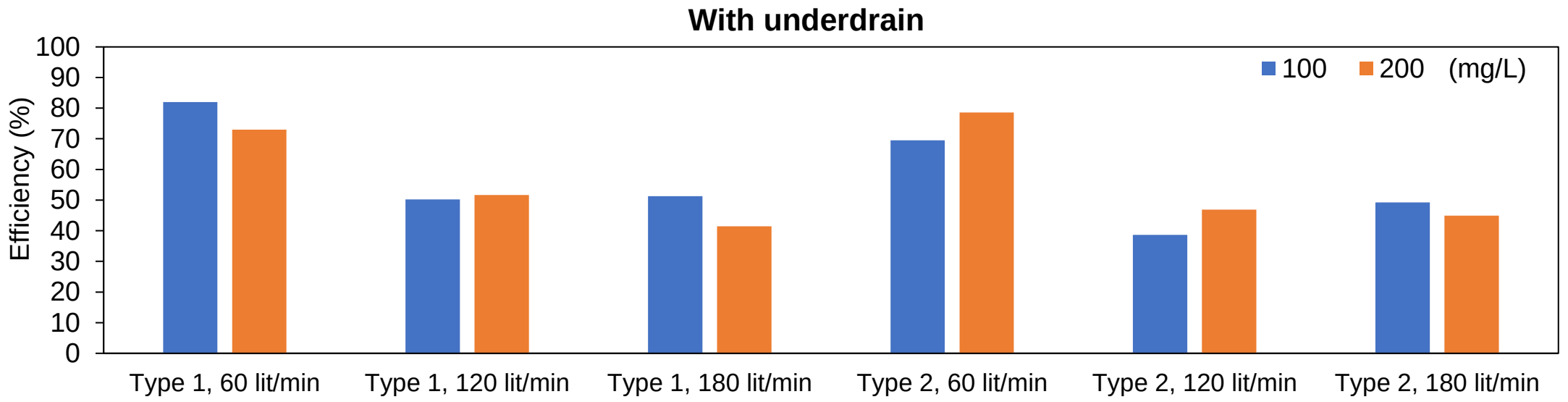


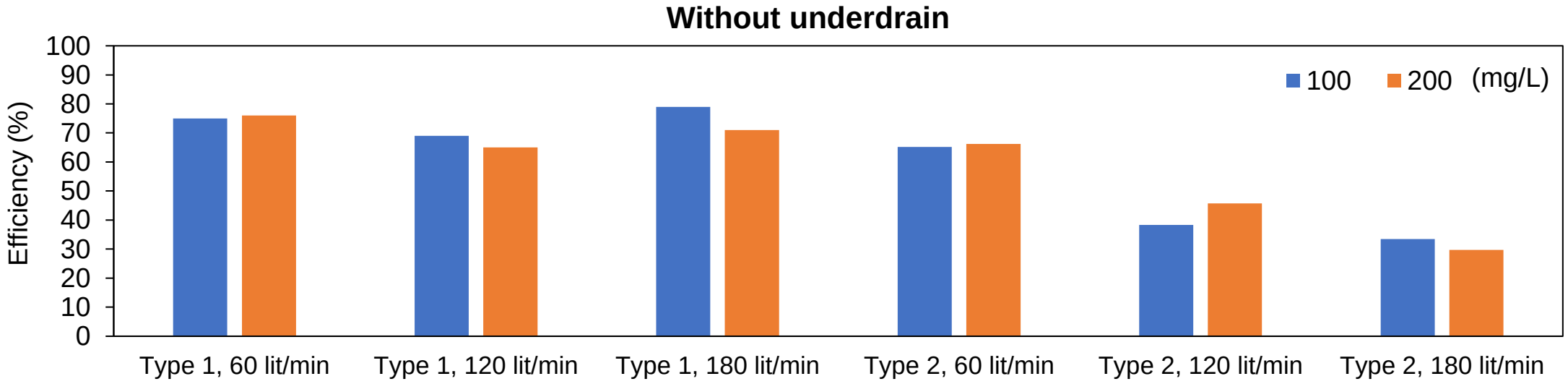
Effect of inflow rate on TSS removal efficiency TSS



