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GEOTECHNICAL ENGINEERING STUDY
PROPOSED SOUTH PARK AMBULANCE DISTRICT
AMBULANCE SUBSTATION
LOTS 7 – 16, BLOCK 12
HARTSEL, COLORADO

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Project No. 19-6-265

December 18, 2019

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SUMMARY

1. A representative of Kumar and Associates, Inc. observed five exploratory pits in proposed building and pavement areas on the subject property. Below a shallow depth of organic topsoil, the natural site soils consisted of medium dense poorly graded sand (SP) and poorly graded gravel (GP) with cobbles, extending to the full depth of exploration of about 10 feet below the ground surface. The medium dense, native, granular soils encountered are considered good for support of shallow foundations, floor slabs, pavement and concrete flatwork.

2. Groundwater was not encountered in the pits at the time of excavation. Groundwater depths can vary seasonally, and local areas of perched water or zones of higher moisture content may develop in the soil profile, dependent on seasonal or climatic factors. Wet or unstable subgrade conditions may be encountered during construction and may require stabilization typically consisting of removal and replacement or use of geogrid reinforcement of the existing subgrade and new base course section.

PURPOSE AND SCOPE OF STUDY

This report presents the results of a geotechnical engineering study for a proposed ambulance substation project on the subject parcel. The project site is located on the north side of Highway 24, west of the intersection of Highway 24 and Highway 9, in Hartsel, Colorado, as shown on Figure 1. The purpose of the study was to develop recommendations for foundation design for the building and pavement section recommendations for parking and drive lanes. The study was conducted in accordance with our proposal for geotechnical engineering services with the South Park Ambulance District, Proposal No. P6-19-222, dated November 5, 2019 and revised November 14, 2019.

A field exploration program consisting of exploratory pits and a site reconnaissance was conducted to obtain information on the surface and subsurface conditions. Samples of the subsoils obtained during the field exploration were tested in the laboratory to determine their classification and other engineering characteristics. The results of the field exploration and laboratory testing were analyzed to develop recommendations for foundation types, depths and allowable pressures for the proposed structure foundations. This report summarizes the data obtained during this study and presents our conclusions, design recommendations and other geotechnical engineering considerations based on the proposed construction and the subsoil conditions encountered.

PROPOSED CONSTRUCTION

Based on review of preliminary plans and discussions with the Project Team, we understand the project consists of the construction of an approximate 5,500 square foot ambulance station with associated parking and access drives, situated on the subject parcel as shown on Figure 1. The structure will be a one level structure of wood-frame or light steel frame construction with a slab-on-grade. Grading for the project is anticipated to be relatively minor and structural loads are anticipated to be relatively light and typical of the proposed construction. A buried propane tank is proposed to the northeast of the building, and a water well will be drilled to the northwest of the building.

If construction plans are different than those described above, we should be notified to re-evaluate the recommendations presented in this report.

SITE CONDITIONS

The project site consists of a vacant lot located on the north side of Highway 24. The site is relatively level with a slight slope down toward the east and is about 3 to 5 feet lower than the adjacent Highway 24 alignment to the south. The lot is mostly clear of vegetation with the exception of scattered grass and weeds and may have been graded relatively level in the past.

FIELD EXPLORATION

The field exploration for the project was conducted on December 5, 2019. Five exploratory pits were excavated within proposed development areas at the approximate locations shown on Figure 1, to evaluate the subsurface conditions. The pits were excavated with a tracked mini-excavator and logged by a representative of Kumar & Associates, Inc.

Samples of the subsoils were taken with disturbed sampling methods. Depths at which the samples were taken are shown on the Logs of Exploratory Pits, Figure 2. The samples were returned to our laboratory for review by the project manager and testing.

LABORATORY TESTING

Laboratory testing performed on samples obtained from the exploratory pits consisted of natural moisture content, percent passing the No. 200 sieve and gradation analysis. The results of gradation analyses performed on the minus 3-inch fraction of the natural granular soils are shown on Figure 4. The laboratory test results are shown on the Logs of Exploratory Pits, Figure 2, and summarized in Table 1.

SUBSURFACE CONDITIONS

Soil Types Encountered: Graphic logs of the subsurface conditions encountered at the site are shown on Figure 2. Below a shallow depth of organic topsoil, the natural site soils consist of medium dense poorly graded sand (SP) and poorly graded gravel (GP) with cobbles, extending to the full depth of exploration of about 10 feet below the ground surface. The subsoils were typically slightly silty. The medium dense, native, granular soils encountered are considered good for support of shallow foundations, floor slabs, pavement and concrete flatwork.

Groundwater: Groundwater was not encountered in the pits at the time of excavation. Groundwater depths can vary seasonally, and local areas of perched water or zones of higher moisture content may develop in the soil profile, dependent on seasonal or climatic factors. Wet or unstable subgrade conditions may be encountered during construction and may require stabilization typically consisting of removal and replacement or use of geogrid reinforcement of the existing subgrade and new base course section.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

Subsurface data indicate that medium dense granular sand and gravel with cobbles will likely be the predominant soil type encountered beneath shallow foundation, floor slab, flatwork and pavement areas. The anticipated natural SP and GP soils at the foundation level are considered good for shallow foundation support.

The onsite granular soils typically contain a relatively low percentage of fine soil and excavations in the soils will need to be laid back or require shoring to prevent caving of the excavation walls. Standard heavy-duty excavation and drilling equipment should be suitable for excavations into the granular soils for buried propane tanks and the onsite well. Buried propane tanks can bear on the natural site soils or a levelling course of properly compacted structural fill. Groundwater was not encountered to the explored depth of 10 feet in this study. Groundwater depths for the proposed water well can be estimated by review of published well data from nearby wells and consultation with local well drillers.

