

Memorandum

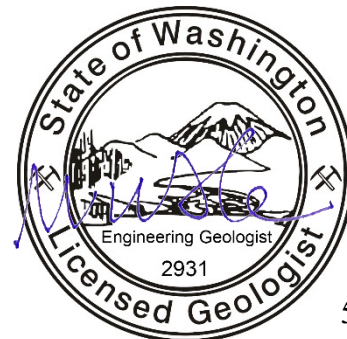
Date May 26, 2026

To: Patrick Fry, PE
City of Snoqualmie Parks and Public Works Department
P.O. Box 987
Snoqualmie, Washington 98065

cc: Andrew Austreng, LHG, Geosyntec Consultants



5/26/2026



5/26/2026

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Re: **Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington**

Project No.: 26000080

This memorandum presents the results of the Geosyntec Consultants, Inc. (formerly Aspect Consulting), geotechnical evaluation of the alignment of the City of Snoqualmie's (City) Canyon Springs water supply pipeline (Project). The pipeline extends along the slope of the right bank of the North Fork of the Snoqualmie River for approximately 5,600 feet from spring collectors to a

pressure-relief valve (PRV), meters, and chlorination station in Ernie's Grove; from there, it connects to the City's distribution system. Much of the 5,600-foot alignment is on steep, unstable slopes. An access path parallels the pipeline alignment for its entire length.

Our services were performed in general accordance with the scope of work in "Amendment No. 4 to Consultant Services Contract for Water Rights Permitting Services, City of Snoqualmie Water Right Permitting Support and Geotechnical Monitoring."

Project History

The City's pipeline has been in operation since the 1950s. The original wood-stave pipeline was abandoned in place and replaced with a ductile-iron pipeline in the 1980s. In 2017, a landslide downslope from a 150-foot-long section of the pipeline exposed the abandoned wood-stave pipeline and threatened to undermine the active ductile-iron pipeline. In response, at the City's request, Aspect performed and reported on a geotechnical assessment of the slide area (Aspect, 2018a) and made recommendations for slide repair measures. Aspect then prepared a design report and plans for the repair (Aspect, 2018b), performed periodic inspections, and prepared a final inspection memo during construction of the repair in 2019 (Aspect, 2019).

Starting in 2020, Aspect has performed several traverses of the pipeline alignment and reported findings and recommendations in six memos (Aspect, 2020; 2021; 2022a; 2022b; 2023; 2024; 2025a; 2025b). Geosyntec performed the most recent (spring) traverse of the pipeline alignment in March 2026 and performed a UAV reconnaissance of selected areas of the alignment on May 1, 2026. This memo presents findings and recommendations from the spring 2026 traverse and UAV flight.

Site Conditions

The geologic setting for the pipeline was discussed in detail in the geotechnical assessment of the landslide (Aspect, 2018a). A summary of the relevant geology follows.

From the PRV at Station (STA) 00+00 to STA 37+25 (Figures 1 and 2), the steep slope into which the pipeline and access trail are cut is underlain by mostly intact bedrock. Because of this, the geologic hazard to the City's infrastructure continues to be low, though some areas should be monitored. These areas are described in detail in the following sections.

In contrast, from STA 37+25 to the end of the pipeline at the collectors at STA 56+00 (Figure 3), the pipeline and access trail are cut into a steep slope underlain by sand and gravel glacial outwash deposits. Here, the geologic hazards to the City's infrastructure continue to be higher. As of March 2026, we have identified an elevated hazard to the segment of pipeline between STA 41+50 and 43+50.

Slope Monitoring

During our autumn 2024 site visit, we installed four monitoring points in portions of the slope where, in our determination, there was the highest risk to the pipeline. Each monitoring point consists of an 18-inch-long piece of ¼-inch diameter steel rebar, which we drove vertically into the ground surface at least 6 inches. Each monitoring point was assigned a prefix of "AMP" followed by an identification number (e.g., "01"). We obtained high-precision GPS coordinates for each monitoring point using a handheld GPS unit and collected photos documenting each monitoring

point location and surrounding conditions. During subsequent site visits, we collected repeat GPS coordinates for each point and noted any changes in surrounding conditions, including tilting, erosion or accumulation of surrounding material, and distance from monitoring point to the edge of scarp, where appropriate. We will continue monitoring each point during subsequent site visits.

