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Date: April 26, 2007

To: Hearing Examiner
City of Woodinville
17301 133rd AVE NE
Woodinville, WA 98072

Job No: 03-208 / 03-248

Project: Wood Trails / Montevallo

Enclosed are:

- ☒ *Prints*
- ☐ *Copies*
- ☐ *Reproducibles*
- ☒ *Reports*
- ☒ *Documents*
- ☐ *Specifications*
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Quantity	Date	Description
1	4/26/07	Phoenix Development Rebuttal Memorandum prepared by G. Richard Hill
1	4/26/07	Response Letter to Additional Review Comments prepared by Transpo
1	4/24/07	Response Letter prepared by Woodinville Water District
1	4/25/07	Response Letter prepared by Sewall Wetland Consulting
1	4/25/07	Response Letter to CNW Comments prepared by Earth Solutions NW
1	4/24/07	Rebuttal to CNW Narrative prepared by Phoenix Development Inc.
1	4/24/07	Response to Comments RE: City Capacity Analysis prepared by Erika Jensen
1	4/26/07	Response Letter to CNW Volume 4 Comments prepared by Mark Keller
1	4/26/07	Letter regarding Summers Addition prepared by Mark Harrison

Remarks:

Rebuttal items to be entered into the record for both Wood Trails and Montevallo Preliminary Plat and Rezone applications.

Sent By: Erika K.W. Jensen, AICP
Project Planner

Copies To:

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BEFORE THE HEARING EXAMINER
CITY OF WOODINVILLE

In the Matter of: **WOOD TRAILS REZONE** **ZMA 2004-053** **WOOD TRAILS PRELIMINARY PLAT APPLICATION** **PPA 2004-054** In the Matter of: **MONTEVALLOREZONE** **ZMA 2004-094** **MONTEVALLO PRELIMINARY PLAT APPLICATION** **PPA 2004-093**	**APPLICANT PHOENIX DEVELOPMENT'S REBUTTAL MEMORANDUM**

1. INTRODUCTION

The Wood Trails and Montevallo proposals are undoubtedly the most exhaustively analyzed 66-lot subdivisions in the history of the State of Washington. They are the subject of a Final EIS that is over 400 pages in length plus hundreds of pages of technical appendices. Hundreds of comment letters have been submitted. Thorough staff reports have been prepared. Three nights of public hearings have been held. Concurrently, the City has sponsored a Sustainability Study to evaluate development issues in the R-1 zones that include Wood Trails and Montevallo.

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What is the ultimate conclusion the City has reached to date in all of these analyses? Simply put, the proposals as mitigated will have no significant adverse impacts, are fully consistent with the City's land use plans and policies, and are compatible with neighboring land uses.

A. The Final EIS Concluded the Wood Trails and Montevallo Proposals' Environmental Impacts Are Nonsignificant.

As for earth (soil stability and erosion issues), the Final EIS concluded that Wood Trails will have no significant adverse impacts so long as the pond is replaced by a vault, no dispersion trenches are placed within 50 feet of the top of slope, and no utility trenches are dug in steep slopes. FEIS 3.1-22. The Final EIS concluded that the Montevallo proposal would have negligible adverse earth impacts. FEIS 2.1-18.

As for water, the Final EIS concluded that the changes to the hydro-geologic regime for both proposals will be "minor," and that impacts to water quantity and water quality issues will be "minimal." FEIS 3.2-37.

As to plants and animals, the Final EIS concluded that impacts would "not be significant," as to Wood Trails, and would be "minimal," as to Montevallo. FEIS 3.3-20 - 3.3-21.

As to land use, the Final EIS concluded that the Wood Trails and Montevallo proposals are compatible with existing adjacent residential land uses. FEIS 3.4-17 – 3.4-18. The Final EIS found the proposals to be consistent with applicable comprehensive plan land use policies. FEIS 3.4-22 – 3.4-28. The Final EIS also found the proposals to be consistent with the zoning code purpose statements for R-4 zones. FEIS 3.4-30.

As to traffic and parks, the Final EIS found no significant adverse impacts from either proposal. FEIS 3.5-94 and 3.6-8.

