Noatak Water Treatment Plant

ANTHC-09-D-52948

Site & Facility Assessment Report

October 25, 2009
100% DRAFT

PREPARED FOR: Alaska Native Tribal Health Consortium
Division of Environmental Health & Engineering
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Anchorage, Ak 99508

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1.0 INTRODUCTION

The Noatak Water Treatment Plant was constructed in 1995. In the past five-years the plant foundation has exhibited settlement indicative of soil destabilization. On 09/22/2009 a structural assessment team visited the site to investigate the extent of settlement and determine the cause of the destabilization. The assessment team consisted of Danny Graham PE, Structural Engineer from Larsen Consulting Group (LCG) and Ed Yarmak, Arctic Foundations, Inc. Representing the plant was Paul Walton, Plant Operator for Noatak.

Noatak is a community of 512 residents (2008 estimate) comprised of approximately 100 occupied homes. The community is served by a piped, recirculation water and sewer distribution system connected to 77 homes, the school and businesses in Noatak. The remaining homes cannot use the service due to lack of plumbing. The community does not have a washeteria.

Figure 1. Water Treatment Plant Location (#1 – Water Treatment Plant; #2 Water Storage Tank; #11- Power Plant & Fuel Tank Farm)

This report provides the following information:

- A contour elevation diagram of the plant floor illustrating the existing settlement with accuracy to +/- 0.25 inches.

- An evaluation of the integrity and performance of the existing thermosyphons, including pressure measurements and an estimate of the impact of buried or drifting snow upon their effectiveness (addressed in the aforementioned Chuck Eggener report).

- A forecast of consequent settlement to the facility if no action is taken to stop the existing building settlement and soil destabilization.

- An opinion of how the plant structure and process systems will be affected if no action is taken to stop the existing building settlement and soil destabilization.

- Alternatives and recommendation to stabilize the foundation with the goal of extending the plant's useful life by 20 years or more.

- Alternatives and recommendations for required repairs or adjustments to the plant's structural components with the goal of extending the plant's useful life by 20 years or more.

- Alternatives and recommendations to repair or adjust the plant's piping and equipment to enable reliable treatment and distribution operations for 2 years or more.

- Cost estimates for the three aforementioned alternatives to extend the plant's useful life.

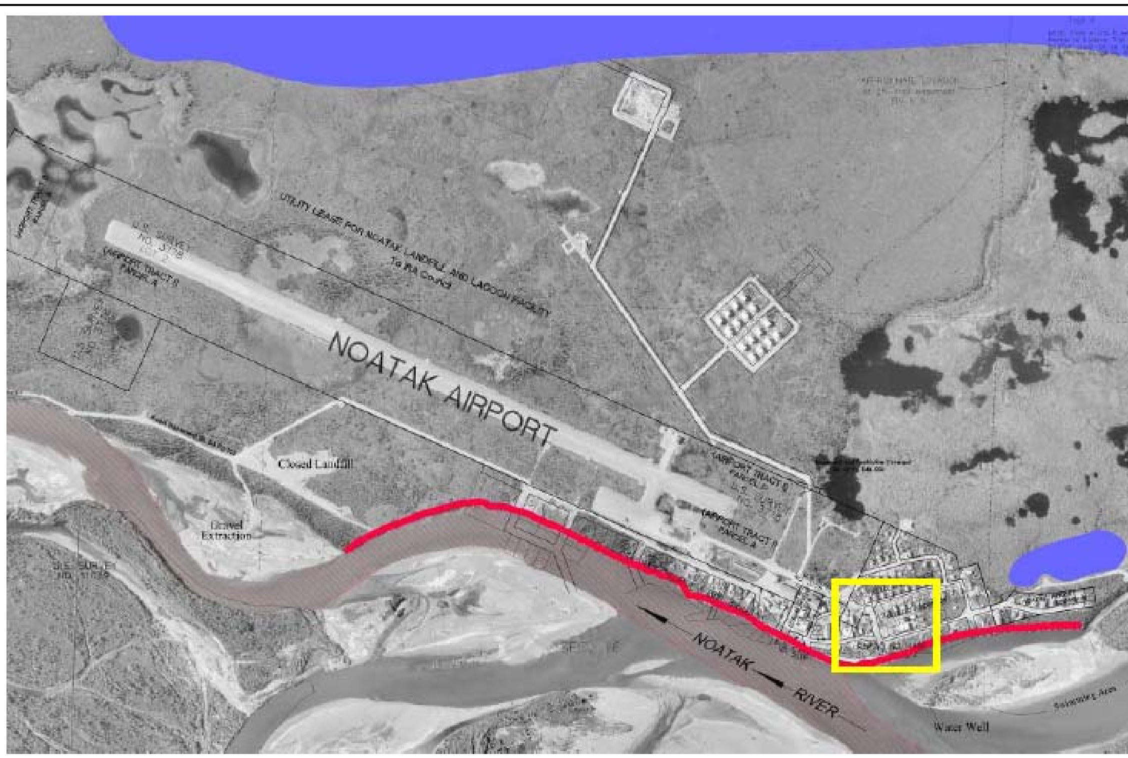


Figure 2. Noatak Community (Figure 1 area outlined in yellow).

2.0 FACILITY FINDINGS

2.1. FACILITY / SITE DESCRIPTION

The Noatak Water Treatment Plant is located in the community core near the power generation facility and community store. The plant is located below the horizontal plane of the Water Storage Tank and above the horizontal plane of Main Street. Water flows into the plant from the storage tank via a 4”. HDPE supply line encased in arctic pipe. The water is filtered and chlorinated then distributed to the community via three supply manifolds exiting the rear of the plant below grade. The supply manifolds pass through the plant’s concrete floor into 4”x12” . arctic pipes. Each supply line has a corresponding return line as part of the recirculation system.

Constructed in 1995, the 36’ x 72’ plant was designed as a conventional wood framed building placed upon a concrete slab oriented in a north-south direction along its long axis.. The plant is segregated into two activities. The South end of the plant is used as a maintenance facility. The North end of the plant houses the water treatment system.

When constructed, the soils under the plant were frozen. This soil condition was maintained by providing 10 thermosyphon condensers spaced 8’ oc along the west wall of the plant. The condensers fins are spaced 2-feet from the wall and start about a foot and a half from the ground. The thermosyphons pass vertically beneath the condensers’ until they are under the subgrade insulation, then slope to the east wall perimeter at a 5% slope. Along most of the foundation, the thermosyphons ran the entire width of the building. However, where the treated water supply manifolds exit the building, the thermosyphons terminated at this point of supply line exit.

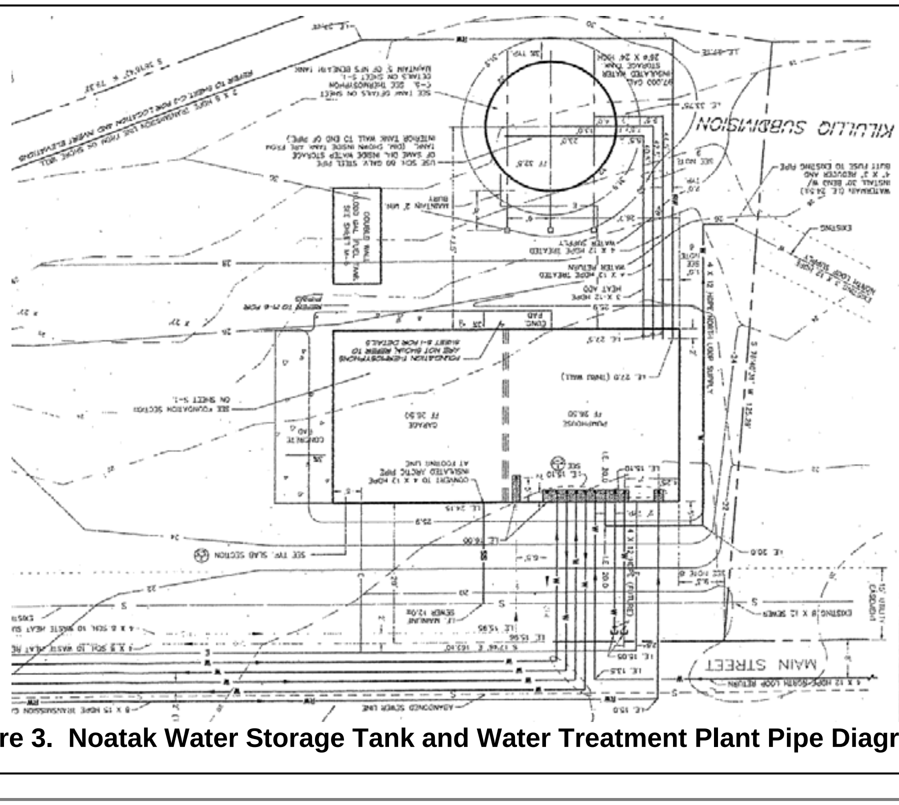


Figure 3. Noatak Water Storage Tank and Water Treatment Plant Pipe Diagram

In addition to the water process system, the plant utilizes waste heat system for environmental control. This system encompasses insulated water lines entering the plant to circulated tempered water from the power generation plant.

2.2. CURRENT STRUCTURAL/FOUNDATION DEFICIENCIES

The building, over the past 5-years has slowly exhibited instability of subsurface soils due to thawing of the permafrost. This has caused the building to settle along its eastern perimeter wall that is most pronounced in the northeastern corner. In the Northeast corner of the building the tensioning brace is deforming the connection indicating the building's wall system is essentially supporting the concrete foundation in the location through the tension rods.

The supply manifolds have also settled toward the concrete slab floor indicating the subsurface soils supporting the arctic pipe are destabilizing. Outside the east wall the gravel bed of cover material (covering the supply/return lines from the plant to the community) also exhibits depressions indicating permafrost thawing in the subsurface soils. These depression may extend to areas under the concrete floor.

The remainder of the facility appears to be structurally sound. A contour elevation diagram for the plant floor illustrating the settlement of the eastern perimeter wall is enclosed.

2.3. INTEGRITY & PERFORMANCE OF EXISTING THERMOSYPHON SYSTEMS

The thermosyphons were evaluated by Ed Yarmak, Arctic Foundations, Inc. The internal pressures were measured with a 0-600 psi gauge from Wika. Using the relationship for pressure vs. temperature for saturated CO_2, the temperature of the liquid/vapor interface was computed. This computed temperature approximates the liquid pool at the lower end of the thermosyphon evaporator. Measured thermosyphon pressures varied from 480 psig to 495 psig and correspond to temperatures of 30.6-degrees (F) and 32.6-degrees (F) respectively. A complete list of measured pressures and corresponding temperatures is attached.

The computed temperatures are warmer than expected for an installation of this type. The anticipated temperature should range from 26-28-degrees (F). Several factors are thought to be contributing to this deviation.

First, snow drifts along the plant's west wall and settles around the thermosyphon condensers. Approximately half of the condenser surface area is being covered by drift snow resulting in a 30% decrease in thermosyphon efficiency.

Second, rainfall runoff from the plant roof infiltrates the foundation soil along the perimeter of the east and west walls. Thawed Noatak gravel is well draining material and water flow is more likely to drain into, rather the over, the grave base upon which the plant rests. Along the west wall perimeter, the rainwater infiltrates the subsurface soil and passes underneath the foundation slab. This rainfall is providing a heat load that impacts the stability of the subsurface soils (i.e. thawing of frozen soils).

Third, the original design specified the area around the plant to be covered with fine soils and vegetated. The south and west grounds surrounding the plant are vegetated. However the north and east grounds are not. This unseeded area is allowing the exposed gravel to absorb radiant heat from the sun and contribute to subsurface soil instability. The measured thermosyphon temperatures at the northern end of the building reflect a higher temperature supporting this finding.

Finally, the subgrade insulation board was originally designed to extend beyond the east building line to provide further insulation of the circulating supply lines and, in conjunction with vegetating the slope, protect against solar radiant heat. It is likely the lack of this insulation is contributing to the heat loading of the surrounding subsurface soils.

Figure 4. Thermosyphons along West Wall (Looking South & North)

Although the thermosyphon system is impacted, it is operating as designed. The units continue to function when the evaporator temperature is above 60°F. There is no 'setpoint' for thermosyphon operation to start at 32°F. Rather, these thermosyphons move heat against gravity whenever the upper portion of the unit (Typically the condenser) is colder then the lower portion of the unit (typically the evaporator). When the air temperature is below the evaporator temperature, the thermosyphon will release heat to the air and the evaporator temperature will rapidly equilibrate along its length.

2.4. IMPACT OF WASTE HEAT CIRCULATION LINES UPON PLANT FOUNDATION

Another source of heat upon the plant subsoils to consider consists of the tempered water circulating between the community power generation plant and the water treatment plant. The water line is encased by 4x8 arctic pipe to insulate the ground from heat transfer from the tempered water. According to the plant operator, the amount of waste heat circulating through the plan has gone down since the new school was built. The pipe enters the plant above the exterior grade, so it is unlikely to be adding to the heat load of the plant foundation. It would be a contributing factor if the line is leaking water along its joints near the plant foundation. This leak of tempered water, in conjunction with the graveled soil characteristics, could contribute to the heat load of the foundation. The circulation lines would need to excavated along a 20-foot length extending from the entry point to the plant to confirm leakage.

Figure 5. Waste Heat Circulation Line at Water Treatment Plant

2.5. FORECAST OF CONSEQUENT SETTLEMENT TO THE FACILITY

The plant foundation will continue to deteriorate if the subsurface soil is not stabilized. The contributing heat loading factors discussed in paragraphs 2.3 and 2.4 will cause further thawing of the permafrost and destabilization of the soils underneath and surrounding the plant's foundation and perimeter walls. If left unchecked, the foundation will continue to settle, especially along the northern and eastern walls causing further settlement.

The destabilization likely began upon completion of the facility. However, based upon the plant operator's knowledge, the subsurface destabilization has presented itself over the past 5-years in the form of foundation and process system settlement. In this period, the floor in the northeast corner has settled approximately 4-inches. The process system, specifically the water supply/return manifolds have settled 4-6 inches. This rate of settlement (1-inch per year) is likely to accelerate as more of the permafrost melts) Eventually, this settlement will further affect other structural components of the plant's wall and roof system that could result in an eventual failure of one or more components.

2.6. IMPACT UPON THE PLANT STRUCTURE AND PROCESS SYSTEMS

The major impact that will likely present itself first is the failure of the water supply and return lines where they connect to the manifolds inside the plant. The manifolds were designed to connect to the supply line (4"x12" HDPE encased in arctic pipe) approximately 8-inches above the concrete floor surface inside the plant. Most of the manifolds have settled to the point where these connections are close to, or resting upon, the concrete floor. If this settlement continues, these connections will fail.

The next impact will be upon the concrete floor and perimeter wall foundation. The northeast corner of the perimeter wall has already settled up to 4-inches. Floor cracks within the plant along the building midpoint indicate the entire eastern half of the building is settling. Eventually, this continued settlement will cause damage and potential failure to the plant's roof system and foundation walls along the north and south faces.

3.0 ALTERNATIVES & RECOMMENDATIONS

3.1. RECOMMENDATIONS TO STABILIZE THE FOUNDATION, STRUCTURAL COMPONENTS, AND PIPING/EQUIPMENT

The immediate corrective action that must occur is halting the destabilization of the subsoil below the foundation. This single action should stop the settlement of the plant's foundation and water supply/return lines. Stabilizing requires returning the subsoil to a constant frozen state. To accomplish this, the following work must be performed:

- Rainwater Heat Load- Divert roof rainwater runoff away from the foundation. This will require installing gutters along the eaves of the roof divert runoff to drainpipes at grade that lead away from the plant foundation.

- Rainwater Heat Load – Divert rainwater runoff from the Water Storage Tank to flow away from the plant. This will require grading the ground between the tank and plant and possibly installing a 6-inch culvert to Onalik Street (to the south of the tank and plant).

- Extending the East wall Perimeter insulation. Extend the existing EPS insulation under the concrete pad to 6' beyond the foundation perimeter wall. This will require excavating below the concrete pad to emplace 4-inches of rigid EPS foam board.

- Solar Radiant Heat Load-Topsoil and vegetate the ground along the north and east perimeter walls. This will require approximately 40-cubic yards of soil to place a 6-inch layer of soil extending 20-feet from the perimeter wall.

- Snowdrift Impact- The thermosyphons along the west wall should be extended to raise the condensers above the annual snowdrift line. This may require angling the thermosyphons at a 45-degree angle to enable the condensers to extend beyond the roof line.

It is not necessary to re-level the building at this time. The existing settlement is not adversely impacting the structural integrity of the building. However, the settlement of the water supply/return manifolds must be corrected. Any further settlement of these manifolds risks a line failure at the manifold connection. Two alternatives for accomplishing this work are:

- Extend the HDPE pipe passing through the concrete floor to a height that returns the manifold connections back to their design height (approximately 8-inches above the floor line). This will require removal of approximately 40-square feet of concrete floor and all the materials normally required to form a connecting between two similar HDPE pipes. In lieu of pouring new concrete to fill the channel created around the manifolds, it should be filled with rigid EPS foam board. This will eliminate future risk to the connections should the pipes settle.

- Reroute water lines through the wall as opposed to through the floor to remove any contributing heat load radiating from the insulated pipes or from water leaks.

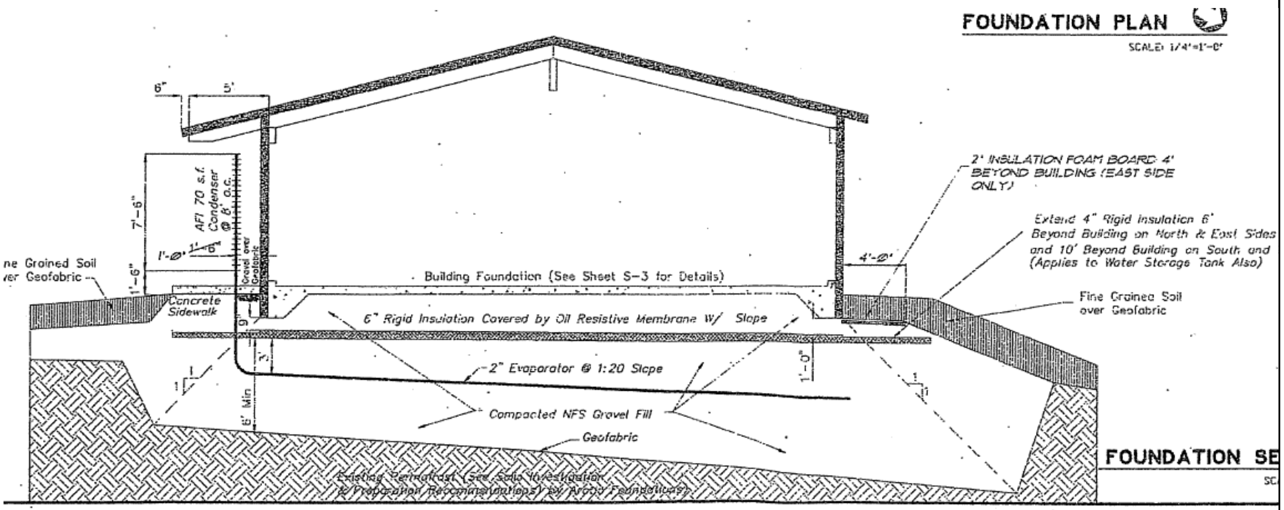


Figure 5. Illustration of Plant Foundation as Designed

3.2. ALTERNATIVES TO RECOMMENDATIONS

Most of the alternatives presented are used to enhance the recommendations rather than substitute them. The cause of settlement is clear and the corrective solution is straight forward. Alternatives to consider if funding is available are:

- <u>Snowdrift Impact</u>- In lieu of, or addition to, elevating the condensers along the western wall, thermosyphons could be installed along the eastern wall that extends below the eastern perimeter wall. These thermosyphons would not be prone to snowdrift compacting. This would require approximately 6-feet of thermosyphon and 8-feet of condenser for a total of 14’ . These would be spaced 8’ oc mirroring the ones along the west perimeter wall. The would be placed vertically to mitigate any damage to existing siphons during their installation. Installation would require the use of portable motor driven augers and hand shovels.

