WATER RESILIENCE IN THE GARDEN

PERMACULTURE DESIGN

By

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and
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"When I was a little boy,
I liked to catch the rain
While people all around my town
Watched it flow right down
the drain..."

"There's no such thing as waste,
Misusing water's a disgrace"

Formidable Vegetable

THANKS TO:

BILL MOLLISON AND DAVID HOLMGREN, FOR GIVING US PERMACULTURE; TRINE AND LISE FOR MENTAL SUPPORT AND PRACTICAL HELP WITH THE DESIGN; DELVIN SOLKINSON FOR HIS STATE-OF-THE-ART ENCOURAGEMENT, BELIEF IN, AND APPRECIATION OF, OUR WORK; PER AND MARIANNE FOR BEING MOST KIND-HEARTED NEIGHBOURS; KAROLINE, CATHRINE AND THYCO FOR A GREAT PDC COURSE AND A SUPER HANDY PERMACULTURE TOOLBOX; BARBARA, SKYE JIN AND MALI FOR SPOT-ON IDEAS.

THE DESIGN WOULDN'T BE POSSIBLE WITHOUT BORIS AND HIS SKILLFUL ENGINEERING AND ARTISTIC WORK. AND SPELL CHECKS.

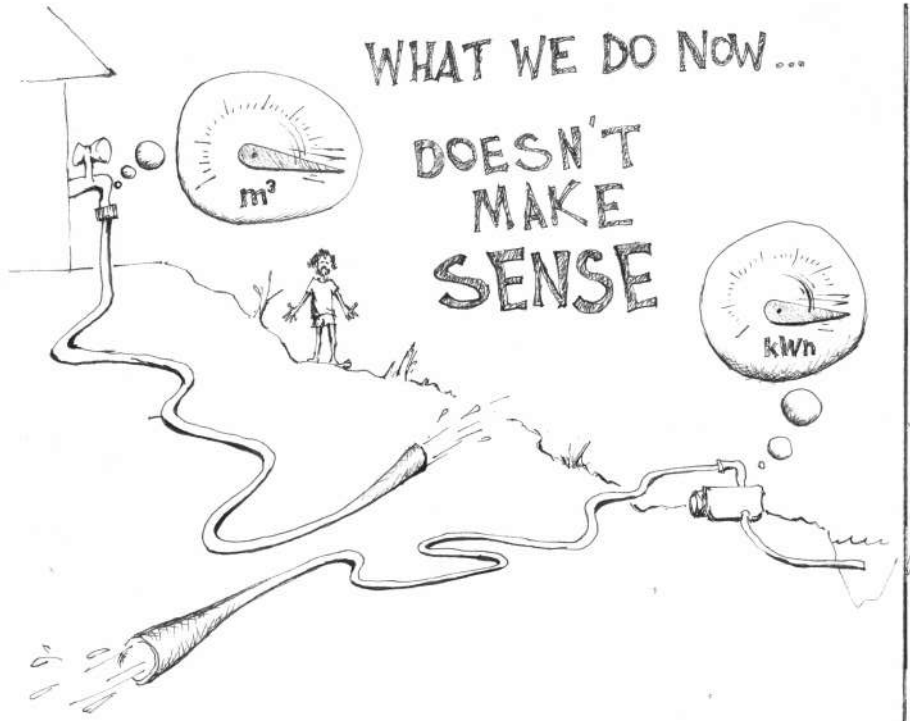
DISCLAIMER:

THIS COMIC IS A COMPRESSED VERSION OF WHAT HAPPENED. IN REALITY THERE WERE MANY MORE STEPS AND A LOT MORE TRIAL-AND-ERROR. FOR EXAMPLE, THE FIRST RAIN BARRELS WE BOUGHT. AND THEN MY FRIEND TRINE OFFERED USED TANKS. THEY WERE WHITE, SO WE BOUGHT SOME BLACK COVER MATERIAL, WHICH WAS DESTROYED AFTER A YEAR BY THE WIND. THEN ONE DAY, OUR NEIGHBOUR PER HELPED OUT WITH BLACK TANKS. AS CAN HAPPEN WITH A MOVIE BASED ON A BOOK, HERE TOO, WE HAD TO CUT DOWN ON DETAILS, TO KEEP THE STORY A BIT MORE CONCISE AND THE NUMBER OF ILLUSTRATIONS TO A MANAGEABLE QUANTITY. WE LEFT OUT SOME LINKS IN THE CHAIN. WE HOPE THE CHAIN STILL MAKES SENSE AND CAN SERVE AS AN INSPIRATION FOR PERMACULTURE DESIGNERS.