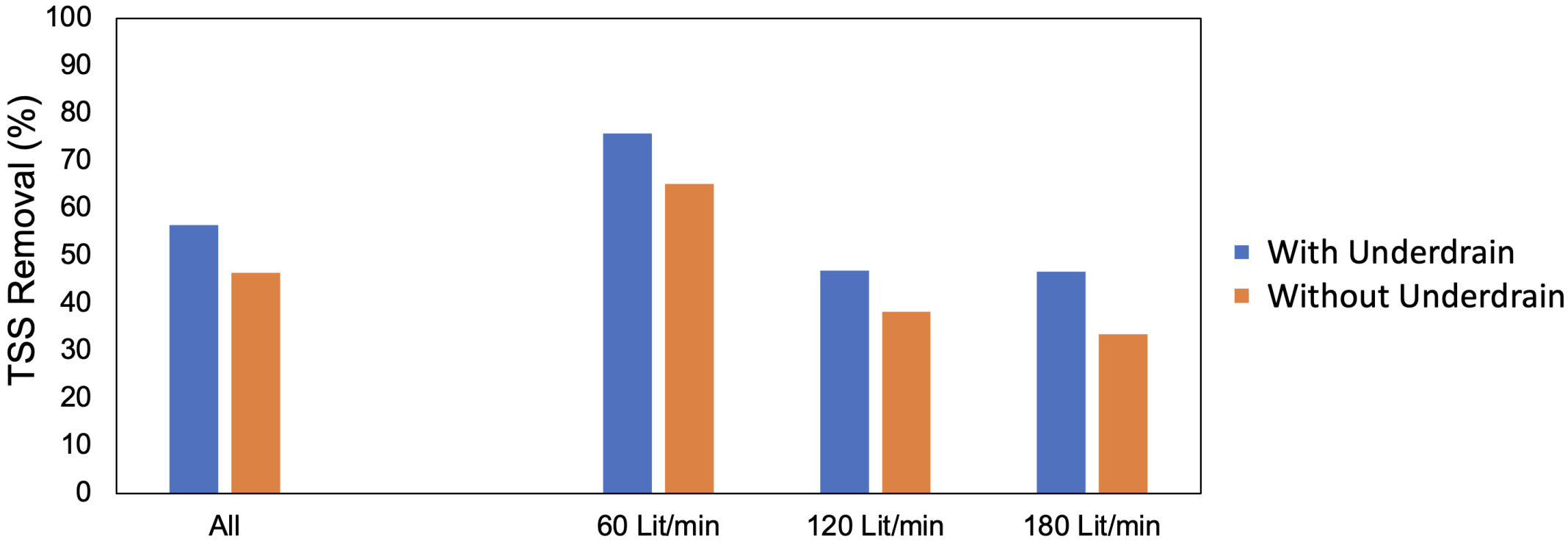


Effect of influent sediment concentration on TSS removal efficiency





TSS removal efficiency for all test scenarios

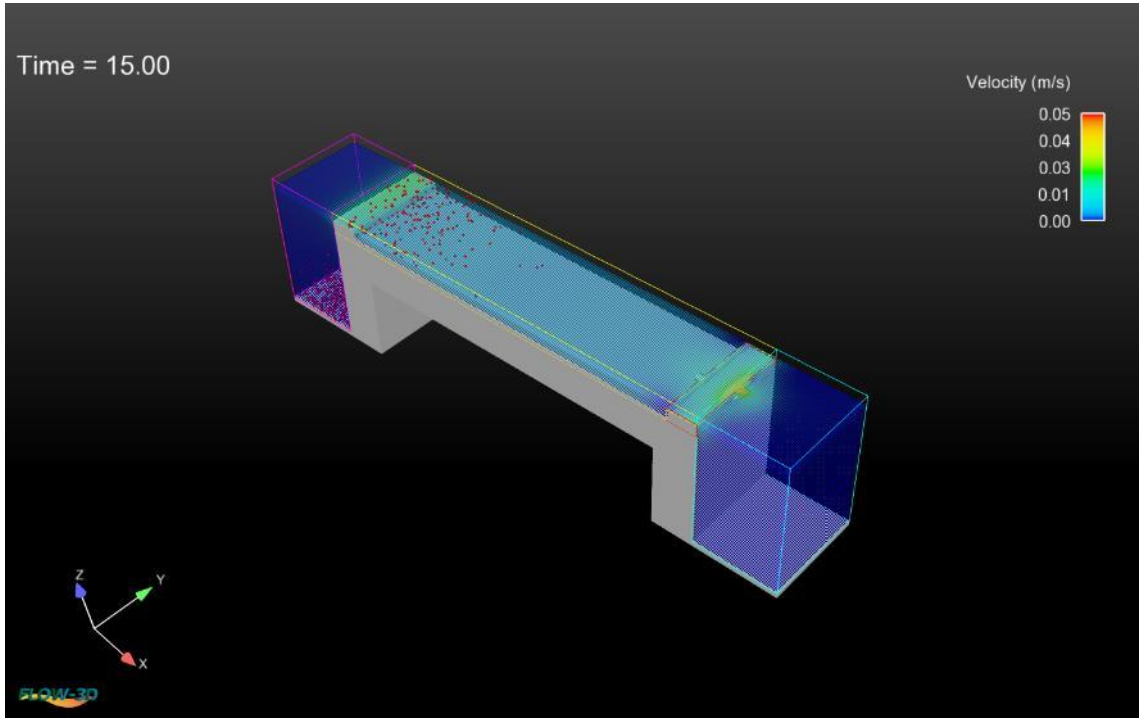


Conclusions

- TSS and Tu were reduced up to 80% in the water infiltrated through the expanded shale media, and 65% in water leaving the swale through the outlet weir.
- Swale with 6-inch infiltration layer was more effective than the one with a 4-inch thick infiltration layer in reducing TSS and Tu.
- Adding underdrain increased the swale removal efficiency, especially for high-inflow experiments
- Type 1 expanded shale (coarser materials) showed better performance in reducing TSS
- With the increase in inflow rate, the overall efficiency of the swale reduced.
- Increase in influent sediment concentration did not impact swale efficiency
- Overall swale with expanded showed promising performance in removing suspended sediment from influent with high TSS loads (100-200 mg/L) typically associated with the *first flush*.

Work Underway

- Assess the expanded shale performance in the removal of other pollutants such as nitrogen and phosphorus
- Numerical modeling of flow and TSS in the expanded shale media
- Flow virilization to examine the distribution of water movement in the swale



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- The research team would like to express their gratitude for the invaluable technical guidance provided by Dr. Muttiah from the City of Fort Worth and Ms. Heather Firn from TRA.
