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July 9, 2012

Tim & Michaela Burns
103 Plantation Road
Houston, TX 77024-6125

Job Number: 12-9229

Subject: Subsoil and Foundation
Investigation, Proposed Burns Residence,
56965 Golden Tide Place, Colorado.

Gentlemen:

As requested, NWCC, Inc. (NWCC) has prepared this report that presents the results of a Subsoil and Foundation Investigation for the proposed Burns residence to be constructed at 56965 Golden Tide Place in Routt County, Colorado. The property is also referred to as Replat Lots 77-83, Steamboat Lakes, Filing 1, Routt County, Colorado. The approximate project site location is shown on Figure 1.

The scope of our work included obtaining data from cursory observations made at the site, observation of two test pits, sampling of probable foundation soils and laboratory testing of samples obtained. This report presents 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 the proposed residence will generally consist of a two story wood-framed structure constructed over a full-depth walkout basement. Based upon site topography and typical area construction practices, we have also assumed the lower level of the structure will be constructed using concrete a slab-on-grade floor system placed from 0 to 6 feet below the existing ground surface.

For design purposes, we have assumed that the building loads will be light to moderate typical of this type 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 project site is located along the east side of Golden Tide Place in the Steamboat Lakes Subdivision, Filing 1 in Routt County, Colorado. The building site was vacant and undisturbed at the time of this investigation and is located within a mature mixed aspen and pine forest also vegetated with grasses, weeds and scattered deciduous brush. A recently completed water well head was located southwest of the building site.

The topography of the building site is variable and generally slopes strongly down to the west and northwest on the order of 10 percent. A maximum elevation difference of approximately 4 feet appears to exist across the proposed building site.

Subsurface Conditions: To investigate the subsurface conditions at the site, two test pits were excavated on June 25, 2012 with a trackhoe. The approximate test pit locations are shown on Figure 2.

The subsurface conditions encountered in the test pits were fairly consistent and generally consisted of a layer of topsoil and organic materials overlying conglomerate sandstone of the Browns Park Formation that extended to the maximum depth investigated, 8 feet below the existing ground surface. Graphic logs of the exploratory test pits and the associated Legend and Notes are presented on Figure 3.

A layer of topsoil and organics was encountered at the ground surface and varied from approximately 6 to 12 inches in thickness. Conglomerate sandstone bedrock was encountered beneath the topsoil and organic materials. The sandstone was gravelly and silty with scattered cobble sized particles, non-plastic, weathered to firm, fine to coarse grained, moist and brown. Samples of the bedrock material classified as SM soils in accordance with the Unified Soil Classification System. The laboratory test results are summarized in the attached Table 1.

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

Foundation Recommendations: Based on the soils encountered in the test pits, it appears that conglomerate sandstone bedrock will be encountered at proposed foundation grades. Based upon experience, NWCC recommends a foundation system consisting of continuous footings or individual pads with grade beams founded on the sandstone. Foundation movement should be within tolerable limits if the following design and construction criteria are observed.

1) Footings placed on the sandstone should be designed using an allowable soil bearing pressure of 3,000 psf. A minimum dead load is not required.

2) Footings or pad sizes should be computed using the above soil pressures and placed on the undisturbed, natural sandstone. Footings should have a minimum width of 16 inches.

3) Conventional heavy-duty excavating equipment should be capable of completing foundation excavations.

4) Footing areas should be prepared by removal of topsoil and organic materials, moisture conditioning to near optimum moisture content and compacting using a mechanical compactor.

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

6) Footings or pads exposed to freezing temperatures 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.

7) Based on experience, NWCC estimates 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 on Figure 4.

8) NWCC recommends we be retained to observe foundation excavations when they are near completion to identify the bearing soils and confirm the recommendations in this report.