 - LOOK FOR THE "STAR" TO SPOT PERMACULTURE PRINCIPLES


SETTING THE SCENE
HEY, HOW DO WE ACTUALLY WATER THIS PLACE?
WELL, WE EITHER USE THE TAP, OR WE CAN PUMP WATER FROM THE CREEK
$W_{pump} = 0.65\,kW$
$Price_{EL} \cong 3.5\ \frac{DKK}{kWh}$
$Q_{pump} = 3\ \frac{m^3}{h}$
AL-KO Jet 3000 DATASHEET
$Price_{pump} = 3.5\ \frac{DKK}{kWh} \cdot 0.65\ kW = 2.28\ \frac{DKK}{h}$
$\frac{Price_{pump}}{Q_{pump}} = \frac{2.28\ \frac{DKK}{h}}{3\ \frac{m^3}{h}} \cong$
$= 0.76\ \frac{DKK}{m^3} \ll 50\ \frac{DKK}{m^3}$
Price of Pumping creek water
<<
Price of tap water !
NOW, HOW CAN WE AUTOMATE THIS ?
A WI FI PLUG!
ON!


BUT HOW DO WE WATER THE WHOLE PLACE AT ONCE?
OF COURSE— DRIP IRRIGATION!
MAP OF DRIP IRRIGATION HOSES
A WEEK LATER...
HOLES CLOGGED WITH CREEK WATER
NEED FILTERS
FILTERS NEED REGULAR CLEANING
COMPLEX SOLUTION
NOT PRACTICAL FOR LONG ABSENCES!
WELL, LET'S TRY TO DESIGN BASED ON PERMACULTURE PRINCIPLES!
WHAT PRINCIPLES?..
THERE ARE A FEW WE CAN APPLY:
1) CATCH & STORE ENERGY
2) USE RENEWABLES
HEY, LET'S DO RAIN COLLECTION!
IT'S RENEWABLE,
AND WE'LL STORE IT.



SO WHAT'S NEXT?

* **S**URVEY, **A**NALYSE, **D**ESIGN, **I**MPLEMENT, **M**AINTAIN/**M**ONITOR, **E**VALUATE, **T**WEAK.

OK, LET'S GATHER RELEVANT DATA FOR RAIN COLLECTION.

SURVEY

RAIN MAP OF DENMARK

USE RENEWABLES

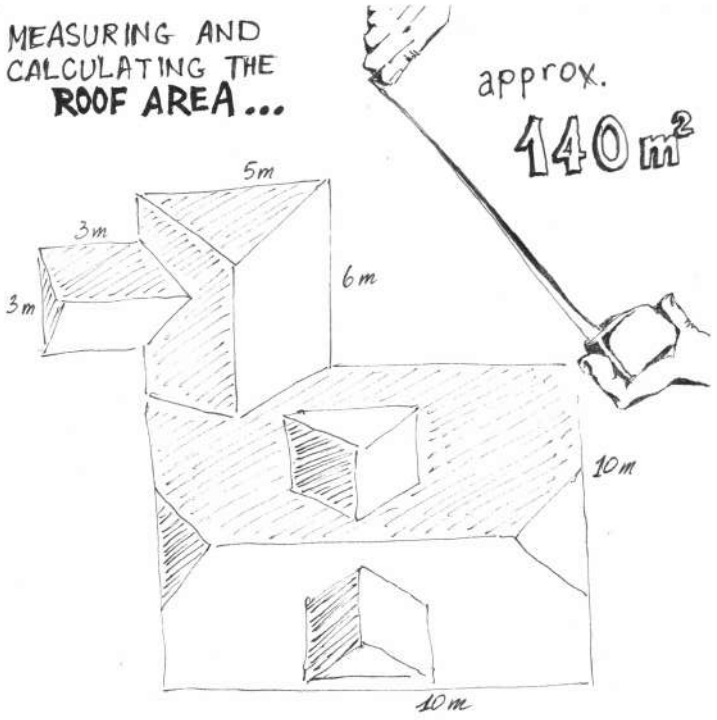
STORE ENERGY

WE CAN FOR SURE COLLECT A LOT OF RAIN...

WE LIVE IN ONE OF THE RAINIEST PLACES IN DENMARK!

