GEOTECH
CONSULTANTS, INC.

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January 7, 2021

JN 20503

Ty and Ayesha Harper
6551 – 81st Avenue S.E.
Mercer Island, Washington 98040
via email: ayeshaharper@hotmail.com

Subject: **Foundation, Landslide Hazard, and Erosion Hazard Considerations**
Proposed Additions to Existing Residence
6551 – 81st Avenue S.E.
Mercer Island, Washington

Dear Mr. and Mrs. Harper:

We are pleased to provide this geotechnical report with recommendations for the additions to your existing residence in Mercer Island. Our scope of work for this project included visiting the site to observe site conditions, completing shallow hand explorations in the area of the proposed additions, providing recommendations for foundations, and evaluating slope stability and erosion hazards at the site. This work was authorized by our **Contract for Professional Services.**

From the information provided, we that the existing covered storage area off the southeast corner of the existing house will be removed and be replaced with an enclosed addition to the house that will occupy essentially the same small footprint. A two-story addition will be extended off the southern face of the existing house, extending into the existing side yard. A small addition to the kitchen in the northwest corner of the house will replace the existing cantilevered bay window. No deep excavations for below-grade living spaces are expected for this project.

SITE CONDITIONS

The existing residence is located on the western side of 81st Avenue Southeast, with Southeast 65th Street abutting the southern property boundary. The property around the house is relatively flat, and is mostly covered by driveway, walkways, a low rear deck, and yard and landscaping. The existing residence appears to be underlain by a crawl space. Based on our soil probing, the top of the perimeter foundation is only approximately 12 inches below the ground surface.

There are not steep slopes on, or around, the site. The ground surface on your lot and the surrounding properties slopes very gently down toward the north. The nearest steep slopes are located to the east of, behind, the houses that are situated on the eastern side of 81st Avenue Southeast. This is over 150 from the eastern boundary of the site.

Our review of the Mercer Island GIS indicates that the site is mapped to lie within both potential landslide hazard and potential seismic areas. The steep slope located to the east of the houses situated on the eastern side of 81st Avenue Southeast is well known for periodic landslides resulting from seepage that exits the steep slope at an interface between dense, glacially-compressed soil (glacial till) and a localized terrace of more permeable sands overlying the glacial till at the location of the steep slope. These slides typically affect the backyards of the houses located above (east of)

and below (west of) the steep slope. As discussed above, the subject lot is located over 150 feet west of the toe of this steep slope, and is far removed from this landslide hazard.

During our December 28, 2020 visit to the site, we assessed the soil conditions in hand-excavated test holes conducted at the three planned additions. The approximate locations of these Test Holes are shown on the attached copy of the Site Plan. The test holes conducted at the southeastern storage area (TH-1), and at the southeast corner of the planned southern addition (TH-2) revealed approximately 3.0 feet of topsoil and silty sand fill beneath the existing ground surface. This fill was underlain by loose, silty sand that became dense at a depth of 3.5 to 4.0 feet. The test holes conducted at the southwest corner of the southern addition (TH-3) and at the planned kitchen addition (TH-4) found loose, sandy silt with organics to the maximum 5-foot depth that was explored. This soil appears to be uncompacted fill. No undisturbed native soil was found in these test holes. Groundwater was encountered in TH-2 at 2.5 feet, and at a depth of 3.5 feet in TH-3 and TH-4.

CONCLUSIONS AND RECOMMENDATIONS

Based on our subsurface exploration, and available geologic information, the site is underlain by glacially compressed soil that is suitable to support the foundation loads from the new additions. However, due to the excavation depth required to expose suitable bearing soils, particularly in the west side of the southern addition and in the kitchen addition, and the potential that these excavations could undermine existing foundations, we recommend that the foundations for the new additions be supported on small diameter pipe piles. These piles would be driven to refusal through the upper loose fill into the glacially compressed soil below, avoiding excessive post-construction settlement of the new construction. The use of pipe piles instead of conventional foundations in this case would help to reduce the excavation extents and limit the site disturbance to the minimum necessary to install the pipe piles and construct the pile supported foundations. It will also minimize the amount of settlement that the new foundations will undergo, which will limit the potential for noticeable settlement between the new and existing construction.

