

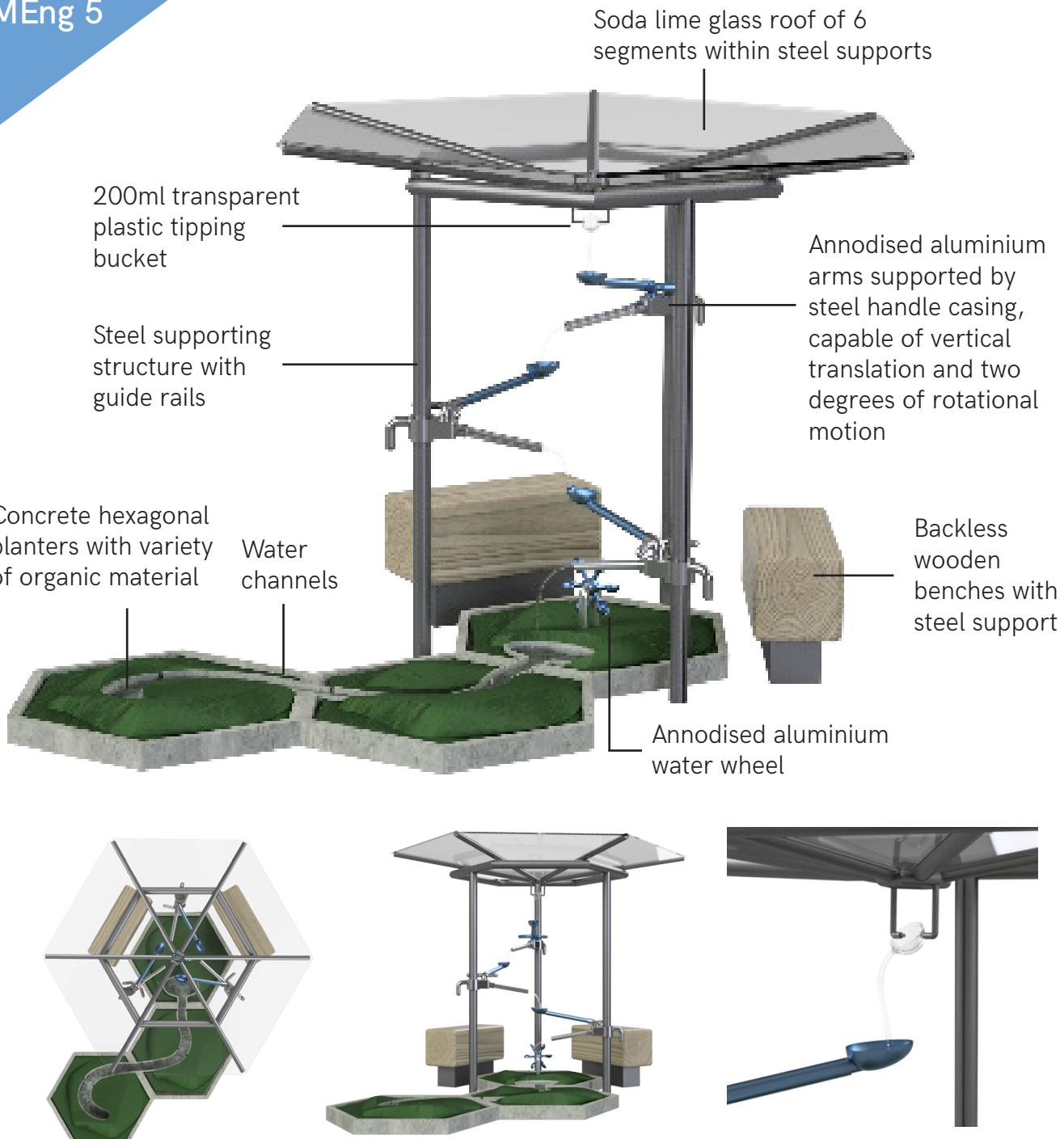
Lia Minty
PDE MEng 5

Trickle

10 page
summary



Product overview



Trickle is a public rain shelter and interactive water feature. During the rain, the shelter collects the rainwater and directs it to the water feature, without additional pumping. By diverting the journey of the rain, Trickle brings a new dimension of joy and curiosity to the experience of rain. As a unique piece of rain-responsive infrastructure, the product will capture the attention of the public and encourage them to engage with their surroundings on rainy days. Trickle introduces water and nature in otherwise grey spaces, and encourages spontaneous, collaborative play for both adults and children.

Who?

Any member of the public, in particular workers on a lunch break, students on campus, or parents and children in parks

What?

The product is an interactive rain shelter, which uses rainwater to supply a low volume water feature. The public can sit under the shelter or stand and interact with the water by manipulating its path with various movable 'arms': completing the water feature

Where?

The product would best be implemented in urban areas where people are likely to wait/spend time, such as campuses, hospitals, city centre and parks

When?

The rain feature operates during the rain, but has the potential to be used any time by the user pouring in their own water or scooping from the water channel

Why?