B. The Sustainability Study Found No Environmental Impacts Justifying Retention of R-1 Zoning.

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The City's Sustainability Study placed the Wood Trails and Montevallo sites in the "Hillside Drainages" area. As to that area, the consultants concluded that "geologically hazardous areas in and adjacent to the R-1 zone depend primarily on proper development practices and stormwater management, not maintenance of R-1 zoning." Ex. 139 at p. 26. It also found that transportation issues were not a basis for maintenance of R-1 zoning, and that capital facilities were available to support R-4 zoning. Ex. 139 at p. 23.

C. The Staff Reports Confirm that the Wood Trails and Montevallo Proposals Comply with the Comprehensive Plan, with the Woodinville Municipal Code, and are Compatible with the Adjacent Residential Neighborhoods.

The City's Planning Director conducted her own independent review of the project applications, the Final EIS, the Sustainability Study, applicable City policies and codes, and found that the Wood Trails and Montevallo proposals, as mitigated pursuant to her recommended conditions, complied with all applicable City requirements. See Wood Trails Staff Report, pp. 13-28, Montevallo Staff Report, pp.10-20.

D. The Evidence Presented to the Hearing Examiner Reinforces the Conclusions Reached in the City's Final EIS, Sustainability Study, and Staff Reports.

The opponents presented arguments to the Hearing Examiner to seek to question the exhaustive research that had already gone into the analysis of Wood Trails and Montevallo. However, as the City's and Applicant's responses demonstrate, these arguments have no merit.

The testimony offered by and the evidence submitted by Joel Birchman, P.E., of Perteet Engineering and Mike Swenson, P.E., of The Transpo Group, added to that already in the Final EIS, demonstrate that there is adequate capacity for the additional traffic the proposals will generate, and that traffic can be handled safely. The City will require appropriate mitigation to address any increased risk on the streets that access the project to ensure no decrease in level of safety occurs. See Wood Trails Exhibits 86, 129; letter report from Mike Swenson, P.E., submitted on April 26,

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2007; testimony of Joel Birtschman, P.E.

The evidence testified to and submitted by Ray Coglas, P.E., of Earth Solutions NW, in addition to the thorough analyses contained in the Final EIS, show that development of both proposals can proceed without incurring risk due to geologic hazards, so long as appropriate best management practices are followed. See Wood Trails Exhibit 131; letter report from Ray Coglas, P.E., submitted on April 26, 2007.

Mark Keller, P.E., of Triad Associates submitted evidence that confirmed the conclusions in the Final EIS that stormwater drainage will be safely retained and released in accordance with applicable drainage codes. The level of analysis completed at this stage of the process is appropriate and typical. Triad's preliminary analysis has identified that there may be some sections of the system downstream that may need to be upgraded (increased pipe size or increased pipe slope) and that there is adequate space to make these changes. Yosh Monzaki, the City Public Works staff person responsible for this issue, confirmed Mr. Keller's analysis. See Wood Trails Exhibit 134; Memorandum from Mark Keller, P.E., submitted on April 26, 2007; testimony of Yosh Monzaki.

Ed Sewall of Sewall Wetland Consulting testified and submitted evidence confirming that the project impacts on plants and animals will be nonsignificant, that impacts on wetlands will be mitigated, and that the current hydrogeology of the Montevallo wetland will be protected. See Wood Trails Exhibit 133; letter report from Ed Sewall, Senior Biologist, submitted on April 26, 2007; testimony of Ed Sewall.

With respect to land use planning and zoning need issues, Matthew Gardner, Bob Vick, and Mike McCormack testified and submitted evidence. There is a clear land use need for more dense zoning than R-1 can provide. R-1 zoning is a grossly inefficient use of land in an age of land

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scarcity. All sound planning principles require a minimum urban density within urban growth areas. R-4 is considered by most to be the minimum urban density. See Exhibits 88 (Matthew Gardner memorandum attached as Exhibit A; Mike McCormack, AICP, memorandum attached as Exhibit B), 128, 136, 138; testimony of Bob Vick, Matthew Gardner; letter report from Bob Vick submitted on April 26, 2007.

