June 6, 1997

Snake River Construction
P.O. Box 773504
Steamboat Springs, CO 80477

Job No. 97-2943

Subject: Open Hole Inspection, Vanatta Residence, Lot 80, Filing 4, The Sanctuary Subdivision, Steamboat Springs, Colorado.

Gentlemen:

As requested, Northwest Colorado Consultants, Inc. visited the project site on June 5, 1997 to observe the foundation excavations for the Vanatta Residence being constructed within Lot 80, Filing 4 of The Sanctuary Subdivision in Steamboat Springs, Colorado.

At the time of our site visit, the excavation contractor had completed the foundation excavations to the final grades. The depth of the excavations ranged from approximately 3 to 5 feet in depth. The soils exposed in the excavations consisted mainly of natural sands and gravels. The sands and gravels were generally silty, fine to course grained with cobbles and boulders, non-plastic, medium dense and brown in color. The sands and gravels are similar to those encountered in the subsoil investigation conducted by our office, under this job number and dated April 14, 1997. The contractor had placed screened rock in areas where cobbles and boulders were encountered at the proposed footing grades. The depth of the screened rock was approximately 2 to 8 inches in thickness.

We believe that the natural sands and gravels and the screened rock should provide adequate bearing for spread footings designed for an allowable soil bearing pressure of 2,500 psf, as indicated in the soils report.

If you have any questions regarding this letter, our observations or recommendations or if we may be of further service, please contact this office.

Sincerely,
NORTHWEST COLORADO CONSULTANTS, INC.,

Timothy S. Travis, P.E.

Reviewed by Brian D. Len, P.E.

cc: Routt County Building Department

April 14, 1997

Joe Robbins
P.O. Box 771463
Steamboat Springs, CO 80477

Attention: Shelley Pastachak

Job Number 97-2943

Subject: Subsoil Investigation, Proposed Vanatta Residence, Lot 80, Filing No. 4, The Sanctuary, Steamboat Springs, Colorado.

Ladies & Gentlemen:

This report presents the results of a subsoil investigation and geotechnical evaluation for the proposed Vanatta Residence to be constructed within Lot 80, Filing No. 4 of the The Sanctuary in Steamboat Springs, Colorado. The approximate project site location is shown on Figure #1.

The scope of our work included obtaining data from a visual inspection of the site, the excavation of two test pits, the sampling of the probable foundation soils and the laboratory testing of the samples obtained. The contents of this report present recommendations for economically feasible and safe type foundations, as well as allowable soil pressures and other design and construction considerations that are advisable, but not necessarily routine to quality design and building practices.

Proposed Construction: We understand that the owner proposes to construct a one to two story wood framed structure with an attached garage. The lower level of the structure will be constructed with a structural floor system placed near or slightly above the existing ground surface. The attached garage will be constructed utilizing a slab-on-grade floor system also located near the existing ground surface.

For design purposes, we have assumed that the building loads will be light to moderate, typical of residential construction. If loadings or conditions are significantly different from those above, we should be notified to reevaluate the recommendations in this report.

Site Conditions: The building site is situated east of South Steamboat Boulevard in Steamboat Springs, Colorado. The site was vacant and was covered with approximately 2 feet of snow at the time of this

investigation. The site appeared to be well vegetated with natural grasses, weeds and deciduous brush in a moderately dense aspen forest.

The topography of the site is fairly consistent and generally slopes gently down to the south on the order of 2 to 3 percent. It appears that a maximum elevation difference of approximately 2 feet exists across the proposed building site.

Subsurface Conditions: To investigate the subsurface conditions at the site, two test pits were advanced with a trackhoe on April 9, 1997. The approximate test pit locations are shown on Figure #2.

The subsoils encountered were fairly uniform and generally consisted of a layer of topsoil and organics overlying natural sands and gravels to the maximum depth investigated, 8 feet. Graphic logs of the exploratory test pits, along with the associated Legend and Notes, are presented in Figure #3.

