Permaculture Design for a Cold Temperate Property for the 2015 Geoff Lawton Online Permaculture Design Certificate Course

by
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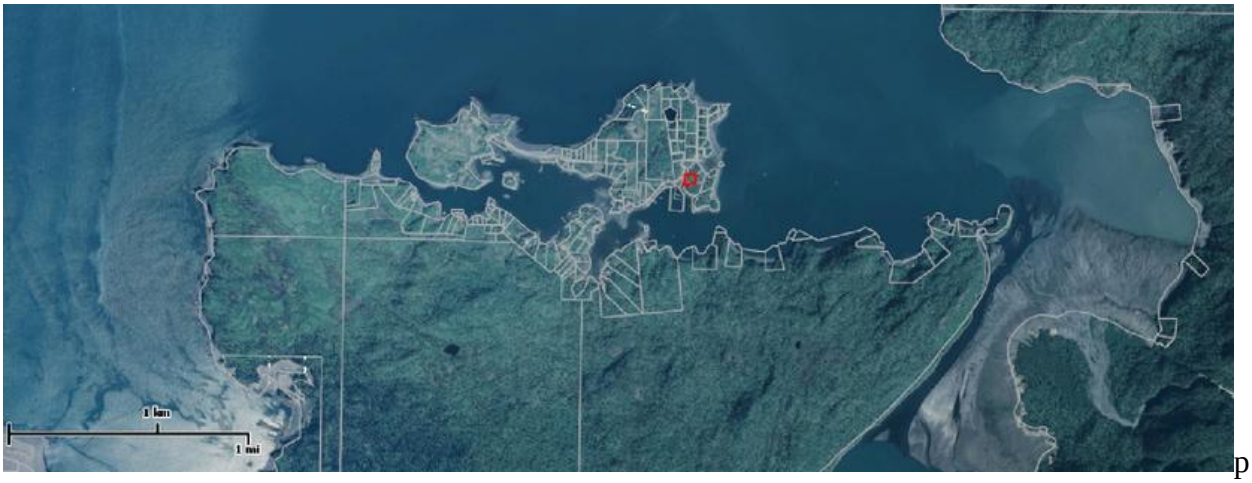
aerial view of Ismailof Island and Halibut Cove from northwest

Introduction

The property selected for this design exercise is located in Halibut Cove, Alaska, USA at the following coordinates: 59.595501 (N), -151.219287 (W)

pointer marks location of property in Alaska

pointer marks location of property within Kachemak Bay



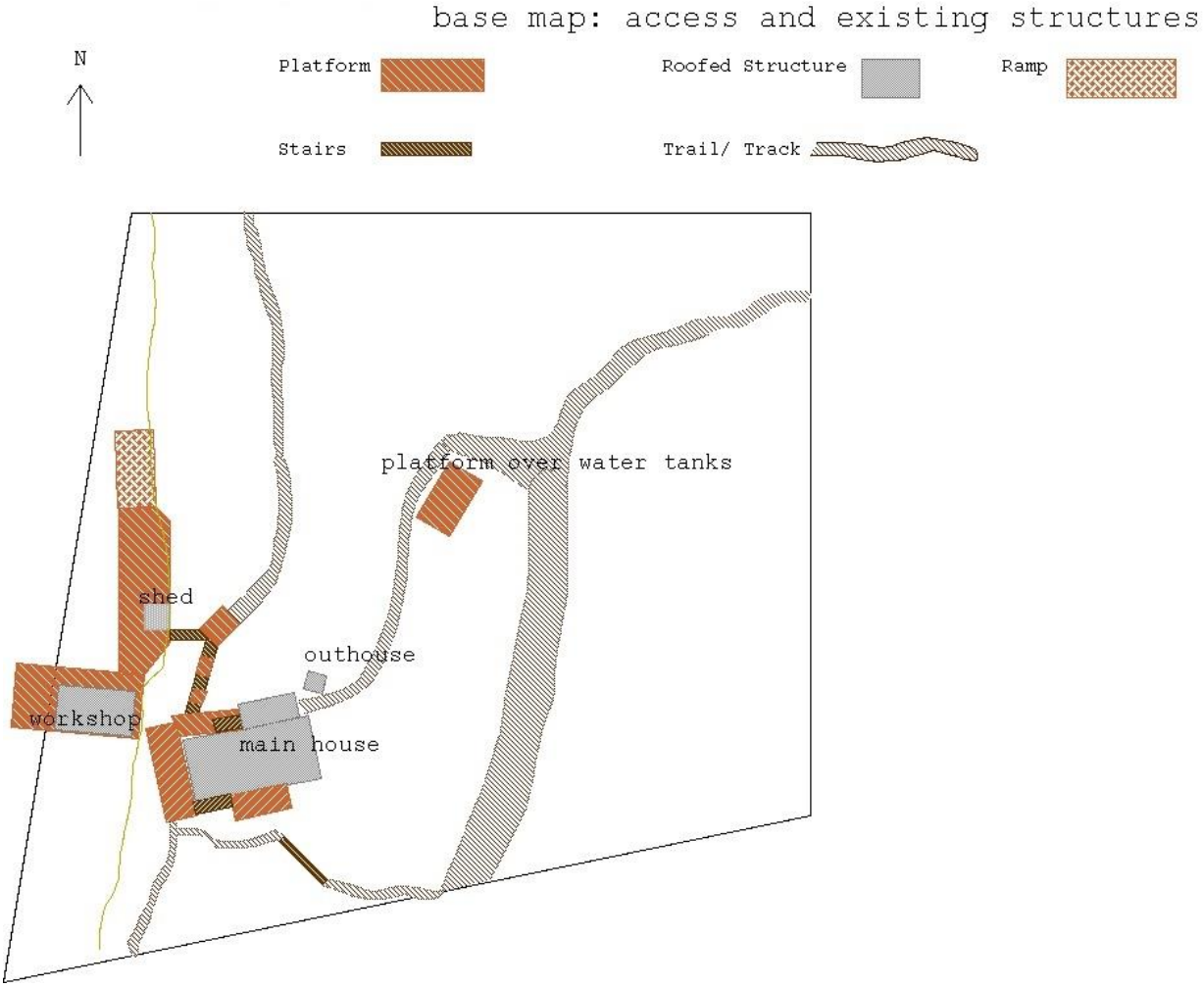
property outlined in red showing location on Ismailof Island and in the Halibut Cove area


best available satellite image of the property with property lines, courtesy of http://mapserver.borough.kenai.ak.us/flexviewer/