The four monitoring points are located at approximately STA 46+40 (AMP-01), STA 44+20 (AMP-02), STA 43+30 (AMP-03), and STA 41+80 (AMP-04; Figure 3). Descriptions of each monitoring point location are provided in the following sections. In addition to the global observations gathered during our biannual hazard assessments, repeat measurements at these discrete monitoring points along the slope will allow us to more accurately quantify incremental changes to the slope at these points over time.

Bedrock Slope, STA 00+00 to STA 37+25

The Bedrock Slope portion of the pipeline alignment extends from the PRV near the parking area at the end of SE 70th Street (STA 00+00) to the cleared platform on the slope located directly south of the 2019 landslide repair (STA 37+25; Figures 1 and 2). The geologic hazards to the pipeline, access trail, and chlorination stations in the Bedrock Slope area are generally low. We observed no new indications of recent or imminent slope movement of a scale that could threaten the pipeline.

Near the PRV (STA 4+75), we observed a segment of the ductile-iron pipe visible near the culvert inlet on the upslope side of the trail. The exposed pipe has been visible and unchanged since 2019. As in the previous surveys, in several areas (e.g., STA 10+00, 13+75, 16+95), springs and rivulets on the slope above have caused minor erosion on the trail surface, and in a few other areas (e.g., STA 14+50, STA 17+50), small deposits of rockfall or colluvial material exist on the uphill side of the access trail. There has been no significant change along this section since our autumn 2025 assessment. None of the erosion or deposition onto the path threatens the pipeline at this time.

Glacial Outwash Slope, STA 37+25 to 56+00

The Glacial Outwash Slope extends from the 2019 landslide repair (STA 37+25) to the spring boxes located at the eastern end of the pipeline alignment (STA 56+00; Figure 3). The geologic hazards to the pipeline are higher where it traverses the glacial outwash slope along the meander bends of the North Fork Snoqualmie River in this slope segment. As in the previous traverses of the alignment, we observed evidence of shallow colluvial landslide activity in several locations that originate both upslope and downslope of the pipeline alignment.

During the spring 2026 traverse, we observed that the anchored mesh installed to stabilize the 2017 landslide area was in generally good condition and functioning as intended. We observed some areas where a 1- to 2-inch gap was visible between the mesh and underlying colluvial material (Figure 4: Photograph 1). Small deciduous trees and brushy vegetation have become established within the anchored mesh of the slide repair.

The five areas of the glacial outwash slopes listed below deserve more detailed descriptions (although the hazard to the pipeline is only elevated in one of these areas compared to our last assessment and observations made in autumn 2025).

1. STA 40+00 to 41+50

The colluvial slide that originates approximately 80 feet upslope of the access trail and pipeline between STA 40+00 and about 41+50 continues to actively slough and ravel. The vertical head

scarp is about 5 feet high and appears to have continued to retreat upslope since the autumn 2025 site visit. Glacial outwash, including boulders, cobbles, and gravel in a sandy matrix, are exposed in the head scarp. The fan below the head scarp consists of glacial outwash, deadwood, and organic debris in several “chutes” that overlap the pipeline alignment and the access trail (Figure 4: Photograph 2). At the toe of the fan, at about the location of the pipeline alignment, immature deciduous trees are growing, and we observed boulders up to a few feet in diameter that were retained on the slope only by resting against tree trunks.

Continued mass movement within the slide area will deposit more material at the toe of the fan, burying the pipeline deeper and restricting access to the trail. While the growing debris fan does not itself present a significant hazard to the integrity of the buried pipeline, if material is removed from the toe of the fan, either by construction activities or by natural slope failure processes, the hazard to the pipeline would increase.