- <u>Level Foundation</u>- Though not required at this time, leveling the foundation would return the plant to its design specifications and limit the immediate impact of future settlement upon the plant’s structural and mechanical systems.

- <u>Water Line Heat Load</u>- In lieu of further insulating the water supply and return lines, thermosyphons could be added along the path of the lines to a point where the lines intersect with Main Street. This would require the installation of four thermosyphons spaced approximately 8-feet oc and containing 15-feet of thermosyphon and 8-feet on condenser.

3.3. COST ESTIMATE

The 100% Draft Cost Estimate, prepared by HMS, Inc., is located in Appendix B.

4.0 CONCLUSIONS & RECOMMENDATIONS

The Noatak Water Treatment Plant has been experiencing subsoil destabilizing since its construction in 1995 due to permafrost thawing. The current thawed area is estimated to have a depth of 5-10 feet. Several factors, collectively, are contributing to this destabilization. If left unchecked, the soil will continue to thaw and the building, and associated community water supply/return lines, will continue to settle. These will likely result in, 1) structural damage or failure to the plant, and 2) failure of water supply/return lines connections at the manifolds.

The immediate corrective actions center upon reducing the contributing heat load factors causing the permafrost thawing. The implementation of the corrective actions will likely refreeze the current thawed area within the first winter and return the foundation subsoils to their state at the time of construction.

In conjunction with this work is returning the water supply/return lines to their design height within the plant. These two actions will extend the serviceable life of the building to the desired 20-year goal, if not more.

APPENDIX A: PHOTO LOG

S01
Noatak WTP (Looking South)

S02
WTP East Wall

S03
Graveled Bank Along East Wall

S04
WTP West Wall

S05
Water Lines from WST to WTP

S06
Foundation Thermosiphons Along West Wall

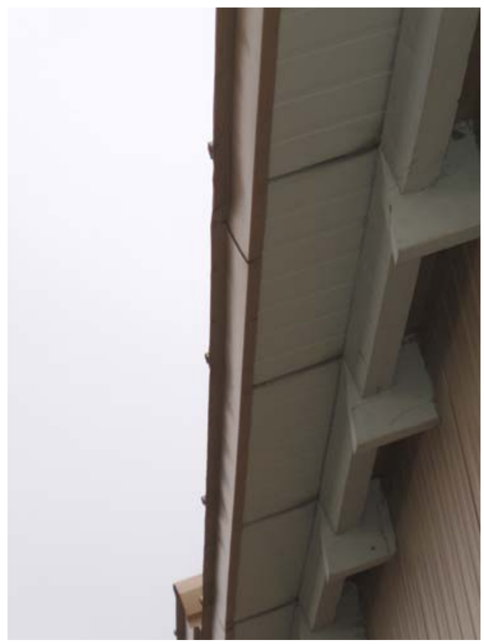
S07
Loop Circulator Piping Manifold

S08
Loop Circulator Piping Manifold

S09
Cartridge Filters

S10
Cartridge Filters and Pressure Pump

S11
Floor Cracks Along Settlement Line Below Water Circulation Manifolds



S12
Buckled Soffit Indicating Wall System Stress dueto Building Settlement

S13
Building Mid-Line and Electrical Panels

S14
Access Man-Hole

S15
Sloped Gravel Cover Over Water Circulation Lines to Community

S16
WTP Entry Concrete Landing

APPENDIX B: 100% COST ESTIMATE

HMS Project No. 09146

100% FINAL SITE AND FACILITY ASSESSMENT REPORT
CONSTRUCTION COST ESTIMATE

STABILIZE FOUNDATIONS
NOATAK WATER TREATMENT PLANT
NOATAK, ALASKA

PREPARED FOR:

Larsen Consulting Group, Inc.
3710 Woodland Drive, Suite 2100
Anchorage, Alaska 99517

October 29, 2009

HMS
inc

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NOTES REGARDING THE PREPARATION OF THIS ESTIMATE

DRAWINGS AND DOCUMENTS

Level of Documents:	Site and facility assessment report including drawings of existing facility
Date:	October 28, 2009
Provided By:	Larsen Consulting Group, Inc. of Anchorage, Alaska

RATES

Pricing is based on current material, equipment and freight costs.

Labor Rates: A.S. Title 36

BIDDING ASSUMPTIONS

Contract:	Standard construction contract without restrictive bidding clauses
Bidding Situation:	Competitive bids assumed
Bid Date:	February 2010
Start of Construction:	Spring 2010
Months to Complete:	Within (3) months depending on a selected recommendation

EXCLUDED COSTS

1. A/E design fees
2. Administrative and management costs
3. Any other work to water treatment plant, except foundations upgrades
4. Remediation of contaminated soils, if found during construction

NOTES REGARDING THE PREPARATION OF THIS ESTIMATE (Continued)

GENERAL

When included in HMS Inc.'s scope of services, opinions or estimates of probable construction costs are prepared on the basis of HMS Inc.'s experience and qualifications and represent HMS Inc.'s judgment as a professional generally familiar with the industry. However, since HMS Inc. has no control over the cost of labor, materials, equipment or services furnished by others, over contractor's methods of determining prices, or over competitive bidding or market conditions, HMS Inc. cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from HMS Inc.'s opinions or estimates of probable construction cost.

This estimate assumes normal escalation based on the current economic climate in Alaska. It is not possible to gauge the effect of the global economic down turn on construction costs in Alaska. HMS Inc. will continue to monitor these events and the resulting construction climate, and will adjust costs and contingencies as deemed prudent.

GROSS FLOOR AREA

Water Treatment Plant	2,592 SF

HMS Project No.: 09146

COST SUMMARY

	Total
BASE BID	
1. Divert Roof Rain Water Run-Off	$ 4,292
2. Divert Water Storage Tank Run-Off	9,333
3. Extend East Foundation Wall Insulation	13,070
4. Topsoil Around North and East Walls	4,116
5. Extend Thermosyphons Along West Wall	36,257
TOTAL BASE BID (SPRING 2010 CONSTRUCTION):	***$ 67,068***
OPTION 1 - RE-LEVEL BUILDING SLAB	$ 23,629
ALTERNATES TO RECOMMENDATIONS	
1. New Thermosyphons to Mitigate Snow Drift Impact	$ 40,375
2. Re-Level Building Slab and Foundations	$ 57,815
3. New Thermosyphons for Exterior Pipes	$ 17,210
4. Redirect Exterior Pipes through East Wall	$ 40,133

Note: Alternates 1 and 3 are recommendations over and above Base Bid solutions. Alternate 2 negates Option 1. Alternate 4 is a 'stand alone' item.

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BASE BID - STABILIZE FOUNDATIONS ***1. Divert Roof Rain Water Run-Off***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Install 5"x5" roof gutters at eaves (2)	144	LF	6.35	914	3.50	504	9.85	1,418
5"x5" downspouts (4)	64	LF	6.90	442	4.00	256	10.90	698
18"x30"x2" concrete splash blocks	4	EA	35.00	140	30.00	120	65.00	260
Grade site at downspouts	100	SF	0.50	50	0.85	85	1.35	135
SUBTOTAL:								*$ 2,511*
General Conditions, Overhead and Profit	45.00%							1,130
Contingencies	15.00%							546
Escalation to 2010 Spring Construction (6 months)	2.50%							105
TOTAL ESTIMATED COST:								***$ 4,292***

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BASE BID - STABILIZE FOUNDATIONS ***2. Divert Water Storage Tank Run-Off***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Grade average 6" deep site away from building between plant and tank (58 CY)	2,600	SF	0.55	1,430	0.75	1,950	1.30	3,380
12" buried culvert at Onalik Street including excavation and backfill (1)	40	LF	23.00	920	29.00	1,160	52.00	2,080
SUBTOTAL:								*$ 5,460*
General Conditions, Overhead and Profit	45.00%							2,457
Contingencies	15.00%							1,188
Escalation to 2010 Spring Construction (6 months)	2.50%							228
TOTAL ESTIMATED COST:								***$ 9,333***

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BASE BID - STABILIZE FOUNDATIONS ***3. Extend East Foundation Wall Insulation***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Hand excavate 8'0"x2'0" deep adjacent to foundation wall and stockpile	55	CY			55.00	3,025	55.00	3,025
Protect pipes (4)	24	LF	2.50	60	5.50	132	8.00	192
Place 4" rigid foam board insulation above pipes	736	SF	1.60	1,178	0.70	515	2.30	1,693
Stockpiled backfill, manually compacted (assume 50% usable)	28	CY			22.00	616	22.00	616
NFS backfill, manually compacted (assume 50% usable)	38	CY	28.00	1,064	22.00	836	50.00	1,900
Regrade to drain away from building	736	SF			0.30	221	0.30	221
SUBTOTAL:								*$ 7,647*
General Conditions, Overhead and Profit	45.00%							3,441
Contingencies	15.00%							1,663
Escalation to 2010 Spring Construction (6 months)	2.50%							319
TOTAL ESTIMATED COST:								***$ 13,070***

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BASE BID - STABILIZE FOUNDATIONS ***4. Topsoil Around North and East Walls***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Hand place 6" topsoil up to 20'0" beyond wall	44	CY	22.00	968	18.00	792	40.00	1,760
Regrade to drain away from building	2,160	SF			0.30	648	0.30	648
SUBTOTAL:								*$ 2,408*
General Conditions, Overhead and Profit	45.00%							1,084
Contingencies	15.00%							524
Escalation to 2010 Spring Construction (6 months)	2.50%							100
TOTAL ESTIMATED COST:								***$ 4,116***

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BASE BID - STABILIZE FOUNDATIONS ***5. Extend Thermosyphons Along West Wall***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Remove condensers and save for reuse	10	EA			145.00	1,450	145.00	1,450
New 2"x4" insulated lines along building wall (10)	364	LF	12.35	4,495	19.50	7,098	31.85	11,593
Install 2"x4" insulated fittings	10	EA	32.00	320	55.00	550	87.00	870
Reinstall condensers	10	EA	50.00	500	170.00	1,700	220.00	2,200
Recharge thermosyphons and test	10	EA	175.00	1,750	335.00	3,350	510.00	5,100
SUBTOTAL:								*$ 21,213*
General Conditions, Overhead and Profit	45.00%							9,546
Contingencies	15.00%							4,614
Escalation to 2010 Spring Construction (6 months)	2.50%							884
TOTAL ESTIMATED COST:								***$ 36,257***

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OPTION 1 - RE-LEVEL BUILDING SLAB	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
SLAB UPGRADE								
Saw cut 4" slab around pipes (10)	80	LF	1.30	104	6.50	520	7.80	624
Cut and remove slab	40	SF			2.75	110	2.75	110
Hand excavate and dispose subbase	1	CY			65.00	65	65.00	65
Add 8" EPS insulation around pipes	40	SF	2.90	116	1.50	60	4.40	176
RAISE PIPE MANIFOLDS								
Disconnect pipe flanges	10	EA			85.00	850	85.00	850
Disconnect pipe at vertical connections	10	EA			75.00	750	75.00	750
Remove and set aside approximately 8'0"x3'0" high manifolds	10	EA			265.00	2,650	265.00	2,650
Add 8" extension to pipes at flanges	10	EA	85.00	850	150.00	1,500	235.00	2,350
Modify vertical pipe for new connections	10	EA	40.00	400	85.00	850	125.00	1,250
Lift and install pipe manifolds in place	10	EA	50.00	500	390.00	3,900	440.00	4,400
Test manifolds	10	EA	15.00	150	45.00	450	60.00	600
SUBTOTAL:								*$ 13,825*
General Conditions, Overhead and Profit	45.00%							6,221

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OPTION 1 - RE-LEVEL BUILDING SLAB	*QUANTITY*	*UNIT*	*MATERIAL*		*LABOR*		*TOTAL*	*TOTAL*
			RATE	*TOTAL*	*RATE*	*TOTAL*	*UNIT RATE*	*MATERIAL/LABOR*
			$	*$*	*$*	*$*	*$*	*$*
Contingencies	15.00%							3,007
Escalation to 2010 Spring Construction (6 months)	2.50%							576
TOTAL ESTIMATED COST:								***$ 23,629***

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ALTERNATES TO RECOMMENDATIONS ***1. New Thermosyphons to Mitigate Snow Drift Impact***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Hand excavate for thermosyphons along west wall, 8'0" o/c	34	CY			55.00	1,870	55.00	1,870
NFS backfill, compacted	41	CY	28.00	1,148	22.00	902	50.00	2,050
4" rigid insulation	900	SF	1.55	1,395	0.65	585	2.20	1,980
Finish grade above pipe	900	SF			0.20	180	0.20	180
2" evaporator pipe	150	LF	8.20	1,230	13.50	2,025	21.70	3,255
2"x4" condenser pipes (10)	80	LF	10.50	840	17.25	1,380	27.75	2,220
2" fittings	16	EA	32.00	512	55.00	880	87.00	1,392
Condensers	10	EA	385.00	3,850	165.00	1,650	550.00	5,500
Charge thermosyphons	10	EA	175.00	1,750	335.00	3,350	510.00	5,100
Testing	1	EA			75.00	75	75.00	75
SUBTOTAL:								*$ 23,622*
General Conditions, Overhead and Profit	45.00%							10,630
Contingencies	15.00%							5,138
Escalation to 2010 Spring Construction (6 months)	2.50%							985
TOTAL ESTIMATED COST:								***$ 40,375***

HMS Project No.: 09146

ALTERNATES TO RECOMMENDATIONS ***2. Re-Level Building Slab and Foundations***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
SLAB UPGRADE								
Cut, jack up sill plate and install (2) 4"x6" shims	108	LF	10.30	1,112	27.50	2,970	37.80	4,082
Saw cut 4" slab	100	LF	1.30	130	6.50	650	7.80	780
Cut and remove slab	1,088	SF			2.75	2,992	2.75	2,992
Hand excavate and dispose subbase	20	CY			55.00	1,100	55.00	1,100
Add 4" EPS insulation	1,088	SF	1.50	1,632	0.65	707	2.15	2,339
Add 4" concrete slab (13 CY)	1,088	SF	3.90	4,243	3.40	3,699	7.30	7,942
Fill cracks in remaining slab	1,088	SF	0.50	544	1.10	1,197	1.60	1,741
RAISE PIPE MANIFOLDS								
Disconnect pipe flanges	10	EA			85.00	850	85.00	850
Disconnect pipe at vertical connections	10	EA			75.00	750	75.00	750
Remove and set aside approximately 8'0"x3'0" high manifolds	10	EA			265.00	2,650	265.00	2,650
Add 8" extension to pipes at flanges	10	EA	85.00	850	150.00	1,500	235.00	2,350
Modify vertical pipe for new connections	10	EA	40.00	400	85.00	850	125.00	1,250
Lift and install pipe manifolds in place	10	EA	50.00	500	390.00	3,900	440.00	4,400

HMS Project No.: 09146

ALTERNATES TO RECOMMENDATIONS			*MATERIAL*		*LABOR*		*TOTAL*	*TOTAL*
2. Re-Level Building Slab and Foundations	*QUANTITY*	*UNIT*	*RATE $*	*TOTAL $*	*RATE $*	*TOTAL $*	*UNIT RATE $*	*MATERIAL/LABOR $*
RAISE PIPE MANIFOLDS (Continued)								
Test manifolds	10	EA	15.00	150	45.00	450	60.00	600
SUBTOTAL:								*$ 33,826*
General Conditions, Overhead and Profit	45.00%							15,222
Contingencies	15.00%							7,357
Escalation to 2010 Spring Construction (6 months)	2.50%							1,410
TOTAL ESTIMATED COST:								***$ 57,815***

HMS Project No.: 09146

ALTERNATIVES TO RECOMMENDATIONS ***3. New Thermosyphons for Exterior Pipes***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
Hand excavate for thermosyphons (4)	14	CY			55.00	770	55.00	770
NFS backfill, compacted	16	CY	28.00	448	22.00	352	50.00	800
4" rigid insulation	360	SF	1.55	558	0.65	234	2.20	792
Finish grade above pipe	360	SF			0.20	72	0.20	72
Revegetate	360	SF	0.50	180	0.55	198	1.05	378
2" evaporator pipes (4)	60	LF	8.20	492	13.50	810	21.70	1,302
New 2"x4" insulated pipes (4)	32	LF	12.35	395	19.50	624	31.85	1,019
Install 2"x4" insulated fittings	8	EA	32.00	256	55.00	440	87.00	696
New condensers	4	EA	385.00	1,540	165.00	660	550.00	2,200
Charge thermosyphons and test	4	EA	175.00	700	335.00	1,340	510.00	2,040
SUBTOTAL:								*$ 10,069*
General Conditions, Overhead and Profit	45.00%							4,531
Contingencies	15.00%							2,190
Escalation to 2010 Spring Construction (6 months)	2.50%							420
TOTAL ESTIMATED COST:								***$ 17,210***

