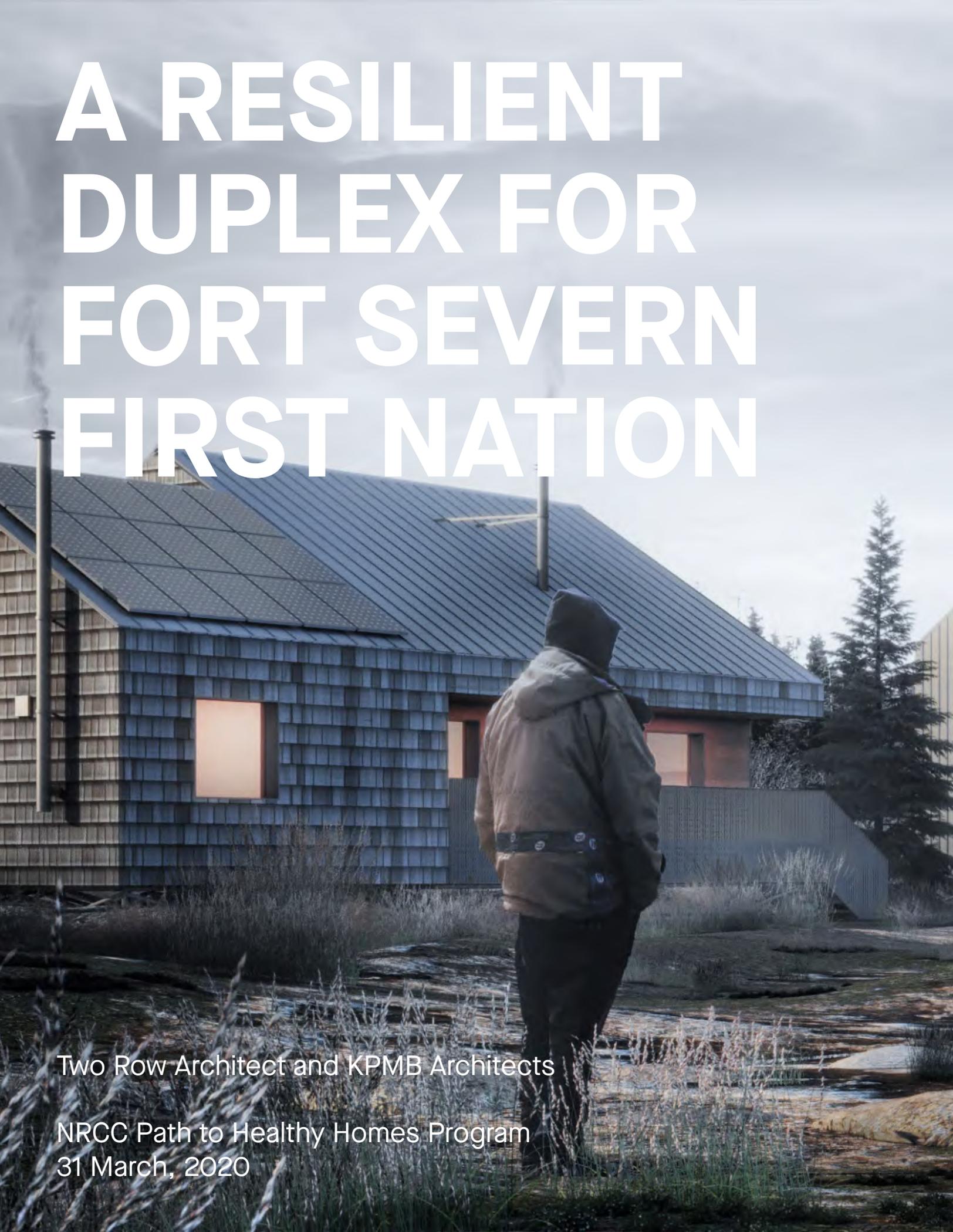


A RESILIENT DUPLEX FOR FORT SEVERN FIRST NATION



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NRCC Path to Healthy Homes Program

31 March, 2020

A RESILIENT DUPLEX FOR FORT SEVERN FIRST NATION

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Path to Healthy Homes Program**

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1. CULTURE AND CONTEXT



The interior of a community-built smoking tent in Fort Severn. The structures, which are widespread in the community, are used for smoking goose and caribou.

HUDSON BAY

FORT SEVERN
55°59'N 87°38'W

SHAMATTAWA, MB
winter access only

BIG TROUT LAKE

PICKLE LAKE
*northernmost point in the
Ontario highway system*

SIOUX LOOKOUT

THUNDER BAY

MOOSE FACTORY
*northernmost rail
terminal in Ontario*

TORONTO



1.1 GEOGRAPHY AND CLIMATE



Map indicating the boundary of Fort Severn 89 Indian Reserve and its relationship to the Severn River and Hudson Bay. The small areas excluded from the reserve boundary are the former site of the town's airstrip and a parcel formerly controlled by the Ministry of Natural Resources and Forestry.

1.1.1 LOCATION

Located at 55°59'N 87°38'W, Fort Severn is the northernmost settlement in Ontario. The community is situated on the north bank of the Severn River, approximately 12 kilometers south of the river's outlet in Hudson Bay. Fort Severn is a remote isolated community—the nearest neighboring communities are Peawanuck, ON, 177 kilometers to the east-southeast, and Kaskattama, MB, 190 kilometers to the west-northwest.

1.1.2 POLITICAL GEOGRAPHY

Fort Severn First Nation is located on Treaty 9 land, and is a member of the Nishnawbe Aski Nation and The

Keewatinook Okimakanak (Norther Chiefs) Council. Fort Severn is a West Main (sometimes known as “Swampy”) Cree community. The community shares a cultural lineage with first nations ranging from Moose Factory (Moose Cree) and Alberta (Plains Cree).

1.1.3 ECOSYSTEM

Fort Severn is located in the Hudson Bay Coast Ecoregion (Ecoregion OE), which falls within the Hudson Bay Lowlands Ecozone. The ecoregion is characterized by low, flat plains pocked by small bodies of open water and carved by wide, slow-moving rivers that drain into Hudson Bay. The ecoregion is within the continuous permafrost zone. Wetlands and open water cover almost 80% of the



Aerial view of the Hudson Bay Lowlands landscape, a vast peat bog with plant and animal species drawn from both the subarctic and boreal forest ecosystems. (Source: Google Earth)

ecoregion's land area. The soil is primarily marine clay covered by a thick layer of organic matter, usually peat. Poor drainage means that the soil is often saturated, creating the ground condition known as muskeg. The area is a site of rapid postglacial uplift, which may help offset the impact of rising sea levels due to climate change. Fort Severn is located on a tidal estuary at the mouth of the Severn River; residents report that the river is tidal for approximately another kilometer upstream of the community. Residents report that the river freezes over around mid-November, and that the ice breaks up around mid-May.

Ecoregion OE is within the Boreal Forest Region, although Fort Severn itself is located close to the tree line. Most tree specimens in and around the community display stunted growth, and a few kilometers north of the settlement, the trees give way to an open tundra landscape. The region is distinctive in that it represents a transitional zone between the boreal and arctic ecosystems, with plant and animals species from both ecosystems represented.

Characteristic sites in the ecoregion feature stands of black spruce (white spruce, balsam poplar, tamarack, paper birch, and trembling aspen are also represented), with an understory of shrub willows,



A mother polar bear with two cubs observed near the town landfill in September 2019.

sedges, blueberries, Labrador teas, lichen, and moss. Fort Severn residents report that since about 2003, the area's coniferous trees—which typically were only able to reproduce risomatically—have been producing pine cones. This signals that the tree line is beginning to move north, likely as a result of warmer temperatures associated with climate change.

Polar bears come off the ice in the summer and remain in the area through the autumn. The mouth of the Severn River is home to a small summer concentration of Beluga whales, which swim upstream from the bay

to feed in the estuary. Community members report that two herds of caribou—numbering approximately 6,000 and 3,000 individuals, respectively—migrate through the immediate area. Arctic Fox and squirrels are also common. Bird life is widespread and diverse—many residents have installed homemade bird houses on the eaves or exterior walls of their houses. The area is near the northern terminus of both the Atlantic and Mississippi migratory bird flyways; the ecozone is the summer home of over 2.5 million snow geese and hundreds of thousands of Canada geese, whose spring and fall migration is an important cultural event in Fort Severn. Anecdotally, Fort Severn residents report that the community is perhaps the only area where you can see polar bears, black bears, caribou, moose, Canada geese, snow geese, and arctic fox all in one place.

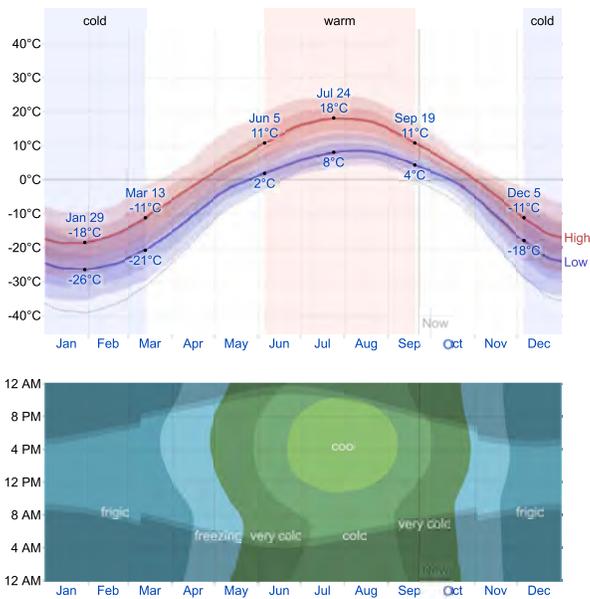
1.1.4 CLIMATE

Fort Severn is in the Low Subarctic Ecoclimate Region. On average, the temperature rises above 0° C. from only late April to the end of October. Even in the warmest months (late June through early September), hourly average temperatures reach a maximum range of only 13° to 18° C. In late January, the temperature rises only to a daily average of about -26° C.

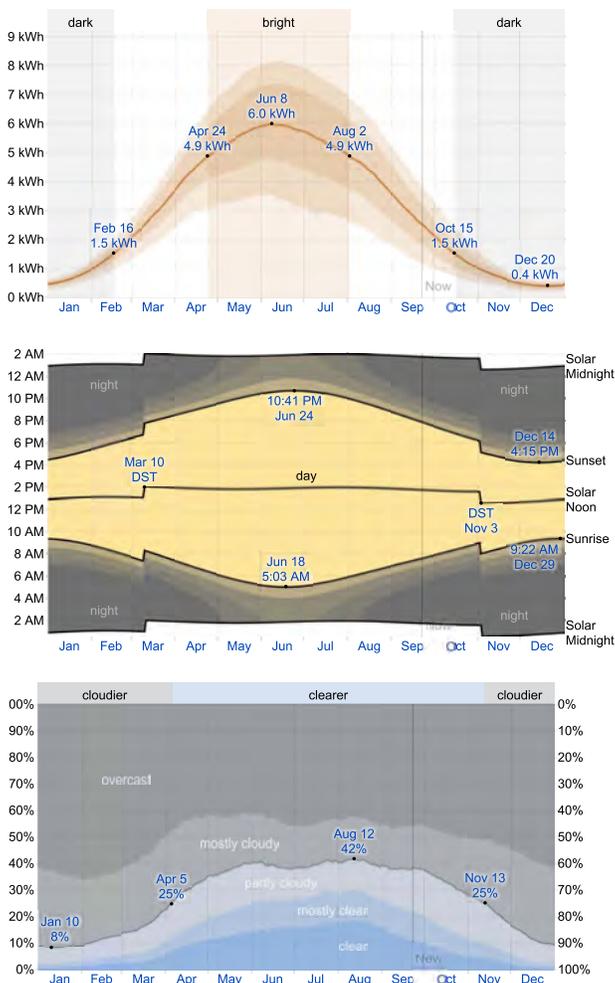
Because of its high latitude, the length of days varies dramatically throughout the year. Around the summer solstice, the sun rises around 5:00am and sets at around 10:30pm; around the winter solstice, the sun rises after 9:00am and sets at around 4:00pm. From early May to mid-August, the sky is never absolutely dark. The aurora borealis is visible in late summer and early fall.

The weather is predominantly overcast or mostly cloudy. Prevailing winds are predominantly from the north and east in the summer, and from the west in the winter. Clearer skies are somewhat more common during the summer months, though winds from the north passing over ice in Hudson Bay can create extensive fog. Mean annual total precipitation is relatively low, roughly 500-600mm, including approximately 200-250mm of rain.

These climate conditions result in a growing season—i.e. a continuous period without frost—of less than 65 days.



Average daily temperatures in Fort Severn and their impact on outdoor human comfort. (Source: weatherspark.com)



Average daily solar radiation, hours of daylight, and cloud cover over the course of a year. (Source: weatherspark.com)

1.1.5 EFFECTS OF CLIMATE CHANGE

According to Stewart and Lockhart (2005), The Hudson Bay Lowlands are likely to continue to experience significant changes in climate conditions due to global warming. Average temperatures will rise several degrees celsius, with winter warming more than summer. Summer precipitation will increase by 10-20 percent. The tree line and permafrost line will both move north.

According to Climate Canada, if greenhouse gas emissions continue at current rates (RCP 8.5 projection), Fort Severn will shift to a boreal forest ecosystem with discontinuous permafrost. The number of days when the temperature dips below freezing will be reduced by over a month, and the number of very cold days will be reduced from an average of around 125 to around 30.

SOURCES:

<https://www.ontario.ca/page/ecosystems-ontario-part-1-ecozones-and-ecoregions>

<https://weatherspark.com/y/146534/Average-Weather-at-Fort-Severn-Airport-Canada-Year-Round>

Lockhart and Stewart (2005)

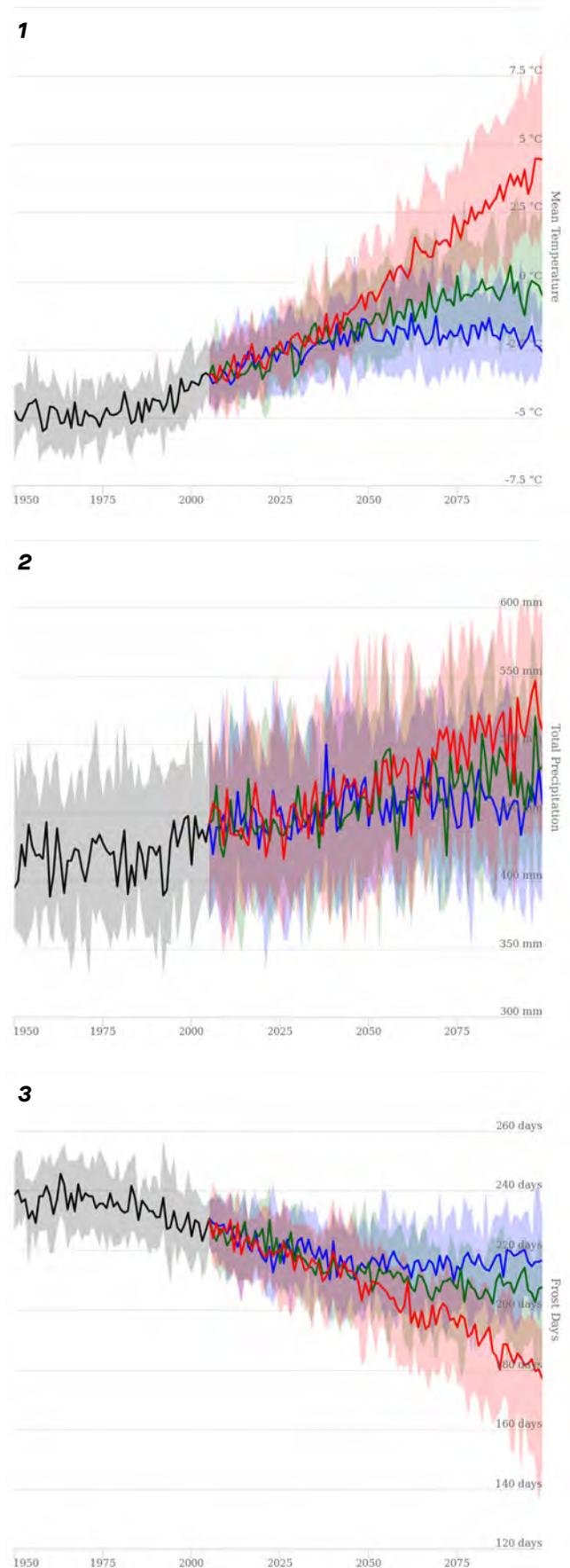
<https://climatedata.ca/explore/location/?loc=FESVT>

<https://www.ontariobeneathourfeet.com/sea-level-rise-james-hudson-bay>

Right: These charts indicate projected climate conditions in Fort Severn based on three possible climate change scenarios.

1. Daily mean temperature
2. Total annual precipitation
3. Frost days (days with min. temperature below 0° C.)

Source: Climate Canada
(<https://climatedata.ca/explore/location/?loc=FESVT>)





WINTER ROAD TO SHAMATTAWA, MB

AIRPORT

TO BARGE LANDING

SOLAR FARM

LANDFILL

TOWN CENTER

RESERVOIRS

WASTE LAGOONS

TO HUDSON BAY

DETAIL PLAN ON PAGES 20-21

SEVERN RIVER



1.2 TOWN PLANNING AND PHYSICAL INFRASTRUCTURE

1.2.1 TRANSPORTATION AND LOGISTICS

Fort Severn is primarily a fly-in community. Fort Severn Airport (YER) is served by one passenger flight per day, run by Wasaya Airways, a regional airline owned by a consortium of Northern Ontario First Nations, including Fort Severn First Nation. The cost of a regular return ticket to Sioux Lookout is approximately \$1300, though there are special rates for community members. The daily Wasaya flight also frequently carries unaccompanied cargo and supplies for residents. In addition, the Northern Store in Fort Severn is restocked twice weekly via dedicated supply planes.

For goods that are too large or heavy to ship by air, Fort Severn receives two to three barges of supplies from Moose Factory per year. One barge is dedicated entirely to diesel fuel. Supply ships were formerly able to navigate up-river to the town centre, but lower water levels and larger boats have necessitated that the barge now land at a point approximately 5km north of the community. Supplies are transferred from the barge to Fort Severn by truck, ATV and snowmobile.