2. STA 41+50 to 43+50

The slide that originates below the pipeline between STA 41+50 and 43+50 showed evidence of significant additional failure between autumn 2025 and spring 2026. The head scarp has receded about 5 feet since our autumn 2025 visit. In 2025, the scarp was about 16 feet below the pipeline alignment at the closest point; the scarp is now about 11 feet from the pipeline alignment. Our monitoring point AMP-04 (STA 41+80) was about 5 feet from the head scarp in autumn of 2025; the monitoring point is now less than 6 inches from the scarp (Figure 4: Photograph 4). In the near-vertical to overhanging head scarp, up to about 8 feet tall, colluvium and tree roots are exposed. The roots of several mature conifers growing at the edge of the scarp are partially exposed and the trees are now susceptible to toppling. Large tree topples can contribute to sudden and significant head scarp recession. Fresh colluvium and toppled vegetation were visible in the debris fan below the scarp (Figure 4: Photograph 3).

In our opinion, the overall hazard to the pipeline has increased at this location. The geology, geomorphology, and relative location of this slide compared to the pipeline and river are all similar to the 2017 landslide that necessitated the slope repair, and this location may warrant a similar repair in the next few years.

3. STA 44+00 to 45+50

The slide that crosses the pipeline between STA 44+00 and 45+50 originates at the top of the entire slope, approximately 350 feet upslope from the pipeline, and continues down to the river, approximately 50 feet downslope. If this entire slide were to reactivate, it could scour material from around and below the pipeline and threaten the pipeline’s integrity.

In spring 2026, we observed no additional movement or activity on this slope above or below the pipeline alignment except right at the water’s edge. We did not observe any changes to monitoring point AMP-02, located just upslope from the pipeline alignment at STA 44+20. At the water’s edge, we noted fresh bank erosion and new recession of the near-vertical head scarp, as well as newly leaning and toppled trees. As further bank erosion occurs, the slope failure will propagate upslope and closer to the pipeline alignment, but no increased hazard to the pipeline is imminent. The overall hazard to the pipeline is moderate at this location and unchanged since our last site visit.

4. STA 46+00 to 46+50

The steep slope located on the downslope side of the trail and pipeline alignment is about 40 feet in height with some leaning and toppled trees. This slope area is more densely vegetated and with less exposed soil and colluvium than more active slide areas downstream, and it does not appear to be rapidly failing now. However, the leaning and toppled trees here indicate that the slope is slowly moving or creeping, and the slope should be monitored for indications of increased instability. A slide below the pipeline here could present a hazard to the pipeline. Monitoring point AMP-01, located downslope of the trail at 46+40, was not located during the spring 2026 traverse; several large trees toppled in the vicinity of the monitoring point and possibly obscured it. The overall hazard to the pipeline is generally low in this area.

5. STA 49+00 to 54+00

Streams that flow over and under the access trail and pipeline in several places along the alignment between STA 49+00 and 54+00 present an erosional hazard to the pipeline. Additionally, flow from culvert outlets is incising into the slopes below the access trail. When culverts that convey streams under the pipeline are blocked with fallen deadwood, vegetation, and stream bedload, the streams could be diverted or backed up, which will cause erosion to the embankment supporting the trail and pipeline.

During the spring 2026 site visit, we observed woody debris and sediment causing partial blockage of the culvert inlets from about 51+00 to 51+40, which has resulted in water ponding upslope and flowing over the trail in places. Water still flowed freely through the culverts despite the partial blockage. We observed a greater degree of trail erosion due to water flowing from upslope in the vicinity of the spring boxes located near STA 49+50 (Figure 4; Photograph 5). Several pieces of black corrugated plastic pipe appear to have broken off from the culvert near STA 49+50 and are scattered in the stream below the trail.

