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HCI Howard Consultants, Inc.
Consulting Geotechnical Engineers & Geologists
11100 Airport Drive #7, Hayden Idaho 83835 208-772-2428

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March 31, 1989

J-U-B Engineers, Inc.
2005 Ironwood Parkway
Coeur d'Alene, Idaho 83814

Attention: Mr. James R. Coleman, P.E.

RE: Report Addendum
Geotechnical Engineering Evaluation
Armstrong Park Subdivision
Coeur d'Alene, Idaho

Gentlemen:

At your request we have reviewed the preliminary site grading plans for Armstrong Park subdivision with respect to our original geotechnical engineering report dated January 30, 1989. This addendum presents the results of our review and additional engineering analyses.

It is our understanding that certain cut and fill slopes are proposed to be constructed at angles steeper than we recommended in our original report. Therefore, we performed engineering analyses to assess the stability of the proposed slopes. To perform the analyses we estimated soil engineering properties based on the results of the original geotechnical engineering evaluation. Laboratory work was not performed to quantify the engineering properties of the soil. Therefore, the results of the analyses should be considered approximate and used only to indicate general stability.

Cut slopes in soil appear to be stable when constructed at a slope angle of 1.5:1 (horizontal to vertical) if the height of the slope is less than 10 feet. We recommend that 1.5:1 cut slopes in soil, which are greater than 10 feet in height, be benched at approximately half height. The bench should be at least 5 feet wide and sloped to provide drainage of the bench.

Fill slopes appear to be stable when constructed at a slope angle of 1.5:1. We recommend that fill slopes designed for a slope of 1.5:1 be compacted to at least 95% of the maximum dry density as determined by ASTM D-1557. The fill should be benched into the existing slope. The benches should be 10 feet wide and no more than 2 feet high.

All slopes constructed at 1.5:1 are very susceptible to erosion and surface sloughing. Therefore, we recommend that the slopes be revegetated immediately after construction. Surface sloughing will occur and periodic maintenance of the slopes will be necessary.

We revised Plate 1, Site Plan, to indicate additional areas adjacent to the proposed roadway which will likely encounter rock at the time of excavation. As presented in the original report, we recommend that cut slopes in rock be designed for a slope angle of 0.75:1. Cut slopes in rock should be evaluated at the time of construction to verify that the recommended slope angle is appropriate for the orientation of the rock mass discontinuities.

The above recommendations assume that the slopes are well drained and are not affected by structural loads. We recommend that the stability of individual slopes be assessed in the event that any structure is located within 50 feet of the crest of a cut slope or within 25 feet of the toe of a fill slope. These assessments should be specific to each lot and should be performed prior to residential construction.

If you have any questions or require further information, please do not hesitate to call.

Sincerely,
HOWARD CONSULTANTS, INC.

Chris C. Beck, E.I.T., G.I.T.
Geological Engineer

Terry R. Howard, P.E., P.G.
Managing Principal

HCI Howard Consultants, Inc.
Consulting Geotechnical Engineers & Geologists
11100 Airport Drive #7, Hayden Idaho 83835 208-772-2428

January 30, 1989
Project No. 3011-10

J-U-B Engineers, Inc.
2005 Ironwood Parkway, Suite 201
Coeur d'Alene, Idaho 83814

Attention: Mr. James R. Coleman, P.E.

RE: Report
Geotechnical Engineering Evaluation
Armstrong Park Subdivision
Coeur d'Alene, Idaho

Gentlemen:

Howard Consultants, Inc. has completed the authorized geotechnical engineering evaluation for the Armstrong Park subdivision. The attached report summarizes the results of our field and laboratory testing and presents our conclusions and recommendations.

Based on the results of the field and laboratory testing, engineering and geology analyses and our experience with similar site conditions, it is our opinion that the site is suitable for the proposed development. The presence of fill, clayey soil and rock outcrops will require consideration during design and construction of the subdivision and the individual lots. Our recommendations to assist the planning, design and construction of the proposed development are included in the report for your review.

We appreciate the opportunity to be of service to you on this project. If you have any questions or require further assistance, please do not hesitate to give us a call.

Sincerely,
HOWARD CONSULTANTS, INC.

Chris C. Beck, E.I.T., G.I.T.
Geological Engineer

Terry R. Howard, P.E., P.G.
Managing Principal

REPORT

GEOTECHNICAL ENGINEERING EVALUATION
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

for

J-U-B Engineers, Inc.

January 30, 1989

HCI Howard Consultants, Inc.
Consulting Geotechnical Engineers & Geologists

Boise Moscow

REPORT

GEOTECHNICAL ENGINEERING EVALUATION
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

for

J-U-B Engineers, Inc.

January 30, 1989

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INTRODUCTION

HOWARD CONSULTANTS, INC. has completed the authorized geotechnical engineering evaluation for the Armstrong Park subdivision. This report summarizes the results of our field and laboratory testing and presents our conclusions and recommendations.

The purpose of the evaluation was to assess the geologic and subsurface soil conditions within the proposed development area and to provide geotechnical engineering recommendations to assist project planning, design and construction. To perform the evaluation we accomplished the following scope of work:

1. Reviewed pertinent soil and geologic literature for the site and surrounding area.

2. Excavated twenty-three test pits. Visually classified the soil encountered and logged the soil profiles. Obtained representative soil samples for laboratory testing.

3. Performed laboratory tests including "R"-value, moisture-density curves, Atterberg limits and gradation on representative soil samples.

4. Reviewed the results of the field and laboratory testing with respect to the proposed construction.

5. Prepared recommendations to assist in project planning, design and construction.

6. Prepared a final report.

PROPOSED CONSTRUCTION

It is our understanding that development will include the construction of an access road and secondary roads, the installation of underground utilities and preliminary site grading for individual lots. The proposed development and the locations of the roads and lots are shown on Plate 1, Site Plan. The project will be constructed in phases. Phase I will consist of Blocks 1 and 2 in the southwest portion of the proposed development area as shown on Plate 1, Site Plan. For Phase I, earthwork will typically require excavations and structural fills of less than 10 feet. Structural loads are not available for the proposed buildings but we anticipate the loading will be relatively light one- and two-story residential homes and townhouses. Blocks 3 and 4 will constitute the second and third phases of the project. In general, it appears that the earthwork for these phases will be more extensive than for Phase I. Again, we anticipate that the structural loading will be relatively light.

INVESTIGATIVE PROCEDURES

Twenty-three test pits were excavated in the proposed development area. The locations of the test pits are shown on Plate 1, Site Plan. Test pits were located in areas which could be safely accessed by a four-wheel-drive backhoe. The test pits were excavated by a tractor-mounted backhoe equipped with a 24-inch-wide bucket and soil excavation teeth.

The soils encountered were visually classified and described in general accordance with ASTM D-2487 and ASTM D-2488. Representative soil samples were obtained for laboratory testing. The results of the field evaluations are presented on Plate 2, Summary of Test Pit Results.

The test pits were loosely backfilled at the conclusion of the field evaluation. The backfill will consolidate with time. If the test pits underlie the proposed pavement, sidewalk or building areas, the backfill should be removed, replaced and compacted to at least 92% of the maximum dry density as determined by ASTM D-1557.

SITE CONDITIONS

The Armstrong Park subdivision will be located on Potlach Hill, between Coeur d'Alene Lake and Fernan Lake, east of Coeur d'Alene, Idaho. Specifically, the subdivision will be located in the NW 1/4 of Section 20 of T50N, R3E.

The site was accessed by way of the Potlach Hill Road; a private gravel road which currently provides access to the Sky Harbor Estates subdivision. The grade of the road ranges from nearly flat to approximately 10%. There are several tight switchbacks in the road alignment. Fill has been placed along portions of the roadway in the past to achieve the existing grades and alignment.

Vegetation in the proposed development area is primarily low grasses and coniferous trees with minor deciduous trees and bushes present locally. Vegetation is moderately dense.

The slope of the ground surface varies from gently sloping in Block 2 of Phase I to very steep on the side slopes of Block 1, Phase I and of Phases II, III and IV. Typically, the slope of the ground surface on the ridges varies from 5% to 20%. The slope of the ground surface on the side slopes varies from 30% to 60%.

The Soil Survey of Kootenai County Area, Idaho indicates the proposed development area is underlain by silt loam, stony loam and gravelly silt loam. This report also indicates that the surface soil cover is underlain by basalt or metasedimentary rock at depths ranging from 19 inches to greater than 60 inches.

GEOLOGIC SETTING

The proposed development area is underlain by metasedimentary rocks of the Belt Supergroup and volcanic rocks and sedimentary interbeds associated with the Columbia River basalts. The pre-Cambrian metasedimentary rocks were classified as argillite and quartzite. The quartzite and argillite had been subjected to intense metamorphism as evidenced by the folding, faulting and shearing of the remnant bedding. Fracture spacing for the metasedimentary rocks ranged from less than an inch to greater than 3 feet. Typically, the strike of the metasedimentary rocks was northeast to east. The dip of the metasedimentary rocks was to the south and ranged from approximately 20 degrees to greater than 80 degrees.

The basalt in the proposed development area is a local flow of the Columbia River basalts which are Miocene in age. In outcrop, the basalt is very dense with fracture spacing on the order of 1 to 3 feet. In test pit excavations, boulder and cobble layers of basalt were encountered overlying massive vesicular basalt. Sedimentary interbeds of the Latah Formation may be present between basalt layers underlying the proposed development area. These sedimentary beds are typically clays, silt and sands that were deposited in a lacustrine environment.