There is a single winter road, extending past the airport, that connects Fort Severn to Peawanuck, ON to the southeast and Shamattawa, MB and Gillam, MB to the west. The community is currently working to convert the road to Shamattawa to year-round access, extending the road a little bit every year.

1.2.2 TOWN PLANNING

The road running northwest-to-southeast between the Fort Severn airstrip and the river creates a spine along which the community is organized. As it approaches the town, the road follows the course of an old tributary stream, evidence of which is still visible in aerial photography. At the southeast end of the road is the community's civic and infrastructural hub, which includes the band office, the school, the



View of Fort Severn from the second-floor balcony of the Niska Inn, looking toward the river.



Typical building fabric and landscape in Fort Severn.

nursing station, the hotel, the mechanic's shop, the youth centre, the hockey rink, the generators, and the water treatment plant. This community core is adjacent to the most recent site of the Hudson Bay Company's Fort Severn supply post, as indicated in historical aerial photographs.

The primary residential areas of the community are arrayed along the riverbank on either side of the civic core. The area immediately to the northeast includes some of the oldest homes in the town—dating to the mid-1970s—including the former Indian agent's house, which is still standing. In the early 1990s, a major residential street running northeast from the town centre was established; it now is lined by houses on both sides. In the late 1990s and early 2000s,



Fort Severn's municipal generators run on approximately 1 million litres of imported diesel fuel per year.

another node of development was established to the southwest of the civic core. Most recently, enabled by the digging of a long drainage ditch, another row of residential parcels has been created behind the early 1990s development.

1.2.3 MOBILITY

Fort Severn's roads are exclusively gravel, often engineered to include culverts in order to allow small streams to pass under them on their way to the river. Residents get around on foot, by car (the vast majority of vehicles in town are pickup trucks), and, seasonally, by ATV or snowmobile. The community operates a fleet of heavy machinery (bulldozers, front loaders, graders, etc.), apparently in large part to maintain the road network.

1.2.4 ENERGY

Fort Severn residents report that most homes in the community received electric power in the early 1990s. (Starting in the mid-1980s, residents



The town's \$2.5m solar farm is not yet on line.

connected extension cords from the school, which was electrified, to watch broadcast television in their homes.) The town's electrical grid is powered by three diesel generators located on the western edge of the community. The community imports approximately one million litres of diesel fuel—an entire barge's worth—per year in order to power the generators.

Many buildings in the community—including newly built houses, the Youth Centre, and various equipment sheds, have rooftop solar arrays. In 2015, Fort Severn Chief Paul Burke began a \$2.5 million project to establish a solar farm between the town and the airport, with the goal of cutting the community's reliance on diesel fuel in half. Most of the panels have been constructed but the array is not yet functional due to disagreements with the companies the community had partnered with. Since solar energy is most available during times of year when it is least needed for heating, Chief Burke has also been exploring the potential of large-scale battery storage.

Most homes in Fort Severn use electric heat, supplemented in most cases by wood stoves. Electricity costs \$0.97/kWh (compared to peak Ontario Hydro rates of \$0.134), and winter heating bills can reach \$200/month. Residents use a combination of locally harvested wood and imported firewood as fuel for wood stoves.

1.2.5 WATER

Fort Severn maintains a network of buried water lines designed to supply civic buildings and most homes with potable water. The water is pumped up from the

river, stored in reservoirs at the northern edge of the town (first constructed in the late 1980s), treated at a facility that was upgraded in 2016, and distributed throughout the community.

Despite the presence of this infrastructure, at the time of the team's visit the community had been on a boil advisory since February 2019. Residents report that every winter, pipes freeze and burst, causing contamination. The visiting team was told that while most of the water lines are insulated, it is particularly difficult to insulate the pipe joints.

1.2.6 WASTE

Fort Severn's health clinic and the newly built primary school are served by piped sewer infrastructure, but all other buildings in the community use septic tanks. Waste is trucked from septic tanks to lagoons constructed in the mid-1990s and expanded in 2004.

1.2.7 COMMUNICATIONS

Homes in Fort Severn are connected to the internet via a cable network that was originally built in the early 1990s to carry the community cable television service. In 2000, internet service was upgraded to broadband via the C-Band data satellite network. Community members make extensive use of Facebook to communicate among themselves and post notices of community events. The internet provider is KNet, a First-Nations-owned company that serves communities in Northern Ontario.

Rogers covers Fort Severn on its roaming network, and residents are able to purchase mobile phone service through KNet, which operates a dedicated network. Some residents who have regular business outside the community, e.g. the chief, carry two mobile phones—one for use inside the community and one for use elsewhere.

SOURCES:

http://kochiefs.ca/fort_severn

<https://teachforcanada.ca/en/community/fort-severn-first-nation/>

<https://www.thestar.com/news/queenspark/2018/05/11/isolated-fort-severn-ont-tries-to-chart-its-own-course.html>



Fort Severn First Nation Water Treatment Plant (ext.)



Fort Severn First Nation Water Treatment Plant (int.)



Drinking Water Reservoir



Waste Lagoon



LANDFILL

↑
TO AIRPORT

RESERVOIRS

GENERATORS

WATER TREATMENT PLANT

PROPOSED SITE OF NEW DUPLEX DEVELOPMENT

HOCKEY RINK

BASEBALL DIAMOND

HOTEL

NURSING STATION

MECHANIC'S SHOP

PRIMARY SCHOOL

YOUTH CENTRE

TEACHERS' HOUSING

BAND OFFICE

OLD CHURCH

HOUSING (1990s-2000s)

KIHS

CIVIC CORE

HOUSING (1970s-1980s)



FORT SEVERN FIRST NATION

TO WASTE
LAGOONS

NEW DUPLEX HOUSING
UNDER CONSTRUCTION

DRAINAGE CHANNEL

CHURCH

NORTHERN
STORE

HOUSING
(EARLY 1990s)

RECENTLY
CONSTRUCTED
SIX-PLEX

OLD STORE





Fort Severn as seen from the air in June 2019 and in an archival photograph. (Inset source: Archives Ontario)



Fort Severn's original church, now unused, as seen in June 2019 and in an archival photograph. (Inset source: Archives Ontario)

1.3 SOCIAL AND CULTURAL INFRASTRUCTURE

1.3.1 DEMOGRAPHICS AND GOVERNANCE

As of the 2016 Census, Fort Severn had a population of 361, up from 334 in 2011. This included 105 children (ages 0-14) and 35 individuals over the age of 65. Recent news reports now claim the Population is closer to 500. In 2016, 230 residents reported speaking some Cree, and 10 residents reported speaking no English. 75 residents reported speaking Cree most often in the home.

Fort Severn is led by an elected chief and a four-member council. The current chief, Paul Burke, was re-elected to a second term in 2019.

1.3.2 EDUCATION

Wasaho Cree Nation School is the largest (1765m²) and most recently constructed (2016) civic building in Fort Severn. It serves students in Kindergarden through Grade 8, and currently has a student population of 97. It includes a science lab, computer lab, gymnasium, and library. The school is staffed by a mix of local residents and Teach for Canada participants. Teachers live in dedicated accommodations across the road from the school. The school offers a popular hot breakfast program.

After Grade 8, students typically continue their education outside the community in Sioux Lookout, Thunder Bay, or Dryden. These students typically return to the community only at Christmas, March break, and in the summer. In 1999 KNet launched the Keewatinook Internet High School, which has locations in northern communities across Ontario, including Fort Severn. KIHS offers Grades 9 through 12, and serves a mix of youth and mature students who want to earn their Ontario Secondary School Diploma without leaving their communities.

Fort Severn operates a Junior Canadian Ranger program, co-administered with the Canadian Rangers,



Fort Severn as seen in a 1955 archival photograph. (Source: Archives Ontario)



The "eskigan," a sod-covered tipi, was the traditional dwelling type of the West Main Cree communities living around Fort Severn before the imposition of Euro-Canadian forms of architecture. (Source: Archives Ontario)

which runs outdoor and land-based programs for youth aged 12-18. The program aims to teach skills including first aid, gun safety, drug and alcohol awareness, and traditional practices. After-school programs for younger children are run by the band out of the Youth Centre, which consists of one large, open, flexible room with a kitchen at one end.



Wasaho Cree Nation Primary School, completed in 2016, is the largest building in the community.



The church.



The Niska Inn, an 8-room hotel run by the band.



The nursing station.

1.3.3 ECONOMY

The band office, school, nursing station, and the Northern Store are the town's largest employers. Some residents make crafts including beading and tamarack sculptures. The pelts of locally trapped small animals are available for purchase at the Northern Store. The band operates an eight-room motel-style hotel with a shared kitchen, which is used primarily for short- and medium-term visitors, including nursing staff, Canadian Junior Rangers leadership, and a mechanic who operates and maintains the band's heavy machinery.

Fort Severn Chief Paul Burke told the visiting team that he is pursuing several economic development initiatives, including positioning Fort Severn as an alternative to Churchill, MB for polar bear tourism, developing an off-grid eco-hotel. Burke reports that he has been approached by mining companies regarding the possibility of resource speculation in on the community's lands.

1.3.4 HEALTHCARE

Fort Severn is served by a local health clinic staffed by a rotating team of nurses. A doctor visits the community for one week every month. The clinic provides basic emergency and holistic healthcare, including the administration of some prescriptions. For any specialized care, including prenatal care, residents must travel by plane to hospitals in Sioux Lookout,

Thunder Bay, or Winnipeg.

1.3.5 FOOD

Wild-caught game—including caribou, goose, and fish—is a major food source for the community. The spring goose hunt, when the geese arrive from their migration in early May, is a significant annual event. School closes for a week and many families spend the time living on the land at family hunting camps outside of town. The caribou hunt is in the fall. Community members fish year-round, using fixed gillnets in the tidal waters during the summer, and ice fishing in the winter. The annual ice fishing derby is another community event frequently cited as a favorite of residents; the prize for the largest catch is a pickup truck.

Residents either freeze or smoke the game they hunt, and draw down on their supplies over the course of the year. Residents who hunt share their game with those who do not, including family members and elders. Many homes have contemporary versions of traditional smoking huts in the backyard. Made with lumber or slender log framing, plywood, and tarps, these structures feature a central fire pit, a smoke hole in the roof, cooking racks to roast Caribou and smoke goose, and prep areas around the perimeter.

The Northern Store is the community's primary source of purchased food, in addition to serving as the hardware store, outdoor outfitter, post office, and gas station. The Northern Store sells primarily frozen, packaged, and non-perishable food items, although there is a small section of fresh fruits and vegetables. Foods deemed healthy are subsidized through the Nutrition North Canada program, but fresh food prices are still significantly higher than in the south due to the cost of transportation. Based on informal observation, food security and nutrition is one of the community's most significant challenges.

Chief Burke reports that some community members have small gardens, and that the band has investigated the possibility of creating a community garden for food production, though the short growing season limits the potential output. Burke also reports that he has explored the possibility of partnering with other communities to develop a hydroponic grow operation in a nearby city, which would serve communities with limited access to fresh fruits and vegetables.



Top: Fort Severn resident Philip Mathew checks on fishing nets in an archival photograph from 1955. Above: Similar nets continue to be used in the community today.



Contemporary versions of traditional smoking tents, typically built from logs, lumber, plywood, and tarps, are widespread in the community.



The Northern Store is the community's only commercial operation. It serves as grocery store, hardware store, outdoor outfitter, post office, and gas station. It also sells furniture, appliances, and vehicles by catalog.



1.4 HOUSING

1.4.1 OVERVIEW

In 2016, residents of Fort Severn lived in 80 dwellings, 75 of which were single-detached homes. There were 15 two-bedroom homes, 35 three-bedroom homes, and 30 homes with four or more bedrooms. The average household size was 4.6, almost double the national average. Only ten households reported owning their homes—the rest were renters or lived in band housing.

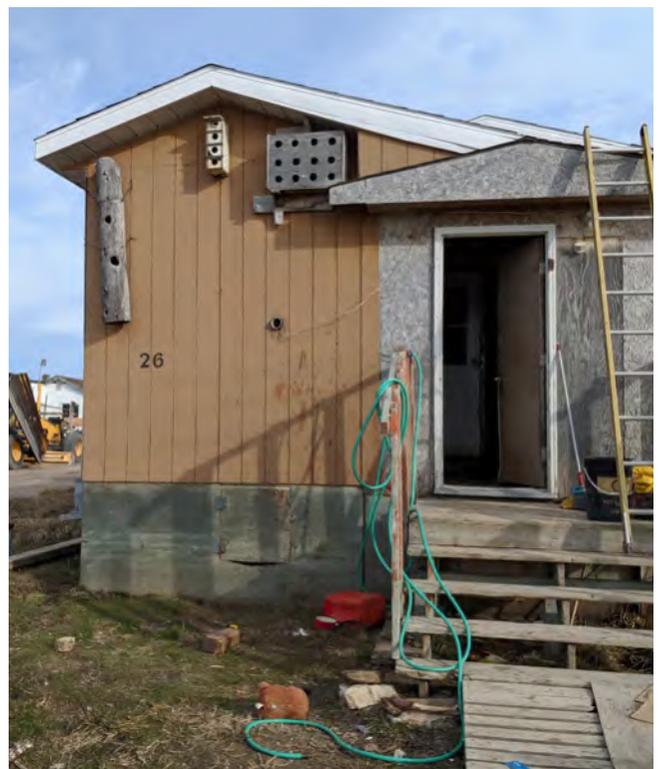
Houses in Fort Severn are almost exclusively single-story bungalows. (There is one duplex, whose upper floor is occupied by the elementary school principal.) The houses are simple rectangular volumes, small windows, low pitched roofs, and enclosed entries.

Depending on their age, the houses feature wood or vinyl siding, with asphalt shingle or corrugated metal roofing. Interior finishes are chipboard or drywall, with vinyl tile flooring. Many houses show evidence of incremental modification by the occupants, including the widespread addition of wall-mounted birdhouses.

Houses are generally laid out in rows facing the street on small individual lots. They are typically serviced by a gravel driveway. Open space around the houses is used to store firewood, spare vehicle parts, and other material. Many homes have an outbuilding used to smoke goose and caribou meat.

Overcrowding is a challenge in Fort Severn, though perhaps not as much as in some other similar communities. The visiting team received reports of a few houses with 14-18 occupants, mostly due to children growing up and having families of their own, but not being able to move out into their own home.

Other major challenges include differential foundation settling in the muskeg soil, and water damage in winter from burst pipes. Mold contamination and public health effects were not widespread, although the team's observations were limited.



A survey of typical existing exterior housing conditions in Fort Severn, showing evidence of foundation settling and occupant modifications such as bird houses.



5.2 EXISTING CONDITIONS CASE STUDIES

During the team's first visit, we were able to visit three occupied homes, built in three different decades, to assess existing conditions. The team was accompanied by Fort Severn's housing manager.

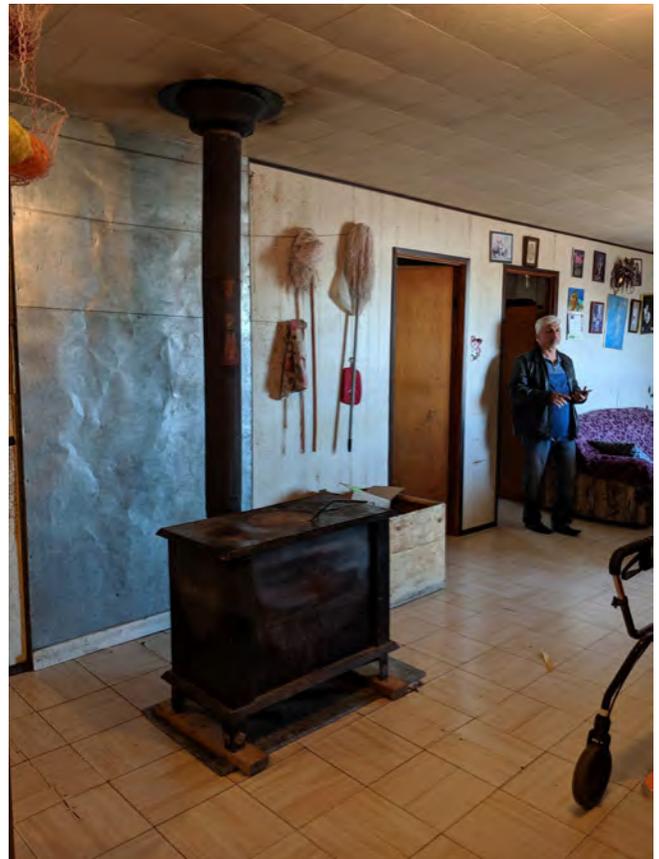
House 1

This house was built in 1973 by the current occupant's father. It uses a 2x4 stud frame construction. Interior partition finishes are chipboard. The house has been condemned due to a decaying foundation beam. There was evident moisture damage in the bathroom. The house was clean and tidy, but storage space is at a premium – the closets are filled to capacity.

House 2

This three-bedroom house was built in 1985. The interior features the same chipboard wall finish, vinyl floor tiles, and an acoustical tile drop ceiling. As with House 1, storage space was at a premium and every available space was filled with belongings and supplies. One storage space was being used as a computer room.

A large top-loading wood stove sits in the center of the house. There was water damage evident in the bathroom floor and ceiling, and the living room ceiling. The house is fitted with a heat recovery ventilator, but it was not operating at the time of the team's visit. The house was noticeably humid.





House 3

This four-bedroom home was built in 1995. When the team visited, the current occupants were just moving back in after a renovation—a burst pipe had caused water damage that needed to be repaired. The finish between the walls and ceiling showed signs of differential foundation settling.

Outside, there was indication of fire damage to the skirting around the crawlspace – the electrified coils meant to keep the water pipes from freezing had been installed too close to the house, causing it to scorch the skirting. (The housing director said that the occupants were fortunate that the house had not burned down.)



1.4.3 RENOVATIONS AND NEW CONSTRUCTION

With funding from Indigenous Services Canada (ISC), Fort Severn has recently completed construction of a six-plex on the eastern side of town, and is currently building five new duplexes, each comprised of two four-bedroom units. In addition, ISC has allocated funding for the renovation of ten housing units in Fort Severn. This work is being completed by a small team of local residents, supplemented by some skilled labour from outside the community. Two electricians and two unlicensed plumbers live in the community.