We observed a deep gulley incising into the slope downslope of the access trail near STA 52+00. This gulley is not currently posing a hazard to the pipeline but should be monitored (Figure 4; Photograph 6). The culvert outlet is about 15 feet waterward of the pipeline alignment as of spring 2026. This gulley should be monitored for ongoing erosion downslope of the trail, especially if mature tree roots become exposed or undercut. A second gulley was observed incising into the slope at the culvert outlet below the trail near STA 51+50. The overall hazard to the pipeline through this area is generally low, except in areas where the culvert inlets are blocked.

At Station 51+50, there is a boulder partially blocking the culvert inlet. Currently, water flow is not completely blocked; however, the culvert is at risk of being blocked if additional material is added or the boulder shifts.

In general, between 49+00 and 54+00, slopes above and below the pipeline are densely vegetated and appear relatively stable. The river does not appear to be actively incising into the slope toe in this area.

Conclusions and Recommendations

Substantial slope movement has occurred in the area between STA 41+50 and 43+50. We consider the hazard to the pipeline to be elevated in this area compared to previous other areas and elevated

compared to our hazard assessment from previous site visits. We recommend slope stabilization treatment in this area, similar to the area around STA 37+25 that was stabilized in 2019.

In addition, the steep slopes above and below the entire length of the alignment merit regular monitoring, especially at the locations listed below.

Rockfalls Near STA 12+50 and Elsewhere

Although rockfalls, surficial landslides, and tree falls from the steep slopes onto the road from the PRV to STA 37+25 do not present significant hazard to the pipeline, they could threaten function and access to the chlorination stations. Though the hazard is low, the environmental and safety risk from damage to the chlorination station may be high. We recommend visual inspections of the chlorination stations after intense or prolonged precipitation to ensure that rockfall or tree fall have not damaged or obstructed access to them.

Slides Downslope of the Pipeline from STA 44+00 to 45+50

Although these slides do not threaten the pipeline imminently, they should be monitored for disturbance. The distance from the pipeline to the top of the scarp in both areas is 17–20 feet, which is unchanged from previous observations. When that distance is less than 10 feet, those areas should be monitored after each substantial storm event.

Culverts from STA 51+50 to 52+00

The inlets for these culverts should be inspected and cleared of blockage periodically and following storm events. Even with the inlets only partially blocked, heavy streamflow can overtop the access path and quickly erode down to the pipeline. Action should be taken to remove blockage from culvert inlets as needed. We recommend inspecting culverts in this area for damage and repairing when needed. Flow from upslope should be conveyed through culverts under the trail and should not be allowed to flow uncontrollably over the trail surface. The slopes below the culvert outlets in the vicinity of 52+00 should be monitored for ongoing erosion.

Next Steps

Geosyntec recommends continued twice-yearly walking traverses of the pipeline alignment, starting with our walking traverse in fall 2026.

We recommend that consideration be given to the design and construction of an anchored mesh slope stabilization for the area between STA 41+50 and 43+50 where the head scarp has moved several feet closer to the pipeline since our last site visit. Geosyntec plans to complete a supplemental site walk with our geotechnical engineer on the afternoon of May 28, 2026. We understand that as part of the slope stabilization construction contract, the City would like to improve or restore the access path leading out to the spring boxes at STA 56+00 so that they can be more readily accessed with small, motorized gator/side-by-side equipment for maintenance and repair. Our proposal will include evaluation and design of the slope stabilization from 41+50 to 43+50 and trail improvements out to the spring boxes near STA 56+00.