Slickensides in metamorphosed clay were observed in test pits TP-2 and TP-3. These test pits are located along what we would project to be the contact between the basalt and the metasedimentary rock. The geomorphology and the results of the test pits are inconclusive as to whether this a flow contact or a fault. However, if a fault is present there is no evidence of movement that would classify it as an active fault.

SUBSURFACE CONDITIONS

Topsoil was encountered at the ground surface in all test pits except TP-17, TP-21 and TP-23. The topsoil was classified as dark brown, loose, wet, silty fine sand with root and organics. The thickness of the topsoil ranged from 6 inches in TP-20 to 18 inches in many of the test pits.

Fill was encountered at the ground surface in TP-17, TP-21 and TP-23. It appeared the fill had been placed during construction of the existing roadway. The fill was classified as dark brown to brown, loose to medium dense, moist to very moist, fine to medium sandy, clayey silt. The fill contained rock fragments and organic materials such as leaves, pine needles and tree branches. We visually estimated the percentage of organic material to be less than 10% by weight. It should be noted that the amount and nature of the organic material in the fill may vary from that observed in the test pits.

Residual soil was encountered beneath the topsoil and the fill in each of the test pits except TP-18, TP-19, TP-20 and TP-22. The residual soil was classified as sand, silt and clay. The color of the residual soil varied across the site. In general, the sands were medium dense to dense; the silts and clays were stiff to very stiff. The moisture content varied from humid to moist.

Basalt was encountered beneath the residual soil in test pits TP-3 and TP-9. The basalt was gray to dark gray, very hard, vesicular and moderately fractured. The backhoe was able to excavate only the upper few inches of the basalt bedrock.

Metasedimentary rock, classified as argillite and quartzite, was encountered beneath the residual soil in test pits TP-6, TP-8, TP-11, TP-13, TP-14, TP-15 and TP-17 through TP-22. The argillite and quartzite was light gray, very hard and dry to humid. Fracture spacing ranged from less than an inch to greater than three feet. Typically, 6 inches to 2 feet of cobbles and boulders, derived from the argillite and quartzite, was encountered above the competent bedrock. The backhoe could not excavate the competent bedrock.

Weathered granite was encountered beneath the residual soil in TP-16. The weathered granite showed remnant structure but was decomposed and able to be excavated by a backhoe. It was classified as light gray, medium dense, humid, fine to medium sandy silt.

Backhoe refusal was encountered in many of the test pits. Backhoe refusal represents the point at which the backhoe can no longer efficiently excavate the material in a trench. Typically, backhoe refusal represents the upper limit of competent bedrock.

Ground water was not encountered in the test pits at the time of the field evaluation. The moisture content of the soils encountered was typically humid to moist. It should be noted, however, that the elevation of the water table will vary with seasonal changes in precipitation, infiltration, irrigation and many other factors and may occur within the depths explored.

LABORATORY TESTING

Representative soil samples were tested to determine the "R"-value, gradation, plastic limit, liquid limit, plasticity index, maximum dry density and optimum moisture content. The "R"-value for the existing fill and clayey soil is 20. The "R"-value for the residual gravelly, silty fine to coarse sand is 40. The maximum dry density and optimum moisture content for the soils were determined in general accordance with ASTM D-1557 (Modified

Proctor). The moisture-density curves for the existing fill and the residual gravelly, silty fine to coarse sand are presented on Plates 4 and 5. The gradations for these soils and the residual silty clay are presented on Plates 6 through 8. Also presented on the Plates 6 through 8 are the plastic limits, liquid limits and plasticity indices for the soils.

The plasticity index for the dark brown, sandy, clayey silt was 3.4 and 6.7 for the light gray to brown, gravelly, silty sand. The gray silty clay encountered in TP-4 and TP-5 had a plasticity index of 24.9 with a liquid limit of 63.6%. Therefore, the gray clay is considered a high plasticity soil. High plasticity soils are susceptible to volume changes with changes in moisture content.

DISCUSSION

Plate 8, Geotechnical Terrain Unit Map, presents areas of similar soil and geologic characteristics. These areas are shown as geotechnical terrain units (GTU). The areas in geotechnical terrain units are grouped together based on soil, geology, slope angle and our experience. The boundaries between geotechnical units represent broad if not vague zones of change. They are not intended to represent sharp breaks from one geotechnical terrain unit to the next.

GTU-1 is comprised of ridges and side slopes underlain by basalt. GTU-2 consists of flat to rolling topography underlain by a relatively thick soil profile. GTU-3 is comprised of ridges and side slopes with shallow soil cover underlain by metasedimentary rocks classified as argillite and quartzite. Steep side slopes underlain by metasedimentary rock are shown as GTU-4.

RECOMMENDATIONS

The following recommendations are presented as guidelines for subdivision development. We recommend that each lot be evaluated by a geotechnical engineer at the time of construction to verify that the conditions do not deviate from those presented in this evaluation.

GTU-1

GTU-1 is comprised of ridges and side slopes underlain by basalt. There are numerous outcrops of basalt in this area and we anticipate that basalt will be encountered in shallow (less than 10 feet) excavations. Clayey soil may overlie or be associated with the basalt. The relatively high plasticity index of the clay and the swell/shrink potential indicate that this soil is not suitable for support of buildings.

Site Preparation and Grading, GTU-1

We recommend that the topsoil be excavated and removed from the proposed building, sidewalk and pavement areas. The topsoil should be removed from the sites or stockpiled and re-used for landscaping. The topsoil is not suitable for re-use as structural fill.

(GTU-1 CONT.)

After the topsoil is removed from the proposed building, sidewalk and pavement areas, we recommend that the areas be proofrolled prior to construction or the placement of structural fill. Proofrolling should be performed by a rubber-tired vehicle weighing at least 20 tons, such as a loaded dump truck. Proofrolling should be accomplished by making at least three passes in each of two perpendicular directions in the proposed construction areas and ten feet beyond. If loose or soft soil is identified, it should be compacted or excavated and removed. Proofrolling should be observed by a geotechnical engineer or engineering geologist to provide that adequate remedial work is accomplished. After the topsoil has been stripped and the areas proofrolled, the upper 12 inches of the exposed native soil should be compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557 prior to construction or the placement of structural fill.

(3) (4) (5)

Structural fill should consist of GW, GP, GM, SW, SP, SM, or ML soil as designated by the Unified Soil Classification System, Plate 3. All structural fill soil should be approved by a geotechnical engineer prior to placement. The silt and sand soils are suitable for re-use as structural fill. The clay soil present in this unit is not suitable for re-use as structural fill but may be used for backfill in non-structural areas. Structural fill should be placed in six-inch, loose lifts at near optimum moisture content and compacted to a

(6) (7) (8)

GTU-1 (CONT)

minimum of 92% of the maximum dry density as determined by ASTM D-1557. Non-structural fill should be placed in six- to twelve-inch, loose lifts and compacted to a minimum of 90% of the maximum dry density as determined by ASTM D-1557. (9)

Excavations in GTU-1 will likely encounter basalt bedrock. Based on the results of the test pits and visual inspections of outcrops, it appears that ripping and/or blasting may be necessary for deep excavations in basalt.

Foundation Design, GTU-1

We recommend that the proposed structures be supported on conventional continuous or individual spread footings. The foundations should bear on native silt or sand, or on compacted structural fill. If clay is present beneath the (10) foundation, it should be excavated an removed. The excavation should then be backfilled with structural fill.

After the foundations are excavated, the upper twelve (12) inches of exposed soil should be compacted to at least 92% of the maximum dry density as determined by ASTM D-1557 prior to forming the foundations. All foundation bearing surfaces should be free of loose soil and debris. Exterior footings (13) should bear at least 30 inches below the exterior ground surface to protect against frost action. The foundations for the structures should be designed based on maximum allowable (14) bearing pressure of 3000 pounds per square foot. All footings should be a minimum of 12 inches in width. Based on these recommendations, we estimate that maximum total settlement will be less than one inch and maximum differential settlement will be less than one-half inch.

Pavement Design, GTU-1

Pavement sections should be designed based on an "R"-value of 20 for the sandy, clayey silt. We recommend the subgrade soil for all pavement, driveway and sidewalk sections be compacted in the upper twelve inches to at least 92% of the maximum dry density as determined by ASTM D-1557. Pavement, driveway and sidewalk sections should be designed to protect against moisture and frost heave.

Lateral Earth Pressure, GTU-1

We recommend that lateral earth pressures be calculated using an equivalent fluid pressure of 60 pounds per cubic foot for the at-rest case (no wall movement), 40 pounds per cubic foot of the active case (outward wall movement) and 300 pounds per cubic foot for the passive case (inward wall movement). This recommendation assumes that the wall is drained and there are no hydrostatic stresses. If the wall is not drained, 62.4 pounds per cubic foot should be added to the equivalent fluid pressures to account for hydrostatic stresses. A coefficient of friction of f_s = 0.35 should be used for retaining wall design. 16

Slope Design and Stability, GTU-1

There was no surface evidence of slope instability in GTU-1. It is our opinion that the natural slopes in this unit are stable in their current state. We recommend that cut slopes in soil for this unit be designed for a 2:1 (horizontal to vertical) slope. Cut slopes in basalt should be analyzed on an individual basis to determine stability. For planning and estimating purposes, a slope of 0.75:1 may be used. Structural fill slopes should be designed for a maximum 2:1 slope. Foundations and roads should not be located near the crest of cut slopes without a stability analysis by a geotechnical engineer. Typically, the house or roadway should be located at least as far back from the crest as the cut bank is high.