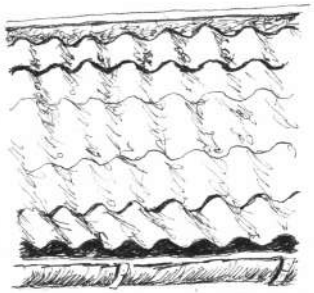
MEASURING AND CALCULATING THE ROOF AREA...

approx. 140 m²



AND LET'S NOT FORGET TO CONSIDER ROOF MATERIALS:

OLD "ETERNITTAG" (FIBRE-CEMENT) ✗



ZINC & COPPER ✗

CONCRETE TILES ✓

PLANNING FOR HEIGHTS (SLOPES)

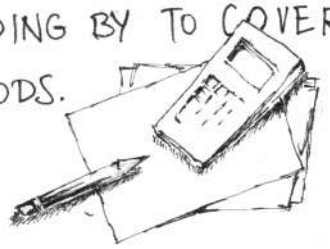
USE OF GRAVITY

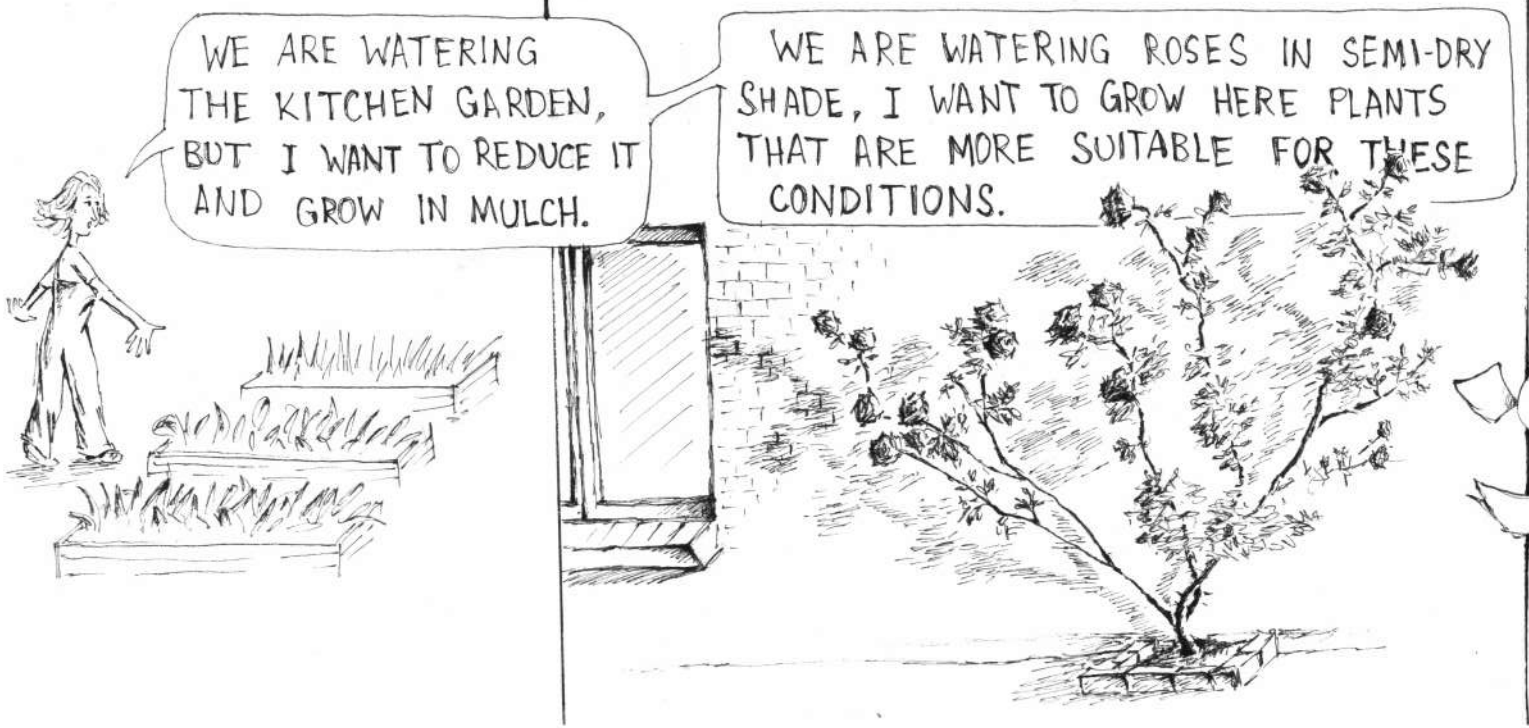
A quick-n'-dirty calculation shows that with a total amount of 800 mm rain per year and a roof area of 140 m^2, we can collect a total of $V = 140 \times 0.8 = 112\ m^3$

That's roughly:

$$112/365 \approx 1\ m^3 \text{ per 3 days.}$$

By using more tanks, we can have more water standing by to cover longer dry periods.



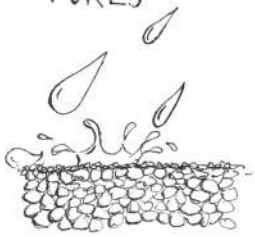


UNCOVERED SOIL IS PRONE TO EROSION

RAIN DROPS SHATTER SOIL CRUMBS. FINE PARTICLES SEAL THE SURFACE.

