1800 River Drive North
Great Falls, MT 59401

TD&H Engineering

406.761.3010
tdhengineering.com

REPORT OF GEOTECHNICAL INVESTIGATION

2035 FISH HATCHERY ROAD
SOUTHEAST OF LEWISTOWN, MONTANA

CLIENT
Montana Fish, Wildlife & Parks
Design & Construction Division
1522 Ninth Avenue
PO Box 200701
Helena, MT 59620-0701

ENGINEER
Craig Nadeau, PE
Craig.nadeau@tdhengineering.com

JOB NO. 20-060-001 June 2020

Table of Contents

APPENDIX

GEOTECHNICAL REPORT
2035 FISH HATCHERY ROAD
SOUTHEAST OF LEWISTOWN, MONTANA

1.0 EXECUTIVE SUMMARY

A geotechnical investigation was performed for the proposed hatchery house structure to be located at 2035 Fish Hatchery Road southeast of Lewistown, Montana. This investigation encountered surficial lean clay soils overlying severely weathered sandstone and claystone bedrock. The bedrock strata are extremely soft and more closely resemble soil for the purposes of design on this project. Based on the site conditions encountered, the limited depth of the investigation, and our experience, the seismic site class is D. The risk of seismically-induced liquefaction or soil settlement is considered low and does not warrant additional evaluation. The primary geotechnical concerns regarding this project are the presence of relatively soft, compressible fine-grained soils and shallow ground water which may impact this project depending on the final building configuration, which has not yet been determined.

In our opinion, the site is suitable for the use of conventional shallow foundation systems bearing on properly compacted native soils with recommended maximum allowable bearing pressures of 1,500 psf. The shallow ground water has the potential to rise from the elevations observed at the time of this study. This should be considered during the selection of the planned building configuration. If basement alternatives are considered, we would advise that the bury depth of the footings be raised slightly to account for potential ground water fluctuations.

A single boring was performed in the vicinity of the planned septic drain field for classification of the soil conditions present. This boring encountered similar conditions with severely weathered sandstone present at a depth of only 2.5 feet below existing grade. However, this material is nearly completely weathered and would likely classify as a very gravelly sandy loam or very gravelly sandy clay loam in accordance with the U.S. Department of Agriculture classification system.

2.0 INTRODUCTION

2.1 Purpose and Scope

This report presents the results of our geotechnical study for the proposed hatchery house to be located southeast of Lewistown, Montana, at 2035 Fish Hatchery Road. The purpose of the geotechnical study is to determine the general surface and subsurface conditions at the proposed site and to develop geotechnical engineering recommendations for support of the proposed structure. This report describes the field work and laboratory analyses conducted for this project, the surface and subsurface conditions encountered, and presents our recommendations for the proposed foundations.

Our field work included drilling four soil borings. Three were drilled in proximity to the proposed structure while the fourth was located to the west in the area for the proposed drain field construction. Samples were obtained from the borings and returned to our Great Falls laboratory for testing. Laboratory testing was performed on selected soil samples to determine engineering properties of the subsurface materials. The information obtained during our field investigations and laboratory analyses was used to develop recommendations for the design of the proposed foundation system.

2.2 Project Description

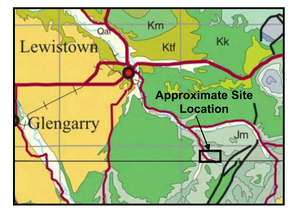
It is our understanding that the proposed project consists of, in part, a single-story, wood-framed structure being approximately 1,500 square feet in plan. The structure is proposed to be supported on conventional shallow foundations. At this time, the planned configuration for the structure has not been determined and options for potential basements, crawlspace, and conventional slab-on-grade construction are being evaluated. Structural loads had not been developed at the time of this report. However, for the purpose of our analysis, we have assumed that wall loads will be less than 2,500 pounds per lineal foot and column loads, if any, will be less than 25 kips.

Site development will most likely include landscaping and exterior concrete flatwork. If the assumed design values presented above vary from the actual project parameters, the recommendations presented in this report should be reevaluated.

3.0 SITE CONDITIONS

3.1 Geology and Physiography

The site is geologically quite complex due to its proximity to the Big Snowy mountain range. Areas directly along Big Spring Creek and Castle Creek, the confluence of which is located northwest of this site, are mapped as alluvium. These deposits are generally comprised of gravel, sand, silt, and clay associated with stream and river channels as well as floodplains. Areas not directly adjacent to these streams are mapped as bedrock of the Swift, Morrison, Rierdon, and Piper Formations. The Morrison Formation is part of the Livingston Group while the Swift, Rierdon, and Piper Formations are associated with the Ellis Group. This particular site appears to lie within the Swift Formation and is anticipated to consist of orangish brown, glauconitic, flaggy-bedded, fine-grained sandstone or sandy coquina with subordinate dark gray shale interbeds. The Morrison Formation is the next most common material mapped in the vicinity of this site with lesser amounts of the Rierdon and Piper formations present, mostly to the south and east. These formations are all generally comprised of mudstone or limestone materials. Areas to the north and west of this site encountered bedrock of the Kootenai Formation which are also consistent with more mudstone, siltstone, and limestone formations.



Geologic Map of Montana, Edition 1.0 (2007)
Montana Bureau of Mines & Geology

Based on the subsurface conditions encountered, the site falls under seismic Site Class D. The appropriate 2015 International Building Code (IBC) seismic design parameters for the site include site coefficients of 1.6 and 2.4 for F_a and F_v, respectively. The corresponding design spectral response accelerations at short periods (SD_s) and at 1-second period (SD_1) are 0.105g and 0.069g, respectively. These values represent two-thirds of the mapped response accelerations following correction for the appropriate site classification and assume the proposed construction to fall into risk category **II**. These values may warrant modification or verification by the structural if newer versions of the IBC will be utilized for design on this project. The likelihood of seismically-induced soil liquefaction or settlement for this project is low and does not warrant additional evaluation.

RE-BID - JANUARY 10, 2022
Geotech Sheet 1/7

3.2 Surface Conditions

The proposed project site is located southeast of Lewistown, Montana, at 2035 Fish Hatchery Road. The triangular area is currently vegetated with native grasses. The southern edge of the parcel is separated from Fish Hatchery Road by a well-developed stand of trees. The northwest and northeast sides of the property are fenced. Just beyond the fence to the northwest is an existing gravel access road into the hatchery facility. An existing concrete canal system runs along the northeast side of the property beyond the fence. Based on background information and site observations, the site slopes downward toward the northeast at slopes ranging from 2 to 25 percent. The topography is best described as nearly level for the majority of the site with a strong downward slope along the northeast side towards the existing concrete canal.

It is our understanding that a pre-existing structure had been located in this general area and was completely removed long before our investigation. Historic aerial photographs of the area show the structure present on the property up until early 2012. It is reported that this previous structure incorporated a full depth basement and that fill may exist in this area to depths of approximately eight feet. The planned building location for this project is to be northeast of the original structure and is not anticipated to encounter fill materials. However, if the building location is changed, the potential fill should be evaluated to assess and potential impacts it may have on the new construction given the lack of information available regarding its placement.

3.3 Subsurface Conditions

3.3.1 Soils

The subsurface soil conditions appear to be relatively consistent based on our exploratory drilling and soil sampling. In general, the subsurface soil conditions encountered within the borings consist of approximately 2.5 to 9.0 feet of surficial lean clay soils containing varying amounts of sand. The lean clay is underlain in all borings by very soft sandstone and claystone bedrock which extends to depths of at least 17.0 feet, the maximum depth investigated.

The subsurface soils are described in detail on the enclosed boring logs and are summarized below. The stratification lines shown on the logs represent approximate boundaries between soil types, and the actual in situ transition may be gradual vertically or discontinuous laterally.

LEAN CLAY

The lean clay is present in all four borings and ranges in thickness from 6.0 to 9.0 feet beneath the building site. The surficial clay is much thinner, approximately 2.5 feet, in the area of the planned septic drain field. The lean clay is considered very soft to firm as indicated by penetration resistance values which ranged from 2 to 7 blows per foot (bpf) and averaged 5 bpf. This material is moderately compressible and slightly expansive as

indicated by the consolidation-swell test results shown on Figures 14 and 15. Three samples of the material contained between 0.5 and 5.4 percent gravel, between 20.5 and 30.1 percent sand, and between 69.4 and 78.9 percent Fines (silt and clay). Three additional samples exhibited liquid limits ranging from 30 to 41 percent and plasticity indices ranging from 14 to 20 percent. Two unconfined compressive strength specimens resulted in undrained shear strengths of 704 and 1,312 pounds per square foot (psf), respectively. The natural moisture contents varied from 16 to 23 percent and averaged 20 percent.

WEATHERED BEDROCK

Severely weathered sandstone and claystone bedrock was encountered in all four borings at depths of 2.5 to 9.0 feet and extends to depths of at least 17.0 feet. The rock is considered completely weathered and very soft as indicated by penetration resistance values which ranged from 3 to 34 bpf and averaged 13 bpf. The natural moisture contents varied from 10 to 27 percent and averaged 16 percent.

3.3.2 Ground Water

Ground water was encountered in all four borings at depths ranging from 6.6 to 9.8 feet below the ground surface. Based on the estimated ground surface elevations, this equates to water level elevations ranging from 4,168.7 to 4,170.0 feet. Water levels were measured shortly after the completion of drilling to allow time for water levels to stabilize. The presence or absence of observed ground water may be directly related to the time of the subsurface investigation. Numerous factors contribute to seasonal ground water occurrences and fluctuations, and the evaluation of such factors is beyond the scope of this report.

4.0 ENGINEERING ANALYSIS

4.1 Introduction

The primary geotechnical concerns regarding this project are the presence of relatively soft, compressible fine-grained soils and shallow ground water which may impact this project depending on the final building configuration, which has not yet been determined.

4.2 Site Grading and Excavations

The ground surface at the proposed site is relatively flat over the majority of the site with a strong downward slope at the northeast edge of the building site to the existing concrete canal system. Slopes are estimated to be between 2 and 25 percent based on the topographic information provided to us. Based on our field work, foundation and utility excavations are anticipated to encounter surficial lean clay soils overlying severely weathered sandstone bedrock. The bedrock will be easily excavatable with conventional equipment and will act more like a soil than rock due to its severe weathering. Based on the borings, ground water should be expected in foundation or utility excavations extending to elevation 4,170 or below. Occasional pockets of trapped or perched ground water associated with recent precipitation events may be encountered above this elevation. Furthermore, ground water levels may fluctuate seasonally, and the magnitude of such fluctuations has not been evaluated.

4.3 Conventional Shallow Foundations

Considering the subsurface conditions encountered and the nature of the proposed construction, the structure can be supported on conventional shallow foundation systems bearing on properly compacted native soils. If, during construction, the native soils cannot be compacted to the specified limits outlined in Section 5 of this report, the use of a reinforcing geotextile and structural fill may be needed to ensure proper bearing. The ability to compact the native soils will be largely controlled by the depth of the footings and the selected building configuration. Foundations nearing the ground water table are more likely to encounter excessive soil moisture and non-compactible clay soil.

Based on our experience, the one-dimensional consolidation result, and the theory of elasticity, foundations designed using the bearing pressures provided in this report are not anticipated to realize total vertical movements exceeding ¾-inch when supported on properly prepared and compacted soils. Differential settlement within the limits of the structure should be on the order of one-half this magnitude.

The lateral resistance of spread footings is controlled by a combination of sliding resistance between the footing and the foundation material at the base of the footing and the passive earth pressure against the side of the footing in the direction of movement. Design parameters are given in the recommendations section of this report.

4.4 Foundation Walls

Foundation walls associated with crawlspace or basement alternatives will be subjected to horizontal loading due to lateral earth pressures. The lateral earth pressures are a function of the natural and backfill soil types and acceptable wall movements, which affect soil strain to mobilize the shear strength of the soil. More soil movement is required to develop greater internal shear strength and lower the lateral pressure on the wall. To fully mobilize strength and reduce lateral pressures, soil strain and allowable wall rotation must be greater for clay soils than for cohesionless, granular soils.

The lowest lateral earth pressure against walls for a given soil type is the active condition and develops when wall movements occur. Passive earth pressures are developed when the wall is forced into the soil, such as at the base of a wall on the side opposite the retained earth side. When no soil strain is allowed by the wall, this is the "at-rest" condition, which creates pressures having magnitudes between the passive and active conditions.

The distribution of the lateral earth pressures on the structure depends on soil type and wall movements or deflections. In most cases, a triangular pressure distribution is satisfactory for design and is usually represented as an equivalent fluid unit weight. Design parameters are given in the recommendations section of this report.

4.5 Floor Slabs and Exterior Flatwork

The natural on-site soils, exclusive of topsoil, are suitable to support lightly to moderately loaded, slab-on-grade construction. A leveling course of granular fill directly beneath the slab is recommended to provide a structural cushion, a capillary-break from the subgrade, and a drainage medium. Construction typically utilizes six inches of compacted granular fill beneath slabs; however, the requirements may vary locally.

Based on the laboratory testing performed, the lean clay soils are considered only marginally expansive and are not anticipated to have any significant detrimental impact on the use of slab-on-grade construction. Some potential vertical movement related to expansion is possible; however, we do not anticipate slab displacements to exceed ½-inch. We have included recommendations for interior improvements to help minimize the impact associated with such movements.

4.6 Drain Field Conditions

A single boring performed within the limits of the planned drain field encountered approximately 2.5 feet of surficial topsoil and lean clay overlying severely weathered sandstone bedrock. The sandstone is very soft and should be treated more like a soil based on the degree of weathering. The surficial lean clay is considered to classify as clay under the U.S. Department of Agriculture (USDA) classification system typically utilized during septic design. The underlying weathered sandstone is considered a very gravelly sandy loam or very gravelly sandy clay loam using this

system. The weathered rock is expected to have adequate infiltration properties for use in septic design; however, no on-site infiltration testing was performed as part of our scope of work. Furthermore, ground water was encountered at a depth of approximately 6.6 feet at this location and could impact the final drain field design for the project.

5.0 RECOMMENDATIONS

5.1 Site Grading and Excavations

1. All topsoil and organic material should be removed from the proposed building and pavement areas and any areas to receive site grading fill. For planning purposes, a stripping thickness of 6 to 9 inches should be adequate to remove the majority of organic material. Tree roots may be encountered below this depth due to the surrounding trees. While occasional tree roots are not likely to be detrimental, excessive root growth can impact the structure and should be evaluated during construction to assess if additional stripping depth may be warranted.

2. All fill and backfill should be non-expansive, free of organics and debris and should be approved by the project geotechnical engineer. The on-site soils, exclusive of topsoil, are considered suitable for use as backfill and general site grading fill on this project. All fill should be placed in uniform lifts not exceeding 8 inches in thickness. All materials compacted using hand compaction methods or small walk-behind units should utilize a maximum lift thickness of 6 inches to ensure adequate compaction throughout the lift. All fill and backfill shall be moisture conditioned to near the optimum moisture content and compacted to the following percentages of the maximum dry density determined by a standard proctor test which is outlined by ASTM D698 or equivalent (e.g. ASTM D4253-D4254).

   a) Below Foundations or Spread Footings 95%
   b) Below Slab-on-Grade Construction 95%
   c) Foundation Wall Backfill 95%
   d) General Landscaping or Nonstructural Areas 92%

   For your consideration, verification of compaction requires laboratory proctor tests to be performed on a representative sample of the soil prior to construction. These tests can require up to one week to complete (depending on laboratory backlog) and this should be considered when coordinating the construction schedule to ensure that delays in construction or additional testing expense is not required due to laboratory processing times or rush processing fees.

3. The need for imported structural fill materials is not anticipated for this project; however, if during construction subgrade moistures preclude proper compaction of the bearing layer, a reinforcing geotextile and limited structural fill depth may be warranted to ensure proper foundation support. If needed, imported structural fill should be non-expansive, free of organics and debris, and conform to the material requirements outlined in Section 02234 of the Montana Public Works Standard Specifications (MPWSS). All gradations outlined in this standard are acceptable for use on this project; however, conventional proctor methods (outlined in ASTM D698)

shall not be used for any materials containing less than 70 percent passing the ¾-inch sieve. Conventional proctor methods are not suitable for these types of materials, and the field compaction value must be determined using a relative density test outlined in ASTM D4253-4254.

4. Develop and maintain site grades which will rapidly drain surface and roof runoff away from foundation and subgrade soils, both during and after construction. The final site grading shall conform to the grading plan, prepared by others to satisfy the minimum requirements of the applicable building codes.

5. At a minimum, downspouts from roof drains should discharge at least six feet away from the foundation or beyond the limits of foundation backfill, whichever is greater. All downspout discharge areas should be properly graded away from the structure to promote drainage and prevent ponding.

6. Irrigation around the perimeter of individual structures should be minimized. Landscaping around foundation walls should consider plant varieties that do not require significant irrigation such as drought-resistant species.

7. It is the responsibility of the Contractor to provide safe working conditions in connection with underground excavations. Temporary construction excavations greater than four feet in depth, which workers will enter, will be governed by OSHA guidelines given in 29 CFR, Part 1926. For planning purposes, subsoils encountered in the borings are considered Type B for the native clays and Type C for the weathered bedrock. The soil conditions on site can change due to changes in soil moisture or disturbances to the site prior to construction. Thus, the contractor is responsible to provide an OSHA knowledgeable individual during all excavation activities to regularly assess the soil conditions and ensure that all necessary safety precautions are implemented and followed.