19

17

Erosion and Drainage, GTU-1

The soils of GTU-1 are moderately susceptible to erosion. The design and layout of the individual lots and the roadways should allow for dissipated drainage of run-off water. We recommend that run-off water not be allowed to concentrate on cut or fill slopes. Revegetation of exposed soil should take place immediately after construction to minimize erosion.

Ground water was not encountered in the test pits. However, development of the subdivision will alter the local elevation of the water table and effect the run-off and infiltration of the site. The presence of clay layers and bedrock in the subsurface profile may dramatically effect construction and long term performance of underground structures. Ground water may perch on the clay layers and bedrock. Basements and other underground structures should be designed with drainage of ground water in mind. (18)

GTU-2

GTU-2 is comprised of flat to rolling topography underlain by a relatively thick soil profile. The soil types include clay, silt and sand. The clayey soil has a relatively high plasticity index and potential for swell/shrink problems. The clayey soil is not suitable for support of buildings.

Site Preparation and Grading, GTU-2

We recommend that the topsoil be excavated and removed from the proposed building, sidewalk and pavement areas. The topsoil should be removed from the sites or stockpiled and re-used for landscaping. The topsoil is not suitable for re-use as structural fill.

After the topsoil is removed from the proposed building, sidewalk and pavement areas, we recommend that the areas be proofrolled prior to construction or the placement of structural fill. Proofrolling should be performed by a rubber-tired vehicle weighing at least 20 tons, such as a loaded dump truck. Proofrolling should be accomplished by making at least three passes in each of two perpendicular

(GTU-2 CONT.)

directions in the proposed construction areas and ten feet beyond. If loose or soft soil is identified, it should be compacted or excavated and removed. Proofrolling should be observed by a geotechnical engineer or engineering geologist to provide that adequate remedial work is accomplished. After the topsoil has been stripped and the areas proofrolled, the upper 12 inches of the exposed native soil should be compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557 prior to construction or the placement of structural fill.

Structural fill should consist of GW, GP, GM, SW, SP, SM, or ML soil as designated by the Unified Soil Classification System, Plate 3. All structural fill soil should be approved by a geotechnical engineer prior to placement. The silt and sand soils are suitable for re-use as structural fill. The clay soil present in this unit in not suitable for re-use as structural fill but may be used for backfill in non-structural areas. Structural fill should be placed in six-inch, loose lifts at near optimum moisture content and compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557. Non-structural fill should be placed in six- to twelve-inch, loose lifts and compacted to a minimum of 90% of the maximum dry density as determined by ASTM D-1557.

Foundation Design, GTU-2

We recommend that the proposed structures be supported on conventional continuous or individual spread footings. The foundations should bear on native silt or sand, or on compacted structural fill. If clay is present beneath the foundation, it should be excavated an removed. The excavation should then be backfilled with structural fill.

After the foundations are excavated, the upper twelve inches of exposed soil should be compacted to at least 92% of the maximum dry density as determined by ASTM D-1557 prior to forming the foundations. All foundation bearing surfaces should be free of loose soil and debris. Exterior footings should bear at least 30 inches below the exterior ground surface to protect against frost action. The foundations for the structures should be designed based on maximum allowable bearing pressure of 3000 pounds per square foot. All footings should be a minimum of 12 inches in width. Based on these recommendations, we estimate that maximum total settlement will be less than one inch and maximum differential settlement will be less than one-half inch.

Pavement Design, GTU-2

Pavement sections in GTU-2 should be designed based on an "R"-value of 20 for the sandy, clayey silt. We recommend that the subgrade soil for all pavement, driveway and sidewalk sections be compacted in the upper twelve inches to at least

92% of the maximum dry density as determined by ASTM D-1557. Pavement, driveway and sidewalk sections should be designed to protect against moisture and frost heave.

Lateral Earth Pressure, GTU-2

We recommend that lateral earth pressures be calculated using an equivalent fluid pressure of 60 pounds per cubic foot for the at-rest case (no wall movement), 40 pounds per cubic foot of the active case (outward wall movement) and 300 pounds per cubic foot for the passive case (inward wall movement). This recommendation assumes that the wall is drained and there are no hydrostatic stresses. If the wall is not drained, 62.4 pounds per cubic foot should be added to the equivalent fluid pressures to account for hydrostatic stresses. A coefficient of friction of f_s = 0.35 should be used for retaining wall design.

Slope Design and Stability, GTU-2

There was no surface evidence of slope instability in GTU-2. It is our opinion that the natural slopes in this unit are stable in their current state. We recommend that cut slopes in soil for this unit be designed for a 2:1 (horizontal to vertical) slope. Structural fill slopes should be designed for a maximum 2:1 slope. Foundations and roads should not be located near the crest of cut slopes without a stability analysis by a geotechnical engineer. Typically, the house or roadway should be located at least as far back from the crest as the cut bank is high.

Erosion and Drainage, GTU-2

The soils of GTU-2 are moderately susceptible to erosion. The design and layout of the individual lots and the roadways should allow for dissipated drainage of run-off water. We recommend that run-off water not be allowed to concentrate on cut or fill slopes. Revegetation of exposed soil should take place immediately after construction to minimize erosion.

Ground water was not encountered in the test pits. However, development of the subdivision will alter the local elevation of the water table and effect the run-off and infiltration of the site. The presence of clay layers and bedrock in the subsurface profile may dramatically effect construction and long term performance of underground structures. Ground water may perch on the clay layers and bedrock. Basements and other underground structures should be designed with drainage of ground water in mind.

GTU-3

GTU-3 is comprised of ridges and side slopes with shallow soil cover underlain by metasedimentary rocks classified as argillite and quartzite. The metasedimentary rock is typically overlain by six inches to 4 feet of residual soil. The residual soil is primarily sand although there are localized zones of clay and silt.

Site Preparation and Grading, GTU-3

We recommend that the topsoil be excavated and removed from the proposed building, sidewalk and pavement areas. The topsoil should be removed from the sites or stockpiled and re-used for landscaping. The topsoil is not suitable for re-use as structural fill.

After the topsoil is removed from the proposed building, sidewalk and pavement areas, we recommend that the areas be proofrolled prior to construction or the placement of structural fill. Proofrolling should be performed by a rubber-tired vehicle weighing at least 20 tons, such as a loaded dump truck. Proofrolling should be accomplished by making at least three passes in each of two perpendicular directions in the proposed construction areas and ten feet beyond. If loose or soft soil is identified, it should be compacted or excavated and removed. Proofrolling should be observed by a geotechnical engineer or engineering geologist to provide that adequate remedial work is accomplished. After the topsoil has been stripped and the areas proofrolled, the upper 12 inches of the exposed native soil should be compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557 prior to construction or the placement of structural fill.

Structural fill should consist of GW, GP, GM, SW, SP, SM, or ML soil as designated by the Unified Soil Classification System, Plate 3. All structural fill soil should be approved by a geotechnical engineer prior to placement. The residual soils of this unit appear to be suitable for re-use as structural fill. Structural fill should be placed in six-inch, loose lifts at near optimum moisture content and compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557. Non-structural fill should be placed in six- to twelve-inch, loose lifts and compacted to a minimum of 90% of the maximum dry density as determined by ASTM D-1557.

Excavations in GTU-3 will likely encounter metasedimentary bedrock. Small, deep excavations will likely require blasting. Excavation in large areas may be accomplished with the use of a single-tooth ripper, although blasting may be necessary depending on the orientation and competency of the bedrock.

Foundation Design, GTU-3

We recommend that the proposed structures be supported on conventional continuous or individual spread footings. The foundations should bear on residual soil, compacted structural fill or competent rock. Foundations which bear on both soil and rock are susceptible to cracking from differential settlement. If a foundation is underlain by both rock and residual soil or compacted fill, the rock should be over-excavated by at least twelve inches. The excavation should then be backfilled with structural fill.

After the foundations are excavated, the upper twelve inches of exposed soil should be compacted to at least 92% of the maximum dry density as determined by ASTM D-1557 prior to forming the foundations. All foundation bearing surfaces should be free of loose soil and debris. Exterior footings should bear at least 30 inches below the exterior ground surface to protect against frost action. The foundations for the structures which bear on residual soil or compacted fill should be designed based on maximum allowable bearing pressure of 3000 pounds per square foot. Foundations which bear on rock should be designed based on a maximum allowable bearing pressure of 4000 pounds per square foot. All foundations should be a minimum of 12 inches in width. Based on these recommendations, we estimate that maximum total settlement will be less than one inch and maximum differential settlement will be less than one-half inch.

Pavement Design, GTU-3

Pavement sections in GTU-3 should be designed based on an "R"-value of 40 for the gravelly, silty fine to coarse sand. We recommend that the subgrade soil for all pavement, driveway and sidewalk sections be compacted in the upper twelve inches to at least 92% of the maximum dry density as determined by ASTM D-1557. Pavement, driveway and sidewalk sections should be designed to protect against moisture and frost heave.

