



Recirculate
Upcycled Paddling Equipment

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Intro

Paddling is one of the most immersive experiences someone can have in the outdoors. It places you in the heart of an ecosystem and leaves not even a footprint behind. However, the same cannot be said for the equipment paddlers use, as virgin plastics are frequently used to withstand extreme conditions. The industry is overdo to take responsibility for their impact by considering the entire lifespan of the products they create.

Recirculate brings the paddling industry into the **circular economy*** by **upcycling*** damaged river equipment through partnerships with local outfitters. This business model removes unwanted clutter from river guiding outposts and transforms it into functional gear to be sold to guides and guests.

This project specifically creates waterproof portage packs from an damaged Tomcat Tandem inflatable kayak, donated by Hardwater Sports, a whitewater rafting outfitter in Sandstone, MN.

***Upcycling:**
“Creation of any product out of used materials in an attempt to generate something of higher quality or value than the compositional elements.”

According to Sung, K et al in Individual Upcycling Practice

***Circular Economy:**
“Products are designed and manufactured with new uses already in mind”

According to Braungart, M in Cradle to Cradle. Remaking the Way We Make Things

A misty mountain landscape with a river and a blue inflatable boat. The scene is overcast and foggy, with a large mountain in the background and a dense forest of evergreen trees on the slopes. In the foreground, there are several thin, leafy trees and a blue inflatable boat partially submerged in the water. The overall mood is serene and somewhat somber due to the muted colors and mist.

Phase 1: Research



The River Rat

Profile

Bodie has an advanced knowledge of river running. He's on the water everyday for work and recreation. Certified as a Swiftwater Rescue Technician

Location

Salmon, ID

Occupation

River Guide

Needs

A product that reflects their passion for the enviornment without compromising functionality

Key Insights

1.

“Black Hole”

Single large compartments with top down openings make it difficult to see and locate items on the bottom of the bag

2.

“Rig to Flip”

Everything should be secure and waterproofed in instance of flip. Be wary of entrapment hazards

3.

“Schnadel”

“Sh*t Needing a Designated Location.” Miscellaneous items, especially straps, clutter bags and the boat

Dry Bag Benchmarking

							
Name	Tough Sack	Ocoee Duffel Dry Bag	Aleutian Deck Bag	Epic Backpack	Mesh Divider Organizer Duffel	Thawrt Bag	Everyday Backpack
Brand	NRS	Watershed	Watershed	ULA	Sol Gear	Sol Gear	Peak Design
Price	\$22.95	\$133.00	\$164.00	\$299.99	\$160.00	\$70.00	\$279.95
Capacity	5L	10.5L	11.5L	65L	81L	20L	20L
Material	18oz TobaTex w/ welded seams	RF Welded Polyurethane Ripstop Nylon	RF Welded Polyurethane Ripstop Nylon	420D heavy duty nylon	Nylon Mesh	Nylon Mesh	100% recycled DWR coated 400D nylon canvas
Closure	Roll Top w/ 1 buckle	Roll Top w/ 2 buckles	Roll Top w/ 2 buckles	Roll Top w/ 1 buckle	YKK Dual Reversible Zipper	YKK Dual Reversible Zipper	#8 Weatherproof Zips
Notable Features	D-ring on buckle Some models offer transparant window	Duffel profile fits under kayak deck Optional padded divider set Padded carrying handles	Clear map case Waterbottle holder Elasto-Lok buckle for bilge pump	After market frame compatible with any dry bag Contoured hip and shoulder straps Mesh bellowed pocket	Multiple handles Zipper pocket 4 compartments Compatible with Watershed Colorado dry bag	Sewn in cambuckles attach to raft thawrt	MagLatch hardware provides internal expansion FlexFold Dividers Dual Side Access Zips



Insights

A market opportunity exists in a waterproof daypack (10L–40L) that has organizational features and can easily be carried

Upcycling Benchmarking



Lessons from Successful Upcycling Business Models

Design directly with the repurposed material

Identify & experiment with material to understand what it can and cannot do

Minimize the use of any new materials, maximize the amount of repurposed material

Highlight evidence of reuse by incorporate imperfections, tags, and branding from the products previous life

Repeat silhouettes that work and plot patterns directly onto waste material

Work from largest silhouettes to smallest to maximize material usage. Quilt leftovers