5.2 Conventional Shallow Foundations

The design and construction criteria below should be observed for a spread footing foundation system. The construction details should be considered when preparing the project documents.

8. Both interior and exterior footings should bear on properly compacted native soils and should be designed for a maximum allowable soil bearing pressure not to exceed 1,500 pounds per square foot (psf) provided settlements as outlined in the Engineering Analysis are acceptable.

   If during construction subgrade moistures preclude proper compaction of the bearing layer and the requirements of Item 2a cannot be satisfied, a reinforcing geotextile and limited structural fill depth may be warranted to ensure proper

foundation support. If encountered during construction, our geotechnical engineers should be involved to assess the subgrade soil and provide additional recommendations for modifications for structural fill inclusion.

9. Soils disturbed below the planned depths of footing excavations should either be re-compacted or be replaced with suitable compacted backfill approved by the geotechnical engineer.

10. Footings shall be sized to satisfy the minimum requirements of the applicable building codes while not exceeding the maximum allowable bearing pressure provided in Item 8 above.

11. Exterior footings and footings beneath unheated areas should be placed at least 48 inches below finished exterior grade for frost protection. For consideration, conventional full-depth basement foundations which bear 8 to 9 feet below grade are more likely to encounter ground water which can complicate construction. We are not aware of any ground water issues with the previous structure; however, the depth of footings for this structure are also unknown. The use of a partial basement with shallower footing depths would be advisable to alleviate significant ground water concerns.

12. Lateral loads are resisted by sliding friction between the footing base and the supporting soil and by lateral pressure against the footings opposing movement. For design purposes, a friction coefficient of 0.25 and a lateral resistance pressure of 150 psf per foot of depth are appropriate footings bearing on and backfilled with properly compacted native lean clay soils.

13. A representative of the project geotechnical engineer should be retained to observe all footing excavations and backfill phases prior to the placement of concrete formwork to verify that subgrade preparation conforms to the recommendations outlined above and that the subgrade can support the design bearing pressure.

5.3 Foundation Walls

The design and construction criteria presented below should be observed for foundation walls associated with either crawlspace or basement foundation systems. The construction details should be considered when preparing the project documents.

14. Crawlspace or basement walls 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 60 pcf for backfill consisting of properly compacted native lean clays.

15. If a crawlspace configuration is utilized, fill should be placed and compacted on the interior of the crawlspace to an elevation equal to the top of the exterior footings. This fill is intended to provide lateral support to the wall during exterior backfill and help reduce the potential for water accumulation in the crawlspace of exterior sources.

16. Backfill should be selected, placed, and compacted per Item 2 above. Care should be taken not to over-compact the backfill since this could cause excessive lateral pressure on the walls. Only hand-operated compaction equipment should be used within 5 feet of foundation walls.

17. Exterior footing drains are required by the applicable building codes for all structures incorporating a usable below-grade space such as a basement or crawlspace. Drains should consist of a minimum 3-inch diameter, geotextile-wrapped, flexible, slotted pipe (ADS) or perforated, SDR 35, 4-inch diameter, PVC drain tile in poorly-graded gravel with geotextile placed at or below exterior footing grade. Drains shall be covered by at least 12 inches of free-draining, open-graded, granular material. The open-graded granular material should be enveloped in a geotextile to prevent the migration of fines. Use of a single piece of geotextile with a full-width lap at the top is preferred; however, two separate pieces of fabric may be used provided a minimum overlap distance of 12 inches is maintained at all joints. Drains should be sloped to an interior sump or surface discharge location determined by others. A typical perimeter foundation drain is shown on Construction Standard No. 02801-06C.

18. Foundation walls for basement or crawlspace systems in which the footing elevation is no deeper than five feet below existing grades should de damp-proofed in accordance with the applicable sections of the International Building Code (IBC).

19. Basement foundation walls associated with a basement in which the footings bears more than five feet below existing grade should be water-proofed in accordance with the applicable sections of the International Building Code (IBC) due to the potential for ground water exposure associated with seasonal fluctuation.

5.4 Floor Slabs and Exterior Flatwork

20. For normally loaded, slab-on-grade construction, a minimum 6-inch cushion course consisting of free-draining, crushed gravel should be placed beneath the slabs and compacted to the requirements of Item 2 above.

21. Cushion course materials utilized beneath slab-on-grade applications should conform to the requirements outlined in Section 02235 of the Montana Public Works Standard Specifications (MPWSS). All gradation outlined in this specification are

acceptable for this application. Prior to placing the cushion course, the upper six inches of subgrade should be compacted per Item 2.

22. Concrete floor slabs should be designed using a modulus of vertical subgrade reaction no greater than 150 pci when designed and constructed as recommended above.

23. *Geotechnically*, an underslab vapor barrier is not required for surface slab applications. However, a vapor barrier is advised when a basement foundation bearing more than five feet below existing grade is used for this project. When utilized, a minimum 10-mil vapor barrier is recommended unless otherwise specified by the architect and/or structural engineer.

24. To minimize impacts to the interior finishes of the structure associated with potential expansive slab displacements, interior, non-bearing partition walls resting on floor slabs can be provided with slip joints so that potential slab movements cannot be transmitted to the upper structure. Slip joint construction consisting of fastening studs to the upper joists with lateral restraint at the bottom is preferred. A typical detail is shown on Construction Standard 02801-08.

5.5 Continuing Services

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

25. Consultation between the geotechnical engineer and the design professionals during the design phases is highly recommended. This is important to ensure that the intentions of our recommendations are incorporated into the design, and that any changes in the design concept consider the geotechnical limitations dictated by the on-site subsurface soil and ground water conditions.

26. Observation, monitoring, and testing during construction is required to document the successful completion of all earthwork and foundation phases. A geotechnical engineer from our firm should be retained to observe the excavation, earthwork, and foundation phases of the work to determine that subsurface conditions are compatible with those used in the analysis and design.

27. During site grading, placement of all fill and backfill should be observed and tested to confirm that the specified density has been achieved. We recommend that the Owner maintain control of the construction quality control by retaining the services of an AASHTO accredited construction materials testing laboratory. TD&H Engineering operates a fully AASHTO accredited testing laboratory from our Great Falls office location and we are available to provide construction inspection services

as well as materials testing of compacted soils and the placement of Portland cement concrete for this project. In the absence of project specific testing frequencies, TD&H recommends the following minimum testing frequencies be used:

Compaction Testing

Beneath Column Footings	1 Test per Footing per Lift
Beneath Wall Footings	1 Test per 25 LF of Wall per Lift
Beneath Slabs	1 Test per 500 SF per Lift
Foundation Backfill	1 Test per 25 LF of Wall per Lift

LF = Lineal Feet SF = Square Feet

6.0 SUMMARY OF FIELD AND LABORATORY STUDIES

6.1 Field Explorations

The field exploration program was conducted on May 1, 2020. A total of four borings were drilled to depths ranging from 16.5 to 17.0 feet at the approximate locations shown on Figure 1 to observe subsurface soil and ground water conditions. The borings were advanced through the subsurface soils using a track-mounted Geoprobe 6610X drill rig equipped with 6-inch hollowstem augers which is owned and operated by TD&H Engineering. The subsurface exploration and sampling methods used are indicated on the attached boring logs. The borings were drilled by Mr. Craig Nadeau, PE and logged by Mr. Bill Colenso, EI of TD&H Engineering. The location of the borings were determined using field measurements to existing surface features. Elevations were subsequently estimated from existing topographic data provided by the architect for our use.

Samples of the subsurface materials were taken using 1⅜-inch I.D. split spoon samplers. The samplers were driven 18 inches, when possible, into the various strata using a 140-pound drop hammer falling 30 inches onto the drill rods. For each sample, the number of blows required to advance the sampler each successive six-inch increment was recorded, and the total number of blows required to advance the sampler the final 12 inches is termed the penetration resistance ("N-value"). This test is known as the Standard Penetration Test (SPT) described by ASTM D1586. When the sampler is driven more than 18 inches, the number of blows required to advance the sampler the second and third six-inch increments are used to determine the N-value. Penetration resistance values indicate the relative density of granular soils and the relative consistency of fine-grained soils. Samples were also obtained by hydraulically pushing a 3-inch I.D., thin-walled Shelby tube sampler into the subsoils. Logs of all soil borings, which include soil descriptions, sample depths, and penetration resistance values, are presented on the Figures 2 through 5.

Measurements to determine the presence and depth of ground water were made in the borings by lowering an electronic water sounder through the open boring shortly after the completion of drilling. The depths of the water levels measured, if encountered, and the date of measurement are shown on the boring logs.

6.2 Laboratory Testing

Samples obtained during the field exploration were returned to our materials laboratory where they were observed and visually classified in general accordance with ASTM D2487, which is based on the Unified Soil Classification System. Representative samples were selected for testing to determine the engineering and physical properties of the soils in general accordance with ASTM or other approved procedures.

Tests Conducted:	To determine:
Natural Moisture Content	Representative moisture content of soil at the time of sampling.
Grain-Size Distribution	Particle size distribution of soil constituents describing the percentages of clay/silt, sand and gravel.
Atterberg Limits	A method of describing the effect of varying water content on the consistency and behavior of fine-grained soils.
Consolidation	Measurements of the percent compression experienced under various loading conditions. For use in settlement analysis and foundation design.
Constant Volume Swell	Determination of the maximum uplift force exerted by a soil specimen during inundation by gradual increases in the applied resisting force to maintain a fixed samples height.
UU Shear Strength (Field)	The undrained, unconfined shear strength (s_u) of cohesive soils as determined in the field by either a pocket penetrometer or a hand torvane.
Unconfined Compression	Undrained shear strength properties of cohesive soils determined in the laboratory by axial compression.

The laboratory testing program for this project consisted of 24 moisture-visual analyses, 3 sieve (grain-size distribution) analyses, and 3 Atterberg Limits analyses. The results of the water content analyses are presented on the boring logs, Figures 2 through 5. The grain-size distribution curves and Atterberg limits are presented on Figures 6 through 11. In addition, one consolidation test, one constant volume swell test, and two unconfined compression tests were performed. The results are presented on Figures 12 through 15. Unconfined compressive strengths (q_u) were determined in the field using a pocket penetrometer. The results are shown on the boring logs at the depths the samples were tested.

7.0 LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The findings, analyses, and recommendations contained in this report reflect our professional opinion regarding potential impacts the subsurface conditions may have on the proposed project and are based on site conditions encountered. Our analysis assumes that the results of the exploratory borings are representative of the subsurface conditions throughout the site, that is, that the subsurface conditions everywhere are not significantly different from those disclosed by the subsurface study. Unanticipated soil conditions are commonly encountered and cannot be fully determined by a limited number of soil borings and laboratory analyses. Such unexpected conditions frequently require that some additional expenditures be made to obtain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

The recommendations contained within this report are based on the subsurface conditions observed in the borings and are subject to change pending observation of the actual subsurface conditions encountered during construction. TD&H cannot assume responsibility or liability for the recommendations provided if we are not provided the opportunity to perform limited construction inspection and confirm the engineering assumptions made during our analysis. A representative of TD&H should be retained to observe all construction activities associated with subgrade preparation, foundations, and other geotechnical aspects of the project to ensure the conditions encountered are consistent with our assumptions. Unforeseen conditions or undisclosed changes to the project parameters or site conditions may warrant modification to the project recommendations.

Long delays between the geotechnical investigation and the start of construction increase the potential for changes to the site and subsurface conditions which could impact the applicability of the recommendations provided. If site conditions have changed because of natural causes or construction operations at or adjacent to the site, TD&H should be retained to review the contents of this report to determine the applicability of the conclusions and recommendations provide considering the time lapse or changed conditions.

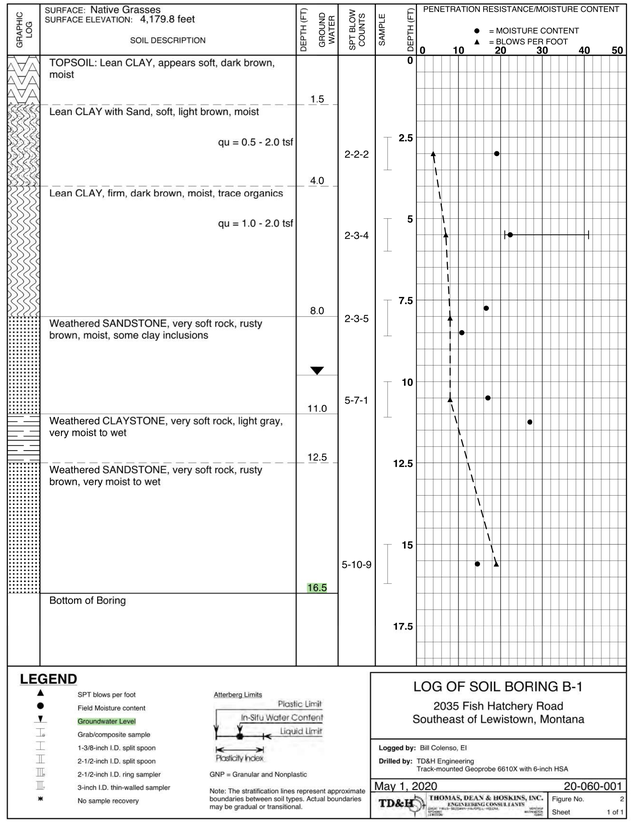
Misinterpretation of the geotechnical information by other design team members is possible and can result in costly issues during construction and with the final product. Our geotechnical engineers are available upon request to review those portions of the plans and specifications which pertain to earthwork and foundations to determine if they are consistent with our recommendations and to suggest necessary modifications as warranted. This service was not included in the original scope of the project and will require additional fees for the time required for specification and plan document review and comment. In addition, TD&H should be involved throughout the construction process to observe construction, particularly the placement and compaction of all fill, preparation of all foundations, and all other geotechnical aspects. Retaining the geotechnical engineer who prepared your geotechnical report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

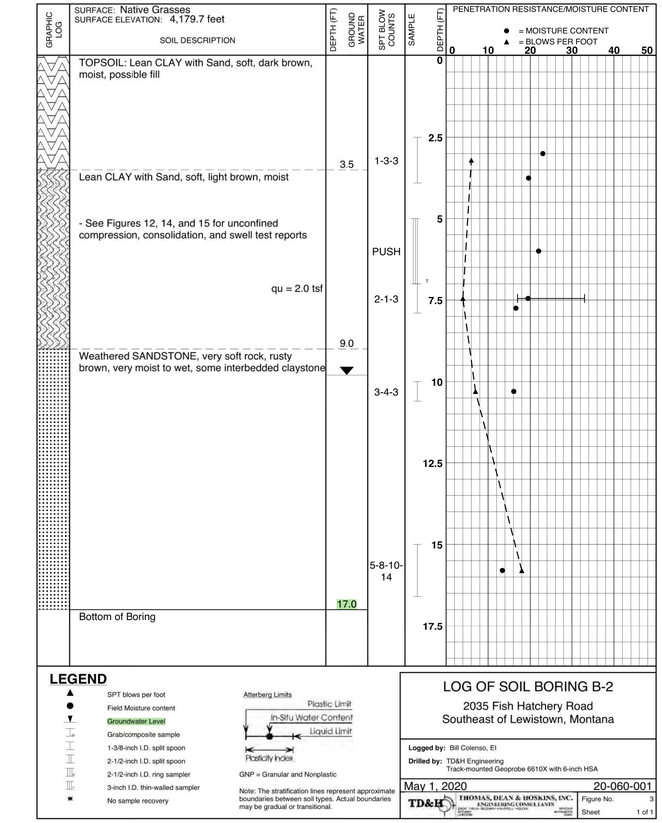
This report was prepared for the exclusive use of the owner and architect and/or engineer in the design of the subject facility. It should be made available to prospective contractors and/or the contractor for information on factual data only and not as a warranty of subsurface conditions such as those interpreted from the boring logs and presented in discussions of subsurface conditions included in this report.

Prepared by:
Craig Nadeau *PE*
Geotechnical Manager
TD&H ENGINEERING

Reviewed by:
Peter Kievberg *PE*
Sr. Geotechnical Engineer
TD&H ENGINEERING

J:\2020\20-060 MT FWP_Lewistown Services\GEOTECH\REPORT\2035 Fish Hatchery Road.doc





RE-BID - JANUARY 10, 2022

Geotech Sheet 4/7

GRAPHIC LOG	SURFACE: Native Grasses SURFACE ELEVATION: 4,177.2 feet SOIL DESCRIPTION	DEPTH (FT)	GROUND WATER	SPT BLOW COUNTS	SAMPLE
	TOPSOIL: Lean CLAY, soft, dark brown, moist	0.5			
	Lean CLAY with Sand, soft, brown, moist	2.5			
	Sandy Lean CLAY, very soft, light brown to grayish brown, moist to very moist qu = 0.75 tsf - See Figure 13 for result of unconfined compression test	6.5		1-1-1	
	Weathered SANDSTONE, very soft rock, rusty brown, moist to very moist, some interbedded claystone	8.5		PUSH	
	Weathered CLAYSTONE, very soft rock, light gray, moist to very moist	9.0		3-3-2	
	Weathered SANDSTONE, very soft rock, gray, very moist to wet, some interbedded claystone to 11.0 feet	16.5		2-3-4	
	Bottom of Boring			4-8-10	

PENETRATION RESISTANCE/MOISTURE CONTENT
● = MOISTURE CONTENT
▲ = BLOWS PER FOOT

LEGEND

- SPT blows per foot
- Field Moisture content
- Groundwater Level
- Grab/composite sample
- 1-3/8-inch I.D. split spoon
- 2-1/2-inch I.D. split spoon
- 2-1/2-inch I.D. ring sampler
- 3-inch I.D. thin-walled sampler
- No sample recovery

Atterberg Limits: Plastic Limit, In-Situ Water Content, Liquid Limit, Plasticity Index

GNP = Granular and Nonplastic

Note: The stratification lines represent approximate boundaries between soil types. Actual boundaries may be gradual or transitional.