Lateral Earth Pressure, GTU-3

We recommend that lateral earth pressures be calculated using an equivalent fluid pressure of 55 pounds per cubic foot for the at-rest case (no wall movement), 40 pounds per cubic foot of the active case (outward wall movement) and 400 pounds per cubic foot for the passive case (inward wall movement). This recommendation assumes that the wall is drained and there are no hydrostatic stresses. If the wall is not drained, 62.4 pounds per cubic foot should be added to the equivalent fluid pressures to account for hydrostatic stresses. A coefficient of friction of $f_s = 0.45$ should be used for retaining wall design.

Slope Design and Stability, GTU-3

There was no surface evidence of slope instability in GTU-3. However, this geotechnical terrain unit is susceptible to shallow landslides because of the steep slope and shallow soil cover. We recommend that cut slopes in soil for this unit be designed for a 2:1 (horizontal to vertical) slope. Cut slopes in metasedimentary rock should be analyzed on an individual basis to determine stability. For planning and estimating purposes, a slope of 0.75:1 may be used.

Structural fill slopes should be designed for a maximum 2:1 slope. Foundations and roads should not be located near the crest of cut slopes without a stability analysis by a geotechnical engineer. Typically, the house or roadway should be located at least as far back from the crest as the cut bank is high.

Erosion and Drainage, GTU-3

The soils of GTU-3 are very susceptible to erosion. The design and layout of the individual lots and the roadways should allow for dissipated drainage of run-off water. We recommend that run-off water not be allowed to concentrate on cut or fill slopes. Revegetation of exposed soil should take place immediately after construction to minimize erosion.

The presence of bedrock in the subsurface profile may dramatically effect construction and long term performance of underground structures. Ground water may perch on the bedrock. Basements and other underground structures should be designed with drainage of ground water in mind.

GTU-4

GTU-4 is comprised of steep side slopes underlain by metasedimentary rock. Subsurface information was not available in this unit because the backhoe could not access the steep side slopes. The following recommendations are general comments based on our experience with similar conditions. Because of the steep slope in this unit and the rock type, we recommend that any development be accompanied by a detailed geotechnical engineering evaluation prior to design and construction.

Site Preparation and Grading, GTU-4

In general, we recommend that the topsoil be excavated and removed from the proposed building, sidewalk and pavement areas. However, if topsoil is removed from steep side slopes, excessive erosion may occur. Therefore, we recommend the construction grading plans be designed to minimize disturbance and erosion. Topsoil that is excavated should be removed from the sites or stockpiled and re-used for landscaping. The topsoil is not suitable for re-use as structural fill.

After the topsoil is removed from the proposed building, sidewalk and pavement areas, we recommend that the areas be proofrolled prior to construction or the placement of structural fill. Proofrolling should be performed by a rubber-tired vehicle weighing at least 20 tons, such as a loaded dump truck. Proofrolling should be accomplished by making at least three passes in each of two perpendicular directions in the proposed construction areas and ten feet beyond. If loose or soft soil is identified, it should be compacted or excavated and removed. Proofrolling should be observed by a geotechnical engineer or engineering geologist to provide that adequate remedial work is accomplished. After the topsoil has been stripped and the areas proofrolled, the upper 12 inches of the exposed native soil should be compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557 prior to construction or the placement of structural fill.

Structural fill should consist of GW, GP, GM, SW, SP, SM, or ML soil as designated by the Unified Soil Classification System, Plate 3. All structural fill soil should be approved by a geotechnical engineer prior to placement. The silt and sand soils are suitable for re-use as structural fill. The clay soil present in this unit is not suitable for re-use as structural fill but may be used for backfill in non-structural areas. Structural fill should be placed in six-inch, loose lifts at near optimum moisture content and compacted to a minimum of 92% of the maximum dry density as determined by ASTM D-1557. Non-structural fill should be placed in six- to twelve-inch, loose lifts and compacted to a minimum of 90% of the maximum dry density as determined by ASTM D-1557.

Excavations in GTU-4 will likely encounter metasedimentary bedrock. Small, deep excavations will likely require blasting. Excavation in large areas may be accomplished with the use of a single-tooth ripper, although blasting may be necessary depending on the orientation and competency of the bedrock.

Foundation Design, GTU-4

We recommend that the proposed structures be supported on conventional continuous or individual spread footings. The foundations should bear on native soil or rock or on compacted structural fill. On steep slopes, foundations should typically be founded in bedrock, because of the shallow soil cover and the potential for sliding between the soil cover and the bedrock.

After the foundations are excavated, the upper twelve inches of exposed soil should be compacted to at least 92% of the maximum dry density as determined by ASTM D-1557 prior to forming the foundations. All foundation bearing surfaces should be free of loose soil and debris. Exterior footings should bear at least 30 inches below the exterior ground surface to protect against frost action. The foundations for the structures bearing on native soil or compacted structural fill should be designed based on maximum allowable bearing pressure of 3000 pounds per square foot. Foundations which bear on rock should be evaluated on an individual basis for stability and bearing capacity. For planning purposes, a maximum allowable bearing capacity of 4000 pounds per square foot may be used. All footings should be a minimum of 12 inches in width.

Pavement Design, GTU-4

Pavement sections in GTU-4 should be designed based on an "R"-value of 40 for the gravelly, silty fine to coarse sand. We recommend that the subgrade soil for all pavement, driveway and sidewalk sections be compacted in the upper twelve inches to at least 92% of the maximum dry density as determined by ASTM D-1557. Pavement, driveway and sidewalk sections should be designed to protect against moisture and frost heave.

Lateral Earth Pressure, GTU-4

We recommend that lateral earth pressures be calculated using an equivalent fluid pressure of 50 pounds per cubic foot for the at-rest case (no wall movement), 30 pounds per cubic foot of the active case (outward wall movement) and 640 pounds per cubic foot for the passive case (inward wall movement). This recommendation assumes that the wall is drained and there are no hydrostatic stresses. If the wall is not drained, 62.4 pounds per cubic foot should be added to the equivalent fluid pressures to account for hydrostatic stresses. A coefficient of friction of f_s = 0.65 should be used for retaining wall design.

Slope Design and Stability, GTU-4

There was no surface evidence of slope instability in GTU-4. However, this geotechnical terrain unit is susceptible to shallow landslides because of the steep slope and shallow soil cover. We recommend that natural slopes, fill and cut slopes in this unit be evaluated on an individual basis to determine stability.

Erosion and Drainage, GTU-4

The soils of GTU-4 are very susceptible to erosion. The design and layout of the individual lots and the roadways should allow for dissipated drainage of run-off water. We recommend that run-off water not be allowed to concentrate on cut or fill slopes. Revegetation of exposed soil should take place immediately after construction to minimize erosion.

The presence of bedrock in the subsurface profile may dramatically effect construction and long term performance of underground structures. Ground water may perch on the bedrock. Basements and other underground structures should be designed with drainage of ground water in mind.

CONSTRUCTION MONITORING

We recommend that Howard Consultants, Inc. be retained to provide construction monitoring to verify the report recommendations have been followed. The costs for these services are not included in the scope of work for this evaluation. If we are not retained to provide the recommended construction monitoring services, we cannot be held responsible for soil engineering related construction errors or omissions.

INVESTIGATION LIMITATIONS

This report has been prepared to assist the planning and design of the proposed Armstrong Park subdivision in Kootenai County, Idaho. Our services consist of professional opinions and conclusions made in accordance with generally accepted geotechnical engineering principles and practices. This acknowledgement is in lieu of all warranties either expressed or implied.

The following plates accompany and complete this report:

Plate 1 - Site Plan

Plate 2 - Summary of Test Pit Results

Plate 3 - Unified Soil Classification System

Plate 4 - Proctor Test Results

Plate 5 - Proctor Test Results

Plate 6 - Sieve Analysis Results

Plate 7 - Sieve Analysis Results

Plate 8 - Sieve Analysis Results

Plate 9 - Geotechnical Terrain Unit Map

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SUMMARY OF TEST PIT RESULTS
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-1	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 9.5	RESIDUUM, Fine sandy, clayey SILT, (ML) - mottled gray and yellow/brown, stiff to very stiff, moist.

Test pit terminated at 9.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-2	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 2.5	RESIDUUM, Silty CLAY, (CL/CH) - gray, stiff to very stiff, moist.
	2.5 - 10.0	RESIDUUM, Fine sandy, silty CLAY (CL/CH) - dark brown, stiff to very hard, moist, with green clay layers and slickensides.

Test pit terminated at 10.0 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-3	0.0 - 1.5	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.5 - 5.0	RESIDUUM, Silty, fine to medium SAND, (SM) - brown, medium dense to dense, moist, with minor layers of green clay with slickensides.
	5.0 -	BASALT, gray to dark gray, very hard, dry, with vesicles.

Backhoe refusal at 5.0 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-4	0.0 - 1.5	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.5 - 2.5	RESIDUUM, Silty CLAY, (CL/CH) - gray, stiff to very stiff, moist.
	2.5 - 10.5	RESIDUUM, Fine to medium sandy, clayey SILT (ML) - brown, orange/brown and green, stiff to very stiff, moist with basalt fragments.