Material Source

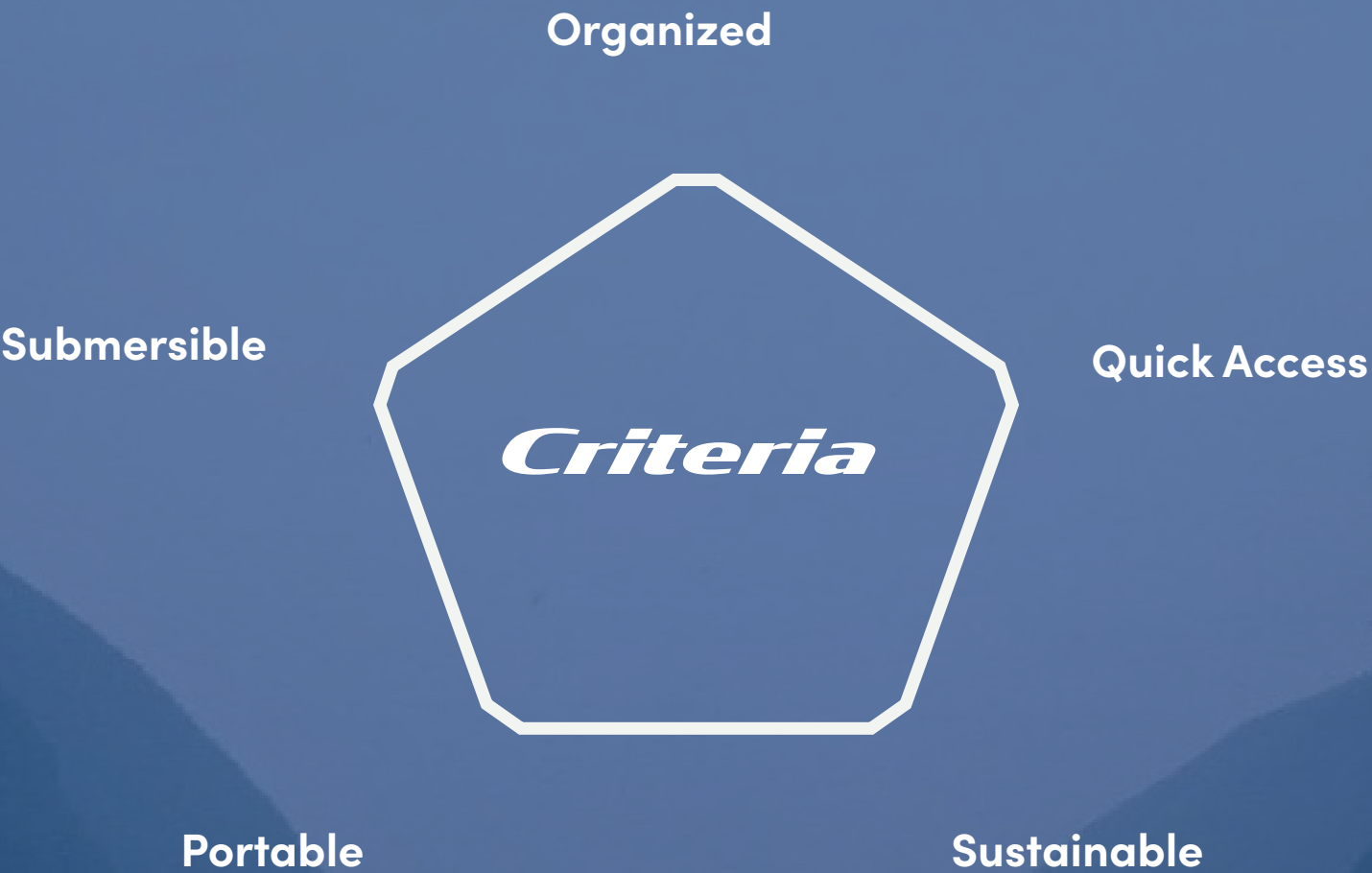


Local Partnership

Hard Water Sports, a local rafting outfitter, was contacted with the question “**Do you have any broken gear you plan to throw out?**” Tony, the business owner, pointed to an **AIRE Tributary inflatable kayak with a blown out zipper**. He was happy to have it out of his way and out of the landfill.



Recirculate
Upcycled Paddling Equipment



Opportunity Statements

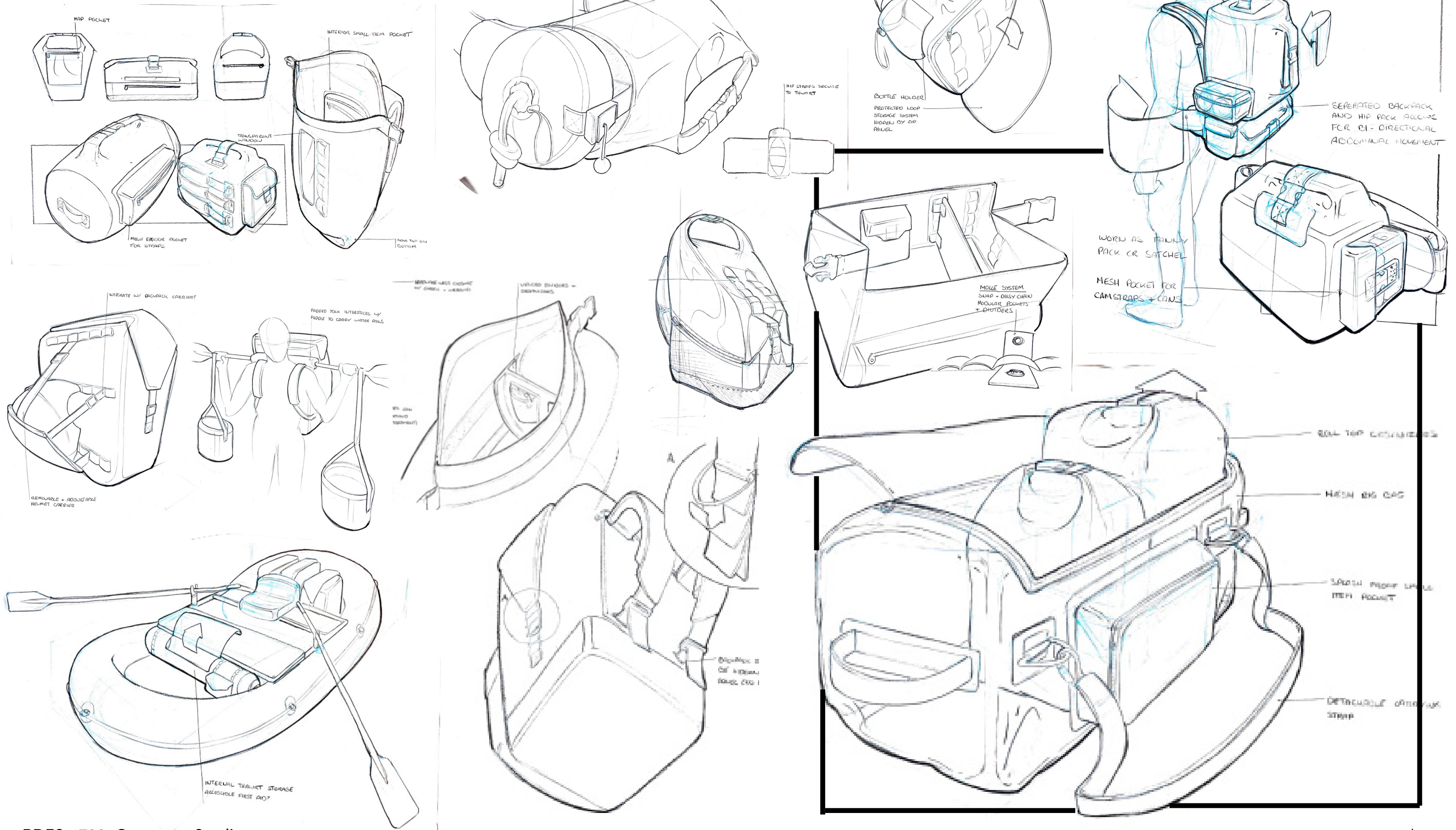
How might we keep personal items organized, dry, and accessible for paddling enthusiasts during day trips?

How might we bring the boating industry into the circular economy using repeatable and scalable methods?

A scenic landscape photograph with a blue color overlay. In the foreground, there is a rocky shoreline with a large pile of driftwood. Behind the shore is a dense forest of evergreen trees. In the background, a range of jagged mountains is visible under a clear sky. The text "Phase 2: Development" is centered over the image in a white, italicized serif font.