Floor Slabs: We have assumed that the lower level of the structure will be constructed utilizing concrete slab-on-grade construction. The natural bedrock materials are capable of supporting lightly to moderately loaded slab-on-grade construction. To minimize potential point loading and resultant cracking of floor slabs due to the presence of large rock, NWCC recommends removal of cobbles to a minimum depth of 12 inches beneath floor slabs and replacement with fill materials as described below.

The following design and construction criteria should be observed for floor slabs:

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. Control joint depth should be a minimum of ¼ the thickness of the slab.

Underslab areas should be prepared by removal of all topsoil and organic materials, scarification to a depth of 6 inches and compacted to the minimum values shown below. Underslab fill materials should consist of non-expansive granular materials approved by NWCC. Fill should be placed in 6 to 8 inch loose lifts and compacted to at least 95% of the maximum standard Proctor density and within 2% of the optimum moisture content. Finer grained on-site materials (6-inch minus material) consisting of gravelly, silty sand are suitable for use in underslab fills, but may require moisture conditioning prior to placement and compaction to attain minimum values indicated above.

Perimeter Drainage System: Floor levels or crawl space areas constructed below finished grades should be protected by a perimeter drainage system to help reduce the problems associated with surface and subsurface drainage during high runoff periods. Localized perched water or runoff can infiltrate the lower levels of the structure at the foundation level. This water can be one of the primary causes of differential foundation and floor slab movement. In addition, moisture in crawl spaces or lower levels can lead to rotting and mildewing of wooden structural members and the formation of mold and mold spores. The formation of mold and mold spores could have detrimental effects on the air quality in these areas, which in turn can lead to potential adverse health effects.

The drainage system should be located around the entire perimeter of the lower levels with drainage piping placed at least 12 inches below any floor slab or crawl space level and at least 6 inches beneath the top of footings. NWCC recommends the use of perforated PVC pipe for the drainpipe that meets or exceeds

ASTM D3034/SDR35 requirements to minimize the potential for crushing the pipe during backfill operations and increase service life. Drainage piping perforations should be oriented down at the 4 o'clock and 8 o'clock positions and covered with at least 12 inches of free draining gravel. The system consisting of piping and gravel drainage layer should be protected from sediment intrusion by a covering of Mirafi 140N subsurface drainage fabric or an equivalent product. Drainage piping should have a minimum slope of 1% and should be daylighted at a positive outfall protected from freezing, or be led to a sump from which the water can be pumped. Multiple daylights are recommended for larger and more complex structures. 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. We also recommend that the client retain NWCC to observe the underdrain system during construction to verify that it is being installed in accordance with our recommendations and observe a flow test prior to backfilling the system.

In addition to standard foundation moisture-proofing, NWCC recommends that an impervious barrier or other water proofing be provided at the foundation exterior to minimize water intrusion to building interior areas. The barrier should be constructed of an impervious material (e.g. 10-mil PVC) approved by NWCC and located beneath the perimeter drainage system and attached to perimeter foundation walls. A typical perimeter drainage system detail is shown on Figure 5. If crawl space areas are planned or evidence of high groundwater conditions are encountered, interior drainage systems and moisture barriers may be required for drainage in addition to proper ventilation.

Foundation Walls and Retaining Structures: 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 imported, free draining granular backfill and the on-site materials.

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 imported, free draining granular backfill and the on-site materials.

The foundation walls and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials. An upward sloping backfill and/or natural slope will also significantly increase the earth pressures on foundation walls and retaining structures and the structural engineer should carefully evaluate these additional lateral loads when designing the foundation and retaining walls.

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 footings on the foundation materials and the passive pressure against the sides of the footings. 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. The fill placed against the sides of the footings to resist lateral loads should be compacted to at least 100% of the maximum standard Proctor density, near the optimum moisture content.

We recommend imported granular soils for backfilling foundation walls and retaining structures because their use results in lower lateral earth pressures. The imported granular materials should be placed to within 2 to 3 feet of the ground surface. Imported granular soils should be free draining and have less than 7 percent passing the No. 200 sieve. The upper 2 to 3 feet of fill should be a relatively impervious soil or pavement structure to prevent surface water infiltration into the backfill.