The topsoil encountered in the test pits was approximately 12 to 18 inches in thickness. Cobbles and boulders were encountered in the topsoil. Natural sands and gravels were encountered below the topsoil layer and extended to depths of 8 to 6 feet, in test pits 1 and 2, respectively. The natural sands and gravels were slightly silty, fine to coarse grained with cobbles and boulders, non-plastic, medium dense to dense, moist and brown in color. Samples of the sands and gravels classified as GM and SM-GM soils in accordance with the Unified Soil Classification System. The laboratory test results are summarized in Table 1. It should be noted that boulders ranging from 1 to 3 feet in diameter were encountered in the test pits.

Groundwater seepage was not encountered in the test pits at the time of this investigation. It should be noted that groundwater conditions can be expected to fluctuate with changes in precipitation and runoff.

Foundation Recommendations: Based on the soils encountered in the test pits, the results of the field and laboratory investigations and the proposed construction, we believe an economically feasible and safe type of foundation system is spread footings or individual pads with grade beams founded on the natural sands and gravels or on properly compacted structural backfill. Foundation movement should be within tolerable limits if the following design and construction precautions are observed.

1) The footings placed on the natural sands and gravels or properly compacted structural backfill should be designed for an allowable soil bearing pressure of 2,500 psf.

2) All footings or pad sizes should be computed based on the above soil pressures and placed on the natural undisturbed soils found below the topsoil or on properly compacted structural backfill. Spread footings placed on granular soils should have a minimum footing width of 16 inches.

3) Any topsoil or loose natural soils encountered within the foundation excavations, should be removed prior to concrete or structural fill placement. If fills are required to bring the footing excavations back to the desired footing grade, the fill placed beneath the footings should be a

non expansive granular soil approved by the soil engineer. Fill should be placed in 6 to 8 inch lifts and uniformly compacted to at least 95% of the maximum modified Proctor density near optimum moisture content in accordance with ASTM D1557. The existing sands and gravels will be suitable for use as fill materials beneath the footings after the cobbles and boulders are removed.

4) All foundation walls should be designed and reinforced to span an unsupported distance of 10 feet or the length between pads, whichever is greater.

5) All footings or pads should be placed well enough below final backfill grades to protect them from frost heave. Forty eight (48) inches is typical for this location considering normal snow cover and other winter factors.

6) Based on experience, we estimate total settlement for footings and pads designed and constructed as discussed in this section will be approximately 1 inch. Additional bearing capacity values along with the associated settlements are presented in Figure #4.

7) We suggest a soils engineer be called to the site when the foundation excavations are near completion to identify the bearing soils and confirm the recommendations in this report. In addition, any fill placed beneath the foundation system should be tested for compaction.

Floor Slabs: The natural soils, exclusive of topsoil, are suitable to support lightly to moderately loaded slab-on-grade construction. Floor slabs should be provided with control joints placed a maximum of 12 feet on center in each direction to help control shrinkage cracking. The location of the joints should be carefully checked to assure that the natural, unavoidable cracking will be controlled.

We recommend that a 6-inch layer of free draining washed rock fill be placed beneath all floor slabs. If fills are required to to bring the underslab areas to grade, the materials placed beneath the floor slabs should be a non expansive granular soil approved by the soil engineer. Fill should be placed in 6 to 8 inch lifts and uniformly compacted to at least 95% of the maximum standard Proctor density, within 2% of the optimum moisture content, in accordance with ASTM D-698. The existing sands and gravels will be suitable for use as fill materials beneath the floor slabs after the cobbles and boulders are removed. We recommend that all of the topsoil and organics be removed from underneath the floor slabs prior to concrete or fill placement.

Underdrain System: If any floor level is placed beneath the finished ground surface, that level should be protected by an underdrain system to help reduce the problems associated with surface drainage during high runoff periods. Localized perched water or runoff can infiltrate the foundation at the footing levels. This water can be one of the primary causes of differential foundation and slab movement.

The drain should be located around the entire perimeter of the foundation level and should be placed between the top and bottom of the footings. We recommend the use of perforated PVC pipe for the drain tile, which meets ASTM D-2729 requirements, to minimize the potential for crushing the pipe during

backfill operations. The holes in the drain tile should be oriented down between 4 o'clock and 8 o'clock to promote rapid runoff of the water. The drain tile should be surrounded with at least 6 inches of free draining gravel and should be protected from contamination by a filter covering of Mirafi 140N subsurface drainage fabric or an equivalent product. The drain should have a minimum slope of 1/8 inch per foot and should be daylighted at a positive outfall protected from freezing, or be led to a sump from which the water can be pumped. Caution should be taken when backfilling so as not to damage or disturb the installed underdrain. We recommend the drainage system include at least one cleanout, be protected against intrusion by animals at the outfall and be tested prior to backfilling. A typical perimeter/underdrain detail is shown in Figure #5.