References

- Aspect Consulting, LLC (Aspect), 2018a, Geotechnical Engineering Landslide Evaluation – Canyon Springs Water Transmission Pipeline, King County, Washington, Project 150386, January 4, 2018.
- Aspect Consulting, LLC (Aspect), 2018b, Canyon Springs Waterline Landslide Repair Basis of Design Report, Prepared for: City of Snoqualmie, Project No. 150386, May 30, 2018.
- Aspect Consulting, LLC (Aspect), 2019, Canyon Springs – Final Letter for Geotechnical Special Inspections, Prepared for: City of Snoqualmie, Project No. 150386, September 23, 2019.
- Aspect Consulting, LLC (Aspect), 2020, Geologic Hazard Assessment– Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, May 11, 2020.
- Aspect Consulting, LLC (Aspect), 2021, Geologic Hazard Assessment– Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, November 17, 2021.
- Aspect Consulting, LLC (Aspect), 2022a, Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, March 23, 2022.
- Aspect Consulting, LLC (Aspect), 2022b, Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, December 27, 2022.
- Aspect Consulting, LLC (Aspect), 2023, Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, July 13, 2023.
- Aspect Consulting (Aspect), 2024, Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, July 12, 2024.
- Aspect Consulting (Aspect), 2024b, Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, November 8, 2024.
- Aspect Consulting (Aspect), 2025, Geologic Hazard Assessment – Canyon Springs Water Transmission Pipeline, King County, Washington. Prepared for: City of Snoqualmie, Project No. 150386, November 8, 2024.

Limitations

Work for this project was performed for the City of Snoqualmie Parks and Public Works Department (Client), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Geosyntec Consultants, Inc. (Geosyntec).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Geosyntec.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Geosyntec should be notified immediately to review the applicability of our recommendations.

Risks are inherent with any site involving slopes, and no recommendations, geologic analysis, or engineering design can assure slope stability. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the Client.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. If project developments result in changes from the preliminary project information, Geosyntec should be contacted to determine whether our recommendations contained in this report should be revised and/or expanded upon.

The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor's site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

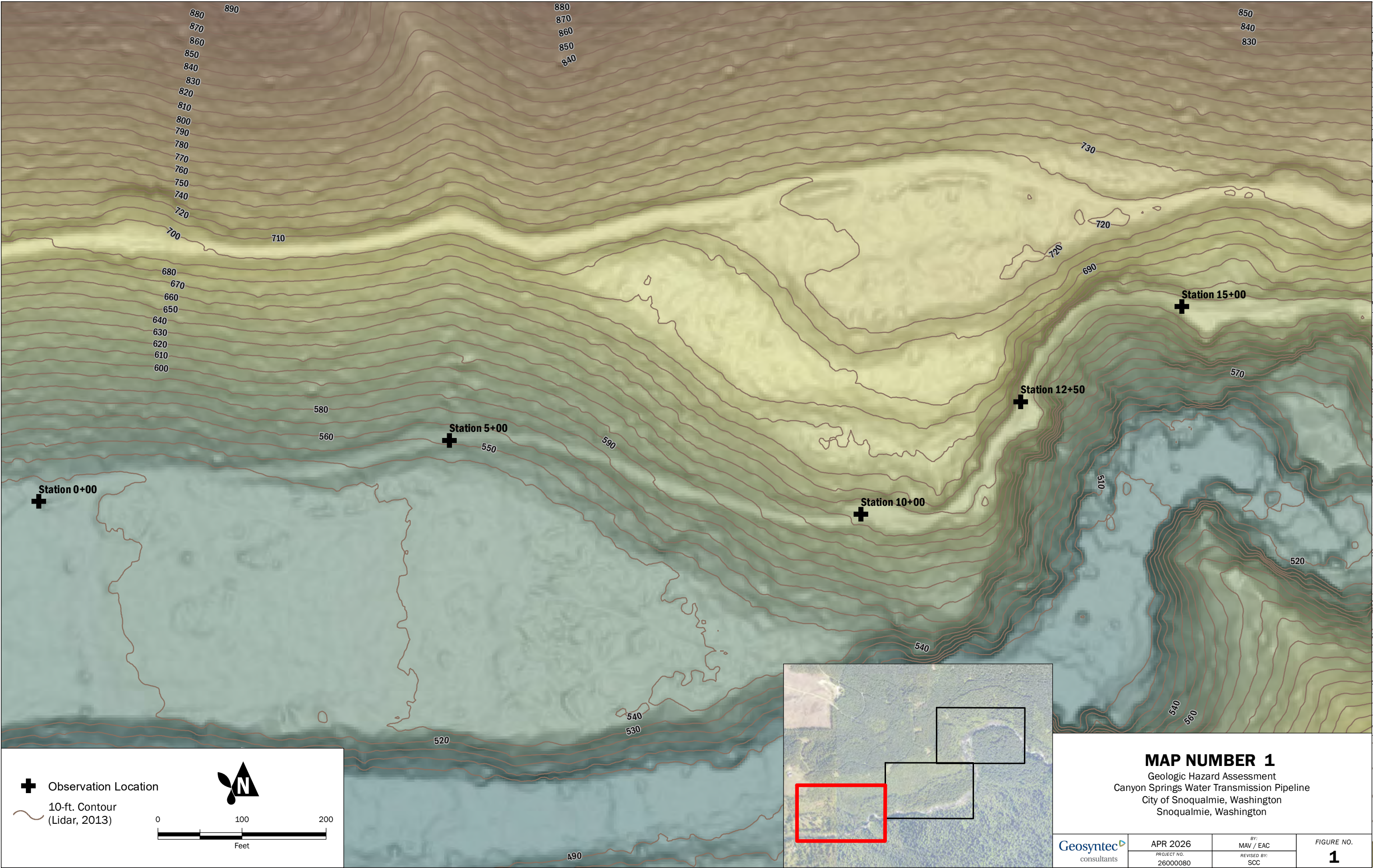
All reports prepared by Geosyntec for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Geosyntec. Geosyntec's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Please refer to Appendix A titled "Report Limitations and Guidelines for Use" for additional information governing the use of this report.