Climate

Koppen climate classification for nearby Homer, Alaska is Dsc (subarctic) but it is on the border of Cfc (subpolar oceanic)climate. Average monthly temperatures according to official data for Homer, Alaska are around-4 C for Jan, Feb and March, but this has not been the case in recent years and Halibut Cove tends to be slightly warmer than Homer, according to local lore, so we may just squeak into Cfc classification here now. In any case the climate here is definitely moderated by the ocean with cooler summers and warmer winters than areas inland. This property is in usda plant hardiness zone 6 with average annual extreme minimum temperature between -5 and -10 F. The area receives approximately 25 inches of rain annually with spring and fall wetter than summer and winter, and summer being the driest season.

Goals and existing water, access, and structures



above: map of property for this design created with tgif after site survey

For my design exercise, I am designing the property of my friends and clients for whom I'm currently building a workshop.

workshop under construction on dock, neighbor's barge in foreground

This protected beachfront property is located on the east end of Ismailof Island in Kachemak Bay, which is part of Cook Inlet. It is 1.1 acre in size and mostly slopes steeply to the west and northwest with a few flatter spots and some sea cliffs of varying heights along the west edge in a north south direction. The average slope throughout the property is around 37 degrees. It has several existing structures and the owners use it as a vacation retreat and also sometimes some family members stay the whole summer here. Given the intermittent occupancy, the goals for this design are as follows:

-to make greater use of onsite energies to make the dwellings more comfortable and easier to maintain

-to create an edible landscape which provides yields without requiring regular inputs of labor.
-to create small growing areas for annual crops for times when there are longer term occupants
-to connect systems and stack functions
-to also explore potentials that could open up with more intensive management, even though not all elements in this design exercise are likely to fit the clients' needs at present.

At present the property has two water sources, one from a community well approximately 1/4 mile away and another from a small dam on a creek approximately 1/2 mile away. The well water is pumped in and the creek water is gravity flow. Both are community owned and maintained systems. Well water is available year round (provided the polyethylene lines are drained after each use in cold months) and the creek water is available from approximately May to October, outside which time range the lines are subject to freezing and bursting and not easy to drain and the creek itself occasionally freezes. There is great potential for rainwater catchment on this site due to significant (25") annual rainfall and significant area under steel roof. The main house alone sheds over 14,000 gallons of precipitation water annually. (944 square feet including roofs over access x 2 feet annual precipitation x 7.5 gallons per cubic foot = 14,160 gallons)

Access to the property is generally by boat. There is a dock on the property accessible at higher tides and a public dock approximately 1/8 mile away accessible at any tide level. (Kachemak bay has a 6 hour variation of up to 27 feet in water level)

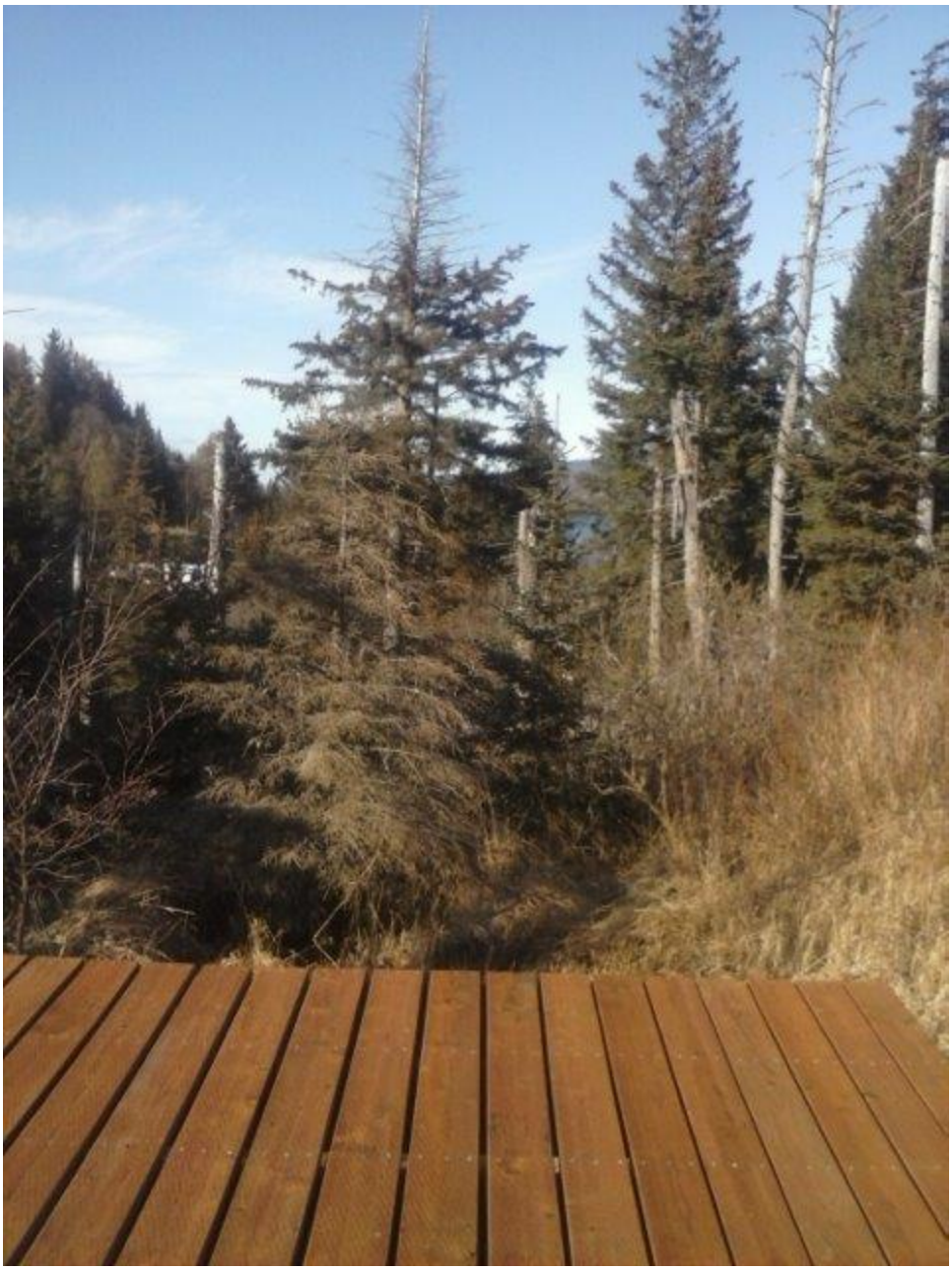
view of same dock as above at lower tide, showing intertidal zone in foreground