Foundation and Retaining Walls: Foundation walls and retaining structures which are laterally supported and can be expected to undergo only a moderate amount of deflection may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 45 pcf for the on-site granular backfill.

Cantilevered retaining structures on the site can be expected to deflect sufficiently to mobilize the full active earth pressure condition. Therefore, cantilevered structures may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 35 pcf for the on-site granular backfill.

All foundation and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials. An upward sloping backfill also increases the earth pressures on foundation walls and retaining structures.

The lateral resistance of retaining wall foundations placed on undisturbed natural soils at the site will be a combination of the sliding resistance of the footing on the foundation materials and the passive pressure against the side of the footing. Sliding friction can be taken as 0.4 times the vertical dead load. Passive pressure against the sides of the footing can be calculated using an equivalent fluid pressure of 250 pcf.

We recommend granular soils for backfilling foundation walls and retaining structures because their use results in lower lateral earth pressures. Granular material should be placed to within 2 feet of the ground surface. The upper 2 feet of fill should be a relatively impervious soil or pavement structure to prevent surface water infiltration into the backfill.

Backfill should be carefully placed in uniform lifts and compacted to between 90 and 95 percent of the maximum standard Proctor density, near the optimum moisture content. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfill materials will occur even if the material is placed correctly.

Compacted fill placed against the sides of the footings to resist lateral loads should be a non expansive material approved by the soil engineer. Fill should be compacted to at least 95% of the maximum standard Proctor density, near the optimum moisture content.

Surface Drainage: Proper surface drainage at this site is of paramount importance for minimizing the infiltration of surface drainage into the wall backfill and bearing soils which could result in increased wall pressures, differential foundation and slab movement. The following drainage precautions should be observed during construction and at all times after the building has been completed:

1) The ground surface surrounding the building should be sloped (minimum of 1.0 inch per foot) to drain away from the building in all directions to a minimum of 10 feet. Ponding must be avoided. If necessary, raising the top of foundation walls to achieve a better surface grade is advisable.

2) Non structural backfill around the building should be compacted to at least 90% of the maximum standard Proctor density at or near the optimum moisture content in order to minimize future settlement of the fill. The backfill should be placed immediately after the braced foundation walls are able to structurally support the fill. Puddling or sluicing must be avoided.

3) The top 2 feet of soil within 10 feet of the foundation should be impervious in nature to minimize infiltration of surface water into the wall backfill.

4) Roof downspouts and drains should discharge well beyond the limits of all backfill. Roof overhangs which project two to three feet beyond the foundation should be considered if gutters are not used.

5) Landscaping which requires excessive watering and lawn sprinkler heads, should be located a minimum of 10 feet from the foundation walls of the building.

6) Plastic membranes should not be used to cover the ground surface adjacent to foundation walls.

Limitations: The recommendations given in this report are based on the soils exposed at this site and the behavior of structures at neighboring, similar sites. We believe that this information gives a high degree of reliability for anticipating the behavior of the proposed structure; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soils profiles beneath those or adjacent to those observed; therefore, no warranties of the accuracy of these recommendations beyond the limits of the obtained data is herein expressed or implied.

This report is based on the investigation at the described site and on the specific anticipated construction as stated herein. If either of these conditions are changed, the results would also most likely change. Man-made or natural changes in the conditions of a property can also occur over a period of time. In addition, changes in requirements due to state of the art knowledge and/or legislation, do from time to time occur. As a result, the findings of this report may become invalid due to these changes. Therefore, this report is subject to review and not considered valid after a period of 3 years or if conditions as stated above are altered.

It is the responsibility of the owner or his representative to insure that the information in this report is incorporated into the plans and/or specifications and construction of the project. It is advisable that a contractor familiar with construction details typically used to dealing with the local subsoils and climatic conditions be retained to build the structure. If you have any questions regarding this report or if we may be of further service, please do not hesitate to contact us.