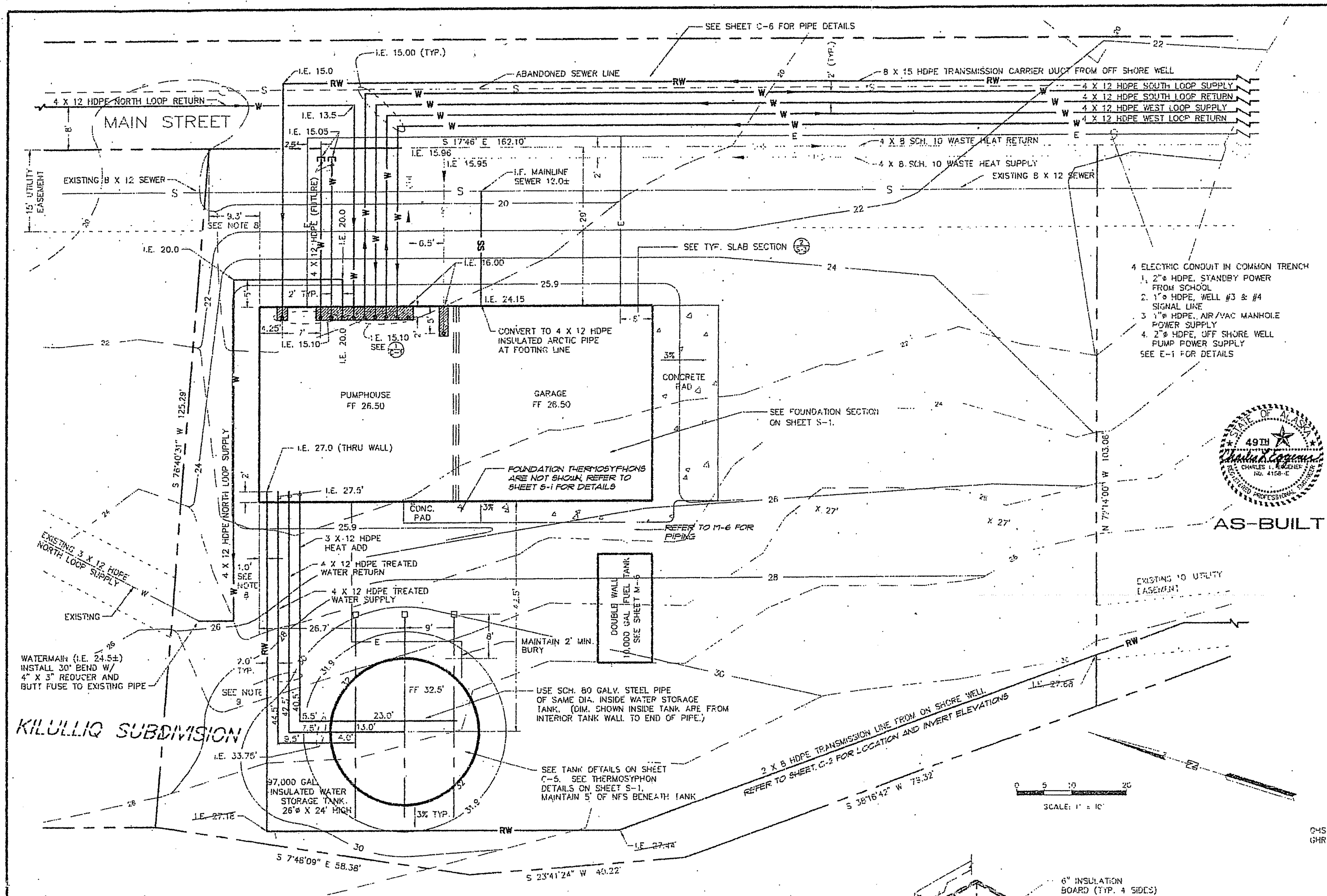
HMS Project No.: 09146

ALTERNATIVES TO RECOMMENDATIONS ***4. Redirect Exterior Pipes through East Wall***	*QUANTITY*	*UNIT*	*MATERIAL RATE $*	*MATERIAL TOTAL $*	*LABOR RATE $*	*LABOR TOTAL $*	*TOTAL UNIT RATE $*	*TOTAL MATERIAL/LABOR $*
OUTSIDE WORK								
Hand excavate to expose pipe	12	CY			55.00	660	55.00	660
NFS backfill, manually compacted	15	CY	28.00	420	22.00	330	50.00	750
Cut 4"x12" arctic pipes	3	EA			60.00	180	60.00	180
Plug ends and abandon pipes in place	3	EA	55.00	165	75.00	225	130.00	390
Install 4"x12" arctic elbow on existing tank pipes	3	EA	245.00	735	295.00	885	540.00	1,620
Drill 12" holes in exterior wall, caulk and seal after pipe installation	3	EA	35.00	105	95.00	285	130.00	390
4"x12" arctic pipes above grade (3)	36	LF	42.00	1,512	39.00	1,404	81.00	2,916
Pipe support stanchions	6	EA	185.00	1,110	150.00	900	335.00	2,010
4"x12" connections to tank pipes	3	EA	75.00	225	130.00	390	205.00	615
4"x12" arctic fittings	6	EA	175.00	1,050	210.00	1,260	385.00	2,310
INSIDE WORK								
Disconnect manifold pipe flanges	10	EA			85.00	850	85.00	850
Cut and remove 4"x36" vertical pipe at manifolds	10	EA			115.00	1,150	115.00	1,150
4" new pipes mounted to walls (3)	75	LF	28.00	2,100	35.00	2,625	63.00	4,725

HMS Project No.: 09146

ALTERNATIVES TO RECOMMENDATIONS			*MATERIAL*		*LABOR*		*TOTAL*	*TOTAL*
4. Redirect Exterior Pipes through East Wall	*QUANTITY*	*UNIT*	*RATE $*	*TOTAL $*	*RATE $*	*TOTAL $*	*UNIT RATE $*	*MATERIAL/LABOR $*
INSIDE WORK (Continued)								
4" connections to exterior pipe	3	EA	60.00	180	95.00	285	155.00	465
Connect 4" pipes to existing manifolds	10	EA	32.00	320	75.00	750	107.00	1,070
4" fittings	20	EA	52.00	1,040	87.00	1,740	139.00	2,780
Test manifolds	10	EA	15.00	150	45.00	450	60.00	600
SUBTOTAL:								*$ 23,481*
General Conditions, Overhead and Profit	45.00%							10,566
Contingencies	15.00%							5,107
Escalation to 2010 Spring Construction (6 months)	2.50%							979
TOTAL ESTIMATED COST:								***$ 40,133***

APPENDIX C: AS-BUILD DRAWINGS



GENERAL NOTES:

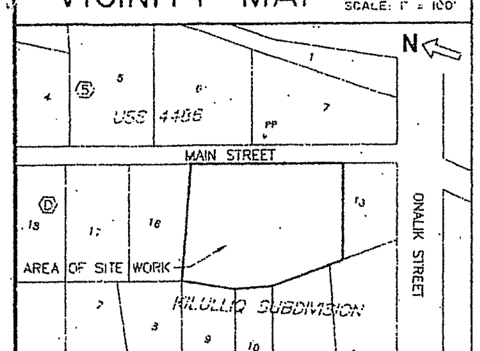
1. THE BENCH MARK IS A SPIKE IN THE SOUTH SIDE OF A POWER POLE LOCATED ON LOT 7, BLK 5, USS 4485, NOATAK TOWNSITE (ACROSS MAIN STREET FROM THE NORTHEAST CORNER OF LOT 14, BLK D, KILULLIQ SUBDIVISION). SEE VICINITY MAP AT LOWER LEFT, THIS SHEET. TBM 91-1 ELEV. 19.60 FT.
2. REMOVE ALL ORGANIC OVERBURDEN AND THAWED SATURATED MATERIAL (UNSTABLE SILTS, ETC.) FROM AREAS DESIGNATED TO RECEIVE FILLS.
3. PLACE FILTER FABRIC (AMOCO 2002 OR EQUAL) ON THE SURFACE OF THE UNDERLYING FROZEN INORGANIC SILTS.
4. FILL LOT WITH RIVER RUN GRAVEL COMPACTED IN ONE FOOT LIFTS TO 95% MAXIMUM DENSITY.
5. CONSTRUCT AN INSULATION "BOX" AROUND ALL PERIMETER SLAB PENETRATIONS. USE 6" OF BOARD FOAM BENEATH INCOMING AND OUTGOING, NORTH AND SOUTH OF THE ASSEMBLAGE OF PIPE RISERS AND ON THE SIDE OF THE PIPE CHASE FACING THE INTERIOR OF THE PUMPHOUSE. MAINTAIN 4" OF CLEARANCE BETWEEN THE PIPE AND INSULATION. SEE DETAIL 2 THIS SHEET.
6. BLEND EDGES OF YARD FILL TO MATCH THE EXISTING CONTOURS.
7. SEE OTHER CIVIL SHEETS FOR FOUNDATION DETAILS AND PIPELINE PLAN AND PROFILE DETAILS.
8. DIMENSIONS ARE IN RESPECT TO THE EDGE OF FOUNDATION.
9. INSTALL "WATER STORAGE TANK LINES" IN THE SAME TRENCH AS THE ON SHORE WELL TRNASMISSION LINE. USE TWO (2) 90° BENDS AND A VERTICAL RISER TO ACHIEVE PROPER INVERT ELEVATION PRIOR TO TANK PENETRATION.

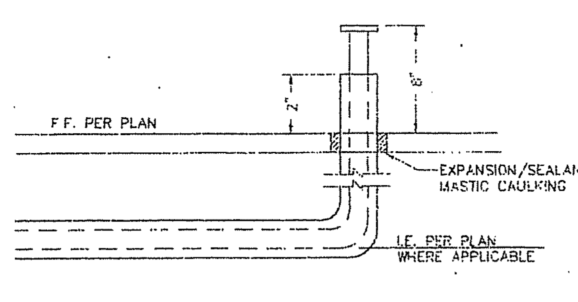
LEGEND

•	"FOUND" LOT CORNER (5/8" X 30" REBAR W/ 2" AL CAP)
x 26'	SPOT ELEVATION
⊛	FLOOR DRAIN
+	PENETRATION
○	CLEANOUT
	EXISTING CONTOUR
	PROPOSED CONTOUR
OHS OHR	WASTE HEAT PIPE (INSULATED 4 X 8 SCH 10 WITH HDPE JACKET)
—RW—	UNTREATED WELL WATER
—S—	SEWER MAIN
—SS—	SEWER SERVICE
—W—	WATER MAIN
	FUEL OIL LINE
	EXISTING 10' UTILITY EASEMENT
	INSULATION BOX – SEE NOTE 5 AND DETAIL 2
	FOUNDATION THERMOSYPHON

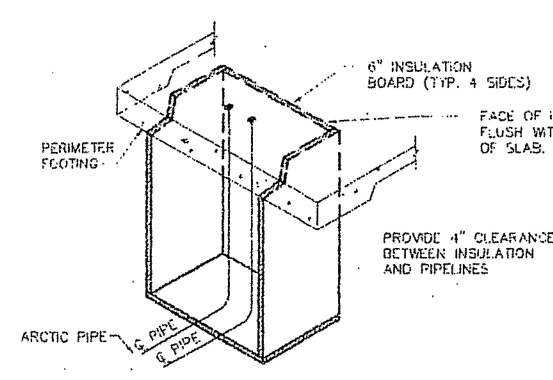
VICINITY MAP

SCALE: 1" = 100'





1/C-1 FLOOR SLAB PENETRATION DETAIL
NOT TO SCALE



2/C-1 INSULATION DETAIL AT PERIMETER FLOOR SLAB PENETRATIONS
NOT TO SCALE

RECORD DRAWING CERTIFICATE
THESE DRAWINGS REFLECT RECORDED INFORMATION OBTAINED DURING CONSTRUCTION. INFORMATION PROVIDED HEREIN IS ACCURATE TO THE BEST OF MY KNOWLEDGE.
NAME: Charles K. Eggener DATE: 1/95

SCALE: AS NOTED

VILLAGE SAFE WATER

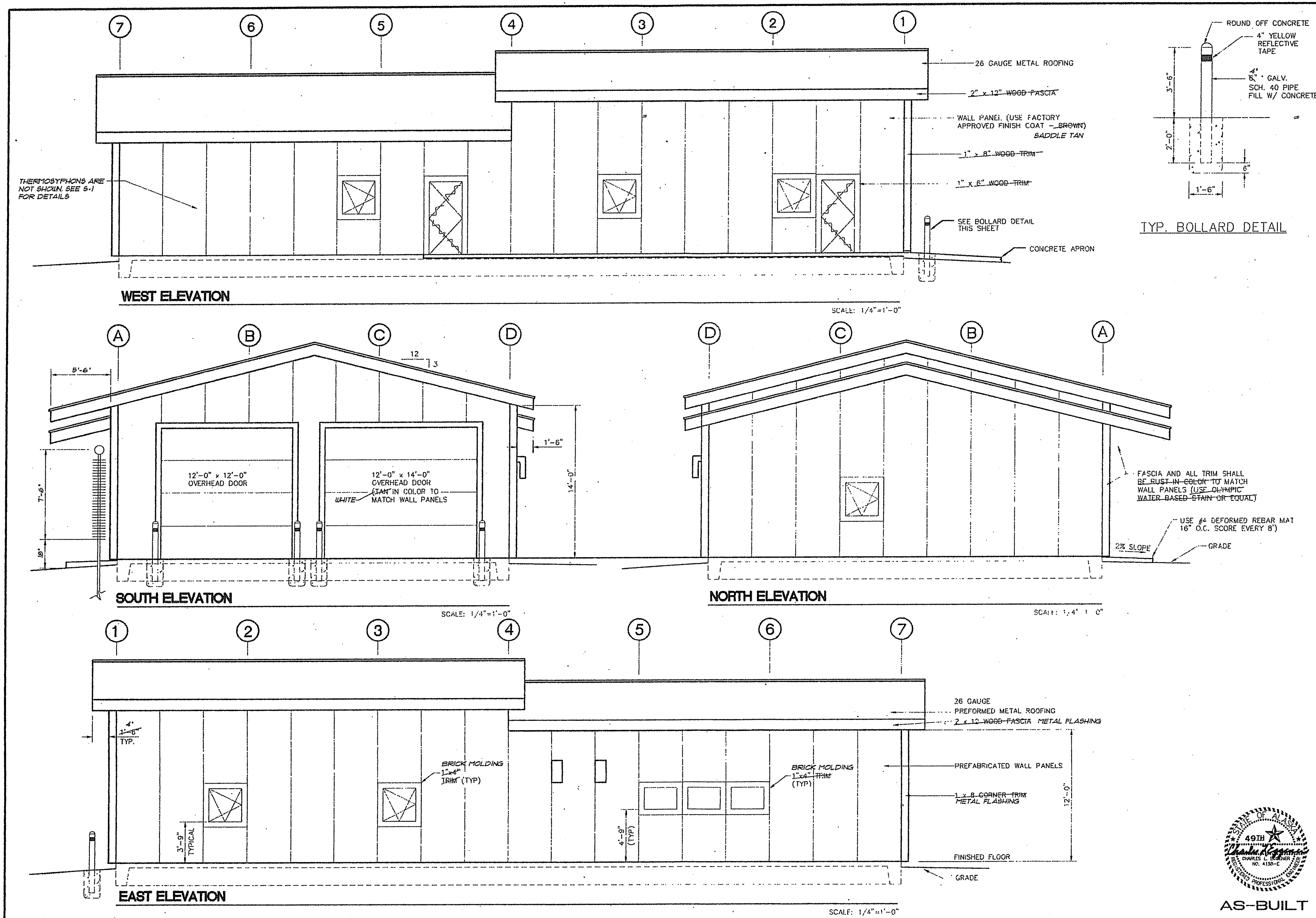
SITE PLAN
NOATAK, ALASKA

CHUCK EGGENER
CONSULTING ENGINEERS
ANCHORAGE, ALASKA

REVISION	BY	DATE
ADDED ASBUILT INFO.	CH	JAN 1995

Project No. CE21894.21
Date 2/1/94
Designed LAP
Drawn KP
Approved CLE

Sheet No. C-1



RECORD DRAWING CERTIFICATE

THESE DRAWINGS REFLECT RECORDED INFORMATION OBTAINED DURING CONSTRUCTION. INFORMATION PROVIDED HEREIN IS ACCURATE TO THE BEST OF MY KNOWLEDGE.

NAME: Charles L. Eggener DATE: 1/95

SCALE: 1" = 4'

VILLAGE SAFE WATER

PUMPHOUSE EXTERIOR ELEVATIONS

NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS

ANCHORAGE, ALASKA

REVISION	BY	DATE
ADDED ASBUILT INFO.	CM.	JAN. 1995

Project No. CE21994.01

Date 02/01/94

Designed RO

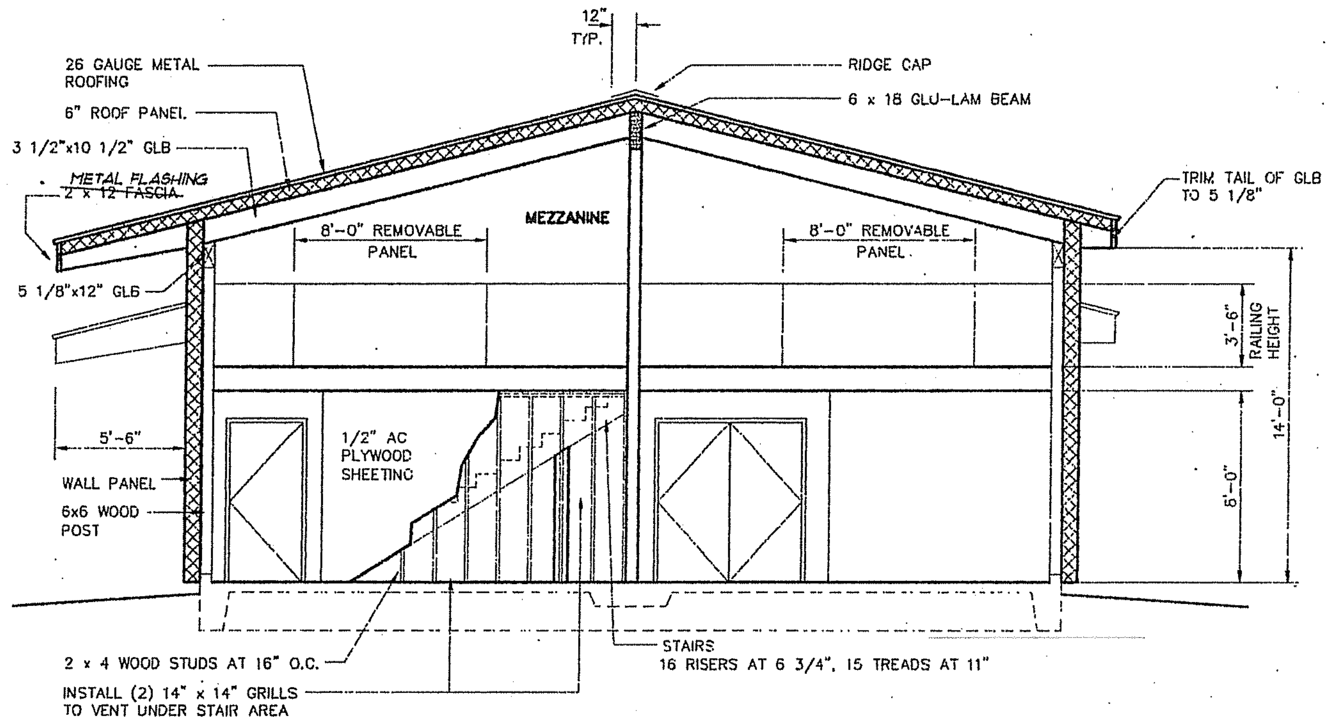
Drawn CM/DEF

Approved CLE

Sheet No. A-2

SHEET ___ OF ___

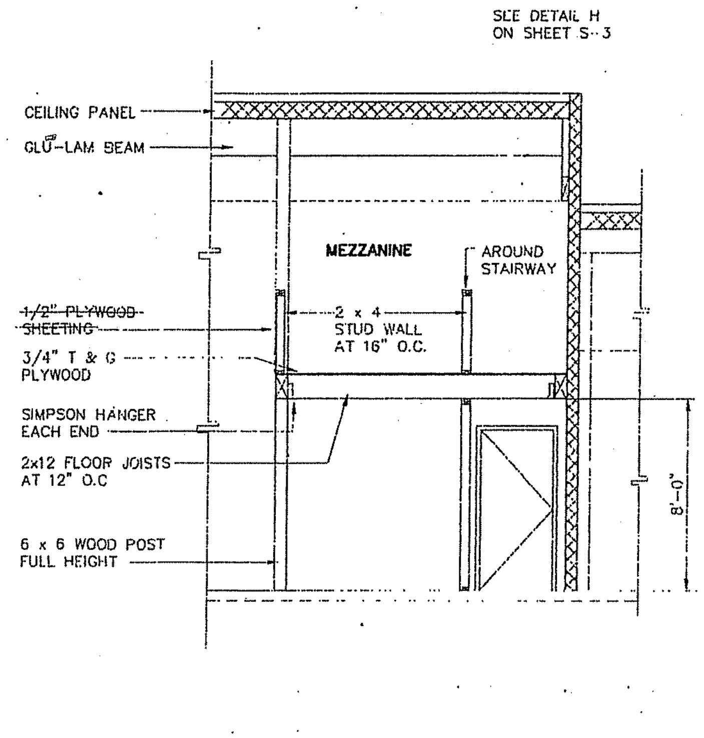
\PROJECTS\NOATAK\NOASB\ASBUILT\A-2



BUILDING SECTION A-A

REFER TO SHEET A 1

SCALE: 1/4"=1'-0"