We appreciate the opportunity to perform these services. If you have any questions, please contact us.

Attachments: Figure 1 – Map Number 1
 Figure 2 – Map Number 2
 Figure 3 – Map Number 3
 Figure 4 – Photograph Log
 Appendix A – Report Limitations and Guidelines for Use

FIGURES



MAP NUMBER 1
Geologic Hazard Assessment
Canyon Springs Water Transmission Pipeline
City of Snoqualmie, Washington
Snoqualmie, Washington

Geosyntec
consultants

APR 2026
PROJECT NO.
26000080

BY:
MAV / EAC
REVISED BY:
SCC

FIGURE NO.
1



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Observation Location

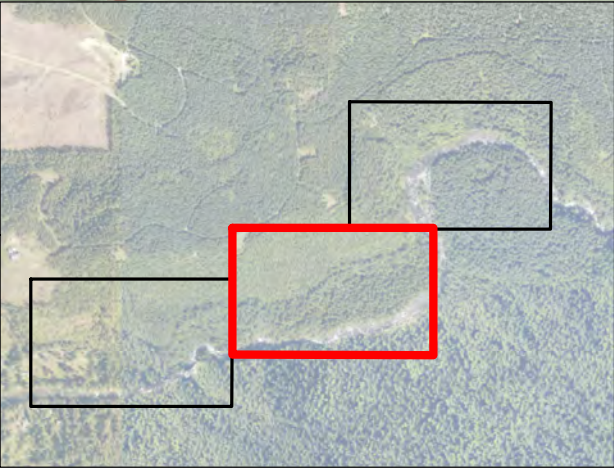
10-ft. Contour
(Lidar, 2013)

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0100200

Feet

Basemap Layer Credits || EagleView Technologies, Inc.



MAP NUMBER 2

Geologic Hazard Assessment
Canyon Springs Water Transmission Pipeline
City of Snoqualmie, Washington
Snoqualmie, Washington