SITE GRADING

The following recommendations should be followed for grading, site preparation, and fill compaction.

1. Where fill is to be placed all topsoil, organic, loose or otherwise unsuitable material should be removed prior to placement of new fill. The exposed soils should then be scarified to a depth of 6 inches, moisture conditioned and compacted to the minimum requirements of the overlying fill. Soils should be compacted with appropriate equipment for the lift thickness placed. Lift thickness should be no more than 8 inches compacted at the recommended moisture content and to the minimum required density.
2. Permanent unretained cut and fill slopes should be graded at 2 horizontal to 1 vertical (2:1) or flatter and protected against erosion by revegetation or other means. The risk of slope instability will be increased if seepage is encountered in cuts and flatter slopes may be necessary. If seepage is encountered in permanent cuts, an investigation should be conducted to determine if the seepage will adversely affect the cut stability. This office should review site grading plans for the project prior to construction.
3. Slopes of 4:1 or steeper should be benched to provide a level surface for compaction.
4. All backfill should be processed so that it does not contain fragments larger than 6-inches in diameter and placed at the recommended moisture content.
5. The following compaction requirements should be used:

TYPE OF FILL PLACEMENT	MOISTURE CONTENT	SOIL TYPE - Compaction Percent (ASTM D698 – Standard Proctor)
Below Foundations	± 2% Optimum	Structural Fill – 98%
Foundation Wall Backfill	± 2% Optimum	Processed On-site or Structural Fill – 95%
Below Floor Slabs	± 2% Optimum	Structural Fill – 95%
Below Floor Slabs (Fills Greater than 8 Feet in Depth)	± 2% Optimum	Structural Fill – 100%
Landscape Areas	± 2% Optimum	Processed On-site – 90%
Below Concrete Flatwork/Pavements	± 2% Optimum	Structural Fill – 95%
Utility Trenches	As they apply to the finished area	

Suitability of On-Site Soil

The on-site SP & GP soils are suitable as backfill after processing to remove all plus 6-inch material and moisture treatment. The on-site topsoil is not suitable for reuse except in the upper 6 to 12 inches of backfill in landscape areas.

Considerable processing may be necessary to reduce the on-site soil to fragments of minus 6-inches. Processing may include screening, rock raking and crushing. All on-site soil should be processed, moisture-conditioned and placed at the minimum required compaction.

Structural Fill

Structural fill used for support of the proposed building and pavement should consist of the on-site processed soils or a relatively well-graded imported granular material with a liquid limit of 35 or less, a plasticity index of 10 or less, 5 to 25 percent material passing the No. 200 sieve, 60 percent or more passing the No. 4 sieve and no rocks larger than 6 inches. CDOT Class 1 structural backfill is acceptable as structural fill. Structural fill should be properly placed and compacted to reduce the risk of settlement and distress. Structural fills should be placed in accordance with the recommendations presented in the SITE GRADING section of this report.

Excavations

It is the responsibility of the Contractor to provide safe working conditions and to comply with the regulations in OSHA Standards, Excavations, 29CFS Part 1926. The onsite granular soil will likely classify as “Type C” in accordance with OSHA regulations. The regulations allow slopes of 1½ horizontal to 1 vertical (1½:1) for dry temporary excavations less than 20 feet deep.

The presence of water, seepage, fissuring, vibrations or surcharge loads will require temporary excavation to have flatter slopes. A Contractor's Competent Person should make decisions regarding cut slopes. A qualified Geotechnical engineer should observe any questionable slopes or conditions. Temporary shoring may be necessary.

FOUNDATIONS

Considering the subsoil conditions encountered in the exploratory pits and the nature of the proposed construction, we recommend the structure be founded with spread footings bearing on the undisturbed granular soils or properly compacted structural fill.

The design and construction criteria presented below should be observed for a spread footing foundation system.

1) Footings placed on the undisturbed natural granular soils or compacted structural fill should be designed for an allowable soil bearing pressure of 2,500 pounds per square foot (psf). Based on experience, we expect movement of footings designed and constructed as discussed in this section will be about 1 inch or less.
2) The footings should have a minimum width of 16 inches for continuous walls and 2 feet for isolated pads.
3) Exterior footings and footings beneath unheated areas should be provided with adequate soil cover above their bearing elevation for frost protection. Placement of foundations at least 48 inches below adjacent exterior grade, (or in accordance with local building code requirements) is recommended for foundations bearing on the SP & GP soils. Concrete should not be placed on frost, frozen soil, snow or ice.
4) Continuous foundation walls should be reinforced top and bottom to span local anomalies such as by assuming an unsupported length of at least 10 feet. Foundation walls acting as retaining structures should also be designed to resist lateral earth pressures as discussed in the "Foundation and Retaining Walls" section of this report.
5) The topsoil and any loose or disturbed soils should be removed, and the footing bearing level extended down to the relatively undisturbed soils or replaced with properly compacted structural fill.
6) The exposed soil in footing areas should then be adjusted to near optimum moisture content and compacted. If water seepage is encountered, the footing areas should be dewatered before concrete placement and we shall be contacted for further evaluation.
7) Structural fill used for support of the foundation should meet the requirements listed in the SITE GRADING section of this report.

8) A representative of the geotechnical engineer should observe all footing excavations prior to forming footings and concrete placement to evaluate bearing conditions.

FOUNDATION AND RETAINING WALLS

Foundation walls and retaining structures which are laterally supported and can be expected to undergo only a slight amount of deflection should be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of at least 45 pounds per cubic foot (pcf) for backfill consisting of the on-site processed soils or suitable granular import. Cantilevered retaining structures which are separate from the foundation and can be expected to deflect sufficiently to mobilize the full active earth pressure condition should be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of at least 35 pcf for backfill consisting of the processed on-site soil or suitable granular import. The backfill should not contain rock larger than about 6 inches in diameter.