Test pit terminated at 10.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

SUMMARY OF TEST PIT RESULTS (CONTINUED)
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-5	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 3.0	RESIDUUM, Silty CLAY, (CL/CH) - gray, stiff to very stiff, moist.
	3.0 - 11.0	RESIDUUM, Silty, fine to medium SAND, (SM) - orange brown, medium dense to dense, damp.

Test pit terminated at 11.0 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-6	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 6.5	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - gray to yellow/brown, dense, damp with rock fragments.
	6.5 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 6.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-7	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 5.5	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - light gray to yellow/brown, medium dense, moist.
	3.0 - 9.5	RESIDUUM, Silty CLAY, (CL/CH) - red/brown to orange/brown, very stiff, moist.

Test pit terminated at 9.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

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SUMMARY OF TEST PIT RESULTS (CONTINUED)
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-8	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 2.5	RESIDUUM, Silty CLAY, (CL/CH) - gray, stiff to very stiff, moist.
	2.5 - 7.0	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - gray to yellow/brown, dense, damp with rock fragments.
	7.0 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 7.0 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-9	0.0 - 1.0	TOPSOIL, Silty fine SAND. (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 1.5	RESIDUUM, Silty CLAY, (CL/CH) - gray, stiff to very stiff, moist.
	1.5 - 2.5	BASALT, Cobbles and boulders, gray to dark gray, medium dense, humid.
	2.5 -	BASALT, gray to dark gray, very hard, dry.

Backhoe refusal at 2.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-10	0.0 - 1.5	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet., with roots and organics.
	1.5 - 3.0	RESIDUUM, Clayey SILT (ML/MH) - light gray to yellow/brown, stiff, moist, with rock fragments.
	3.0 - 11.5	RESIDUUM, Clayey, silty, fine to medium SAND, (SM) - brown, medium dense to dense, moist, with rock fragments.

Test pit terminated at 11.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

SUMMARY OF TEST PIT RESULTS (CONTINUED)
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-11	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 3.0	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - light gray, medium dense, moist, with rock fragments.
	3.0 - 7.0	RESIDUUM, Silty, fine to coarse SAND, (SM) - brown, medium dense to dense, moist, with rock fragments.
	7.0 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 7.0 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-12	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 2.5	RESIDUUM, Silty CLAY (CL/CH) - light gray, stiff, moist, with rock fragments.
	2.5 - 12.5	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - brown, medium dense to dense, moist, with rock fragments.

Test pit terminated at 12.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TP-13	0.0 - 1.5	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.5 - 3.0	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - light gray, medium dense to dense, moist, with rock fragments.
	3.0 - 7.5	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - brown to orange/brown to light gray, medium dense to dense, moist, with rock fragments.
	7.5 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 7.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

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SUMMARY OF TEST PIT RESULTS (CONTINUED)
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-14	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 2.5	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - light gray, medium dense to dense, moist, with rock fragments.
	2.5 - 7.0	ARGILLITE/QUARTZITE, Cobbles and Boulders, light gray, medium dense to dense, humid.
	7.0 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 7.0 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-15	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 3.0	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - light gray to brown, medium dense to dense, moist, with rock fragments.
	3.0 - 9.5	ARGILLITE/QUARTZITE, Cobbles and Boulders, light gray, medium dense to dense, humid.

Test pit terminated at 9.5 feet below the ground surface (difficult excavation).
Ground water was not encountered at the time of excavation.

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-16	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 3.0	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - light gray, medium dense, moist, with rock fragments.
	3.0 - 8.5	WEATHERED GRANITE, Fine to medium sandy SILT, (ML) - light gray, medium dense, humid.

Test pit terminated at 8.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

SUMMARY OF TEST PIT RESULTS (CONTINUED)
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

DEPTH FEET	SOIL DESCRIPTION
0.0 - 3.0	FILL, Fine to medium sandy, clayey SILT (ML) - dark brown to brown, loose to medium dense, moist to very moist, with rock fragments and organics.
3.0 - 6.0	RESIDUUM, Fine sandy, clayey SILT (ML) - light gray to orange/brown, medium dense, moist, with rock fragments.
6.0 - 7.0	ARGILLITE/QUARTZITE, Cobbles and Boulders, light gray, medium dense to dense, humid.
7.0 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

[illegible] refusal at 7.0 feet below the ground surface.
[illegible]ater was not encountered at the time of excavation.

DEPTH FEET	SOIL DESCRIPTION
0.0 - 1.5	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
1.5 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

[illegible] refusal at 1.5 feet below the ground surface.
[illegible]ater was not encountered at the time of excavation.

DEPTH FEET	SOIL DESCRIPTION
0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
1.0 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

[illegible] refusal at 1.5 feet below the ground surface.
[illegible]ater was not encountered at the time of excavation.

DEPTH FEET	SOIL DESCRIPTION
0.0 - 0.5	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
0.5 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

[illegible] refusal at 1.5 feet below the ground surface.
[illegible]ater was not encountered at the time of excavation.

SUMMARY OF TEST PIT RESULTS (CONTINUED)
ARMSTRONG PARK SUBDIVISION
COEUR D'ALENE, IDAHO

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-21	0.0 - 3.5	FILL, Fine to medium sandy, clayey SILT (ML) - dark brown to brown, loose to medium dense, moist to very moist, with rock fragments and organics.
	3.5 - 5.5	RESIDUUM, Gravelly, silty, fine to coarse SAND, (SM) - brown, medium dense, damp to moist, with rock fragments.
	5.5 - 7.5	ARGILLITE/QUARTZITE, Cobbles and Boulders, light gray, medium dense to dense, humid.
	7.5 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 7.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-22	0.0 - 1.0	TOPSOIL, Silty fine SAND, (SM) - dark brown, loose, wet, with roots and organics.
	1.0 - 1.5	ARGILLITE/QUARTZITE, Cobbles and Boulders, light gray, medium dense to dense, humid.
	1.5 -	ARGILLITE/QUARTZITE, light gray, very hard, dry to humid.

Backhoe refusal at 1.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

TEST PIT NUMBER	DEPTH FEET	SOIL DESCRIPTION
TP-23	0.0 - 3.5	FILL, Fine to medium sandy, clayey SILT (ML) - dark brown to brown, loose to medium dense, moist to very moist, with rock fragments and organics.
	3.5 - 6.5	RESIDUUM, Fine sandy, clayey SILT (ML) - light gray to orange/brown, medium dense, moist, with rock fragments.

Test pit terminated at 6.5 feet below the ground surface.
Ground water was not encountered at the time of excavation.

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UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS	GRAVELS	CLEAN GRAVELS	GW	Well-Graded Gravel, Gravel-Sand Mixtures.
			GP	Poorly-Graded Gravel, Gravel-Sand Mixtures.
		GRAVELS WITH FINES	GM	Silty Gravel, Gravel-Sand-Silt Mixtures.
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures.
	SANDS	CLEAN SANDS	SW	Well-Graded Sand, Gravelly Sand.
			SP	Poorly-Graded Sand, Gravelly Sand.
		SANDS WITH FINES	SM	Silty Sand, Sand-Silt Mixtures.
			SC	Clayey Sand, Sand-Clay Mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50%		ML	Inorganic Silt, Silty or Clayey Fine Sand.
			CL	Inorganic Clay of Low to Medium Plasticity, Sandy or Silty Clay.
			OL	Organic Silt and Clay of Low Plasticity.
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH	Inorganic Silt, Micaceous Silt, Fine Sand or Silt, Elastic Silt.
			CH	Inorganic Clay of High Plasticity, Fat Clay.
			OH	Organic Clay of Medium to High Plasticity.
Highly Organic Soils			PT	Peat, Muck and Other Highly Organic Soils.