The Wood Trails and Montevallo proposals are low density, yet urban, developments. All environmental impacts have been mitigated to a level of nonsignificance. The proposals are consistent with all applicable land use policies. It is undisputed that the Growth Management Act requires cities to zone land for urban densities in order to avoid inefficient sprawl. It is equally undisputed that R-1 is not an urban density. The City's own Comprehensive Plan acknowledges that R-4 is a minimum urban density. The City's own land use code **mandates** R-4 development when adequate services can be provided.

In this light, the Wood Trails and Montevallo proposals should be approved.

2. THE WOOD TRAILS AND MONTEVALLO PROPOSALS COMPLY WITH THE CITY'S REZONE CRITERIA.

WMC 20.04.080(1) provides that "developments with densities less than R-4 are allowed only if adequate services cannot be provided." From the applicant's point of view, this land use code requirement begins and ends the rezone discussion. Because Phoenix will be providing sewer and other utility services, this code provision requires development at R-4 densities (at a minimum). To deny an amendment to R-4 on some other, more general, basis, would render this provision a nullity, which is not allowed under the rules of statutory construction. Case closed. See Phoenix Hearing Memorandum, Exhibit 88, pp. 8-9.

CNW, in the brief of its legal counsel submitted on April 19, reiterates its tired argument that these proposals are not vested. Phoenix has thoroughly addressed these issues in its Reply

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Memoranda (Exhibits 141 and 142), and will not repeat here the analysis set forth there. Suffice it to say, however, that the only case cited by CNW in support of its position that was decided since the adoption of GMA is *Hale v. Island County,* 88 Wn.App. 764, 946 P.2d 1192 (1997), which is in fact a case involving a development application in which the Court of Appeals found that the applicant was vested, despite the fact that a component of his application was a rezone!

City staff suggests that, despite the explicit direction of WMC 20.04.080(1), that the applicant must also meet the criteria of WMC 21.44.070. While the applicant respectfully disagrees, it is clear the proposals meet these criteria as well.

The first criterion requires that the applicant show that "there is a demonstrated need for additional zoning of the type proposed." The applicant has certainly made that demonstration. See the testimony and exhibits of Matthew Gardner, Bob Vick, and Mike McCormack, as well as the discussions of this issue in the prior memoranda submitted by Phoenix (Exhibits 88, 128, 136, 138, 141, and 142). Moreover, as pointed out in the memorandum submitted by Erika Jensen dated April 26, 2007, the available land in the City with low density yet still urban R-4 zoning is less than 3% of the land area of the City, as compared with the 30% of the land area of the City gobbled up by inefficient, sprawling, non-urban, exclusivist R-1 zoning.

The opponents contend that there is no "demonstrated need" because the City has shown that it has adequate supply to meet its growth targets. However, the opponents are wrong. As Ms. Jensen's memorandum demonstrates, the City's capacity analysis is inaccurate and incorrect. It is not based on an updated inventory of vacant or redevelopable land. Land developed between 2002 and 2007 has not been removed from the inventory, and actual observed densities on the lands developed between 2002 and 2007 have not been used to determine capacity on remaining land. Finally, remaining vacant and redevelopable lands have not been adjusted to reflect new critical area

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buffers and stormwater detention requirements adopted after 2002. Failure to make these adjustments results in a significant over-estimation of buildable land. Accordingly, the City's assertion that it has remaining adequate capacity has no basis in fact, but is truly a result of wishful thinking and faulty analysis.

The second criterion is that the zone reclassification is consistent and compatible with uses and zoning of the surrounding properties. In this case, the City's Final EIS and the City's Staff Report both agree that the zone reclassification is consistent with surrounding uses and zoning. FEIS at 3.4-17 – 3.4-18; Wood Trails Staff Report at 14-15; Montevallo Staff Report at 15. R-4, like R-1, is a low density zone under the City's land use code. The City's Comprehensive Plan specifically allows R-4 land uses on the Wood Trails and Montevallo sites. Surrounding uses are all residential, as are the proposals. City staff has proposed perimeter buffering to provide visual screening of the more dense R-4 development from the less dense R-1 development. Accordingly, the second criterion is met.