Phase 2: Development

Idea Generation



Idea Evaluation

Methods

Each concept was named and **evaluated against the design criteria** established during user research. Pros and cons were described and the leading ideas were **chosen based on user feedback**.

Concept #6

MOLLE System Organizers

Modular molle system used for tactical gear uses snap buttons and daisy chains to securely attach pockets and dividers to interior of dry bag

Pros

- Organizers stay securely fastened no matter conditions
- Modularity allows users to customize their bag to their specific gear

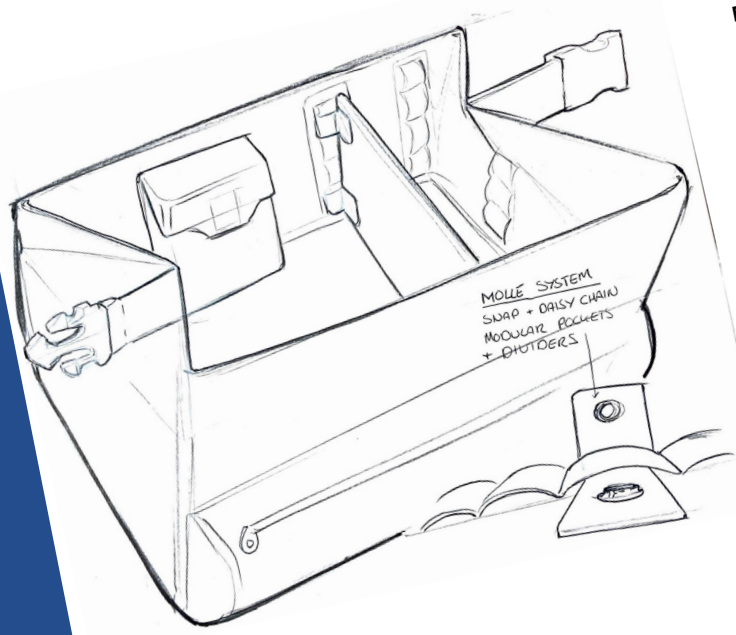
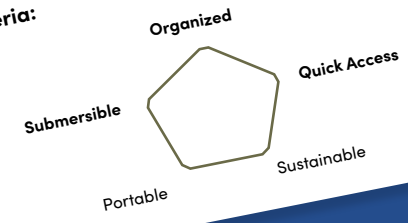
Cons

- Patented system
- Limited visibility while setting up snap buttons inside bag

Problem Statements:

- How might we keep personal items organized, dry, and accessible for paddling enthusiasts during day trips?
- How might we transport and securely stow the personal items of paddling enthusiasts during day trips?
- How might we upcycle damaged river equipment using repeatable and scalable methods?

Design Criteria:



Concept #9

Supportive Hip Pack and Backpack System

Backpack rests on flat top of fanny pack transferring weight to hips

Pros

- Each pack can be used independently or as a system
- Allows torso to rotate separately from lower body

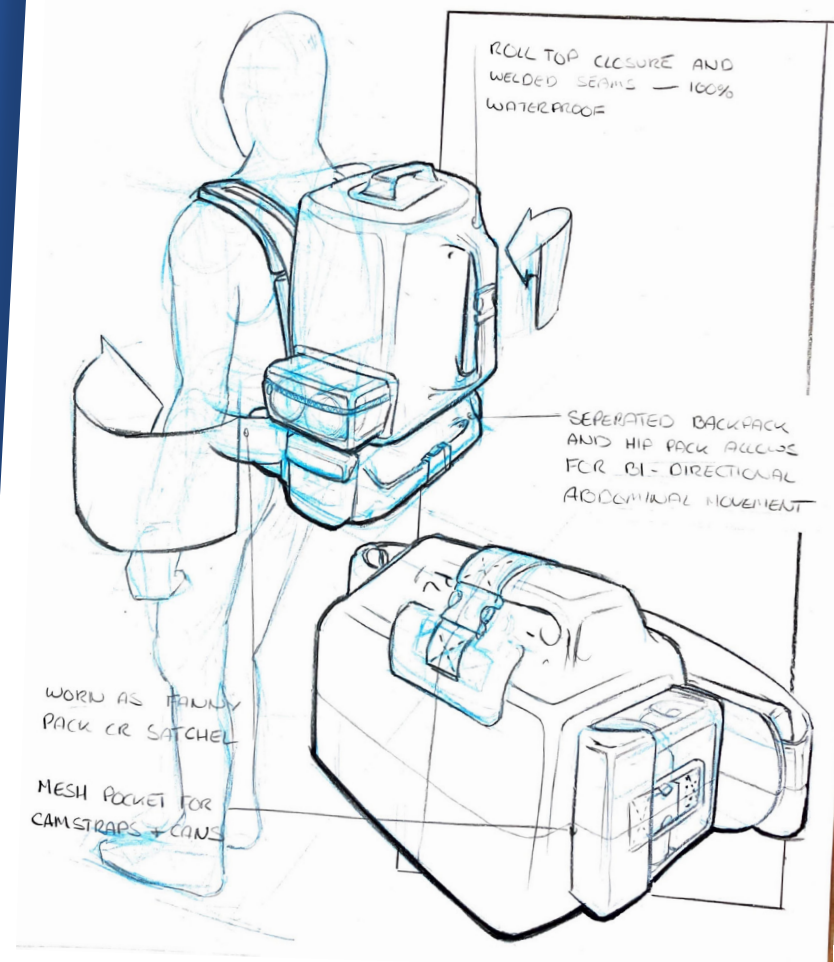
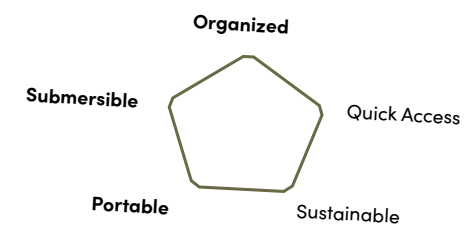
Cons

- Hip pack must be fully stuffed to properly support weight of backpack

Problem Statements:

- How might we keep personal items organized, dry, and accessible for paddling enthusiasts during day trips?
- How might we transport and securely stow the personal items of paddling enthusiasts during day trips?
- How might we upcycle damaged river equipment using repeatable and scalable methods?