Sincerely,

NORTHWEST COLORADO CONSULTANTS, INC.

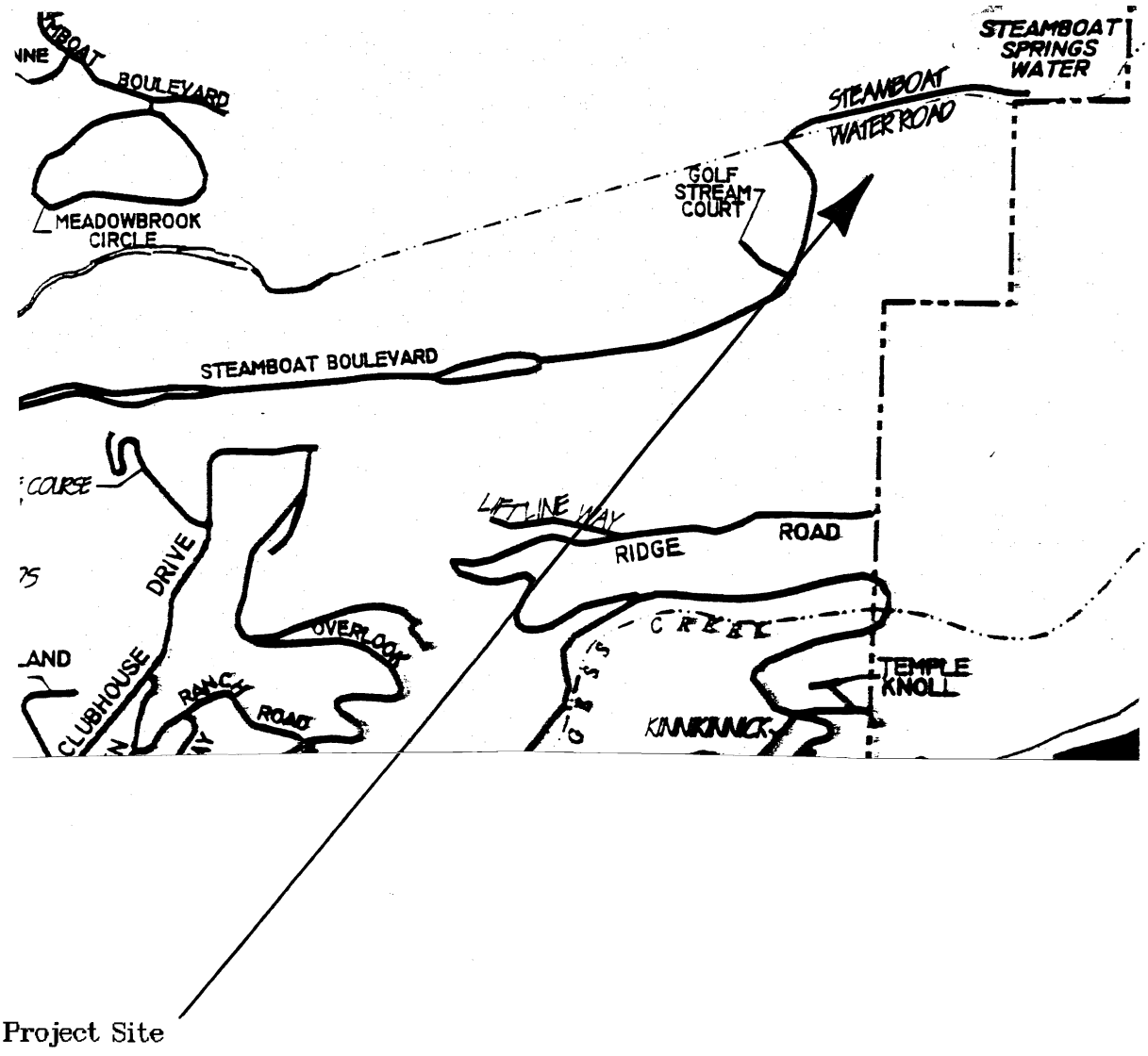
Timothy S. Travis, P.E.