The foundations that will support the new additions will be embedded into dense, non-liquefiable soils. This will mitigate the seismic hazard for the project.

There are no steep slopes on, or near, the site. The planned development is located over 150 feet from steep, slide-susceptible slope situated to the east of the homes that are on the east side of 81st Avenue Southeast. The planned development will require minimal excavations, which will not increase the landslide hazard to the site or the neighboring properties. Also, the large setback between the eastern steep slope, and the presence of a street and existing homes between the planned development and the steep slope will protect the proposed additions from damage due to any future instability on the steep slope. No additional mitigation measures, such as slide protection walls or additional buffers, are needed to address the mapped potential landslide hazard.

Because the site and the surrounding area are sloped at least than 15 percent, it would not meet their definition of an erosion hazard area under the Mercer Island Code. A straw wattle or silt fence should be erected around the downslope sides of the work area. Existing vegetation and surface cover should remain undisturbed outside of the work area. Care will have to be taken to prevent tracking of soil or mud off the site by trucks or workers.

The site is underlain by silty, glacially-compressed soil that is essentially impervious. This has created a shallow perched groundwater condition present at least during the wet season.

Considering these issues, and the relatively flat nature of the site, it is our professional opinion that onsite infiltration or dispersion of runoff from impervious areas is infeasible.

In order to satisfy the City of Mercer Island's requirements, we make the following statement:

> In our judgment, the development practices that we have recommended in this report should render the new construction as safe as if it were not located in a geologic hazard area.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site soil profile within 100 feet of the ground surface is best represented by Soil Profile Type D (Stiff Soil).

The dense soils that will support the foundations will not liquefy under the ground motions of the Code-required Maximum Considered Earthquake (MCE), which has a 2 percent probability of occurrence in a 50-year time period (once in 2,475 years).

PIPE PILES

A 2-inch-diameter pipe pile driven with a minimum 90-pound jackhammer or a 140-pound Rhino hammer to a final penetration rate of 1-inch or less for one minute of continuous driving may be assigned an allowable compressive load of 3 tons. Extra-strong, Schedule 80 steel pipe should be used. Load tests are not required to verify this capacity.

Three- or 4-inch-diameter pipe piles driven with a 850- or 1,100- or 2,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE (850-pound hammer)	FINAL DRIVING RATE (1,100-pound hammer)	FINAL DRIVING RATE (2,000-pound hammer)	ALLOWABLE COMPRESSIVE CAPACITY
3 inches	10 sec/inch	6 sec/inch	2 sec/inch	6 tons
4 inches	16 sec/inch	10 sec/inch	4 sec/inch	10 tons

Note: The refusal criteria indicated in the above table are valid only for pipe piles that are installed using a hydraulic impact hammer carried on leads that allow the hammer to sit on the top of the pile during driving. Load tests are not required for piles driven in this manner. If the piles are installed by alternative methods, such as a vibratory hammer or a hammer that is hard-mounted to the installation machine, numerous load tests to 200 percent of the design capacity would be necessary to substantiate the allowable pile load. The appropriate number of load tests would need to be determined at the time the contractor and installation method are chosen.

As a minimum, Schedule 40 pipe should be used for 3- or 4-inch piles.

The site soils are not highly organic and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard “black” pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles. Subsequent pipe sections should be connected using threaded or slip couplers, or by welding. If slip couplers are used, they must fit snugly into the ends of the pipes. This can require that shims or beads of welding flux be applied to the couplers.

Pile caps and grade beams should be used to transmit loads to the piles. A minimum of two piles should be used in isolated pile caps, to prevent eccentric loading on individual piles.

Lateral loads may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or surrounded by level structural fill. We recommend using an ultimate (no safety factor included) passive earth pressure of 300 pounds per cubic foot (pcf) for this resistance. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. Due to their small diameter, the lateral capacity of vertical pipe piles is negligible.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test holes are representative of subsurface conditions on the site.