Design Criteria:



Outcome

A system in which a **backpack rests on top of a wasit pack**, transferring weight to the hips, was among the most promosing ideas. This has an ergonomic advantage for long portages.

This would be used in conjunction with the **MOLLE modular organization system** used in tactical gear.

Material Inventory

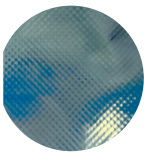
Repurposed 1670 Denier PVC

A common material for whitewater boats, PVC is abrasion resistant and water proof. It can be glued using Stabond advehsive or RF welded to create watertight seams

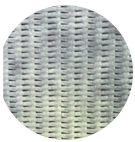


95%

Upcycled Material*



PVC, Straps, Hardware
Damaged inflatable kayak



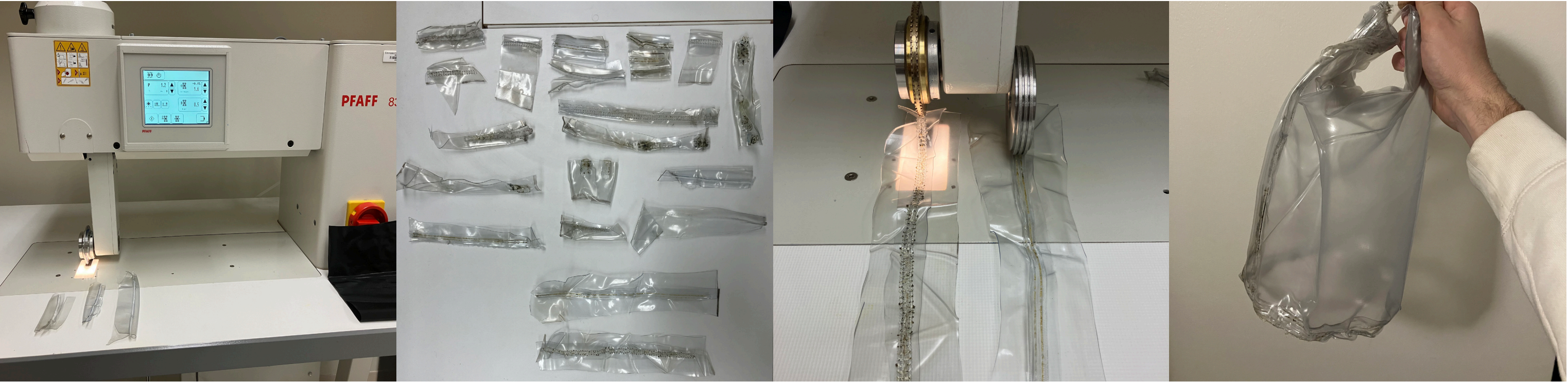
Mesh
Retired billboard



Bias Tape, Storm Strip
Popped bike tubes

Technology Exploration

Radio Frequency Welding



3 Input Variables

- 1. Speed
- 2. Power
- 3. Pressure

Testing Seam Strength

It was found that **1.2% power, 0.1 bar, and a 1.8m/min** feed rate formed the strongest seam in the transparant vinyl.

Disk Type

Disks preform a similar function to the foot on a sewing machine

The **knobbed disk** produced the most consistent weld (ie. no weak points, no burn holes)

Prototype Liner

Following the seam lines of existing dry bags, a prototype liner was welded.

Attaching the circular bottom proved difficult without the tooling used in manufacturing, alternative shapes and assembly must be explored

Midfidelity Prototypes



User Testing

Methods:

Users were tasked with three assignments. To wear the packs seperately and together, to remove and replace an object in the bag, and to externally attach a dopp back to the pack organizer.

Altering Strap Length

Complaints of shoulder discomfort were common. This could be resolved by attaching the backpack straps directly to the bag vs having elongated adustable straps. The hip pack consistently did not offer enough slack for smaller users.

Rigidity

Both the hip pack and overnight pack sagged when worn, particularly when weighted. The addition of PET or another lightweight semirigid structure would resolve this.

Asymmetry and Closure

Two closure methods were tested, a “millk carton” style and a “slotted zip” style. It appears that a combination of both would be the most practical solution.

External Attachment

The MOLLE system was confusing to unfamiliar users. While it is the standard for modular packs, it appears that the drawbacks may outweigh the benfeits. A sewn in system would be both more acessible and less prone to error.



A photograph of two people kayaking on a river, overlaid with a semi-transparent blue filter. The kayakers are in the foreground, wearing life jackets and hats. The river flows through a narrow canyon with steep, rocky walls covered in dense evergreen trees. The sky is overcast.