The third criterion is that the property is physically and practically suited for the uses allowed in the proposed zone reclassification. The proposed uses are low density residential. There is no question but that the property is physically and practically suited for low density residential uses. No one has proposed industrial or commercial uses for these properties. And, as the Final EIS, the Staff Report, and the Sustainability Study affirm, no environmental constraints preclude R-4 use of the property. See supra, Sections 1(A), (B) and (C).

All of the rezone criteria are met. The proposals should be approved.

3. THE WOOD TRAILS AND MONTEVALLO PROPOSALS MEET THE CITY'S SUBDIVISION APPROVAL CRITERIA.

Counsel for the opponents submitted on April 19, 2007 a document entitled "Evidence summary and argument by CNW in opposition to rezone and plats" ("CNW Argument"). In the

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CNW Argument, a number of questions are raised relation to the compliance of the proposals with the City's subdivision approval criteria. None of those questions has merit. Each will be addressed in turn.

A. The Plat Drawings Are Accurate.

CNW contends that at the last minute, the applicant proposed changes to plat drawings. See Exhibit 90. This is not the case. As was clearly stated at the hearing by Triad Associates Landscape Architect Jeff Cox and Planning Director Cindy Baker, the proposal before the Hearing Examiner is the surveyed proposal submitted by Phoenix in its initial application. Exhibit 90, they both testified, was a response to the recommended conditions set forth in the Staff Reports relating to perimeter buffering, the Wood Trails drainage pond, and dispersion trenches. To provide the public and the Examiner with a conceptual design that showed one way of responding to those conditions, the applicant prepared a sketch, which was presented at the hearing solely for that purpose. As Ms. Baker made clear in her testimony, in the event the Examiner approves the subdivision, the applicant will be required to submit revised drawings that incorporate the Examiner's recommended conditions. Ms. Baker and her staff will review those drawings to be certain the conditions are complied with.

B. Stormwater Drainage Analysis is Adequate.

CNW inaccurately states that there has been no stormwater drainage analysis. To the contrary, the Final EIS summarizes the thorough analysis of drainage issues that was completed by the applicant. See FEIS 3.2-1 – 3.2-37, and Appendices E, F, G, H and M. That analysis includes a modeled downstream analysis. The questions raised by CNW appear to focus on the conditions recommended by City staff to revise the detention facilities at Wood Trails and Montevallo. In the event the Examiner approves those conditions, the applicant will provide final design of facilities to

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comply with those conditions. City staff will assure those facilities comply with the storm drainage code and with the conditions of approval.

C. Road Improvement Mitigation Is Adequate.

City staff has imposed, as a condition of approval, that certain improvements, such as traffic calming, of the streets that access the Wood Trails proposal will be required by the City Engineer. The purpose of this requirement is to ensure that any increased risk due to increased traffic will be mitigated. As Mike Swenson's memorandum of April 5, 2007 states (Exhibit 129), several measures can be implemented that will focus on controlling and reducing speeds which would reduce the sight distance needed, along with measures that provide advance notification associated with the deficient zone. Mr. Swenson's letter report submitted April 26, 2007 confirms that these proposed mitigation measures are common and implemented in other areas where sight distance issues exist and reprofiling of roads is not an option. CNW cites to no authority requiring public review and approval of improvements to be made to City streets, nor is there any.

D. The Site's Critical Areas Have Been Exhaustively Surveyed and Studied.

As stated above, these two properties have been analyzed more thoroughly than virtually any residential subdivision property in history. The properties have been poked, prodded, measured, surveyed, walked, viewed and re-viewed. See Final EIS Sections 3.1 through 3.5 and related technical appendices. It is somewhat incredulous for CNW to assert that there have been no sensitive area studies. As Mr. Sewall and Mr. Coglas stated in their testimony to the Examiner, the studies they completed for the proposals, which are contained in the EIS appendices, comply with all of the substantive requirements for a critical area study. See also Exhibits 131, 133. Finally, as Mr. Sewall testified, the Montevallo proposal no longer needs a buffer reduction for the wetlands, as it complies with applicable buffering requirements. See also Exhibit 133.

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E. The Montevallo Site Plan Will Be Revised As Directed by the Hearing Examiner.

