

Contract ID: SC-INF01-1469
Our File #:18-304

**Sanayut Consulting Professional
Engineers Corporation**

ENR Bunkhouse Foundation Pile Condition Assessment

PREPARED BY:

Sanayut Consulting Professional Engineers Corporation
PO Box 3033 Inuvik, NT X0E 0T0





Covering Letter

August 29, 2018

Government of the Northwest Territories
Department of Infrastructure
Projects Division
3rd floor, GNWT Multiuse Building
Bag Service #1
106 Veterans Way
Inuvik, NT X0E 0T0

Attn: Joao Nuncio

Dear Sir:

Regarding: ENR Bunkhouse Foundation Pile Condition Assessment
Location: Lot 4 Block 91, Inuvik, NT

Sanayut Consulting Professional Engineers Corporation (Sanayut) is pleased to provide the following report regarding the foundation pile condition assessment for the above-referenced building.

This report has been prepared under my direct supervision.

We appreciate the opportunity to work with you. Please feel free to contact us if you have any questions regarding the enclosed report.

Sincerely,

Sanayut Consulting Professional Engineers Corporation



Mark Hasegawa, P.Eng.

Enclosures

MH/cms

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EXECUTIVE SUMMARY

An assessment of the pile foundation of the ENR Bunkhouse building located at Lot 4 Block 91, Inuvik, was conducted on June 19, 2018.

The wooden pile foundation that formerly supported the bunkhouse building had been removed and replaced with 18 steel piles located around the exterior of the building, supporting steel beams which span from pile to pile under the building. The topography of the ground under and around the building varies and there is a low spot under the building. As a result, some of the steel piles extend only a few feet above the ground while other extend up to four feet above ground (refer to site photos in Appendix C). During the pile inspection the location and condition of each pile was observed and documented. An assessment of the extent of pile deterioration was conducted on each pile by exposing buried portions of each pile and observing conditions. In addition, an evaluation of existing overland drainage patterns was conducted. The drainage appears to flow from the north down towards the south and southeast. There was some standing water observed around piles A3 – A7 along the back (east side) of the building in the depression beneath the building.

The results of this report indicate that the steel piles are in relatively good condition with minor rust and flaking on the surface. Based on this analysis the foundation appears to be performing as designed.

1. EXISTING CONDITIONS

The bunkhouse building rests on eighteen steel piles located outside the building footprint which support nine steel beams that span from pile to pile underneath the building. The pile sizes are 9" and 12" in diameter. The dimensions and pile spacings are shown on [Figure 1](#), [Appendix A](#) and further described in subsequent sections.

2. METHODOLOGY

The following section includes a summary of assessment methodology for the existing pile conditions as documented in the previous section.

2.1 Project Objectives

The project objectives stated in the TOR are as follows:

"The GNWT requires consultant engineering services to complete a foundation investigation for wooden pile foundations for Beaufort Delta and Sahtu buildings and to determine remedial work required which may include the change of foundation type as part of a final report."

2.2 Project Implementation

The following is the action taken to fulfill the scope of work set forth in the TOR.

2.2.1 Data Acquisition

No design or design or construction documentation of the building such as as-builts, building plans or date of construction could be identified. In addition, an inquiry was made with the Town of Inuvik for topographical data for the area and general topographic information, but none was available.

2.2.2 Code Review and References

Code and reference reviews were conducted of key codes and regulations and include the following applicable Acts, Standards and Guidelines:

1. *Good Building Practice for Northern Facilities*, Government of the Northwest Territories
2. National Building Code 2015
3. Town of Inuvik Zoning Bylaw & Engineering Standards
4. *GNWT Deteriorated Untreated Wood Piles: Cause, Detection and Correction* document
5. Pile remediation contractors.

Since the bunkhouse had already been repaired and there are no wood piles, no costing or recommendations with respect to repairs were made.

2.2.3 Site Visit

A site visit and inspection of each pile was conducted on June 19, 2018. The inspection for each pile included:

-) Visual observation of the site and existing overland drainage patterns. Site drainage was observed to determine if it was potentially impacting the piles and possibly enhancing pile deterioration.
-) Observations and measurements as to the general building footprint, pile types, sizes, and dimensions between piles (this information is summarized on [Figure 1](#)
-) Excavation around each pile and down to a maximum depth of 500mm below ground surface
-) Photographs were also taken and a selection of photos illustrating findings is attached (refer to [Appendix B-Photographs](#)).