Phase 3: Refinement

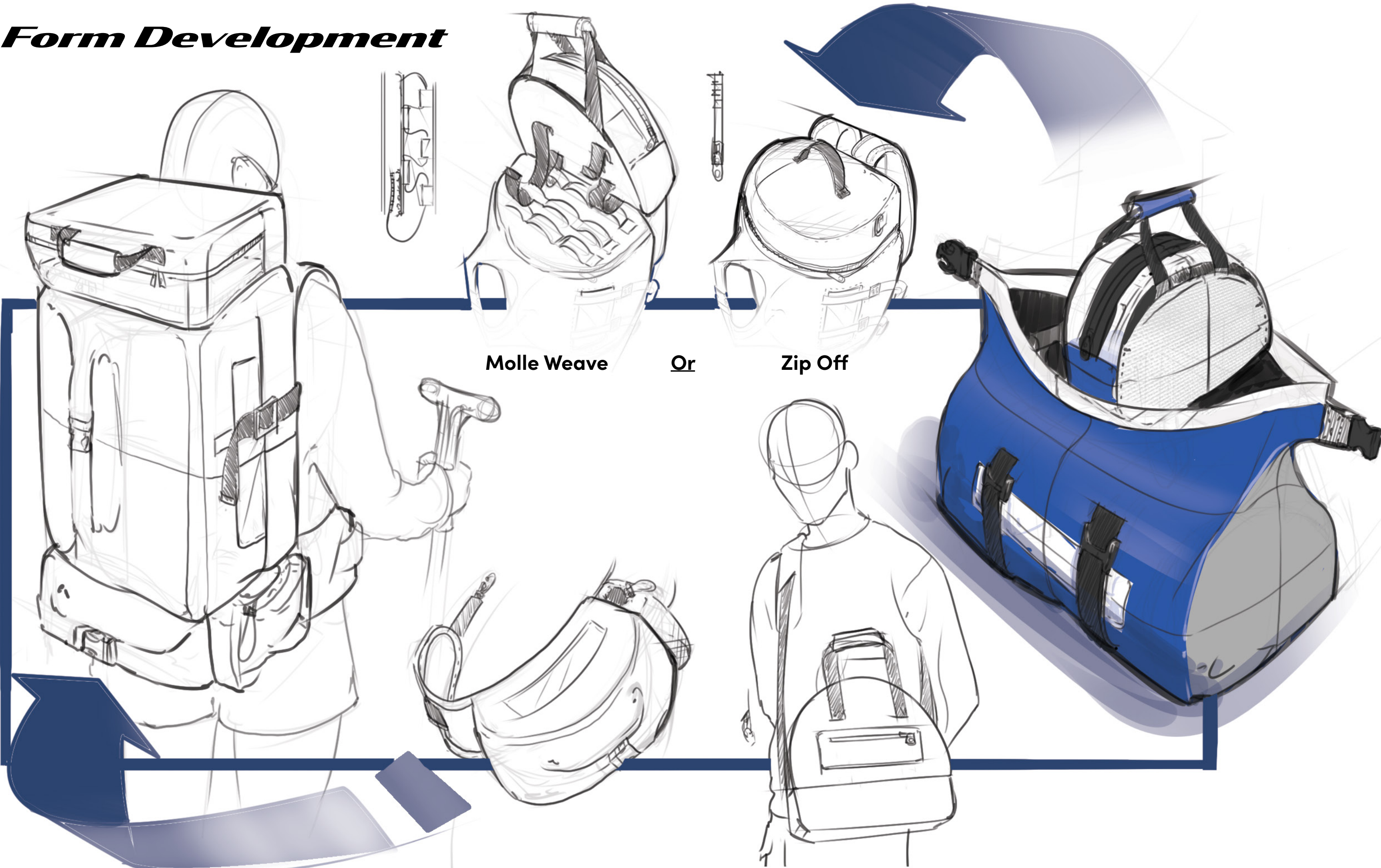


Vintage.
Functional.
Durable.

Design Element	Description
Form	Cubic shapes with rounded radii, broken graphically. Functionally technical appearance.
Details	Modular packs with zippered connection. Waterproof and water soluble compartments and pockets. Roll top closure
Materials	Opaque and transparant PVC from inflatable kayak. Mesh billboard PVC. Nylon webbing. Stainless steel D-Ring accents.
Color	True black, royal blue, midtone grey, white,
Texture	Stiff, heavyweight, semiglossy, durable.
Personality	Distinctly upcycled and hand done. Technical and functional. Strong graphic prescence that is honest to original materials

Design Language

Form Development

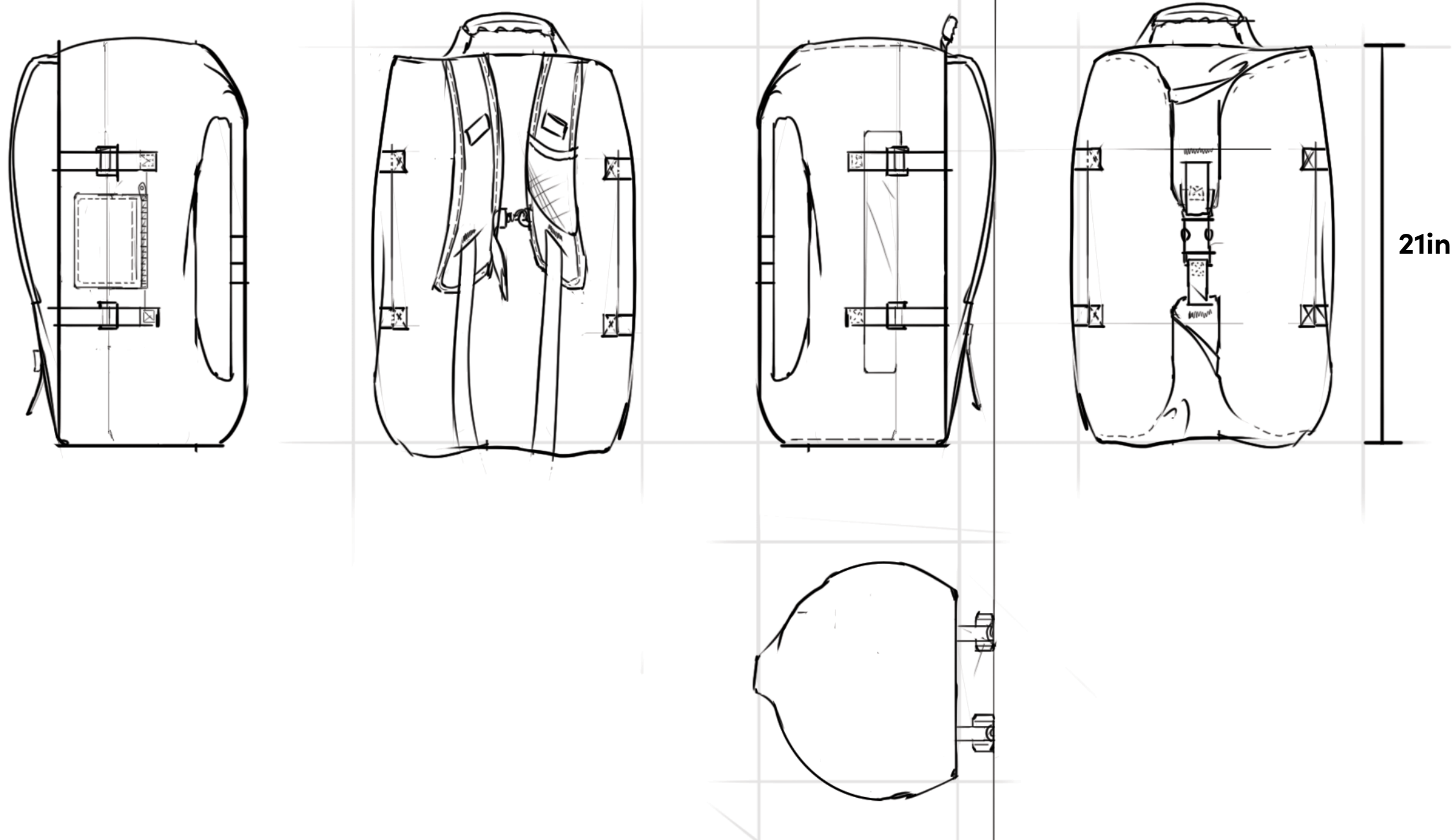


Outcome

Semi circle profile

Rolltop closure was moved opposite to back for better balance

Transparant window, zip pocket, and compression straps were added to pack exterior