The wall backfill should be carefully placed in uniform lifts and compacted to a minimum of 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.

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 structure has been completed:

1) The ground surface surrounding the structure should be sloped (minimum of 1.0 inch per foot) to drain away from the structure 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 placed around the structure should be compacted to at least 95% 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 to 3 feet of soil placed 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 structure.

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

Site Grading: The following measures should be observed for site grading.

1) Permanent, unretained cuts should be kept as shallow as possible and not exceed a 3(Horizontal) to 1(Vertical) configuration for topsoil and organic materials and a 2(H) to 1(V) configuration for the natural overburden soils and bedrock materials. The risk of slope instability will be significantly increased if groundwater seepage is encountered in cuts. NWCC should be notified immediately to evaluate the site if seepage is encountered or deeper cuts are planned. Additional investigations

and/or stabilization measures may be warranted based upon site conditions exposed at the time of construction.

2) Excavating during periods of low runoff at the site can reduce potential slope instability during excavation. Excavations are generally not recommended during the spring or early summer when seasonal runoff and groundwater levels are typically high.

3) Fills up to 15 feet in height should be constructed to a 2(H) to 1(V) or flatter configuration. Fill areas should be prepared by stripping any existing fill materials and topsoil and organics, scarification and compaction to at least 95% of the maximum standard Proctor density and within 2% of optimum moisture content as determined by ASTM D698. Fills should be properly benched/keyed into natural hillsides after removal; of topsoil and organic materials. Fill materials may consist of the on-site soils (exclusive of topsoil, organics or silts) and be uniformly placed and compacted in 6 to 8 inch loose lifts to the minimum density value and moisture content range indicated above. Rock fills should be placed and track-compacted in lift thicknesses equal to the nominal grain size. Voids between rocks should be thoroughly filled with free draining screened rock. Placement of a layer of geotextile filter fabric (Mirafi 140N or equivalent) and/or drainage piping may also be required to minimize erosion of finer grained fill materials and rockfill foundation areas.

4) Proper surface drainage features should be provided around all permanent cuts and fills to direct surface runoff away from these areas. Cuts, fills and other stripped areas should be protected against erosion by revegetation or other methods. Areas of concentrated drainage should be avoided and may require the use of riprap or drainage piping for erosion control.

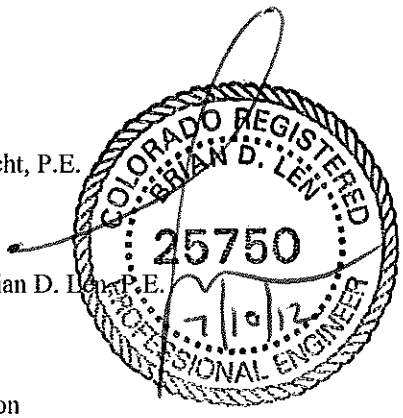
Limitations: The recommendations given in this report are based on the soils encountered at this site and our understanding of the proposed construction. We believe that this information gives a high degree of reliability for anticipating the behavior of the proposed structures; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soil profiles beneath those or adjacent to those observed. No warranties express or implied are given on the content of this report.

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 is changed, the results would also most likely change. Therefore, we strongly recommend that our firm be contacted prior to finalizing the construction plans so that we can verify that our recommendations are being properly incorporated into the construction plans. 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,
NWCC, INC.



Harold N. Schlicht, P.E.