The lateral resistance of foundation or retaining wall footings will be a combination of the sliding resistance of the footing on the foundation materials and passive earth pressure against the side of the footing. Resistance to sliding at the bottoms of the footings can be calculated based on a coefficient of friction of 0.45. Passive pressure of compacted backfill against the sides of the footings can be calculated using an equivalent fluid unit weight of 460 pcf. The coefficient of friction and passive pressure values recommended above assume ultimate soil strength. Suitable factors of safety should be included in the design to limit the strain which will occur at the ultimate strength, particularly in the case of passive resistance. Fill placed against the sides of the footings to resist lateral loads should be a suitable granular material compacted to at least 95% of the maximum standard Proctor dry density at a moisture content near optimum.

All foundation and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent footings, traffic, construction materials and equipment. The pressures recommended above assume drained conditions behind the walls and a horizontal backfill surface. The buildup of water behind a wall or an upward sloping backfill surface will increase the lateral pressure imposed on a foundation wall or retaining structure. An underdrain should be provided to limit hydrostatic pressure buildup behind walls.

Backfill in patio, pavement, and walkway areas should be placed in uniform lifts and compacted to at least 95% of the maximum standard Proctor (ASTM D-698) dry density. Backfill placed in landscape areas should be compacted to at least 90% of the maximum standard Proctor dry density at a moisture content near optimum. Care should be taken not to overcompact the backfill or use large equipment near the wall, since this could cause excessive lateral pressure on the wall. Some settlement of deep foundation wall backfill should be expected, even if the material is placed correctly, and could result in distress to facilities constructed on the backfill.

FLOOR SLABS

The on-site natural granular soils, exclusive of topsoil, are suitable to support lightly loaded slab-on-grade construction. To reduce the effects of some differential movement, floor slabs should be separated from all bearing walls and columns with expansion joints which allow unrestrained vertical movement. Floor slab control joints should be used to reduce damage due to shrinkage cracking. The requirements for joint spacing and slab reinforcement should be established by the designer based on experience and the intended slab use. A minimum 4-inch layer of free-draining gravel should be placed below grade slabs, if constructed, to facilitate drainage. This material should consist of minus 2-inch aggregate with at least 50% retained on the No. 4 sieve and less than 2% passing the No. 200 sieve. All backfill under floor slabs should be placed in accordance with the SITE GRADING section of this report.

We recommend vapor retarders conform to at least the minimum requirements of ASTM E1745 Class C material. Certain floor types are more sensitive to water vapor transmission than others. For floor slabs bearing on angular gravel or where flooring system sensitive to water vapor transmission are utilized, we recommend a vapor barrier be utilized conforming to the minimum requirements of ASTM E1745 Class A material. The vapor retarder should be installed in accordance with the manufacturers' recommendations and ASTM 1643.

UNDERDRAIN SYSTEM AND DAMP-PROOFING

Groundwater was not encountered during our exploration, but it has been our experience in mountainous areas that groundwater levels can rise, and that local perched groundwater can develop during times of heavy precipitation or seasonal runoff. Frozen ground during spring runoff can create a perched condition. We recommend below-grade construction, such as retaining walls, crawlspace and basement areas, be protected from wetting and hydrostatic pressure buildup by an underdrain and wall drain system. Slab at grade construction should not require an underdrain.

If installed, the underdrain should consist of drainpipe placed in the bottom of the wall backfill surrounded above the invert level with free-draining gravel. The drain should be placed at each level of excavation and at least 12-inches below lowest adjacent finish grade and sloped at a minimum 1% to a suitable gravity outlet, sump and pump system or drywell. Free-draining gravel used in the underdrain system should contain less than 2% passing the No. 200 sieve, less than 50% passing the No. 4 sieve and have a maximum size of 1-inch. The drain gravel backfill should be at least 1½ feet deep and protected by filter fabric. A typical drain detail is shown on Figure 5.

SURFACE DRAINAGE

The following drainage precautions should be observed during construction and maintained at all times after the residence has been completed:

1) Inundation of the foundation excavations and underslab areas should be avoided during construction.
2) Backfill in pavement and slab areas should be compacted to at least 95% of the maximum standard Proctor dry density at a moisture content within 2% of optimum. Exterior backfill placed in landscape areas should be compacted to at least 90% of the maximum standard Proctor dry density at a moisture content near optimum.
3) The ground surface surrounding the exterior of the building should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 6 inches in the first 10 feet in unpaved areas and a minimum slope of 2½ inches in the first 10 feet in paved areas.
4) Roof downspouts and drains should discharge well beyond the limits of all backfill.

PAVEMENT SECTION DESIGN

Based on our understanding of the project, an asphalt-paved access drive and limited parking areas will be constructed as part of project development. Traffic will generally consist of light automotive, medium sized ambulance vehicles and occasional heavy service vehicles. Traffic during construction will consist of heavier vehicles with higher wheel loads and precautions should be taken to prevent damage to the newly constructed pavement during construction.

The proof-rolled, inorganic native granular soils, excluding of topsoil, and properly compacted structural fill will provide, in our opinion, adequate subgrade support for asphalt-paved drives and parking areas associated with the development. Proper pavement section drainage, including site drainage to avoid ponding of water on, or adjacent to parking and drive areas, will be important in reducing the potential for pavement distress. Structural fill placed in paved areas should consist of processed on-site native soil or imported sand and gravel meeting the requirements of the Site Grading section of this report. Fill should be placed in maximum 8-inch lifts, loose thickness, moisture-conditioned, and compacted to at least 95 percent of the standard Proctor density, ASTM D698.