This report has been prepared for the exclusive use of the Harpers, and their representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew, and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we

actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

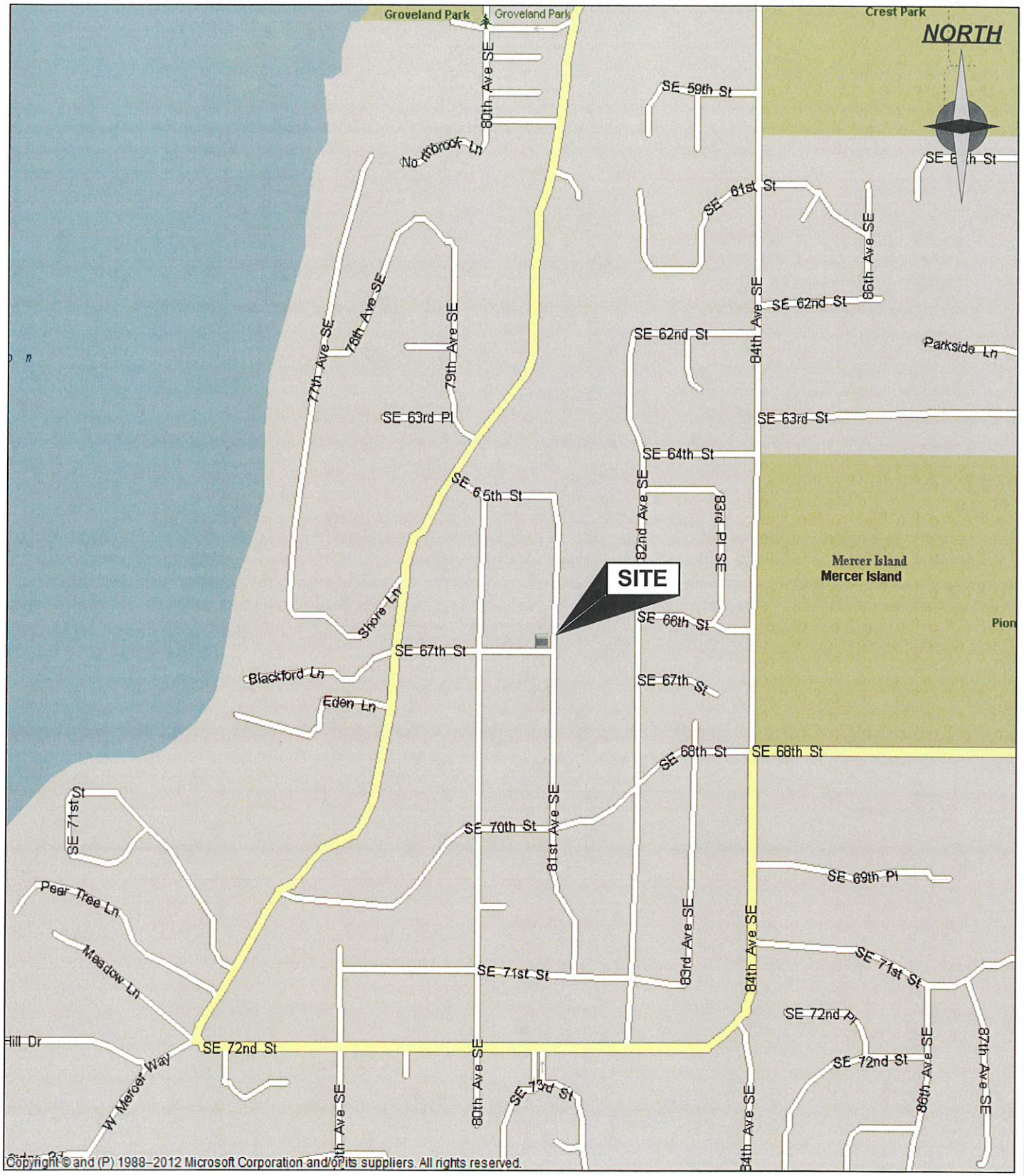
GEOTECH CONSULTANTS, INC.