LOG OF SOIL BORING B-3

2035 Fish Hatchery Road
Southeast of Lewistown, Montana

Logged by: Bill Colenso, EI
Drilled by: TD&H Engineering
Track-mounted Geoprobe 6610X with 6-inch HSA

May 1, 2020 — 20-060-001

THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS — GREAT FALLS · BOZEMAN · KALISPELL · MONTANA; SPOKANE · LEWISTON · WASHINGTON; IDAHO

Figure No. 4
Sheet 1 of 1

GRAPHIC LOG	SURFACE: Native Grasses SURFACE ELEVATION: 4,175.5 feet SOIL DESCRIPTION	DEPTH (FT)	GROUND WATER	SPT BLOW COUNTS	SAMPLE
	TOPSOIL: Lean CLAY, appears soft, dark brown, moist	0.5			
	Lean CLAY with Sand, appears soft, brown, moist	2.5			
	Weathered SANDSTONE, very soft rock, rusty brown, moist to very moist, some interbedded claystone - No Sample Recovered			6-9-8	
				19-18-16	
				1-4-5	
				2-2-1	
				4-6-6	
	Bottom of Boring	16.5			

PENETRATION RESISTANCE/MOISTURE CONTENT
● = MOISTURE CONTENT
▲ = BLOWS PER FOOT

LEGEND

- SPT blows per foot
- Field Moisture content
- Groundwater Level
- Grab/composite sample
- 1-3/8-inch I.D. split spoon
- 2-1/2-inch I.D. split spoon
- 2-1/2-inch I.D. ring sampler
- 3-inch I.D. thin-walled sampler
- No sample recovery

Atterberg Limits: Plastic Limit, In-Situ Water Content, Liquid Limit, Plasticity Index

GNP = Granular and Nonplastic

Note: The stratification lines represent approximate boundaries between soil types. Actual boundaries may be gradual or transitional.

LOG OF SOIL BORING B-4

2035 Fish Hatchery Road
Southeast of Lewistown, Montana

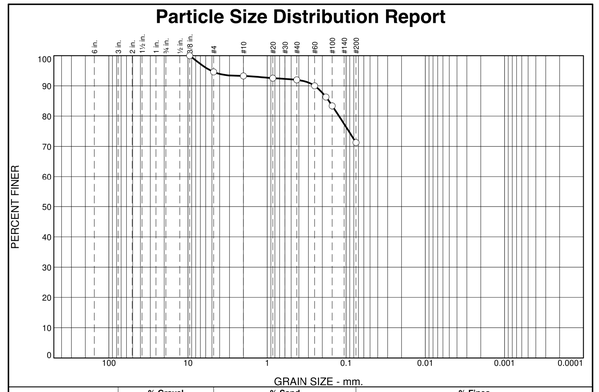
Logged by: Bill Colenso, EI
Drilled by: TD&H Engineering
Track-mounted Geoprobe 6610X with 6-inch HSA

May 1, 2020 — 20-060-001

THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS — GREAT FALLS · BOZEMAN · KALISPELL · MONTANA; SPOKANE · LEWISTON · WASHINGTON; IDAHO

Figure No. 5
Sheet 1 of 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.4	1.3	1.3	20.7	71.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	94.6		
#10	93.3		
#20	92.6		
#40	92.0		
#60	90.0		
#80	86.3		
#100	83.4		
#200	71.3		

* (no specification provided)

Material Description
Lean CLAY with Sand

Atterberg Limits
PL= LL= PI=

Coefficients
D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification
USCS= CL AASHTO=

Remarks
Report No. A-21333-206

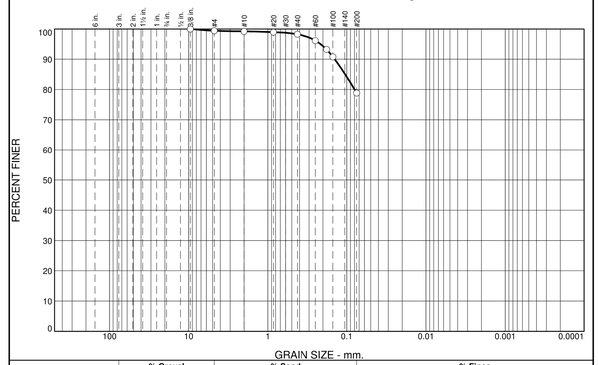
Location: B-1
Sample Number: A-21333 **Depth:** 2.5 - 4.0 ft **Date:** 5-20-2020

THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS — GREAT FALLS · BOZEMAN · KALISPELL · MONTANA; SPOKANE · LEWISTON · WASHINGTON; IDAHO

Client: Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Project No: 20-060-001 **Figure** 6

Tested By: JH **Checked By:** Craig R Madsen

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.2	0.9	19.4	78.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.4		
#10	99.2		
#20	98.9		
#40	98.3		
#60	96.2		
#80	93.2		
#100	90.8		
#200	78.9		

* (no specification provided)

Material Description
Lean CLAY with Sand

Atterberg Limits
PL= LL= PI=

Coefficients
D_{90}= 0.1421 D_{85}= 0.1050 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification
USCS= CL AASHTO=

Remarks
Report No. A-21340-206

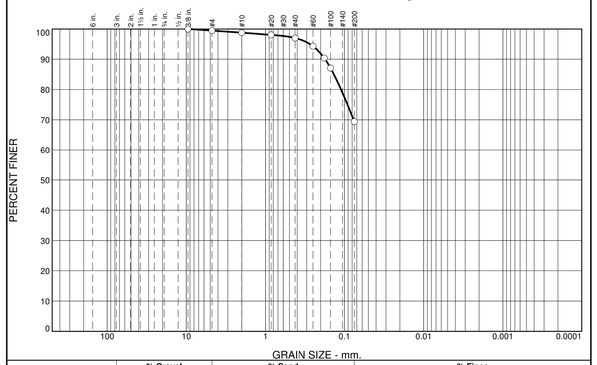
Location: B-2
Sample Number: A-21340 **Depth:** 2.5 - 3.5 ft **Date:** 5-20-2020

THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS — GREAT FALLS · BOZEMAN · KALISPELL · MONTANA; SPOKANE · LEWISTON · WASHINGTON; IDAHO

Client: Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Project No: 20-060-001 **Figure** 7

Tested By: JH **Checked By:** Craig R Madsen

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	0.7	1.8	27.6	69.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.5		
#10	98.8		
#20	98.0		
#40	97.0		
#60	94.3		
#80	90.4		
#100	87.1		
#200	69.4		

* (no specification provided)

Material Description
Sandy Lean CLAY

Atterberg Limits
PL= LL= PI=

Coefficients
D_{90}= 0.1756 D_{85}= 0.1361 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification
USCS= CL AASHTO=

Remarks
Report No. A-21346-206

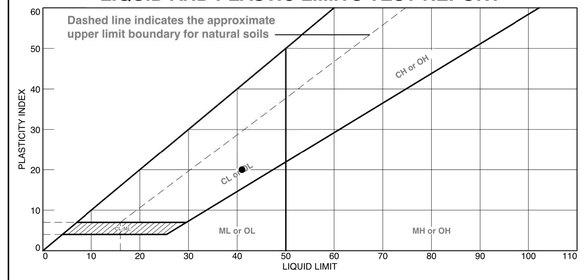
Location: B-3
Sample Number: A-21346 **Depth:** 2.5 - 4.0 ft **Date:** 5-20-2020

THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS — GREAT FALLS · BOZEMAN · KALISPELL · MONTANA; SPOKANE · LEWISTON · WASHINGTON; IDAHO

Client: Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Project No: 20-060-001 **Figure** 8

Tested By: JH **Checked By:** Craig R Madsen

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean CLAY	41	21	20			CL

Project No. 20-060-001 **Client:** Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-1
Sample Number: A-21334 **Depth:** 5.0 - 6.5 ft

Remarks:
● Report No. A-21334-207
Date: 5-20-2020

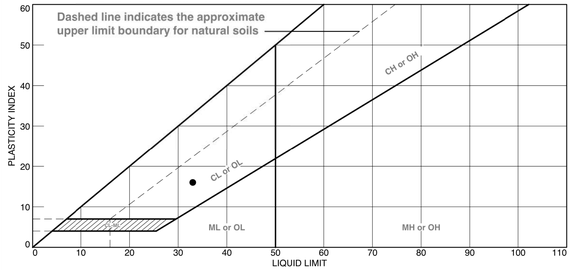
THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS — GREAT FALLS · BOZEMAN · KALISPELL · MONTANA; SPOKANE · LEWISTON · WASHINGTON; IDAHO

Figure 9

Tested By: WJC **Checked By:** Craig R Madsen

Geotech Sheet 5/7
RE-BID - JANUARY 10, 2022

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean CLAY with Sand	33	17	16			CL

Project No. 20-060-001 **Client:** Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-2
Sample Number: A-21343 **Depth:** 7.0 - 8.5 ft

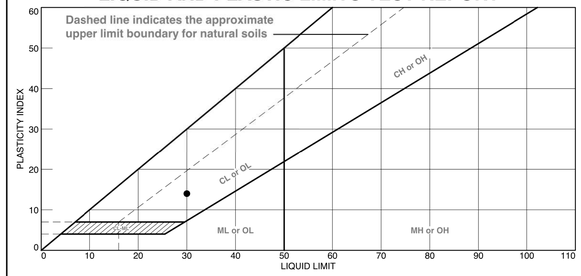
Remarks:
● Report No. A-21343-207
Date: 5-21-2020

TD&H THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS · BOZEMAN · KALISPELL · BILLINGS · LEWISTOWN · MONTANA · WASHINGTON · IDAHO

Figure 10

Tested By: WJC **Checked By:** Craig R Madsen

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Sandy Lean CLAY	30	16	14			CL

Project No. 20-060-001 **Client:** Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-3
Sample Number: A-21346 **Depth:** 2.5 - 4.0 ft

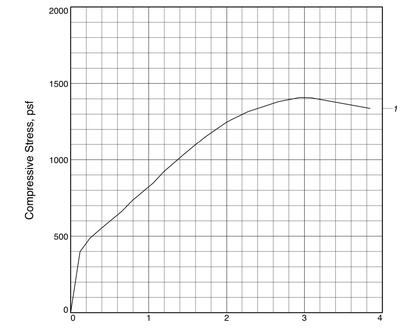
Remarks:
● Report No. A-21346-207
Date: 5-21-2020

TD&H THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS · BOZEMAN · KALISPELL · BILLINGS · LEWISTOWN · MONTANA · WASHINGTON · IDAHO

Figure 11

Tested By: NJ **Checked By:** Craig R Madsen

UNCONFINED COMPRESSION TEST



	1			
Sample No.				
Unconfined strength, psf	1409			
Undrained shear strength, psf	704			
Failure strain, %	2.9			
Strain rate, in./min.	0.030			
Water content, %	22.8			
Wet density, pcf	117.3			
Dry density, pcf	95.5			
Saturation, %	80.4			
Void ratio	0.7642			
Specimen diameter, in.	2.85			
Specimen height, in.	5.59			
Height/diameter ratio	1.96			

Description: Lean CLAY with Sand
LL = **PL =** **PI =** **Assumed GS=** 2.7 **Type:** Shelby Tube

Project No.: 20-060-001
Date Sampled: 5-1-2020
Remarks:
Report No. A-21342-215
Date: 5-15-2020

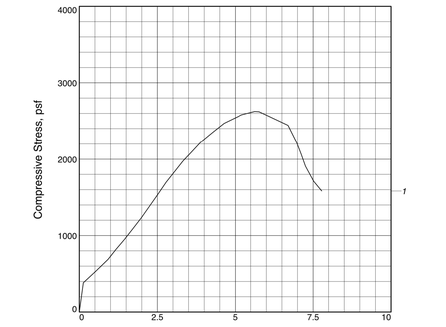
Client: Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-2
Sample Number: A-21342 **Depth:** 5.0 - 7.0 ft

TD&H THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS · BOZEMAN · KALISPELL · BILLINGS · LEWISTOWN · MONTANA · WASHINGTON · IDAHO

Figure 12

Tested By: CRN **Checked By:** Craig R Madsen

UNCONFINED COMPRESSION TEST



	1			
Sample No.				
Unconfined strength, psf	2624			
Undrained shear strength, psf	1312			
Failure strain, %	5.6			
Strain rate, in./min.	0.030			
Water content, %	18.8			
Wet density, pcf	128.5			
Dry density, pcf	108.2			
Saturation, %	91.0			
Void ratio	0.5580			
Specimen diameter, in.	2.85			
Specimen height, in.	5.56			
Height/diameter ratio	1.95			

Description: Sandy Lean CLAY
LL = **PL =** **PI =** **Assumed GS=** 2.7 **Type:** Shelby Tube

Project No.: 20-060-001
Date Sampled: 5-1-2020
Remarks:
Report No. A-21347-215
Date: 5-15-2020

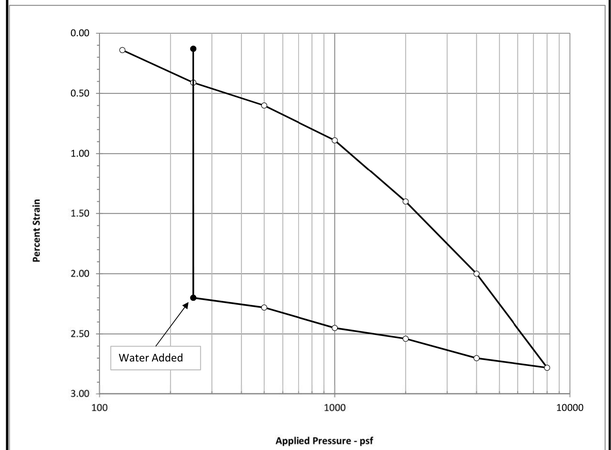
Client: Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-3
Sample Number: A-21347 **Depth:** 6.0 - 6.5 ft

TD&H THOMAS, DEAN & HOSKINS, INC.
ENGINEERING CONSULTANTS
GREAT FALLS · BOZEMAN · KALISPELL · BILLINGS · LEWISTOWN · MONTANA · WASHINGTON · IDAHO

Figure 13

Tested By: CRN **Checked By:** Craig R Madsen

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist	Dry Density (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	Pc (psf)	C_c	C_s	Swell Pressure (psf)	Swell (%)	e_o
83.3	19.2	103.6	-----	-----	2.7	740	~ 1,000	0.034	0.006	250	~ 2.1	0.622

MATERIAL DESCRIPTION	USCS	AASHTO
Lean CLAY with Sand	CL	-----

Project No. 20-060-001 **Client:** Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-2 **Sample Depth (ft):** 5.0 - 7.0

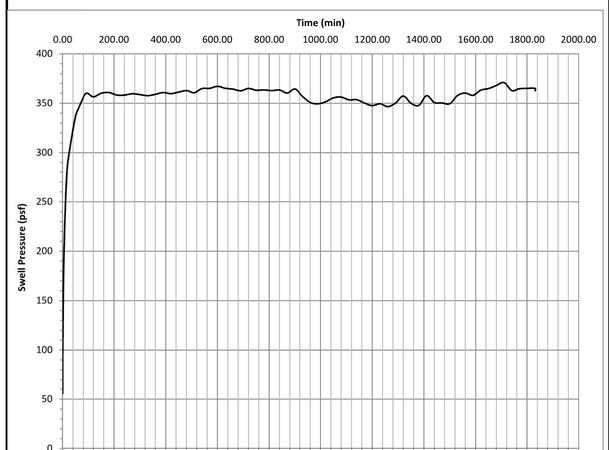
Remarks:
Report No. A-21342-219

TD&H Engineering Thomas, Dean & Hoskins, Inc.
Engineering Consultants

Figure 14

Technician : CRN **Reviewed By:** Craig R Madsen

CONSTANT VOLUME SWELL TEST REPORT



Natural Sat.	Natural Moist	Dry Density (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	Pc (psf)	C_c	C_s	Swell Pressure (psf)	Swell (%)	e_o
74.7	18.7	100.3	-----	-----	2.7	710	N/A	N/A	N/A	~ 370	N/A	0.676

MATERIAL DESCRIPTION	USCS	AASHTO
Lean CLAY with Sand	CL	-----

Project No. 20-060-001 **Client:** Montana Fish, Wildlife & Parks
Project: 2035 Fish Hatchery Road
Southeast of Lewistown, Montana
Location: B-2 **Sample Depth (ft):** 5.0 - 7.0

Remarks:
Report No. A-21342-216

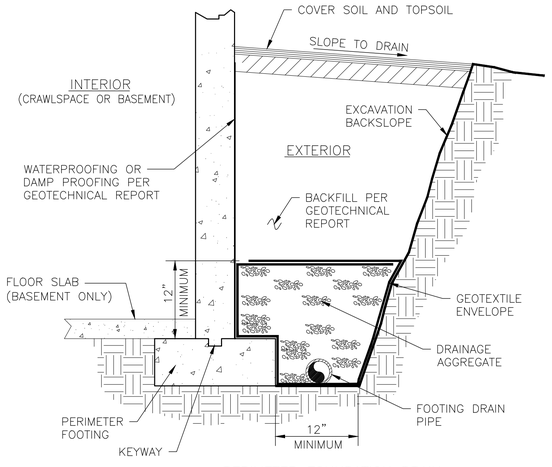
TD&H Engineering Thomas, Dean & Hoskins, Inc.
Engineering Consultants

Figure 15

Technician: CRN **Reviewed By:** Craig R Madsen

Geotech Sheet 6/7

RE-BID - JANUARY 10, 2022



PERIMETER FOUNDATION DRAIN
NO SCALE

NOTES

1. FOOTING DRAIN PIPE SHALL CONSIST OF A MINIMUM 3–INCH DIAMETER, GEOTEXTILE–WRAPPED, FLEXIBLE, SLOTTED PIPE, ADVANCED DRAINAGE SYSTEM (ADS) WITH DRAIN GUARD OR APPROVED EQUIVALENT.
2. GEOTEXTILE ENVELOPE SHALL INCLUDE A FULL WIDTH OVERLAY AT THE TOP. GEOTEXTILE SHALL BE SOILTEX ST120N, MIRAFI 140NC OR APPROVED EQUIVALENT.
3. DRAINAGE AGGREGATE SHALL BE WASHED OR SCREENED GRAVEL CONFORMING TO THE FOLLOWING GRADATION:

SIEVE SIZE	PERCENT PASSING
1 1/2–INCH	100
3/4–INCH	75–95
3/8–INCH	10–20
NO. 4	0–5

4. FOOTING DRAINS SHALL HAVE A MINIMUM SLOPE OF 0.2 PERCENT TOWARDS A SUMP PUMP OR DAY–LIGHTED A MINIMUM OF 15 FEET AWAY FROM THE FOUNDATION.