Reviewed by Brian D. Len, P.E.

cc: Robert Ralston

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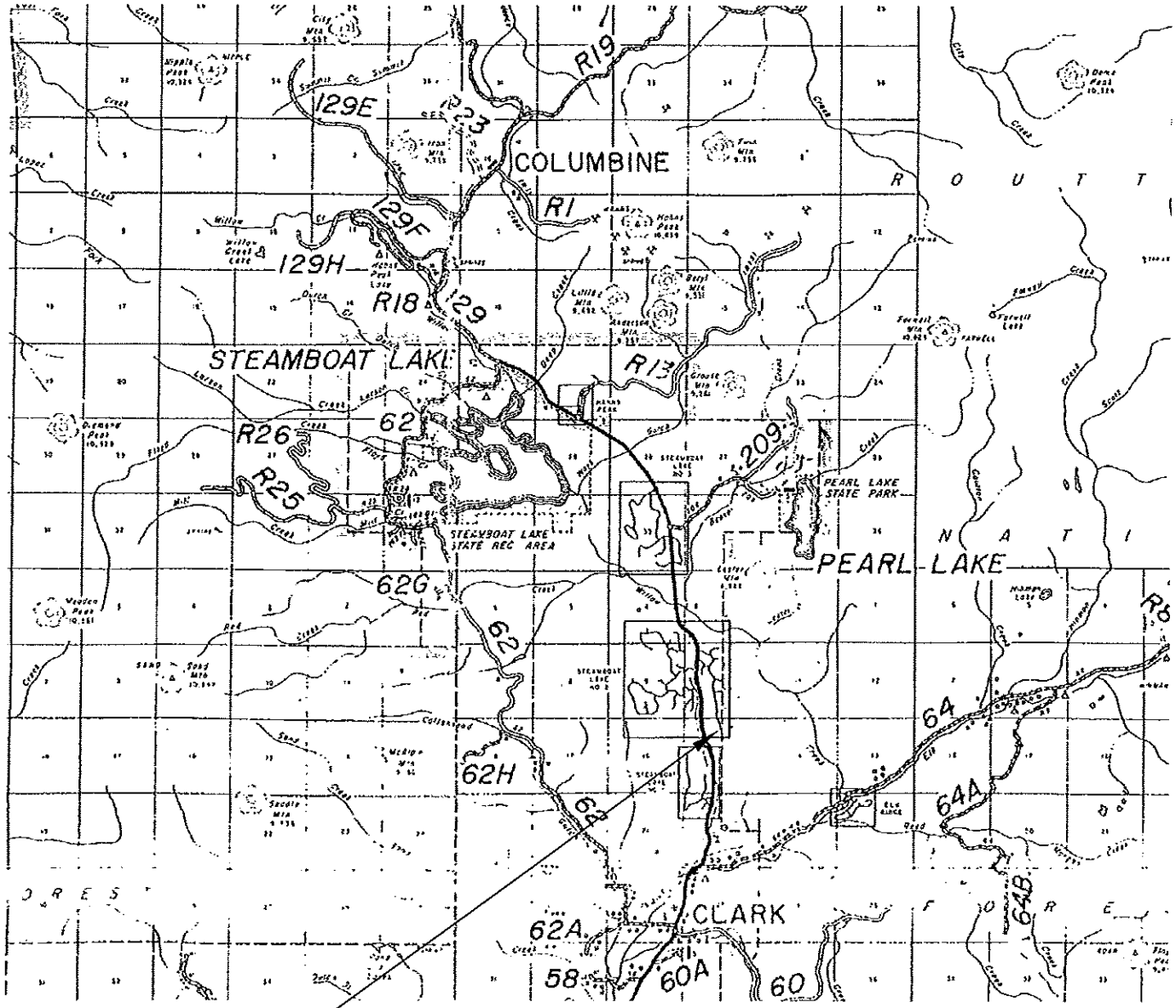
NOT TO SCALE



Title: VICINITY MAP		Date: 7/9/12
Job Name: Proposed Burns Residence		Job No. 12-9229
Location: 56965 Golden Tide Place, Routt County, CO		Figure 1