Steel Piles

-) Visual inspection of pile condition
-) Excavation around each pile up to 500mm below ground to evaluate pile condition
-) Scratch test with screwdriver to determine depth of rust penetration if any is present

3. SUMMARY OF OBSERVATIONS

The results of this analysis are summarized in **Figure 1 (Appendix A)** and **Table 1** below, as well as the pile inventory form in **Appendix A**. The piles have been classified based on the structural criteria set forth in the previous section. Key parameters evaluated included:

-) Diameter of pile
-) Depth of deterioration
-) Vertical extent of deterioration
-) Existence of drainage issues or standing water.
-) Remaining pile diameter with solid material

The results of the site inspection showed that each steel pile had minimal surface rust with no penetration except for piles A7, A9, B3-5, and B7 which had flaking rust. The drainage appears to flow from the north down towards the south and southeast. There was some standing water observed around piles A3 – A7 along the back (east side) of the building in the depression beneath the building.

Table 1. Summary of Pile Observations

	ENR Bunkhouse	Recommendations
Total Piles	18	
< 10% damage		
10-25% damage		
25-50% damage		
>50% damage		
Replaced with steel piles	18	none
Not inspected		

4. REPAIR RECOMMENDATIONS

Based on this analysis the existing steel piles are in good working condition. Any observed rust or deterioration was minimal and not of concern. No repair action is recommended at this time. The ground beneath the building is depressed and allows for standing water. Although the impact to the piles is considered to be minor, over time this will contribute to pile deterioration. The drainage issue could be resolved by filling in the low area.

5. COST ANALYSIS

It is recommended that the low area around the piles and beneath the building be filled to resolve the issue of standing water under the building and around the piles at the rear of the building.

Based on the recommendations above, a cost analysis was performed to evaluate the costs to facilitate the action noted above. Refer to **Table 2**.

Table 2. Class D Cost Estimate

Description	Unit Cost	Units	Amount	Total
Site Preparation	\$ 200.00	LS	1	\$ 200.00
Gravel fill material	\$ 40.00	m ³	50	\$ 2,000.00
Shaping	\$ 15.00	m ²	150	\$ 2,250.00
Site restoration	\$ 1,000.00	LS	1	\$ 1,000.00
Engineering drawing and inspection	\$ 1,000.00	LS	1	\$ 1,000.00
Contingency (10%)				\$ 645.00
Subtotal				\$ 7,095.00
GST				\$ 354.75
Total				\$ 7,449.75

6. SUMMARY AND CONCLUSIONS

An assessment of the foundations of the bunkhouse located at the aforementioned address was conducted on June 19, 2018. A site map is shown on **Figure 1**, [Appendix A](#).

The ENR bunkhouse building currently rests on eighteen steel piles located outside the building footprint, which support nine steel beams that span from pile to pile underneath the building. The piles are 9 inches and 12 inches in diameter (refer to **Figure 1**). The ground around each pile was excavated to a maximum depth of 500mm below ground ensuring that each pile was sufficiently exposed for inspection. A visual inspection as well as a “scratch” test were performed for each steel pile to assess the extent of impact below the ground surface. In addition, an evaluation of drainage patterns was conducted. The drainage flows from the northwest corner of the lot to the south and southeast. There is a drainage channel which releases standing water from the low spot beneath the building. There was standing water observed in the low spot beneath the building and around piles A3 – A7 during the pile assessment. The existing ground topography around the bunkhouse building varies, which contributes to surface water ponding beneath the building. To address the standing water around the piles it is recommended that the low spot be filled with gravel.

The results of this report indicate that the steel piles are in relatively good condition with only surface rust observed on the majority of the piles. Piles A7, A9, B3-5, and B7 showed some flaking rust beneath the ground surface. Based on this analysis the foundation appears to be performing as designed and no repair actions are recommended at this time.