A pavement section is a layered system designed to distribute concentrated traffic loads to the subgrade. Performance of the pavement structure is directly related to the physical properties of the subgrade soils and traffic loadings. Soils are represented for pavement design purposes by means of a soil support value for flexible pavements and a modulus of subgrade reaction for rigid pavements. Both values are empirically related to strength.

Subgrade Soils

Subgrade soils consisting of medium dense poorly graded sand and gravel with cobbles are anticipated to be present at the pavement subgrade level. Based on the laboratory testing, the soils classify as Group A-1 in accordance with the American Association of State Highway and Transportation Officials (AASHTO). The soil type is considered excellent for pavement subgrade support. For design purposes, a seasonally adjusted effective resilient modulus of 5,800 psi was used to represent the subgrade strength for flexible pavements, based on soil type, site location and elevation.

Asphaltic Concrete (AC) Pavement Design

Pavement section recommendations are presented for asphaltic concrete (AC) over aggregate base course (ABC) for the drive lanes and auto only parking areas. We recommend that portland cement concrete (PCC) pavement be used in gutters, entry areas, dumpster enclosures, and other areas that will receive concentrated truck turning movements. Based our understanding of the project and the results of our geotechnical exploration and laboratory testing, the recommended pavement section thicknesses are presented in the following table:

Location	**Asphalt and Aggregate Base Course AC + ABC**
Drive Lanes	*4 inches + 6 inches*
Auto Parking Only Areas	*3 inches + 5 inches*

Asphalt should consist of a mixture of aggregate, filler and asphalt cement established by a qualified engineer. Aggregate Base Course (ABC) should conform to the requirements of AASHTO M147 and to Section 703.03 of the CDOT Standard Specifications for Road and Bridge Construction. The ABC should meet Class 6 grading and quality as defined by the CDOT specifications. The ABC should have a minimum R-value of 77 and a minimum dry unit weight of 120 pcf when placed at the required compaction. The ABC must also meet all other appropriate CDOT specifications.

Portland Cement Concrete Pavement Section

For concrete pavements, we recommend a minimum of 6-inches of Portland cement concrete (PCC) underlain by 4 inches of CDOT Class 6 ABC. Concrete pavement underlain by 4 inches Class 6 ABC is recommended 1) to create a uniform subbase/base, 2) to prevent pumping of fines from beneath the pavement, and 3) provide a working platform for construction.

All concrete should be based on a mix design established by a qualified engineer. A CDOT Class P or D mix would be acceptable. The design mix should consist of aggregate, Portland cement, water, and additives which will meet the requirements contained in this section. The concrete should have a modulus of rupture of third point loading of 650 psi. Normally, concrete with a 28-day compressive strength of 4,200 psi will meet this requirement. Concrete should contain approximately 6 percent entrained air. Maximum allowable slump should not exceed 4 inches.

The concrete should contain joints not greater than 10 feet on centers. Joints should be sawed or formed by pre-molded filler. The joints should be at least 1/3 of the slab thickness. Joints should be reinforced with dowels to provide load transfer between slabs. Concrete pavement joints should meet the requirements of CDOT Standard Plan No. M 412-1 and CDOT Standard Specifications Section 412.13. Expansion joints should be provided at the end of each construction sequence and between the concrete slab and adjacent structures. Expansion joints, where required, should be filled with a ½-inch thick asphalt impregnated fiber. Concrete should be cured by protecting against loss of moisture, rapid temperature changes and mechanical injury for at least three days after placement. After sawing joints, the saw residue shall be removed and the joint sealed.

Subgrade Preparation

Prior to placing compacted fill, the exposed subgrade soils should be thoroughly scarified and well mixed to a depth of 8 inches, adjusted to a moisture content near optimum, and compacted to at least 95% of the standard Proctor (ASTMD 698) maximum dry density.

Proof Roll

Before placing aggregate base course for the pavement section, the subgrade should be proof rolled with a heavily loaded, pneumatic-tired vehicle. The vehicle should have gross vehicle weight of at least 50,000 pounds with a loaded single axle weight of 18,000 pounds and a tire pressure of 100 psi. Areas which deform excessively under heavy wheel loads are not stable and should be removed and replaced to achieve a stable subgrade prior to paving or placement of base course.

Drainage

The collection and diversion of surface drainage away from paved areas is extremely important for the satisfactory performance of pavement. Drainage design should provide for the removal of water from paved areas and prevent wetting of the subgrade soils.

Maintenance

Periodic maintenance of paved areas is critical to achieve the design pavement life. Crack sealing should be performed annually as new cracks appear. Joint seals in concrete should be replaced as they deteriorate. Chip seals, fog seals, or slurry seals applied at approximate intervals of 3 to 5 years are usually necessary for asphalt. As conditions warrant, it may be necessary to perform patching and structural overlays at approximate 10-year intervals. In temporary gravel roadways, periodic regrading should be expected on a yearly basis.