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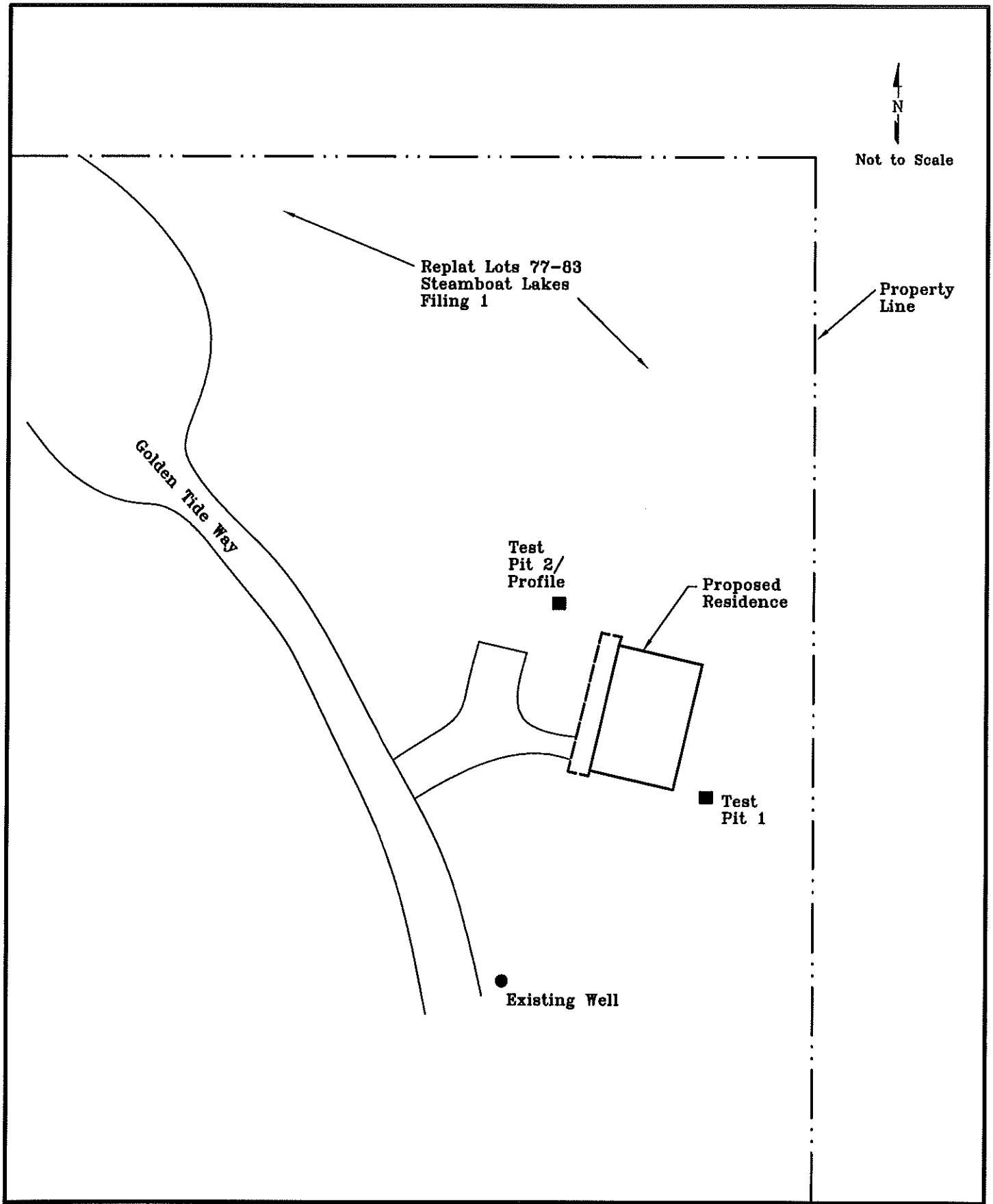