Reviewed by Harold N. Schlicht, P.E.

NORTHWEST COLORADO CONSULTANTS

STEAMBOAT SPRINGS COLORADO

(No Scale)

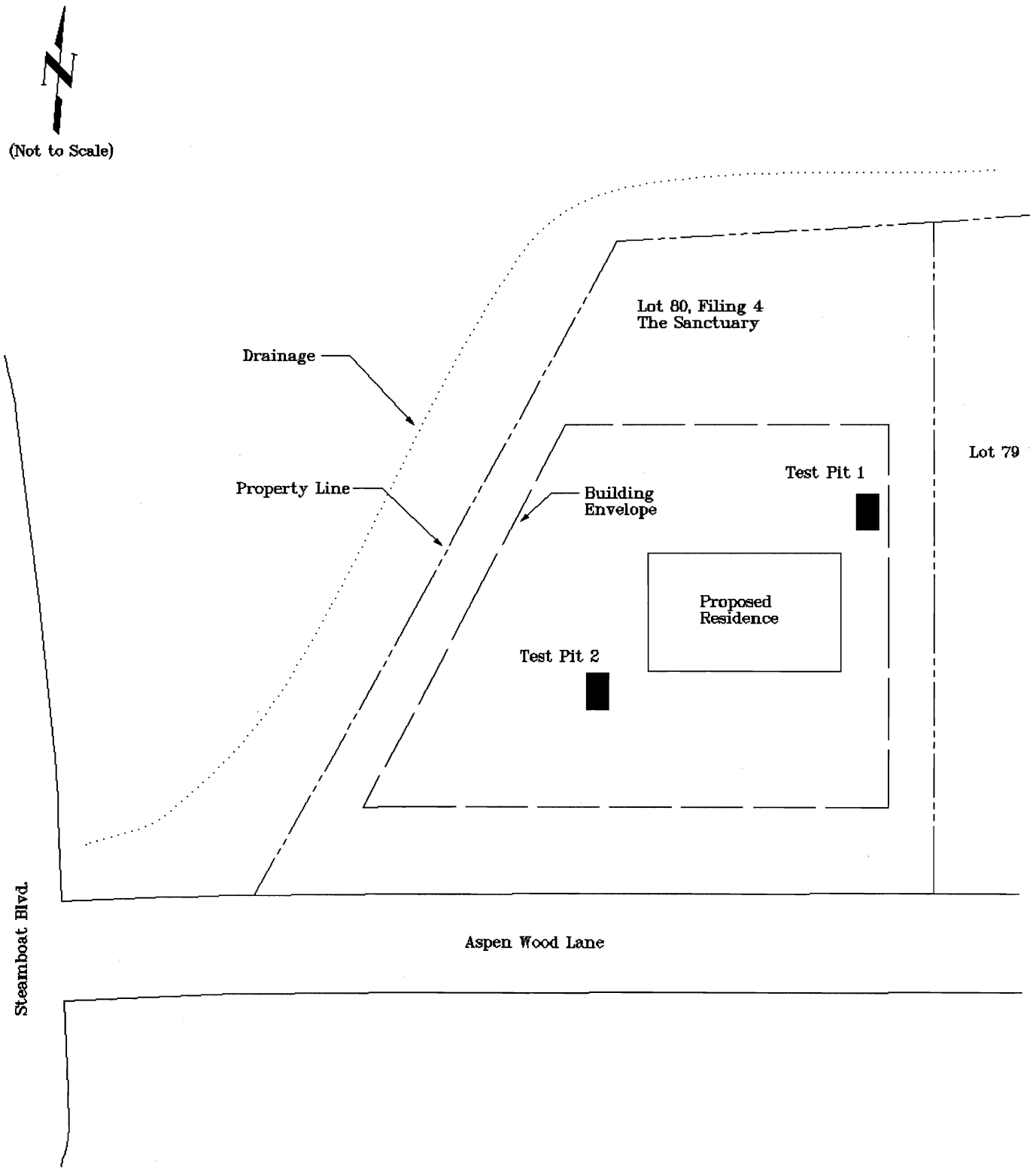


VICINITY MAP

Job Name: Proposed Vanatta Residence	Job No. 97–2943
Location: Lot 80, Fil.4, The Sanctuary, Steamboat Springs, CO	Figure #1