- Special thanks go to Mr. Qays, Technical Staff Assistant of the UTA Civil Engineering Department at for his significant contributions in constructing the experimental setup.
- We would also like to acknowledge Mr. Eric Nelson from ARCOSA for his generous donation of expanded shale and soil mix, which was utilized in the experiments.

Question?

UNIVERSITY OF TEXAS ARLINGTON

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Discussion Items

North Central Texas Council of Governments
Environment & Development

NCTCOG iSWM Task Order Updates

July 12, 2023

TASK 1: AS-NEEDED SUPPORT SERVICES

- iSWM Manual
  - Halff will support NCTCOG and IIS as needed
- SWPPP Revisions
  - No assistance required of Halff at this time

TASK 2: TRAINING

- iSWM development submittal and review process training
  - Review existing materials (complete)
  - Specific items that NCTCOG and IIS want covered
  - Virtual or hybrid option
  - Develop training materials for a 1 to 2-hour presentation for review by NCTCOG and IIS
    - Halff will work with Baird, Hampton and Brown (BHB) to develop training materials

TASK 3: IMPLEMENTATION GUIDANCE

- Panel discussion of iSWM communities
  - Halff will facilitate a 1 to 2-hour panel discussion
  - Seeking someone to lead discussion
  - Seeking ideas on discussion topics
  - Venue and potential dates (Halff can host)