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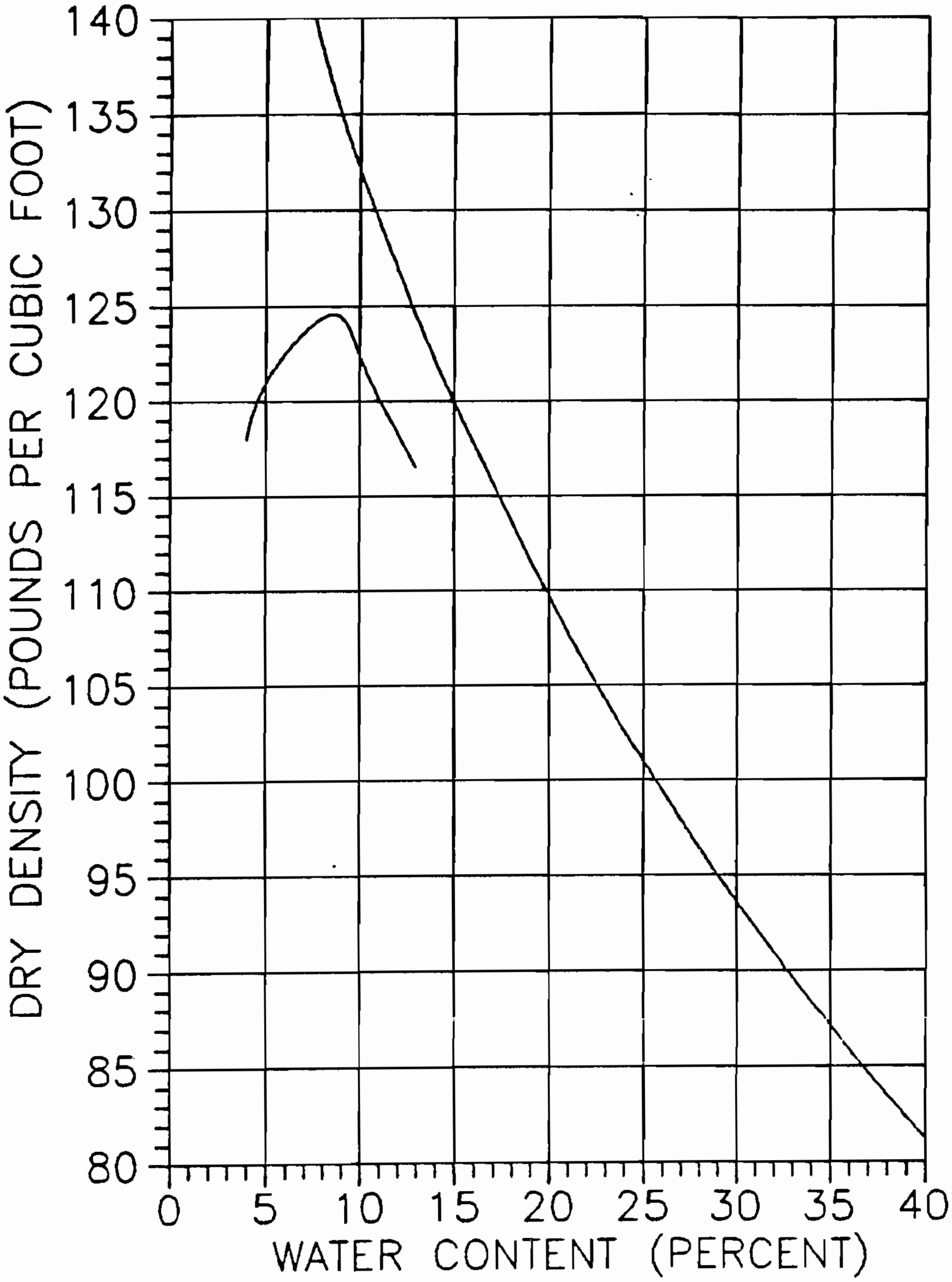

PROJECT – ARMSTRONG PARK SUBDIVISION
SAMPLE – FILL – SANDY, CLAYEY SILT
TP-23, DARK BROWN TO BROWN
MAXIMUM DRY DENSITY = 124.5 PCF
OPTIMUM MOISTURE CONTENT = 8.9 PERCENT
LIQUID LIMIT = 32.6%
PLASTIC LIMIT = 29.2%
PLASTICITY INDEX = 3.4

PROCTOR TEST RESULTS

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

REVISIONS BY_______ DATE_______
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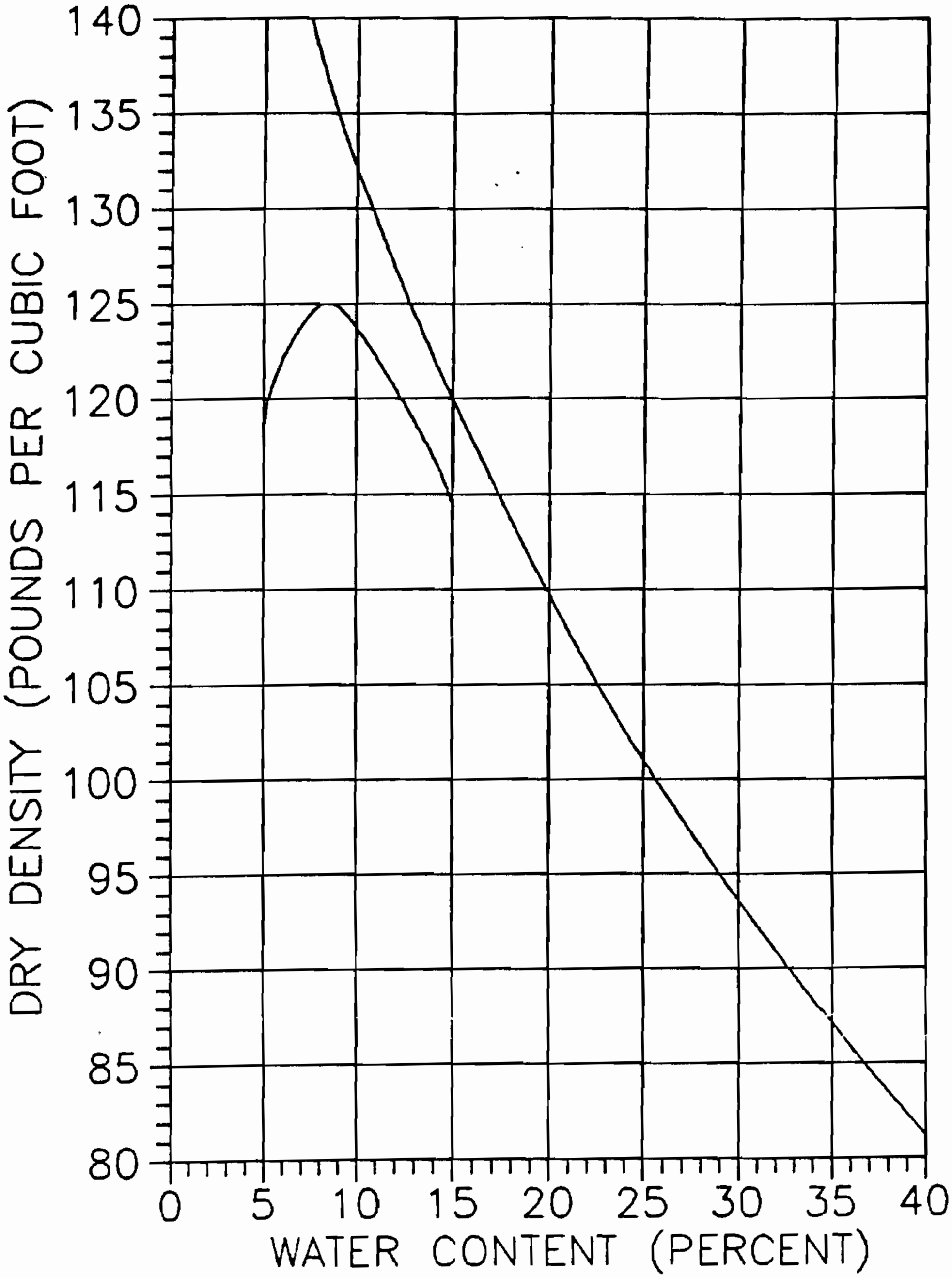
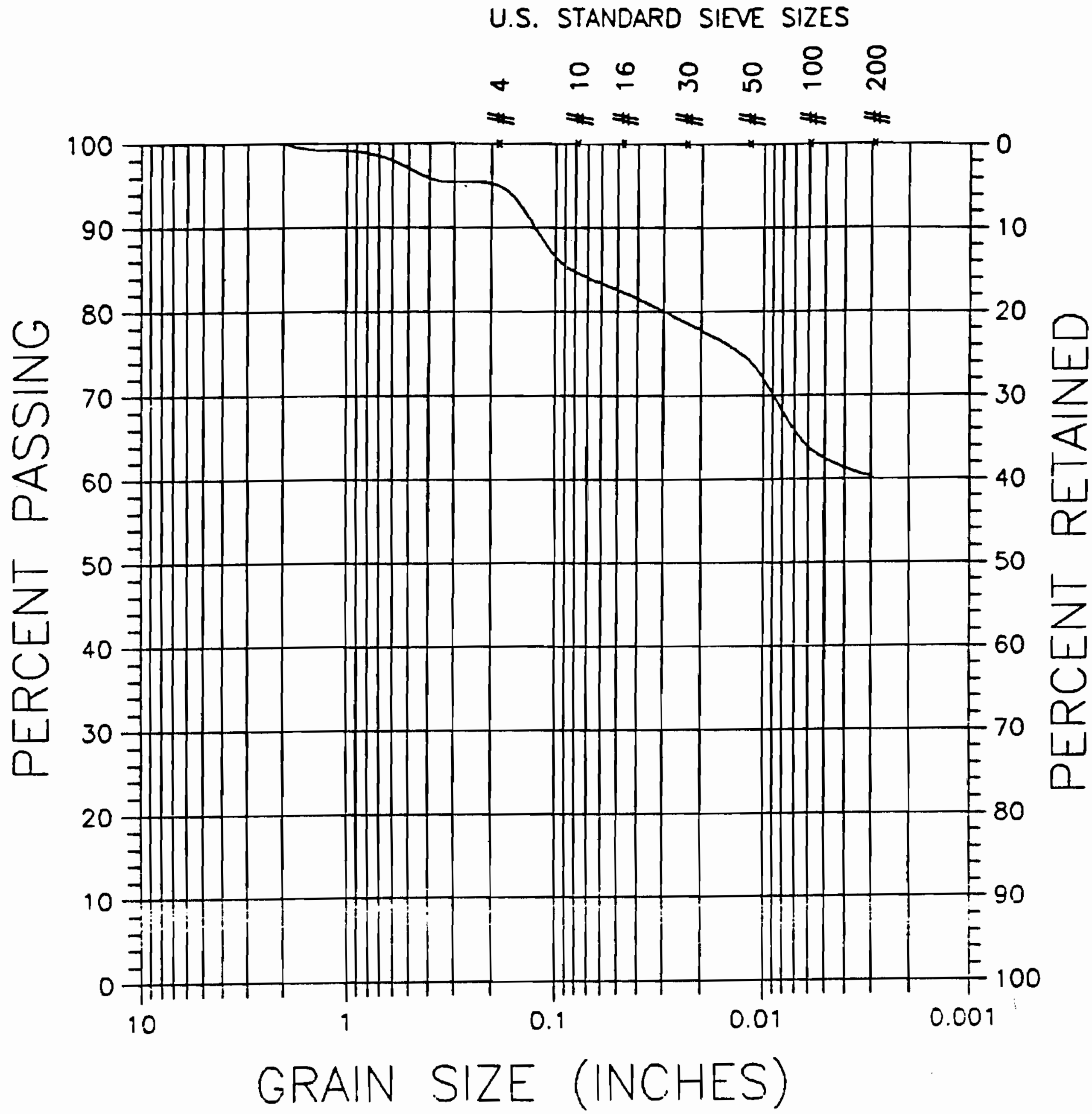