The property is also connected to the trail system of Ismailof Island which allows access by four wheeler and agricultural utility vehicles (usually John Deere Gators) at low to mid tides. The entire island is unconnected to the main road system and there are no cars; the only way to reach Halibut Cove is by boat or float plane. The dock on the property connects to a boardwalk which allows wheeled vehicle access to the dock at mid to low tides.

There is a 20' x 40' two story house on site with a quite good southern aspect, though it is on a north facing slope. The south facing wall has very few windows. The house is framed with 2x4 and insulated with fiberglass.

south side of house seen from north, early April

There is a workshop with upstairs apartment under construction on the dock and a cabin being planned near the boardwalk, construction to begin after workshop is complete. Just uphill from that proposed cabin site there is a 12‘x 20' platform built directly above two 1100 gallon water tanks.

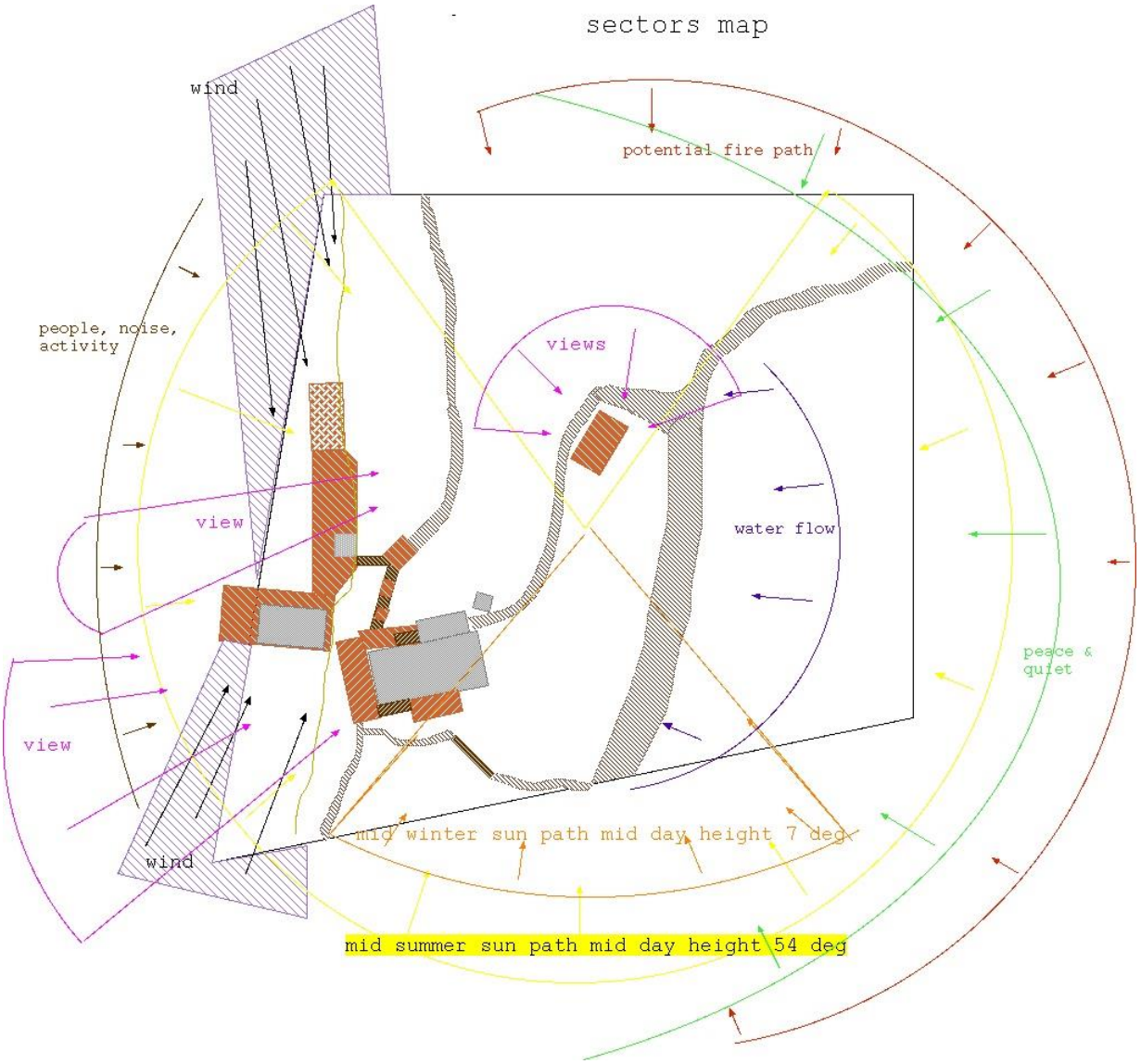


view northeast from platform, water tanks (not shown) below platform

There is an outhouse (a vernacular pit toilet with wood framed structure) near the main house.

Outhouse, rusty menziesia, and squirrel midden

Sectors



On summer solstice the sun reaches a maximum height of approximately 54 degrees at solar noon and rises and sets approximately 54 degrees north of east and west with about 18 hours between sunrise and sunset. on winter solstice it reaches just 7 degrees elevation at solar noon and rises and sets approximately 50 degrees south of east and west with 6 hours between sunrise and sunset.