CONTINUING SERVICES

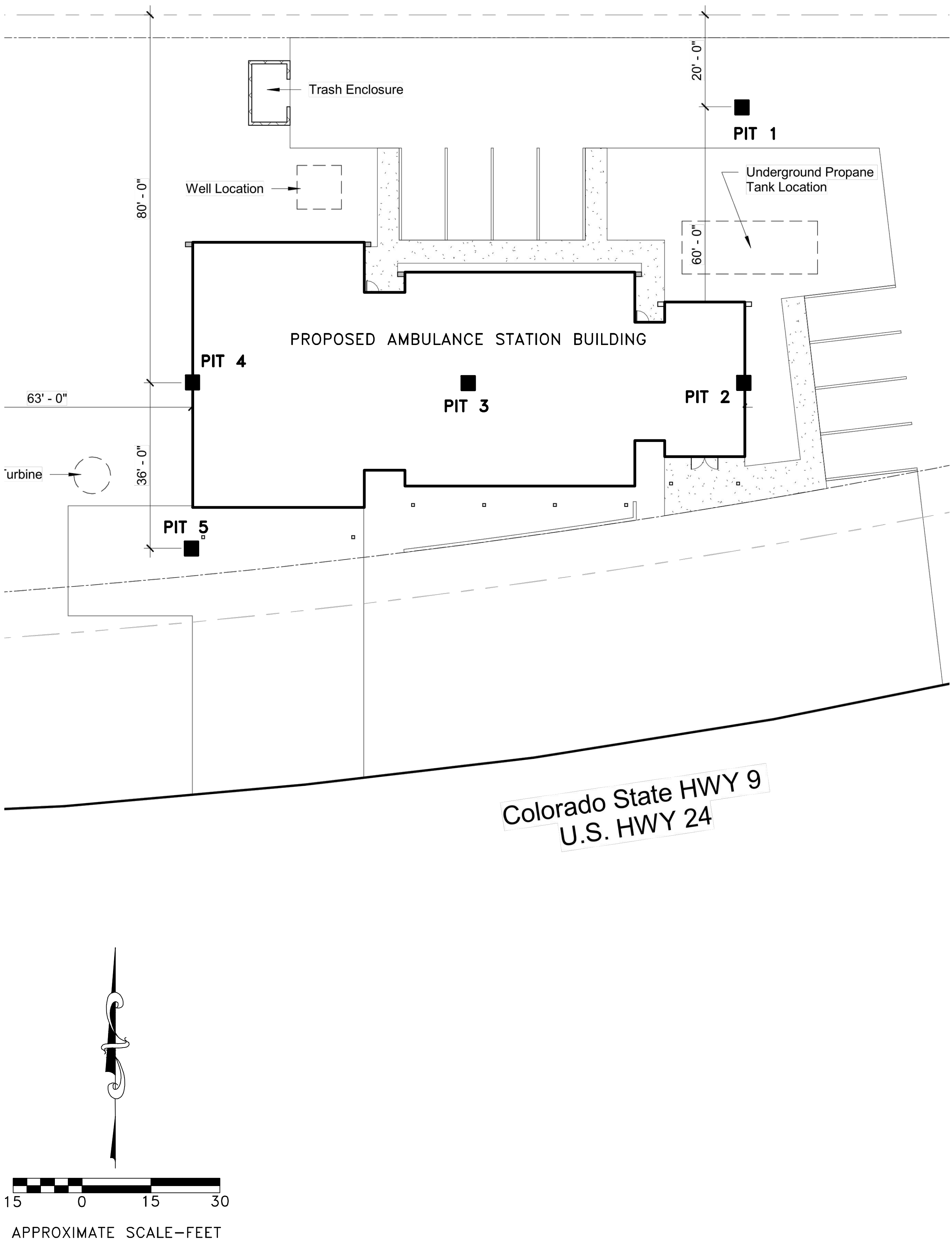
Three additional elements of geotechnical engineering service are important to the successful completion of this project.

1) Consultation with design professionals during the design phases. This is important to ensure that the intentions of our recommendations are properly incorporated in the design, and that any changes in the design concept properly consider geotechnical aspects.
2) Grading Plan Review. Final grading plans were not available for our review at the time of this report. A grading plan with finish floor elevations for the proposed construction should be prepared by a civil engineer licensed in the State of Colorado. Kumar and Associates, Inc. should be provided with grading plans once they are complete to confirm the recommendations contained in this report.
3) Observation and monitoring during construction. A representative of the Geotechnical engineer from our firm should observe the foundation excavation, earthwork, and foundation phases of the work to determine that subsurface conditions are compatible with those used in the analysis and design and our recommendations have been properly implemented. Placement of backfill and asphalt pavement should be observed and tested to judge whether the proper placement and compaction conditions have been achieved. We recommend a representative of the geotechnical engineer observe the drain and dampproofing phases of the work, if constructed, to judge whether our recommendations have been properly implemented.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering principles and practices in this area at this time. We make no warranty either express or implied. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory pits at the locations indicated on Figure 1, the proposed type of construction and our experience in the area. Our services do not include determining the presence, prevention or possibility of mold or other biological contaminants (MOBC) developing in the future. If the client is concerned about MOBC, then a professional in this special field of practice should be consulted. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory pits and variations in the subsurface conditions may not become evident until excavation is performed. If conditions encountered during construction appear different from those described in this report, we should be notified so that re-evaluation of the recommendations may be made.

This report has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our information. As the project evolves, we should provide continued consultation and field services during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. The recommendations contained in this report are contingent upon review of grading and excavation plans prepared by a civil engineer licensed in the State of Colorado. Review of grading plans may alter our recommendations. Significant design changes may require additional analysis or modifications to the recommendations presented herein.