CONSTRUCTION STANDARD NO. 02801-06C	TD&H Engineering (tdhengineering.com) GREAT FALLS–BOZEMAN–KALISPELL–BILLINGS SPOKANE LEWISTON	DRAWN BY: RLT DESIGNED BY: CRN QUALITY CHECK: MMJ DATE: 5/21/15 JOB NO. CAD NO. 02801-06C	FIGURE
PERIMETER FOUNDATION DRAIN RESIDENTIAL CONSTRUCTION		MONTANA WASHINGTON IDAHO NORTH DAKOTA	

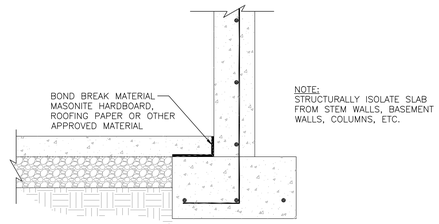
CR_1	0.939	Coefficient of risk (1.0s)
PGA	0.039	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.062	Site modified peak ground acceleration
T_L	4	Long-period transition period (s)
SsRT	0.098	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.101	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.043	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.046	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.6	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

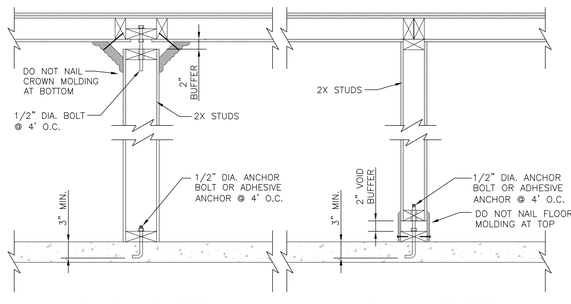
Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.



FLOATING SLAB–ON–GRADE
NO SCALE



FLOOR SUPPORTED
(LATERALLY RESTRAINED AT CEILING)

CEILING SUPPORTED
(LATERALLY RESTRAINED AT FLOOR)

NON–BEARING PARTITION WALL FRAMING DETAILS
NO SCALE

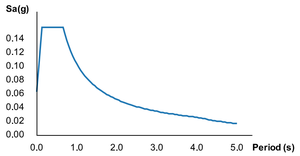
Date: 7/2005	Revised:	By:	CONSTRUCTION STANDARD NO. 02801-08
TD&H Engineering	THOMAS, DEAN & HOSKINS, INC. ENGINEERING CONSULTANTS GREAT FALLS–BOZEMAN–KALISPELL SPOKANE LEWISTON MONTANA WASHINGTON IDAHO		MISC. DETAILS FOR SLAB-ON-GRADE CONSTRUCTION OVER EXPANSIVE SOILS

ATC Hazards by Location

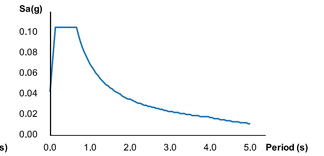
Search Information

Coordinates:	47.00159249331295, -109.34372127056122
Elevation:	4184 ft
Timestamp:	2020-05-27T18:34:48.543Z
Hazard Type:	Seismic
Reference Document:	IBC-2015
Risk Category:	II
Site Class:	D

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.098	MCE_R ground motion (period=0.2s)
S_1	0.043	MCE_R ground motion (period=1.0s)
S_{MS}	0.157	Site-modified spectral acceleration value
S_{M1}	0.104	Site-modified spectral acceleration value
S_{DS}	0.105	Numeric seismic design value at 0.2s SA
S_{D1}	0.069	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.976	Coefficient of risk (0.2s)

THOMAS, DEAN & HOSKINS, INC.
Engineering Consultants
Great Falls, Kalispell, Bozeman, MT
Spokane, WA; Lewiston, ID; Watford City, ND

SOIL CLASSIFICATION AND SAMPLING TERMINOLOGY FOR ENGINEERING PURPOSES

STANDARD PENETRATION TEST (ASTM D1586)

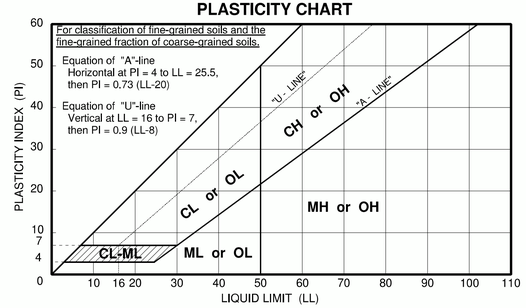
RELATIVE DENSITY*		RELATIVE CONSISTENCY*	
Granular, Noncohesive (Gravels, Sands, & Silts)	Standard Penetration Test (blows/foot)	Fine-Grained, Cohesive (Clays)	Standard Penetration Test (blows/foot)
Very Loose	0-4	Very Soft	0-2
Loose	5-10	Soft	3-4
Medium Dense	11-30	Firm	5-8
Dense	31-50	Stiff	9-15
Very Dense	+50	Very Stiff	15-30
		Hard	+30

*** Based on Sampler-Hammer Ratio of 8.929 E-06 ft/lbf and 4.185 E-05 ft^2/lbf for granular and cohesive soils, respectively (Terzaghi)**

PARTICLE SIZE RANGE

Sieve Openings (Inches)				Standard Sieve Sizes				
12"	3"	3/4"	No.4	No.10	No.40	No.200	<No.200	
BOULDERS	COBBLES	GRAVELS		SANDS			SILTS & CLAYS	
		Coarse	Fine	Coarse	Medium	Fine	(Distinguished By Atterberg Limits)	

PLASTICITY CHART



GW - Well-graded GRAVEL
GP - Poorly-graded GRAVEL
GM - Silty GRAVEL
GC - Clayey GRAVEL

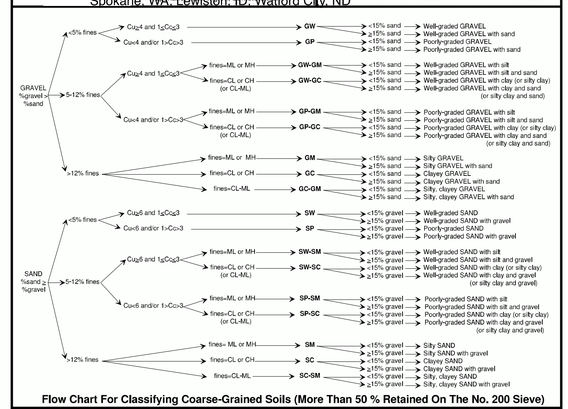
SW - Well-graded SAND
SP - Poorly-graded SAND
SM - Silty SAND
SC - Clayey SAND

CL - Lean CLAY
ML - SILT
OL - Organic SILT/CLAY
CH - Fat CLAY
MH - Elastic SILT
OH - Organic SILT/CLAY

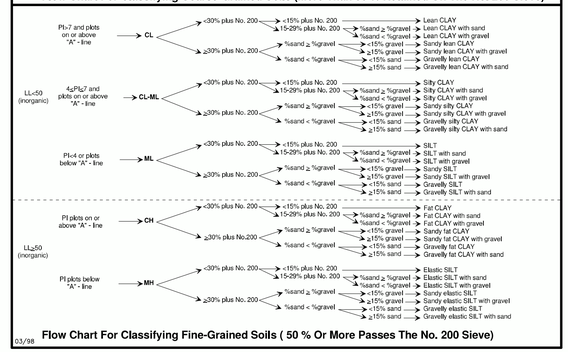
03/01

THOMAS, DEAN & HOSKINS, INC.
Engineering Consultants
Great Falls, Kalispell, Bozeman, MT
Spokane, WA; Lewiston, ID; Watford City, ND

ASTM D2487
CLASSIFICATION OF SOILS
FOR ENGINEERING PURPOSES



Flow Chart For Classifying Coarse-Grained Soils (More Than 50 % Retained On The No. 200 Sieve)



Flow Chart For Classifying Fine-Grained Soils (50 % Or More Passes The No. 200 Sieve)

03/98

Geotech Sheet 7/7

RE-BID - JANUARY 10, 2022

GENERAL NOTES

CODES & STANDARDS

1. INTERNATIONAL BUILDING CODE – 2018 IBC
2. AMERICAN SOCIETY OF CIVIL ENGINEERS – ASCE 7-16
3. AMERICAN CONCRETE INSTITUTE – ACI 318-14
4. AMERICAN INSTITUTE OF STEEL CONSTRUCTION – AISC 360-16
5. SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS – AISC 341-10
6. AMERICAN WELDING SOCIETY – AWS D1.4/D1.4M-2017
7. NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION – NDS 2018
8. INTERNATIONAL MASONRY INSTITUTE – TMS 402-16/TMS 602-16
9. ASTM STANDARDS FOR THE MATERIALS SPECIFIED.

DESIGN & STRUCTURAL CRITERIA

1. PROJECT LOCATION/LOCAL JURISDICTION: LEWISTOWN, MT
2. RISK CATEGORY: CATEGORY II – FOR DETERMINATION OF LOADING, IMPORTANCE & OTHER STRUCTURAL ENGINEERING DESIGN FACTORS.
3. SOIL DESIGN CRITERIA
   - 3.1. FROST DEPTH: 48 INCHES
   - 3.2. ALLOWABLE BEARING PRESSURE: 1500 PSF
   - 3.3. COEFFICIENT OF FRICTION: .25
   - 3.4. AT-REST EARTH PRESSURE: 60 PSF/FT
   - 3.5. PASSIVE EARTH PRESSURE: 150 PSF/FT
4. DEAD LOADS
   - 4.1. ROOF DEAD LOAD: 20 PSF
   - 4.2. FLOOR DEAD LOAD: 17 PSF @ CARPET, 37 PSF @ TILE
5. LIVE LOADS
   - 5.1. ROOF LIVE LOAD: 20 PSF
   - 5.2. FLOOR LIVE LOAD: 100 PSF @ PUBLIC ROOMS, 40 PSF @ PRIVATE ROOMS, AND 15 PSF @ PARTITIONS
6. WIND DESIGN CRITERIA
   - 6.1. BASIC WIND SPEED: V = 110 MPH
   - 6.2. EXPOSURE C
7. SEISMIC DESIGN CRITERIA
   - 7.1. S_s = 0.103g, S_1 = 0.047g
   - 7.2. SITE SOIL CLASSIFICATION: D
   - 7.3. SDS = 0.110g, SD1 = 0.075g
   - 7.4. SEISMIC DESIGN CATEGORY B
   - 7.5. SEISMIC DESIGN RESPONSE COEFFICIENT: C_s = 0.017
   - 7.6. ANALYSIS PROCEDURE: EQUIVALENT LATERAL FORCE
   - 7.7. LATERAL FORCE RESISTING SYSTEM = WOOD WALLS W/ SHEATHING, R=6.5
8. SNOW DESIGN CRITERIA
   - 8.1. GROUND SNOW LOAD (Pg): 55 PSF
   - 8.2. DESIGN ROOF SNOW LOAD (Pf): 43 PSF
   - 8.3. EXPOSURE FACTOR, Ce: 1.0
   - 8.4. THERMAL FACTOR, Ct: 1.1
   - 8.5. IMPORTANCE FACTOR, Is: 1.0
   - 8.6. ROOF SLOPE FACTOR, Cs: 1.0
   - 8.7. EXPOSURE C
   - 8.8. DRIFTING: PER CODE
   - 8.9. UNBALANCED: PER CODE
9. DEFLECTION
   - 9.1. ROOF TOTAL LOAD: L/240
   - 9.2. ROOF LIVE LOAD: L/360
   - 9.3. FLOOR TOTAL LOAD: L/240
   - 9.4. FLOOR LIVE LOAD: L/480
   - 9.5. LATERAL SYSTEMS: L/180

MISCELLANEOUS

1. REFERENCE CIVIL DRAWINGS FOR EQUIPMENT LOCATION AND ORIENTATION ON THE SITE. THE CONTRACTOR AND SUB-TRADES SHALL FURNISH ALL REQUIRED MATERIAL, LABOR, EQUIPMENT AND PERFORM ALL WORK AS NECESSARY, AS INDICATED ON THE PROJECT DOCUMENTS, OR AS REASONABLY INFERRED TO EXECUTE THE SCOPE OF WORK FOR A PROPERLY FINISHED, COMPLETE JOB.
2. THE QUALITY OF WORKMANSHIP SHOULD BE SET AND SUPERVISED BY THE CONTRACTOR TO PASS BUILDING DEPT. OR ENGINEER INSPECTION FOR ROUGH CONSTRUCTION. THE LEVEL OF QUALITY AND TOLERANCE SHOULD BE APPROPRIATE FOR THE INSTALLED ELEMENT TO RECEIVE THE NEXT IN-LINE FINISH ASPECT OF CONSTRUCTION.
3. THE PURPOSE OF PROJECT DRAWINGS IS TO DEPICT THE OVERALL SCOPE OF THE PROJECT. THE PROJECT DRAWINGS HAVE BEEN DEVELOPED TO SHOW A LEVEL OF DETAIL WITH THE OBJECTIVE OF PLAN CHECK APPROVAL AND ISSUANCE OF A BUILDING PERMIT. THIS MODERATE LEVEL OF DETAIL USED SHOULD ALLOW FOR A VARIETY OF STANDARD CONSTRUCTION METHODS AND SEQUENCES. THE PROJECT DRAWINGS ARE INTENDED TO COMPLY WITH THE ORDINANCES, RULES AND REGULATIONS OF THE JURISDICTION IN WHICH THE BUILDING IS LOCATED.
4. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNOLOGIES, SEQUENCES AND PROCEDURES.
5. CONSTRUCTION MATERIAL SHALL BE SPREAD OUT IF PLACED ON FRAMED FLOORS OR ROOF. LOAD SHALL NOT EXCEED THE DESIGN LIVE LOAD PER SQUARE FOOT.
6. WHERE REFERENCE IS MADE TO VARIOUS TEST STANDARDS FOR MATERIALS, SUCH STANDARDS SHALL BE THE LATEST EDITION AND/OR ADDENDUM.
7. OPTIONS ARE FOR CONTRACTOR'S CONVENIENCE. THEY SHALL BE RESPONSIBLE FOR ALL CHANGES NECESSARY IF THEY CHOOSE AN OPTION AND THEY SHALL COORDINATE ALL DETAILS.
8. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL STRUCTURAL NOTES AND TYPICAL DETAILS. WHERE NO SPECIFIC DETAILS ARE SHOWN, CONSTRUCTION SHALL CONFORM TO SIMILAR WORK ON THE PROJECT.
9. TYPICAL DETAILS ARE NOT CUT ON DRAWINGS, BUT APPLY UNLESS NOTED OTHERWISE.
10. IN THE CASE OF DISCREPANCIES BETWEEN THE GENERAL NOTES, SPECIFICATIONS, PLANS/DETAILS OR REFERENCE STANDARDS, THE ARCHITECT/ENGINEER SHALL DETERMINE WHICH SHALL GOVERN. DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE WORK. SHOULD ANY DISCREPANCY BE FOUND IN THE CONTRACT DOCUMENTS, THE CONTRACTOR WILL BE DEEMED TO HAVE INCLUDED IN THE PRICE THE MOST EXPENSIVE WAY OF COMPLETING THE WORK, UNLESS PRIOR TO THE SUBMISSION OF THE PRICE, THE CONTRACTOR ASKS FOR A DECISION FROM THE ARCHITECT AS TO WHICH SHALL GOVERN. ACCORDINGLY, ANY CONFLICT IN OR BETWEEN THE CONTRACT DOCUMENTS SHALL NOT BE A BASIS FOR ADJUSTMENT IN THE CONTRACT PRICE.
11. VISITS TO THE JOBSITE BY THE ENGINEER TO OBSERVE CONSTRUCTION DO NOT IN ANY WAY MEAN THAT THEY ARE THE GUARANTORS OF THE CONTRACTORS WORK, NOR SUPERVISION, NOR SAFETY AT THE JOBSITE.