The prevailing winds on this site are from the southwest year round, but winds also often come from the north. In general the site is northwest facing, and sheltered by the terrain from the north, east, and southeast, but there is an open area of water to the southwest, so winds travel along the cliffs on the west side of the property from the south and blow up onto the property. In winter the winds are frequently katabatic, cool air falling down from the ice field capping the mountains to the south and east and in summer they are frequently from a day breeze effect, as the land heats up the air rises and draws in the cool air from the sea. In both cases the southwest of this property is the direction least sheltered from these effects and with most direct maritime exposure. Wind also has a route in from the north, but the exposure is less direct due to the

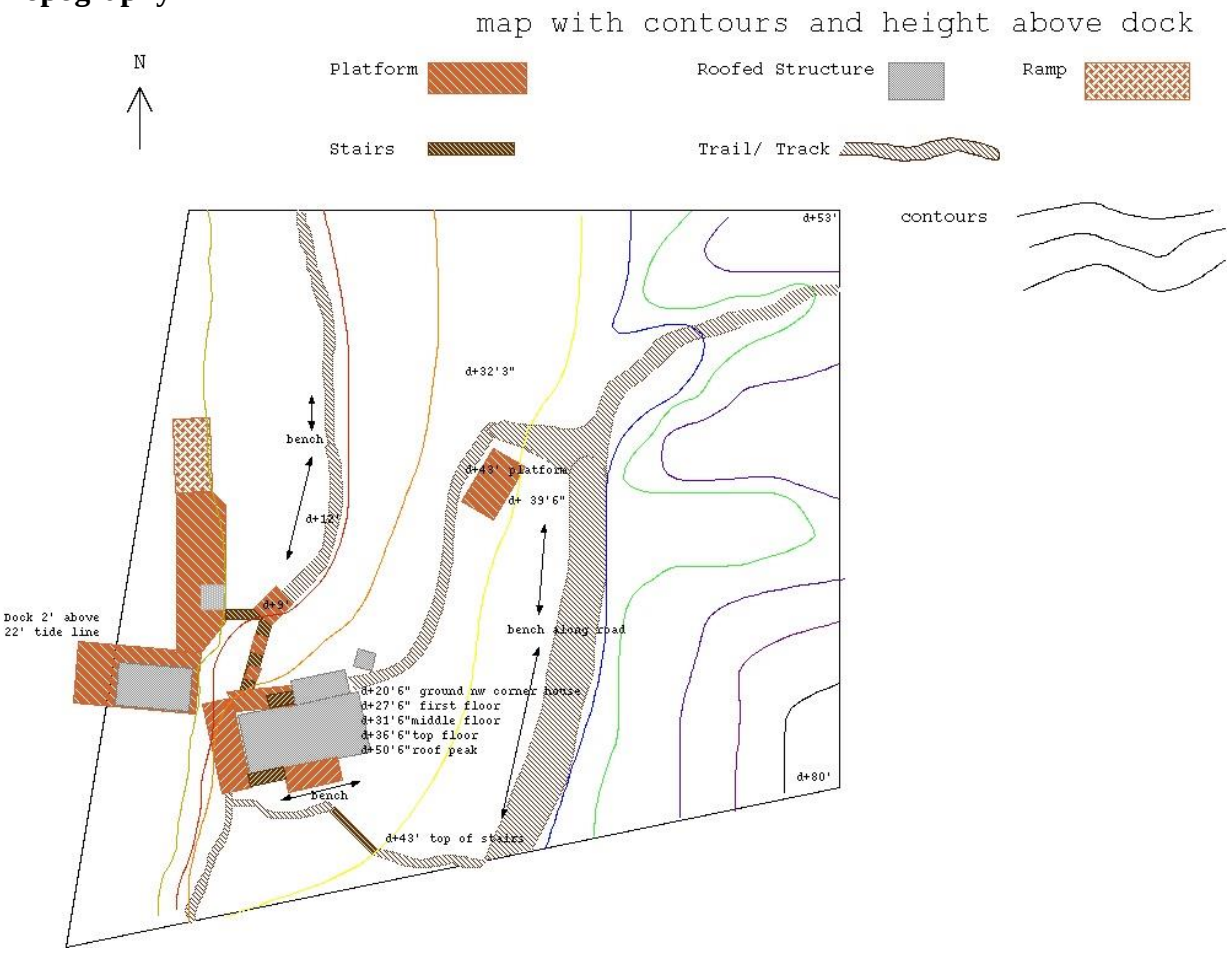
topography of the greater area. North winds are often due to larger hi/lo systems in winter and day breeze effects in the summer as the bulk of Kachemak Bay is to the north of this site but varying cloud cover can cause unequal heating of the larger area resulting in infinite possibilities for least resistence paths of air flow over the larger area. More frequent than a steady north daybreeze is a gentler one that just blows from the sea upward everywhere.