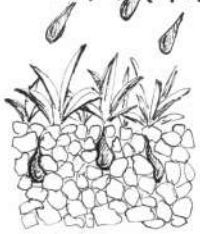
SOME INFILTRATION

DISLODGED PARTICLES BLOCK SOIL PORES



INFILTRATION BLOCKED. HIGH WATER RUNOFF

PLANTS PROTECT SOIL FROM RAIN DROPS IMPACT. DAMS ARE FORMED.



HIGH INFILTRATION. NO RUNOFF.

WITH THE RIGHT AMOUNT OF MULCH AND GOOD GROUND COVER PLANTS, I'M SURE WE WON'T NEED TO WATER MOST OF THE AREAS. THANK GOD WE HAVE THESE BIG TREES!

WHAT WAS A PROBLEM IS NOW A SOLUTION!

THE FOREST GARDEN ALREADY HAS A GOOD ESTABLISHED GROUND COVER OF STRAWBERRIES, GROUND IVY

THE ORCHARD IS UNDER ESTABLISHMENT, I NEED MORE LEAVES OR STRAW BALES, TO START.

WITH A 15 CM LAYER, I WILL NOT NEED TO WATER ALL THESE PERENNIAL PERMANENT PLANTS.

I ALSO LIKE TO BRING ORGANIC MATERIAL FROM HERE AND THERE, ESPECIALLY THE BEACH.

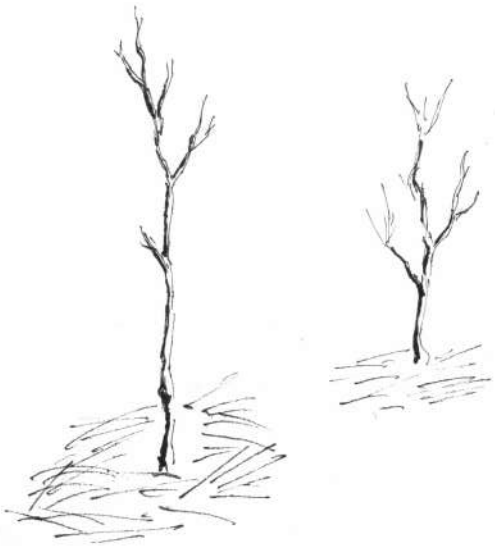
IT'S LIKE BRINGING GOODIES TO KIDS FROM A TRIP.

BUT WHERE DO WE NEED WATERING?

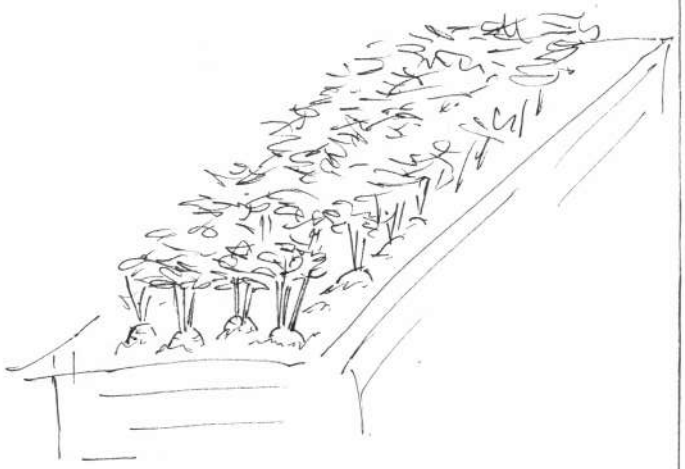
– IN THE GREENHOUSE...