REFERENCES

1. *Untreated Submerged Timber Pile Foundations: Part 1: Understanding Biodegradation and Compressive Strength* Dec, 2013 By Giuliana Zelada-Tumialan, P.E., William Konicki, P.E., Philip Westover, P.E. and Milan Vatovec, Ph.D., P.E. In *Articles, Structural Forensics*.
2. *Untreated Submerged Timber Pile Foundations: Part 2 – Estimating Remaining Service Life* Jan, 2014 By Giuliana Zelada-Tumialan, P.E., William Konicki, P.E., Philip Westover, P.E. and Milan Vatovec, Ph.D., P.E. In *Articles, Structural Forensics*.
3. *Deteriorated Untreated Wood Piles: Cause, Detection and Correction*. By Technical Support Services, Asset Management Division, Public Works and Services, Government of the NWT <http://www.pws.gov.nt.ca>

APPENDIX A

PILE INVENTORY FORM & FIGURE

Pile Inventory Form

BUILDING ASSET NUMBER:
BUILDING NAME: ENR BUNKHOUSE, SHELL LAKE, NT
TOTAL NUMBER OF PILES: 18
DATE INSPECTED: 19-Jun-18

WATER PONDING UNDER BUILDING: Yes
YEAR OF PILE INSTALLATION: Unknown
ADDITION: No
SKIRTING AROUND BUILDING (Y/N): No

PILE TYPE	
W	WOOD
S	STEEL
C	CONCRETE

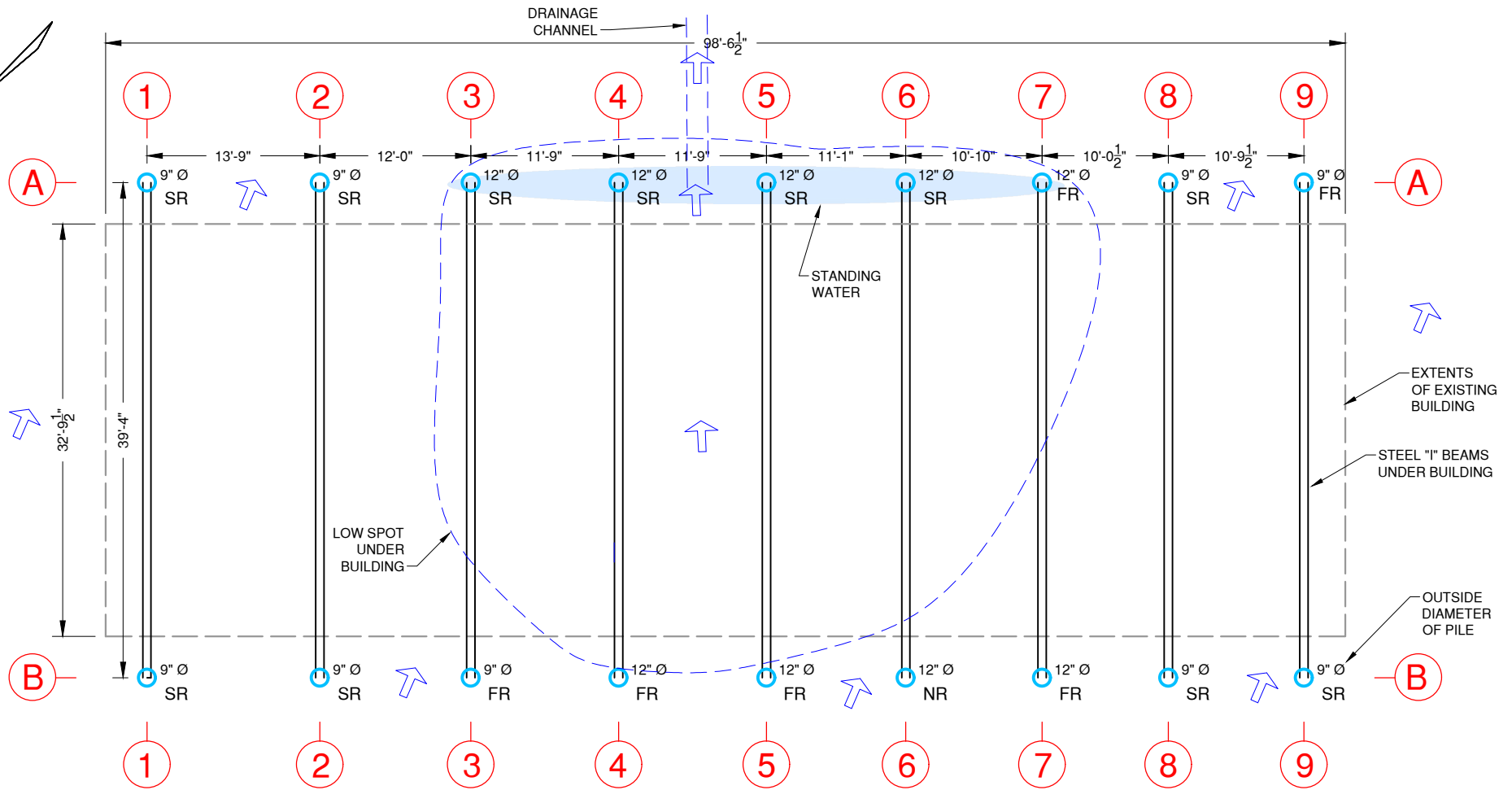
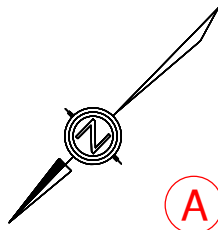
Notes:

WEATHER CONDITIONS: Overcast with scattered showers

TEMPERATURE: 8°C

	Definition - Pile Condition	Range of Rot	Count in each range	Percentage in each Range
A	Little or no rot detected, No repair req'd	0 - 10%	N/A	N/A
B	Rotted, requires monitoring	10 - 25%	N/A	N/A
C	Rotted, requires repair	25 - 50%	N/A	N/A
D	Rotted, requires immediate blocking	50 to 100%	N/A	N/A

No.	Pile Type	Pile Currently Blocked	Previously Repaired	Depth of Rot Detected	Pile Diameter	Pile Circumference	Original Area (Cross section)	remaining	Cross sectional Area of Rot	Percent Rot (Cross section)	Moisture	Pile Condition		Date Pile Blocked	Date Pile Repaired	Date Boron Treatment	Comments/Remarks
	W, S, C	Y/N	Y/N	inches	inches	inches	square inches		square inches	%	%	Def	Date				
A1	S	N	Y		9									2018-06-19			Surface rust
A2	S	N	Y		9									2018-06-19			Surface rust
A3	S	N	Y		12									2018-06-19			Surface rust/some flaking
A4	S	N	Y		12									2018-06-19			Surface rust/some flaking
A5	S	N	Y		12									2018-06-19			Surface rust/some flaking
A6	S	N	Y		12									2018-06-19			no rust observed
A7	S	N	Y		12									2018-06-19			Surface rust/some flaking
A8	S	N	Y		9									2018-06-19			Surface rust
A9	S	N	Y		9									2018-06-19			Surface rust
B1	S	N	Y		9									2018-06-19			Surface rust
B2	S	N	Y		9									2018-06-19			Surface rust
B3	S	N	Y		9									2018-06-19			Surface rust
B4	S	N	Y		8									2018-06-19			Surface rust
B5	S	N	Y		12									2018-06-19			Surface rust
B6	S	N	Y		12									2018-06-19			Surface rust
B7	S	N	Y		12									2018-06-19			Surface rust/some flaking
B8	S	N	Y		9									2018-06-19			Surface rust
B9	S	N	Y		9									2018-06-19			Surface rust/some flaking



LEGEND

- STEEL PILE
- PILE GRID ALIGNMENT
- PILE NUMBER
- NR NO RUST
- SR SURFACE RUST
- FR FLAKING RUST
- APPARENT OVERLAND DRAINAGE DIRECTION

NOTE:

- BUILDING DIMENSIONS SHOWN ARE APPROXIMATE AND FOR REFERENCE ONLY

DRAWING STATUS		FOR REPORT	
#	REVISION	DATE	BY
NOTES			
THIS IS A COPYRIGHT DRAWING AND SHALL NOT BE REPRODUCED IN ANY FORM WITHOUT WRITTEN PERMISSION OF THE ENGINEER			
CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE CONSTRUCTION, ANY ERRORS AND OMISSIONS SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY			
DRAWING SHALL NOT BE USED FOR CONSTRUCTION UNTIL APPROVED			
DO NOT SCALE THE DRAWING			
ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST CODES, MAY IT BE CONSTRUCTION, MECHANICAL, ETC			

CLIENT	GOVERNMENT OF NWT
PROJECT TITLE	PILE ASSESSMENT JUNE 19, 2018
DRAWING TITLE	ENR BUNKHOUSE INUVIK, NT



INSPECTED BY	MO
DRAWN	MO
CHECKED	MH
APPROVED	MH
SCALE	NTS

PROJECT NUMBER	18-304
VERSION NUMBER	IFA1-1
DATE DRAWN	JULY 4, 2018
SHEET NUMBER	FIG. 1

APPENDIX B

PHOTOGRAPHS