Fire is a very unlikely event here due to the island location, but if there were one, it would likely spread through the forested areas to the north, east, and south of the property, the intertidal zone forming a natural break along the west edge of the property.

From higher locations on the property there are views of mountains, but the view of the Halibut Cove public harbor, and mountain foothill boreal forest beyond is the most available view here.

view from the dock on the property to the public dock and harbor and foothills beyond, low tide

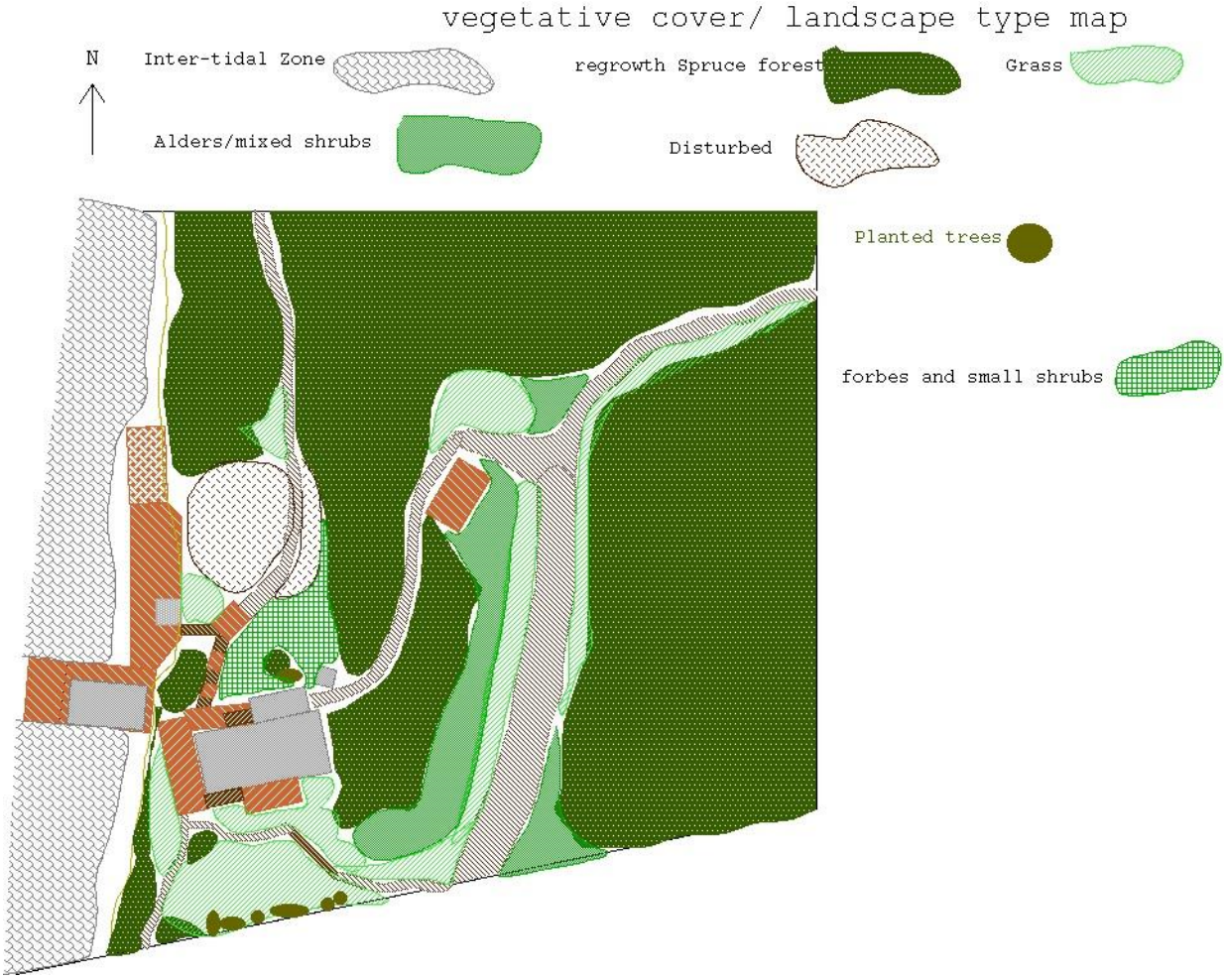
Topography



The lowest point of the property is of course sea level and the mean high tide line forms a roughly straight line along the west boundary of the property. The highest point is approximately 104' above a 0' tide, or 80' above the dock, which is 2' above a 22' tide (the approximate maximum for this area) Most of the property slopes around 37 degrees to the north, west, and northwest, but there are some more level benches on the property. The contours above are rough and are based on a site survey with a pocket compass, 100' tape measure, angle finder and a sight level.


MAYES
LEVEL
ANGLE FINDER
MAGNETIC BASE
100'

Ecosystem elements



Vegetation onsite is regrowth of the typical boreal forest of southcentral Alaska. Spruce (picea glauca and possibly picea sitchensis) are the largest and most common trees. Green alder (Alnus viridis) is the next most common followed by red elderberry (sambucus racemosa) and there are some birches (betula platyphylla). In the understory blackcurrant (ribes hudsonianum) as well as naturalized raspberries (rubus strigosus), devil's club (oplopanax horridus), rusty menzesia (rhododendron menziesii) are commonly encountered.

boreal forest on the property

boreal forest on property

There are also grasses, mosses, lichens, and some ‘forbs’ , notably watermelon berry (streptopus amplexifolius), pushki or cow parsnip (Heracleum maximum), fireweed (Chamerion angustifolium), yarrow, ferns, angelica, and others.