... IN THE POT NURSERY

... FOR THE YOUNG TREES

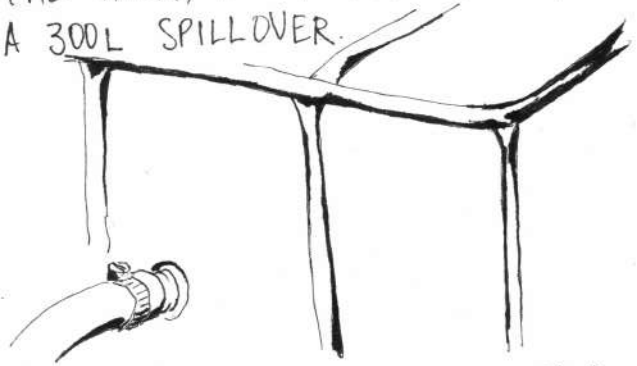


... FOR THE KITCHEN GARDEN



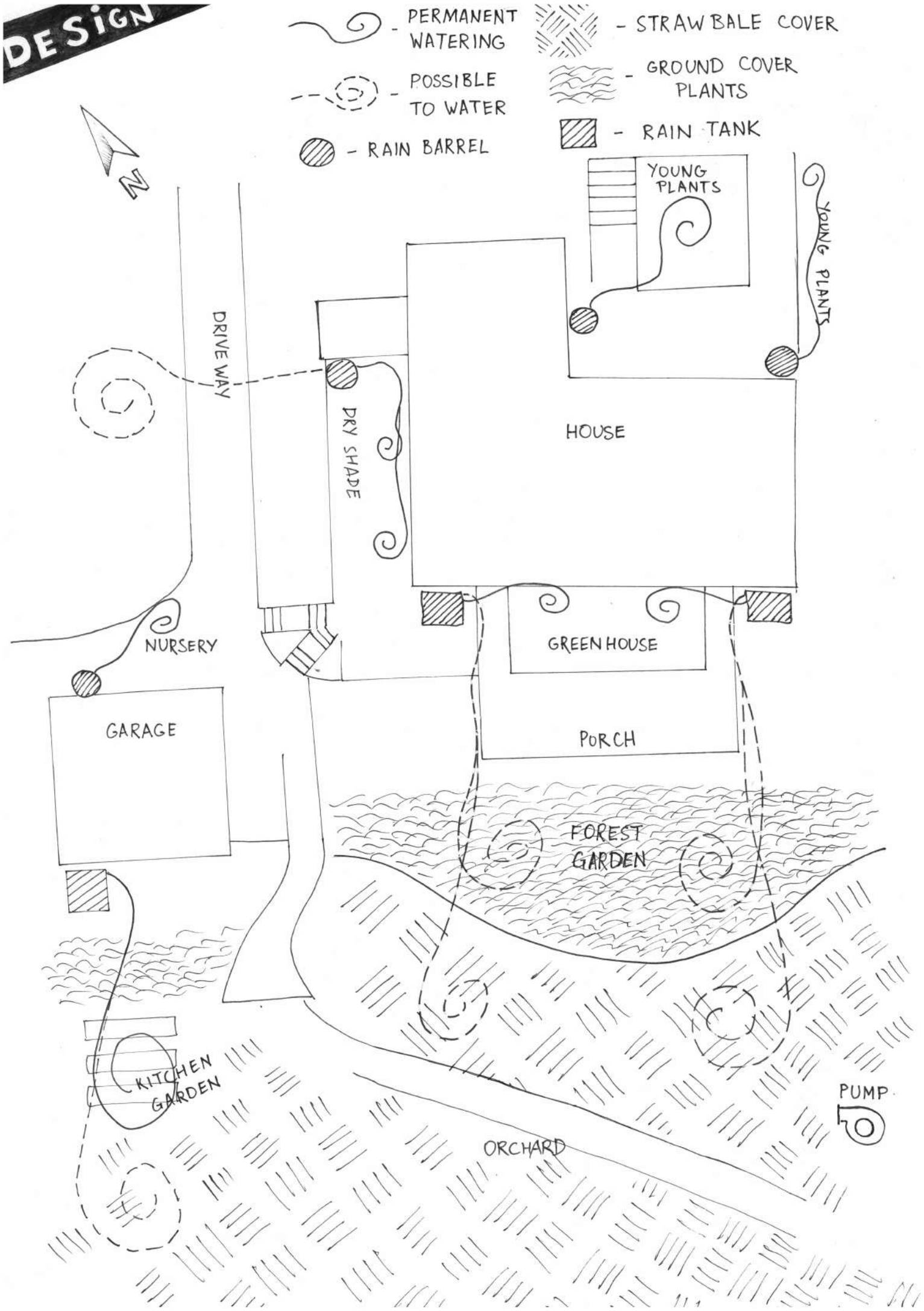
BUT WON'T THE TANKS SPILL OVER?

NO — THERE IS AN OVERFLOW OUTLET 30 CM BELOW THE TOP OF THE TANK, WHICH CAN CONTAIN A 300L SPILLOVER.



DEPENDING ON ROOF AREA EACH TANK WILL COVER, IT'S ROUGHLY:

$0.3 m^3 / 30 m^2 = 10 mm$ OF RAIN, WHICH IS EQUIVALENT TO 2h STRONG RAIN (NOT A CLOUDBURST – THEN IT'S BETTER TO EMPTY THE TANKS).


DESIGN
- PERMANENT WATERING
- STRAW BALE COVER
- POSSIBLE TO WATER
- GROUND COVER PLANTS
- RAIN BARREL
- RAIN TANK
N
YOUNG PLANTS
YOUNG PLANTS
DRIVE WAY
DRY SHADE
HOUSE
NURSERY
GREEN HOUSE
GARAGE
PORCH
FOREST GARDEN
KITCHEN GARDEN
PUMP
ORCHARD

SERENDIPITY

– THE OCCURENCE AND DEVELOPMENT OF EVENTS BY CHANCE IN A HAPPY OR BENEFICIAL WAY.