- Interview
  - Potential candidates
    - Amy Cannon (City of Arlington)
    - Andrew Piel (City of Arlington)
    - George Marshall (City of Corinth)
    - Perry Harts (City of Frisco)
  - Develop interview questions for review by NCTCOG and IIS
  - Potentially model after previous interview with David Hunter (City of Denton)

TASK 4: PROMOTIONAL PRESENTATIONS

- Present at up to 4 promotional events
  - Presenting at StormCon and EWRI LID conference
  - Potential candidate organizations
    - Texas Society of Professional Engineers (TSPE) local chapter meetings
    - American Society of Civil Engineers (ASCE) local chapter meetings
    - Texans by Nature stakeholder meetings
    - Developer Council
    - Others – Public Works Roundup, APWA, AWRA
  - Draft presentation at next IIS meeting for review

TASK 5: STORMWATER QUALITY MONITORING PROGRAM

- No updates at this time
- To be discussed at a future meeting

QUESTIONS?

halff

Information Items

iSWM

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Public Works Program Update

- Public Works Council (PWC), August 17, 9:30am at NCTCOG offices, visit www.nctcog.org/envir/committees/public-works-council
- 24th Annual Public Works Roundup, visit www.nctcog.org/envir/public-works/annual-public-works-roundup
  - September 29, 2023 at the Grapevine Convention Center
  - Please consider submitting an abstract to present on a preferred topic
  - Registration will open July 17, 2023

For more information on the Public Works program please contact Kate Zielke at kzielke@nctcog.org or (817) 695-9227

iSWM

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Public Works Program Update

1. Public Works workforce hiring, retention, recruitment (e.g., for manual labor/entry level), growth/development (e.g. through internships, developing a training program, developing leaders), labor rates, culture of belonging (e.g., among different backgrounds, various work divisions, etc.)
2. Concrete versus asphalt - pros and cons of each
3. Legislative/regulation update (e.g, changes for public works, flood planning, water resources funding, land use and planning and local control, etc.)
4. Innovations (e.g., how cities are operating, new ways to solve old problems)
5. Technologies (e.g.. for field crews, drones, situational awareness applications, traffic management, for vehicles, etc.)
6. Pavement preservation strategies
7. Proactively addressing infrastructure needs through water, wastewater, stormwater, and transportation master planning
8. Handling bulk waste after a storm/disaster debris management
9. Should I contract out services or try to perform the work in-house?
10. Asset management
11. Equipment management
12. Software tools for public works (e.g., work order systems, asset management software, project management, etc.)

For more information on the Public Works program please contact Kate Zielke at kzielke@nctcog.org or (817) 695-9227

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TMDL Program Update

- Upcoming Webinar: Water Quality Modeling Webinar – August 3, 2023 at 1:00 PM via Microsoft Teams
- Projects Under Finalization – expected September 2023:
  - On-Site Sewage Facility (OSSF, or septic system) brochure
- Projects Under Development:
  - On-Site Sewage Facility (OSSF, or septic system) brochure
- Upcoming Meetings:
  - Joint TMDL Stormwater & Wastewater Technical Subcommittee Meeting: August 1, 2023 at 9:30 AM via Microsoft Teams
  - Upper Trinity River Basin Coordinating Committee: August 2, 2023 at 9:30 AM at NCTCOG Offices

For more information on the TMDL program please contact Hannah Allen at hallen@nctcog.org or (817) 695-9215

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Upcoming Events, Conferences, and Opportunities

- EWRI International Low Impact Development Conference
  - Oklahoma City, OK
  - August 6-9, 2023
  - More information available online.

- StormCon 2023
  - Dallas, TX
  - August 28-30, 2023
  - More information available online.

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Upcoming NCTCOG Meetings

- Next iSWM Meeting: October 18, 2023 at 1:30 PM
- Regional Stormwater Management Coordinating Council, August 9, 2023
- Public Works Council, August 17, 2023

Environment & Development Committees Information Available at nctcog.org/envir/committees

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Upcoming iSWM Agenda Topics

- FY23 & 24 Work Program Updates

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Roundtable Discussion

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Contact & Connect

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