19-6-265	Kumar & Associates	LOCATION OF EXPLORATORY PITS	Fig. 1

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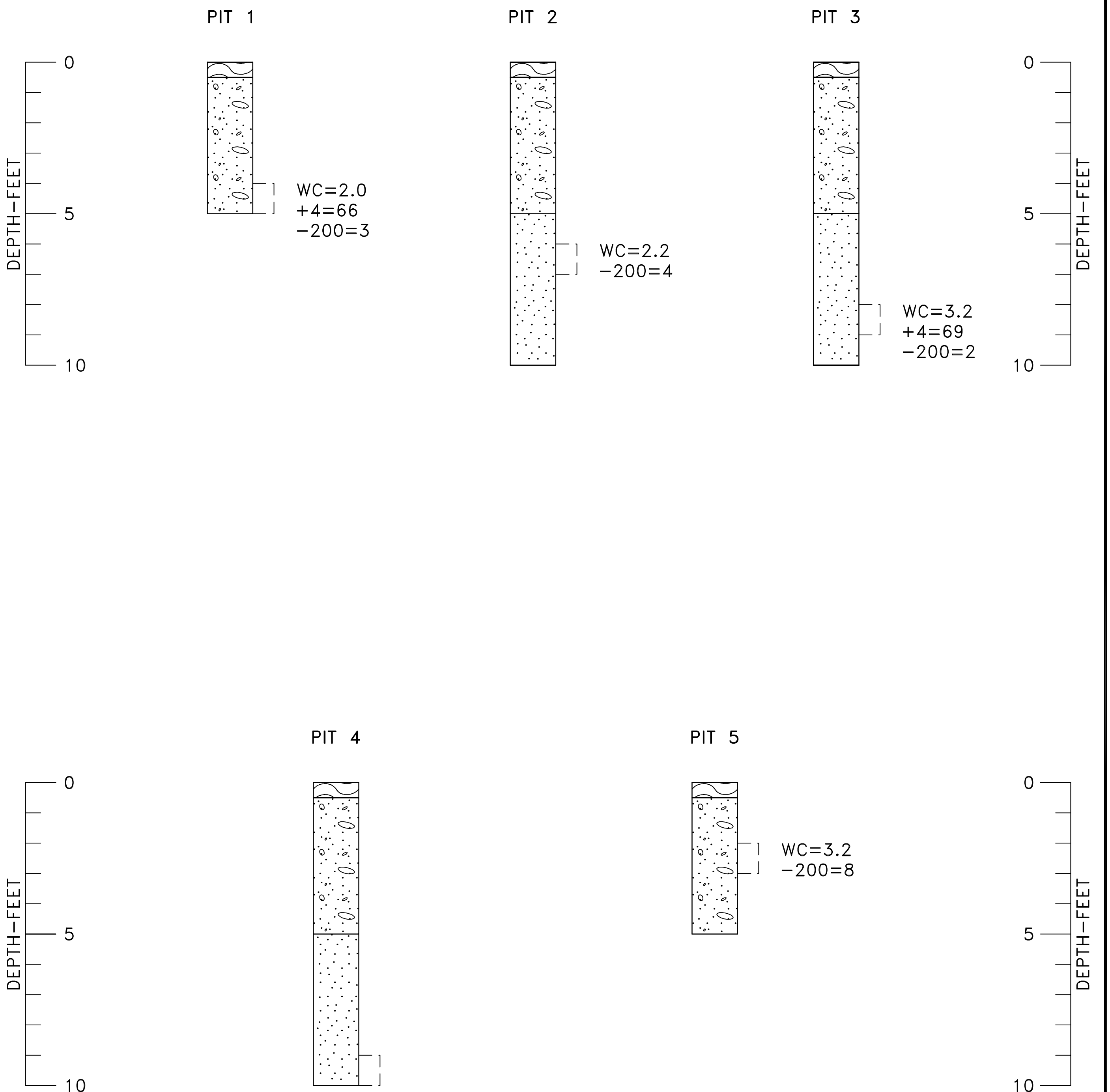

19–6–265	Kumar & Associates	LOGS OF EXPLORATORY PITS	Fig. 2

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LEGEND

TOPSOIL; SILT WITH SAND AND ORGANICS, MOIST, BROWN.

POORLY GRADED GRAVEL (GP); WITH SAND AND COBBLES, MEDIUM DENSE, BROWN.

POORLY GRADED SAND (SP); WITH GRAVEL AND COBBLES, MEDIUM DENSE, MOIST, BROWN.

DISTURBED BULK SAMPLE.

NOTES

1. THE EXPLORATORY PITS WERE EXCAVATED WITH A CAT MINI–EXCAVATOR ON DECEMBER 5, 2019.

2. THE LOCATIONS OF THE EXPLORATORY PITS WERE MEASURED APPROXIMATELY BY PACING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.

3. THE ELEVATIONS OF THE EXPLORATORY PITS WERE NOT MEASURED AND THE LOGS OF THE EXPLORATORY PITS ARE PLOTTED TO DEPTH.

4. THE EXPLORATORY PIT LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY PIT LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.

6. GROUND WATER WAS NOT ENCOUNTERED IN THE PITS AT THE TIME OF EXCAVATION. PITS WERE BACKFILLED SUBSEQUENT TO SAMPLING.

7. LABORATORY TEST RESULTS:
   WC = WATER CONTENT (%) (ASTM D 2216);
   DD = DRY DENSITY (pcf) (ASTM D 2216);
   +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
   –200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140).