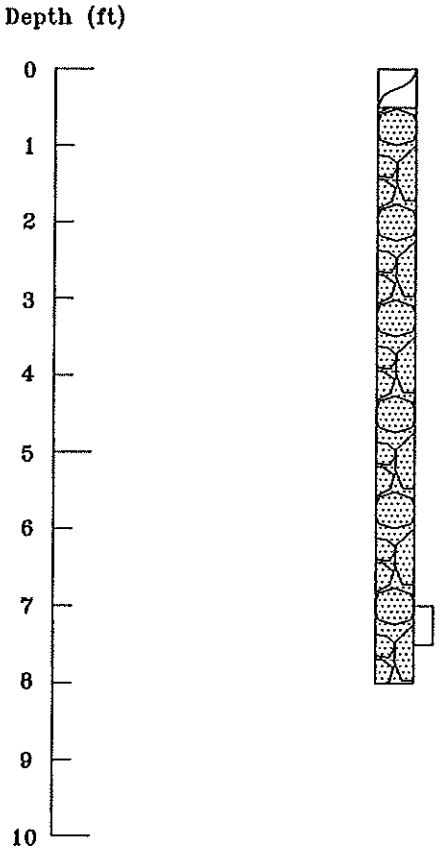
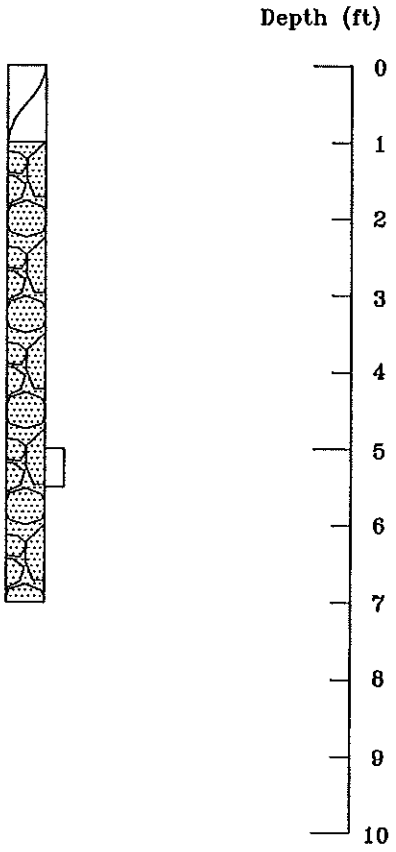