Spending time outdoors is something we all need, and something we often consider limited by rain or wet surfaces. This project aims to bring joy to the experience of rain and encourage playful interaction

Opportunity

RESEARCH



"Across all of the studies included in the review, it appears that time in nature does have a positive effect on physiology, affect, and attention"

Living, playing, working with water

- the potential of open water to contribute to a sense of wellbeing, and to provide opportunities for relaxation and recreation
- water in motion was considered more appealing than still water

Greening the Grey

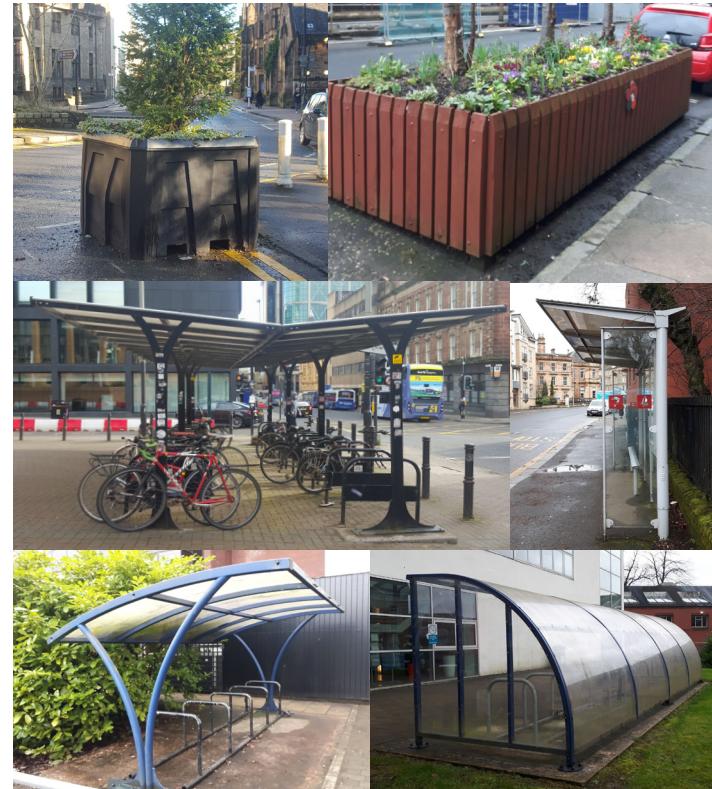
- Integrating green infrastructure has significant social and environmental benefits
- It can reduce the effects of short-term flood damage, urban heating and air pollution

1

VALUE OF TIME OUTDOORS

Research highlighted the value of spending time outdoors, and the benefits of engaging with nature. Introducing nature back into cities has the advantage of improving air quality, drainage and wellbeing of residents. The presence of rain leads to people seeking shelter or avoiding the outdoors completely. The product should create a space where rain can be enjoyed outdoors, encouraging engagement with natural elements.

EXISTING INFRASTRUCTURE



USER INSIGHTS



"getting to work wet/miserable is never a good thing"

"Makes me less likely to go out/leave the house"

"it makes flowers and stuff smell nicer and it's kinda peaceful and destressing"

[It bothers me least] "when it is darker out so there is some more light reflection"

"It makes paths too muddy to walk down without getting soaked"

"crossing roads where drainage is poor makes it hard to cross where it is safe"

2

EASE OF IMPLEMENTATION

Existing rain-related infrastructure includes bus shelters and bike shelters. Neither of which encourage any appreciation of rain or the surroundings. There is also motivation to introduce greenery to urban environments, but it is difficult and expensive to integrate with existing infrastructure. Councils and other bodies are more likely to adopt self contained 'additions'. To cater to stakeholders' needs, the product should be easy to implement.