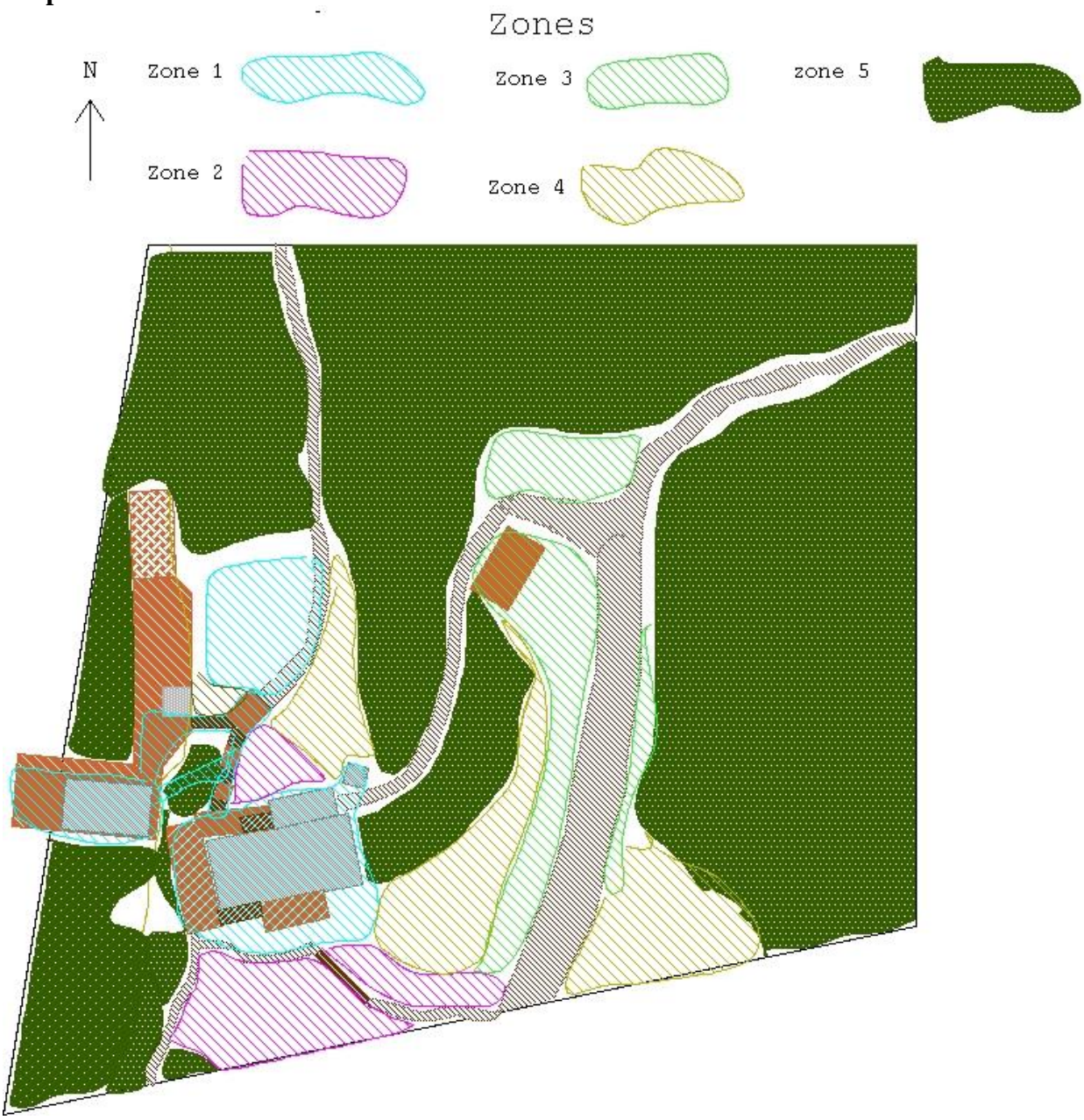
‘fiddlehead’ edible wild fern shoots

pushki (larger) with angelica(smaller fore and left of pushki)

Soils are generally lightly acidic loams with high organic content over shallow bedrock, a maximum of 5 feet deep, but generally around 2-3 feet deep. Occasional layers of volcanic ash can be observed in the soil strata, most likely from eruptions of the not too distant (approximately 60 miles) Augustine volcano. The alkalizing effect of these infrequent events is more than compensated by the continual addition of spruce needles to the soil.
There are cliffs around the mean high tide line anywhere from 5 feet to approximately 20 feet high before the ground becomes more level. On these cliff faces there are some small specialist plants. The intertidal zone is host to many barnacles and kelp of the fucus genus. Squirrels

abound on the property along with several corvids (stellar's jays, magpies, crows and ravens can occasionally be seen). Bald eagles are very common also, and snowshoe hares are occasionally seen. The larger area is home to black bears, coyotes, moose, lynx, wolf, porcupine, marmots, mink, and more. Sea otters and seals are commonly seen, even in the harbor, and various whales and porpoises frequent the area, though unfortunately they are seen less and less.