NORTHWEST COLORADO CONSULTANTS

STEAMBOAT SPRINGS COLORADO

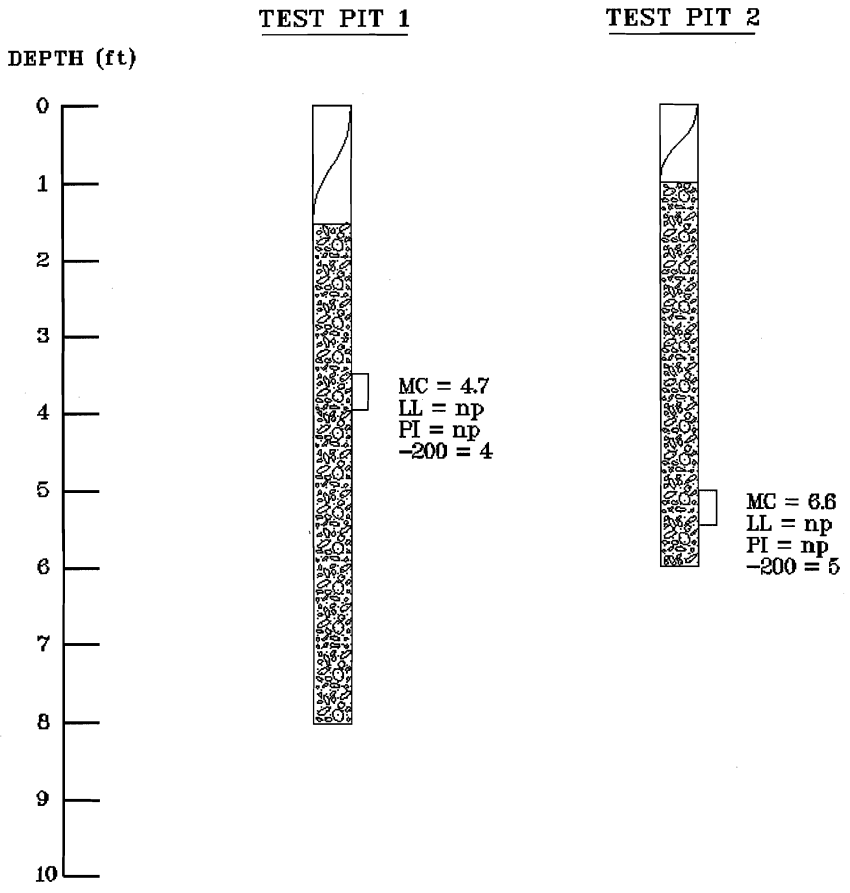


SITE PLAN / LOCATION OF TEST PITS

Job Name: Proposed Vanatta Residence	Job No. 97-2943
Location: Lot 80, Fil. 4, The Sanctuary, Steamboat Springs, CO	Figure #2

NORTHWEST COLORADO CONSULTANTS

STEAMBOAT SPRINGS COLORADO



LEGEND:

TOPSOIL & ORGANICS: With cobbles and boulders.

SANDS & GRAVELS: Slightly silty, fine to course grained with cobbles and boulders, non-plastic, medium dense to dense, moist and brown.

Small disturbed bulk sample.

NOTES:

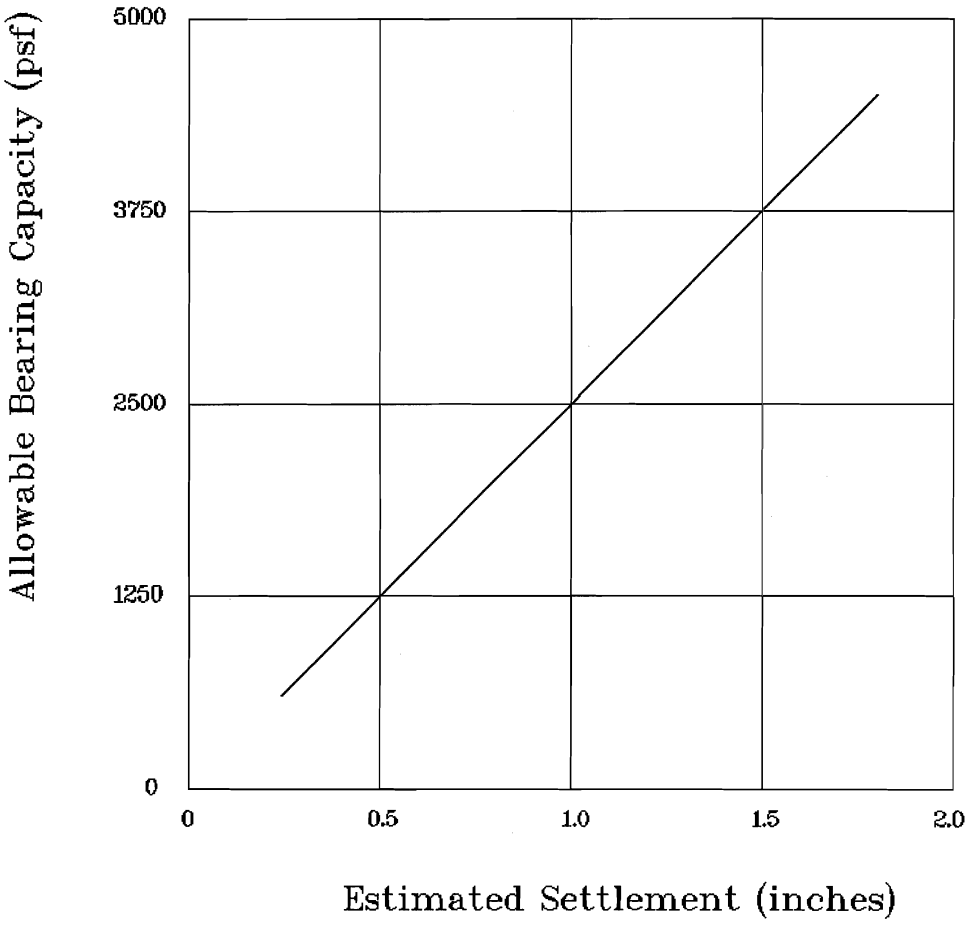
1) MC = Natural Moisture Content (%)
   DD = Natural Dry Density (pcf)
   LL = Liquid Limit (%)
   PI = Plasticity Index (%)
   -200 = Percent Passing the #200 US Standard Sieve
2) Test pits were excavated on 4/9/97 with a Komatsu PC200 trackhoe.
3) Locations of the test pits were determined in the field by pacing from topographic features at the site.
4) Elevations of the test pits were not measured and the logs are drawn to the depth investigated.
5) The lines between materials shown on the test pit logs represent the approximate boundaries between material types and transitions may be gradual.

LOGS, LEGEND, & NOTES

Job Name: Proposed Vanatta Residence	Job No. 97-2943
Location: Lot 80, Fil. 4, The Sanctuary, Steamboat Springs, CO	Figure #3