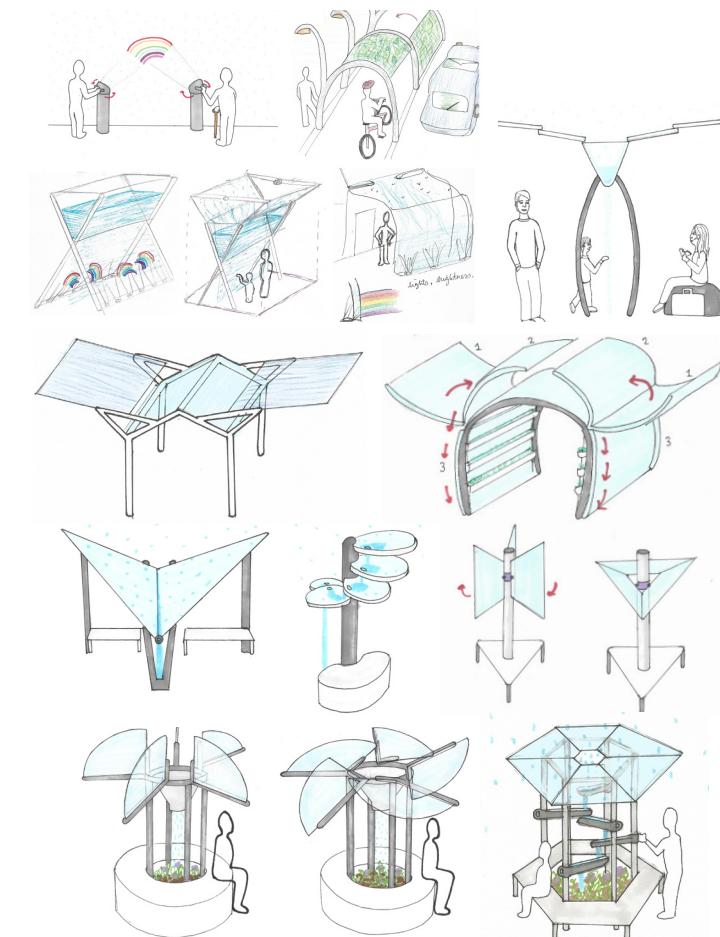
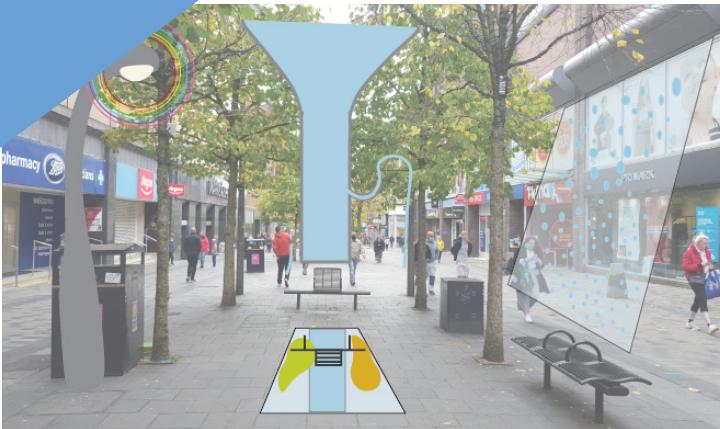
3

IMPROVING EXPERIENCE

Rain is most inconvenient when it is unexpected, and the user is not prepared to get wet. This is common in mandatory journeys such as commutes, where the user is not able to get dry for several hours. Users want to enjoy the positive experiences of rain, while sheltered. The product should enhance the positive sensory aspects while reducing the negatives.

Concept Generation

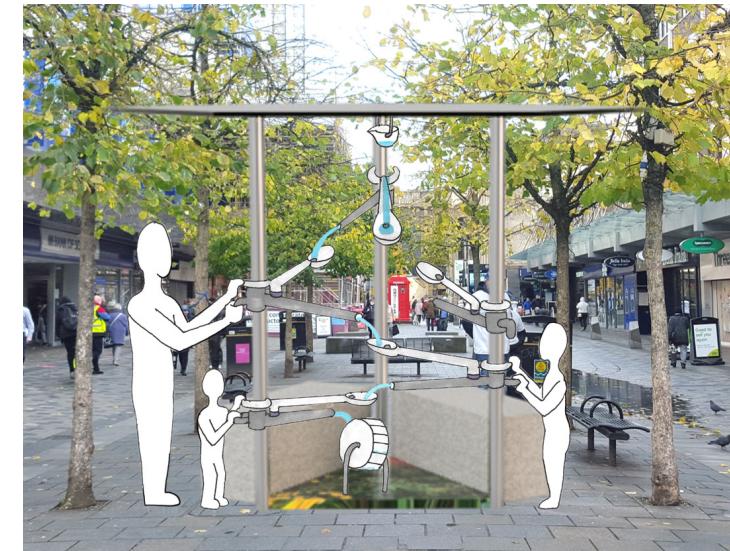
IDEATION



DEVELOPMENT

The form and function of the rain shelter was explored through a variety of ideation and scale modelling. The optimum configuration was found through considering the comfort of the sitting user, the curiosity of the passer by and the coexistence of both relaxation and play.

OVERVIEW



1

RAIN FRIENDLY SPACE

The product provides a relaxing, dry space for the public to meet outdoors in the rain, or use as shelter when caught off guard.

2

ZERO ENERGY

The product has zero energy or pumping requirements. This means the product can be implemented anywhere, without connection to energy or water supplies.

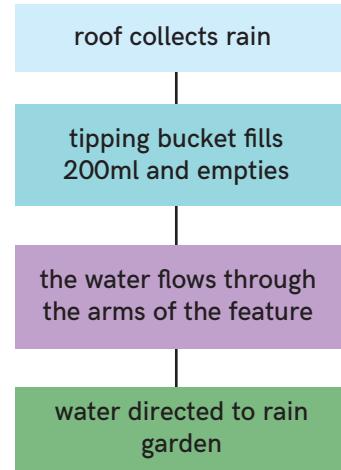
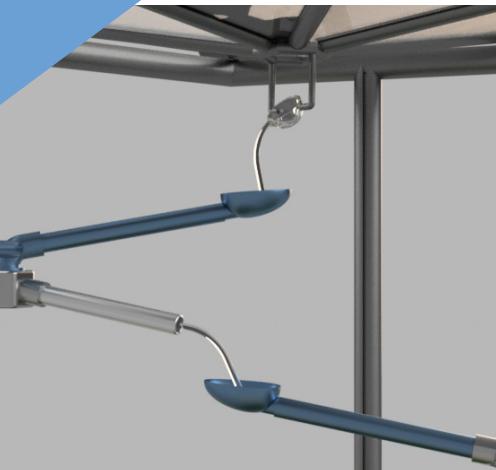
3

INTERACTION WITH WATER

The product encourages playful interaction with the natural elements through collaborative water play.