Title: SITE PLAN–LOCATION OF TEST PITS	Date: 7/9/12	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7851 2563 Copper Ridge Drive Steamboat Springs, Colorado 80477
Job Name: Proposed Burns Residence	Job No. 12-9229	
Location: 56965 Golden Tide Way, Routt County, CO	Figure 2	

Test Pit 1



Test Pit 2/
Profile Pit



LEGEND:

Topsoil and Organics.

CONGLOMERATE BEDROCK: Sand matrix, gravelly and silty with scattered cobbles, non-plastic, weathered to firm, fine to coarse grained, moist and brown.

Small Disturbed Bag Sample.

NOTES:

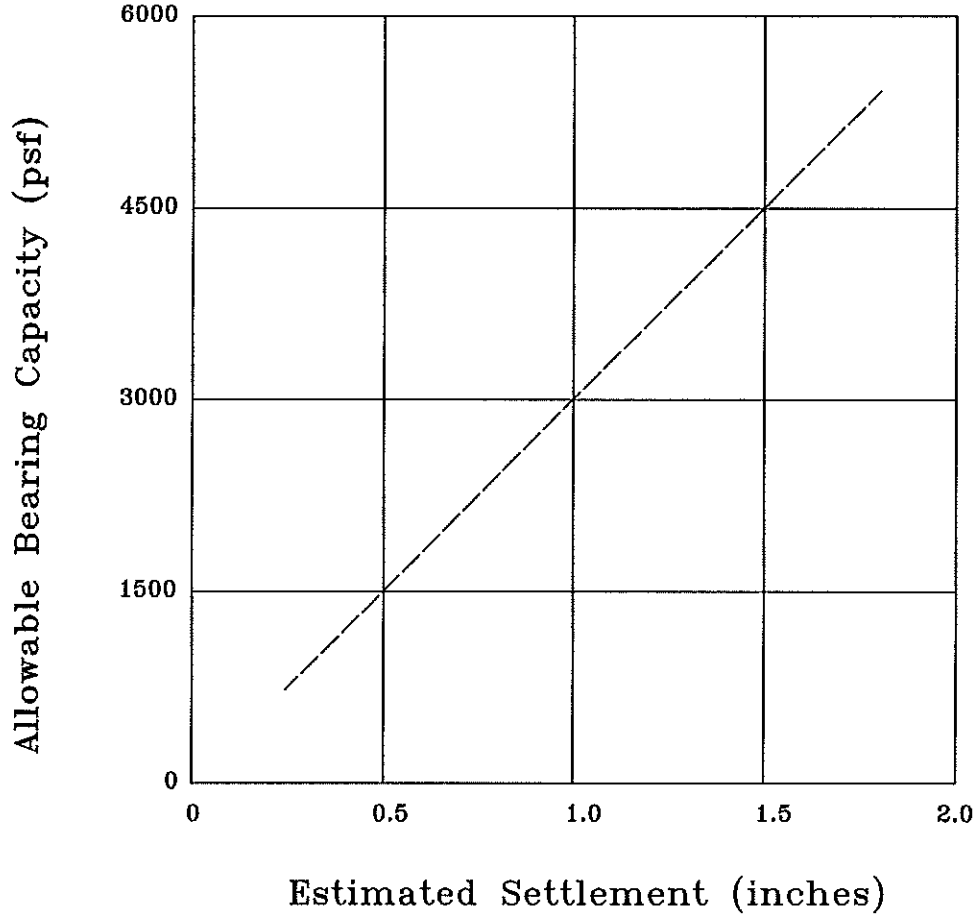
1) Test pits were excavated on June 25, 2012 with a Cat 303-5C minitrackhoe.

2) Test pit locations were determined by pacing from proposed features as staked in the field.

3) Elevations of the test pits were not measured and the logs are drawn to the depths investigated.