GENERAL NOTES - CONT

12. REVIEW OF SHOP DRAWINGS BY THE ENGINEER IS FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS. REVIEW OF SUCH SHOP DRAWINGS BY THE ENGINEER SHALL NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR CORRECTNESS OF DIMENSIONS, FABRICATION DETAILS, SPACE REQUIREMENTS, AND ERRORS IN THE SHOP DRAWINGS, OR FOR DEVIATIONS FROM THE CONTRACT DRAWINGS OR SPECIFICATIONS UNLESS THE CONTRACTOR HAS SPECIFICALLY CALLED ATTENTION TO SUCH DEVIATIONS IN WRITING BY A LETTER ACCOMPANYING THE SHOP DRAWINGS AND THE ENGINEER APPROVES SUCH CHANGE OR DEVIATION IN WRITING.
13. THE CONTRACTOR IS RESPONSIBLE FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK THAT CONFORMS TO THE REGULATIONS OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) SAFETY AND HEALTH STANDARDS FOR THE CONSTRUCTION INDUSTRY.
14. ESTABLISH AND VERIFY ALL OPENINGS AND INSERTS FOR ARCHITECTURAL, MECHANICAL, ELECTRICAL AND PLUMBING WITH APPROPRIATE TRADES, DRAWINGS AND SUBCONTRACTORS PRIOR TO CONSTRUCTION. DO NOT PENETRATE ANY STRUCTURAL ELEMENTS (BEAMS, COLUMNS, WALLS, SLABS, STEEL DECKS, ETC.) WITHOUT PRIOR WRITTEN APPROVAL OF STRUCTURAL ENGINEER THROUGH ARCHITECT.
15. ANY ENGINEERING DESIGN PROVIDED BY OTHERS AND SUBMITTED FOR REVIEW SHALL BEAR THE SEAL OF A CIVIL OR STRUCTURAL ENGINEER REGISTERED IN THE STATE IN WHICH THE PROJECT IS LOCATED.
16. CONTRACTOR SHALL COORDINATE ALL DIMENSIONS AND ELEVATIONS SHOWN ON STRUCTURAL DRAWINGS WITH ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS. NOTED SCALES ARE INTENDED FOR FULL SIZE PLANS. DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS ONLY.

CONCRETE

1. CONCRETE WORK SHALL CONFORM TO ALL REQUIREMENTS OF ACI 301, "STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE" AND ACI 318, "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE." ALL REINFORCING SHALL CONFORM TO THE CRSI SPECIFICATIONS & HANDBOOK. CONCRETE PLACEMENT SHALL MEET ALL COLD WEATHER AND HOT WEATHER REQUIREMENTS OUTLINED IN ACI 306 & 305 RESPECTIVELY.
2. ADDITION OF WATER TO THE BATCH FOR MATERIAL WITH INSUFFICIENT SLUMP WILL NOT BE PERMITTED, UNLESS THE SUPPLIER HAS SPECIFICALLY WITHHELD WATER FROM THE BATCH AT THE PLANT. IN SUCH CASE THE MIX DESIGN AND TRUCK TICKET MUST CLEARLY STATE THE MAXIMUM AMOUNT OF WATER THAT CAN BE ADDED TO THE BATCH ON SITE. IN NO CASE SHALL THE DESIGN WATER TO CEMENTITIOUS MATERIAL RATIO BE EXCEEDED.
3. CONCRETE CONTAINING SUPERPLASTICIZING ADMIXTURE SHALL HAVE A SLUMP OF 4" +/- 1", TO BE FIELD VERIFIED, PRIOR TO ADDING ADMIXTURE, AND NOT EXCEEDING 8" AT PLACEMENT.
4. MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED, INCLUDING SLABS ON GRADE AT 2'-0" OC AROUND AND UNDER-FLOOR DUCTS AND SLAB EDGES, REINFORCING, KEYS, ETC. MECHANICALLY VIBRATE ONLY THE TOP 5 FEET OF CAISSON CONCRETE. REVIBRATE TOP OF CAISSON 15 MINUTES AFTER PLACING CONCRETE.
5. IF CONCRETE IS PLACED BY THE PUMP METHOD, SUPPORTS SHALL BE PRODUCED FOR THE HOSE. THE HOSE SHALL NOT BE ALLOWED TO CONTACT THE REBAR OR TENDONS. THIS REQUIREMENT IS MANDATORY. DISCHARGE SHALL BE DIRECTED SO AS TO PREVENT DISPLACEMENT OF REBAR, TENDONS, OR ACCESSORIES.
6. REINFORCING SHALL BE CONTINUOUS AROUND ALL CORNERS AND THROUGH CONSTRUCTION JOINTS UNLESS SHOWN OTHERWISE.
7. ALL HOOKS ON ALL BARS SHALL BE STANDARD 90 DEGREE HOOKS UNLESS SHOWN OTHERWISE.
8. REINFORCING STEEL SHALL NOT BE BENT OR STRAIGHTENED IN A MANNER INJURIOUS TO THE CONCRETE OR STEEL.
9. ALL REINFORCING TO BE WELDED SHALL BE WELDED IN ACCORDANCE WITH AWS D1.4. NO TACK WELDING OF REINFORCING BARS IS ALLOWED WITHOUT PRIOR REVIEW OF PROCEDURE BY STRUCTURAL ENGINEER.
10. ALL CONDUITS, GROUND WIRES, DRAINS, ANCHOR BOLTS, OTHER EMBEDDED ITEMS, ETC. SHALL BE IN PLACE BEFORE CONCRETE PLACEMENT.
11. REINFORCING LAP SPLICES IN CONCRETE SHALL BE PER TYPICAL DETAIL UNLESS NOTED OTHERWISE. ALL SPLICE LOCATIONS ARE SUBJECT TO APPROVAL. PROVIDE BENT CORNER BARS TO MATCH AND LAP WITH HORIZONTAL BARS AT CORNERS AND INTERSECTIONS OF FOOTINGS AND WALLS.
12. ALL FIELD BENDING OF REINFORCING SHALL BE STANDARD 90 DEGREE HOOKS AS DEFINED IN CURRENT ACI 318 UNLESS NOTED OR DETAILED OTHERWISE.
13. WHEN TOTAL NUMBER OF REINFORCING BARS IS SHOWN ON DESIGN DRAWINGS AND SPACING IS NOT SPECIFIED, BARS SHALL BE EQUALLY SPACED.
14. DETAILS OF REINFORCING NOT SHOWN IN THESE PLANS SHALL BE DONE IN ACCORDANCE WITH ACI 315 AND ACI 318.
15. DRILLED PIER CONCRETE SHALL BE CHANNELED TO FREE FALL DOWN THE SHAFT WITHOUT STRIKING THE REINFORCING OR THE SIDES OF THE SHAFT. MAXIMUM HEIGHT OF FREE-FALL IS 10'-0".
16. ALL SLABS-ON-GRADE SHALL HAVE CONTROL JOINTS CUT IN CONCRETE WITHIN 8 HOURS OF PLACEMENT AT A SPACING NO GREATER THAN 10' OCEW (UNO ON PLANS).

FOUNDATION AND SOIL PREPARATION

SITE GRADING AND EXCAVATIONS

1. FOUNDATIONS HAVE BEEN DESIGNED BASED ON RECOMMENDATIONS PROVIDED IN THE GEOTECHNICAL EVALUATION BY TD&H ENGINEERING DATED JUNE 2020. THE FOLLOWING NOTES ARE TYPICAL AND SHALL NOT GOVERN SITE SPECIFIC REQUIREMENTS AS OUTLINED IN THIS REPORT. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING THIS REPORT AND FOLLOWING THOSE RECOMMENDATIONS.
2. CONFORM TO IBC CHAPTER 18 "SOILS AND FOUNDATIONS".
3. ALL TOPSOIL AND ORGANIC MATERIAL, ASPHALT, CONCRETE AND RELATED CONSTRUCTION DEBRIS SHALL BE REMOVED FROM THE PROPOSED BUILDING AND PAVEMENT AREAS AND ANY AREAS TO RECEIVE SITE GRADING FILL. FOR PLANNING PURPOSES, A MINIMUM STRIPPING THICKNESS OF 6 INCHES IS RECOMMENDED. THICKER STRIPPING DEPTHS MAY BE WARRANTED TO REMOVE ALL DETRIMENTAL ORGANICS AS DETERMINED ONCE ACTUAL STRIPPING OPERATIONS ARE PERFORMED.
4. ALL FILL AND BACKFILL SHALL BE NON-EXPANSIVE, FREE OF ORGANICS AND DEBRIS AND SHALL BE APPROVED BY THE PROJECT GEOTECHNICAL ENGINEER. ALL FILL SHALL BE PLACED IN UNIFORM LIFTS NOT EXCEEDING 8 INCHES IN THICKNESS FOR FINE-GRAINED SOILS AND NOT EXCEEDING 12 INCHES FOR GRANULAR SOILS. ALL FILL AND BACKFILL SHALL BE COMPACTED TO THE FOLLOWING PERCENTAGES OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 OR EQUIVALENT (E.G. ASTM D4253-D4254).
   - 4.1. BELOW FOUNDATIONS OR SPREAD FOOTINGS................................ 95%
   - 4.2. BELOW SLAB-ON-GRADE CONSTRUCTION.. 95%
   - 4.3. FOUNDATION WALL BACKFILL.. 95%
   - 4.4. GENERAL LANDSCAPING OR NONSTRUCTURAL AREAS.................... 92%
5. IMPORTED STRUCTURAL FILL SHALL BE NON-EXPANSIVE, FREE OF ORGANICS AND DEBRIS, AND CONFORM WITH THE MATERIAL REQUIREMENTS OUTLINED IN SECTION 02234 OF MPWSS.

SPREAD FOOTING FOUNDATIONS

1. BOTH INTERIOR AND EXTERIOR FOOTINGS SHALL BEAR ON PROPERLY COMPACTED NATIVE SOILS. AN ALLOWABLE SOIL BEARING PRESSURE OF 1,500 PSF WAS USED FOR ALL FOOTINGS.
2. SOILS DISTURBED BELOW THE PLANNED DEPTHS OF FOOTING EXCAVATIONS SHALL EITHER BE RECOMPACTED OR BE REPLACED WITH SUITABLE COMPACTED BACKFILL APPROVED BY THE GEOTECHNICAL ENGINEER.
3. THE BOTTOM OF THE FOOTING EXCAVATIONS SHALL BE FREE OF COBBLES AND BOULDERS TO AVOID STRESS CONCENTRATIONS ACTING ON THE BASE OF THE FOOTINGS.
4. A REPRESENTATIVE OF THE PROJECT GEOTECHNICAL ENGINEER SHALL OBSERVE ALL FOOTING EXCAVATIONS AND BACKFILL PHASES PRIOR TO THE PLACEMENT OF CONCRETE FORMWORK.

FLOOR SLABS AND EXTERIOR FLATWORK

1. FOR NORMALLY LOADED, SLAB-ON-GRADE CONSTRUCTION, A MINIMUM 6-INCH CUSHION COURSE CONSISTING OF FREE-DRAINING, CRUSHED GRAVEL SHOULD BE PLACED BENEATH THE SLABS AND COMPACTED TO A MINIMUM OF 95 PERCENT DENSITY PER ASTM D698 (OR EQUIVALENT PER ASTM D4253-D4254). THIS MATERIAL SHOULD CONFORM TO SECTION 02235 OF MPWSS AND INCORPORATE A MAXIMUM PARTICLE SIZE OF ¾-INCH. PRIOR TO PLACING THE CUSHION COURSE, THE UPPER SIX INCHES OF SUBGRADE SHALL BE COMPACTED TO 95 PERCENT OF MAXIMUM DENSITY PER ASTM D698.

LEGEND AND ABBREVIATIONS

AB	ANCHOR BOLT
ACI	AMERICAN CONCRETE INSTITUTE
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ALT	ALTERNATE
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ASTM	AMERICAN SOCIETY FOR TESTING MATERIAL
AWS	AMERICAN WELDING SOCIETY
@	AT
BLDG	BUILDING
BLK'G	BLOCKING
BM	BEAM
BOC	BOTTOM OF CONCRETE
BOF	BOTTOM OF FOOTING
BOS	BOTTOM OF STEEL/SLAB
BOT	BOTTOM OF
BRG	BEARING
BTB	BACK TO BACK
BTWN	BETWEEN
C	STEEL CHANNEL
CFS	COLD FORMED STEEL
CIP	CAST IN PLACE
CJ	CONTROL JOINT
℄ OR CL	CENTERLINE
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONT	CONTINUOUS
DEMO	DEMOLISH
DET	DETAIL
DF	DOUGLAS FIR
ø OR DIA	DIAMETER
DIM	DIMENSION
DJ	DOUBLE JOIST
DWG	DRAWING
EA	EACH
EA WAY OR EW	EACH WAY
EF	EACH FACE
EJ	EXPANSION JOINT
EL OR ELEV	ELEVATION
EMBED	EMBEDMENT
ENG	ENGINEER
EOR	ENGINEER OF RECORD
EQ	EQUAL
EXIST OR (E)	EXISTING
EXP	EXPANSION
EXT	EXTERIOR
FDT OR FND	FOUNDATION
FF	FINISH FLOOR
FLR	FLOOR
FTG	FOOTING
GA	GAUGE
GALV	GALVANIZED
GEN	GENERAL
GLB	GLULAM BEAM
GR	GRADE
HORIZ	HORIZONTAL
HSA	HEADED STUD ANCHOR
HSS	HOLLOW STRUCT STEEL
IBC	INTERNATIONAL BUILDING CODE
INT	INTERIOR
L	STEEL ANGLE
LG	LIGHT GAUGE
LLV	LONG LEG VERTICAL
LONG	LONGITUDINAL
MAX	MAXIMUM
MCJ	MASONRY CONTROL JOINT
MECH	MECHANICAL
MANUF OR MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
NO. OR #	NUMBER
(N)	NEW
NTS	NOT TO SCALE
OC	ON CENTER
OCEF	ON CENTER EACH FACE
OCEW	ON CENTER EACH WAY
OPP	OPPOSITE
OWJ	OPEN WEB JOIST
PEMB	PRE-ENGINEERED METAL BUILDING
PLCS	PLACES
PL	PLATE
PREFAB	PREFABRICATED
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TREATED
REF	REFERENCE
REINF	REINFORCEMENT
REQ'D	REQUIRED
REV	REVISION/REVISED
SCH OR SCHED	SCHEDULE
SFE	SUBFLOOR ELEVATION
SHT	SHEET
SIM	SIMILAR
SOG	SLAB-ON-GRADE
SPCS OR SPA	SPACE(S)
SPEC	SPECIFICATION(S)
SQ	SQUARE
STD	STANDARD
STRUCT	STRUCTURAL
SYM	SYMMETRICAL
T&B	TOP & BOTTOM
T&G	TONGUE & GROOVE
THRU	THROUGH
TOB	TOP OF BEAM
TOC	TOP OF CONCRETE
TOF	TOP OF FOOTING
TOS	TOP OF STEEL/SLAB
TOW	TOP OF WALL
TRANS	TRANSVERSE
TYP	TYPICAL
VIF	VERIFY IN FIELD
VERT	VERTICAL
UNO	UNLESS NOTED OTHERWISE
W/	WITH
WF	WIDE FLANGE
WP	WORK POINT
WT	WEIGHT

CONCRETE

CONCRETE MASONRY UNIT

STEEL IN SECTION

ELEVATION NOTED

FLAG NOTE

REVISION SPECIFIED

1 / S1.0 — SECTION OR DETAIL DESIGNATION SYMBOL; SHEET NUMBER WHERE SECTION OR DETAIL IS SHOWN

DRYPACK/FLOWABLE GROUT

1. THE SPACE BENEATH ALL BASEPLATES AND BEARING PLATES SHALL BE THOROUGHLY CLEANED BEFORE DRYPACKING OR GROUTING. DRYPACK/GROUT SOLID BENEATH ALL BASEPLATES AND BEARING PLATES. NO VOIDS ARE PERMISSIBLE. USE OF DRYPACK OR FLOWABLE GROUT IS AT THE PLANS OR DETAILS, DRYPACK/GROUT PER THE FOLLOWING:
   - 1.1. DRYPACK – PORTLAND CEMENT, ASTM C150, TYPE I; AND CLEAN, NATURAL SAND, ASTM C404, SIZE NO. 2, MINIMUM COMPRESSIVE STRENGTH SHALL BE 5000 PSI AT 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C109.
   - 1.2. FLOWABLE GROUT – PREMIXED, NONMETALLIC, NONCORROSIVE, NONSTAINING GROUT CONTAINING SELECTED SILICA SANDS, PORTLAND CEMENT, SHRINKAGE COMPENSATING AGENTS, PLASTICIZING AND WATER-REDUCING AGENTS, COMPLYING WITH ASTM C1107, OF CONSISTENCY SUITABLE FOR APPLICATION, AND A 30-MINUTE WORKING TIME. MINIMUM COMPRESSIVE STRENGTH SHALL BE 5000 PSI AT 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C1107.
2. GROUTING IS THE RESPONSIBILITY OF THE CONCRETE CONTRACTOR. GROUTING SHOULD BE PREFORMED PROMPTLY ONCE STEEL COLUMNS ARE IN THEIR FINAL LOCATIONS. STEEL ERECTOR SHALL NOTIFY CONCRETE CONTRACTOR IMMEDIATELY UPON FINAL PLACEMENT OF COLUMNS.