Overview of operation

USER ENGAGEMENT



The intended interaction with the product is through the handles of the arms. The arms are used to catch the water from the tipping bucket and pass it between neighbouring arms. The water feature is completed when users interact to align the arms. The feature works best with a user at each pole. The design is intended to encourage collaboration and playfulness.



Vertical translation down the shaft, locks in place through push-release mechanism in primary handle



Rotation about the shaft through the main handle, restricted to 60° of motion



Rotation of the top arm about the support through the secondary handle

The user can create their own version of the water feature by experimenting with different heights and configurations of the arms. It is likely that users will interact with the product until they have found several different configurations. While an infinite range of height configurations is possible, there are **six possible sequences** of fluid exchange between the three arms.

NO ENGAGEMENT

Users could also choose not to interact with the arms and merely observe. This is likely for users who are alone, or less inclined to be playful. In this case, the water falls directly downwards onto a water wheel, providing a calm ambient motion.



The feature facilitates both ambient and active experiences, determined by the user

User journey

USER SCENARIO:

Two friends out for a walk get caught in the rain and choose to stay outdoors until it passes



1

They come across the new rain shelters and choose to sit on the dry benches while they finish their coffees



2

Soon they become curious and decide to try the water feature. They discover the range of possible configurations and the satisfying sounds from varying the height



Use case two: Lone user, a worker on their lunch break



Use case three: Strangers use the feature simultaneously



3

Between sequences, they watch the tipping bucket fill and configure the arms into a new position



4

The bucket tips and the next experience begins



User case four: Child plays at ground level while adults shelter

The interaction lasts only a few minutes, but leaves the users with a sense of joy and wonder.

Human factors

USER NEEDS

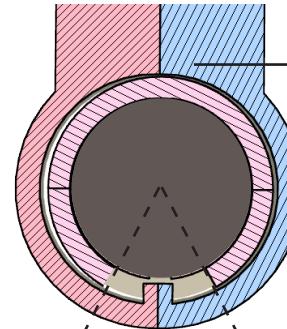
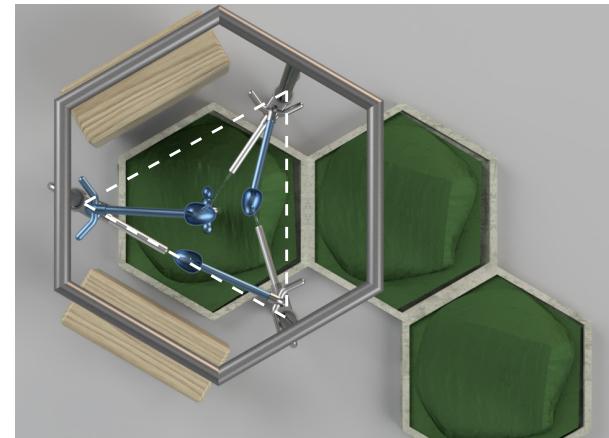
Many types of users will interact with the feature, the configuration was chosen through exploring a variety of user needs. Factors such as user comfort and social etiquette were considered. The final configuration includes two benches, each suitable for two users to sit and talk comfortably. The configuration also allows the water feature to be used by passers by, without disturbing those on the benches. The benches are open-backed to allow the user to face either towards or away from the feature, depending on the level of privacy desired.

INTENDED USER

The product is available to everyone in public but intended for adults, young people and children with adult assistance. The water feature is not intended for under 5s, but freeplay in the water channels is encouraged. Children between 6-12 can operate the arms at low levels, but can only achieve the full range of motion with adult assistance.