The new construction has been made possible by the digging of a new drainage channel that runs southwest-to-northeast behind the new parcels to the river (see map, pp. 20-21). In addition, in order to minimize foundation settling, the band's housing team dug out the existing muskeg and filled the building sites with six-foot-deep gravel pads on which the foundations are built.

The duplex designs are customized kits provided by Olympic Building Centre, a Winnipeg-based company that touts its close relationships with First Nations communities in northern Manitoba and Ontario. The kits, including prefabricated roof trusses, were



Fort Severn's recently constructed six-plex.



An older home under renovation.



This newly constructed duplex is sitting empty until the band receives funding to connect it to the municipal power grid.



In order to create a stable platform for construction, the band excavates the muskeg landscape...



...builds six-foot-deep gravel pads...



...and assembles space-frame foundations after the gravel has settled over at least one winter.

shipped by flatbed truck over the winter roads. Two of the new duplexes use insulated slab-on-grade foundations, and three use (or will use) space frame foundations developed by Multipoint Foundations, a sister company of Triodetic. Made from a combination of steel and aluminum, these rigid-frame foundations distribute the load of the building over a larger-than-typical number of points, reducing the risk of differential settling. The foundation plates sit directly on the gravel pad, and each point can be adjusted with a wrench. Fort Severn Chief Paul Burke is enthusiastic about the performance of these foundations and anticipates using them more widely going forward.

The duplexes use conventional 2x6 framing with OSB exterior sheathing, R-22 insulation in the wall cavities, and ½" drywall in the interior. The roof uses a metal cladding over pre-engineered trusses, with R-50 batt insulation. The houses are brand new and appear to be reasonably well constructed, but there is little indication that they will perform significantly better over time than other conventionally framed houses in the community.

1.4.4 NEEDS ASSESSMENT

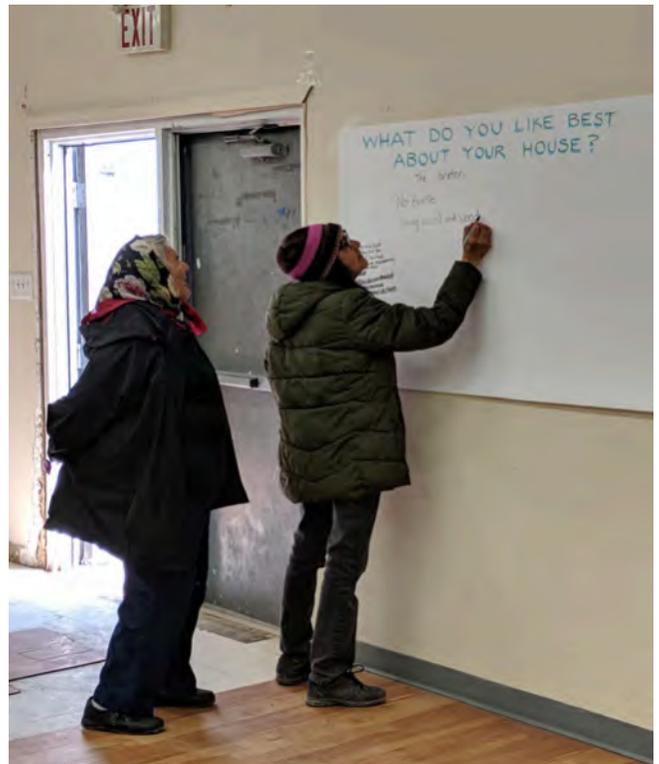
Team members visited Fort Severn twice, once in June 2019 and once in September 2019. In addition to conducting in-person assessment of existing housing conditions, team members conducted a series of meetings and interviews with Fort Severn leadership including the chief, members of council, the band's housing director, local carpenters, band office staff, the principal of the elementary school, and staff at the nursing station. Team members were also given guided tours of the community and the surrounding lands, including two boat trips up into Hudson Bay.

During the June visit, team members led a day of community workshops, culminating in a community feast of caribou stew and bannock cooked by elders. The workshop, which took place in the Youth Centre, was planned with an informal format in order to encourage participation. A series of large posters were hung on the walls of the space, each with a question meant to encourage responses and start conversation. Workshop attendees were encouraged to write responses directly on the poster, or to give feedback to the team verbally.

Questions included:

- What do you like best about your house?
- What difficulties do you have with your house?
- If you could add one room to your house, what would it be and what would you use it for?
- What type of housing does the community need most?
- What stories have you heard from elders about traditional housing in Fort Severn?
- What community events are your most favorite?
- What times of the year are most difficult?

The workshop was attended by approximately 20 community members, including children and elders. A few elders whose primary language is Cree attended, and had the questions and their responses translated for the team by family members.



Scenes from the community dinner and workshop in June 2019.



Based on a synthesis of findings from direct observation, meetings, and the community workshop, the team has developed the following needs assessment:

- Community members love the landscape that surrounds them, but do not feel that their homes are connected to the land or the seasons. They connect to the land when they are out hunting and finishing, or living at their hunting cabins, but not necessarily at home.
- The community would like to find a way to allow elders to continue to live independently or semi-independently in the community.
- Young couples are another target demographic: they are often unable to move out of their parents' houses, even when they begin to have children of their own. This is one of the major causes of overcrowding in the community.
- The high cost of electricity means that there is widespread appetite for higher-performance homes.
- Unreliable water infrastructure is the source of widespread challenges including lack of safe drinking water and water damage caused by burst pipes.

1.4.5 OPPORTUNITIES

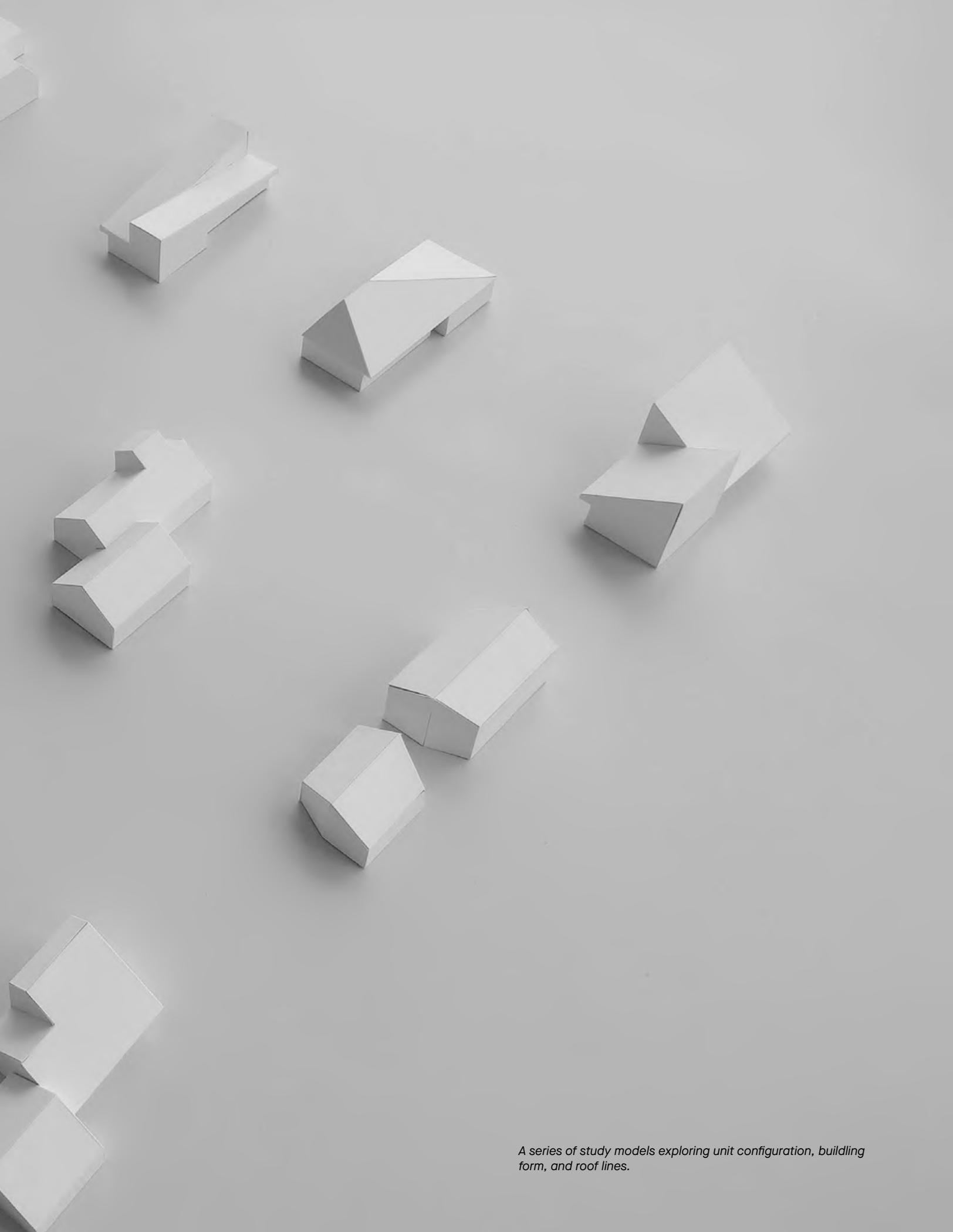
Based on the needs assessment developed following the June visit, the team developed a list of potential opportunities that were discussed with band leadership in a series of meetings during the September visit. The opportunities include:

- Multi-unit elders' housing, potential with an integrated apartment for a healthcare worker.
- A wider variety of unit sizes to accommodate families of different sizes in less crowded conditions. (Small units in particular could act as a release valve, giving young couples somewhere to live for a few years and creating some slack in the system to allow for renovations and construction of additional units.)
- More attention to building orientation, to optimize relationships to sun and wind conditions.
- A passive-first energy strategy using a superinsulated, airtight envelope, electric heat, and an energy-recovery ventilator.
- Cluster developments that could potentially share localized energy and water infrastructure.
- Foundation design that allows for less invasive/ destructive site work and a closer relationship to the land.





3. DESIGN STRATEGIES



A series of study models exploring unit configuration, building form, and roof lines.

3.1 DESIGN PRINCIPLES

CONNECT TO THE LAND

- Conceive of the buildings and their landscape context as an integrated system.
- Engage the productive, performative, and cultural potential of the local landscape.
- Use local materials wherever possible, so that the houses are “of their place.”
- Accommodate traditional practices and activities that may not “fit” within a conventional southern house.
- Work in concert with daily and seasonal cycles of sun, wind, and water.

SUPPORT RESILIENT MULTI-GENERATIONAL COMMUNITIES

- Help reinforce neighbourly relationships and community bonds, especially between generations.
- Design a system that combines a range of unit sizes and functional layouts, so that elders, families, and youth can live in close proximity and support each other.
- Invite the community to customize, upgrade, expand, and reconfigure the houses according to its changing needs.

MAKE EFFICIENT USE OF ENERGY AND RESOURCES

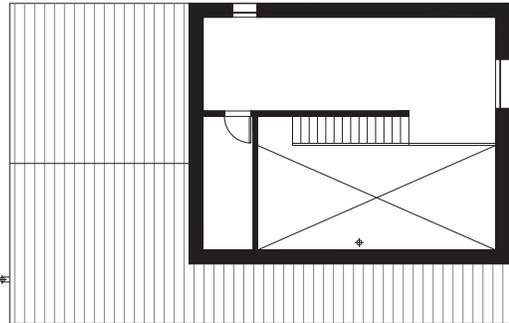
- Prioritize passive strategies and good envelope design.
- Generate and store renewable energy on-site.
- Reduce the load on overburdened infrastructure systems.

DESIGN FOR THE LONG TERM

- Build on what is working: adopt and adapt current knowledge, skills, and practices to maintain familiarity and allow for incremental education of construction crews.
- Employ simple, robust solutions that can be self-built, maintained, and renewed over multiple generations.
- Design for the logistical challenges of material transportation and construction in the remote north.
- Keep functional layouts simple and flexible to ensure long-term usefulness
- Help the community create a culture of care, maintenance, and pride in their homes

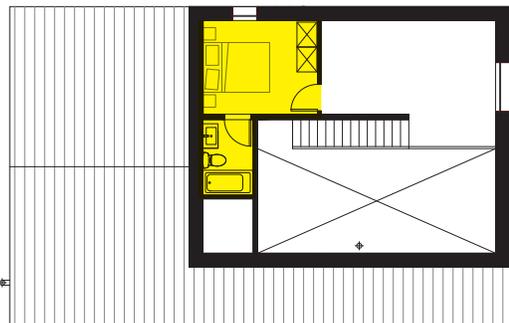


3.2 SUPPORTING A RESILIENT COMMUNITY



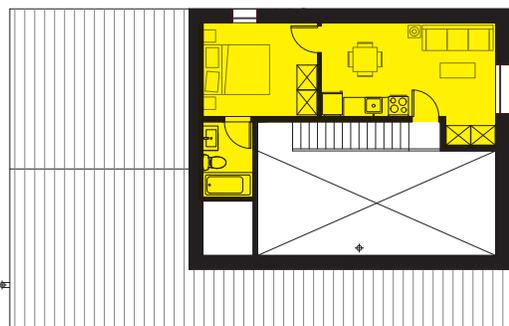
OPEN LOFT

- Storage
- Playroom
- Home office / enterprise
- Community activities
- Sleeping loft



MASTER BEDROOM SUITE

- Preserves open area for playroom or work space



PRIVATE APARTMENT

- Self-contained unit for multi-generational family or caregiver

The Resilient Duplex is an iteration of a housing system designed to be adaptable to a variety of contexts and needs. It takes as its premise the housing needs articulated by members of the Fort Severn community during the community engagement process. With elders and young families identified as the groups that are most in need of housing, the Resilient Duplex imagines a configuration that allows those two groups to live as neighbours and support each other. A single-story accessible elder's apartment (which could also accommodate a single person or a couple without children) is attached to a two-bedroom unit with a flexible loft space. The two units share an entry porch, encouraging interaction between neighbours, and the elder's apartment has a private terrace off the bedroom.

This design is flexible in two important ways. First, the larger unit features a flexible second-floor loft space. Left open, it can be used for storage, a playroom, or as a home office. It can also be partially enclosed to create a master bedroom with ensuite bath, or fully enclosed as a private apartment. Units could be configured differently from the start, or adapted incrementally..

Second, because it is possible to give every room in each unit a window using only the north and south facades, the buildings can be designed in a variety of configurations, from detached homes to large multi-unit dwellings. This includes configurations in which a number of elders' apartments are combined with one large unit, which provides communal space and a private apartment for a nurse.

Left: the second-story loft in the small family unit can be fit out according to the needs of the community, or can be expanded incrementally over time as needs change or funding becomes available.

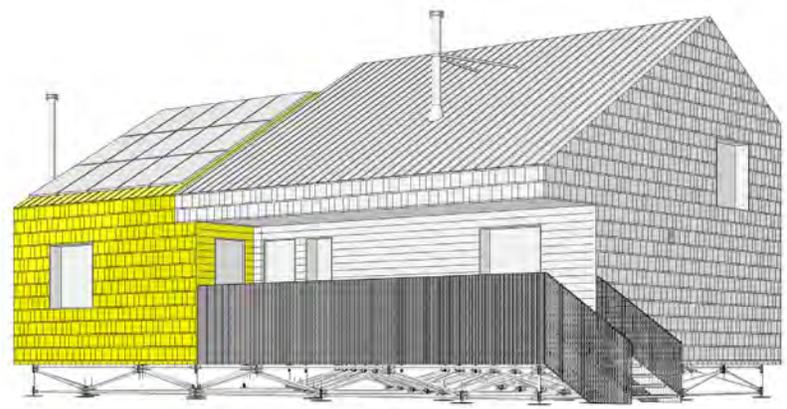
ELDERS' APARTMENT

- 432 ft²
- 1BR + 1BA
- Barrier-Free

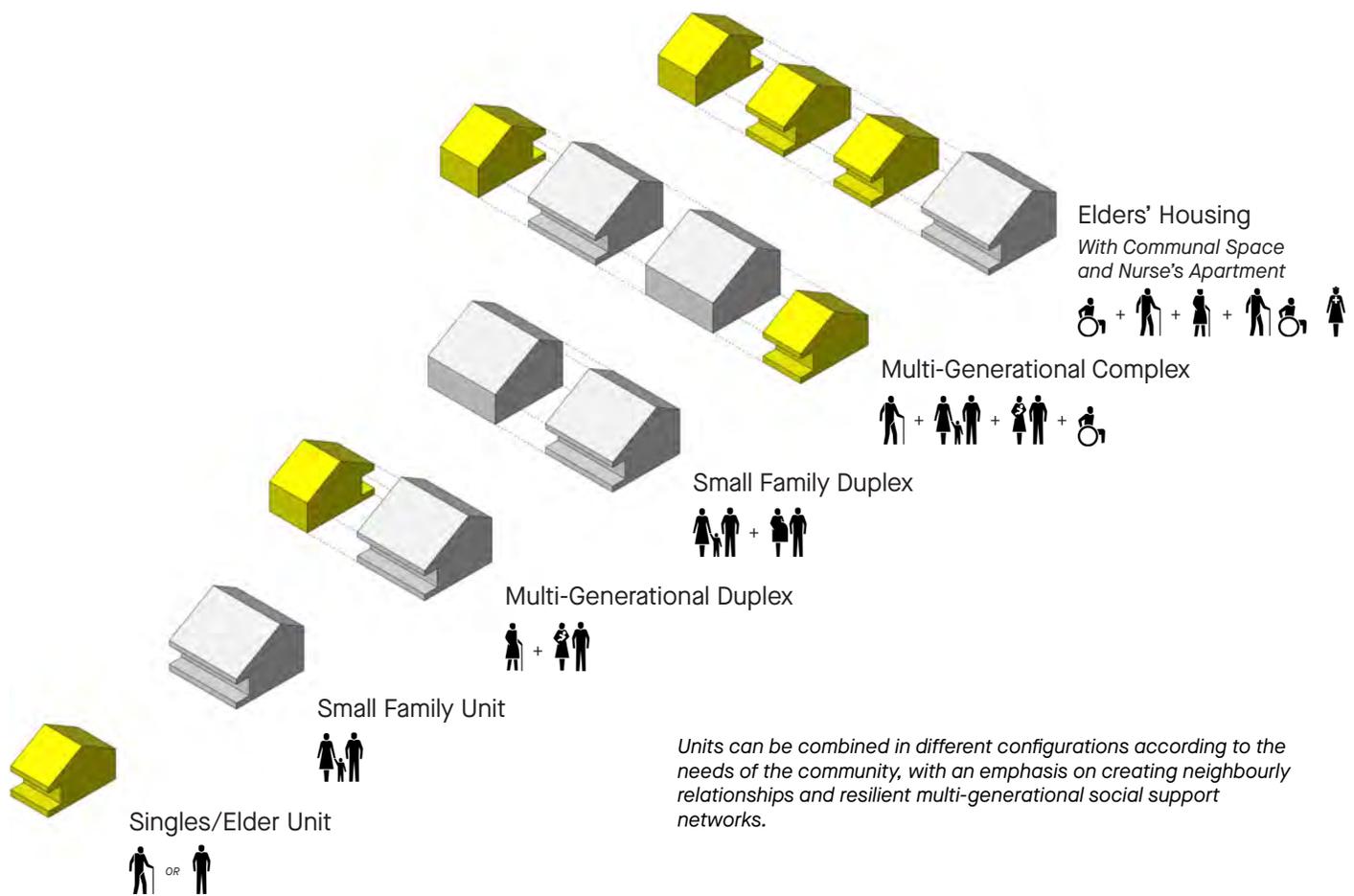


SMALL FAMILY UNIT

- 1080 ft²
- 2BR + 1BA
- Expandable to 3BR/2BA



The multi-generational duplex configuration pairs a small barrier-free apartment designed for an elder with a larger family unit that can be expanded from two bedrooms to three. The units share an entry porch, encouraging regular interaction between neighbours.