TD&H Engineering
tdhengineering.com
MONTANA BRADY ... LASSILA No. 41800 PE LICENSED PROFESSIONAL ENGINEER

FWP BIG SPRINGS RESIDENCE

Big springs Trout Hatchert, Lewistown, MT 59404
Paul Valle, Contact 406.841.4013 pvalle@mt.gov

PHASE	REVISIONS
RE-BID - JANUARY 10, 2022	

20011

GENERAL STRUCTURAL NOTES

S1.0

6/29/2020 3:25:22 PM

MATERIALS

STRUCTURAL STEEL	W & WT	ASTM A992, Fy = 50 KSI
	CHANNEL & ANGLE	ASTM A36, Fy = 36 KSI
	PLATES	ASTM A36, Fy = 36 KSI
	HSS SQ OR RECT	ASTM A500, GR C, Fy = 50 KSI
	HSS ROUND	ASTM A500, GR C, Fy = 46 KSI
CONCRETE	ALL (U.N.O.)	PORTLAND CEMENT ASTM C150 TYPE II W/C RATIO = 0.45 MAXIMUM 28 DAY f'c = 4000 PSI SLUMP RANGE 3-5 INCHES AIR CONTENT = 4.5 – 7.5% (AIR CONTENT OF SLABS-ON-GRADE MAY BE REDUCED TO 2% MIN IF THE SLAB WILL BE PROTECTED FROM FREEZE/THAW CYCLES DURING AND AFTER CONSTRUCTION.) ¾" MAXIMUM NORMAL WEIGHT AGGREGATE
REINFORCING BARS		ASTM A615, GRADE 60 (NON-WELDABLE) ASTM A706, GRADE 60 (WELDABLE) ASTM A-185 (WELDED WIRE FABRIC)
ANCHOR RODS		ASTM F1554, GRADE 36
HIGH STRENGTH BOLTS		ASTM A325N
BOLTS		ASTM A307, GALVANIZED PER ASTM A153 (ONLY WHERE NOTED ON PLANS)
WELD METAL		E70XX ELECTRODE
ADHESIVE ANCHORS	CONCRETE	HILTI HIT RE 500V3
	ALL	ASTM A36 ALL-THREAD WITH CHISEL POINT
WOOD		SILL PLATES, D.F. #2 2x6 STUDS AND LARGER, H.F. #2 SIMPLE SPAN GLU-LAMINATED BEAMS, 24F-V4 CONTINUOUS SPAN GLU-LAMINATED BEAMS, 24F-V8 WALL SHEATHING, 24/16 OSB, EXPOSURE 1 ROOF SHEATHING, 40/20 CDX PLYWOOD FLOOR SHEATHING, ¾" APA RATED STUD-I-FLOOR

ANCHOR ROD NOTES:

1. ANCHOR ROD LOCATIONS AND DIAMETERS ARE PER PLANS.
2. ALL ANCHOR RODS SHALL BE EITHER HEADED OR DOUBLE NUT WITH 1/4"x2"x2" STEEL WASHER.
3. MINIMUM EMBEDMENT PER PLANS.
4. ANCHOR RODS SHALL BE ASTM F1554 GR 36 MATERIAL.
5. ANCHOR NUTS SHALL BE INSTALLED SNUG TIGHT.
6. EPOXY AND EXPANSION ANCHORS SHALL BE HILTI (OR EQUAL) INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.

SHOP DRAWINGS

1. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE ENGINEER AND MUST RECEIVE APPROVAL PRIOR TO FABRICATION. SHOP DRAWINGS SHALL BE SUBMITTED FOR THE FOLLOWING MATERIALS:
   1.1. CONCRETE MIX DESIGN
   1.2. REBAR TYPE & LOCATION
   1.3. BOLTS AND ANCHOR BOLTS
   1.4. STEEL MEMBERS, PROPERTIES & LAYOUT
   1.5. PRE-ENGINEERED TIMBER TRUSS LAYOUT & CALCULATIONS WITH P.E. STAMP IN THE STATE IN WHICH THE PROJECT IS LOCATED
   1.6. FLOOR JOISTS
2. THE GENERAL CONTRACTOR WILL REVIEW AND STAMP ALL SHOP DRAWINGS AND PRODUCT DATA FOR CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS PRIOR TO SUBMISSION. ANY SHOP DRAWINGS OR PRODUCT DATA NOT REVIEWED AND STAMPED BY THE GENERAL CONTRACTOR WILL BE RETURNED WITHOUT REVIEW.
3. ANY SHOP DRAWING NOT CHECKED AND INITIALED BY THE SUPPLIER/DETAILER PRIOR TO SUBMITTING FOR ARCHITECTURAL AND ENGINEERING REVIEW, WILL BE RETURNED WITHOUT REVIEW.
4. THE CONSTRUCTION DOCUMENTS MAY NOT BE REPRODUCED FOR USE AS SHOP DRAWINGS.
5. ELECTRONIC FILES OF CONSTRUCTION DOCUMENTS WILL NOT BE MADE AVAILABLE FOR USE AS SHOP DRAWINGS.

DEFERRED SUBMITTALS

1. DEFERRED SUBMITTALS ARE THOSE PORTIONS FOR THE DESIGN WHICH ARE NOT SUBMITTED AT THE TIME OF PERMIT APPLICATION AND WHICH ARE TO BE SUBMITTED TO THE BUILDING OFFICIAL WITHIN A SPECIFIED PERIOD.
2. SUBMITTAL DOCUMENTS FOR DEFERRED SUBMITTAL ITEMS SHALL BE SUBMITTED TO THE ENGINEER OF RECORD THROUGH THE ARCHITECT AND GENERAL CONTRACTOR WITHIN 6 WEEKS OF AWARD OF CONTRACT TO THE GENERAL CONTRACTOR. ONCE THE SUBMITTAL DOCUMENTS HAVE BEEN FOUND TO BE IN GENERAL CONFORMANCE TO THE CONTRACT DOCUMENTS, THE ENGINEER OF RECORD WILL FORWARD THEM TO THE ARCHITECT WITH A NOTATION INDICATION THAT THEY ARE IN GENERAL CONFORMANCE WITH THE DESIGN OF THE BUILDING. THE ARCHITECT WILL FORWARD THE DEFERRED SUBMITTAL DOCUMENTS TO THE GENERAL CONTRACTOR WHO WILL MAINTAIN ONE SET ON SITE FOR REFERENCE BY THE CITY INSPECTOR. THE DEFERRED SUBMITTAL ITEMS SHALL NOT BE INSTALLED UNTIL THE SUBMITTAL DOCUMENTS HAVE BEEN APPROVED BY THE BUILDING OFFICIAL.
3. ITEMS THAT ARE SUBMITTED FOR CONSIDERATION AS DEFERRED SUBMITTALS ARE AS FOLLOWS:
   3.1. PREFABRICATED WOOD TRUSSES
   3.2. STRUCTURAL FILL MATERIAL
   3.3. CONCRETE MIX DESIGN

WOOD

1. ALL WOOD TO BE CONSTRUCTED USING STANDARD PRACTICES. LATEST EDITION OF NATIONAL DESIGN SPECIFICATION (NDS) APPLIES.
2. PROVIDE ALL ACCESSORY ITEMS FOR ENGINEERED WOOD PRODUCTS (BLOCKS, CLIPS, STRAPS, STIFFENERS, ETC) DESIGNED BY THE MANUFACTURER AS REQUIRED.
3. FOLLOW ALL MANUFACTURERS RECOMMENDATIONS FOR INSTALLATION OF ALL ENGINEERED WOOD PRODUCTS AND ALL FRAMING CONNECTORS, HANGERS AND ANCHORS.
4. PROVIDE FULL BEARING FOR ALL FRAMING MEMBERS UNLESS SHOWN OTHERWISE. ALL WALL FRAMING TO BE HF #2 OR BETTER (UNO). ALL GLUE LAMINATED BEAMS (GLB) SHALL BE 24F-V4 (24F-V8 FOR CONTINUOUS SPANS) AND AC V12 FOR EXPOSED APPLICATIONS UNLESS BEAM IS PROTECTED FROM WEATHER THEN 24F IS ACCEPTABLE. SILL PLATES TO BE DF #2.
5. WALLS TO HAVE 8d NAILS @ 6" OC AT EDGE AND 12" OC IN FIELD, FULLY BLOCKED. ALL OPENINGS TO HAVE 8d NAILS @ 3" OC ALL AROUND. UNO ON SHEAR WALL PLANS.
6. ROOF TRUSSES SHALL BE DESIGNED BY OTHERS AND BE SEALED BY A PROFESSIONAL ENGINEER IN THE STATE IN WHICH THE PROJECT IS LOCATED.
7. ALL TRUSSES AND OVERHANGS TO BE CONNECTED TO WALLS WITH SIMPSON H1 CLIPS.
8. ROOF TRUSSES AND MONOTRUSSES SHALL BE PRESSED-PLATE LUMBER, DESIGNED BY OTHERS, IN ACCORDANCE WITH THE TRUSS PLATE INSTITUTE TP1, AND SUBMITTED TO THE ENGINEER FOR APPROVAL.
9. INSTALL TEMPORARY AND PERMANENT TRUSS BRACING ACCORDING TO MANUFACTURER'S SPECIFICATIONS AND IN ACCORDANCE WITH BCSI GUIDE TO GOOD PRACTICE FOR HANDLING, INSTALLING, RESTRAINING & BRACING OF METAL PLATE CONNECTED WOOD TRUSSES, 2018 EDITION.
10. INSTALL CONTINUOUS LATERAL RESTRAINT BRACING ACCORDING TO MANUFACTURER'S SPECIFICATIONS. CONTRACTOR TO PROVIDE A PROJECT-SPECIFIC PERMANENT INDIVIDUAL TRUSS MEMBER RESTRAINT/BRACING DESIGN SPECIFIED BY A REGISTERED DESIGN PROFESSIONAL IN ACCORDANCE WITH IBC 2303.4.1.2. CONTINUOUS LATERAL RESTRAINTS SHALL BE DIAGONALLY BRACED IN ACCORDANCE WITH BCSI-B3.
11. PLACE FLOOR AND ROOF SHEATHING WITH FACE GRAIN PERPENDICULAR TO THE SUPPORTS AND JOINTS STAGGERED OVER SUPPORTS. PLACE WALL SHEATHING WITH FACE GRAIN VERTICAL.
12. ALL TIMBER SHALL BE CONSTRUCTED ACCORDING TO MINIMUM STANDARDS OUTLINED IN CHAPTER 23 OF THE 2018 IBC INCLUDING USING THE FASTENING SCHEDULE (TABLE 2304.10.1 OF 2018 IBC), EXCEPT AS NOTED DIFFERENTLY ON PLANS.
13. ALL ROOF AND FLOOR SHEATHING SHALL BE CDX PLYWOOD. ALL WALL SHEATHING SHALL BE ORIENTED STRAND BOARD. WALL SHEATHING SHALL EXTEND AND ATTACH TO (USING MIN 10d NAILS @ 6" OC, UNO) THE TOP AND BOTTOM OF THE WALL TOP AND BOTTOM HORIZONTAL PLATES (RESPECTIVELY). NO HORIZONTAL JOINT OF THE SHEATHING CAN BE WITHIN 2' OF THE TOP OR BOTTOM PLATE.
14. TYPICAL SUB-FLOOR SHALL BE ¾" TONGUE & GROOVE APA RATED STURD-I-FLOOR PLYWOOD NAILED W/ 10d @ 6" OC AT SHEET EDGES AND @ 12" OC FIELD. TYPICAL ROOF SHEATHING SHALL BE ⅝" THICK APA SPAN RATED CD-X PLYWOOD NAILED W/ 10d @ 6" OC AT SHEET EDGES AND @ 12" OC FIELD.
15. ALL NAILS SHALL BE COMMON NAILS UNO.
16. ALL METAL FASTENERS AND CONNECTORS IN CONTACT WITH P.T. WOOD SHALL BE GALVANIZED.
17. ALL LUMBER IN CONTACT WITH GROUND, CONCRETE, OR EXPOSED TO WEATHER SHALL BE PRESSURE TREATED. ALL METAL EXPOSED TO WEATHER OR IN CONTACT WITH PRESSURE TREATED LUMBER SHALL BE STAINLESS STEEL, HOT DIPPED GALVANIZED (MIN. G180) OR OTHERWISE PROTECTED AGAINST CORROSION.
18. BRACE STUD WALLS UNTIL ALL PLYWOOD SUB-FLOOR, FLOOR TRUSSES, ROOF TRUSSES, AND SHEAR PANELS ARE IN PLACE.
19. ANCHOR RODS FOR HOLDOWNS SHALL HAVE TACK WELDED NUT OR DOUBLE NUT ON EMBEDDED END UNO. EMBEDMENT AS LISTED ON PLANS SHALL BE MEASURED FROM THE TOP OF THE UPPERMOST EMBEDDED NUT TO THE TOP OF THE CONCRETE.

STATEMENT OF SPECIAL INSPECTIONS

1. SPECIAL INSPECTION AND TESTING SHALL BE PROVIDED BY THE OWNER IN ACCORDANCE WITH CHAPTER 17 OF THE 2018 IBC.
2. ALL SPECIAL INSPECTORS SHALL BE UNDER THE SUPERVISION OF A REGISTERED CIVIL OR STRUCTURAL ENGINEER LICENSED IN THE STATE IN WHICH THE WORK IS TO BE PERFORMED. ALL INSPECTIONS SHALL BE PERFORMED BY EXPERIENCED PERSONNEL MEETING THE REQUIREMENTS OF THE IBC AND AC291 "ACCREDITATION CRITERIA FOR SPECIAL INSPECTION AGENCIES" AND SHALL BE APPROVED BY THE LICENSED ENGINEER OF RECORD.
3. SPECIAL INSPECTIONS ARE NOT REQUIRED FOR WORK OF A MINOR NATURE AS APPROVED BY THE BUILDING OFFICIAL. NOR ARE THEY REQUIRED FOR GROUP U OCCUPANCIES.
4. EACH CONTRACTOR RESPONSIBLE FOR THE CONSTRUCTION OF A MAIN WIND- OR SEISMIC FORCE RESISTING SYSTEM SHALL SUBMIT A WRITTEN STATEMENT OF RESPONSIBILITY TO THE BUILDING OFFICIAL AND THE OWNER PRIOR TO THE COMMENCEMENT OF WORK AS OUTLINED IN 1704.4 OF THE IBC.
5. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE SPECIAL INSPECTOR OR SPECIAL INSPECTION AGENCY AT LEAST TWO WORKING DAYS PRIOR TO PERFORMING ANY WORK THAT REQUIRES SPECIAL INSPECTION. ALL WORK PERFORMED WITHOUT THE REQUIRED SPECIAL INSPECTION IS SUBJECT TO REMOVAL.
6. SPECIAL INSPECTIONS SHALL BE REQUIRED FOR PROPOSED WORK THAT IS, IN THE OPINION OF THE BUILDING OFFICIAL, UNUSUAL IN ITS NATURE, SUCH AS, BUT NOT LIMITED TO THE FOLLOWING EXAMPLES: CONSTRUCTION MATERIALS AND SYSTEMS THAT ARE ALTERNATIVES TO MATERIALS AND SYSTEMS PRESCRIBED BY THE IBC, UNUSUAL DESIGN APPLICATIONS OF MATERIALS PRESCRIBED IN THE IBC, AND MATERIALS AND SYSTEMS REQUIRED TO BE INSTALLED IN ACCORDANCE WITH ADDITIONAL MANUFACTURER'S INSTRUCTIONS THAT PRESCRIBE REQUIREMENTS NOT CONTAINED IN THE IBC OR IN STANDARDS REFERENCED BY THE IBC.

TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

APPLIES	TYPE	CONT	PERIODIC	REFERENCED STANDARD	IBC REFERENCE
X	1. INSPECT REINFORCEMENT, INCLUDING PRESTRESSING TENDONS, AND VERIFY PLACEMENT.	–	X	ACI 318, CH. 20, 25.2, 25.3, 26.6.1–26.6.3	1908.4
	2. REINFORCING BAR WELDING:			AWS D1.4 ACI 318: 26.6.4	–
	a. VERIFY WELDABILITY OF REINFORCING BARS OTHER THAN ASTM A706;	–	X		
	b. INSPECT SINGLE-PASS FILLET WELDS, MAXIMUM 5/16"; AND		X		
	c. INSPECT ALL OTHER WELDS.	X			
X	3. INSPECT ANCHORS CAST IN CONCRETE.	–	X	ACI 318: 17.8.2	–
X	4. INSPECT ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS.				–
	a. ADHESIVE ANCHORS INSTALLED IN HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS.	X		ACI 318: 17.8.2.4	
	b. MECHANICAL ANCHORS AND ADHESIVE ANCHORS NOT DEFINED IN 4.a.		X	ACI 318: 17.8.2	
X	5. VERIFY USE OF REQUIRED DESIGN MIX	–	X	ACI 318: CH. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
X	6. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	–	ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	1908.10
X	7. INSPECT CONCRETE AND SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES.	X	–	ACI 318: 26.5	1908.6, 1908.7, 1908.8
X	8. VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.	–	X	ACI 318: 26.5.3–26.5.5	1908.9
	9. INSPECT PRESTRESSED CONCRETE FOR:			ACI 318: 26.10	–
	a. APPLICATION OF PRESTRESSING FORCES; AND	X	–		
	b. GROUTING OF BONDED PRESTRESSING TENDONS.	X	–		
	10. INSPECT ERECTION OF PRECAST CONCRETE MEMBERS.	–	X	ACI 318: 26.9	–
	11. VERIFY IN-SITU CONCRETE STRENGTH, PRIOR TO STRESSING OF TENDONS IN POST-TENSIONED CONCRETE AND PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAMS AND STRUCTURAL SLABS.	–	X	ACI 318: 26.11.2	–
X	12. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.	–	X	ACI 318: 26.11.1.2(b)	–

TABLE 1705.6
REQUIRED VERIFICATION AND INSPECTION OF SOILS

APPLIES	VERIFICATION AND INSPECTION TASK	CONT	PERIODIC
X	1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY		X
X	2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL		X
X	3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS		X
X	4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL	X	
X	5. PRIOR TO PLACEMENT OF COMPACTED FILL, INSPECT SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY		X

TD&H Engineering
tdhengineering.com

MONTANA
BRADY B. LASSILA
No. 41800 PE
LICENSED
PROFESSIONAL ENGINEER

FWP BIG SPRINGS RESIDENCE

Big springs Trout Hatchert, Lewistown, MT 59404
Paul Valle, Contact 406.841.4013 pvalle@mt.gov
–

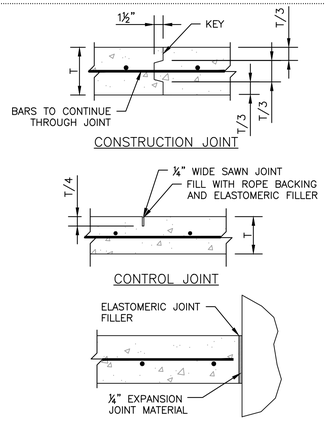
PHASE	REVISIONS
RE-BID - JANUARY 10, 2022	

20011

GENERAL
STRUCTURAL NOTES

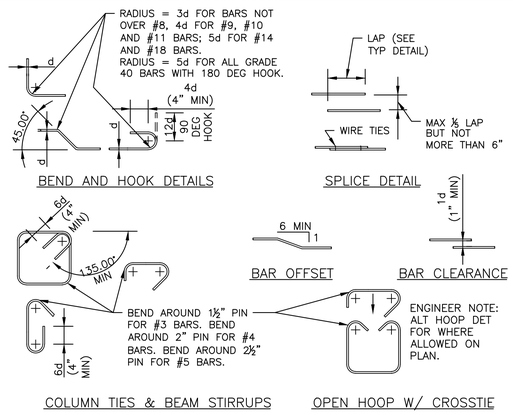
S1.1

6/29/2020 3:25:22 PM



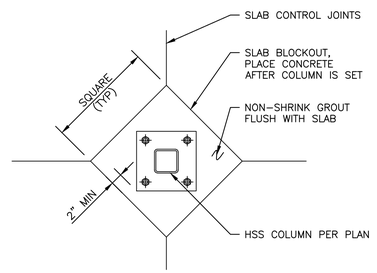
1 CONCRETE SLAB JOINT DETAILS

NTS TDH 1006



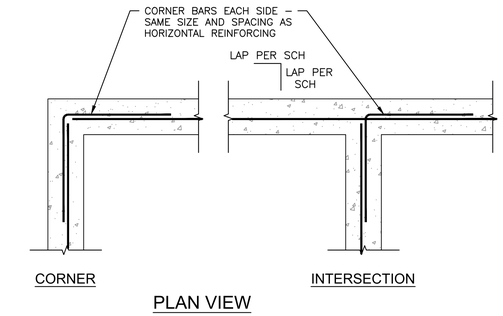
2 TYP CONC REINF BAR DETAILS

NTS TDH 1200



3 TYPICAL BLOCKOUT DETAIL

NTS TDH 1021



PLAN VIEW

4 CORNER AND INTERSECTION CONCRETE REINFORCING DETAIL

NTS TDH 1022

CAST–IN–PLACE (NONPRESTRESSED) CONCRETE	CONCRETE COVER
CAST AGAINST & EXPOSED TO EARTH	3"
EXPOSED TO EARTH OR WEATHER NO. 6 THROUGH NO. 18 BARS NO. 5 BAR, W31 OR D31 WIRE, AND SMALLER	 2" 1½"
CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND SLABS, WALLS, JOISTS NO. 14 AND NO. 18 BARS NO. 11 BAR, AND SMALLER BEAMS, COLUMNS PRIMARY REINFORCEMENT, TIES, STIRRUPS, SPIRALS SHELLS, FOLDED PLATE MEMBERS NO. 6 BAR AND LARGER NO. 5 BAR, W31 OR D31 WIRE, AND SMALLER	 1½" ¾" 1½" ¾" ½"

5 REINFORCING CONCRETE COVER

NTS TDH 11805

BAR SIZE			CONCRETE	
IN–LB	SOFT METRIC	AREA (IN*2)	HORIZ & VERT	TOP
#3	#10	0.11	1'–7"	2'–1"
#4	#13	0.20	2'–1"	2'–9"
#5	#16	0.31	2'–7"	3'–5"
#6	#19	0.44	3'–1"	4'–1"
#7	#22	0.60	4'–6"	5'–11"
#8	#25	0.79	5'–2"	6'–9"
#9	#29	1.00	5'–10"	7'–7"
#10	#32	1.27	6'–7"	8'–6"
#11	#36	1.56	7'–3"	9'–6"

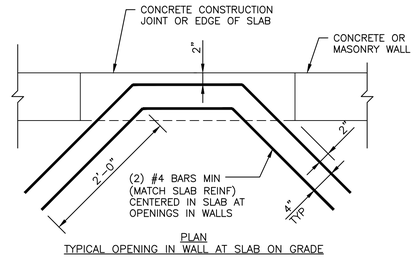
NOTES:
1. FOR REINFORCING WITH EPOXY COATING, MULTIPLY LAP LENGTH SHOWN BY 1.5.
2. CONCRETE LAP LENGTHS ARE CLASS "B" BASED ON F'C=4,000 PSI WITH COVER REQUIREMENTS INDICATED AND BAR SPACING AT LEAST TWO BAR DIAMETERS.
3. TOP BAR LAPS ARE HORIZONTAL LAPS WHERE MORE THAN 12" OF FRESH CONCRETE IS PLACED BELOW THE BARS.
4. TOP BAR LENGTHS MAY BE USED AT ALL LOCATIONS IN CONCRETE AT THE CONTRACTOR'S DISCRETION.

6 TYP. REINFORCING SPLICE LENGTHS

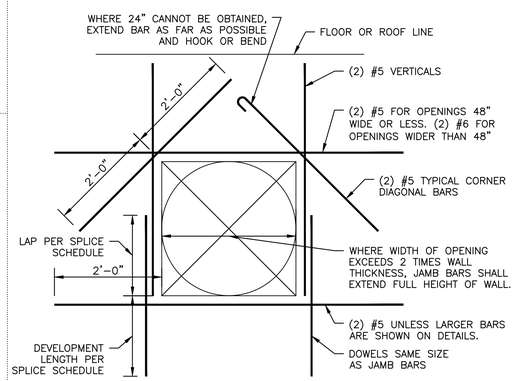
NTS TDH 1904 TDH 11806

7 TYPICAL HEADED ANCHOR ROD DETAIL

NTS

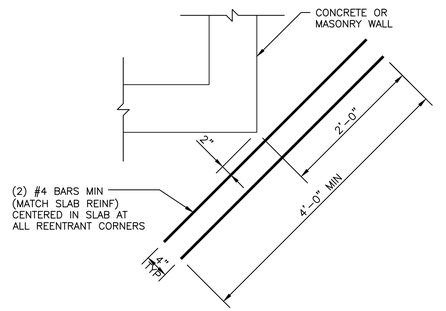


PLAN
TYPICAL OPENING IN WALL AT SLAB ON GRADE



9 TYPICAL OPENING IN CONCRETE WALL DETAIL

NTS TDH 1201 TDH 4001



PLAN
TYPICAL AT REENTRANT CORNER REINFORCING IN SLAB ON GRADE

12 TYPICAL REENTRANT CORNER REINFORCING IN SLAB-ON-GRADE

NTS TDH 1203

TD&H Engineering
tdhengineering.com
MONTANA
BRADY B. KAPP
No. 41800 PE
LICENSED PROFESSIONAL ENGINEER

FWP BIG SPRINGS RESIDENCE

Big springs Trout Hatchert, Lewistown, MT 59404
Paul Valle, Contact 406.841.4013 pvalle@mt.gov

PHASE REVISIONS

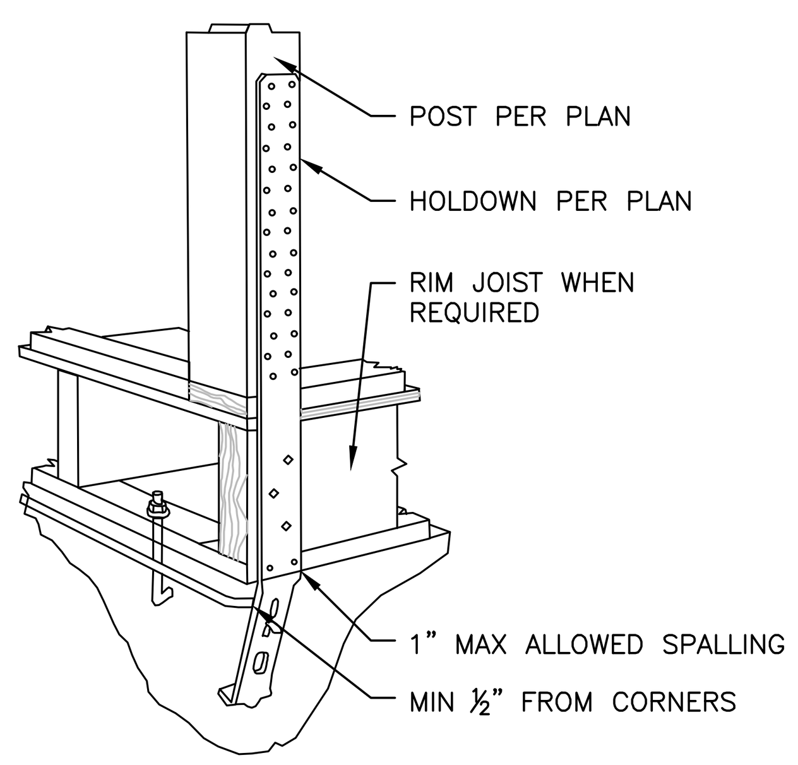
RE-BID - JANUARY 10, 2022

20011

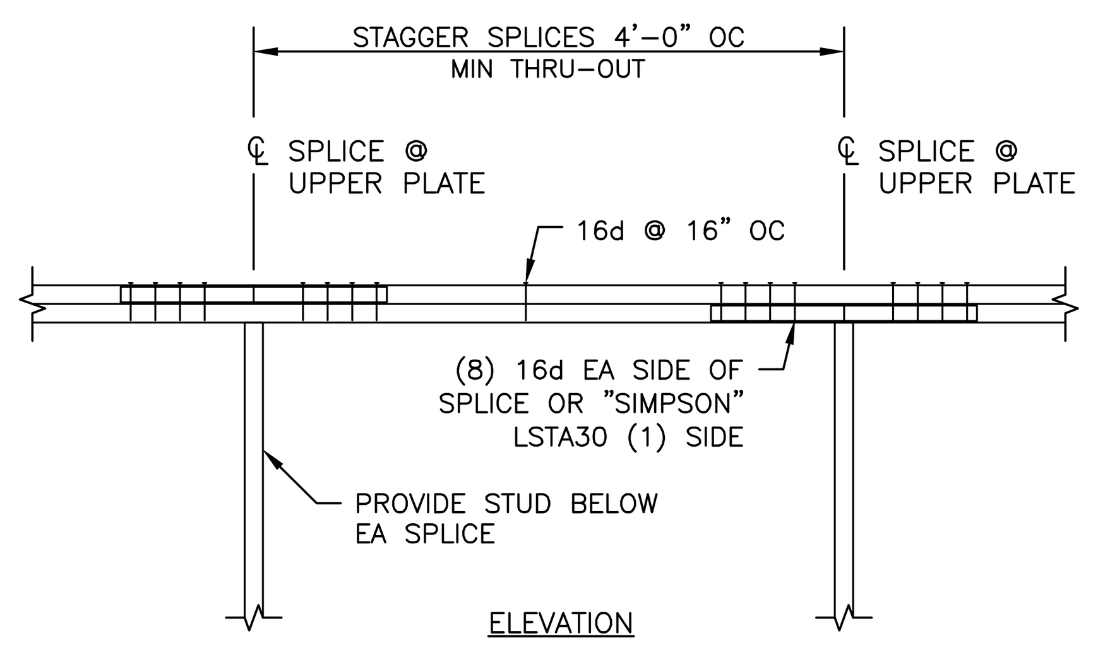
TYPICAL DETAILS

S1.2

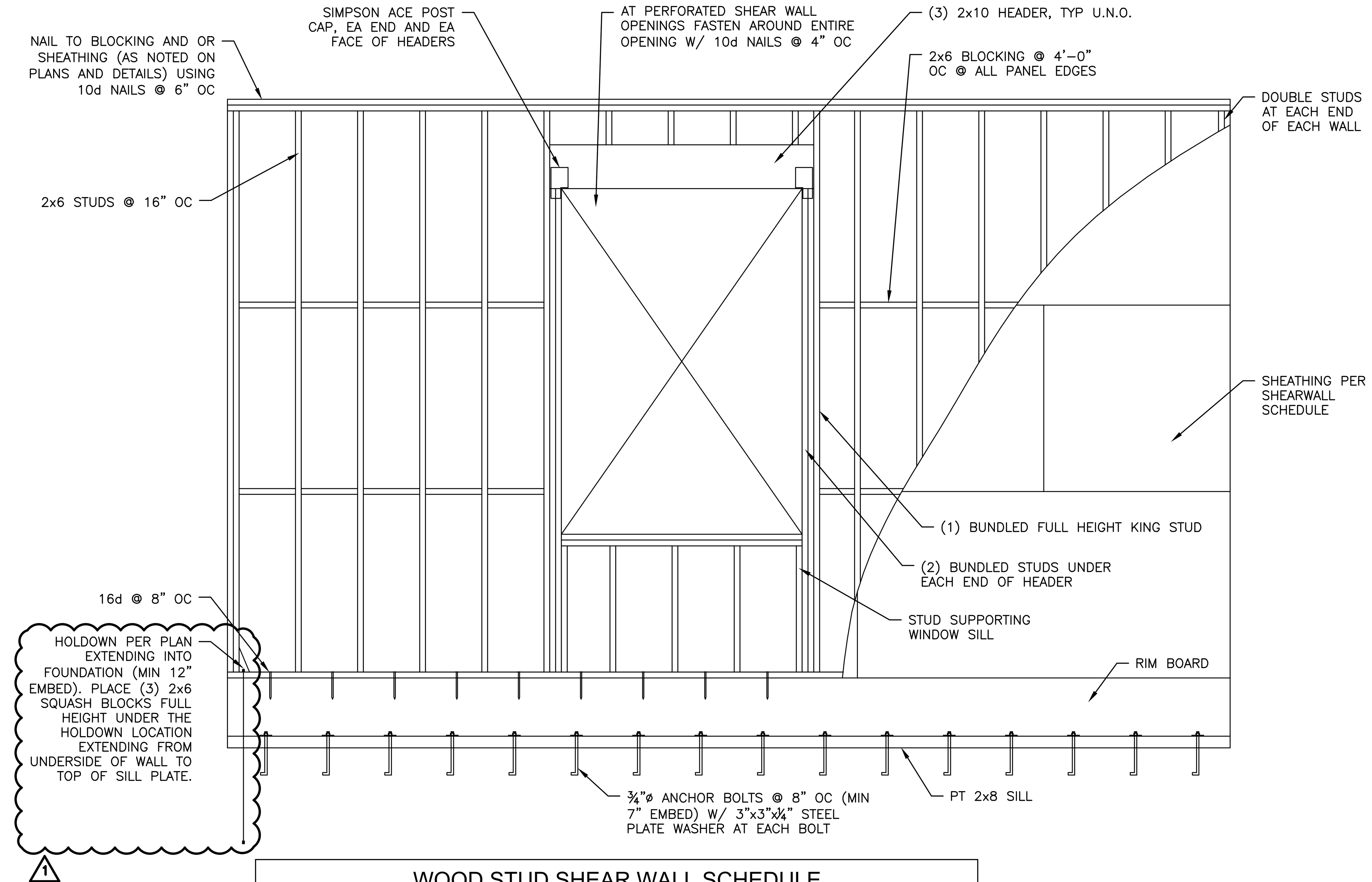
6/29/2020 3:25:22 PM



1 HOLDOWN DETAIL
NTS TDH 3020



2 TOP PLATE SPLICE
NTS TDH 3514



WOOD STUD SHEAR WALL SCHEDULE					
MARK	GWB & APA RATED PLYWOOD/OSB SHEATHING	NAIL SIZE	EDGE NAIL SPACING	FIELD NAIL SPACING	HOLDOWN
SW1	7/16" OSB	8d	6"	12"	NONE
SW2	7/16" OSB	8d	6"	12"	SIMPSON LSTHD8RJ

NOTES:
1. USE 4'x8' WOOD STRUCTURAL PANELS WITH EXTERIOR GLUE.
2. FIELD FASTENERS SHALL BE 12" OC AND STUD SPACING SHALL BE NO GREATER THAN 16" OC.
3. USE 3"x3"x0.229" PLATE WASHERS WITH ALL ANCHOR BOLTS AND 7" MINIMUM EMBEDMENT.
4. NAIL SHEATHING TO PT SILL ON CONCRETE WALL @ 6" OC.
5. NAIL SHEATHING TO WALL SILL @ 6" OC.