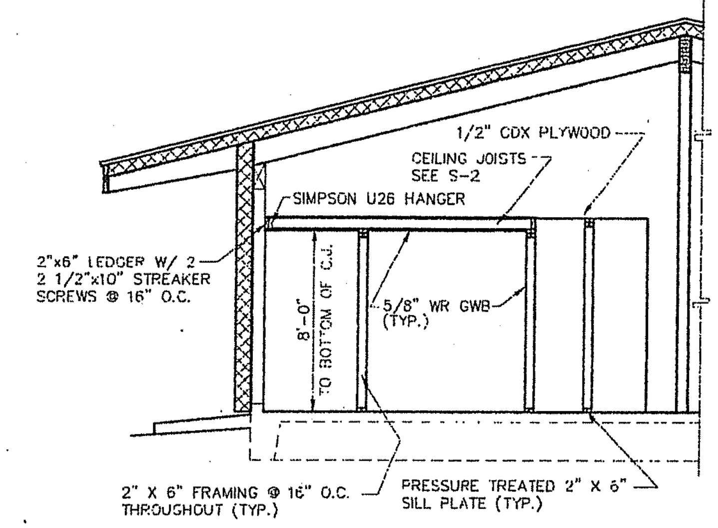


BUILDING SECTION B-B

REFER TO SHEET A 1

SCALE. 1/4"=1'-0"

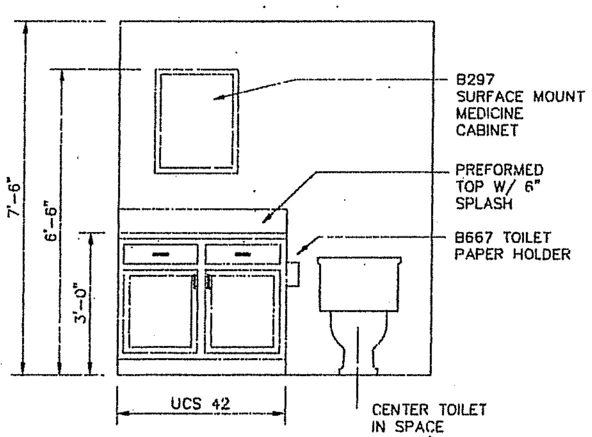
AS-BUILT



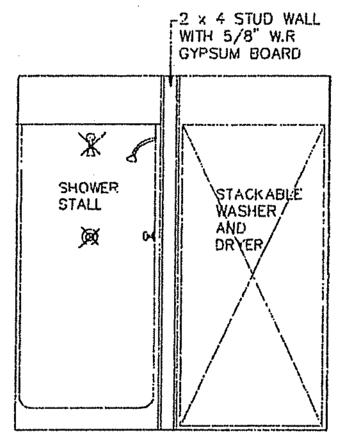
BUILDING SECTION C-C

REFER TO SHEET A 1

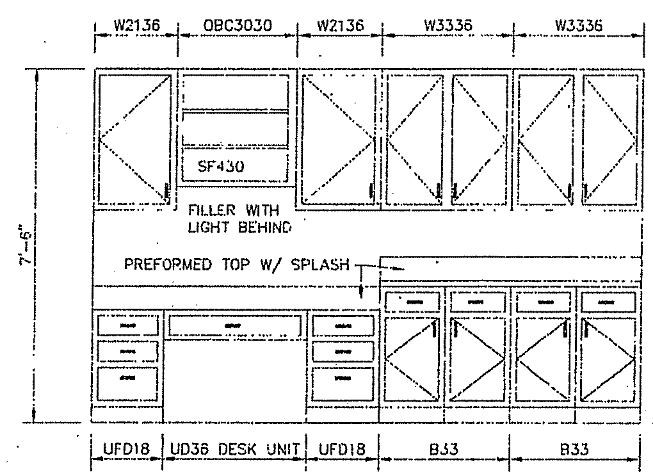
SCALE: 1/4"=1'-0"



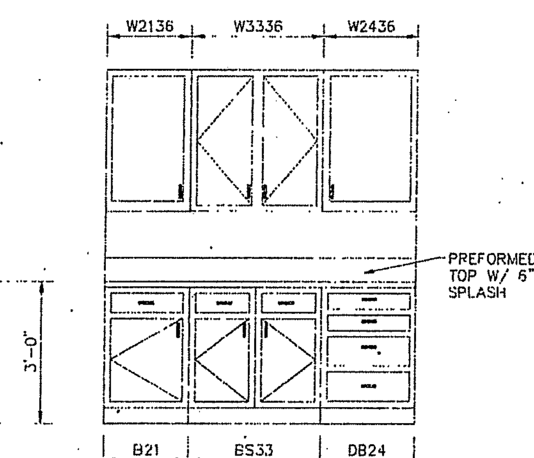
BATH - NORTH



BATH - SOUTH



OFFICE - NORTH



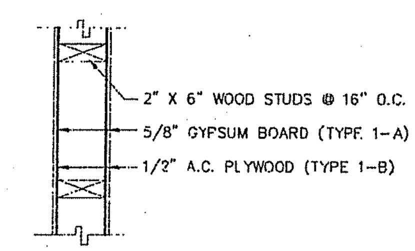
OFFICE - SOUTH

DOOR, FRAME, AND FINISH HARDWARE SCHEDULE

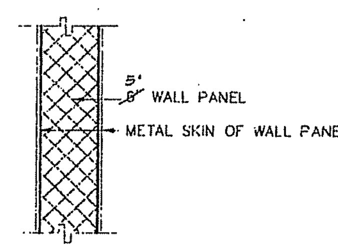
DOOR NUMBER	DOORS						FRAMES				FIRE RATING	DOOR NUMBER	HARDWARE SCHEDULE										DOOR NUMBER
	WIDTH	HEIGHT	THICK NESS	TYPE	MATL	FINISH	JAM THICKNESS	SILL DETAIL	MATL	FINISH			HINGES SIZE	HINGES BOMBER	HINGES # PAIRS	LOCKS / LATCHES CAT.# (SCHLAGE-ORBIT)	CLOSURES CATALOG #	KICK PLATES	STOPS CATALOG #	THRESHOLDS	WEATHERSTRIP		
1	3'-0"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	5 7/8"		H.M.	PAINT	90 MIN.	1	4x4	1	1	A53PD	—	8 x 34	F9076X	STANDARD	MAGNETIC		1
2	3'-0"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	4 5/8"		H.M.	PAINT	90 MIN.	2	4x4		1	A53PD	—	8 x 34	F9078X	H/C	COMPRESSION		2
3	3'-0"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	4 5/8"		H.M.	PAINT	90 MIN.	3	4x4	1	1	A10S	—	8 x 34	F9076X	H/C	MAGNETIC		3
4	3'-0" PR	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	5 7/8"		H.M.	PAINT	90 MIN.	4	4x4	2	2	A53PD	—	(2)8 x 34	(2)F9076X	H/C	MAGNETIC		4
5	3'-0"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	4 3/8"		H.M.	PAINT	90 MIN.	5	4x4		1 1/2	A80PD	—	8 x 34	—	—	COMPRESSION		5
6	2'-8"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	4 3/8"		H.M.	PAINT	90 MIN.	6	4x4		1 1/2	A80PD	—	8 x 34	—	—	COMPRESSION		6
7	3'-0"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	5 7/8"		H.M.	PAINT	90 MIN.	7	4x4	1	1	A53PD	—	8 x 34	—	STANDARD	MAGNETIC		7
8	3'-0"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	5 7/8"		H.M.	PAINT	90 MIN.	8	4x4		1 1/2	A10S	—	8 x 34	F9076X	H/C	COMPRESSION		8
9	2'-8"	6'-8"	1 3/4"	FLUSH	I.M.	PAINT	4 5/8"		H.M.	PAINT	90 MIN.	9	4x4		1 1/2	A10S	—	8 x 34	F9078X	—	COMPRESSION		9
10	12'-0"	12'-0"	1 5/8"	SECT.	I.M.	FACTORY	–					10											10
11	14'-0"	12'-0"	1 5/8"	SECT.	I.M.	FACTORY	–					11											11

DOOR 6 HAS 14" x 14" GRILL   I.M. = INSULATED METAL   H.M.= HOLLOW METAL

WALL TYPES



1A/1B WALL TYPE



2 WALL TYPE

STATE OF ALASKA 49TH Charles L. Eggener No 4158-E REGISTERED PROFESSIONAL ENGINEER

RECORD DRAWING CERTIFICATE
THESE DRAWINGS REFLECT RECORDED INFORMATION OBTAINED DURING CONSTRUCTION. INFORMATION PROVIDED HEREIN IS ACCURATE TO THE BEST OF MY KNOWLEDGE.
NAME Charles L Eggener DATE 1/96

SCALE. 1" = 4'

VILLAGE SAFE WATER

STATE OF ALASKA 49TH Charles L. Eggener No. 4158-E REGISTERED PROFESSIONAL ENGINEER

INTERIOR SECTIONS, SCHEDULES, AND WALL TYPES
NOATAK, ALASKA

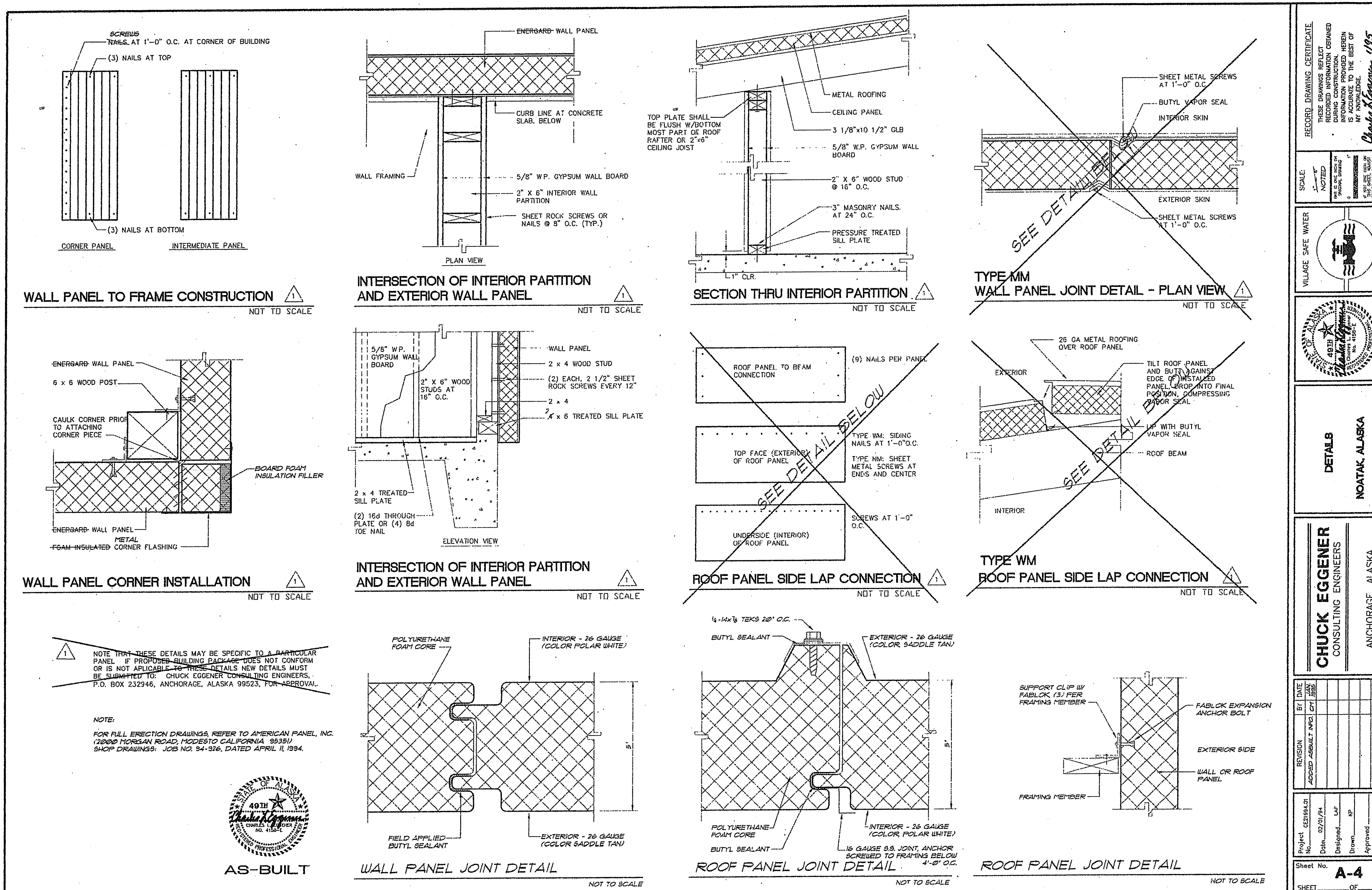
CHUCK EGGENER
CONSULTING ENGINEERS
ANCHORAGE, ALASKA

REVISION	BY	DATE
ADDED ASBUILT INFO.	CY	JAN 1996

Project No. CE21994.01
Date. 02/01/94
Designed RD
Drawn CM
Approved CLE

Sheet No. A-3
SHEET ___ OF ___

PROJECTS\NOATAK\NOA94\ASBUILT\A-3



SCREWS
NAILS AT 1'-0" O.C. AT CORNER OF BUILDING
(3) NAILS AT TOP
(3) NAILS AT BOTTOM
CORNER PANEL
INTERMEDIATE PANEL
WALL PANEL TO FRAME CONSTRUCTION
NOT TO SCALE
ENERGARD WALL PANEL
CURB LINE AT CONCRETE SLAB, BELOW
WALL FRAMING
5/8" W.P. GYPSUM WALL BOARD
2" X 6" INTERIOR WALL PARTITION
SHEET ROCK SCREWS OR NAILS @ 8" O.C. (TYP.)
PLAN VIEW
INTERSECTION OF INTERIOR PARTITION AND EXTERIOR WALL PANEL
NOT TO SCALE
TOP PLATE SHALL BE FLUSH W/BOTTOM MOST PART OF ROOF RAFTER OR 2"x6" CEILING JOIST
METAL ROOFING
CEILING PANEL
3 1/8"x10 1/2" GLB
5/8" W.P. GYPSUM WALL BOARD
2" X 6" WOOD STUD @ 16" O.C.
3" MASONRY NAILS. AT 24" O.C.
PRESSURE TREATED SILL PLATE
1" CLR.
SECTION THRU INTERIOR PARTITION
NOT TO SCALE
SHEET METAL SCREWS AT 1'-0" O.C.
BUTYL VAPOR SEAL
INTERIOR SKIN
EXTERIOR SKIN
SHEET METAL SCREWS AT 1'-0" O.C.
SEE DETAIL BELOW
TYPE MM
WALL PANEL JOINT DETAIL - PLAN VIEW
NOT TO SCALE
ENERGARD WALL PANEL
6 x 6 WOOD POST
CAULK CORNER PRIOR TO ATTACHING CORNER PIECE
BOARD FOAM INSULATION FILLER
ENERGARD WALL PANEL
METAL
FOAM INSULATED CORNER FLASHING
WALL PANEL CORNER INSTALLATION
NOT TO SCALE
5/8" W.P. GYPSUM WALL BOARD
2" X 6" WOOD STUDS AT 16" O.C.
WALL PANEL
2 x 4 WOOD STUD
(2) EACH, 2 1/2" SHEET ROCK SCREWS EVERY 12"
2 x 4
2 x 6 TREATED SILL PLATE
2 x 4 TREATED SILL PLATE
(2) 16d THROUGH PLATE OR (4) 8d TOE NAIL
ELEVATION VIEW
INTERSECTION OF INTERIOR PARTITION AND EXTERIOR WALL PANEL
NOT TO SCALE
ROOF PANEL TO BEAM CONNECTION
(9) NAILS PER PANEL
TOP FACE (EXTERIOR) OF ROOF PANEL
TYPE WM: SIDING NAILS AT 1'-0"O.C.
TYPE NM: SHEET METAL SCREWS AT ENDS AND CENTER
UNDERSIDE (INTERIOR) OF ROOF PANEL
SCREWS AT 1'-0" O.C.
SEE DETAIL BELOW
ROOF PANEL SIDE LAP CONNECTION
NOT TO SCALE
26 GA METAL ROOFING OVER ROOF PANEL
EXTERIOR
TILT ROOF PANEL AND BUTT AGAINST EDGE OF INSTALLED PANEL, DROP INTO FINAL POSITION, COMPRESSING VAPOR SEAL
LIP WITH BUTYL VAPOR SEAL
ROOF BEAM
INTERIOR
SEE DETAIL BELOW
TYPE WM
ROOF PANEL SIDE LAP CONNECTION
NOT TO SCALE
NOTE THAT THESE DETAILS MAY BE SPECIFIC TO A PARTICULAR PANEL. IF PROPOSED BUILDING PACKAGE DOES NOT CONFORM OR IS NOT APLICABLE TO THESE DETAILS NEW DETAILS MUST BE SUBMITTED TO: CHUCK EGGENER CONSULTING ENGINEERS, P.O. BOX 232946, ANCHORAGE, ALASKA 99523, FOR APPROVAL.
NOTE:
FOR FULL ERECTION DRAWINGS, REFER TO AMERICAN PANEL, INC. (2000 MORGAN ROAD, MODESTO CALIFORNIA 95351) SHOP DRAWINGS: JOB NO. 94-326, DATED APRIL 11, 1994.
STATE OF ALASKA
49TH
CHARLES L. EGGENER
NO. 4158-E
REGISTERED PROFESSIONAL ENGINEER
AS-BUILT
POLYURETHANE FOAM CORE
INTERIOR - 26 GAUGE (COLOR POLAR WHITE)
FIELD APPLIED BUTYL SEALANT
EXTERIOR - 26 GAUGE (COLOR SADDLE TAN)
5'
WALL PANEL JOINT DETAIL
NOT TO SCALE
1/4-14x7/8 TEKS 20" O.C.
BUTYL SEALANT
EXTERIOR - 26 GAUGE (COLOR SADDLE TAN)
POLYURETHANE FOAM CORE
BUTYL SEALANT
INTERIOR - 26 GAUGE (COLOR POLAR WHITE)
16 GAUGE S.S. JOINT, ANCHOR SCREWED TO FRAMING BELOW 4'-0" O.C.
5'
ROOF PANEL JOINT DETAIL
NOT TO SCALE
SUPPORT CLIP W/ FABLOK (3) PER FRAMING MEMBER
FABLOK EXPANSION ANCHOR BOLT
EXTERIOR SIDE
WALL OR ROOF PANEL
FRAMING MEMBER
ROOF PANEL JOINT DETAIL
NOT TO SCALE
RECORD DRAWING CERTIFICATE
THESE DRAWINGS REFLECT RECORDED INFORMATION OBTAINED DURING CONSTRUCTION. INFORMATION PROVIDED HEREIN IS ACCURATE TO THE BEST OF MY KNOWLEDGE.
NAME
DATE
1/95
SCALE: NOTED
VILLAGE SAFE WATER
DETAILS
NOATAK, ALASKA
CHUCK EGGENER
CONSULTING ENGINEERS
ANCHORAGE, ALASKA
REVISION
ADDED ASBUILT INFO.
BY CH
DATE JAN 1995
Project No. CE21594.01
Date 02/01/94
Designed LAP
Drawn KP
Approved
Sheet No. A-4
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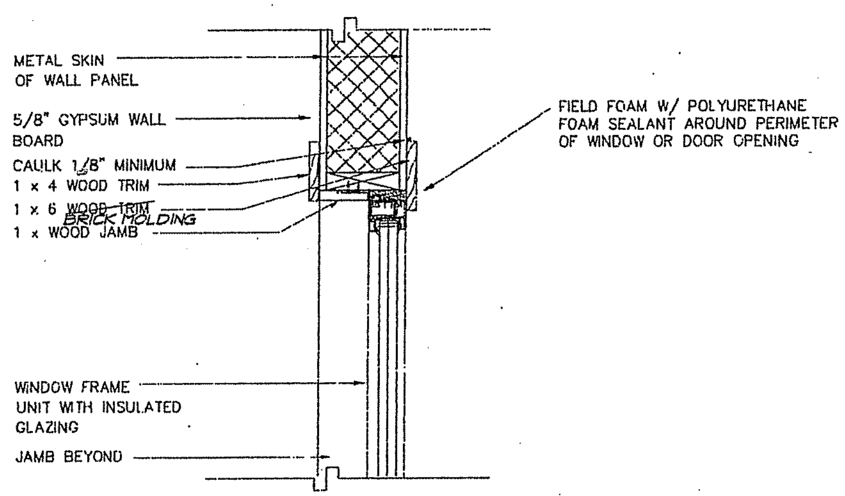