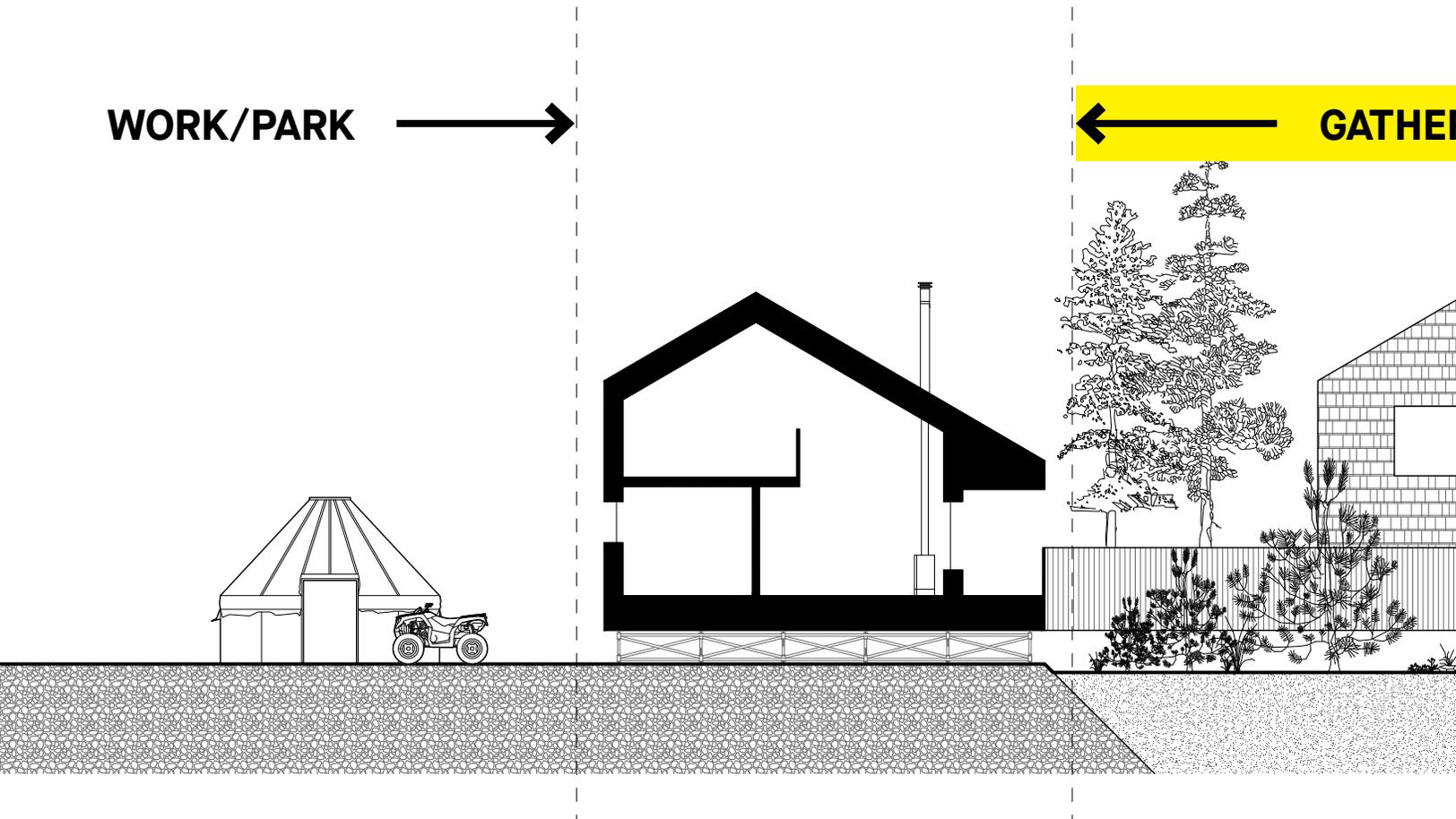


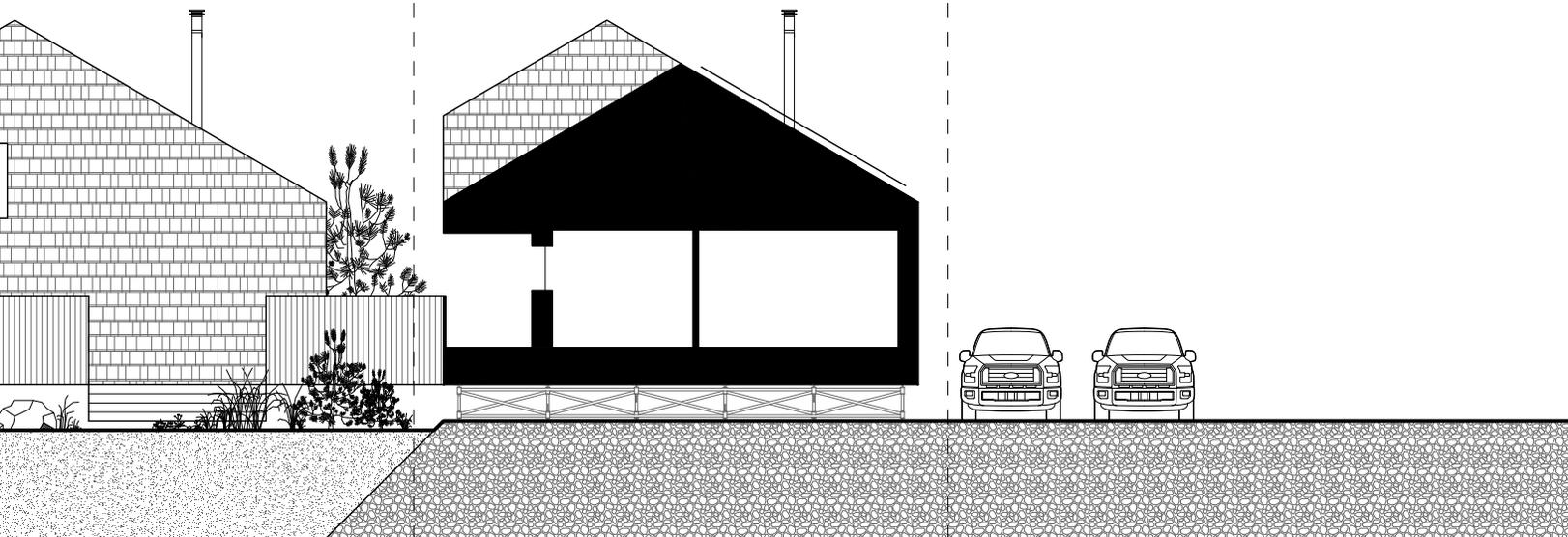
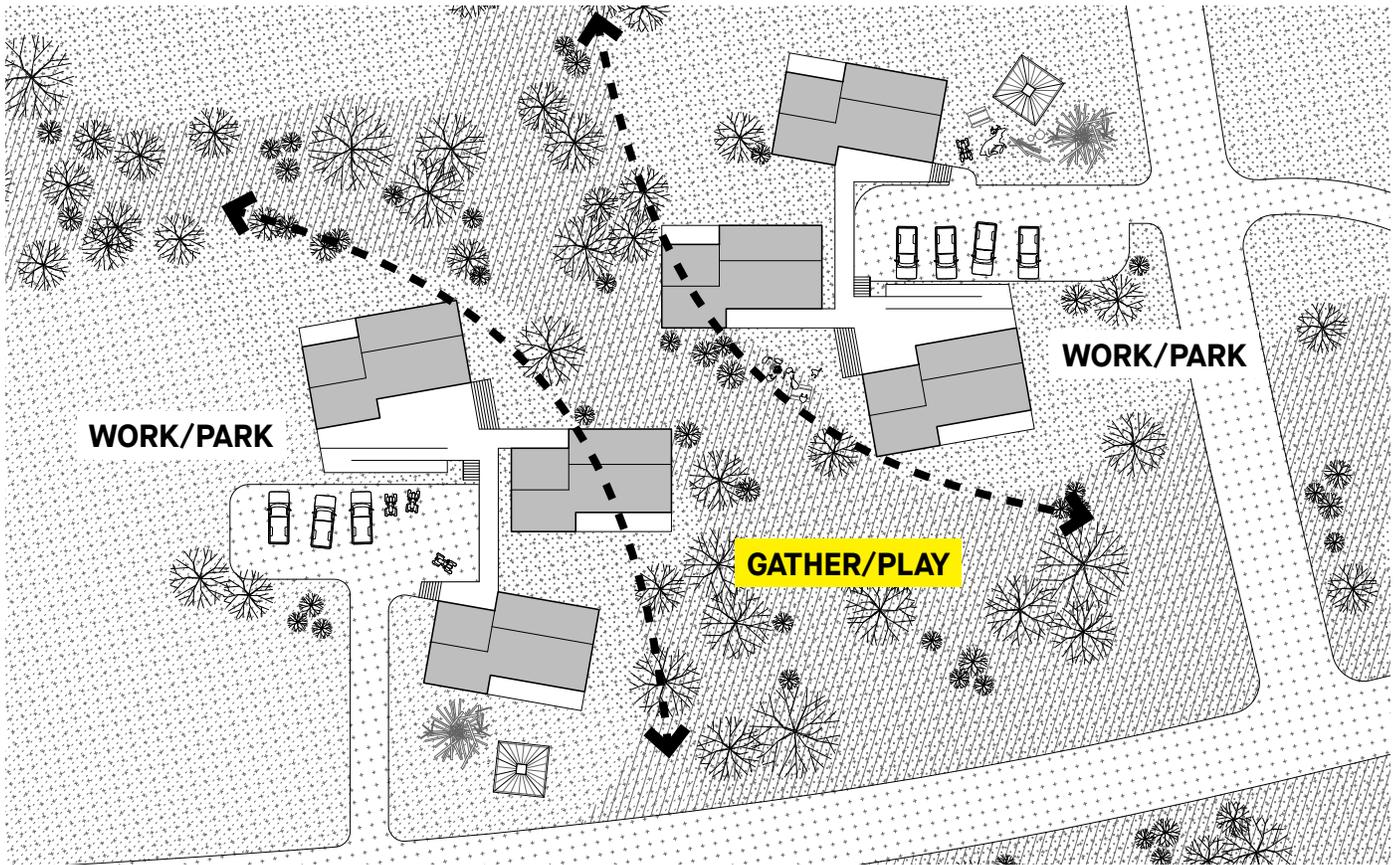
Units can be combined in different configurations according to the needs of the community, with an emphasis on creating neighbourly relationships and resilient multi-generational social support networks.

3.3 LIVING IN THE LANDSCAPE

Rather than continuing to organize the community into rows of individual street-facing lots, the Resilient Duplex site plan arranges twelve units in two clusters, each connected by a network of raised walkways. Each cluster shares a driveway and an accessible ramp for residents with mobility challenges. The walkways could also serve as insulated utilidors for water and energy infrastructure, reducing the number of vulnerable pipe connections that need to be made from the street.

The clusters are organized back-to-back, resulting in an overall configuration that keeps parking and outdoor workspace at the edges of the site, and allowing the natural muskeg landscape to flow through a central communal courtyard that can host larger gatherings around a fire pit, or serve as a children's play area. The goal is for every unit to have a view out onto this natural landscape, to connect residents more to the land and landscape that is so important to them.





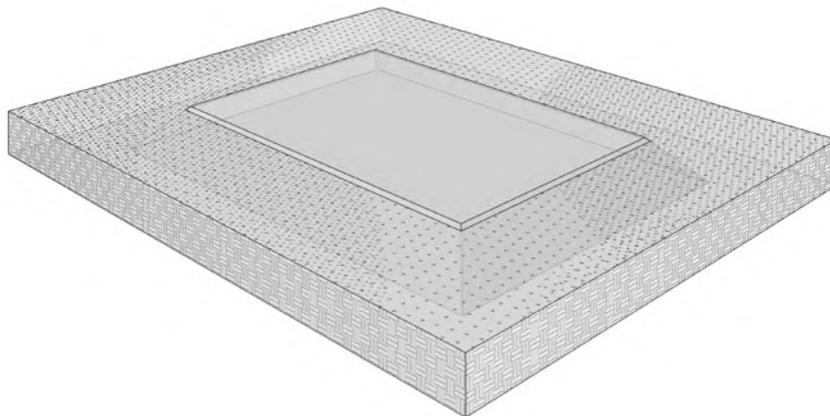
3.4 LAYING A STABLE FOUNDATION

Foundation design and engineering is one of the most difficult challenges in the sub-arctic north, given the unstable nature of the muskeg soil. The Resilient Duplex makes use of the same foundation system that is currently in use in the community today: a space-frame foundation on top of a compacted gravel pad that keeps the house rigid and allows for hand-adjustment of individual footings as the ground shifts.

If the community proceeds with this project, the design team would recommend investing in a geotechnical report and investigating the possibility of using deep helical pile foundations as an alternative to the space frame. The additional cost of the piles may be justified if it allows for the houses to be built without widespread destruction of the surrounding landscape.

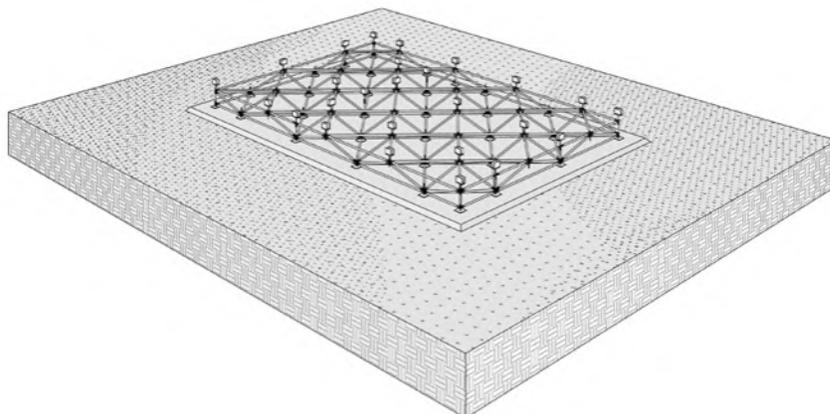
1. GRAVEL PAD

A deep gravel pad, compacted and left to settle over a winter, creates a relatively stable foundation on which to build.



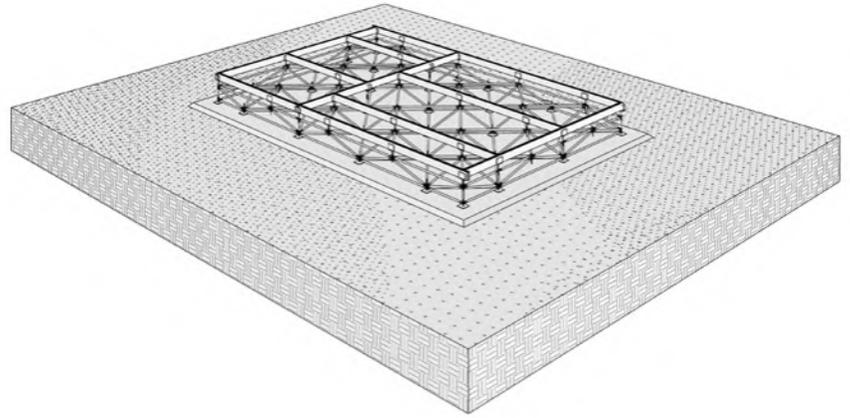
2. MULTIPOINT FOUNDATION

Using a six-foot square structural grid, the space-frame foundation distributes the weight of the building over a large area and is easy to transport and assemble.



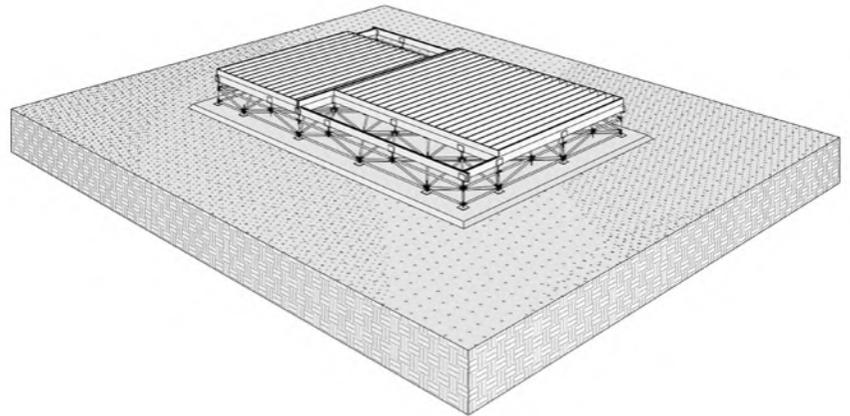
3. PLATFORM FRAME

Built-up beams made from standard 2×12 lumber comprise the first layer of the structural platform.