IMPLEMENTATION

NOW THE DESIGN IS DONE, WHAT DO WE NEED FOR BUILDING IT?

... ANYTHING WE CAN REUSE?

PRODUCE NO WASTE

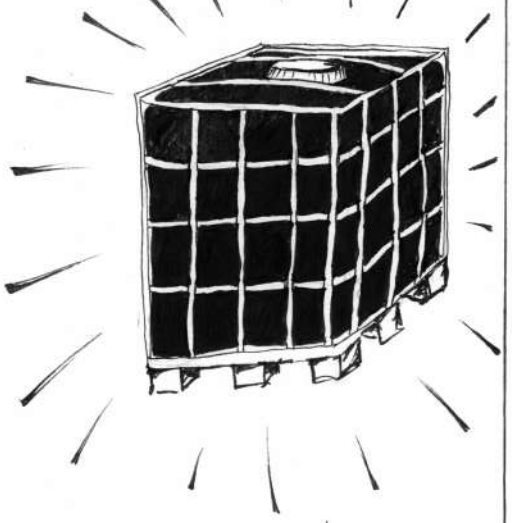
1. TANKS
2. SOME RAIN PIPES
3. GARDEN HOSES
4. FITTINGS
5. ...

LET'S TRY OUR NEIGHBOR, PER! HE WORKS AT THE BOTTLING COMPANY.

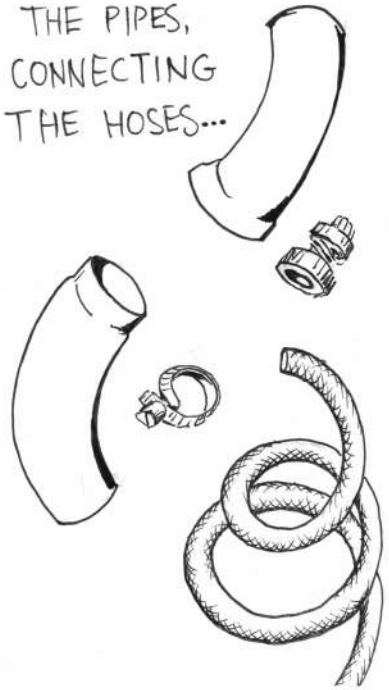
YEAH, HE IS THE ONE PRODUCING THE BOTTLENECKS.

NO PROBLEM! I'LL BRING THE TANKS TO YOU RIGHT NOW.

AND WOW, THEY ARE BLACK! SO NO NEED TO WORRY ABOUT ALGAE.



ASSEMBLING THE PIPES, CONNECTING THE HOSES...



AND NOT TO FORGET EXTRA FILTERS AT THE HOSE INLETS. THE ONE AT THE PIPE INLET IS TOO COARSE.

PLEASURE TO LISTEN TO OUR RAIN GETTING COLLECTED

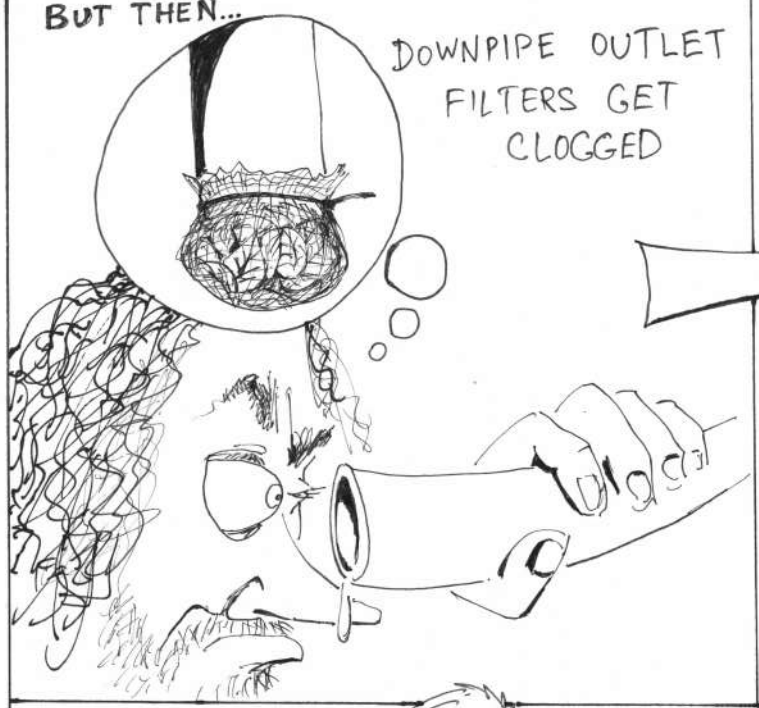
SYSTEM TEST

MONITORING

EVERYTHING WORKS!