Geosyntec

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APR 2026

PROJECT NO.
26000080

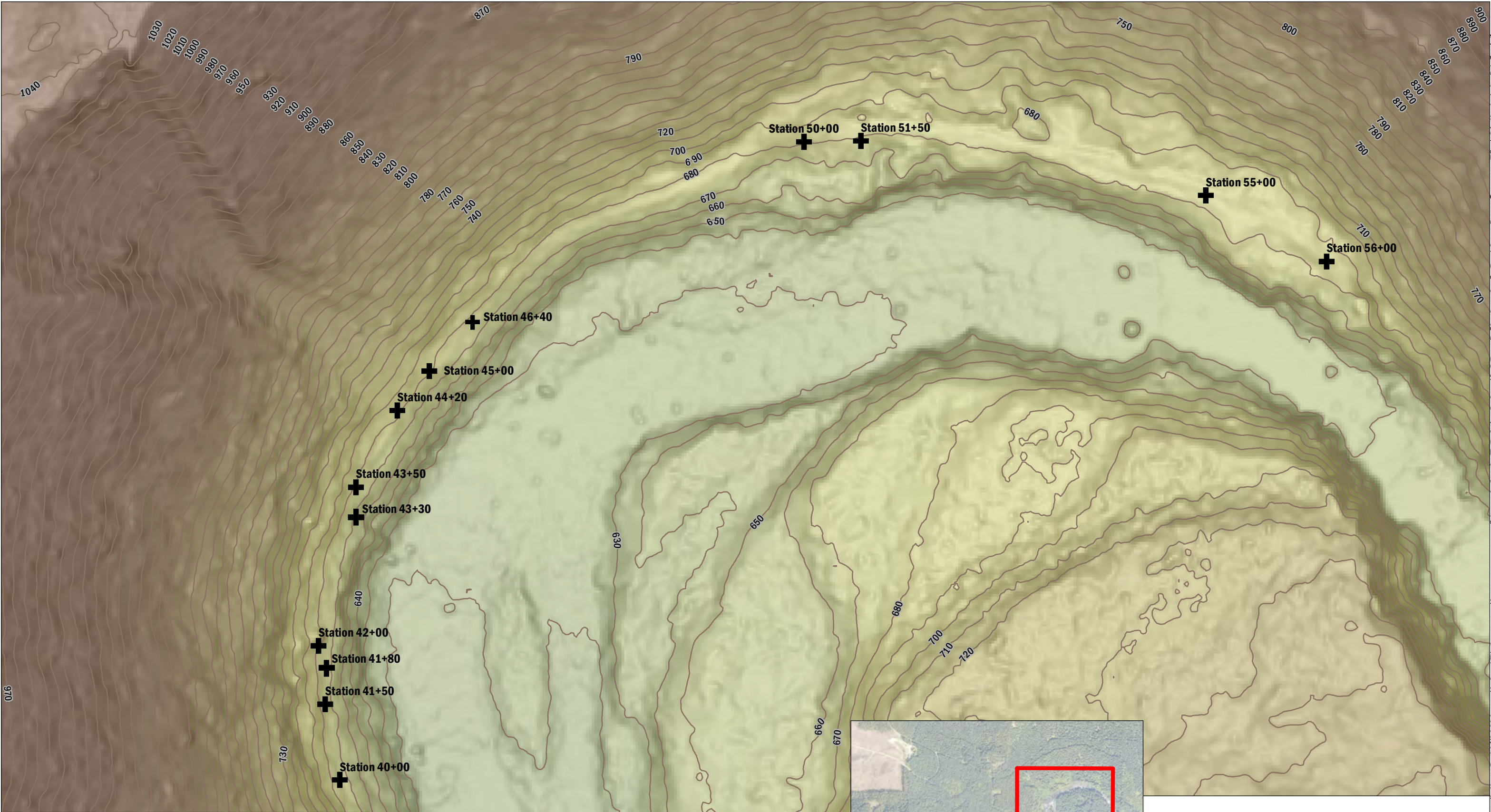
BY:
MAV / EAC

REVISED BY:
SCC

FIGURE NO.