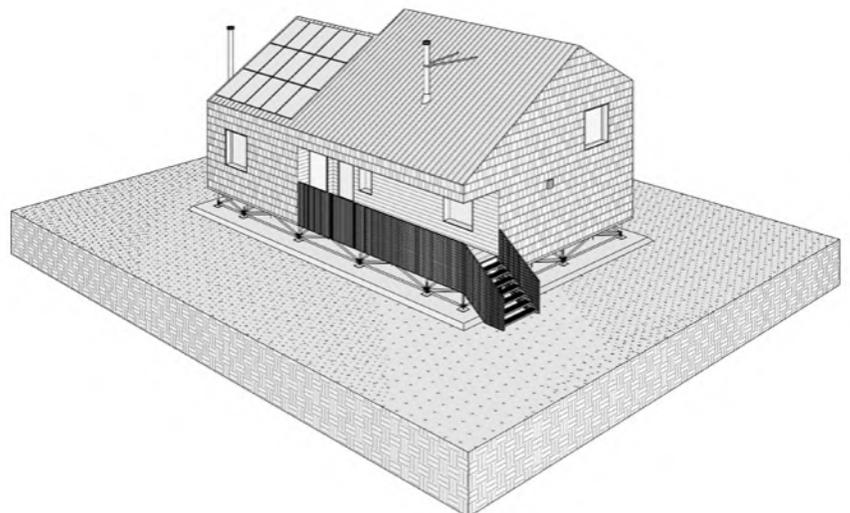
4. FLOOR JOISTS

Running the joists on top of the beams, rather than in the same plane, avoids the need for joist hangers and creates an insulated plenum for services.



5. WALL AND ROOF FRAMING

Wall and roof framing uses conventional stick frame construction, employing 2×6 stud walls and a combination of LVL and prefabricated wood truss roof structure.



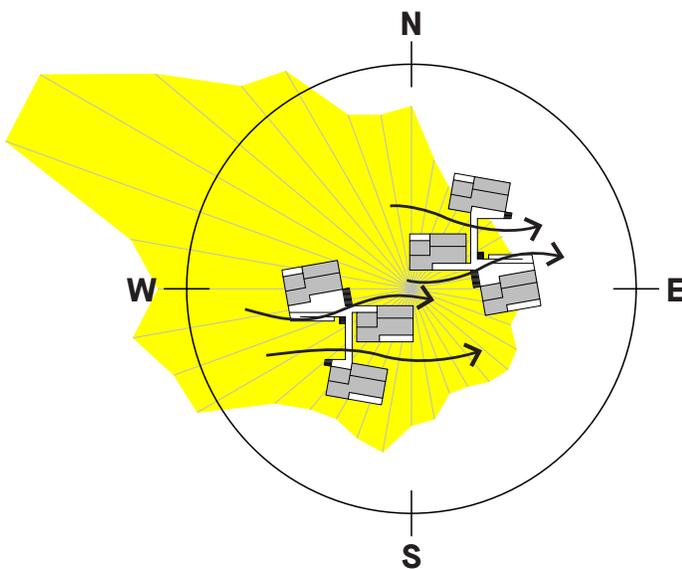
3.5 ACKNOWLEDGING THE ELEMENTS AND SEASONS

The site plan for the proposed cluster development of Resilient Duplex units orients the buildings to the cardinal directions, plus or minus 10°, for reasons of both performance and experience.

In a community that is so far north, daylight is a precious resource in the winter, and a nuisance in the summer. The functional layout of the Resilient Duplex positions living and eating space to the south, and sleeping space to the north. (Entries, washrooms and utility space are at the center of the building, along the party wall.) This allows spaces with daytime occupancy to receive maximum natural daylight even in winter. In summer, the bedrooms will likely need blackout shades to block out the rising and setting sun, which both come from the north.

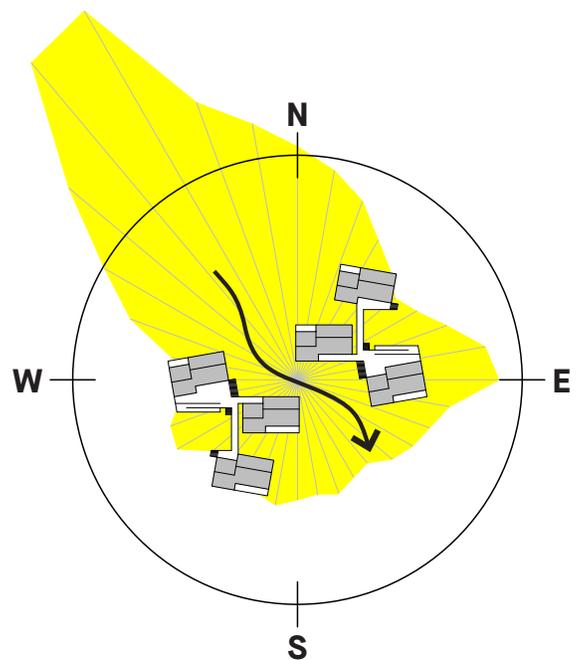
Solar orientation will also have a small effect on energy performance. In the summer, the south-facing eave will block solar gain in the living rooms, helping keep the houses cool. In the winter, the low sun will penetrate deep into the house, helping warm the interior.

The orientation of the houses is also designed to work with the prevailing seasonal wind patterns. In the winter, west winds will scour the long sides of the buildings, helping to prevent snow drifting at entryways. In the summer, warmer breezes will be channeled through the central communal landscape, helping to keep it comfortable and bug-free.



WINTER WIND

Winds from the west scour the long faces of the houses, reducing snow drifts around entrances.



SUMMER WIND

Warmer breezes from the northwest are channeled through the communal landscape.

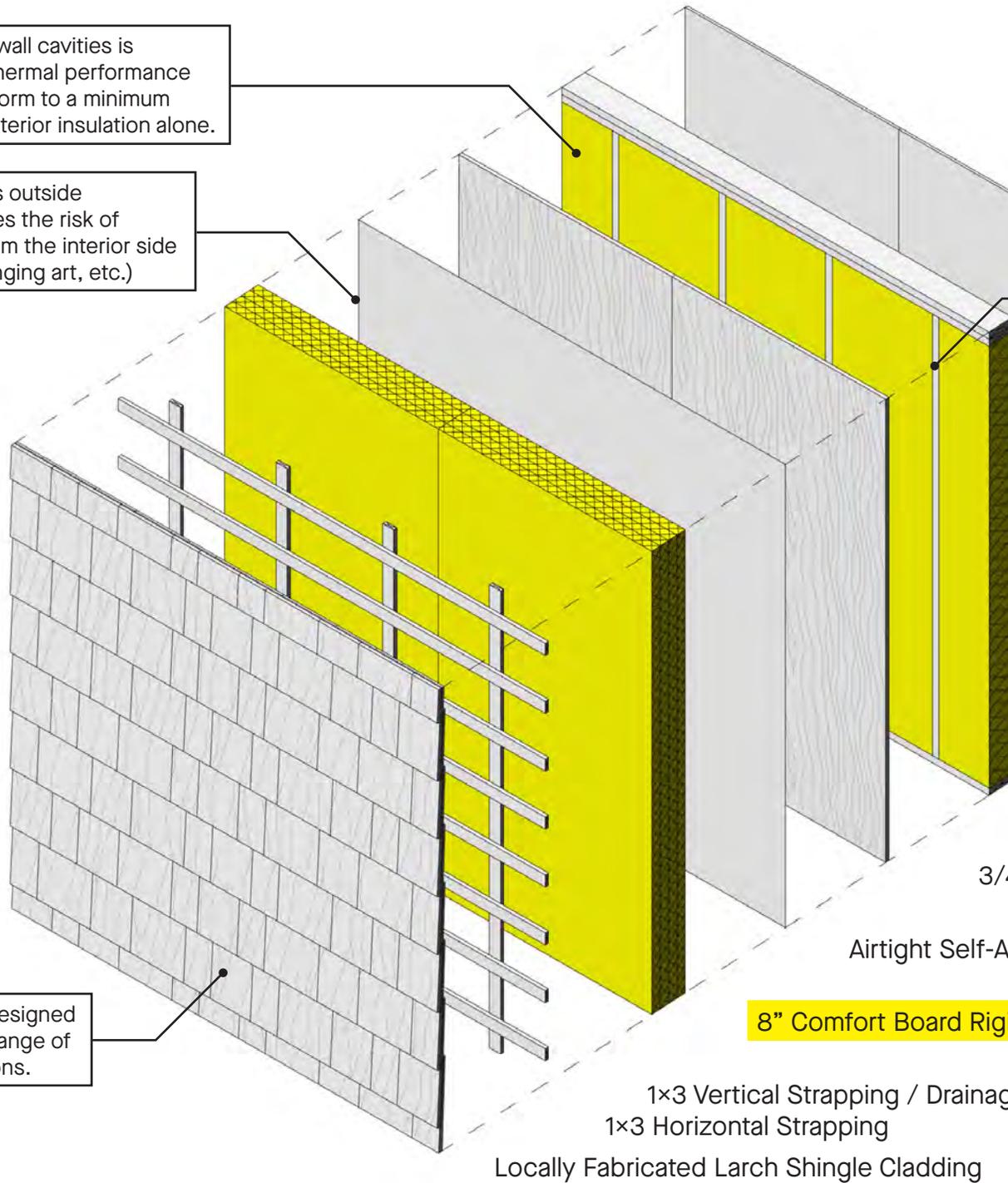
3.6 ACHIEVING A HIGH-PERFORMANCE ENVELOPE

The batt insulation in the wall cavities is redundant. It helps with thermal performance but the envelope will perform to a minimum standard relying on the exterior insulation alone.

Positioning all membranes outside the structural layer reduces the risk of accidental penetration from the interior side (electrical installation, hanging art, etc.)

The envelope system is designed to accommodate a wide range of lightweight cladding options.

EXTERIOR

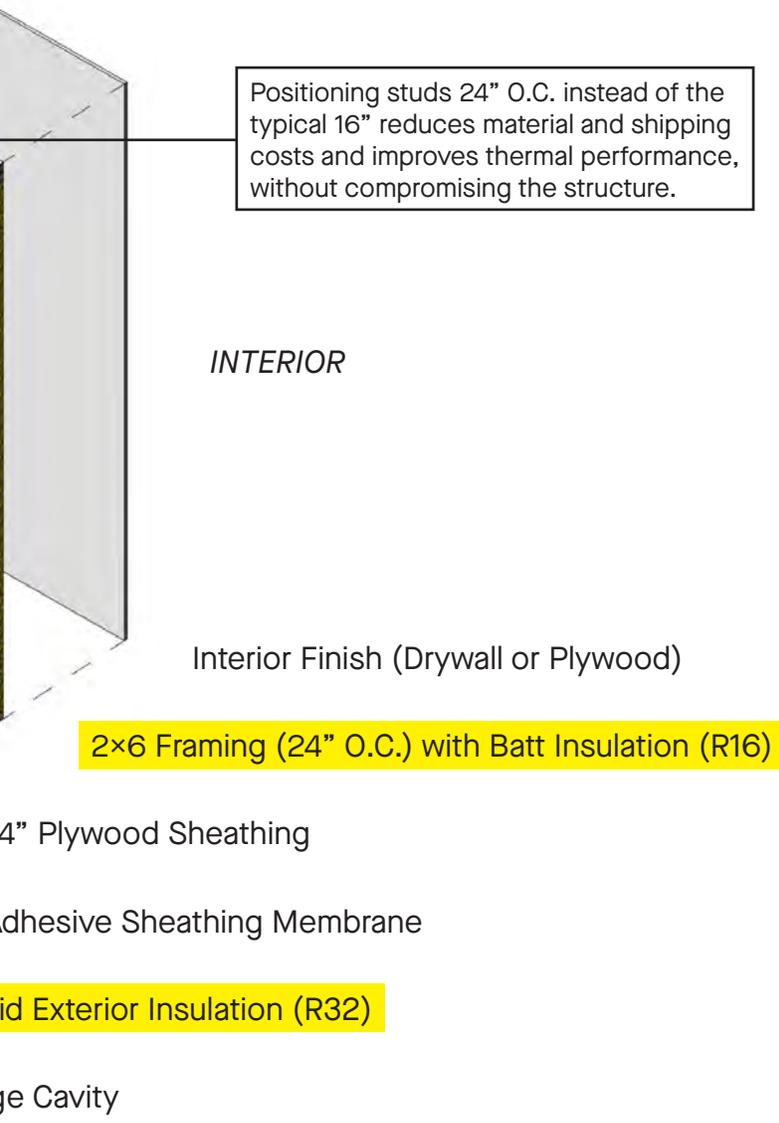


8" Comfort Board Rigid Insulation

1x3 Vertical Strapping / Drainage
1x3 Horizontal Strapping
Locally Fabricated Larch Shingle Cladding

The Resilient Duplex's exterior envelope is inspired by the principles of the Passive House movement. The envelope is airtight and superinsulated, with the goal of significantly reducing the amount of energy required to heat the interior. The air and vapour barrier and the bulk of the insulation is shifted to the outside the exterior sheathing, where it is less likely to be accidentally punctured in the course of construction or by the occupants later.

Instead of the typical vinyl siding, the Resilient Duplex uses locally fabricated tamarack shingles. Tamarack, also known as larch, is a common local tree that could be sustainably harvested and processed (using a portable sawmill) to create an attractive, durable cladding material that would connect the houses to their place. However, the design of the envelope can accommodate a wide range of lightweight cladding alternatives.

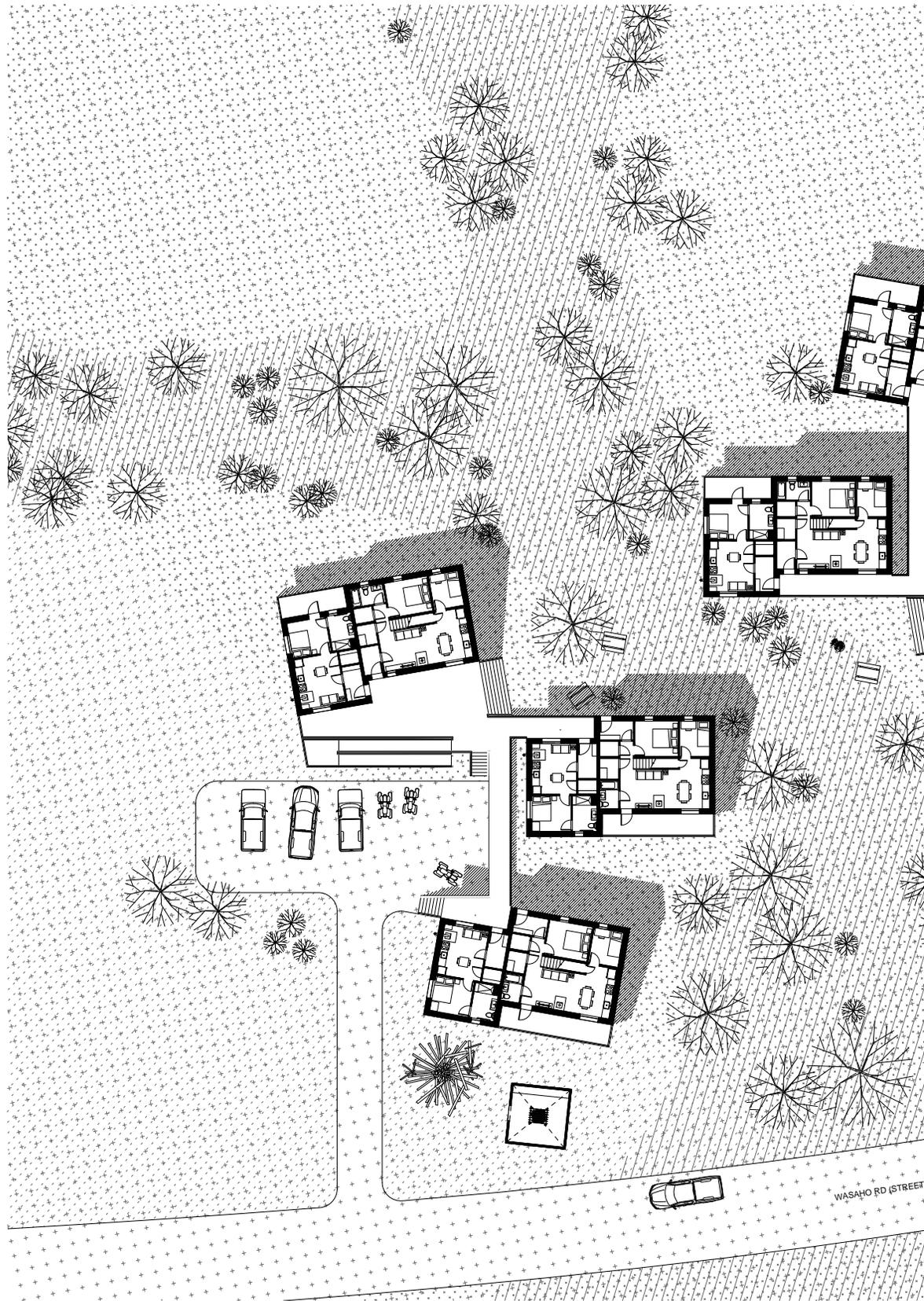


A stand of Tamarack trees (and a curious harp seal) visible from the Severn River just outside Fort Severn.



One of the oldest buildings still standing in Fort Severn is clad in shingles on its gable ends. The species of wood used here is unknown, but Tamarack shingles would weather to a similar silver.