Upcycling Process



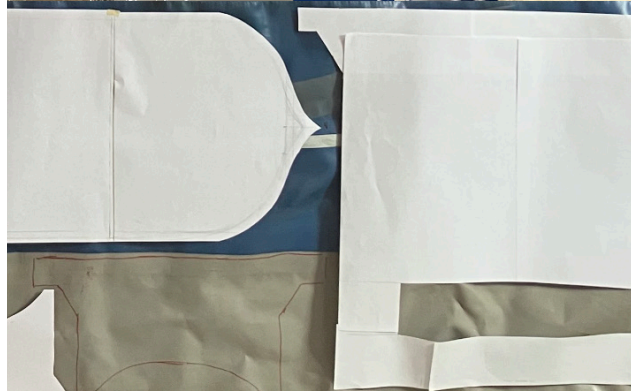
1. Disassemble

Removed all stitching and trim (bias tape, hardware, zippers, etc) using a seam ripper — this was done until the original pattern pieces could be spread flat



2. Clean

A self-service car wash was used to remove any debris from the material.



3. Patterns & Marking

Patterns were based on altered MidFi prototype dimensions & a rough digital model in CLO3D



4. Cut

The panels for the bag were then cut. Pieces were added.



5. Sew

The parts were then stitched together, adding additional trim and straps as necessary.



6. Ultra Sonic Weld Liner

Ultrasonic welded a waterproof liner that was stitched into the finished bag.

40L

Duffle Bag

15L

Sling Bag

10L

Rig Bag



Features

Interior/Exterior Organizer

Stow inside for increased organization or outside to separate wet gear

Mesh Panels & Pockets

Allows damp gear to breathe

Roll Top Closure

Forms carrying handle and never wears out

RF Welded Liner

Keeps contents dry even when completely submerged

Transparant Windows

Improves visibility in the bottom of the bag

Adjustable Straps

Individualized fit and used to carry paddle on portages





3-1 System

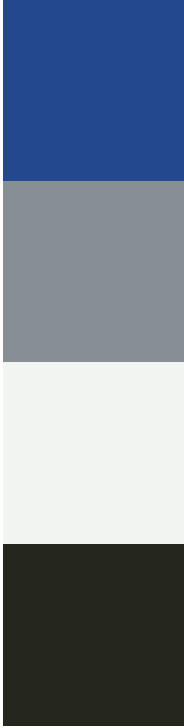
Organizer attaches as brain
via MOLLE/PALS ladder system
used by US Military

Sling bag can be worn around
torso to transfer load of
backpack onto hips

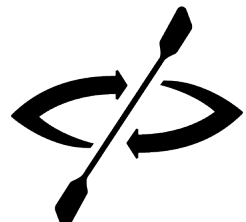
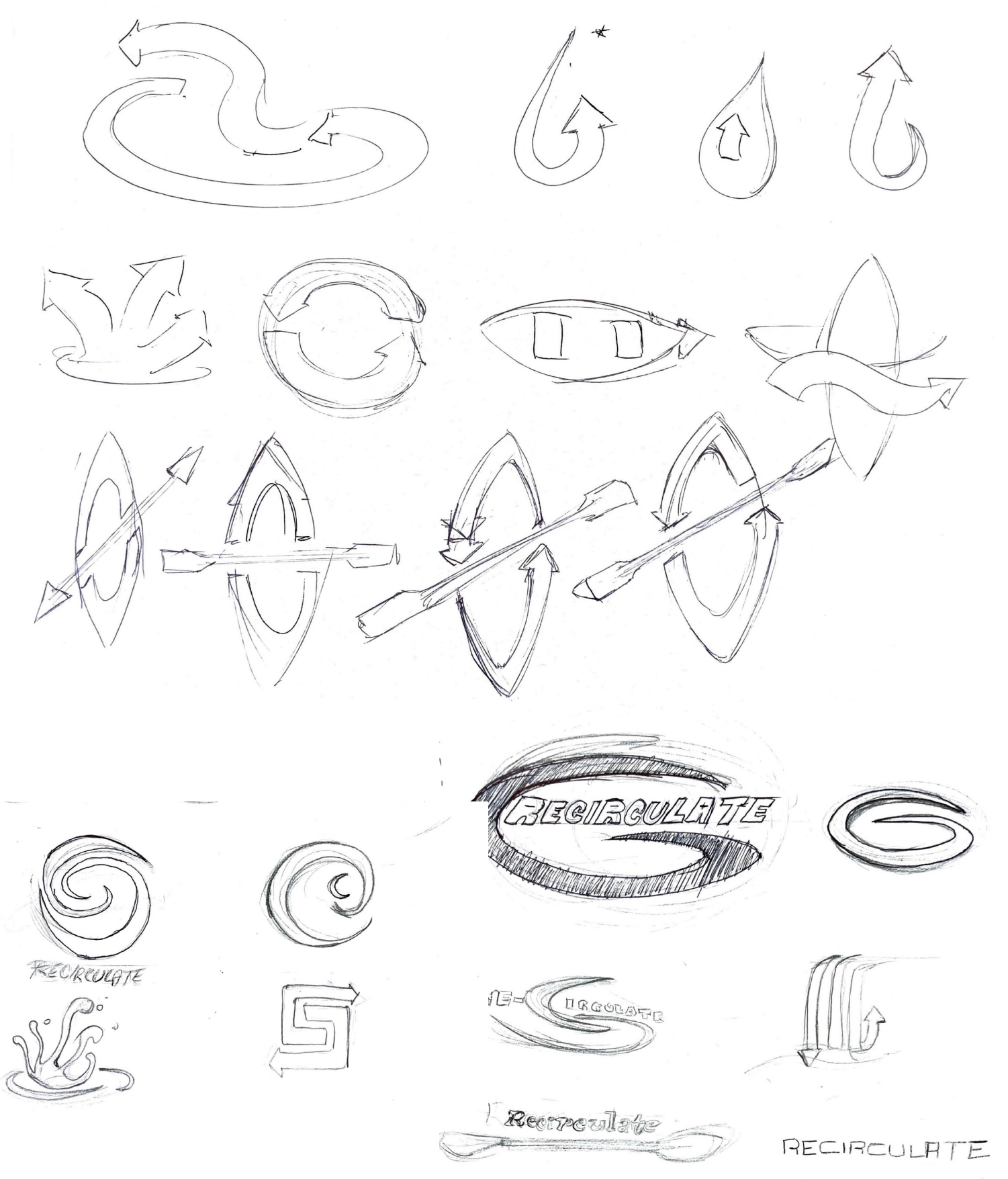


A photograph of several blue inflatable rafts stacked on a flatbed trailer in a wooded area. The rafts have yellow text on them, including 'MONTANA' and 'MONTANA RIVER GUIDES'. The text 'Phase 4: Branding' is overlaid in the center of the image.