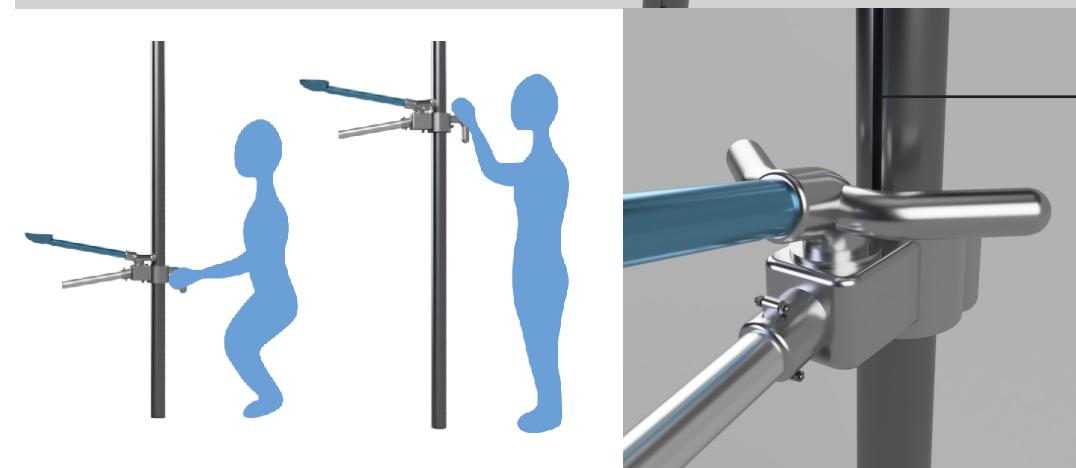
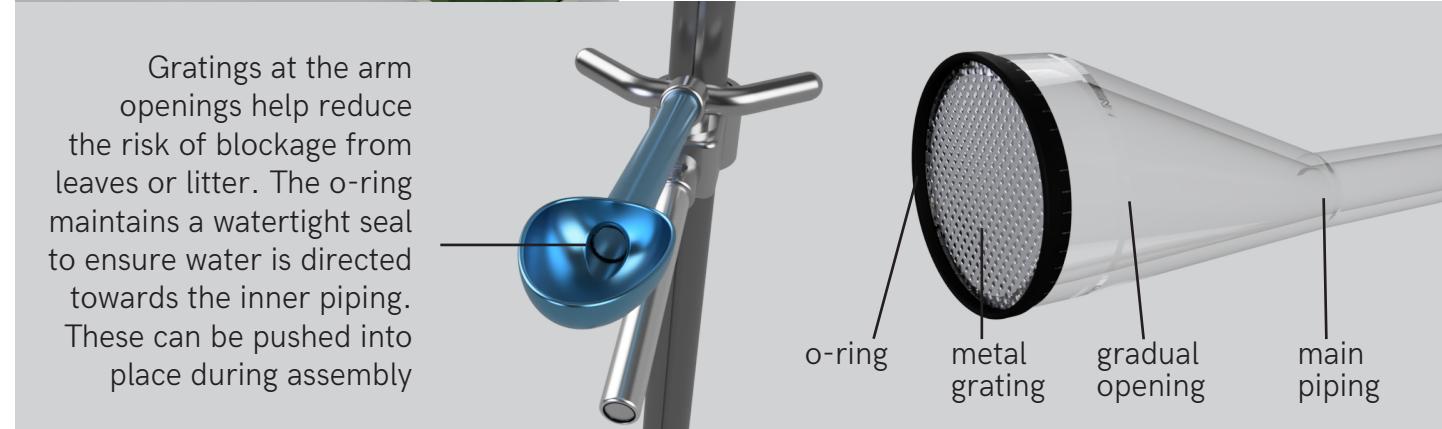


RISK MITIGATION THROUGH DESIGN



main handle restricted to 60°

The rotation is restricted to 60° to ensure the arms are not used outwith the feature to soak people on the benches



Designing for variation

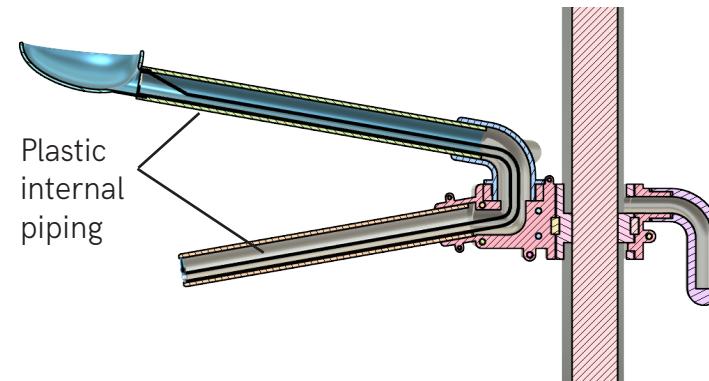
FLOW TESTING

Rain is the main input to the design, which varies greatly in intensity. The water feature should always produce a consistent quality of experience, and not operate poorly in light rain. To ensure consistency in the quality of experience, a tipping bucket was introduced to the design - to collect the rainwater and tip at a certain volume, triggering the water feature. The performance of the water feature depends on numerous interconnected variables, which were explored through flow testing and data analysis to find the optimum dimensions.

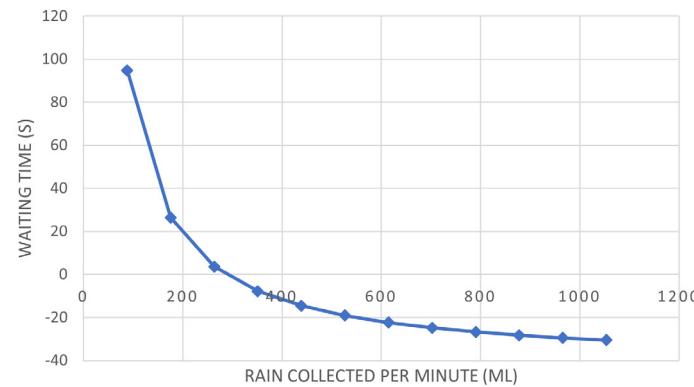


Optimum combination:
10° incline, 12mm top, 8mm bottom , 3mm nozzle piping configuration, tipping bucket volume of 200ml