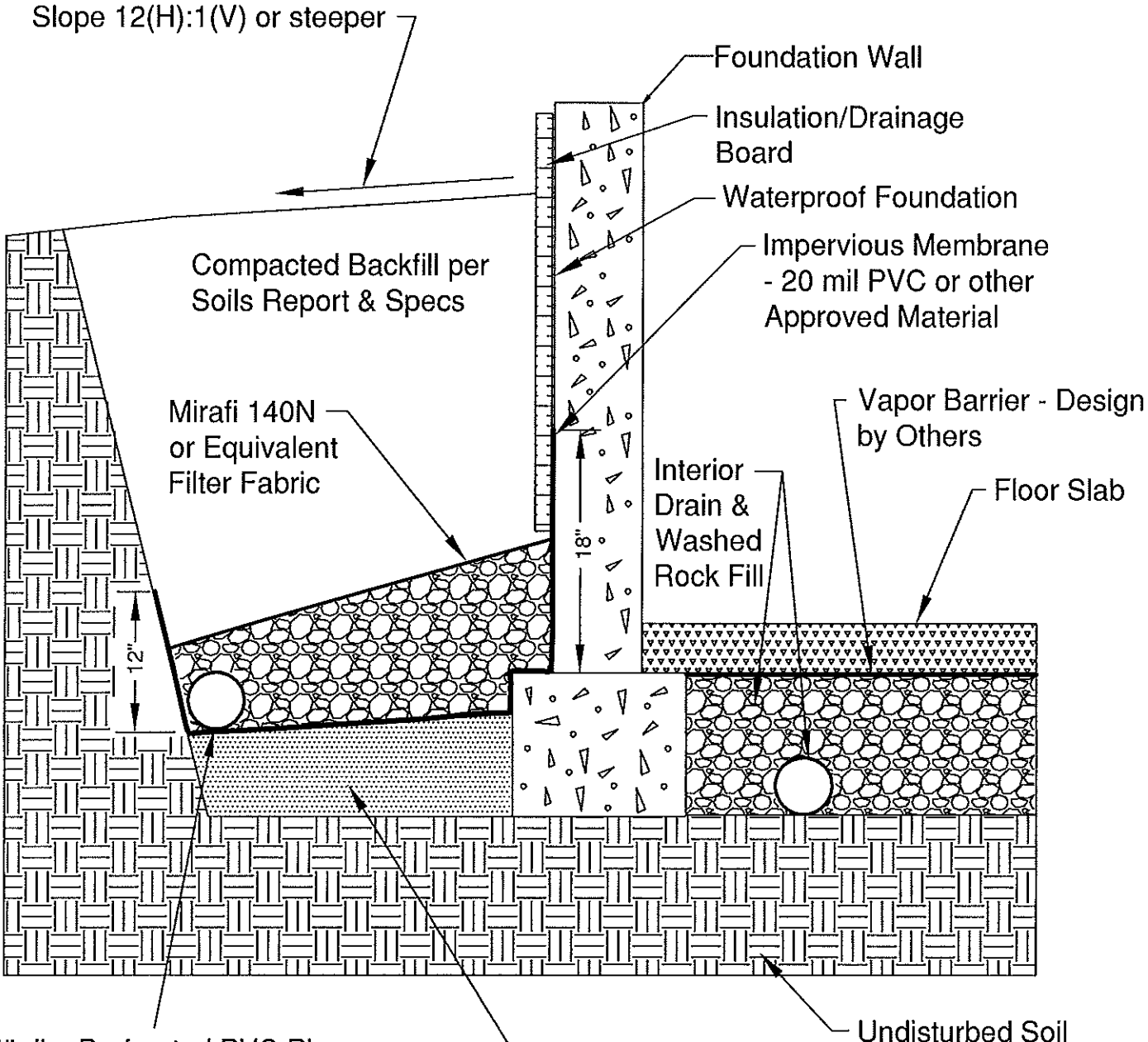
4) The lines between materials shown on the test pit logs represent the approximate boundaries between material types and transitions may be gradual.

Title: LOGS, LEGEND AND NOTES	Date: 7/9/12	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7831 2563 Copper Ridge Drive Steamboat Springs, Colorado 80477
Job Name: Proposed Burns Residence	Job No. 12-9229	
Location: 56965 Golden Tide Place, Routt County, CO	Figure 3	



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.

Title: BEARING CAPACITY CHART	Date: 7/9/12	NWCC North West Colorado Consultants Inc Geotechnical / Environmental Engineering - Materials Testing (970)879-7668 - Fax (970)879-7651 2580 Copper Ridge Drive Steamboat Springs, Colorado 80477
Job Name: Proposed Burns Residence	Job No. 12-9229	
Location: 56965 Golden Tide Place, Routt County, CO	Figure 4	



Title: PERIMETER DRAIN DETAIL		Date: 7/9/12
Job Name: Proposed Burns Residence		Job No. 12-9229
Location: 56965 Golden Tide Place, Routt County, 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 PIT	DEPTH (feet)			LIQUID LIMIT (%)	PLASTICITY INDEX (%)	GRAVEL (%)	SAND (%)				
1	7–8	11.8		26	NP	37	54	9		Conglomerate – Silty, Gravelly Sand	SM
2	5–6	14.0		29	NP	24	58	18		Conglomerate – Silty, Gravelly Sand	SM

JOB NUMBER: 12–9229