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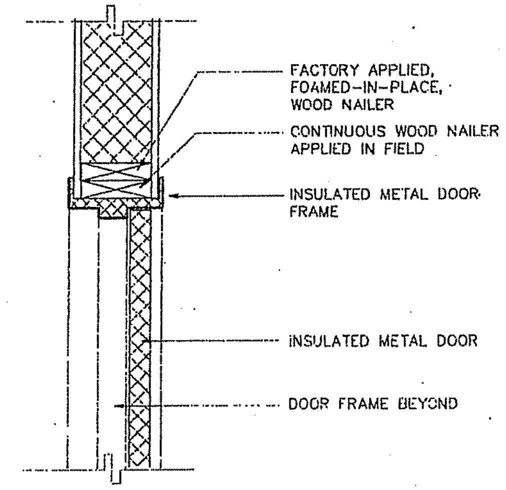

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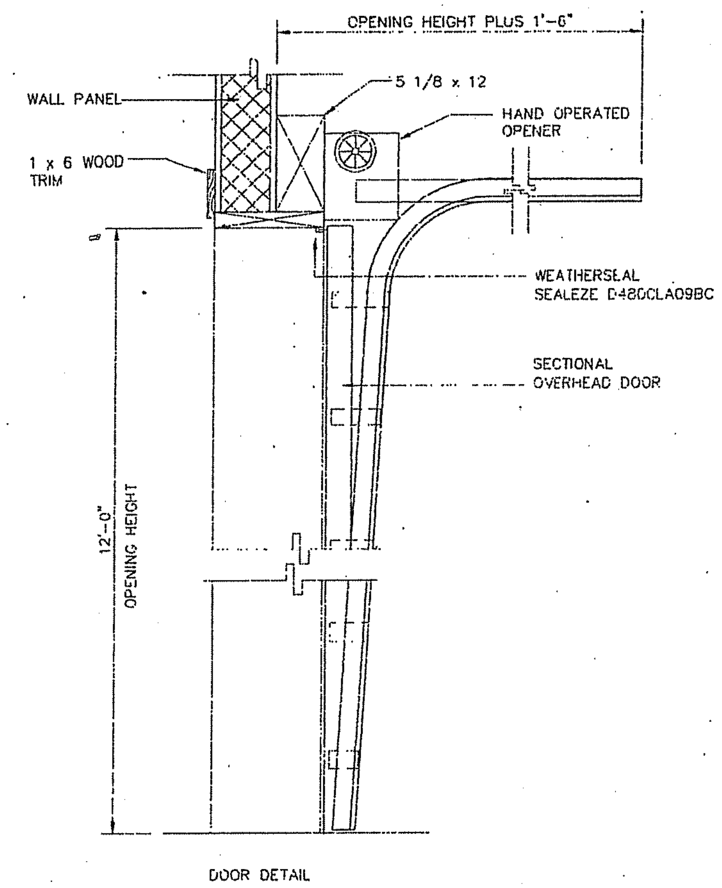
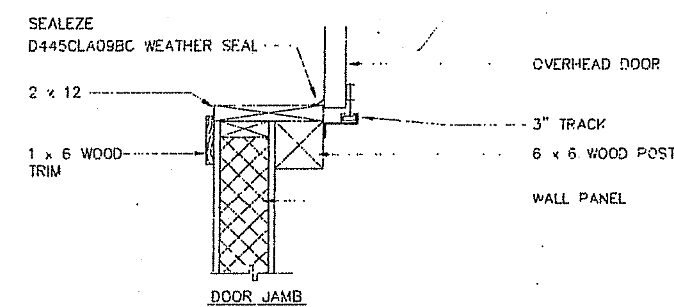
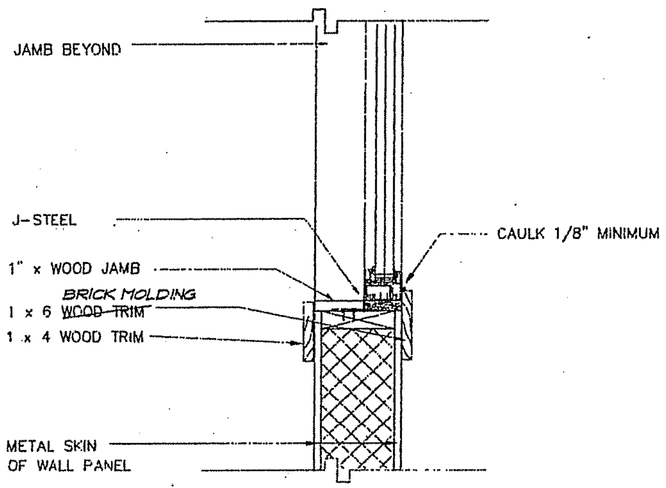
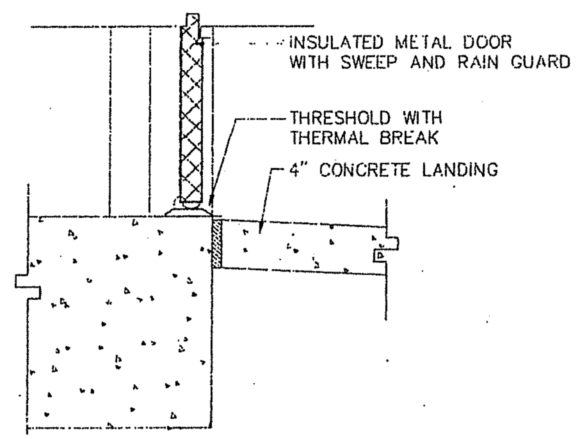






WINDOW SILL

NOT TO SCALE

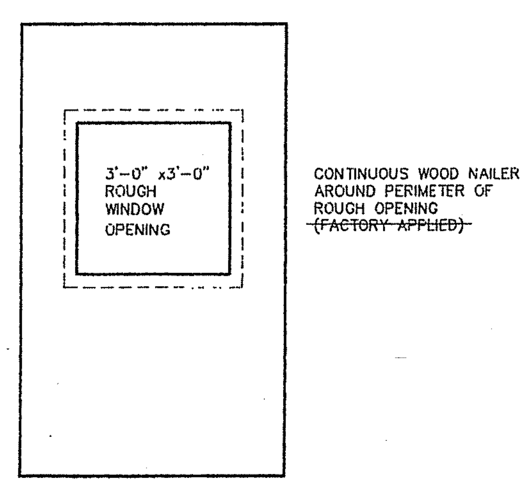


DOOR THRESHOLD

NOT TO SCALE

OVERHEAD DOOR DETAILS

NOT TO SCALE



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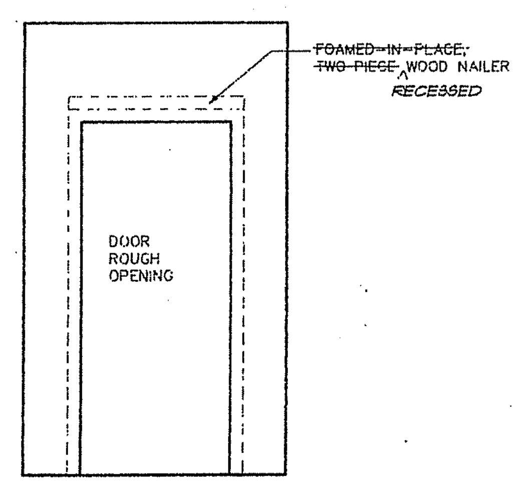

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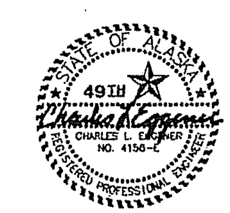

AS-BUILT

RECORD DRAWING CERTIFICATE

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NAME Charles L. Eggener DATE 1/95

SCALE: AS NOTED

VILLAGE SAFE WATER

WALL AND DOOR DETAILS AND WALLTYPES

NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS

ANCHORAGE, ALASKA

REVISION	BY	DATE
ADDED ASBUILT INFO.	CM	JAN. 1995

Project No. CE21994.01

Date 2/01/94

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Approved CLE

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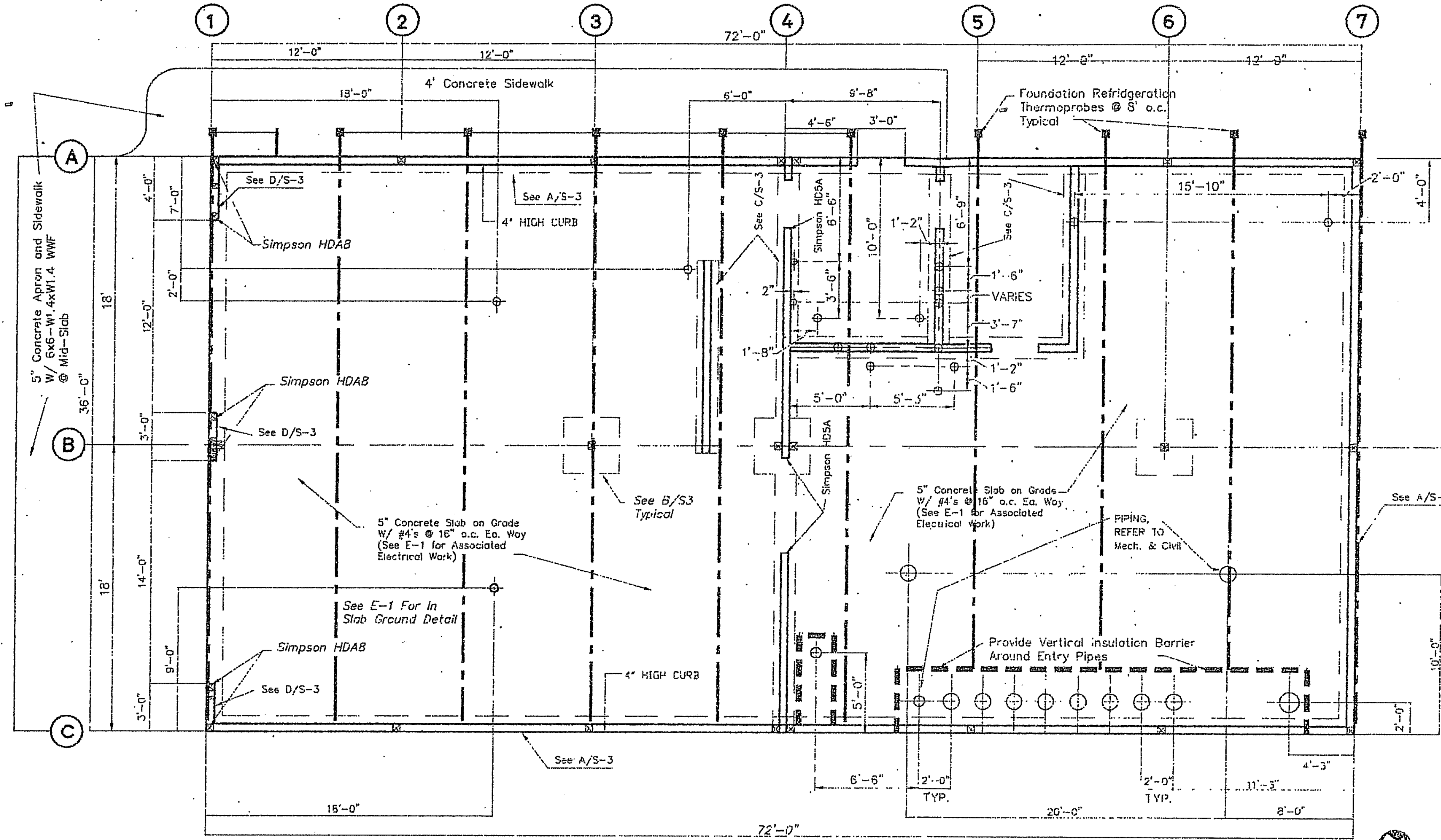
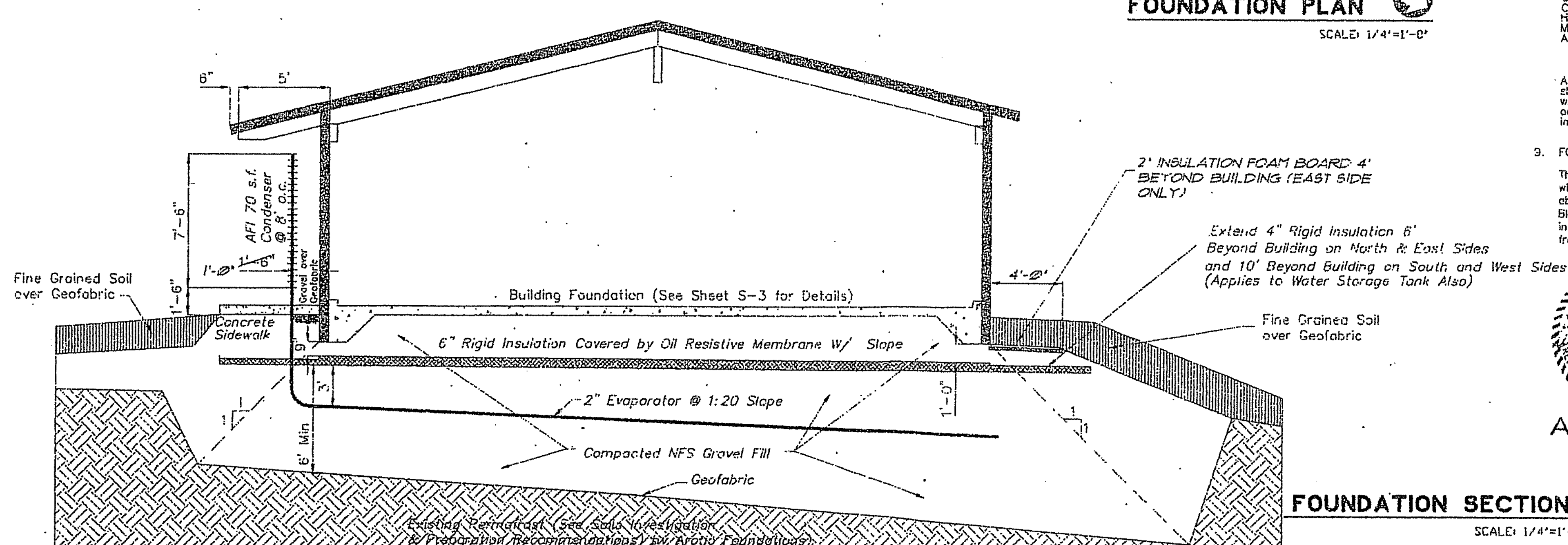


FOUNDATION PLAN

SCALE: 1/4"=1'-0"



FOUNDATION SECTION

SCALE: 1/4"=1'-0"

GENERAL NOTES

Design Criteria: 1991 Uniform Building Code
Roof Live Load: 54 P.S.F.
Floor Live Load: 125 P.S.F.
Soil Pressure: 2000 P.S.F.
Seismic Zone: 1
Wind 100 m.p.h (Exposure C)

1. Soils Data:
On-site soils investigation by Howard Grey and Associates.

2. Concrete shall have a minimum compression strength of 3,000 psi at 28 days, measured , mixed, and placed in place in accordance with A.C.I. Std. 304. Slump shall be 3 inches minimum, 6" maximum. Use 6.5 sack cement mix with 24 oz. Pozzolith 344-N per cubic yard.

3. Reinforcing steel shall conform to ASTM A-615-80, Grade 40. All reinforcing steel shall be detailed, fabricated and placed in accordance with ACI 318-77 and ACI 315-47. All splices in concrete shall be lapped 24 bar diameters minimum.

4. Treated lumber shall be Douglas Fir No. 1 all weather wood. All members shall be treated with ACC or CCA water borne preservative per 1991 U.B.C. Standards Section 25-12. All lumber shall be installed dry with moisture content not to exceed 19.