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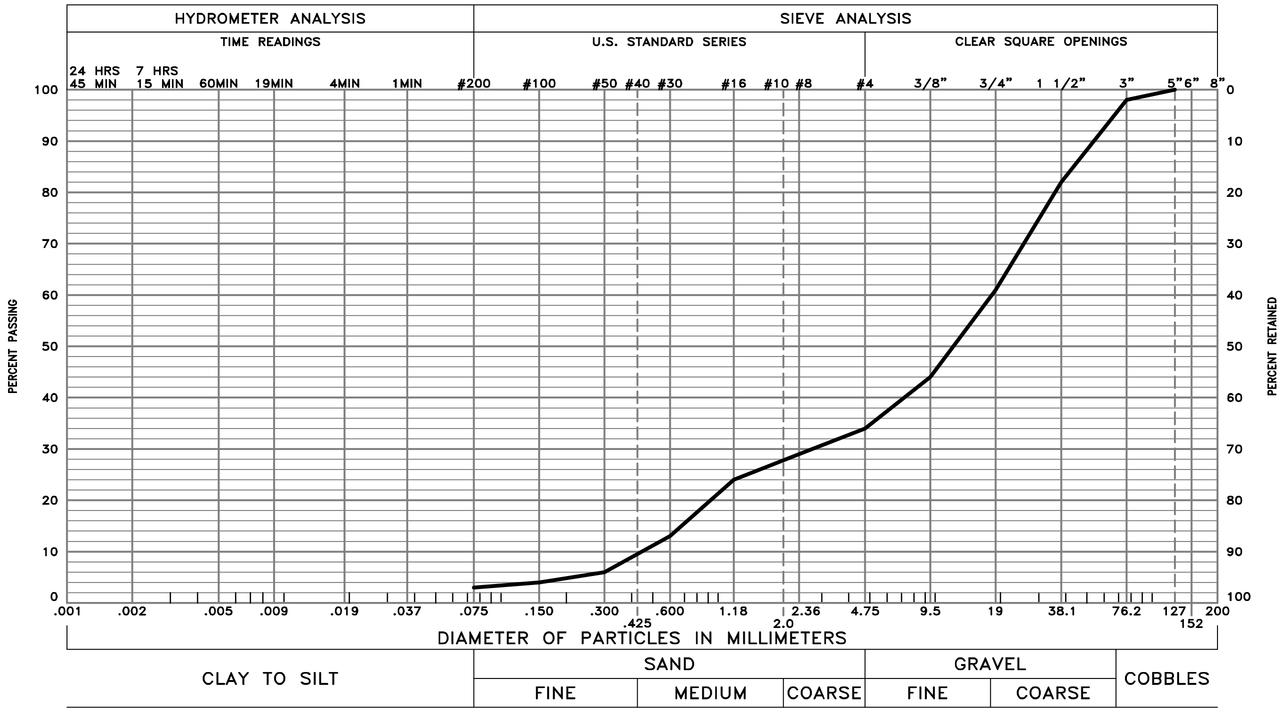
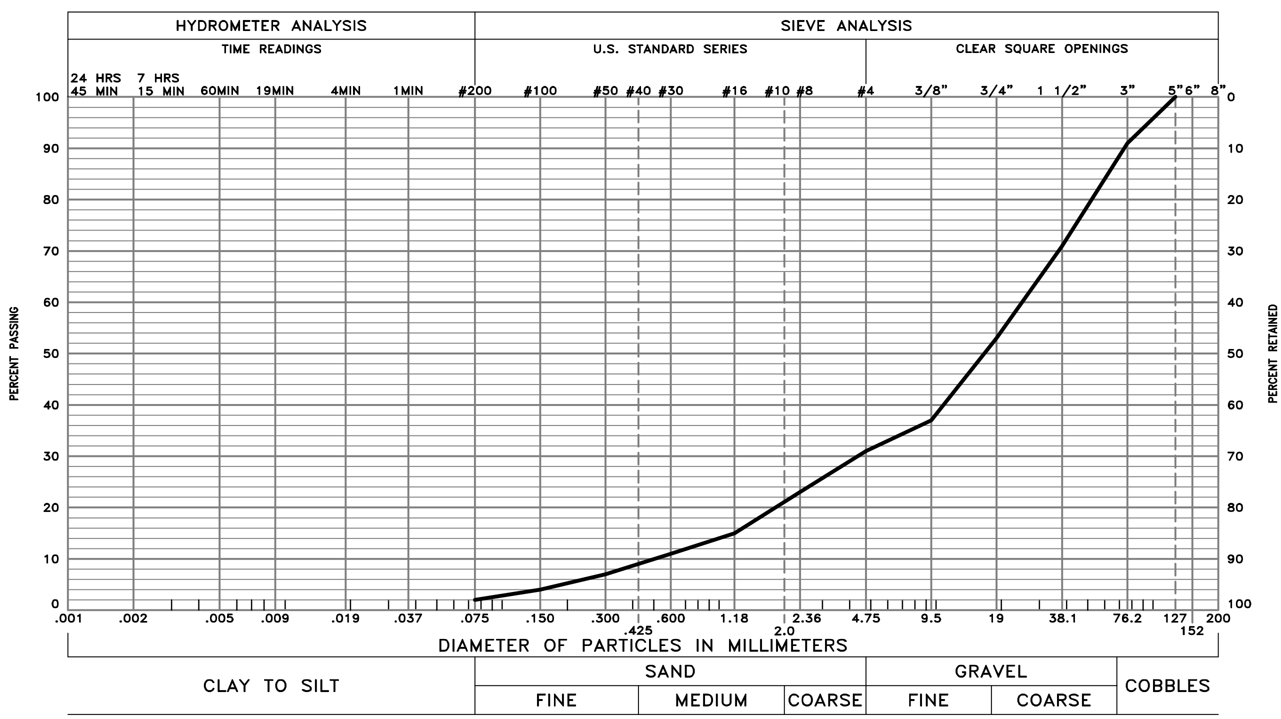


GRAVEL 66 % SAND 31 % SILT AND CLAY 3 %

SAMPLE OF: Poorly Graded Gravel with Sand (GP) FROM: Pit 1 @ 4'



GRAVEL 69 % SAND 29 % SILT AND CLAY 2 %

SAMPLE OF: Poorly Graded Gravel with Sand (GP) FROM: Pit 3 @ 8'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