12/07/2021
Marc R. McGinnis, P.E.
Principal

Attachments: Vicinity Map, Site Exploration Plan

cc: **Floisand Studio** – Allison Hogue
via email: allison@floisandstudio.com

MRM:kg



(Source: Microsoft MapPoint, 2013)

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VICINITY MAP

6551 - 81st Avenue S.E.
Mercer Island, Washington

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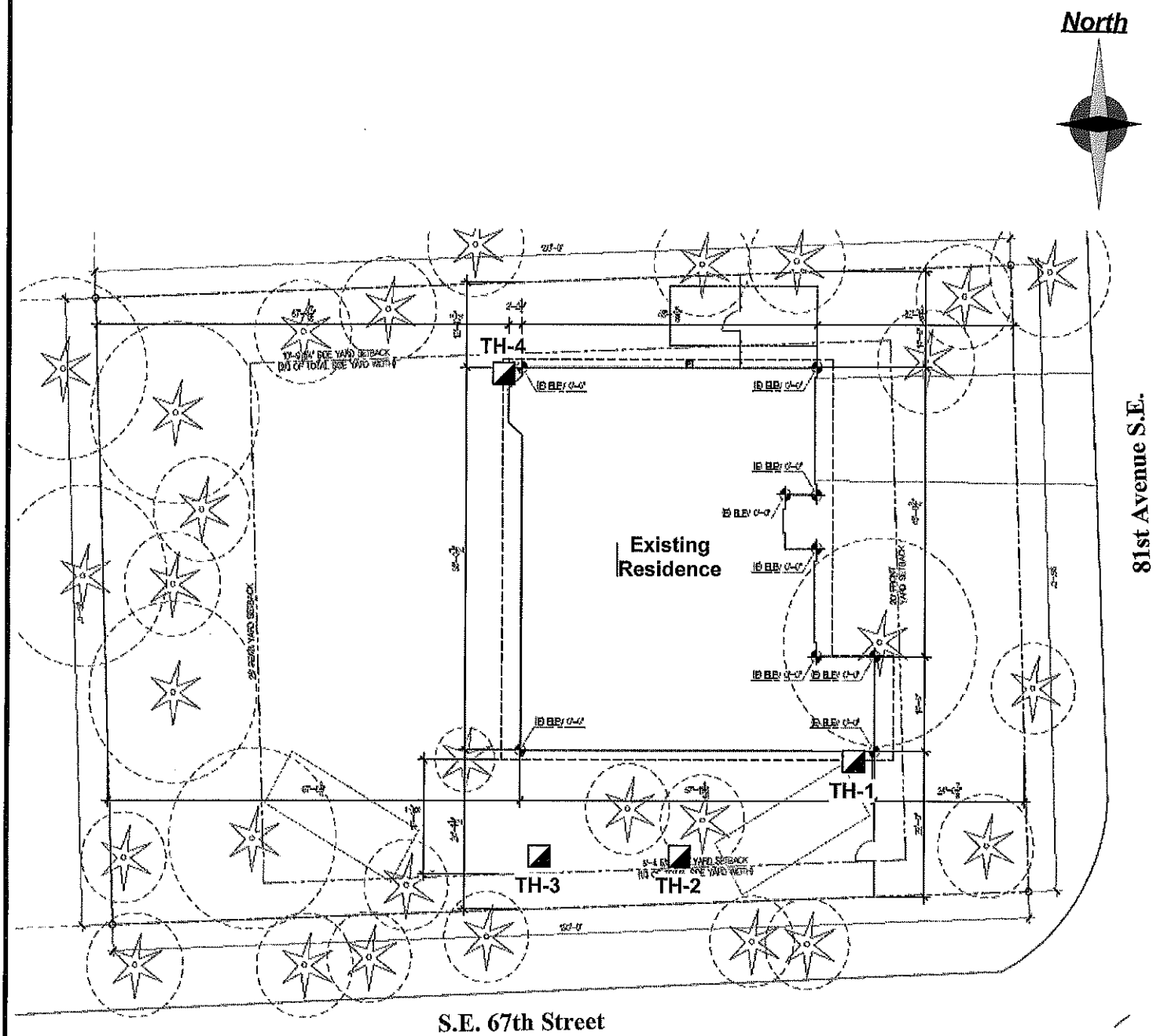
20503	Jan. 2021		1



Legend:

TH-1 Test Hole Location

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SITE EXPLORATION PLAN

6551 - 81st Avenue S.E.
Mercer Island, Washington

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20503	Jan. 2021	No Scale	2