5. Untreated structural grade lumber shall comply with the National Lumber Manufacturers Association "National Specifications for Stress Grade Lumber". Lumber shall be Hem-fir, f_b= 1,150 psi, or better, single member.

6. Wall and roof sheathing to be metal faced premanufactured panels. Wall panels shall have a minimum thermal resistance of R=25, and roof panels shall have a minimum thermal resistance of R=30. The panels shall be designed by the manufacturer for the following loads based on the 1991 Uniform Building Code. The manufacturer shall submit shop and erection drawings of the panel system. Fabrication of the panels shall not proceed until the shop and erection drawings are approved by the Engineer. An ICBO Evaluation Report (or equal) confirming labatory tests of the proposed panel system shall accompany the submittal.

   Snow Load = 54 p.s.f. (Applied per 1991 UBC Appendix Ch. 23, Div. I)
   Wind Load = 100 m.p.h. (Exposure C) Applied per 1991 UBC
   Exterior Wall and Roof panels shall have an allowable shear load parallel to the face of the panel of 210 lbs. per lineal foot, and the center interior wall panel at Grid 4 shall have an allowable shear load capacity parallel to the face of the panel of 530 lbs. per lineal foot.

7. Remove all organic, frost susceptible materials below footings and slabs. Replace with non-frost susceptible structural fill compacted to 95 of maximum density per ASTM D-1557 and ASTM D-2167 and /or ASTM D-2922 and D-3017. A minimum of 5 foot of structural fill shall be placed below all footings.

8. GLUE LAMINATED STRUCTURAL MEMBERS

   All structural glued laminated timber shall be as detailed on the drawings, and shall conform to ANSI/AITC A190.1-1983, "Structural Glued Laminated Timber". Show drawings shall be approved before commencing with fabrication. Lumber for the laminating shall be of such stress grade as to provide glued laminated timbers with allowable working stress values for loads fo normal duration as follows:

DESIGN STRESS	DESIGN VALUE
Bending	2400 p.s.i.
Compression Perpendicular to Grain	650 p.s.i.
Compression Parallel to Grain	1650 p.s.i.
Horizontal Shear	165 p.s.i.
Modulum of Elasticity	1,800,000 p.s.i.
Appearance Grade	Industrial

   Adhesives shall meet requirements for wet use. Surfaces of members shall be sealed with a sealer coat. Members shall be individually wrapped and shall be marked with a qualified inspection and testing agency mark, and in addtion, be accompanied by a certificate to incidate conformance to AMSI/AITC A190.1-1983.

9. FOUNDATION THERMOSYPHONS

   The foundation cooling system shall consist of (10) Thermoprobes with 2"ø evaporator pipes below grade and AFI 70 s.f. condensers above grade as manufactured by Arctic Foundations Inc., 5621 Arctic Blvd., Anchorage, Alaska. For further system description and installation recommendations, see the November 24, 1993 letter from Arctic Foundations to Chuck Eggener Consulting Engineers.

AS-BUILT

RECORD DRAWING CERTIFICATE

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NAME ____ DATE 1/24/96

VILLAGE SAFE WATER

SCALE: 1" = 4'

PUMPHOUSE FOUNDATION PLAN
NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS
ANCHORAGE, ALASKA

REVISION	BY	DATE
ADDED ASBUILT INFO	CY	JAN 1995

Project No. CE21994.01
Date 02/01/94
Designed
Drawn
Approved

Sheet No. S-1

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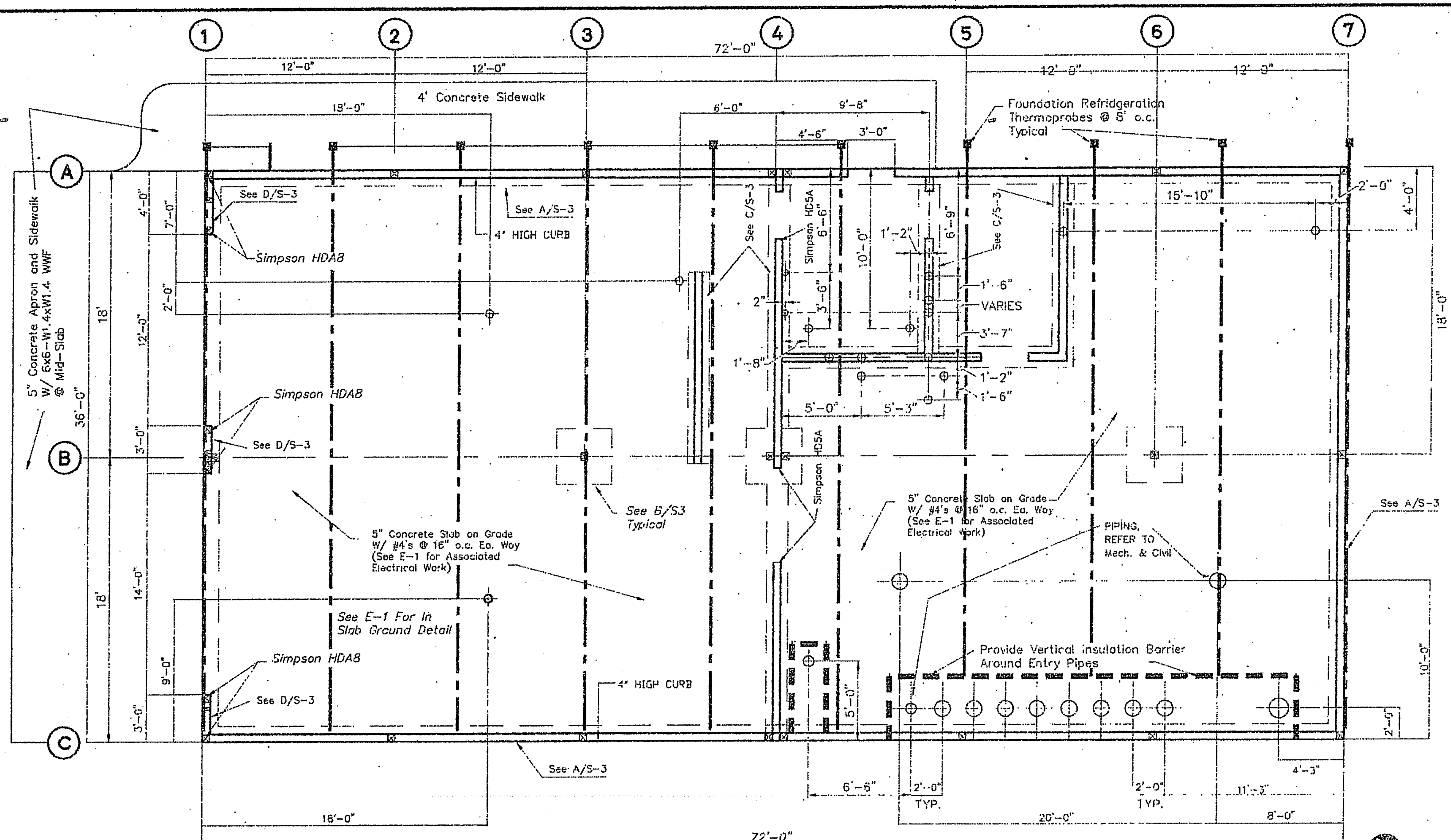
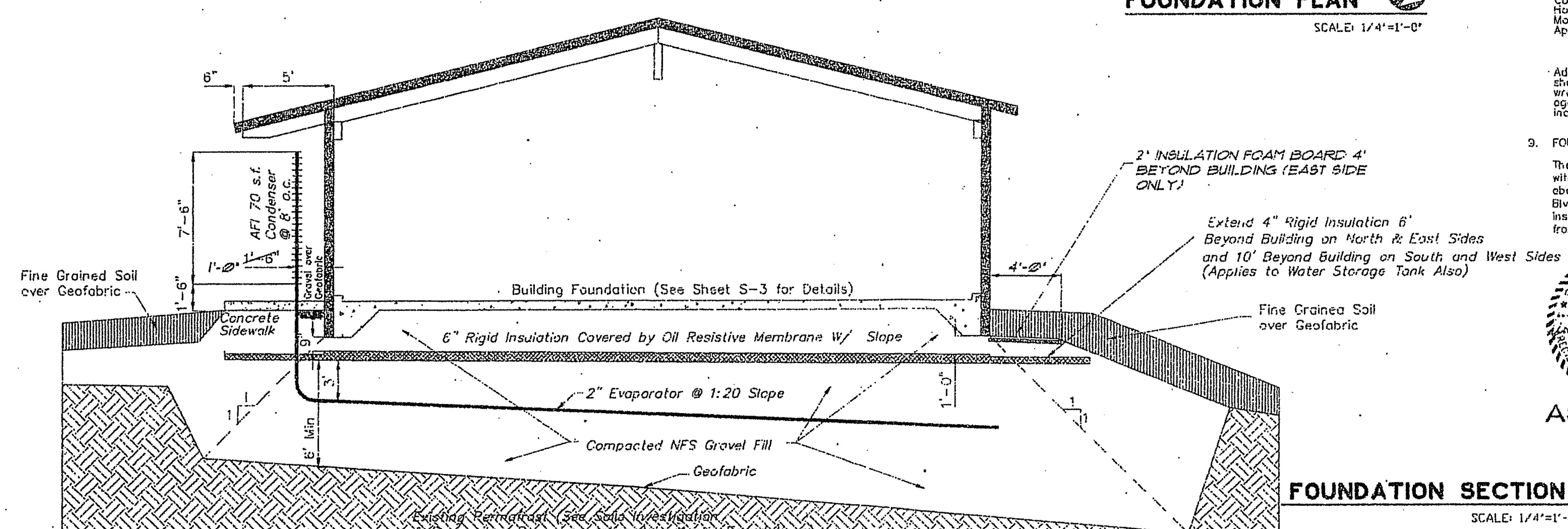


FOUNDATION PLAN

SCALE: 1/4"=1'-0"



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SCALE: 1/4"=1'-0"

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Floor Live Load: 125 P.S.F.
Soil Pressure: 2000 P.S.F.
Seismic Zone: I
Wind: 100 m.p.h (Exposure C)

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Adhesives shall meet requrements for wet use. Surfaces of members shall be sealed with a sealer coat. Members shall be individually wrapped and shall be marked with a qualified inspection and testing agency mark, and in addtion, be accompanied by a certificate to incidate conformance to AMSI/AITC A190.1-1983.

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AS-BUILT

RECORD DRAWING CERTIFICATE

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NAME Arthur H Whitmer DATE 1/24/96

SCALE: 1" = 4'

VILLAGE SAFE WATER

PUMPHOUSE FOUNDATION PLAN

NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS

ANCHORAGE, ALASKA

REVISION: ADDED ASBUILT INFO | BY: CH | DATE: JAN 1996

Project No. CE21994.01
Date 02/01/94
Designed
Drawn
Approved

Sheet No. S-1

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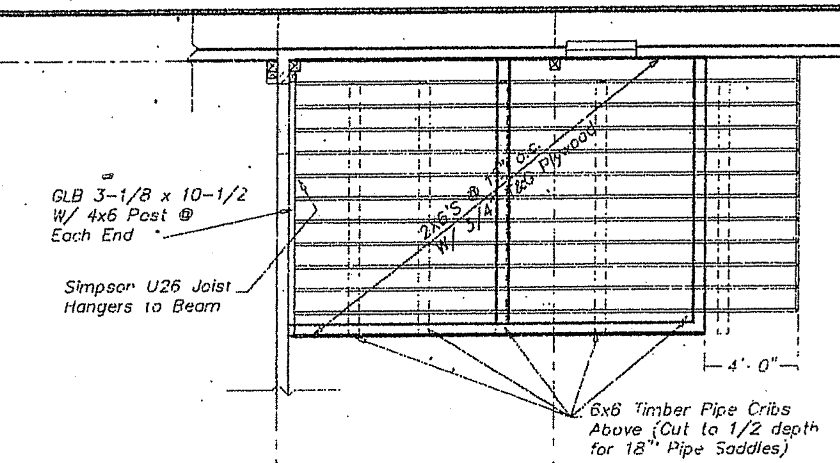
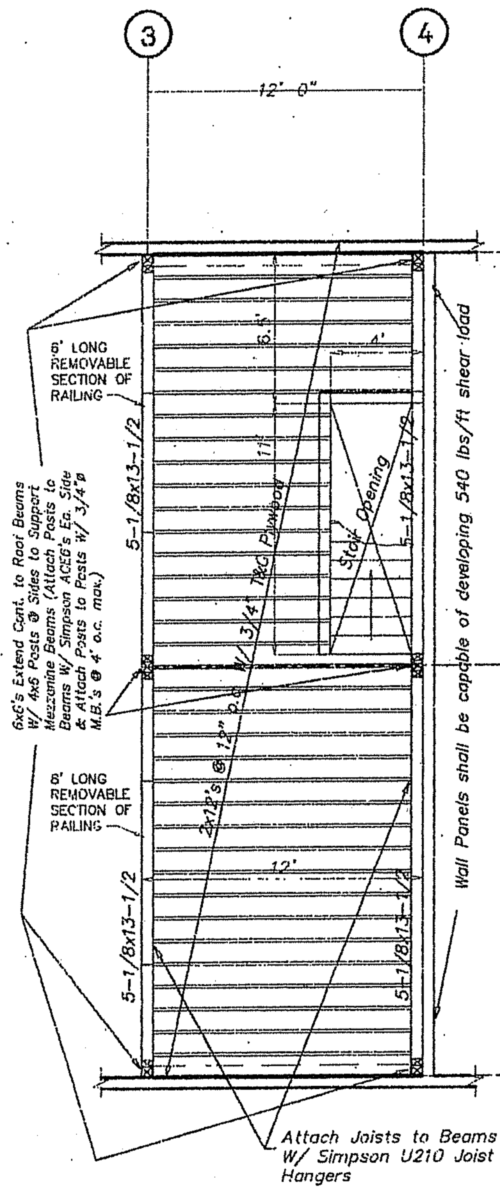
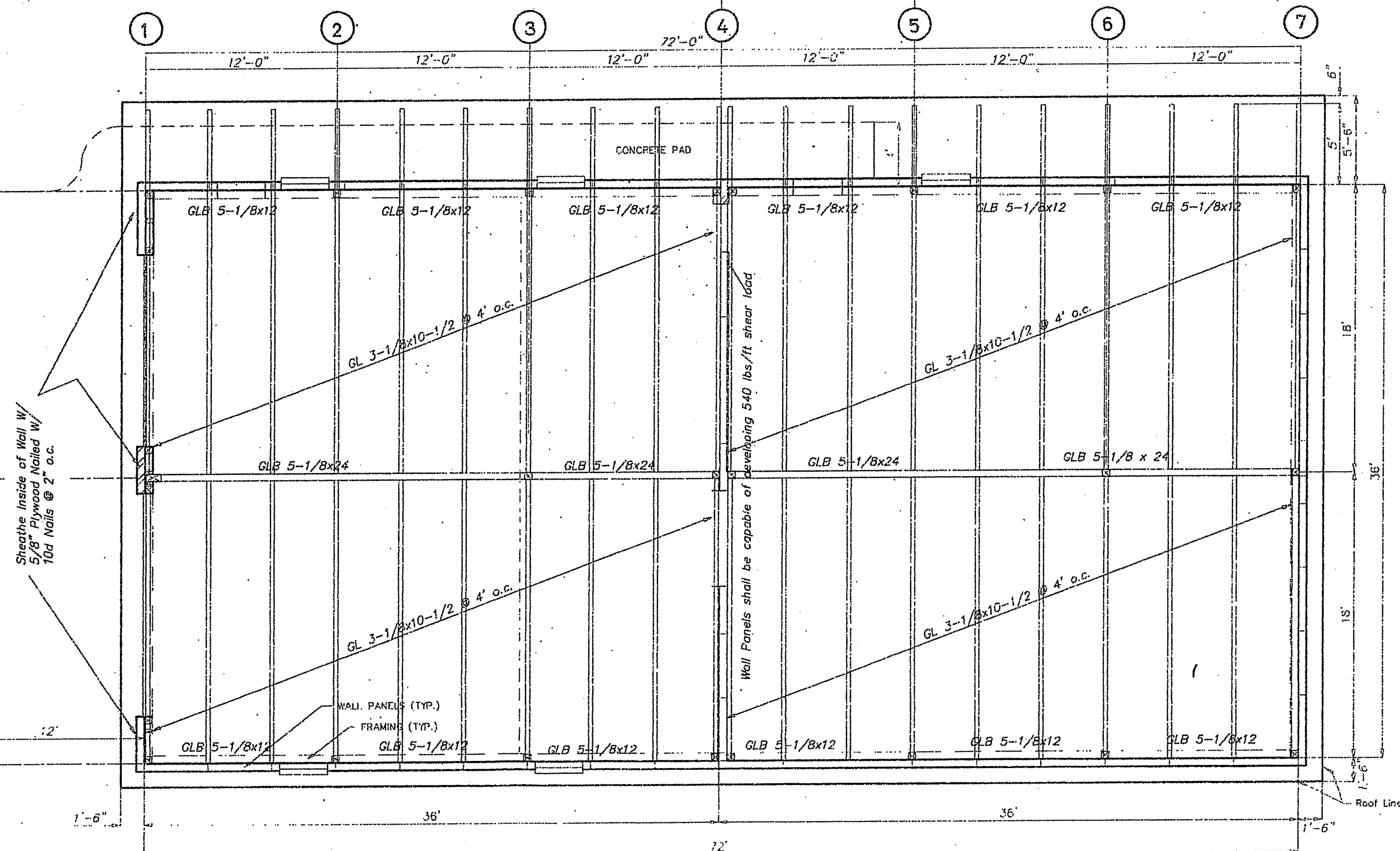


CEILING FRAMING PLAN



MEZZANINE LEVEL FRAMING PLAN



ROOF FRAMING PLAN

1/4" = 1'-0"

AS-BUILT

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NAME 1/24/96 DATE

Consulting Engineering Offices of Arthur H. Whitmer, A Professional Corporation

SCALE: 1" = 4'

BAR IS ONE INCH ON ORIGINAL DRAWING

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

VILLAGE SAFE WATER

PUMPHOUSE FRAMING PLANS

NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS

ANCHORAGE, ALASKA

REVISION	BY	DATE
ASBUILT DRAWING	CH	JAN 1996

Project No.