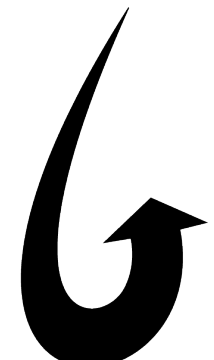
Phase 4: Branding



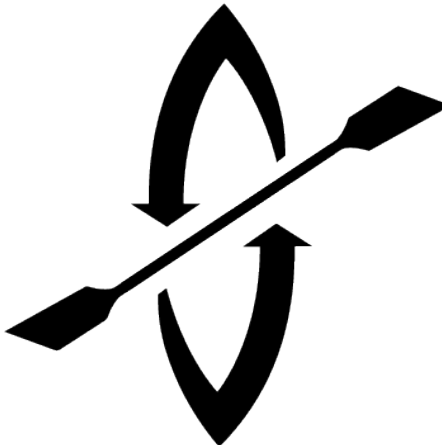
Logo



Recirculate



Recirculate



Recirculate

Hang Tags

Submersible
Roll top closure & welded liner keep contents dry

3-1 System
MOLLE compatible rig bag acts as an organizer or brain

Sling bag transfers weight to hips when worn with backpack

Transparent Window
Improves visibility while packing in low light conditions



15L
Sling Bag

95% Upcycled Material*

- PVC, Straps, Hardware**
Damaged inflatable kayak
- Mesh**
Retired billboard
- Bias Tape, Storm Strip**
Popped bike tubes



*Buckles for roll top closure are factory surplus



Recirculate
Upcycled Paddling Equipment



Retail Display

Hanging Packs

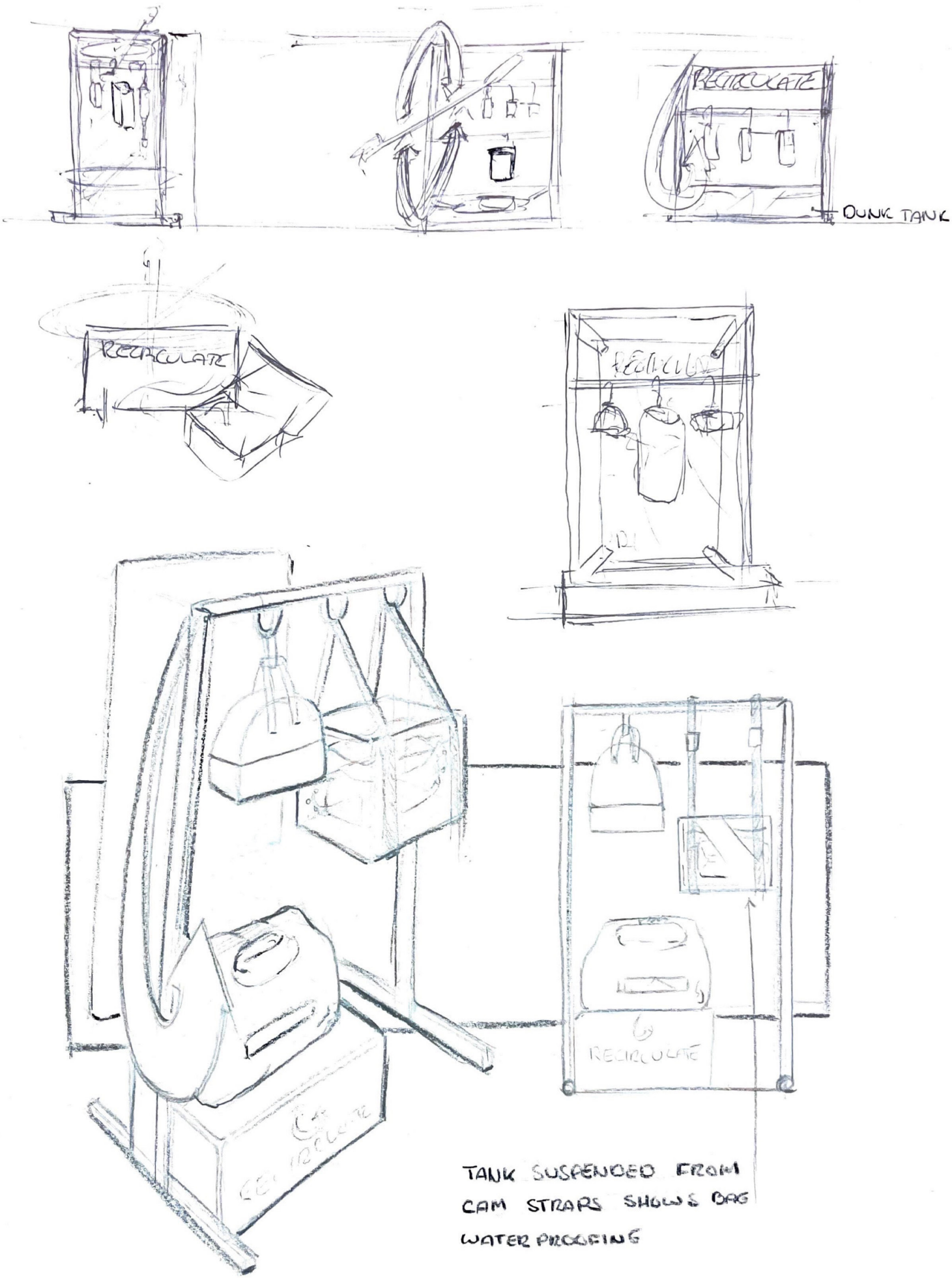
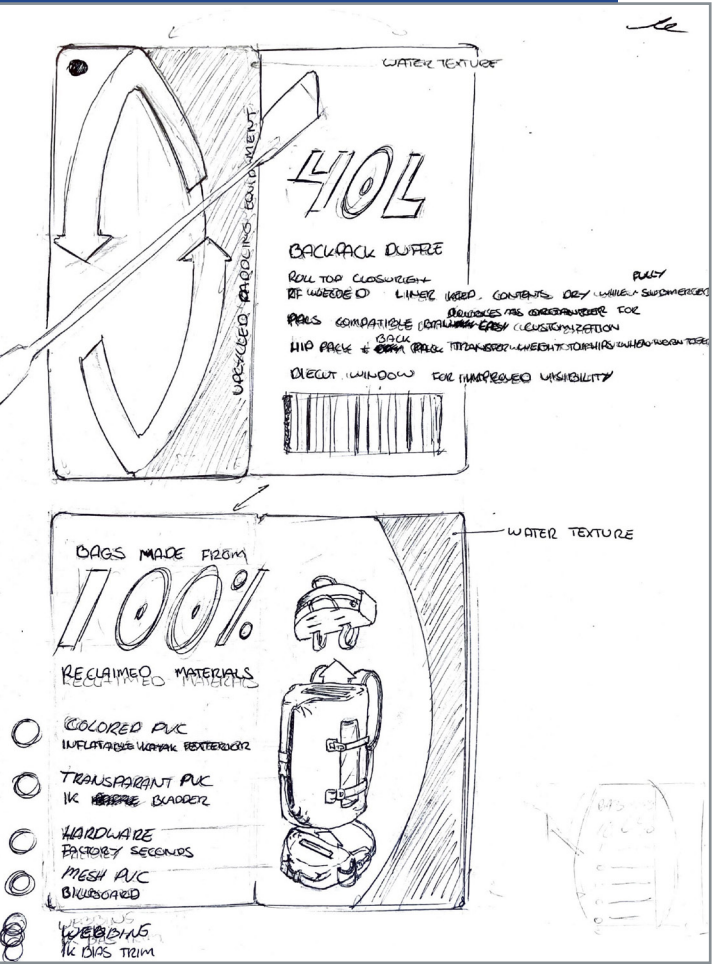
Packs are displayed by suspending them from frame to show full shape / “exploded view”