4. DESIGN DEVELOPMENT DRAWING SET



1 SITE PLAN
A0.1 SCALE 1"=1/16"



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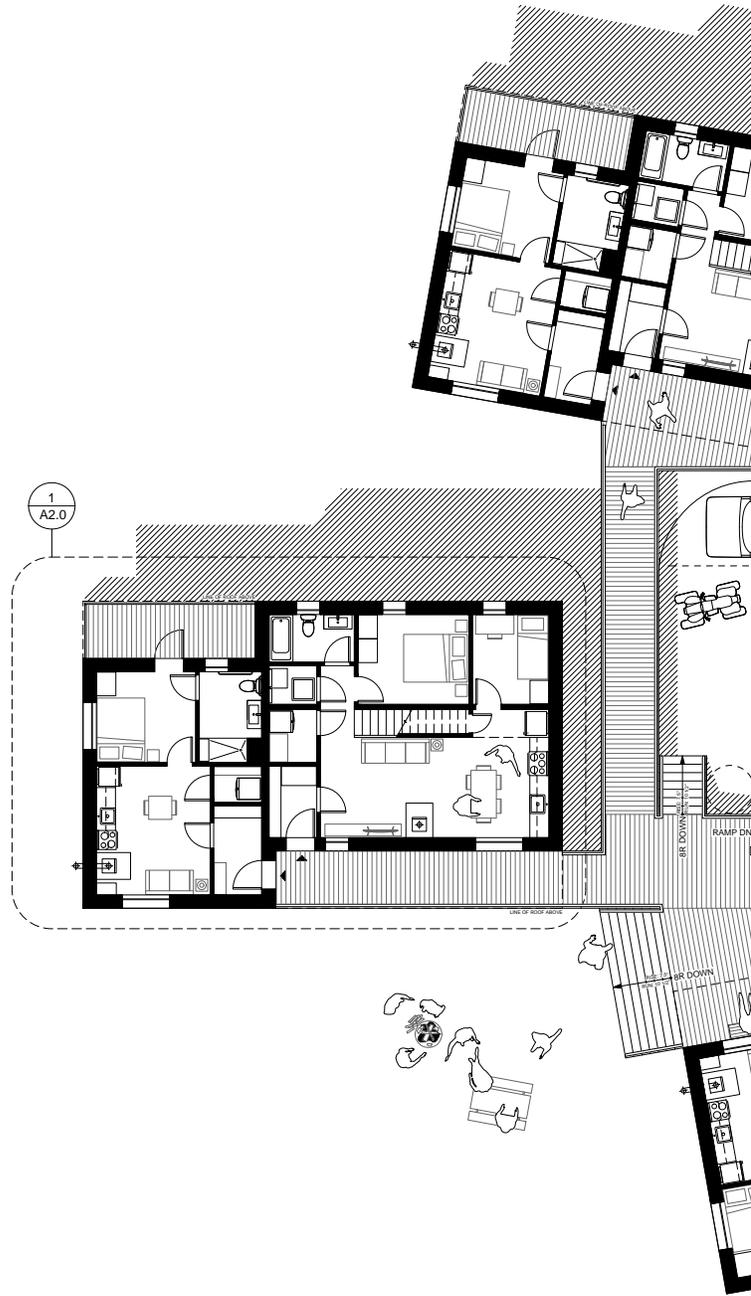
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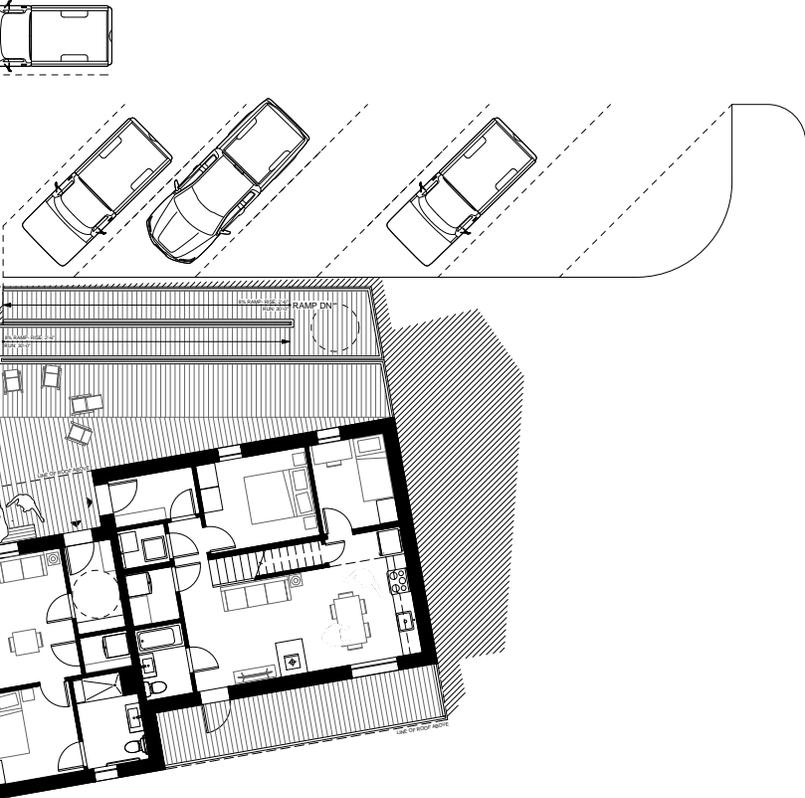
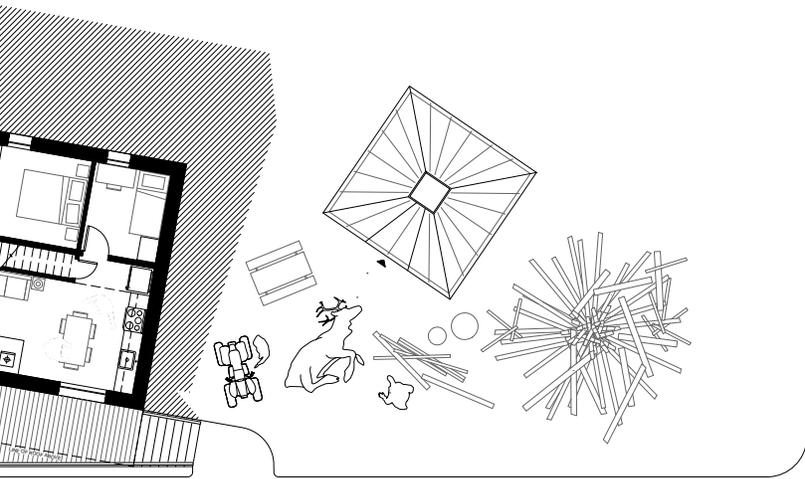
SCALE 1" = 1/16"
 PROJECT NO. 1853
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SITE PLAN

A0.1



1 MAIN LEVEL SITE PLAN
SCALE 1/8"=1'-0"



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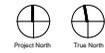
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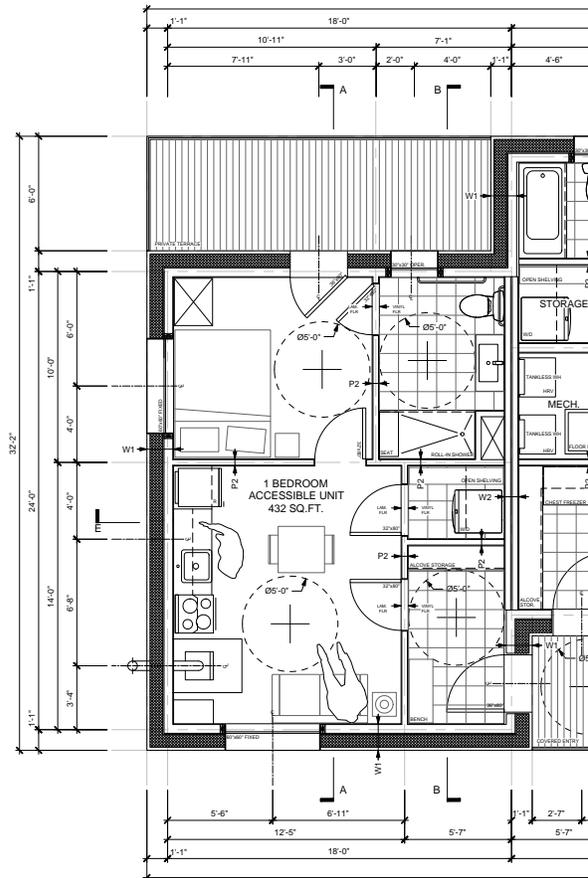
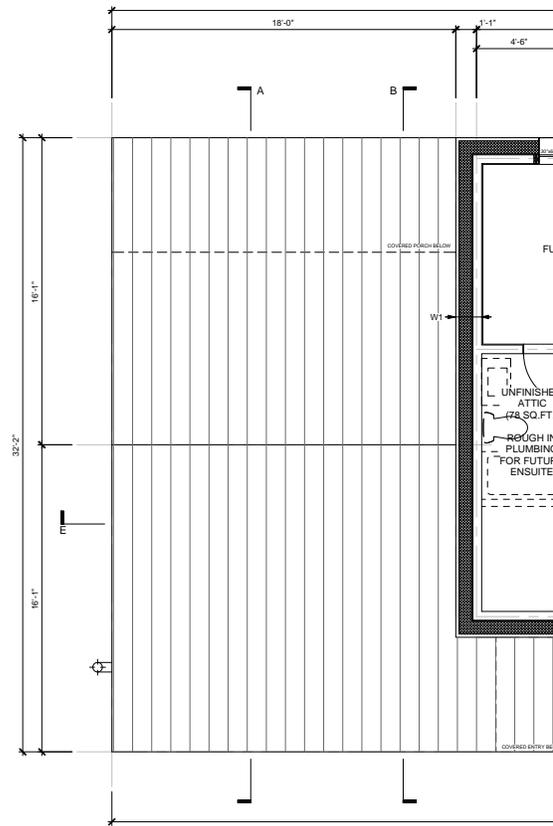
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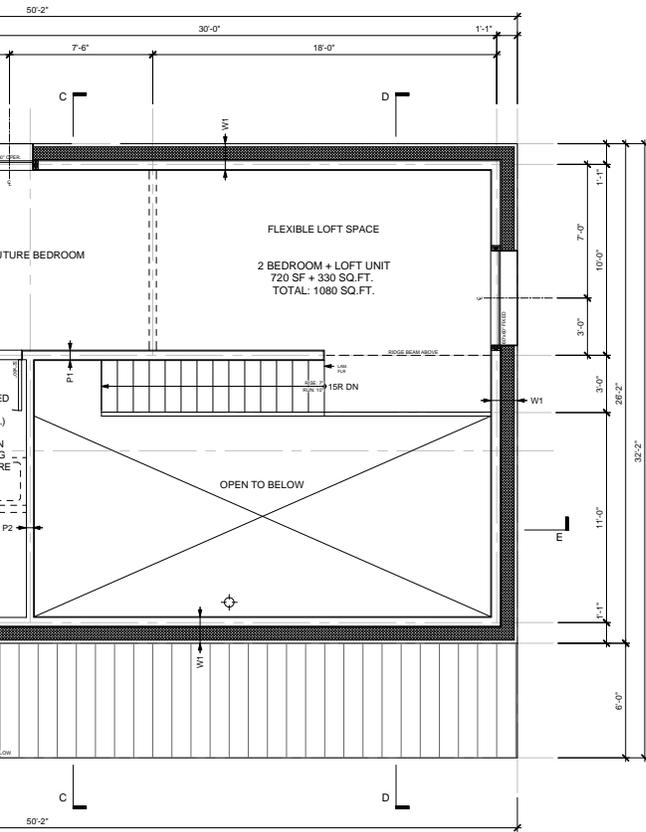


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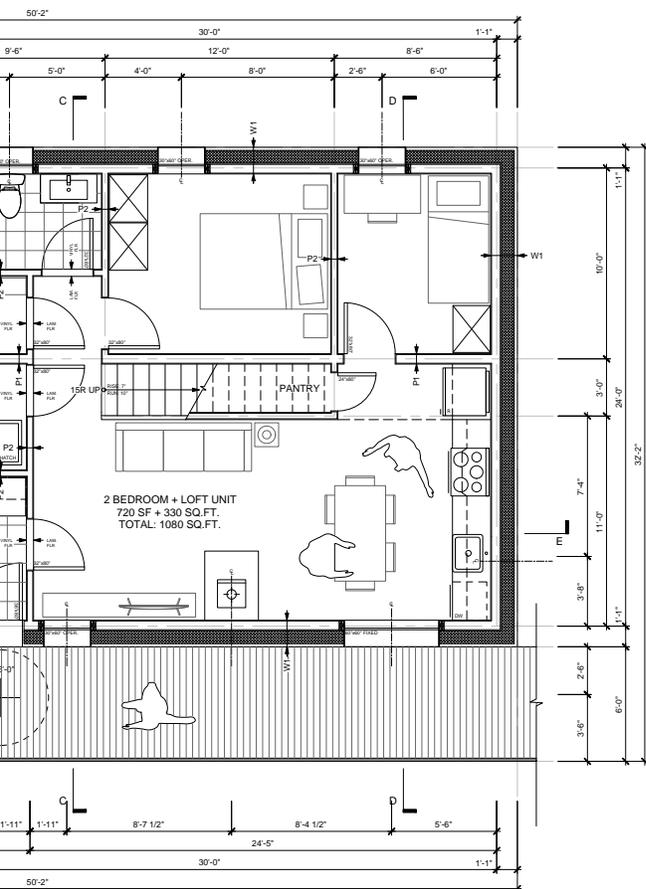
**THREE-MODULE
 SITE PLAN**

A1.0





2 SECOND LEVEL PLAN
SCALE 1/4"=1'-0"



1 MAIN LEVEL PLAN
SCALE 1/4"=1'-0"

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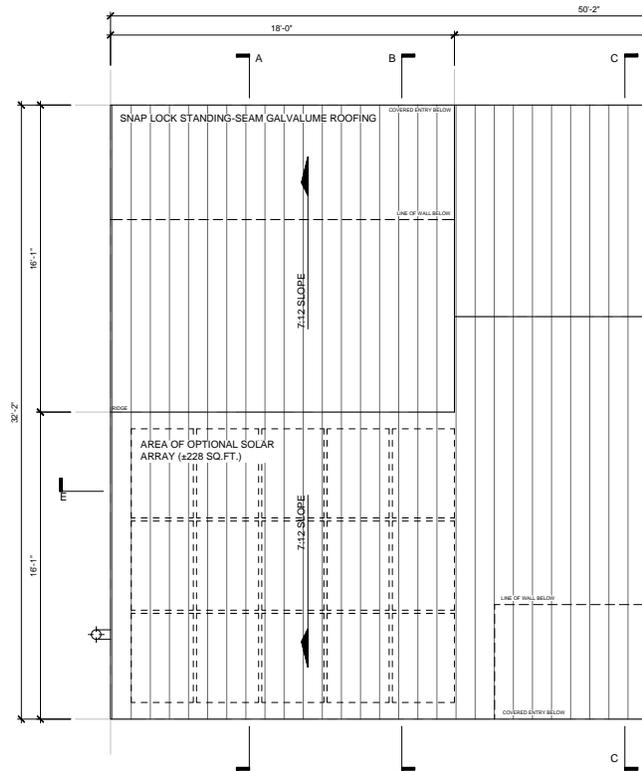
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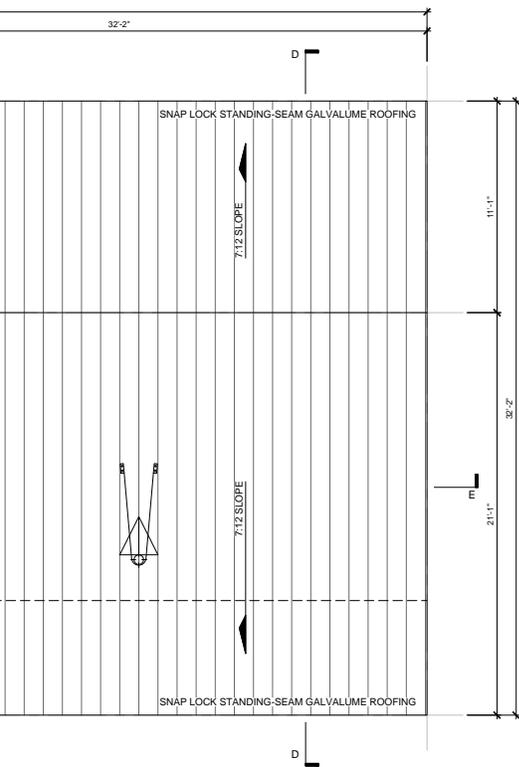
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**MAIN LEVEL AND
SECOND LEVEL FLOOR
PLANS**

A2.0



1 ROOF LEVEL PLAN
A2.1 SCALE 1/4"=1'-0"



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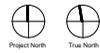
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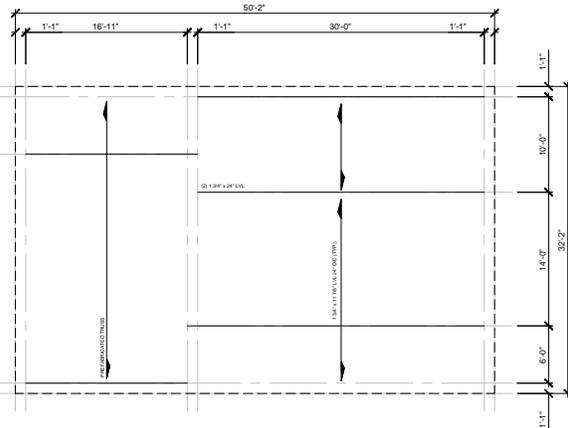
ROOF LEVEL PLAN

A2.1

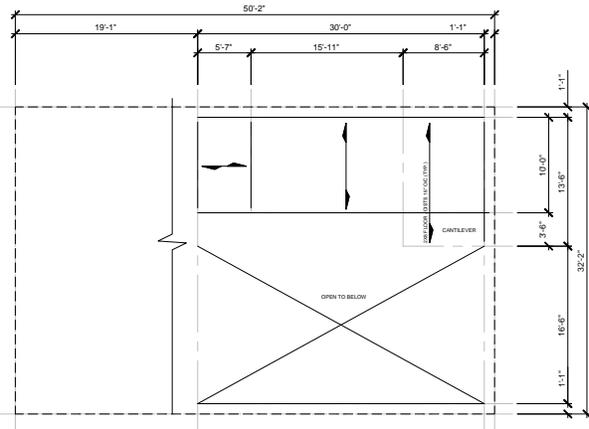


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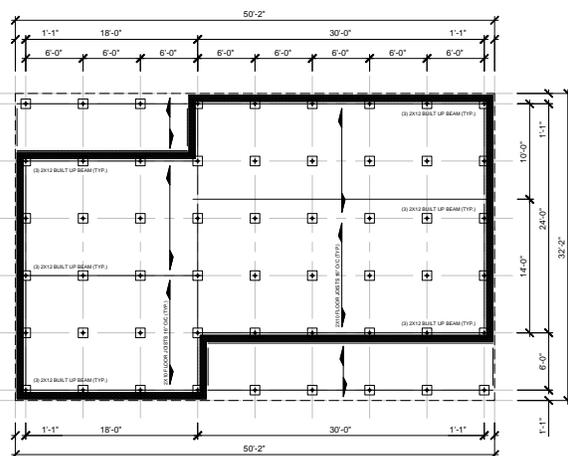
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3 ROOF FRAMING PLAN
 A2.2 SCALE 1/8"=1'-0"