Date 02/01/94

Designed

Drawn

Approved

Sheet No. S-2

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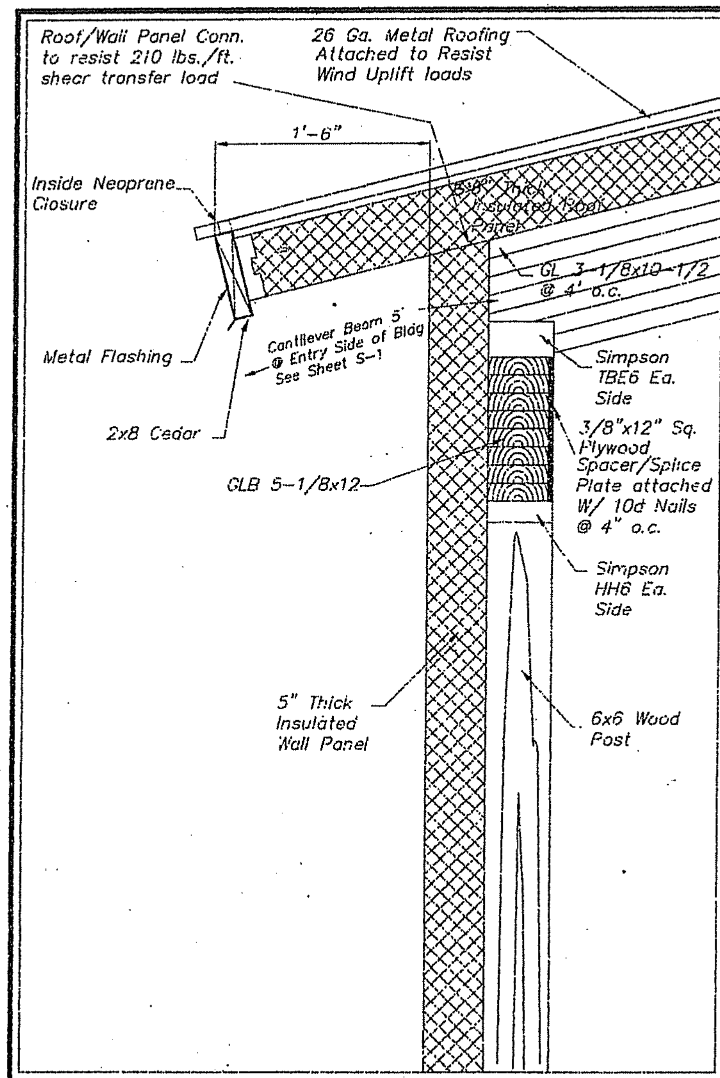
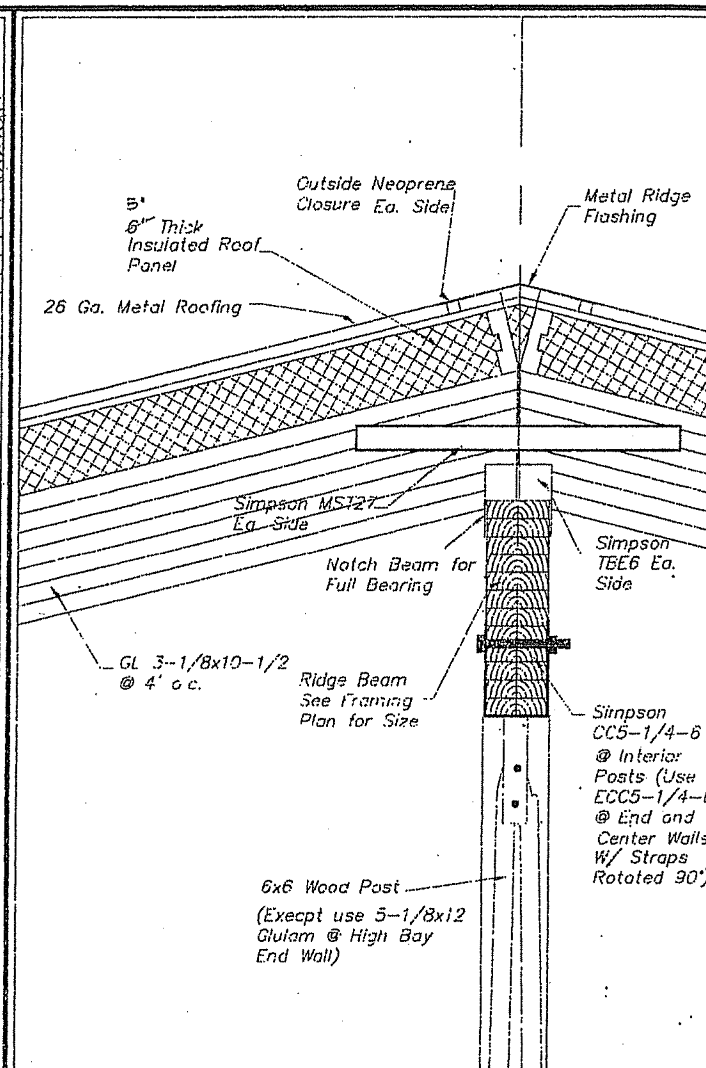


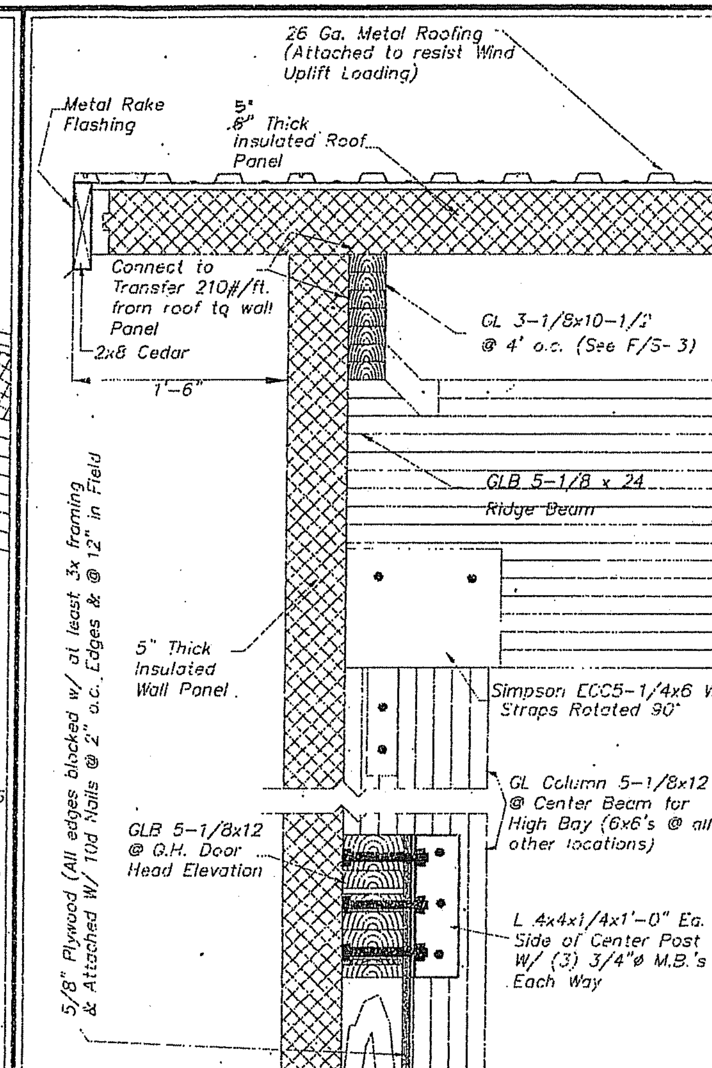
Roof Framing Section @ Eave (E)

SCALE: 1 1/2" = 1'-0"



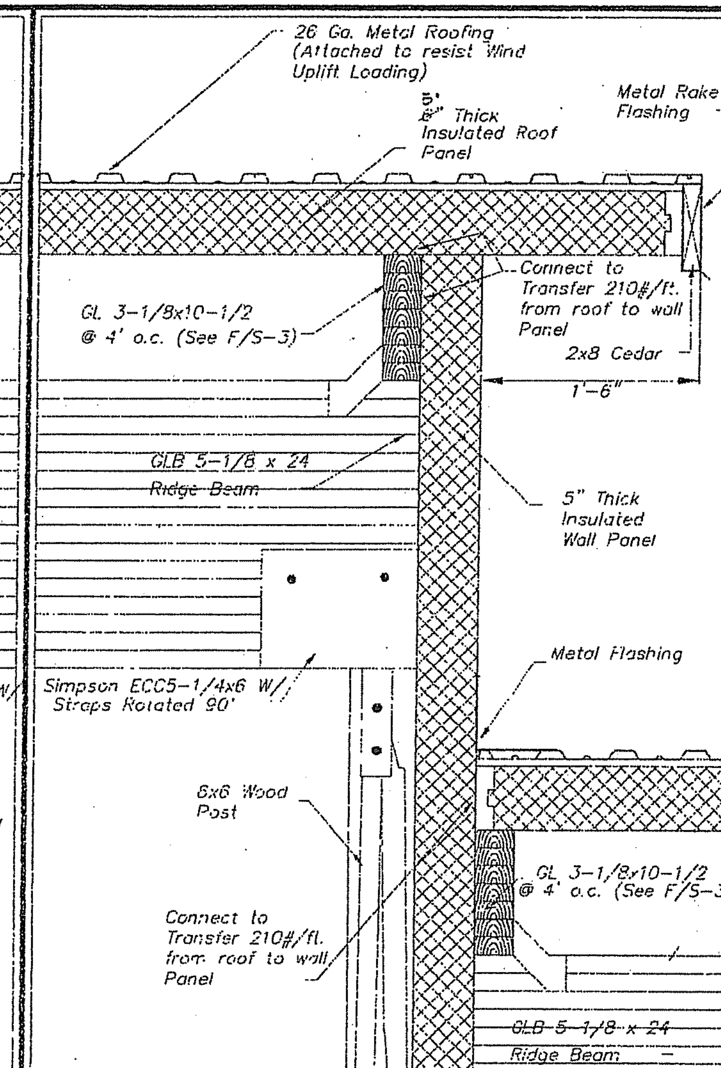
Roof Framing Section @ Ridge (F)

SCALE: 1 1/2" = 1'-0"



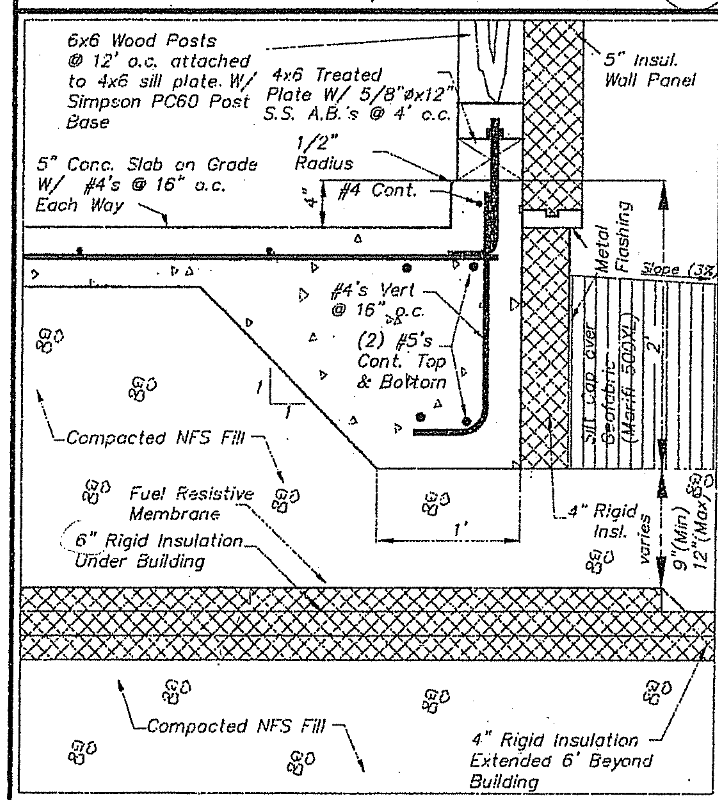
Roof Framing Section @ End Wall (G)

SCALE: 1 1/2" = 1'-0"



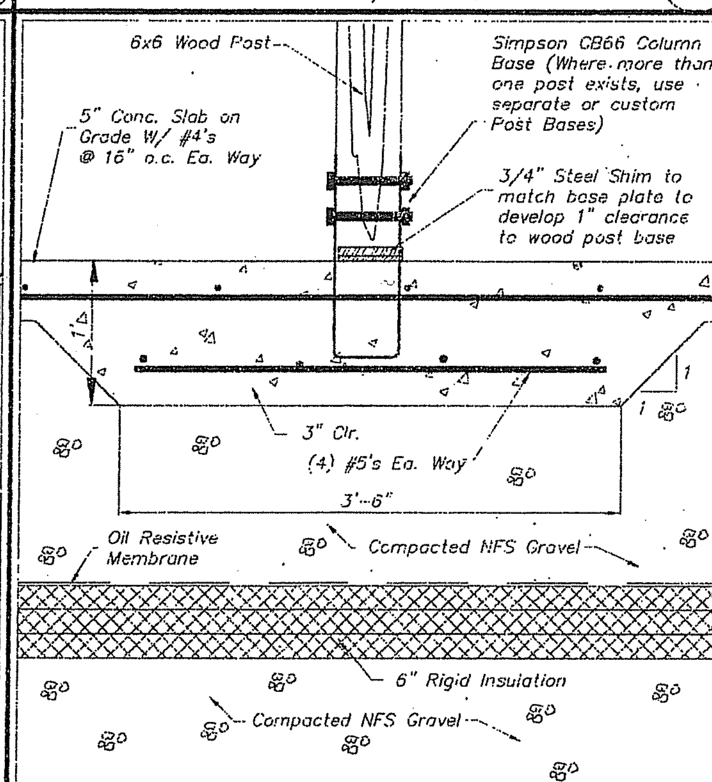
Roof Framing Seciton @ Mid-Roof Transition (H)

SCALE: 1 1/2" = 1'-0"



Typical Perimeter Footing Section (A)

SCALE: 1 1/2" = 1'-0"



Typical Interior Spread Footing Section (B)

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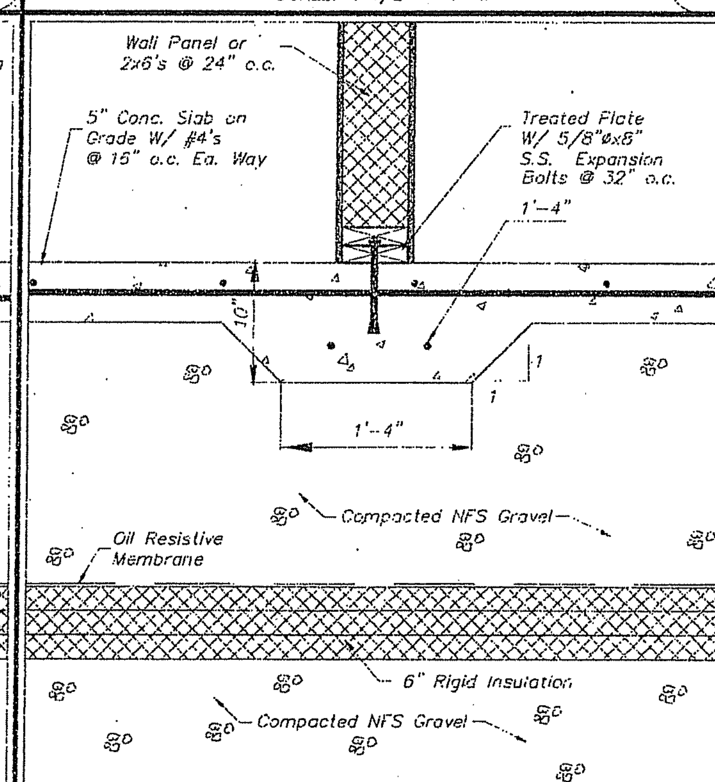
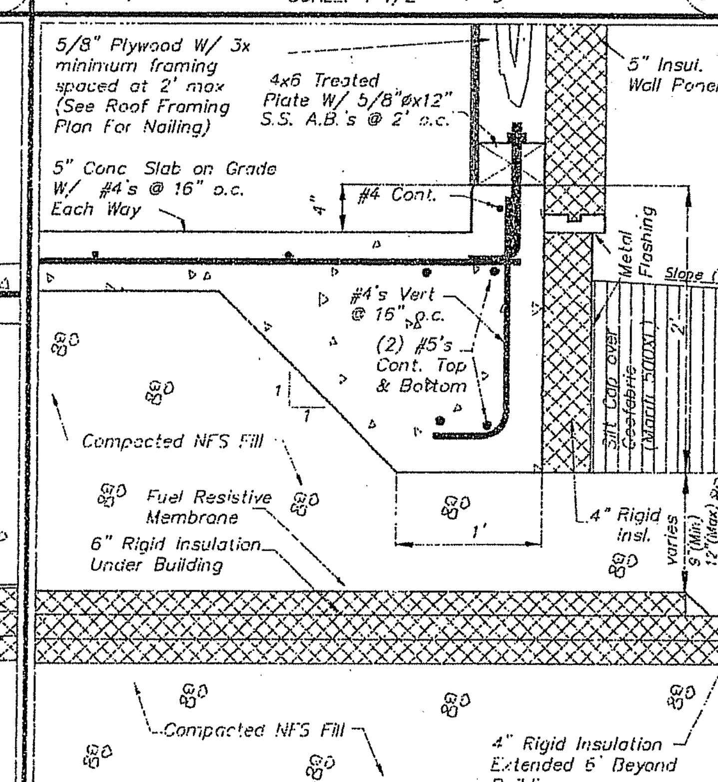


Ribbon Footing Scetion @ Interior Bearing/Shear Wall (C)

SCALE: 1 1/2" = 1'-0"



Perimeter Footing Section @ Shear Wall (D)

SCALE: 1 1/2" = 1'-0"

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SCALE: 1" = 4'

VILLAGE SAFE WATER

PUMPHOUSE SECTIONS & DETAILS

NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS

ANCHORAGE, ALASKA

REVISION	BY	DATE
ASBUILT DRAWING	CT	2/02/98

Project No.