7 TYPICAL WOOD BEARING WALL & SHEARWALL DETAIL
NTS

TD&H Engineering
tdhengineering.com

MONTANA BRADY B. LASSILA No. 41800 PE LICENSED PROFESSIONAL ENGINEER

FWP BIG SPRINGS RESIDENCE

Big springs Trout Hatchert, Lewistown, MT 59404
Paul Valle, Contact 406.841.4013 pvalle@mt.gov

PHASE	REVISIONS	
REV 1	1	1/11/2022

20011

TYPICAL DETAILS

S1.3

6/29/2020 3:25:22 PM

J:\2020\20-060 FWP - Hatchery House - Lewistown\CADD\STRUCTURAL\20060-S1X.dwg, 1/11/2022 11:33:13 AM, RLT

TABLE 2304.10.1	FASTENING SCHEDULE	
DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
ROOF		
1. BLOCKING BETWEEN CEILING JOISTS, RAFTERS OR TRUSSES TO TOP PLATE OR OTHER FRAMING BELOW	3 – 8d COMMON (2½"x0.131"); OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	EACH END, TOENAIL
BLOCKING BETWEEN RAFTERS OR TRUSS NOT AT THE WALL TOP PLATE, TO RAFTER OR TRUSS.	2 – 8d COMMON (2½"x0.131") 2 – 3" x 0.131" NAILS 2 – 3" 14 GAGE STAPLES	EACH END, TOENAIL
	2 – 16d COMMON (3½"x0.162") 3 – 3" x 0.131" NAILS 3 – 3" 14 GAGE STAPLES	END NAIL
FLAT BLOCKING TO TRUSS AND WEB FILLER	16d COMMON (3½"x0.162") @ 6" O.C. 3" x 0.131" NAILS @ 6" O.C. 3" 14 GAGE STAPLES @ 6" O.C.	FACE NAIL
2. CEILING JOISTS TO TOP PLATE	3 – 8d COMMON (2½"x0.131"); OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	EACH JOIST, TOENAIL
3. CEILING JOIST NOT ATTACHED TO PARALLEL RAFTER, LAPS OVER PARTITIONS (NO THRUST). (SEE SECTION 2308.7.3.1, TABLE 2308.7.3.1)	3 – 16d COMMON (3½"x0.162"); OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131" NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	FACE NAIL
4. CEILING JOIST ATTACHED TO PARALLEL RAFTER (HEEL JOINT). (SEE SECTION 2308.7.3.1, TABLE 2308.7.3.1)	PER TABLE 2308.7.3.1	FACE NAIL
5. COLLAR TIE TO RAFTER	3 – 10d COMMON (3"x0.148"); OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131" NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	FACE NAIL
6. RAFTER OR ROOF TRUSS TO TOP PLATE (SEE SECTION 2308.7.5, TABLE 2308.7.5)	3 – 10d COMMON (3"x0.148"); OR 3 – 16d BOX (3½"x0.135"); OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131 NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	TOENAIL[c]
7. ROOF RAFTERS TO RIDGE VALLEY OR HIP RAFTERS; OR ROOF RAFTER TO 2–INCH RIDGE BEAM	2 – 16d COMMON (3½"x0.162"); OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131 NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	END NAIL
	3 – 10d COMMON (3"x0.148"); OR 4 – 16d BOX (3½"x0.135"); OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131 NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	TOENAIL

TABLE 2304.10.1-CONTINUED	FASTENING SCHEDULE	
DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
WALL		
8. STUD TO STUD (NOT AT BRACED WALL PANELS)	16d COMMON (3 ½" x 0.162");	24" O.C. FACE NAIL
	10d BOX (3"x0.128"); OR 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	16" O.C. FACE NAIL
9. STUD TO STUD AND ABUTTING STUDS AT INTERSECTING WALL CORNERS (AT BRACED WALL PANELS)	16d COMMON (3½"x0.162"); OR	16" O.C. FACE NAIL
	16d BOX (3½"x0.135"); OR	12" O.C. FACE NAIL
	3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	12" O.C. FACE NAIL
10. BUILT–UP HEADER (2" TO 2" HEADER)	16d COMMON (3½"x0.162"); OR	16" O.C. EACH EDGE, FACE NAIL
	16d BOX (3½"x0.135")	12" O.C. EACH EDGE, FACE NAIL
11. CONTINUOUS HEADER TO STUD	4 – 8d COMMON (2½"x0.131"); OR 4 – 10d BOX (3"x0.128")	TOENAIL
12. TOP PLATE TO TOP PLATE	16d COMMON (3½"x0.162"); OR	16" O.C. FACE NAIL
	10d BOX (3"x0.128"); OR 3" x 0.131" NAILS; OR 3" 14 GAGE STAPLES, 7/16" CROWN	12" O.C. FACE NAIL
13. TOP PLATE TO TOP PLATE, AT END JOINTS	8 – 16d COMMON (3½"x0.162");OR 12 – 10d BOX (3"x0.128"); OR 12 – 3" x 0.131" NAILS; OR 12 – 3" 14 GAGE STAPLES, 7/16" CROWN	EACH SIDE OF END JOINT, FACE NAIL (MINIMUM 24" LAP SPLICE LENGTH EACH SIDE OF END JOINT)
14. BOTTOM PLATE TO JOIST, RIM JOIST, BAND JOIST OR BLOCKING (NOT AT BRACED WALL PANELS)	16d COMMON (3½"x0.162"); OR	16" O.C. FACE NAIL
	16d BOX (3½"x0.135"); OR 3" x 0.131" NAILS; OR 3" 14 GAGE STAPLES, 7/16" CROWN	12" O.C. FACE NAIL
15. BOTTOM PLATE TO JOIST, RIM JOIST, BAND JOIST OR BLOCKING AT BRACED WALL PANELS	2 – 16d COMMON (3½"x0.162");OR 3 – 16d BOX (3½"x0.135"); OR 4 – 3" x 0.131" NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	16" O.C. FACE NAIL
16. STUD TO TOP OR BOTTOM PLATE	4 – 8d COMMON (2½"x0.131"); OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131" NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN; OR	TOENAIL
	2 – 16d COMMON (3½"x0.162");OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	END NAIL
17. TOP PLATES, LAPS AT CORNERS AND INTERSECTIONS	2 – 16d COMMON (3½"x0.162")OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	FACE NAIL

TABLE 2304.10.1-CONTINUED	FASTENING SCHEDULE	
DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
WALL		
18. 1" BRACE TO EACH STUD AND PLATE	2 – 8d COMMON (2½"x0.131"); OR 2 – 10d BOX (3"x0.128"); OR 2 – 3" x 0.131" NAILS; OR 2 – 3" 14 GAGE STAPLES, 7/16" CROWN	FACE NAIL
19. 1" X 6" SHEATHING TO EACH BEARING	2 – 8d COMMON (2½"x0.131"); OR 2 – 10d BOX (3"x0.128")	FACE NAIL
20. 1" X 8" AND WIDER SHEATHING TO EACH BEARING	3 – 8d COMMON (2½"x0.131"); OR 3 – 10d BOX (3"x0.128")	FACE NAIL
FLOOR		
21. JOIST TO SILL, TOP PLATE, OR GIRDER	3 – 8d COMMON (2½"x0.131"); OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	TOENAIL
22. RIM JOIST, BAND JOIST, OR BLOCKING TO TOP PLATE, SILL OR OTHER FRAMING BELOW	8d COMMON (2½"x0.131"); OR 10d BOX (3"x0.128"); OR 3" x 0.131" NAILS; OR 3" 14 GAGE STAPLES, 7/16" CROWN	6" O.C., TOENAIL
23. 1" X 6" SUBFLOOR OR LESS TO EACH JOIST	2 – 8d COMMON (2½"x0.131"); OR 2 – 10d BOX (3"x0.128")	FACE NAIL
24. 2" SUBFLOOR TO JOIST OR GIRDER	2 – 16d COMMON (3½"x0.162")	FACE NAIL
25. 2" PLANKS (PLANK & BEAM – FLOOR & ROOF)	2 – 16d COMMON (3½"x0.162")	EACH BEARING, FACE NAIL
26. BUILT–UP GIRDERS AND BEAMS, 2" LUMBER LAYERS	20d COMMON (4"x0.192")	32" O.C., FACE NAIL AT TOP AND BOTTOM STAGGERED ON OPPOSITE SIDES
	10d BOX (3"x0.128"); OR 3" x 0.131" NAILS; OR 3" 14 GAGE STAPLES, 7/16" CROWN	24" O.C., FACE NAIL AT TOP AND BOTTOM STAGGERED ON OPPOSITE SIDES
	AND: 2 – 20d COMMON (4"x0.192"); OR 3 – 10d BOX (3"x0.128"); OR 3 – 3" x 0.131" NAILS; OR 3 – 3" 14 GAGE STAPLES, 7/16" CROWN	ENDS AND AT EACH SPLICE, FACE NAIL
27. LEDGER STRIP SUPPORTING JOISTS OR RAFTERS	3 – 16d COMMON (3½"x0.162");OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131" NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	EACH JOIST OR RAFTER, FACE NAIL
28. JOIST TO BAND JOIST OR RIM JOIST	3 – 16d COMMON (3½"x0.162");OR 4 – 10d BOX (3"x0.128"); OR 4 – 3" x 0.131" NAILS; OR 4 – 3" 14 GAGE STAPLES, 7/16" CROWN	END NAIL
29. BRIDGING OR BLOCKING TO JOIST, RAFTER OR TRUSS	2 – 8d COMMON (2½"x0.131"); OR 2 – 10d BOX (3"x0.128"); OR 2 – 3" x 0.131" NAILS; OR 2 – 3" 14 GAGE STAPLES, 7/16" CROWN	EACH END, TOENAIL

TD&H Engineering
tdhengineering.com
MONTANA
REGISTERED
No. 41800 PE
LICENSED PROFESSIONAL ENGINEER

FWP BIG SPRINGS RESIDENCE

Big springs Trout Hatchert, Lewistown, MT 59404
Paul Valle, Contact 406.841.4013 pvalle@mt.gov

PHASE	REVISIONS
RE-BID - JANUARY 10, 2022	

20011

TYPICAL DETAILS

S1.4

6/29/2020 3:25:22 PM

J:\2020\20-060 MT FWP_Lewistown Services\CAD\STRUCTURAL\20060-S1X.dwg, 7/8/2020 10:05:55 AM, RLT

TABLE 2304.10.1-CONTINUED	FASTENING SCHEDULE		
DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION	
WOOD STRUCTURAL PANELS (WSP), SUBFLOOR, ROOF AND INTERIOR WALL SHEATHING TO FRAMING AND PARTICLEBOARD WALL SHEATHING TO FRAMING[a]			
		EDGES (INCHES)	INTERMEDIATE SUPPORTS (INCHES)
30. 3/8" – 1/2"	6d COMMON OR DEFORMED (2"x0.113") (SUBFLOOR AND WALL)	6	12
	8d COMMON OR DEFORMED (2 1/2"x0.113") (ROOF) OR RSRS–01 (2 3/8"x0.113") NAIL (ROOF)[d]	6	12
	2 3/8" x 0.113" NAIL (SUBFLOOR AND WALL)	6	12
	1 3/4" 16 GAGE STAPLE, 7/16" CROWN (SUBFLOOR AND WALL)	4	8
	2 3/8" x 0.113" NAIL (ROOF)	4	8
	1 3/4" 16 GAGE STAPLE, 7/16" CROWN (ROOF)	3	6
31. 19/32" – 3/4"	8d COMMON (2 1/2"x0.131"); OR 6d DEFORMED (2"x0.113") (SUBFLOOR AND WALL)	6	12
	8d COMMON OR DEFORMED (2 1/2"x0.131") (ROOF) OR RSRS–01 (2 3/8"x0.113:) NAIL (ROOF)[d]	6	12
	2 3/8" x 0.113" NAIL; OR 2" 16 GAGE STAPLE, 7/16" CROWN	4	8
32. 7/8" – 1 1/4"	10d COMMON (3"x0.148"); OR 8d DEFORMED (2 1/2"x0.131")	6	12
OTHER EXTERIOR WALL SHEATHING			
33. 1/2" FIBERBOARD SHEATHING[b]	1 1/2" GALVANIZED ROOFING NAIL (7/16" HEAD DIAMETER); OR 1 1/4" 16 GAGE STAPLE WITH 7/16" OR 1" CROWN	3	6
34. 25/32" FIBERBOARD SHEATHING[b]	1 3/4" GALVANIZED ROOFING NAIL (7/16" DIAMETER HEAD); OR 1 1/2" 16 GAGE STAPLE WITH 7/16" OR 1" CROWN	3	6
WOOD STRUCTURAL PANELS, COMBINATION SUBFLOOR UNDERLAYMENT TO FRAMING			
35. 3/4" AND LESS	8d COMMON (2 1/2"x0.131"); OR 6d DEFORMED (2"x0.113")	6	12
36. 7/8" – 1"	8d COMMON (2 1/2"x0.131"); OR 8d DEFORMED (2 1/2"x0.131")	6	12
37. 1 1/8" – 1 1/4"	10d COMMON (3"x0.148"); OR 8d DEFORMED (2 1/2"x0.131")	6	12
PANEL SIDING TO FRAMING			
38. 1/2" OR LESS	6d CORROSION–RESISTANT SIDING (1 7/8" x 0.106"); OR 6d CORROSION–RESISTANT CASING (2" x 0.099")	6	12
39. 5/8"	8d CORROSION–RESISTANT SIDING (2 3/8" x 0.128"); OR 8d CORROSION–RESISTANT CASING (2 1/2" x 0.113")	6	12

TABLE 2304.10.1-CONTINUED	FASTENING SCHEDULE		
DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION	
WOOD STRUCTURAL PANELS (WSP), SUBFLOOR, ROOD AND INTERIOR WALL SHEATHING TO FRAMING AND PARTICLEBOARD WALL SHEATHING TO FRAMING[a]			
		EDGES (INCHES)	INTERMEDIATE SUPPORTS (INCHES)
INTERIOR PANELING			
40. 1/4"	4d CASING (1 1/2"x0.080"); OR 4d FINISH (1 1/2"x0.072")	6	12
41. 3/8"	6d CASING (2"x0.099"); OR 6d FINISH (PANEL SUPPORTS AT 24 INCHES)	6	12

FOR SI: 1 INCH = 25.4 mm

a. NAILS SPACED AT 6 INCHES AT INTERMEDIATE SUPPORTS WHERE SPANS ARE 48 INCHES OR MORE. FOR NAILING OF WOOD STRUCTURAL PANEL AND PARTICLEBOARD DIAPHRAGMS AND SHEAR WALLS, REFER TO SECTION 2305. NAILS FOR WALL SHEATHING ARE PERMITTED TO BE COMMON, BOX OR CASING.

b. SPACING SHALL BE 6 INCHES ON CENTER ON THE EDGES AND 12 INCHES ON CENTER AT INTERMEDIATE SUPPORTS FOR NONSTRUCTURAL APPLICATIONS. PANEL SUPPORTS AT 16 INCHES (20 INCHES IF STRENGTH AXIS IN THE LONG DIRECTION OF THE PANEL, UNLESS OTHERWISE MARKED).

c. WHERE A RAFTER IS FASTENED TO AN ADJACENT PARALLEL CEILING JOIST IN ACCORDANCE WITH THIS SCHEDULE AND THE CEILING JOIST IS FASTENED TO THE TOP PLATE IN ACCORDANCE WITH THIS SCHEDULE, THE NUMBER OF TOENAILS IN THE RAFTER SHALL BE PERMITTED TO BE REDUCED BY ONE NAIL.

d. RSRS–01 IS A ROOF SHEATHING RING SHANK NAIL MEETING THE SPECIFICATIONS IN ASTM F1667.

TD&H Engineering
tdhengineering.com

MONTANA
BRADY B. LASSILA
No. 41800 PE
LICENSED
PROFESSIONAL ENGINEER

FWP BIG SPRINGS RESIDENCE

Big springs Trout Hatchert, Lewistown, MT 59404
Paul Valle, Contact 406.841.4013 pvalle@mt.gov

PHASE	REVISIONS
RE-BID - JANUARY 10, 2022	

20011

TYPICAL DETAILS

S1.5

6/29/2020 3:25:22 PM