As stated above, once the Hearing Examiner determines the conditions of approval of the subdivisions, the preliminary plat will be revised to comply with those conditions. City staff will review those plans to ensure that City codes and the conditions of approval are met. That will include, of course, the Montevallo storm drainage facilities.

F. The Wood Trails Dispersion Trenches Proposal Will Be Revised As Directed by the Hearing Examiner.

City Staff proposed, as a condition of approval, that the proposed Wood Trails dispersion trenches be eliminated, or placed at least fifty feet from top of slope. The applicant believes that condition can be complied with. As stated in Mark Keller's memorandum submitted on April 26, 2007, three alternatives have been through a preliminary analysis and each of the three (staying fifty feet away from top of slope, tightline to the detention pond, or tightline to below the 40% slope) are viable options. In the event the Hearing Examiner agrees with that condition, a final design will be submitted to City staff for its review in light of applicable codes and the Hearing Examiner's conditions of approval.

G. No Montevallo Wetland Impacts are Anticipated.

The City has required that the sewer line be bored beneath the Montevallo wetland. Accordingly, the proposal will not be affecting the Montevallo wetland, and no mitigation plan will be required. See testimony of Ed Sewall.

H. Tree Retention and NGPA Areas Are Disclosed.

Contrary to the contentions of CNW, tree retention plans were submitted as part of the preliminary plat application. The City has approved this plan. See Exhibit 163. In addition, the preliminary plat discloses the proposed NGPA tracts. See Wood Trails and Montevallo Exhibits 11.

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No landscape plans are required at the time of preliminary plat application.

I. Sewer and Water Availability Letters Have Been Submitted.

Contrary to the contentions of CNW, current sewer and water availability letters have been submitted. See Wood Trails and Montevallo Exhibits 7 and 8.

J. The Applicant Will Pay Park Impact Mitigation Fees.

The Final EIS discusses parks at pp. 3.6-1 – 3.6-8. It concludes that after payment of the parks mitigation fees, "no impacts [on parks] would remain" and "there would be no significant impacts to public services." The Final EIS makes clear that under City code, a developer has the option of either paying the City's fees or including within their proposed projects recreation facilities to offset all or a portion of the park impact fees assessed. In this case, the applicant will pay the sum of $403,225 in parks impact fees, according to the current fee schedule.

K. The Summers Addition Plat Did Not Dedicate a Public Street.

As the letter from Triad Associates Licensed Land Surveyor Mark Harrison, P.E. (submitted April 26, 2007) states, the Summers Addition Plat did not dedicate a street to the public. Rather, it merely identified a future inchoate public street that must be developed when Lot 1 of the plat is developed. The location of the street is explicitly not defined. The proposed Montevallo plat creates the future street anticipated at the time of the Summers Addition Plat. The street created in the Montevallo plat will be dedicated to the City.

L. The Phoenix Proposals Comply with the City's Subdivision Criteria.

As the Staff Reports concluded, Wood Trails and Montevallo comply fully with each of the City's subdivision criteria. Try as it might, CNW can find no fault with the City's analysis. The subdivision should be approved.

4. CONCLUSION

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Many questions have been asked of the Wood Trails and Montevallo subdivisions. They have all been answered. All applicable City codes have been met. Phoenix therefore respectfully asks the Hearing Examiner to approve the Wood Trails and Montevallo preliminary subdivisions and to recommend approval of the zoning map amendment of the Wood Trails and Montevallo sites to R-4 density.

DATED: April 26, 2007.

Respectfully submitted,

McCULLOUGH HILL, PS

G. RICHARD HILL, WSBA #8806
Attorneys for Applicant
Phoenix Development

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TG: 04007.00

Mr. Rich Hill
McCullough Hill, PS
701 Fifth Avenue, Suite 7220
Seattle, Washington 98104

SUBJECT: WOOD TRAILS/MONTEVALLO RESPONSE TO ADDITIONAL REVIEW COMMENTS

Dear Rich:

This letter has been prepared in response to additional issues raised by the public during the last public hearing (April 5, 2007), as well as information presented by the Concerned Neighbors of Wellington (CNW). This letter briefly addresses the following points:

- Video of queuing at 156th Avenue/Woodinville-Duvall Road
- Analysis of Local Roads Providing Access to Wood Trails (CNW)
- Sight Distance Analysis of the Local Road Connections on 156th Avenue NE (CNW)
- Actual Traffic Growth (CNW)

Video of queuing at 156th Avenue/Woodinville-Duvall Road

Transpo staff was in attendance the night of the April 5, 2007 hearing while the video was played. Since no information was presented as to the traffic volumes that coincided with the video observations, it is difficult to provide a direct comparison between the two analyses and explain why the results are different. The process by which the queuing analysis was conducted for the FEIS included traffic counts, queue observations, and the development of a calibrated traffic model. This process was approved by City staff and is described in detail on page 3.5-18 of the FEIS with additional information on the calibration methodology presented in Appendix O. While the results of the baseline (without-project) analysis may have differed due to the time gap between the initial study prepared by the FEIS and the observations presented by CNW, the general impacts of the project would remain the same. As noted on page 3.5-57 of the FEIS the increase in queue length for the right and left-turns are one car. If in fact the southbound left-turn queue length does exceed the storage provided today, the expected increase in the southbound queue length on 156th Avenue would be two cars during the weekday AM peak period. Given the existing queue lengths and the conditions as noted in the video presented by the CNW, this increase would not be considered significant.

Analysis of Local Roads Providing Access to Wood Trails

As presented by City staff on April 5th, the City will be imposing a condition that requires that measures be taken to reduce the risk potential within the sight distance deficient zones, that results

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from the increase in traffic. The previous memorandum (April 5, 2007) prepared by Transpo identified several measures which could be implemented that would focus on controlling/reducing speeds which would reduce the sight distance needed, or providing advance notification associated with the deficient zone. The mitigation measures proposed are common and implemented in other areas where sight distance issues exist and reprofiling of roads are not an option. As noted in the added conditions of approval, the City Engineer has the final authority on what is required and it is presumed that the City will implement the measures that are necessary to maintain the current risk level.

Sight Distance Analysis of the Local Road Connections on 156th Avenue

While additional analysis of the entering sight distance calculations were presented by CNW, the general conclusions of that analysis did not differ from that reported by Transpo. When considering the entering sight distance, there is subjectivity with respect to the location of "obstructions" and the definition of these objects. It is not unlikely that two observers would produce two different results. The entering sight distances were not "surveyed" by Transpo, but were based on field measurements conducted with observers and field measuring devices. The analysis by CNW presents additional information on the entering sight distance measurements and concludes that two locations; NE 201st Street and NE 198th Street do not meet the desirable entering sight distance values. Even though the calculations provided by CNW and Transpo differ, the conclusions made in Transpo's April 5, 2007 memo with respect to NE 201st Street and NE 198th Street are the same.

CNW makes reference to the stopping sight distance for a right turn from NE 198th Street. Stopping sight distance is a measurement provided for 156th Avenue, so it is unclear how the conclusion reached in the CNW was made. The analysis conducted by Transpo (April 5, 2007 memorandum) identified that all four access road intersections meet the stopping sight distance requirements. This was validated by Perteet; as the conclusions of their analysis presented at the April 5, 2007 hearing resulted in the same conclusion.

Actual Traffic Growth

As noted in Transpo's April 5, 2007 memorandum we did not disagree with the 16 percent increase in traffic noted in the study prepared by Costco; that is the results of the counts performed. We simply question the use of that figure as a basis for long-term growth projections. Typically jurisdictions default to a general background growth rate in the 2.5 percent range. Woodinville staff requested that we go one step beyond and include traffic from approved projects in Snohomish County. In the April 5, 2007 Transpo provided an overview of the methodology used to develop future traffic volumes. As noted in that memorandum, while a 2.5 percent growth rate was applied to the background traffic, traffic associated with pipeline traffic volumes were also provided. That methodology resulted in an annual growth rate of approximately 8 percent per year. When equating the 16 percent increase for a 15 month period to a 12 month rate, a 12 percent growth rate is derived. Thus, the true difference in growth rate assumptions equates to approximately 4 percent per year. Based on existing traffic volumes, the difference in 4 percent per year equates to only 50 vehicles over a two year period.

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The Transpo Group

If you have additional questions or need further clarification on any of these items, please do not hesitate to call.