Date 02/01/94

Designed

Drawn

Approved

Sheet No. S-3

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STATE OF ALASKA 49TH Arthur H. Whitmer CE 3057 REGISTERED PROFESSIONAL ENGINEER

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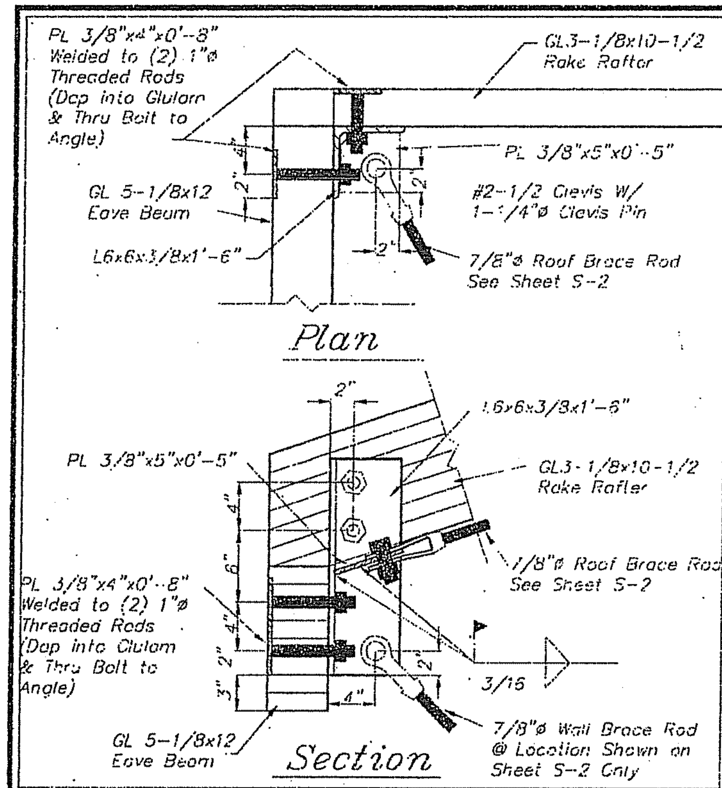
Arthur H. Whitmer (signature), NAME — 1/24/96, DATE



Roof Bracing Connection @ Eave (A)
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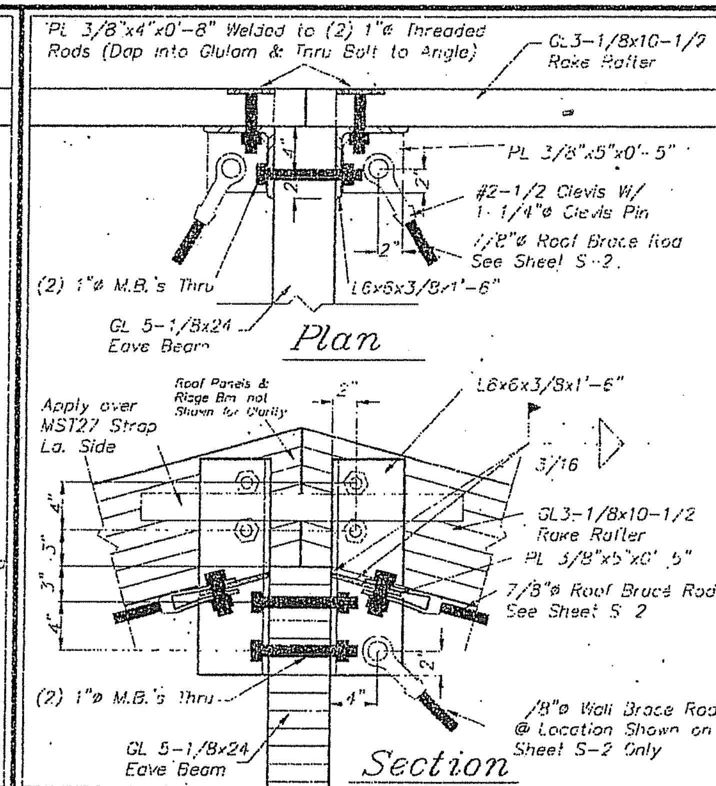
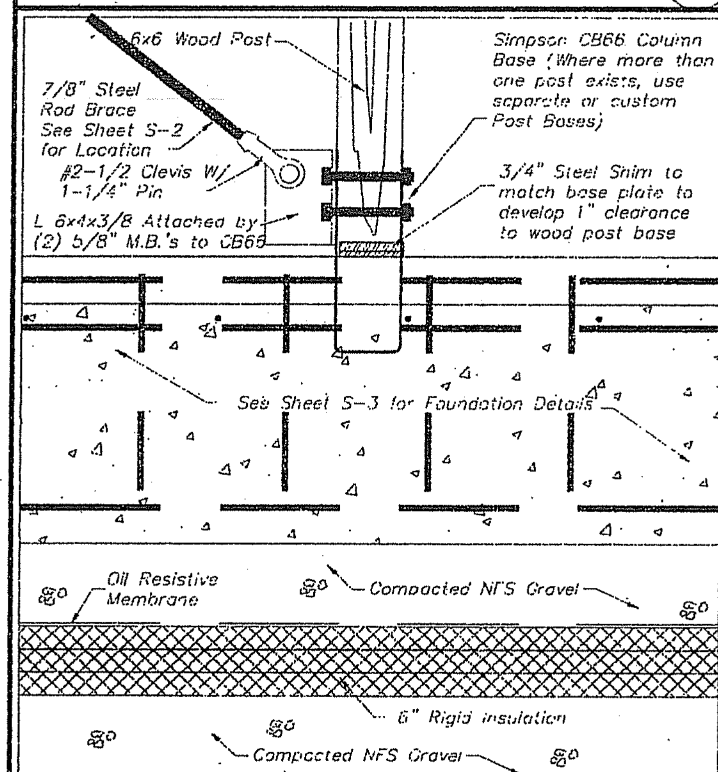


Roof Bracing Connection @ Ridge (B)
SCALE: 1 1/2" = 1'-0"



Bracing Rod Connection Detail @ Floor (C)
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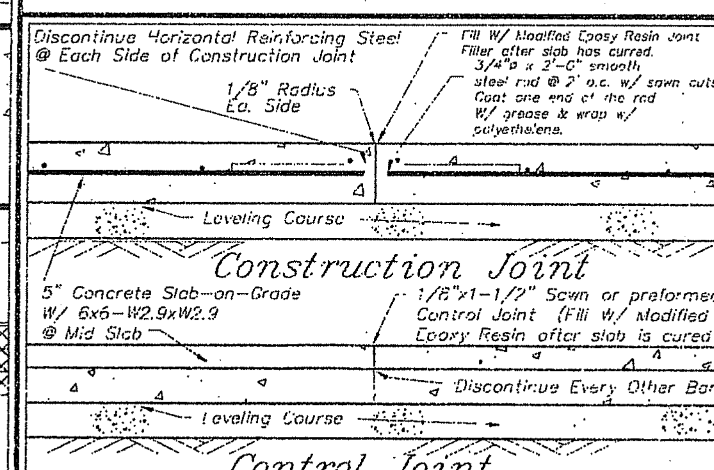

Slab Joint Details (c.j.'s) (D)
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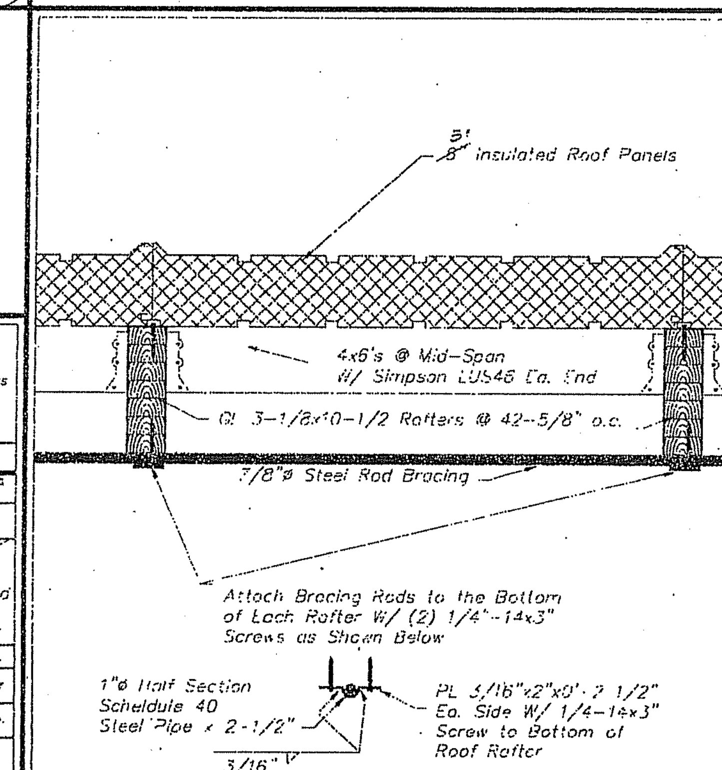

Roof Bracing Connection @ Btm. of Rafters (E)
SCALE: 1 1/2" = 1'-0"

Consulting Engineering Offices of Arthur H. Whitmer, A Professional Corporation

STATE OF ALASKA 49TH Arthur H. Whitmer CE 3057 REGISTERED PROFESSIONAL ENGINEER

SCALE: 1" = 4'

VILLAGE SAFE WATER

STATE OF ALASKA 49TH Charles L. Eggener No. 4158-E REGISTERED PROFESSIONAL ENGINEER

PUMPHOUSE
Brace Conn. Details
NOATAK, ALASKA

CHUCK EGGENER
CONSULTING ENGINEERS
ANCHORAGE, ALASKA

REVISION	BY	DATE
ADDED ASBUILT INFO.	CH	JAN 1996

Project No. | Date | Designed | Drawn | Approved

Sheet No. S-4

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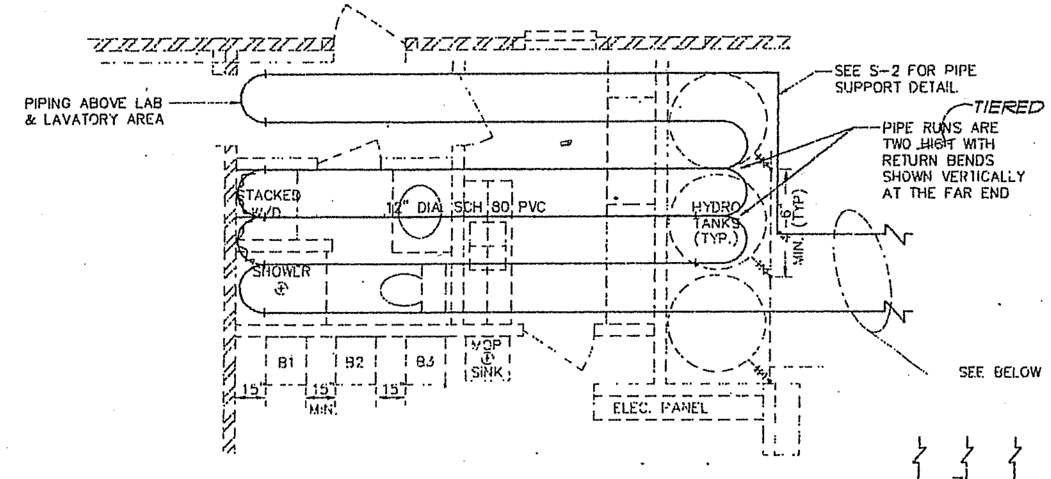
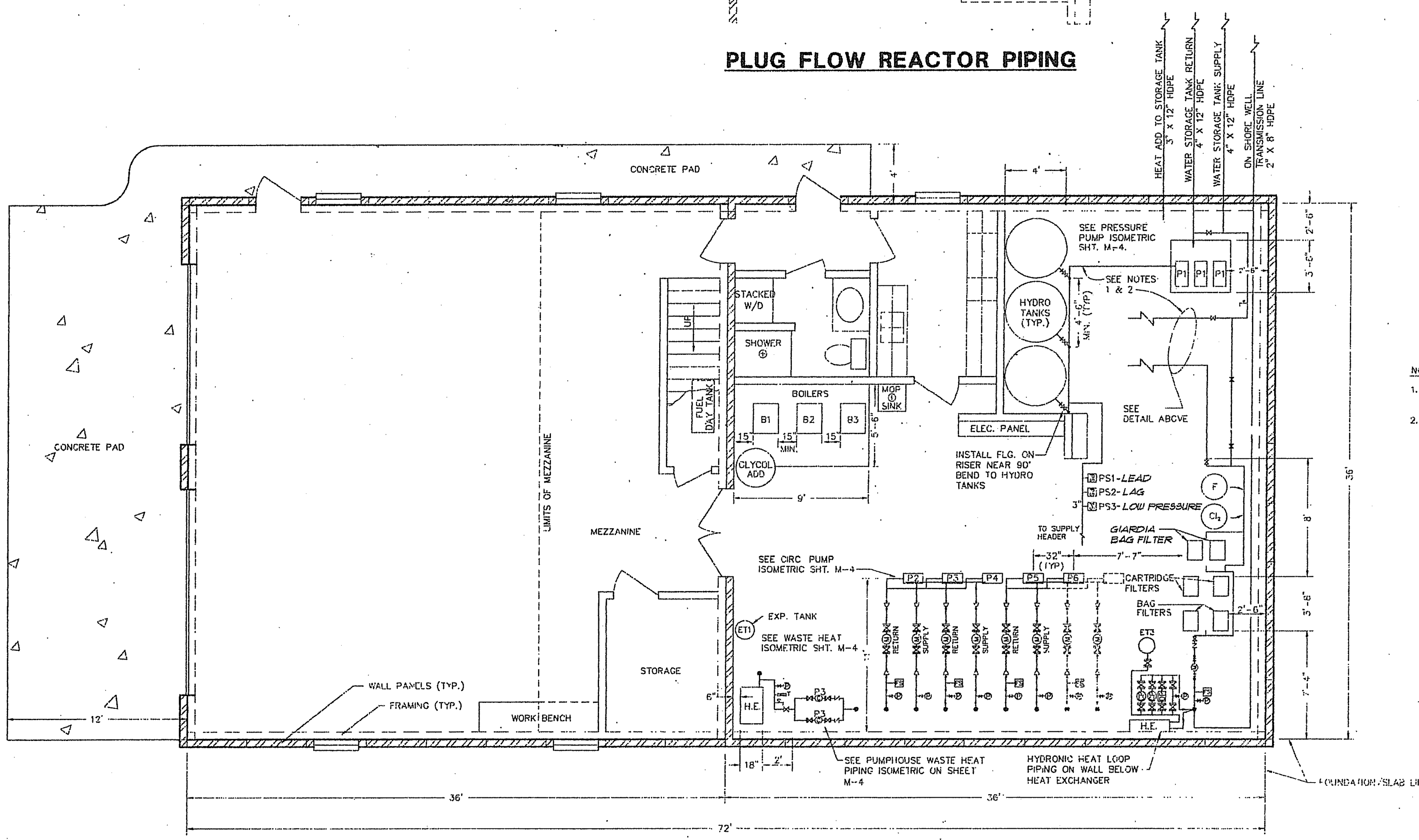


PLUG FLOW REACTOR PIPING



MECHANICAL FLOOR PLAN

SCALE 1/4" = 1'-0"

AS-BUILT

NOTES:

1. MAINTAIN MIN. 8'-4" CLEARANCE FROM FLOOR
2. SUPPORT OVERHEAD PIPE FROM CEILING EVERY 6' W/CLEAVIS TYPE HANGERS INCLUDING RUBBER ISOLATION PADS

RECORD DRAWING CERTIFICATE

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NAME / DATE 1/95

SCALE: 1" = 4'

VILLAGE SAFE WATER

MECHANICAL LAYOUT PLAN

NOATAK, ALASKA

CHUCK EGGENER CONSULTING ENGINEERS

ANCHORAGE, ALASKA

REVISION	BY	DATE
ASBUILT DRAWING	CY	JAN. 1995

Project No. CE21994.01

Date 02/01/94

Designed LAP

Drawn KP\DEF

Approved CLE

Sheet No. M-3

SHEET ___ OF ___

\NOATAK94\MECHPLAN

APPENDIX D: ARCTIC FOUNDATIONS REPORT

ARCTIC FOUNDATIONS, INC.

September 28, 2009

Larsen Consulting Group, Inc.
3710 Woodland Drive • Suite 2100
Anchorage, AK 995017

Attn: Danny Graham, P.E.

Re: Water Treatment Plant Inspection
Noatak, Alaska

At the request of Danny Graham of Larsen Consulting Group, Inc., Ed Yarmak of Arctic Foundations, Inc. traveled to Noatak on September 22, 2009 to assist with investigating the cause of differential movement that has occurred at the water treatment plant. Travel to Noatak was via Alaska Airlines between Anchorage and Kotzebue and via Frontier (Hageland Aviation) between Kotzebue and Noatak. Both the work and travel were completed in a single long day.

The water treatment plant is a wood framed slab-on-grade structure that is approximately 36' x 72'. The long axis of the building runs NNW and will be considered as running north for the remainder of this letter report. The south end of the building is a maintenance shop with rails in the slab to accommodate tracked equipment on the concrete floor. The north half of the building houses the water treatment and distribution equipment.

A gallery of vertical pipes exit the water treatment area through the floor along the east wall. Eight of the pipes make up the four loops of the circulating water distribution system, another is the waste heat return line and another is an intake line from one of the wells. The waste heat supply line comes up out of the ground vertically just outside the building footprint and penetrates the side wall near the other piping.

There is a row of 10 thermosyphon condensers spaced 8' c-c along the west side of the structure. The condensers are approximately two feet from the outside wall panel. The condenser fins start about a foot and a half from the ground. Per the construction plans, the thermosyphons continue vertically beneath the condensers until they are under the subgrade insulation and then slope to the east under the building at 5%.

To the west of the building is the water tank. The tank is founded at-grade and is just uphill from the water treatment plant. Some of the fill material around the water tank is held back by a failing wood retaining structure.

The south side of the building is the driveway to the shop area and is fairly level. To the east of the building, the gravel slopes away at approximately 1:3 (vertical:horizontal). There is a slight depression in the gravel where the piping gallery exits the building and that depression appears to continue out into the street. On the north side of the

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building, the ground slopes away at about 1:4 for about 6 feet and then slopes down at about 1:3.

The internal pressures of the thermosyphons were measured with a 0-600 psi gauge from Wika. Using the relationship for pressure vs. temperature for saturated CO_2, the temperature of the liquid/vapor interface was computed. This temperature is basically the temperature of the liquid pool at the lower end of the thermosyphon evaporator. Measured thermosyphon pressures varied from 480 psig to 495 psig and correspond to temperatures of 30.6°F to 32.6°F, respectively. A complete list of the measured pressures and completed temperatures is attached.

The computed temperatures are warmer than expected for an installation of this type. Generally, we are expecting to see temperatures on the order of 26°F to 28°F at this time of the year. There are four factors contributing to warming the subgrade under the building in addition to the normal heat from the structure. The actual reason why the temperatures are so warm is probably a combination of these factors.

Paul Walton, the WTP Operator, said that in the area where the condensers are there are drifts every winter up to approximately midway on the condenser fins. This drifted snow effectively blocks off half of the condenser area and reduces the cooling capacity of the thermosyphons by approximately 30%.

Mr. Walton also related that the roof sheds a substantial amount of water right along the east and west sides of the building. This water is nothing but a heat load when absorbed into the gravel pad. Water on the west side of the building has nowhere to go and probably infiltrates the pad and flows over the membrane that covers the subgrade insulation to the east side of the structure.

Typically, the highest heat load is in the center of the building and the thermosyphons at the ends of a building are cooler than the units in the center. On this building, the southernmost unit is relatively cool but the northernmost unit is quite warm, indicating that there is heat coming laterally through the fill embankment in summer. We suspect the same lateral heat flow in through the embankment on the west side as the slopes are quite steep and not protected with vegetation. The original plan for these slopes called for a topping of fine grained soils that would support vegetation over time.

The heat load from the circulating loops and the waste heat lines may be somewhat isolated from the foundation subgrade by the vertical insulation barrier to the west of the vertical pipe gallery, but the subgrade outside the building line is not protected. From the levels taken by Danny Graham inside the building, it is apparent that the exterior piping is sinking away from the structure.

Because the settlement has only been apparent for the past 5 or so years (per Paul Walton), it is thought that the cause of the settlement is due to thaw consolidation at the building perimeter and outside the building footprint in the pipe gallery area. There could also be lateral movement of some of the fill material into the road at this localized area.

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