RAIN VARIATION



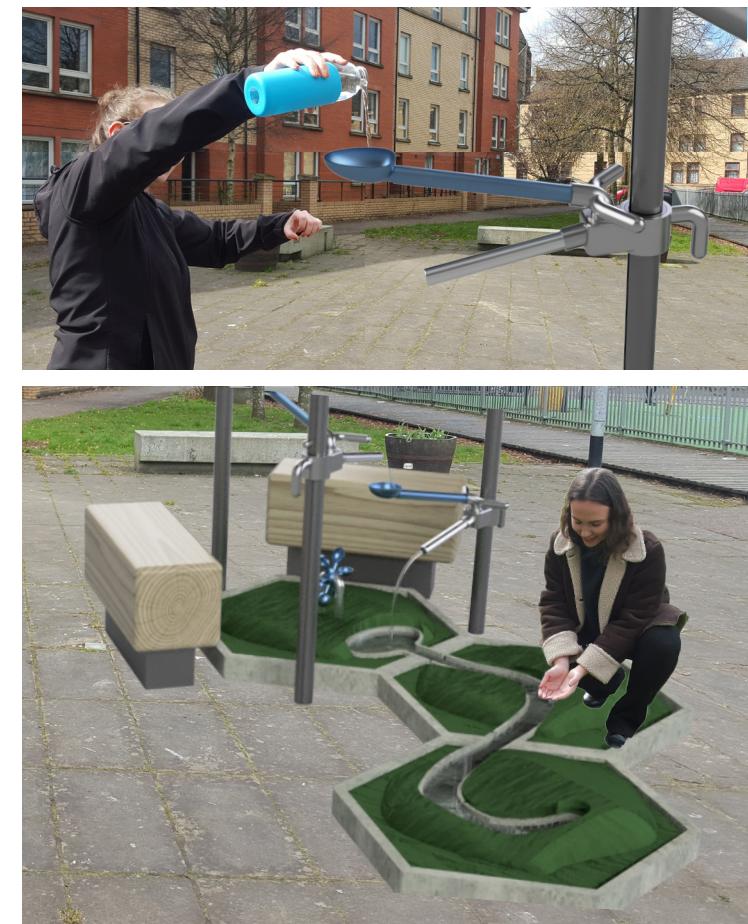
VARIATION IN WAITING TIME WITH RAIN INTENSITY



Comparing test data to rain intensity data, it was discovered that the water feature functions within the full range of rain intensity variation, with a combination of continuous and discontinuous experiences.

Experience time: 42s
Fill time: Max = 137s Min=11s
Waiting time: Max = 94s Min=-30s