2

GIS Path: I:\projects_8\GIS\GIS\Inquire\CanyonSprings\Mapbook.mxd | 150396 | Delivered File 2021 | Field Observations | Mapbook.mxd | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | Drawn: 11/15/2021 | User: tullen | Print Date: 11/15/2021



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Observation Location

10-ft. Contour
(Lidar, 2013)

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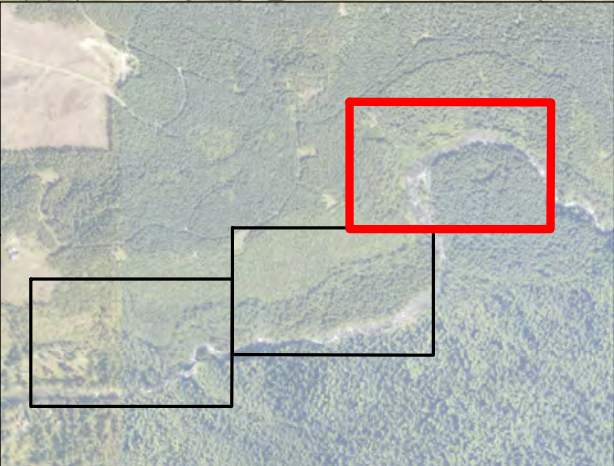
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Feet

Basemap Layer Credits || EagleView Technologies, Inc.



MAP NUMBER 3

Geologic Hazard Assessment
Canyon Springs Water Transmission Pipeline
City of Snoqualmie, Washington
Snoqualmie, Washington

Geosyntec

consultants

APR 2026

PROJECT NO.
26000080

BY:
MAV / EAC

REVISED BY:
MRH

FIGURE NO.
3

GIS Path: I:\Projects_8\GIS\Inquiries\CanyonSprings\GIS\Assessment_150386_Delivered\Fig2021_FigObs\Observations_Mapbook.mxd | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | Drawn: 11/15/2021 | User: tullen | Print Date: 11/15/2021

PHOTO 1: 2017 landslide repair area. Mesh is in generally good condition. Pipeline is under path in the upper right of the photograph. View to the south.



PHOTO 4: Landslide headscarp downslope of the pipeline. Orange flag is AMP-04, STA 41+80. Pipeline is in upper part of photograh, about 11 feet from head scarp.



PHOTO 2: Slide debris from colluvial slide above pipeline near Sta 41+00. Pipeline is approximately under the photographer's boots. View to the west, up slope.



PHOTO5: Ponding upslope of embankment and flow of water over embankment near culverts at STA 49+50 resulting in minor trail erosion. View to the west.



PHOTO 3: Steep slope below pipeline alignment near STA 42+50. Pipeline is about 11 feet upslope from head scarp. View from UAV to the west.



PHOTO 6: Gully incising into slope below trail at culvert outlet near STA 52+00. View downslope and to the southeast.



Photograph Log

Geologic Hazard Assessment
Canyon Springs Water Transmission Pipeline
City of Snoqualmie, Washington
Snoqualmie, Washington

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APR 2026
PROJECT NO.
26000080

BY:
MRH
REV BY

FIGURE NO.
4

APPENDIX A

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE

This Report and Project-Specific Factors

Geosyntec Consultants considered a number of unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you
- Not prepared for the specific purpose identified in the Agreement
- Not prepared for the specific real property assessed
- Completed before important changes occurred concerning the subject property, project or governmental regulatory actions

Geoscience Interpretations

The geoscience practices (geotechnical engineering, geology, and environmental science) require interpretation of spatial information that can make them less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Report Limitations and Use Guidelines" apply to your project or site, you should contact Geosyntec.

Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared.

Property Conditions Change Over Time

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by events such as a change in property use or occupancy, or by natural events, such as floods, earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance of the report, you should contact Geosyntec so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Discipline-Specific Reports Are Not Interchangeable

The equipment, techniques, and personnel used to perform a geotechnical or geologic study differ significantly from those used to perform an environmental study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually address any environmental findings, conclusions, or recommendations (e.g., about the likelihood of encountering underground storage tanks or regulated contaminants). Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding the subject property.

We appreciate the opportunity to perform these services. If you have any questions please contact the Geosyntec Project Manager for this project.