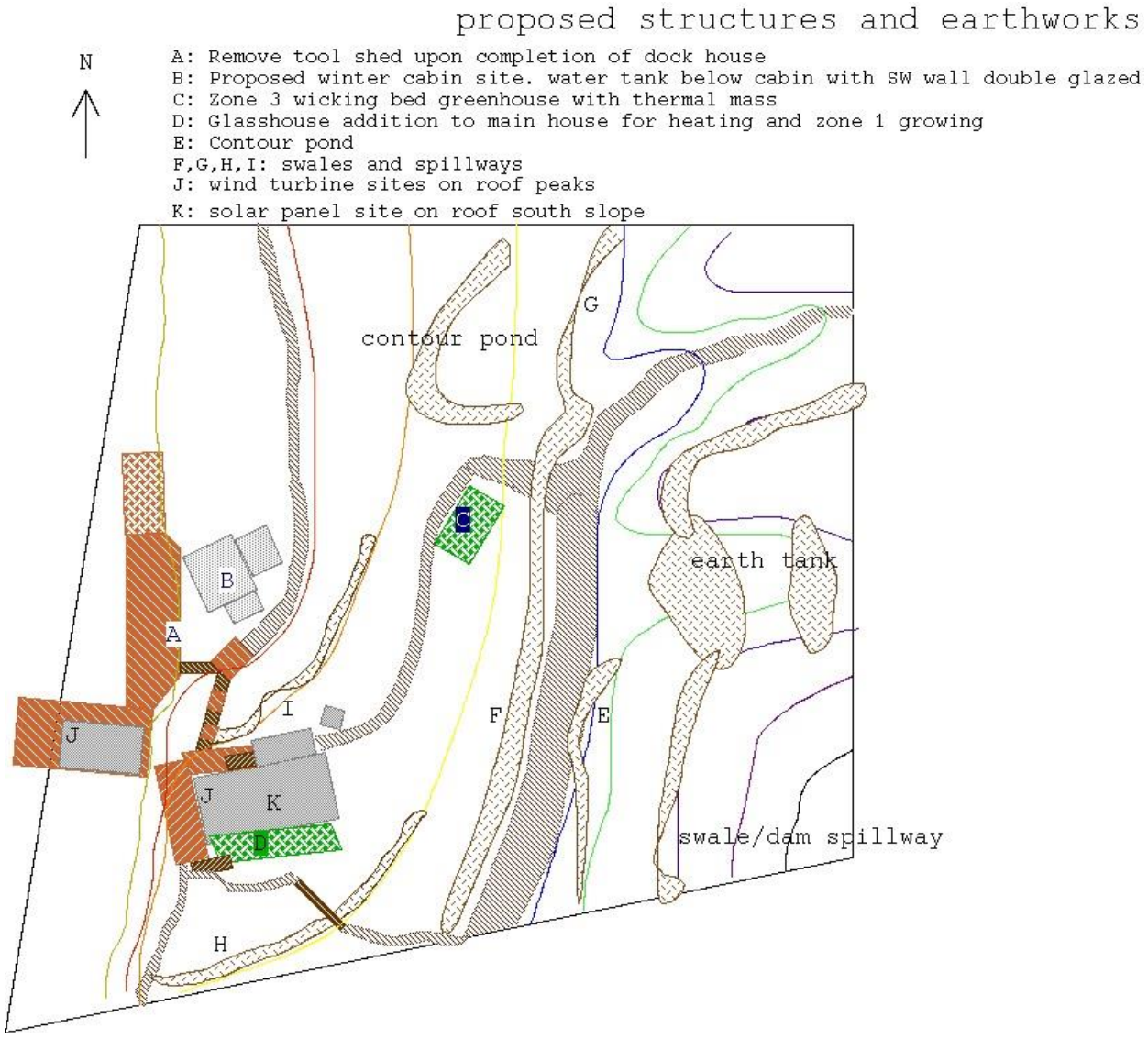
Proposed zones



Zonation proposal is as follows:

Higher quality regrowth boreal forest left as is as zone 5. Main house and small flat area to south, plus workshop and proposed cabin are zone 1. Zone 2 food forest located on slope to south of house, as well as slope to north of house. Zone 3 main crop areas located alongside the major track on benched areas. Zone 4 farm forestry of varying types located in 3 areas- north of the house with focus on korean nut pine, southeast of house with focus on hippophae rhamnoides, and further southeast of house as alder coppice.

Design proposals



Design proposals for the property are as follows:
-polycarbonate greenhouse addition/ retrofit for the main house including precise tree removal and trimming to open up the path of the sun. Since the deck on the south side of the house is

lower than the main floor, there is an ideal opportunity for passive heating, by building a greenhouse and adding opening windows low in the main floor wall into the greenhouse area. Thus the windows can be opened when the greenhouse is hot to bring heat into the house and when its cold and not sunny the greenhouse just adds a small amount of extra insulation to the house. The greenhouse would receive sun at least at mid day when the sun rises above 15 degrees above the horizon, which is most of the year but excluding the period from around November 1 to February 10. During this time the site topography will allow for no direct sunlight to reach the main house at ground level, but possibly some at the roof peak. During the summer months however, the greenhouse could receive around 12 hours of direct sun per day, particularly if one spruce tree were removed and another strategically pruned. This would make a very substantial contribution to energy savings or increasing comfort in the house, since heat is generally needed year round in this climate. This would of course also open up opportunities associated with a hot room (the greenhouse itself) in summer for either growing warmer season annual plants like tomatoes or simply for sunbathing and soaking up the heat, or as a drying room, etc.