2 SECOND LEVEL FRAMING PLAN
 A2.2 SCALE 1/8"=1'-0"



1 MAIN LEVEL FRAMING PLAN
 A2.2 SCALE 1/8"=1'-0"

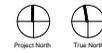
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Client Name
**NRCC PATH TO
 HEALTHY HOMES -
 FORT SEVERN
 FIRST NATION**

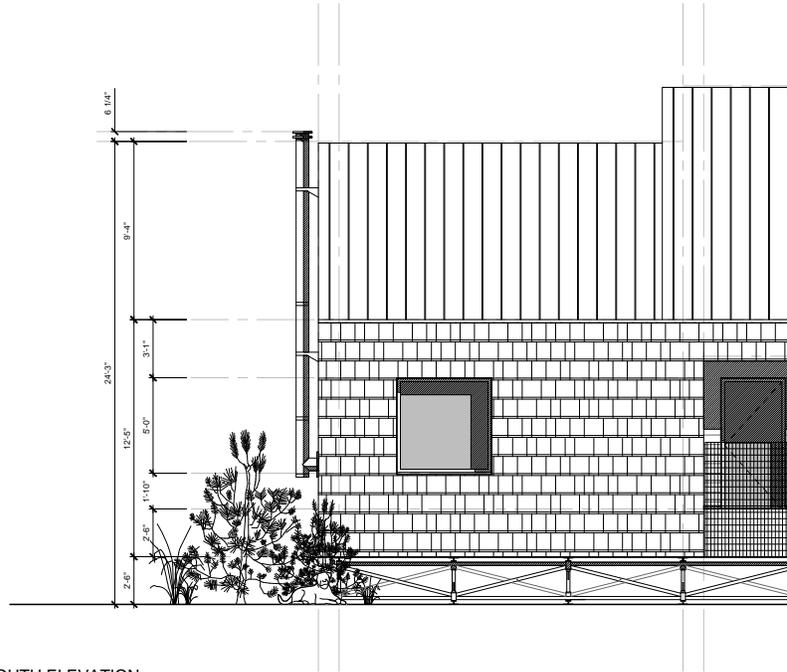
FORT SEVERN
 ONTARIO, POV 1W0



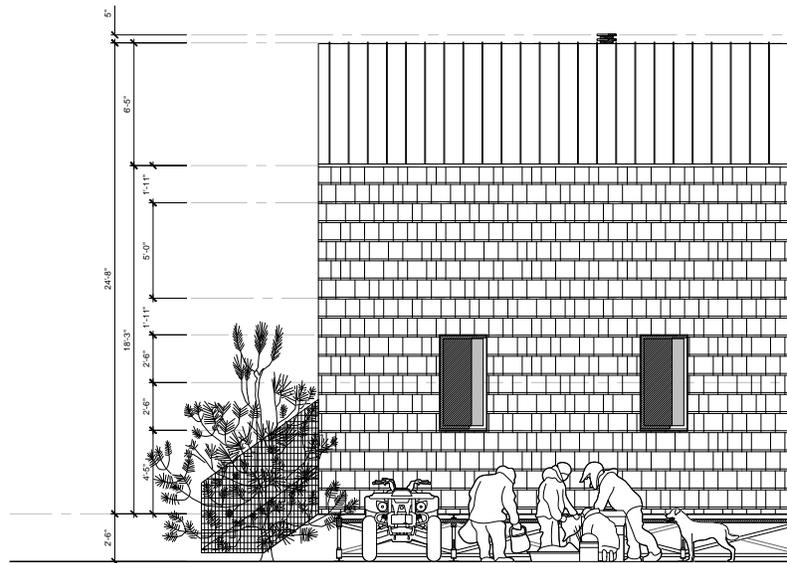
SCALE 1/8" = 1'-0"
 PROJECT NO. 1953
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**FLOOR
 FRAMING PLANS**

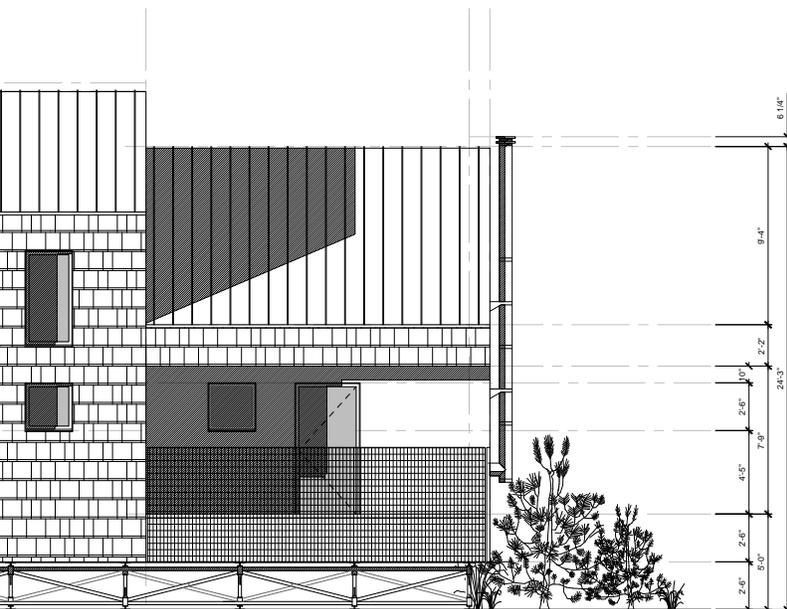
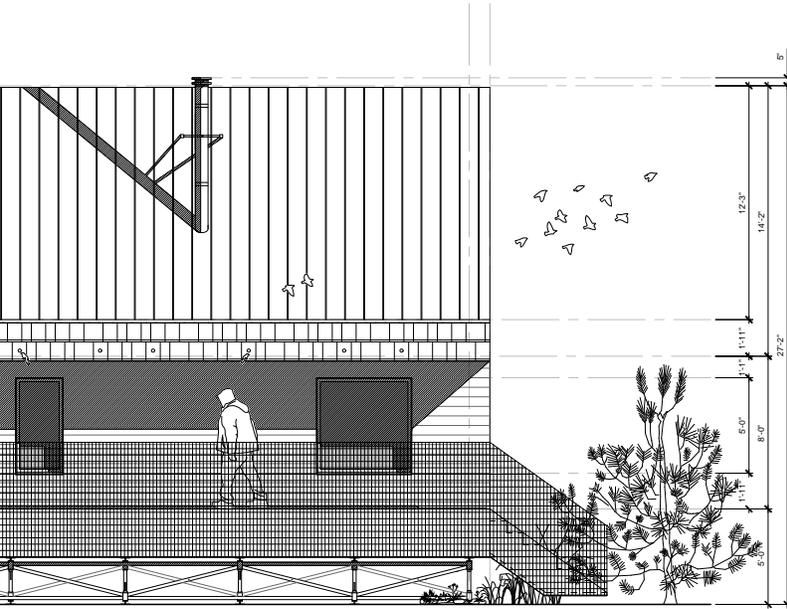
A2.2



1 SOUTH ELEVATION
A3.0 SCALE 1/4"=1'-0"



2 NORTH ELEVATION
A3.0 SCALE 1/4"=1'-0"



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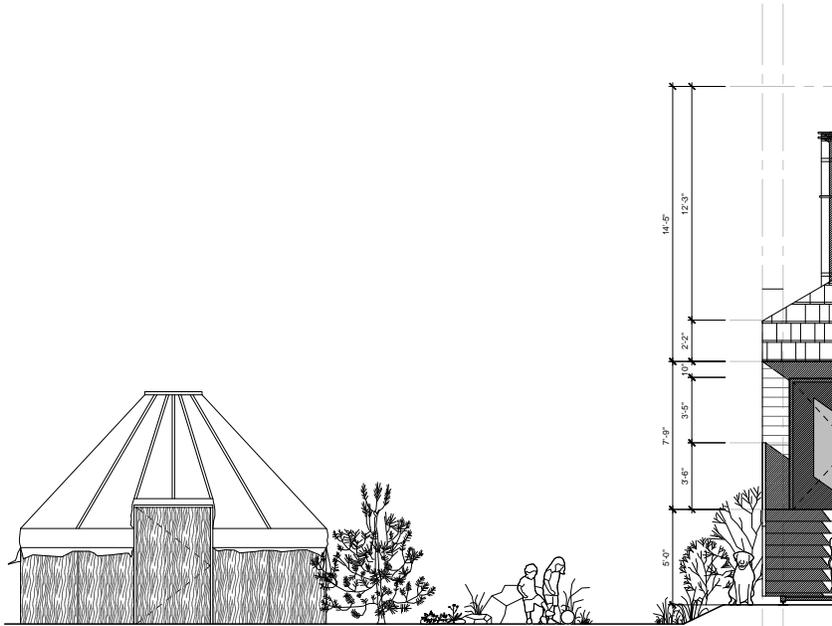
FORT SEVERN
 ONTARIO, POV 1W0



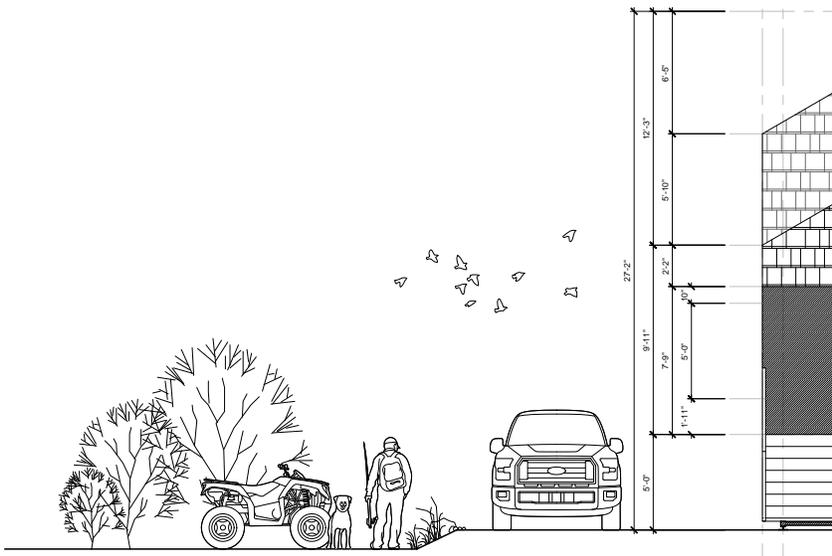
SCALE 1/4" = 1'-0"
 PROJECT NO. 1953
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ELEVATIONS

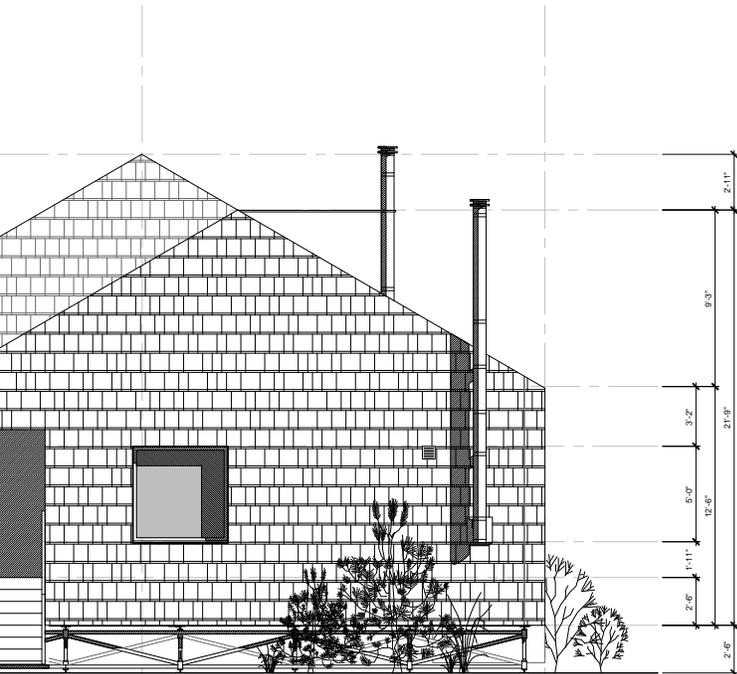
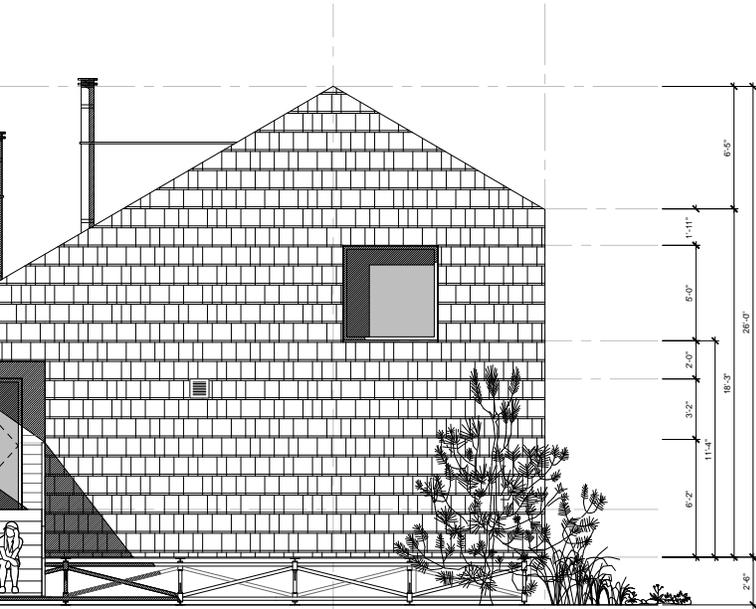
A3.0



1 EAST ELEVATION
A3.0 SCALE 1/4"=1'-0"



2 WEST ELEVATION
A3.0 SCALE 1/4"=1'-0"



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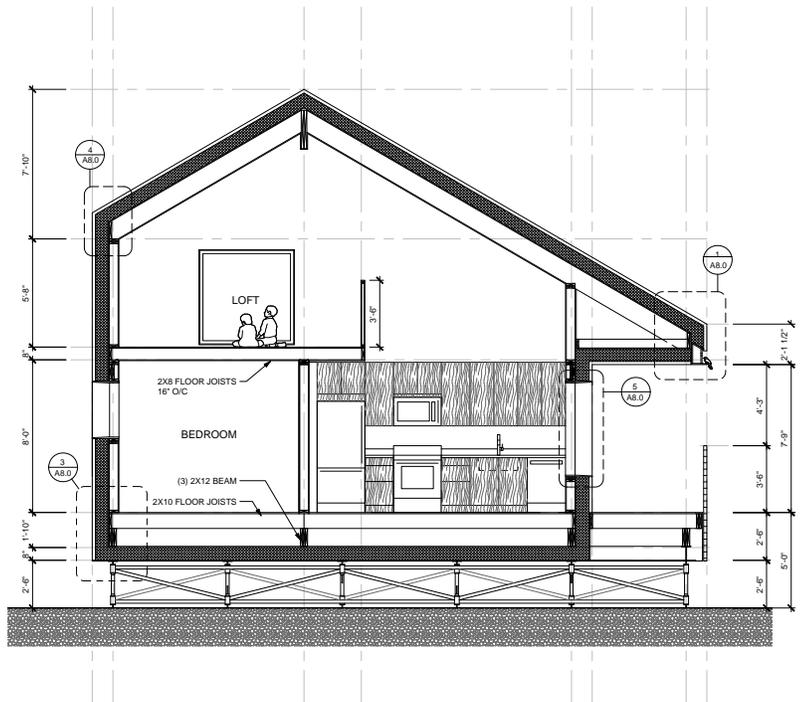
FORT SEVERN
 ONTARIO, POV 1W0



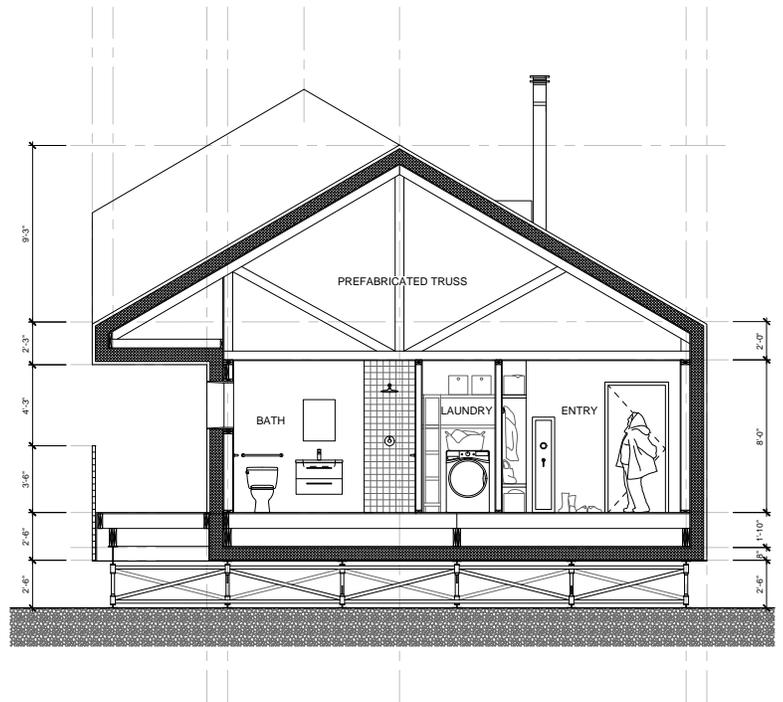
SCALE 1/4" = 1'-0"
 PROJECT NO. 1953
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ELEVATIONS