BUT THEN...

DOWNPIPE OUTLET FILTERS GET CLOGGED

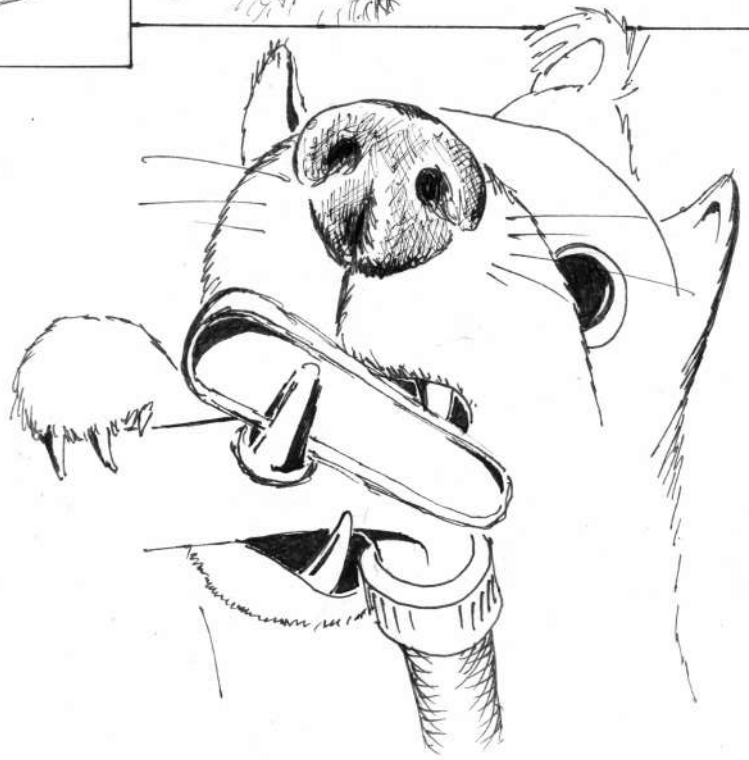


SOLUTION:

CLEAN GUTTERS REGULARLY, ESPECIALLY BEFORE STRONG RAINS.

TWEAKING

JONATHAN STANDS ON THE TAP TO CLIMB ONTO THE RAIN BARREL...



THE DOG GNAWS ON THE TAPS...

SOLUTION:

A FRIENDLY EXPLANATION TO THE CHILD AND THE DOG

TWEAKING

EVALUATION

I THINK SO!
IF YOU VIEW IT FROM THE OBTAIN-A-YIELD PERSPECTIVE, THEN WE HAVE ACHIVEUD MULTIPLE YIELDS:

WATER FOR CROPS
A MORE RESILIENT AND PRODUCING GARDEN
SAVED TIME (NO WATERING)
SAVED MONEY
ADDITIONAL YIELDS,
SERENDIPITY.

AND LET'S CHECK IF WE ARE INLINE WITH PERMACULTURE ETHICS:

EARTH CARE

...IS ABOUT LIVING SOIL AND BIODIVERSITY; AND MAKING SURE THE LAND WE OWN IS IN BETTER CONDITION AFTER OUR STEWARDSHIP.
STORING WATER IN LANDSCAPES BY USE OF GROUNDCOVERS MAKES OUR GARDEN MORE RESILIENT AND FERTILE.

PEOPLE CARE

...STARTS WITH SELF CARE, BECAUSE IT'S ONLY WHEN WE ARE PHYSICALLY AND MENTALLY HEALTHY CAN WE TAKE CARE OF OTHERS.
WITH THIS DESIGN WE DO NOT NEED TO SPEND TIME WATERING PLANTS.
WE HAVE MORE TIME FOR OURSELVES AND OTHERS; AND JONATHAN GETS SO MUCH OUT OF IT.