-small zone 1 garden just outside this sunroom and zone 2 food forest in the surrounding slope. many cool season crops thrive here, especially the mustards and brassicas, carrots, lettuce, spinach, potatoes and many more. With regard to the zone 2 food forest, several varieties of apples, notably 'Norland' fruit in Halibut Cove outdoors, as well as a variety of berries- raspberries, currants, gooseberries, strawberries are commonly grown. No trials have been done here (except one beginning in my very own living room) on seaberry (Hippophae rhamnoides) or siberian pea tree (caragana arborescens) but conditions here match their requirements listed on the pfaf.org database and they seem very promising as support species, along with lespedeza bicolor. A proposal for food forest development would be, after implementing swales, to sheet mulch the area with wet cardboard and an attractive mulch on top, plant many useful nitrogen fixing and other support species throughout, like seaberry, pea tree, bush clover, comfrey and then space less of other high value species, like apple, hazels (might work here but no trials in the area that I know of), honeyberry (lonicera caerulea- seems very promising as great success

has been had in Soldotna, about 60 miles away) arctic kiwi (actinidia kolomikta- which has been successfully grown in Anchorage), rhodiola rosea, jerusalem artichokes, tachys genus mint plants with edible tubers (sprouting successfully in my garden) camassia quamash, dioscorea polystachya (no trials here but theoretically matches the climate) and others, including the typically grown currants, gooseberries, raspberries, juneberry, etc. While this area is north to northwest facing, there are no south slopes on the property and it still gets significant summer sun and helps mitigate the common problem of plants opening up too soon due to warm sunny days in late winter and spring and then getting their new shoots frozen.

-areas of zone 4 with emphasis on Korean nut pine (pinus koraiensis). This tree which bears very large edible pine nuts at maturity seems ideally suited to this climate and site according to available literature, which suggests it prefers north facing slopes and cool temperatures. This along with pinus sibirica (more cold hardy but smaller nuts) has the potential to be Alaska's future staple food. Other zone 4 areas where less tall trees are required to avoid shading could focus on alder for pollarding for fuel or caragana and hippophae for their fruits and biomass.

proposed zone 4 area north of the house. space for several korean nut pines with support species here

-a zone 3 wicking bed greenhouse on top of the existing platform over water tanks, connected to the thermal mass of the tanks below and kept full by rainwater from the roof. A wicking bed is a bed with a layer of gravel and water at bottom and a layer of soil on top separated from the gravel/water layer by landscape fabric, which only requires the gravel filled water reservoir to be kept full to keep the soil moist. this is a typical dryland strategy, but a greenhouse in any climate simulates a dryland situation. The northeast and northwest walls could be insulated outside with thermal mass inside, like brick, block, or concrete with with rigid foam outside. The floor could be insulated with foam and concrete on top or the tanks below could be enclosed and insulated so the water serves as thermal mass. Wicking beds fed by roof water which from their overflow then drains off to a nearby contour pond (see proposed structures and earthworks graphic) would allow this to be a truly zone 3 element and extend the season and climate, potentially allowing winter squash and tomatoes to be grown. This is one of the sunniest sites on the property, receiving the full range of summer sun apart from some dappled shade from trees, but still not receiving any sunlight below 16 degrees above the horizon, due to local topography. If this option were seriously pursued, some strategic pruning or removal of certain trees could open up some more light.

-a small contour dam to the north of the above mentioned zone 3 greenhouse for growing aquatic food plants, like wapato (sagittaria latifolia) and various edible lilies. Could have a deep for fish to overwinter and sedges and cattails at outflow to translate accumulated nutrient back into biomass. The outflow here could potentially link back up to swale “I” north of the main house by traversing a steep area of zone 5 through a pipe, or simply overflow into zone 5.

contour dam site for aquatic food production and beautiful pond

-a small contour dam in a naturally wet area on the uphill side of the wide track near the center of the property where a septic leach field meets a naturally wet spot. While not suitable for root crops, a great deal of biomass could be produced by cattails and sedges for throwing across the track to the zone 3 area.


track to west of main house and upslope. bench is much wider than track. derelict skiff in location of year round wet area, could become contour pond with drain under road to swale on downslope side of road. foreground has alder seedlings in proposed zone 3 strip

-all along the road and next to the platform over water tanks, there is a bench which would be suitable for potatoes or other main crops, either in raised beds or as perennials or even annuals with alder chop and drop, as young alders are prolific in some of these areas.

-a high storage dam with pond liner filled with water from main house and cabin roofs pumped up by solar or wind powered 12V pumps operated by float switch in small collecting tanks for property wide irrigation. This earth tank could also be fed by swales as in the graphic above

-dragon biomass boilers from www.silverfire.us for the main house and cabin for cooking and heating. These would make great use of the abundant stick fuel as spruce and alder available on the property.

- there is a cabin proposed to be built on the disturbed area above the ramp and boardwalk. It will have a west/southwest aspect and be on pilings with a water tank below. The west south west wall of the tank/ utility room could be sheathed with double or triple walled polycarbonate greenhouse glazing on both sides to take advantage of the several hours of direct sun for many days a year and bank this heat in the water tank. this would keep the space drier, keep the water at a warmer temperature, moderate the cabin temperature, and give warmth and light to the utility area (usually cold dark damp places)

-swales in several locations throughout the property, hydrating the landscape but spilling any overflows away from the houses. Since the area receives only around 25 inches of annual rain and it is spread somewhat equally throughout the year and the property has a small catchment, there being less than one additional acre of land on its side of the ridge above, large rain events resulting in large amounts of runoff are quite unlikely, and swales could be small and still effective. These should be implemented before any major plantings.

Thanks very much to Geoff Lawton and team for this course, and thanks so much to Amy and Erika for letting me do a design of their site, and thanks to my wonderful wife, Olesya for lovingly tolerating my near nonstop talking about permaculture and countless hours spent watching videos, studying, and working on my design.

Corey and wife, Olesya with tomato and caragana seedlings, Halibut Cove