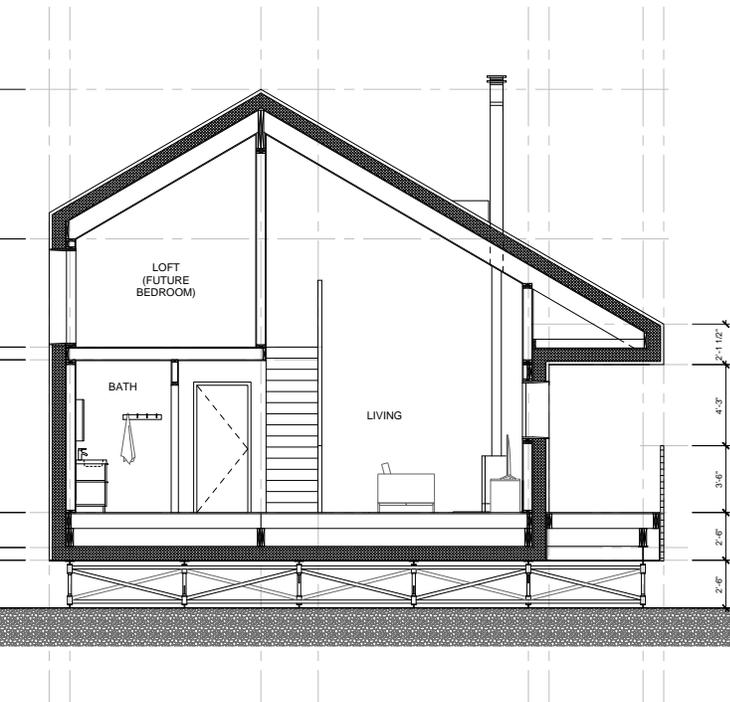
A3.1



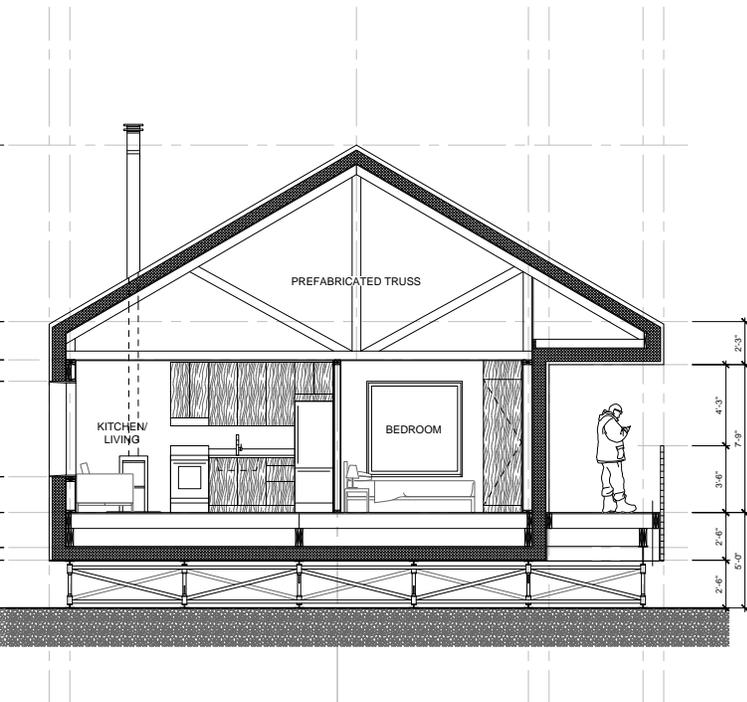
5 SECTION D
A4.0 SCALE 1/4"=1'-0"



2 SECTION B
A4.0 SCALE 1/4"=1'-0"



4 SECTION C
A4.0 SCALE 1/4"=1'-0"



1 SECTION A
A4.0 SCALE 1/4"=1'-0"

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Client Name
**NRCC PATH TO
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FORT SEVERN**

FORT SEVERN
ONTARIO, POV 1W0



SCALE 1/4" = 1'-0"
PROJECT NO. 1953
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SECTIONS

A4.0

1 BEDROOM
ACCESSIBLE UNIT
432 SQ.FT.

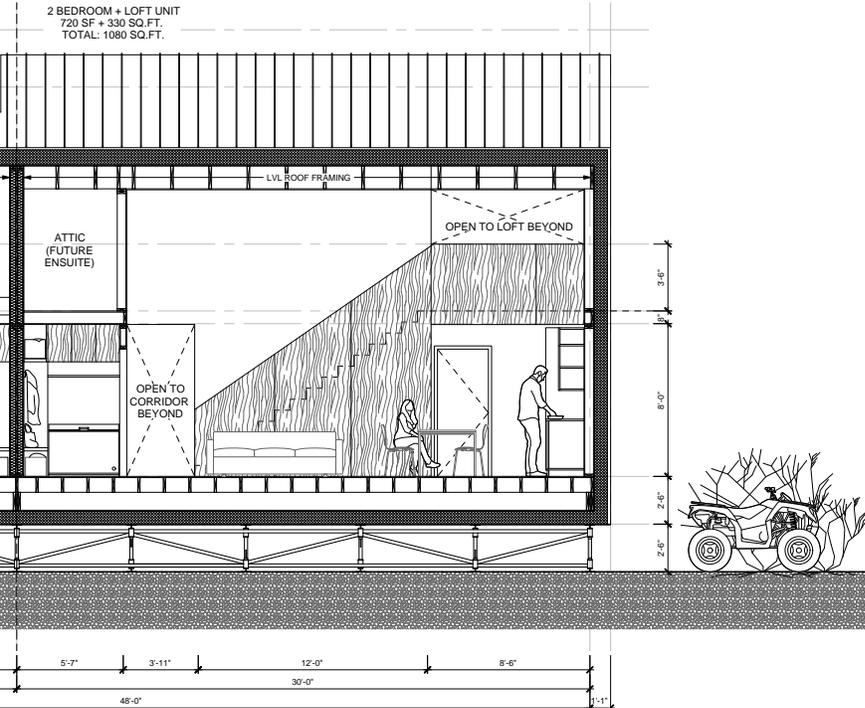


1 SECTION E
A4.1 SCALE 1/4"=1'-0"

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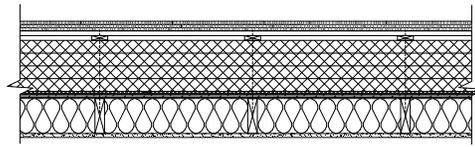
FORT SEVERN
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SCALE 1/4" = 1'-0"
 PROJECT NO. 1953
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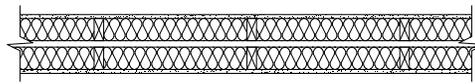
SECTIONS

A4.1



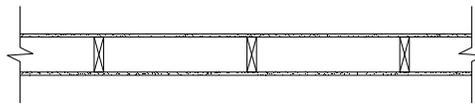
**W1 EXTERIOR WALL
2X6 24" EXTERIOR INSULATED (R48)**

TAMARACK SHINGLE SIDING
 1X3 STRAPPING (HORIZONTAL)
 1X3 STRAPPING/DRAINAGE CAVITY (VERTICAL)
 RIGID EXTERIOR INSULATION (8" COMFORT BOARD) R32
 AIRTIGHT SELF-ADHESIVE SHEATHING MEMBRANE
 3/4" PLYWOOD SHEATHING
 2X6 24" O/C FRAMING
 BATT INSULATION (R16)
 1/2" INTERIOR FINISH (GWB OR PLY)



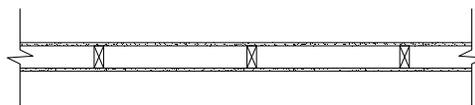
W2 ONE-HOUR FIRE SEPARATION

5/8" TYPE X GYPSUM BOARD
 TWO ROWS 2X4 WOOD STUD WITH 1" SPACE BETWEEN
 3 1/2" MINERAL WOOL INSULATION



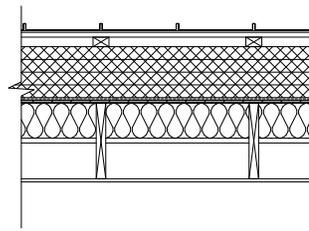
**P1 INTERIOR PARTITION WALL
2X6 24" O/C**

1/2" GWB OR PLYWOOD
 2X6 24" O/C FRAMING



**P2 INTERIOR PARTITION WALL
2X4 24" O/C**

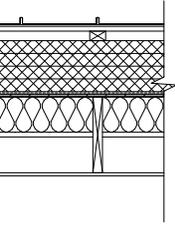
1/2" GWB OR PLYWOOD
 2X4 24" O/C FRAMING



ROOF - 7:12 SLOPE (MIN R48)

PRE-FORMED SNAP LOCK STANDING SEAM GALVALUME CLADDING
 1X3 STRAPPING (HORIZONTAL)
 2X3 STRAPPING/DRAINAGE CAVITY (VERTICAL)
 RIGID EXTERIOR INSULATION (8" COMFORT BOARD) R32
 AIRTIGHT SELF-ADHESIVE SHEATHING MEMBRANE
 3/4" PLYWOOD SHEATHING
 STRUCTURE (1" 3X4" X 7'8" LVL 24" O/C OR TRUSS 24" O/C)
 BATT INSULATION (MIN 5 1/2" R16)
 1/2" INTERIOR FINISH (GWB OR PLY)

1 WALL AND ROOF ASSEMBLIES
 SCALE 1"=1'-0"



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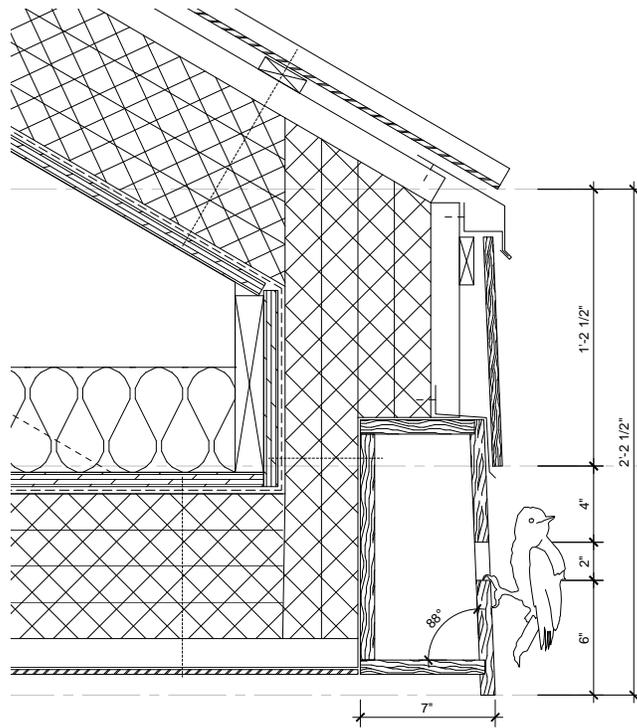
FORT SEVERN
 ONTARIO, POV 1W0



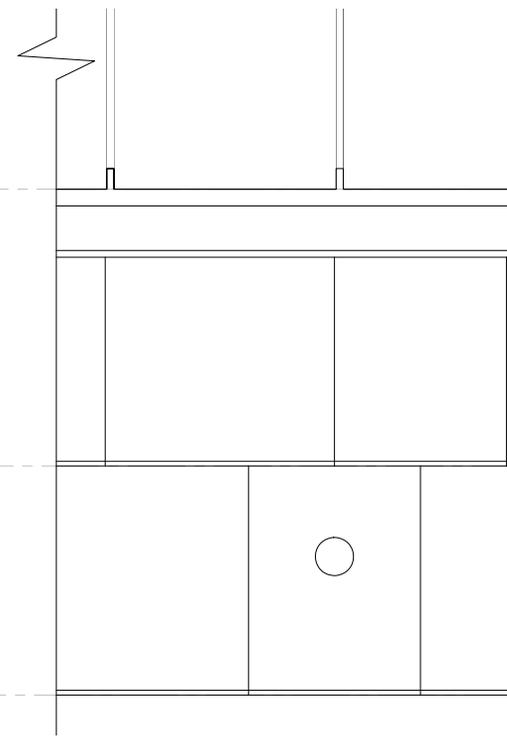
SCALE AS INDICATED
 PROJECT NO. 1953
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**WALL AND ROOF
 ASSEMBLIES**

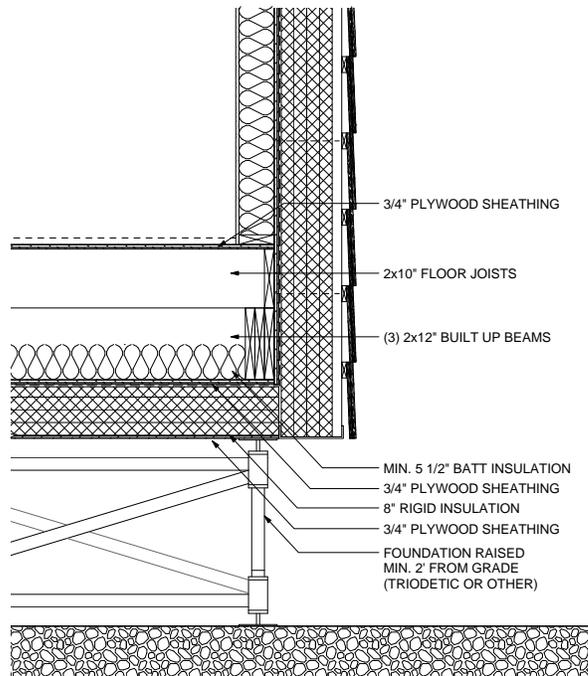
A7.0



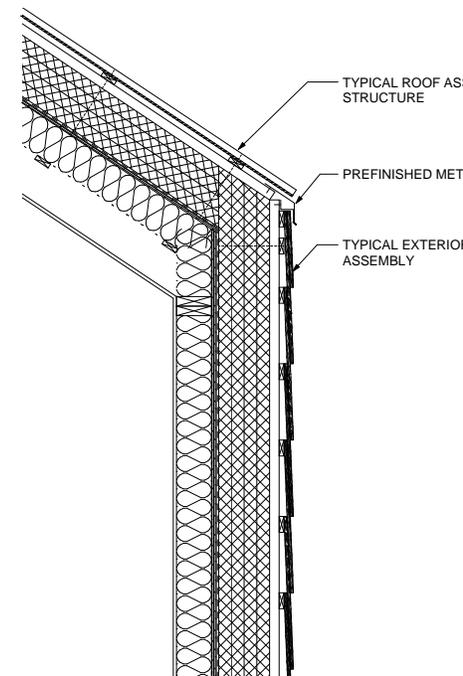
1 BIRDHOUSE SHINGLE
SCALE 3/4"=1'-0"



2 BIRDHOUSE SHINGLE ELEVATION
SCALE 3/4"=1'-0"



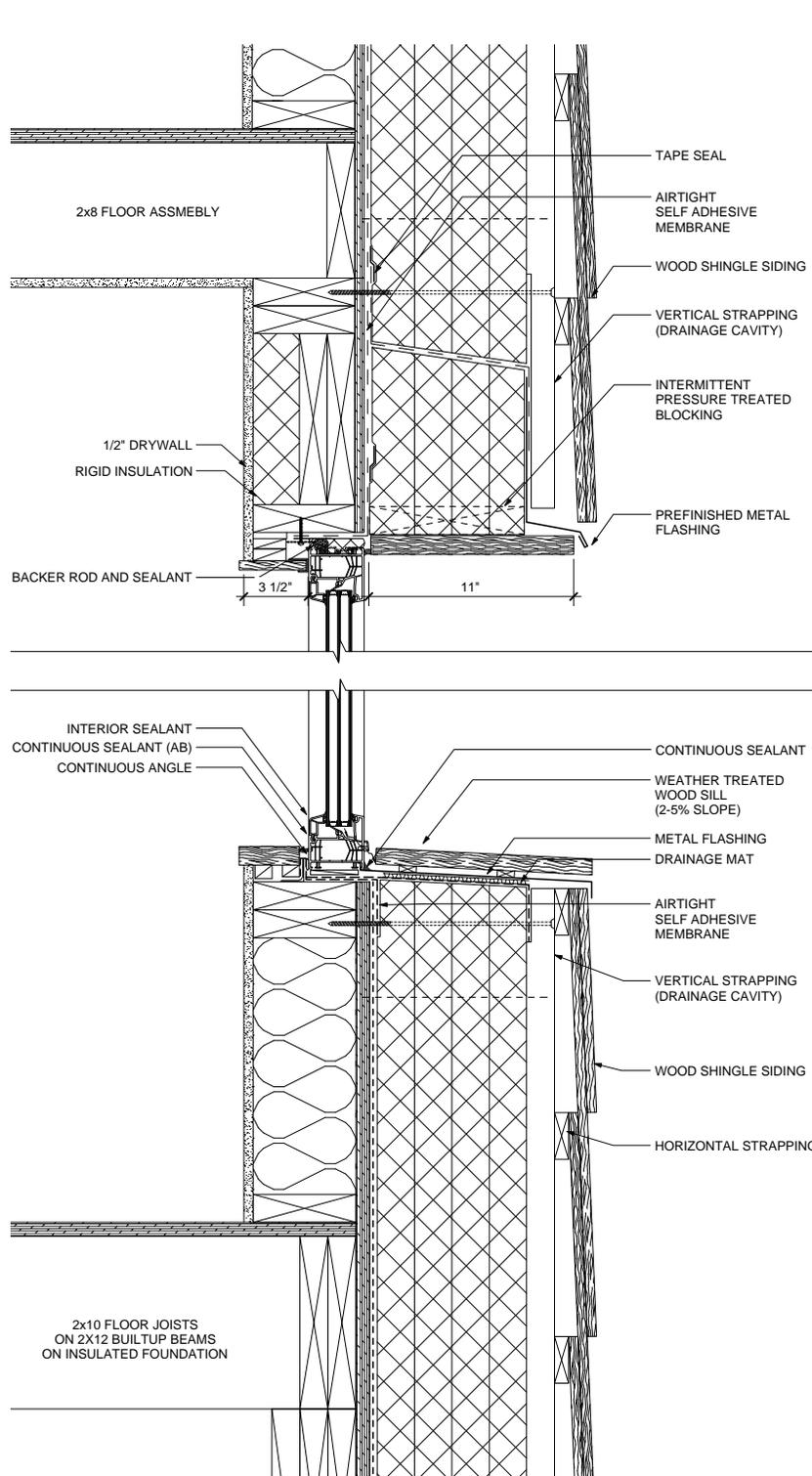
3 DETAIL AT FOUNDATION
SCALE 1/4"=1'-0"



4 ROOF TO WALL DETAIL
SCALE 1/4"=1'-0"

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DETAILS

A8.0

5 WINDOW DETAILS
 A8.0 SCALE 3/4"=1'-0"