Sincerely,
The Transpo Group, Inc.

Michael J. Swenson, P.E., P.T.O.E.
Senior Transportation Engineer

MJS/

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GENERAL MANAGER
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April 24, 2007

Bob Vick
Phoenix Development Incorporated
16108 Ash Way, Suite 201
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RE: Sewer Service for the Developments of Wood Trails and Montevallo

Dear Mr. Vick,

This letter has been written in response to questions that you had regarding the capacity of the District's system and the requirements for connection.

The Woodinville Water District recently completed an update to the Sewer Comprehensive Plan which modeled the capacity of the existing sewer system. The model indicated that currently, there are no capacity issues anywhere in the system. An interim condition model was run, (year 2012), which indicated that there were only four manholes in the entire District that displayed any surcharging, but that there was still at least five feet of freeboard remaining in each structure. None of these manholes were downstream of the R-1 area.

A third model was run for build-out conditions which assumed that the entire R-1 area was built out to an R-4 density. The model did indicate surcharging in manholes downstream of the R-1 area in the City of Woodinville. The manholes that were shown to experience overflow are candidates for the Capital Improvement Program at some date, although these conditions are years into the future.

Your second question was in regard to connection to the District sewer system. The Woodinville Water District does not have any requirements for connection to the sewer system if a sewer main is extended along the frontage of a property. As long as your septic system is functioning properly, and there are no requirements from the City or the County Health Department, the District will not require the property owner to connect.

If you have any questions regarding these issues, please contact me at (425) 487-4104 or email me at kmcdowell@woodinvillewater.com.

Respectfully,

Ken McDowell

Ken McDowell, P.E.
District Engineer

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Sewall Wetland Consulting, Inc.
1103 W. Meeker St. Suite 101
Kent, WA 98032-5751
Phone: 253-859-0515
Fax: 253-852-4732

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April 25, 2007

Hearing Examiner
City of Woodinville
17301 NE 133rd Avenue NE
Woodinville, WA 98072

RE: Applicant Response to *Analysis of Wood Trails Rezone and Plat Application Vol 4* Exhibit 161 prepared by Concerned Neighbors of Wellington
SWC Job#A4-166

Dear Hearing Examiner,

The following is our response to the Concerned Neighbors of Wellington *Analysis of Wood Trails Rezone and Plat Application Vol 4* Exhibit 161. Specifically this is a response to the information in this document on pages 158-166. Additionally, I have also included comments on the April 19, 2007, letter to Cindy Baker from Otto Paris.

On Page 158 of Exhibit 161 in the third paragraph a statement is made that roads, houses etc. will require rock placement and grading that will potentially fail and impact the stream located off-site to the north of the Wood Trails site. As stated in our April 5, 2007, response to CNW's last round of comments, the stream is located off-site 100' away at its closest point and the buffers of this feature do not encroach onto the site. Erosion control measures that will be employed as standard construction practice will avoid any impacts to areas outside the construction footprint of the project. Additionally, the idea of slope failures is speculation and has already been addressed in the geological studies for the project.

In the third paragraph of Page 158 and 161 of Exhibit 161, CNW restates they feel the off-site stream located a minimum of 100' north of the Wood Trails site is an important feature in providing hydrology to Little Bear Creek. Again, as we stated in our April 5th, 2007 response to CNW's last set of comments, we know that all streams are important. However, this stream is not located on the site and there are no impacts proposed to this stream. The off-site stream is being protected as required by Code and no impacts to this feature are proposed. Enhancement plantings proposed along the riparian area will actually enhance this stream over existing conditions. The reality is one of the larger threats to water quality is existing septic systems throughout the Wellington neighborhood. These septic systems over time impact water quality in the surficial groundwater table that ultimately feeds this small tributary. The placement of sewer in this neighborhood as is proposed for the Wood Trails and Montevallo development will eliminate the possibility of septic contamination of groundwater from the proposed developments. Additionally, it will provide sewer hookups for the Wellington neighborhood which can be utilized by the residents if they choose to connect. Given CNW's concern for water quality in this stream and its receiving water body Little Bear Creek, we assume they would want to hook up to this system.