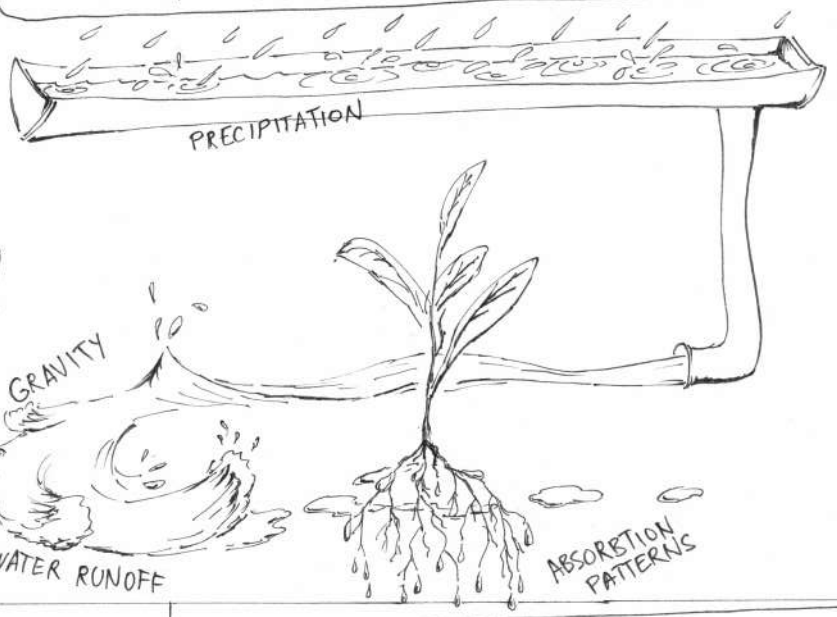
FAIR SHARE

...IS ABOUT OUR CONSUMPTION PATTERNS AND SAVING EARTH'S RESOURCES.
RAIN COLLECTION IS A GREAT WAY TO SAVE BOTH WATER AND ELECTRICITY.
AND THANKS TO SLOPE AND GRAVITY WE CAN IRRIGATE PASSIVELY.
IT DOESN'T GET MORE EFFICIENT THAN THIS!

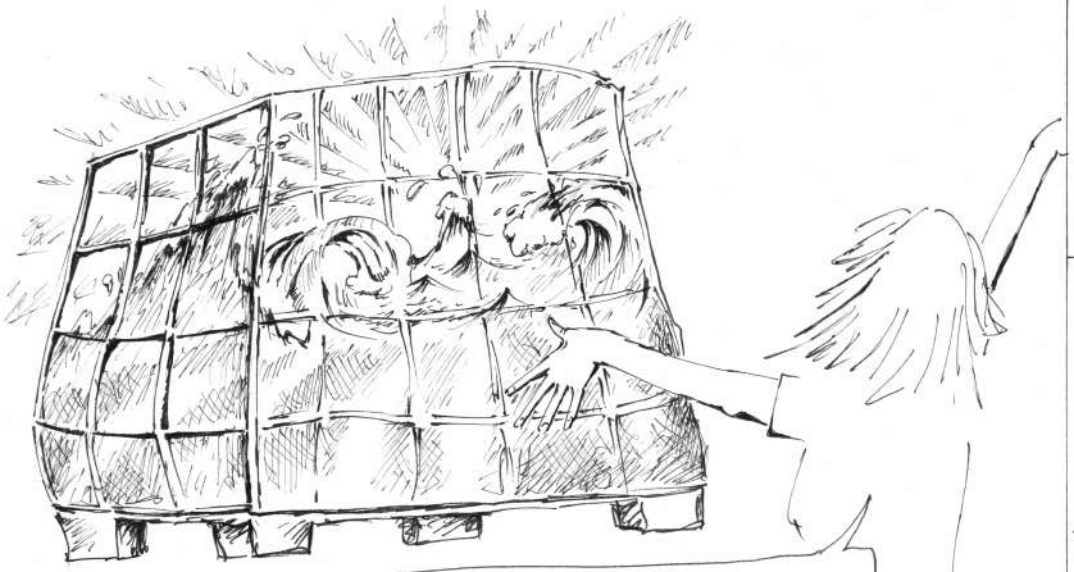
REFLECTION

NOW THE DESIGN IS DONE, AND WE CAN REFLECT ON WHAT WE'VE LEARNED.

FOR ME IT WAS AMAZING TO LEARN THE DIFFERENT PATTERNS IN RELATION TO WATER —



AND OBSERVE THE BIG ROLE THEY PLAY IN THE DESIGN!



FOR ME IT WAS HOW THE PRINCIPLES WEAVE INTO EACH OTHER: USING RENEWABLES, CATCHING AND STORING ENERGY, PRODUCING NO WASTE, INTEGRATING RATHER THAN SEGREGATING.

WHAT SHOULD OUR NEXT PROJECT BE??

WHAT WOULD MAKE OUR GARDEN EVEN MORE RESILIENT IS TO HAVE A POND. THIS WOULD INCREASE BIODIVERSITY EXPONENTIALLY. WATER IS A MAGNET FOR LIFE!

DOES THAT MEAN WE HAVE TO DO A DESIGN AGAIN?

YES, ABSOLUTELY.

GOSADIMET?

MAYBE OBRADIMET, OR CEAP, OR DESIGN WEB, OR ZENIFY!