NORTHWEST COLORADO CONSULTANTS

STEAMBOAT SPRINGS COLORADO



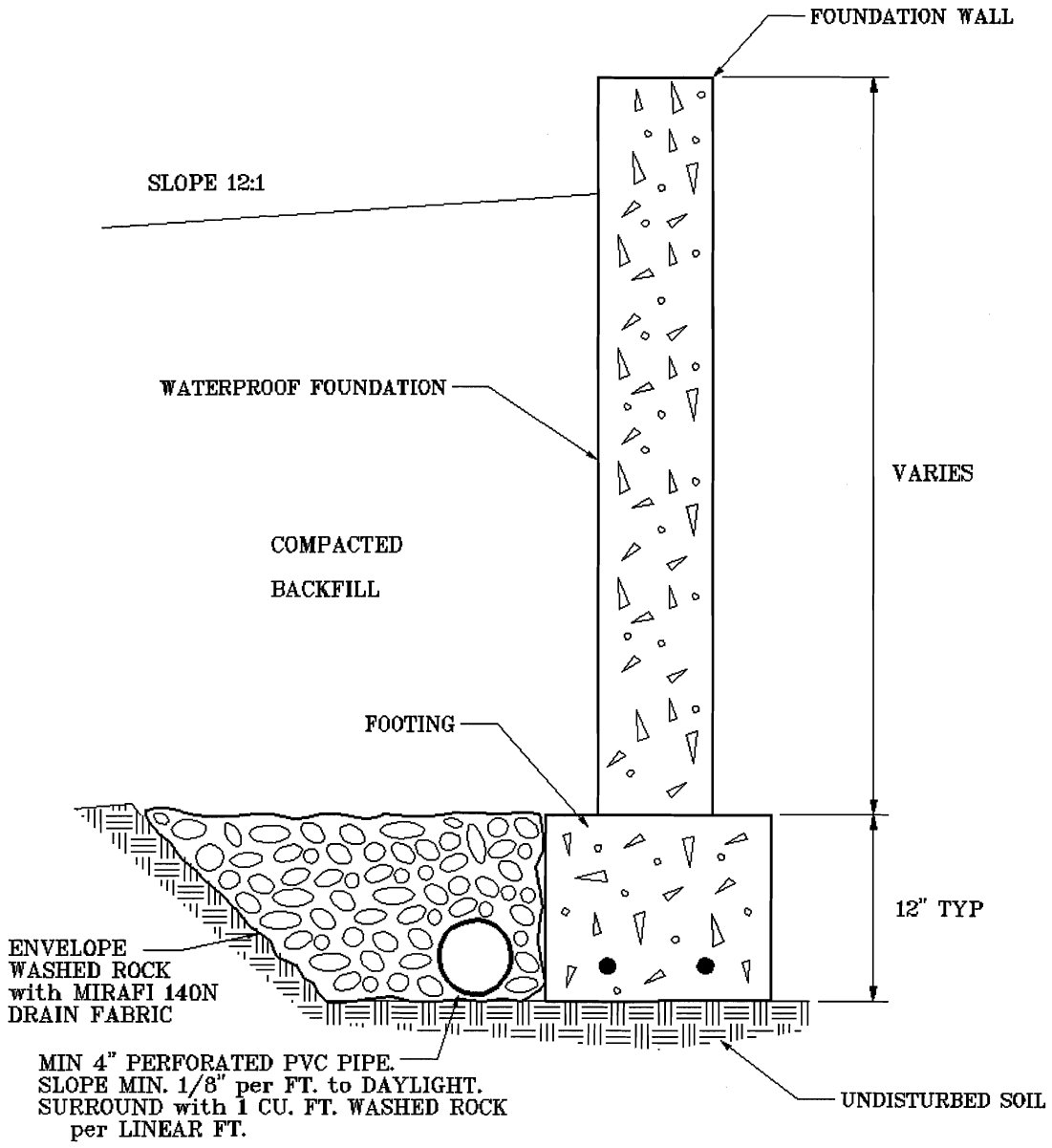
Note: These values are based on footing widths of 1 to 4 feet.
If the footing width is to be greater than 4 feet in width, then we should be notified to re-evaluate these recommendations.

BEARING CAPACITY CHART

Job Name: Proposed Vanatta Residence	Job No. 97-2943
Location: Lot 80, Fil. 4, The Sanctuary, Steamboat Springs, CO	Figure #4

NORTHWEST COLORADO CONSULTANTS

STEAMBOAT SPRINGS COLORADO



PERIMETER/UNDERDRAIN DETAIL

Job Name: Proposed Vanatta Residence	Job No. 97-2943
Location: Lot 80, Fil. 4, The Sanctuary, Steamboat Springs, CO	Figure #5

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TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	ATTERBERG LIMITS		GRADATION		PERCENT PASSING No. 200 SIEVE	UNCONFINED COMPRESSIVE STRENGTH (psf)	SOIL or BEDROCK DESCRIPTION	UNIFIED SOIL CLASS.
TEST HOLE	DEPTH (feet)			LIQUID LIMIT (%)	PLASTICITY INDEX (%)	GRAVEL (%)	SAND (%)				
1	3 1/2	4.7		np	np	67	29	4		Sands and Gravels	GM
2	5	6.6		np	np	49	46	5		Sands and Gravels	SM-GM

JOB NO. 97-2943