19-6-265	Kumar & Associates	GRADATION TEST RESULTS	Fig. 4

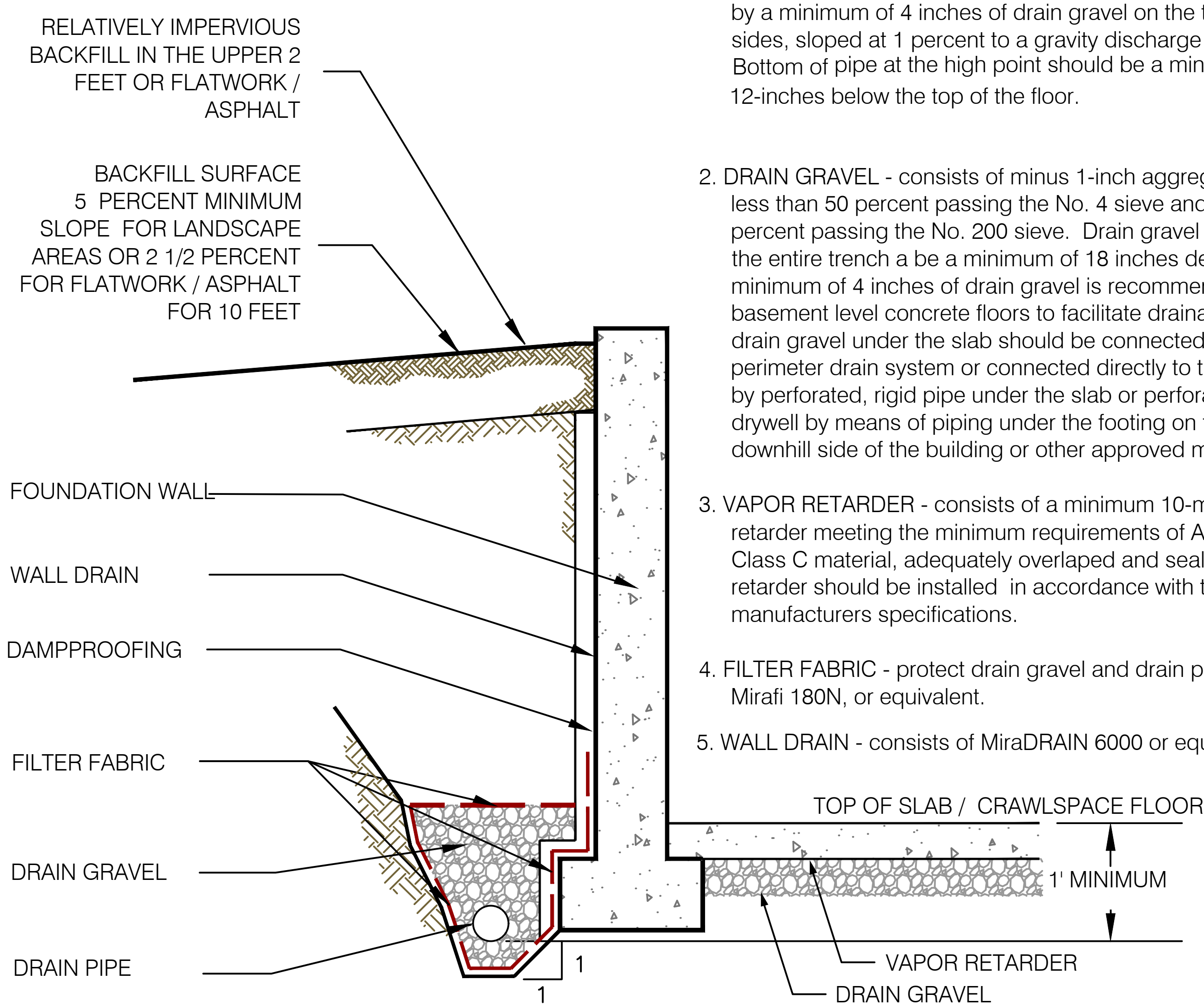
1. DRAIN PIPE - consists of 4-inch perforated PVC, surrounded by a minimum of 4 inches of drain gravel on the top and sides, sloped at 1 percent to a gravity discharge or drywell. Bottom of pipe at the high point should be a minimum of 12-inches below the top of the floor.

2. DRAIN GRAVEL - consists of minus 1-inch aggregate with less than 50 percent passing the No. 4 sieve and less than 2 percent passing the No. 200 sieve. Drain gravel should fill the entire trench a be a minimum of 18 inches deep. A minimum of 4 inches of drain gravel is recommended under basement level concrete floors to facilitate drainage. The drain gravel under the slab should be connected to the perimeter drain system or connected directly to the drywell by perforated, rigid pipe under the slab or perforation in the drywell by means of piping under the footing on the downhill side of the building or other approved method.

3. VAPOR RETARDER - consists of a minimum 10-mil vapor retarder meeting the minimum requirements of ASTM E1745 Class C material, adequately overlaped and sealed. Vapor retarder should be installed in accordance with the manufacturers specifications.

4. FILTER FABRIC - protect drain gravel and drain pipe with Mirafi 180N, or equivalent.

5. WALL DRAIN - consists of MiraDRAIN 6000 or equivalent.



NOT TO SCALE

19–6–265	Kumar & Associates	TYPICAL DRAIN DETAIL	FIG. 5

Kumar & Associates

JOB NO: 19-6-265

JOB NAME: PROPOSED SOUTH PARK AMBULANCE STATION

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE LOCATION		NATURAL MOISTURE CONTENT	NATURAL DRY UNIT WEIGHT	GRADATION			ATTERBERG LIMITS		SWELL-COMPRESSION		HVEEM STABILOMETER (R-VALUE)	WATER SOLUBLE SULFATES	SOIL OR BEDROCK DESCRIPTION
PIT (#)	DEPTH (feet)	(%)	(pcf)	GRAVEL (%)	SAND (%)	SILT & CLAY (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SWELL (%)	SUR-CHARGE (psf)		(%)	
1	4	2.0		66	31	3							POORLY GRADED GRAVEL WITH SAND (GP)
2	6	2.2				4							POORLY GRADED SAND WITH GRAVEL (SP)
3	8	3.2		69	29	2							POORLY GRADED GRAVEL WITH SAND (GP)
5	2	3.2				8							POORLY GRADED SILTY GRAVEL WITH SAND (GP-GM)