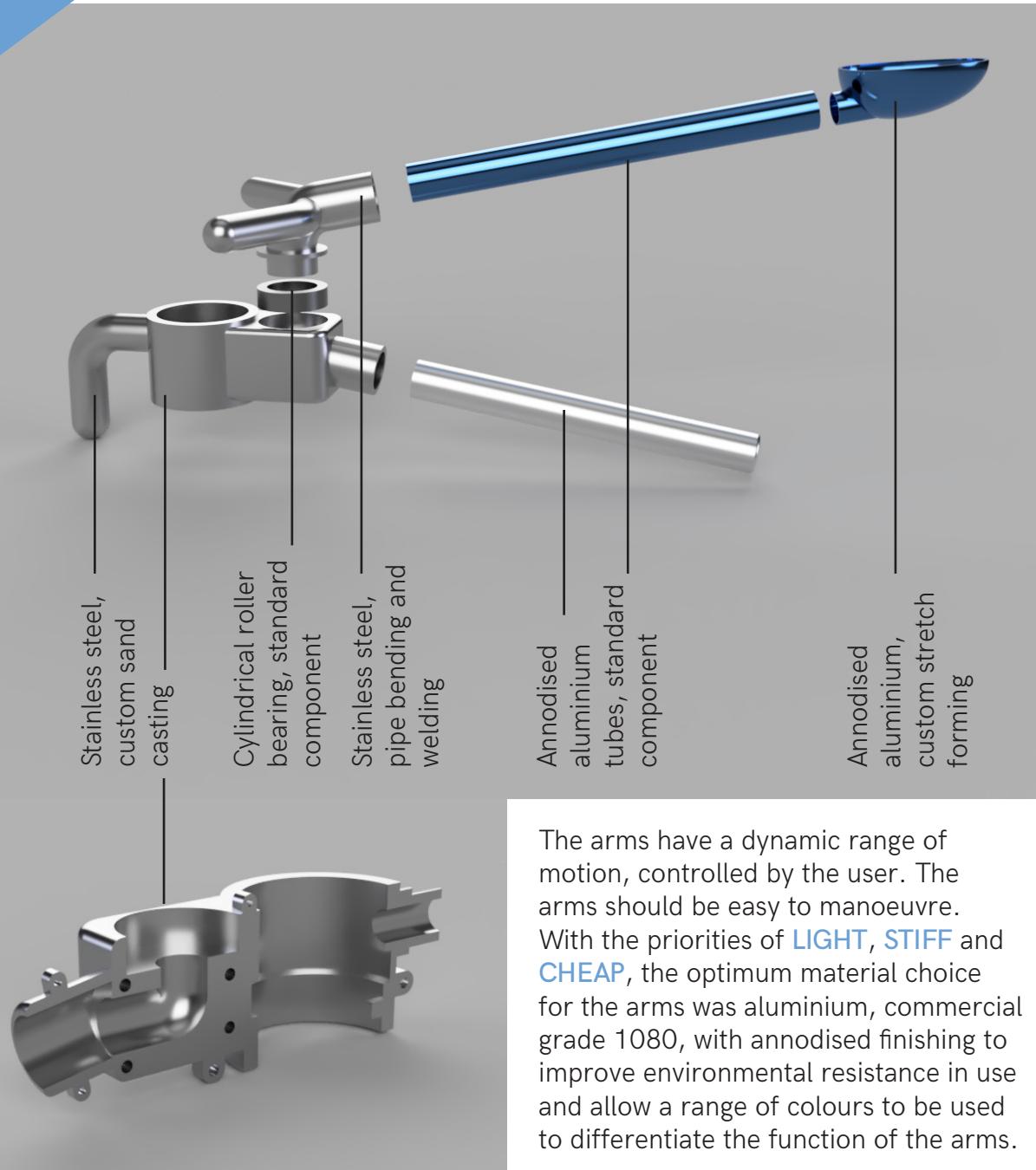
NO RAIN



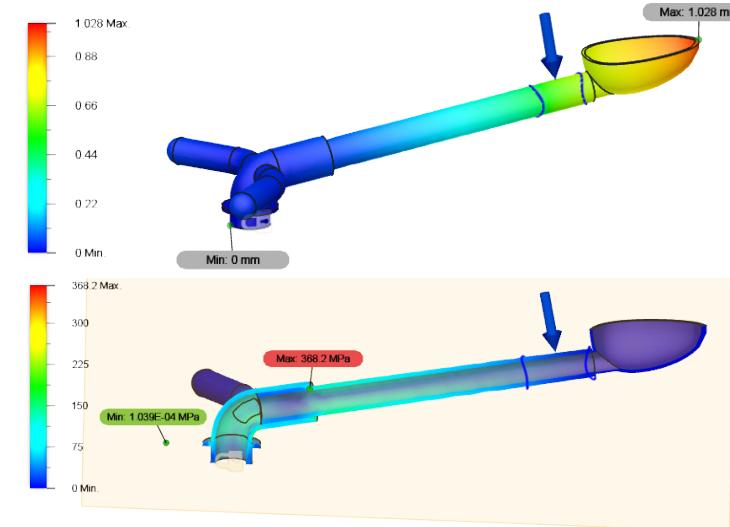
It rains 167 days a year in Glasgow, which leaves many dry days where the water feature will not operate by itself. However since the feature only requires 200ml to operate, there is scope for spontaneous interaction from the public. By pouring their own water or moving water from the channel, the user can initiate the water feature on dry days. If this is not done, the product's main function will be as a bench, with the advantage of being dry at all times.

Testing and improvement

MATERIALS AND MANUFACTURE



LOADING SIMULATIONS

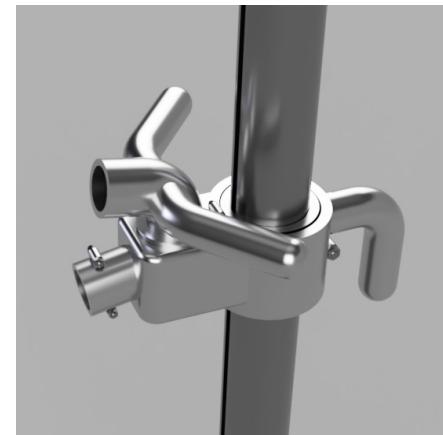
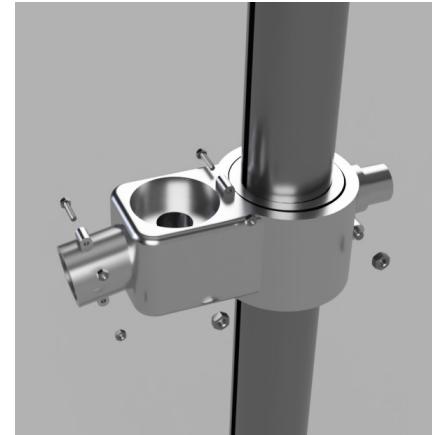
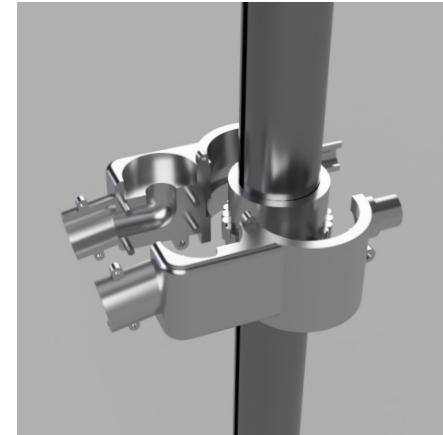