PROJECT – ARMSTRONG PARK SUBDIVISION
SAMPLE – GRAVELLY, SILTY, FINE TO COARSE SAND
TP–13, RESIDUUM, LIGHT GRAY TO BROWN
MAXIMUM DRY DENSITY = 125.0 PCF
OPTIMUM MOISTURE CONTENT = 8.5 PERCENT
LIQUID LIMIT = 30.3%
PLASTIC LIMIT = 23.6%
PLASTICITY INDEX = 6.7

PROCTOR TEST RESULTS

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS



PROJECT: ARMSTRONG PARK SUBDIVISION
SAMPLE: FILL – SANDY CLAYEY SILT
TP-23, DARK BROWN TO BROWN
LIQUID LIMIT = 32.6%
PLASTIC LIMIT = 29.2%
PLASTICITY INDEX = 3.4

SIEVE ANALYSIS RESULTS

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

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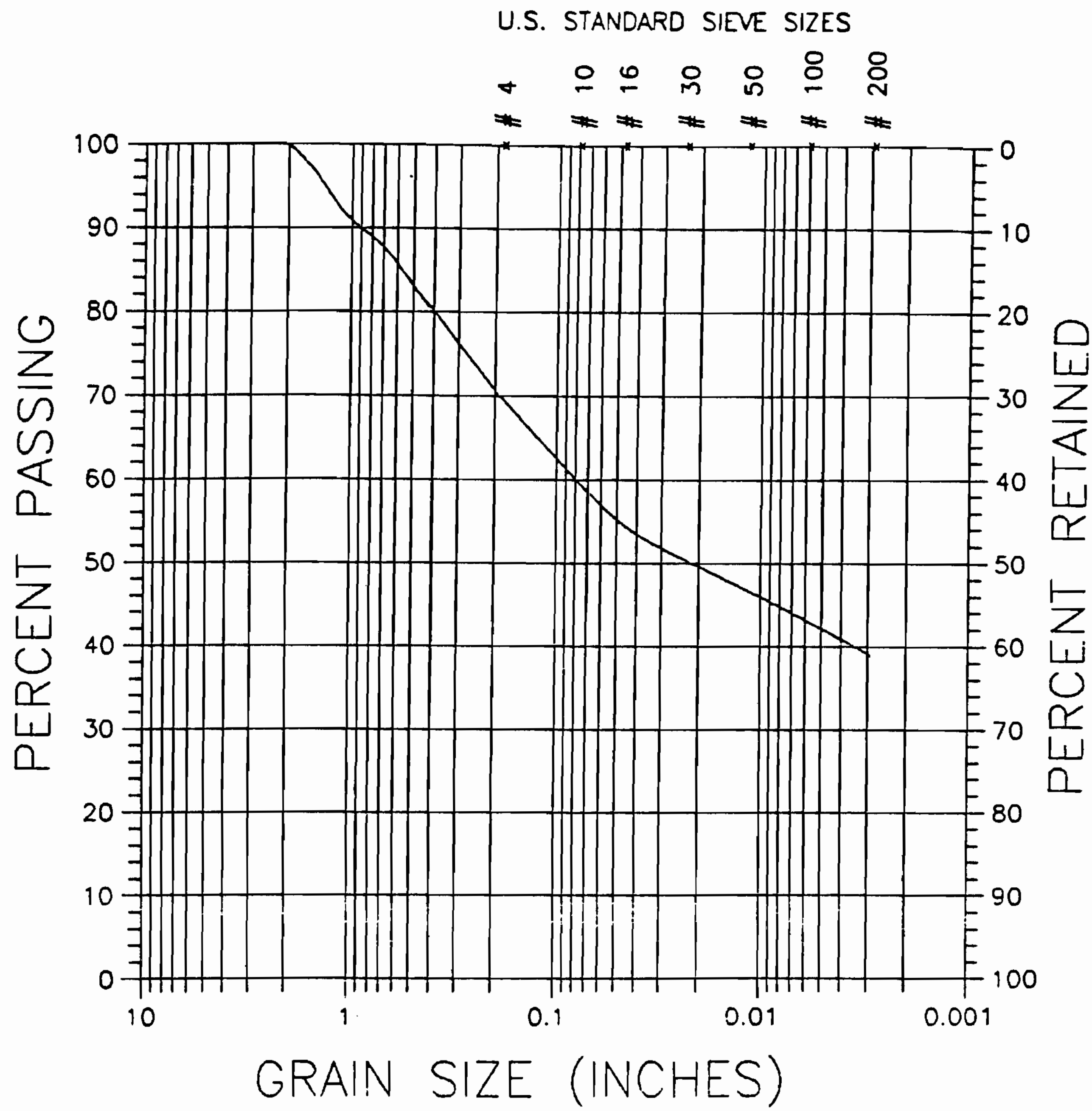

PROJECT: ARMSTRONG PARK SUBDIVISION
SAMPLE: GRAVELLY, SILTY, FINE TO COARSE SAND
TP-13, RESIDUUM, LIGHT GRAY TO BROWN
LIQUID LIMIT = 30.3%
PLASTIC LIMIT = 23.6%
PLASTICITY INDEX = 6.7

SIEVE ANALYSIS RESULTS

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

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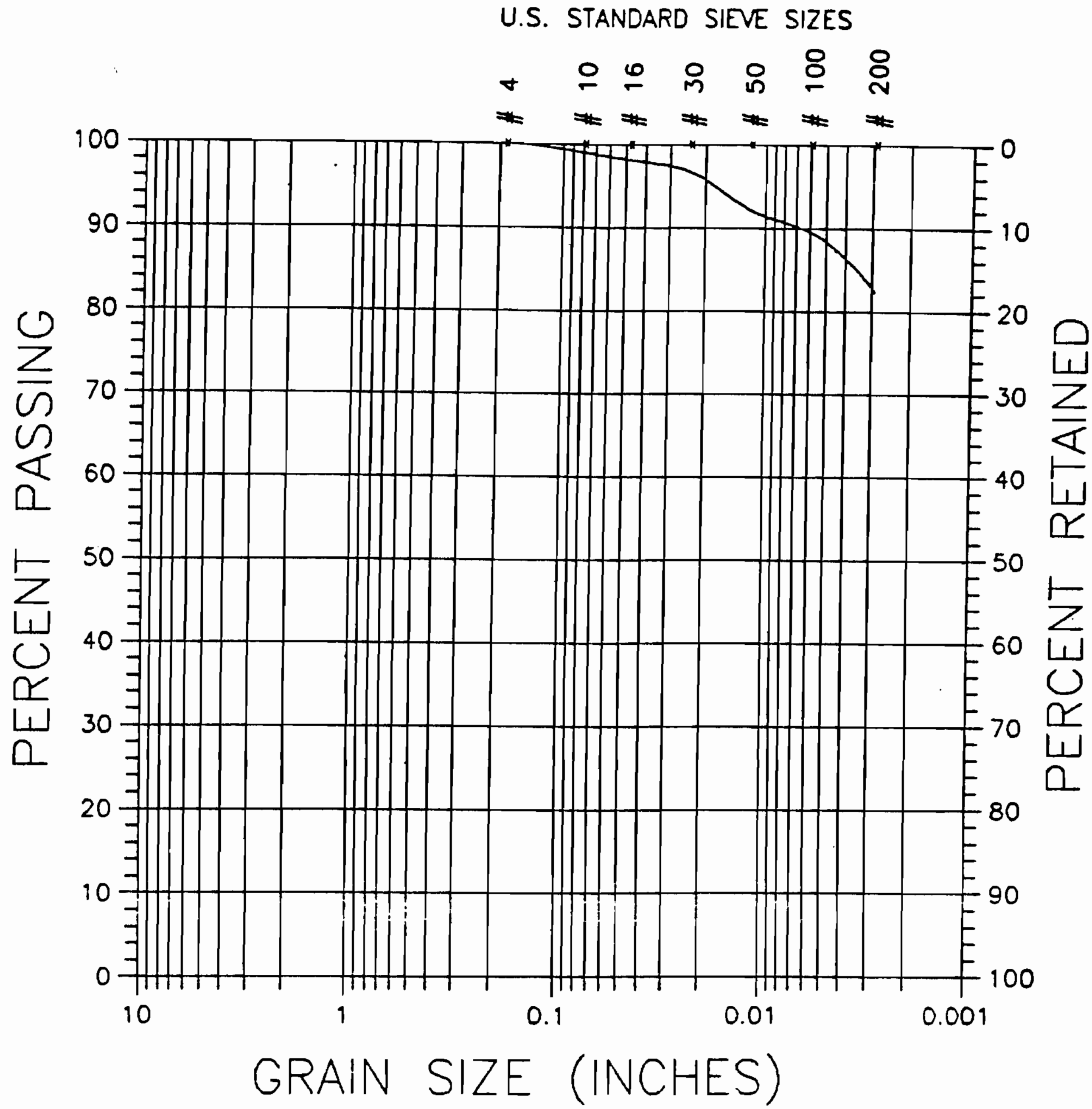