Shipping Box and/or Hang Tag

Sustainable materials and branded tissue paper

Graphic Backing

Explains product story + use



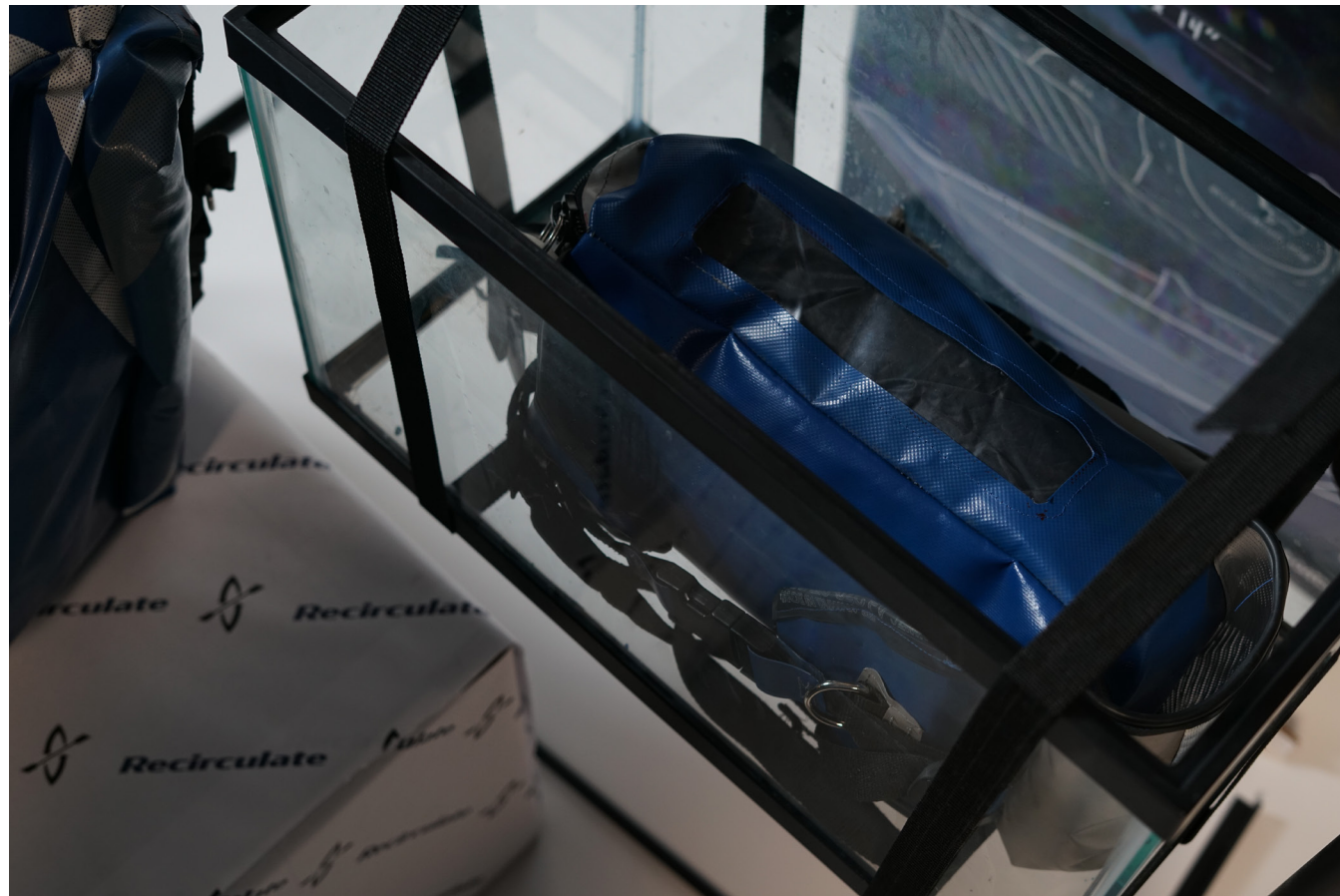
Scale Model

Proportions

A scale model was created to determine proportions and composition. It was useful to understand fabrication methods order of assembly in a time efficient way.



Retail Display



Thank you!