PUBLIC SAFETY STANDARDS

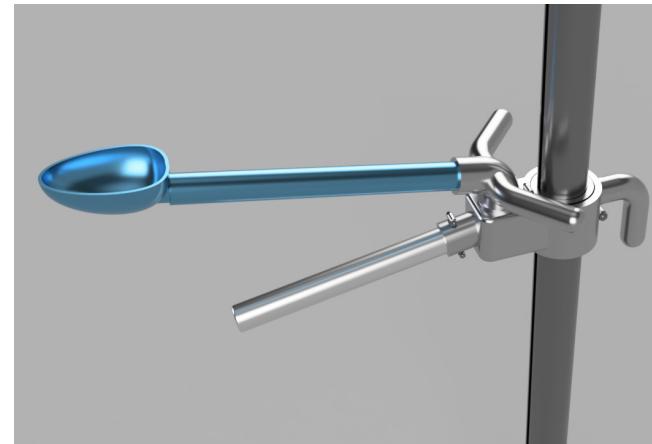
The results from the FEA simulations showed that the current design fails to meet the British Standards related to playground equipment. In the test loading case, plastic deformation was seen in some areas, but the arm did not fail in such a way to cause a safety risk. Significant visible plastic deformation would be seen long before injury would occur. The design is suitably durable to withstand its likely range of user loading but may fail in intentional abuse cases. Durability of the product is important, but there is a trade-off between longevity and playfulness within the public domain. The current design prioritises the playful range of motion, as this was missing from existing public infrastructure. A more durable product is possible but will likely be less dynamic. Further exploration is needed.

The arms are more susceptible to damage and likely to have a shorter lifespan than the rest of the structure

Installation and maintenance



The design of the arms allows them to be attached to the supporting structure onsite. This ensures ease of **disassembly** and **replacement** at their end of life.



INSTALLATION

The unit consists of several distinct components and subassemblies. Most of the unit can be assembled onsite, including the arms, rain garden and roof panels. The only components which require ground-level installation are the steel supporting structure and benches. These would require concrete setting and bolting respectively.



MAINTENANCE

As with all public installations, the unit requires regular semi-maintenance to maintain quality. This would include:

1. Upkeep of rain garden
2. Glass cleaning
3. Clearing dirt/litter/blockages
4. Annual safety checks

Future expansion

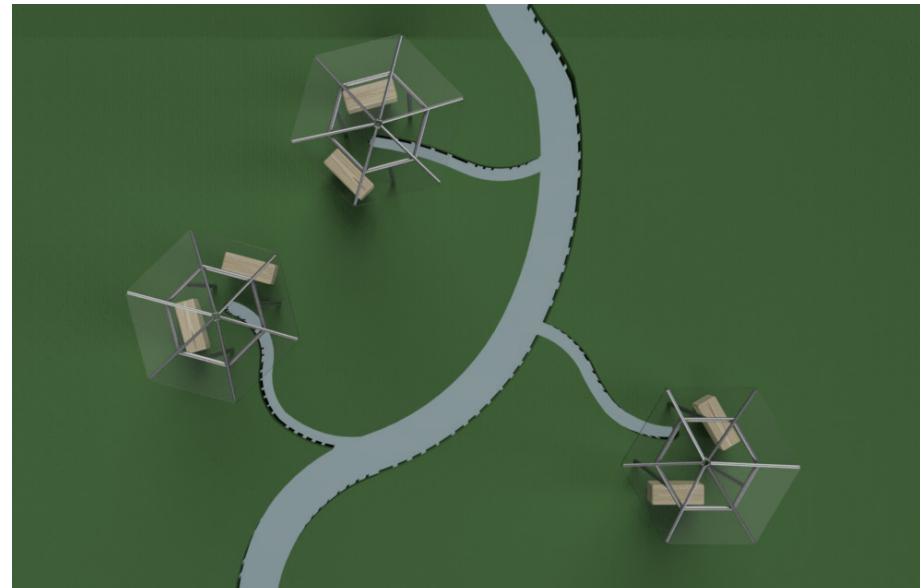
ADDITION TO INFRASTRUCTURE

Due to the ease of implementation, these rain shelters and planters could be easily introduced to cities. This could be individual rain shelters scattered around the city, or hubs of rain shelter networks. Building a network of rain shelters will be a transition to a rain-friendly city.



INTEGRATION WITH LANDSCAPE

With a greater level of planning, the rain shelters could be integrated into the landscape to join different bodies of water. This would require significant changes within the city, but could be part of a sustainable urban redevelopment to strengthen connection to natural elements.



REFLECTION

This project has identified the opportunity to introduce playfulness and connection with rain in public spaces. The proposed design is just one example of a rain-powered water feature, but many variations are possible. There is great opportunity to design the experience of rain into cities in a way that benefits residents and their perception of 'bad weather' in urban environments. Introducing rain-related infrastructure to cities has the potential to increase the time spent outdoors and encourage engagement with natural elements. This project relates to many wider social and environmental goals and has much scope for further development.