PROJECT: ARMSTRONG PARK SUBDIVISION
SAMPLE: SILTY CLAY
TP-5, RESIDUUM, GRAY
LIQUID LIMIT = 63.6%
PLASTIC LIMIT = 38.7%
PLASTICITY INDEX = 24.9

SIEVE ANALYSIS RESULTS

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

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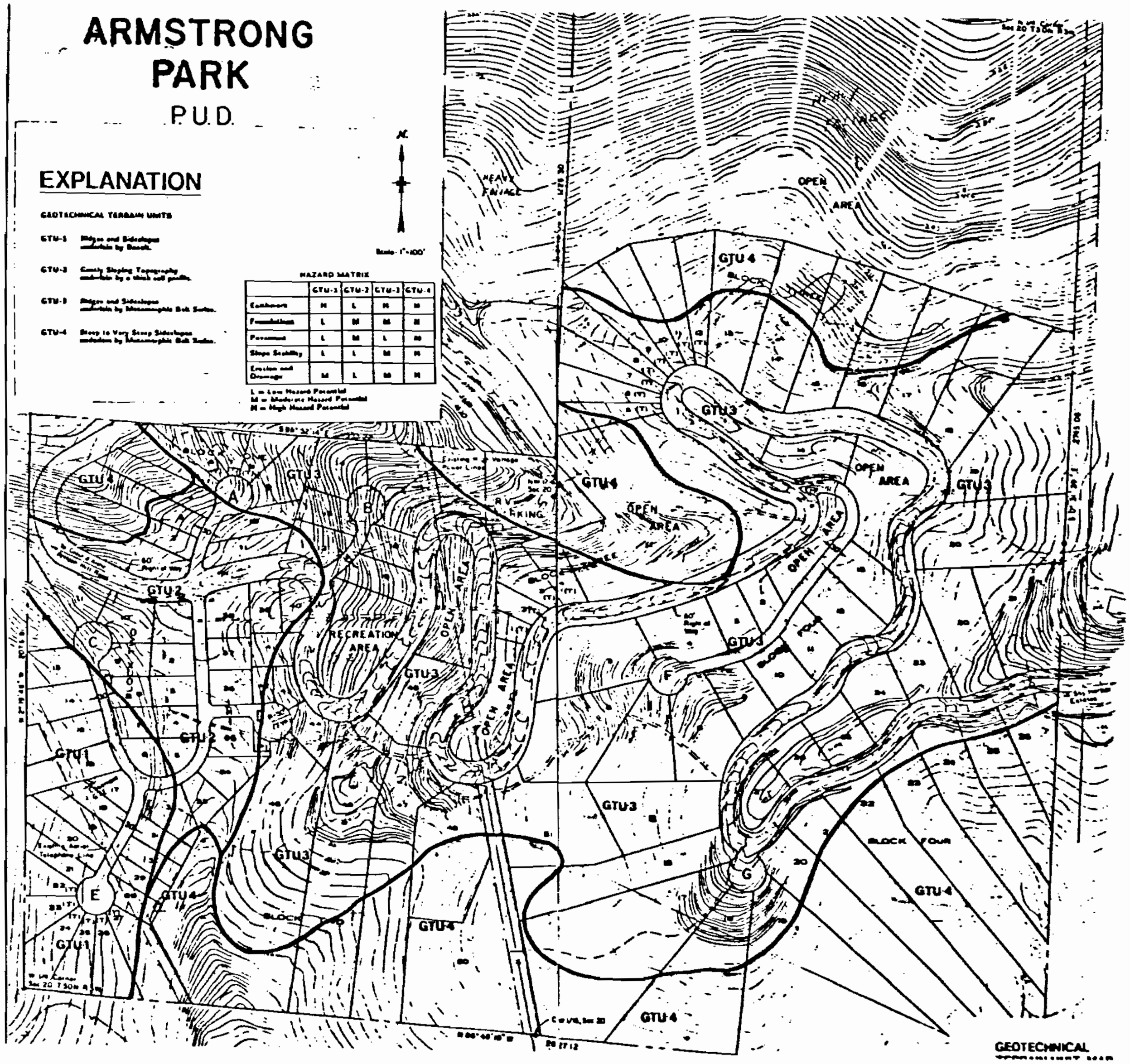
ARMSTRONG
PARK
P.U.D.
EXPLANATION
GTU-4
HAZARD MATRIX
GTU 4
GTU 3
GTU 2
GTU 1
GTU3
GTU4
OPEN AREA
RECREATION AREA
BLOCK FOUR
GEOTECHNICAL

PLANNING DIRECTOR
DAVE YADON

COEUR D'ALENE

CITY COUNCIL MEETING

MAY 2, 1989

RAYMOND L STONE
MAYOR

MEMBERS OF THE CITY COUNCIL

RESOLUTION 89-135

A RESOLUTION OF THE CITY OF COEUR D'ALENE, KOOTENAI COUNTY, IDAHO AUTHORIZING AN AGREEMENT OBTAINING RIGHT-OF-WAY ON HANLEY AVENUE FROM HECLA MINING COMPANY.

Motion by Reid, seconded by Jones to adopt the foregoing resolution.

ROLL CALL: Hassell, Aye; Jones, Aye; Macdonald, Aye; McCrea, Aye; Reid, Aye; Edinger, Absent. Motion carried.

RESOLUTION 89-136

A RESOLUTION OF THE CITY OF COEUR D'ALENE, KOOTENAI COUNTY, IDAHO AUTHORIZING AN AGREEMENT WITH AUBLE & ASSOCIATES, INC.

Motion by Reid, seconded by Hassell to adopt the foregoing resolution.

ROLL CALL: Hassell, Aye; Jones, Aye; Macdonald, Aye; McCrea, Aye; Reid, Aye; Edinger, Absent. Motion carried.

RESOLUTION 89-127

A RESOLUTION OF THE CITY OF COEUR D'ALENE, KOOTENAI COUNTY, IDAHO AUTHORIZING AN AMENDMENT TO THE ARMSTRONG PARK ANNEXATION AGREEMENT.

Motion by Reid, seconded by Macdonald to adopt the foregoing resolution with the amendment to Exhibit B-1 of a deletion of a six inch of top soil requirement.

ROLL CALL: Hassell, Aye; Jones, Aye; Macdonald, Aye; McCrea, Aye; Reid, Aye; Edinger, Absent. Motion carried.

RESOLUTION 89-137

A RESOLUTION OF THE CITY OF COEUR D'ALENE, KOOTENAI COUNTY, IDAHO APPROVING AN AGREEMENT TO PERFORM SUBDIVISION WORK AND TO MAINTAIN OPEN SPACE AT ARMSTRONG PARK ADDITION.

Motion by Reid, seconded by Jones to adopt the foregoing resolution with the condition precedents of obtaining the required bond and the correction of the CC&R's to resolve the Parkland Dedication issue.

ROLL CALL: Hassell, Aye; Jones, Aye; Macdonald, Aye; McCrea, Aye; Reid, Aye; Edinger, Absent. Motion carried.

FINAL PLAT APPROVAL - ARMSTRONG PARK, FIRST PHASE: Motion by Reid, seconded by Macdonald to approve acceptance of the Armstrong Park, First Phase final plat with the following conditions precedent: Plat must be properly signed, CC&R's must be changed to resolve the Parkland Dedication issues, utility plans must be completed, any corrections to plat as required must be completed, and that the bond is in an acceptable form. Motion carried.

STEWART EXPRESSES APPRECIATION: Roger Stewart, on behalf of the developer, engineers and owners of project, expressed his appreciation for the efforts and diligence of the Staff, the Planning & Zoning Commission and Council.

CONSENT CALENDAR: Motion by Reid, seconded by Jones to approve the Consent Calendar which included the following items.

1. Approval of minutes of April 3, 4, 5, 12, 1989.

2. Approval of bills as submitted and on file in the City Clerk's Office.

3. Approval of Amusement Machine License for Safeway.

4. Approval of minutes correction for April 3, 1989.

ROLL CALL: Hassell, Aye; McCrea, Aye; Reid, Aye; Macdonald, Aye; Jones, Aye. Motion carried.

EXECUTIVE SESSION: Motion by Jones, seconded by Hassell to enter into Executive Session as provided by Idaho Code 67-2345 Subsection (F) to consider and advise its legal representatives in pending litigation or where there is a general public awareness of probable litigation.

ROLL CALL: Reid, Aye; Macdonald, Aye; McCrea, Aye; Jones, Aye; Hassell, Aye. Motion carried.

Members present were the Mayor, Council, Acting City Administrator and City Attorney.