On Page 159 of Exhibit 161 in the section "*Response to Sewall Item 5, Wetland Mitigation*", CNW infers the proposed enhancement is not needed in the stream corridor. This is an uninformed statement. The area of the stream corridor is a deciduous canopy forest comprised of stump-sprout origin big-leaf maple. This area was logged within the last 50 years and nearly the entire historic conifer component was removed from the forest. Historically this area was undoubtedly forested with Douglas fir, western

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hemlock,, western red cedar and possibly sitka spruce. Conifers create year long shade and generally provide more shade and habitat than deciduous trees. This is advantageous in a stream corridor where the shade provides cooler water temperatures which benefits all downstream species. Additionally, conifers are a climax forest component whereas deciduous species are early successional species. No conifer recruitment to the forest is currently occurring so the return of this area to a conifer dominated forest will require planting conifers. The proposed enhancement does just that and is an appropriate and beneficial mitigation.

The last paragraph on page 159 states that the proposed storm water system won't protect "wetland inhabitants". The storm water systems meet Code and Washington Department of Ecology standards which were specifically designed to protect receiving areas of treated storm water. This is the highest standard currently provided by any development and is considered by storm water experts to successfully treat storm water. Only the Montevallo storm water system has some discharge to the wetland buffer. The purpose of this is to provide hydrology to the wetland to replace that portion of surface water runoff that previously would have sheet-flowed to the wetland. Currently the water sheet flowing to the wetland is untreated water that is generally of low quality from livestock effluent runoff and an existing untreated gray-water outflow to the east side of the Montevallo wetland. These sources of existing contamination will be removed by the proposed development. All other stormwater will be discharged to existing storm drains.

On pages 161 and162 of Exhibit 161, CNW generally states the wildlife only use the flat eastern side of the site. This is untrue as most wildlife observed have been seen on the steeper western side of the site. All the wildlife seen or thought to use the site do not appear to be selective as to slope steepness.

On page 162 second paragraph section "b." states it *is a bold statement to say no standing water is present.* Actually it is not just a bold statement but a fact. The wetland is a slope type wetland. This means it is not flat but on a slope at an angle and only exists because of some soil saturation. Generally, unless there are some small interior depressions, slope-type wetlands have no standing water. This is the case with this wetland, not only is there no standing water present but soil saturation was found at a depth of -12", just barely making this area meet the hydrology criteria of a wetland.

On page 162 Section 4 CNW again states they don't like the habitat enhancement proposed. To summarize; Pileated Woodpecker management guidelines developed by WDFW (Washington Department of Fish and Wildlife) were discussed and incorporated into the project as mitigative measures. They are not a requirement, but guidance when designing a development to attempt to consider this species in the planning process. The proposed measures are appropriate and typical for impacts in and around this species in Western Washington. Placement of stumps and logs (of appropriate size and tree species) throughout the site in a specific pattern will add woody material to the forest floor to increase foraging habitat for pileated woodpeckers. Only appropriate material will be utilized in this enhancement. Any development whether under an R1 or R4 zoning would have identical impacts of removing forested area. The proposed enhancement is scientifically sound and will increase foraging habitat on the site for pileated woodpeckers in the remaining open space.

Pages 163-166 re-state previously submitted information by CNW about wildlife observed on the site. The facts remain that none of the wildlife observed in or around the site have any special status or require any additional protection other than that being proposed. All species are common wildlife or, are considered game species with no special protection. The proposed Wood Trails and Montevallo sites are meeting the highest regulatory standards in protecting critical areas and wildlife.

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In regards to the April 19th 2007 letter to Cindy Baker from Otto Paris (Exhibit 162), the entire subject has been answered several times in the wetland studies and storm water and downstream analysis. To summarize, the wetland on Montevallo is a degraded wetland from past livestock use, existing untreated storm water discharge, existing untreated gray water discharge, alteration of portions into lawn by Wellington residents and altered hydrology from ditching and berming. The wetland is a very disturbed feature and the hydrology has been disturbed. The proposed storm water system will release most treated water to an existing storm water line located west of the site. As is routinely done in developments along wetlands, some treated water is directed to the wetland through dispersion trenches to maintain the sheet flow of water that would have flowed to the wetland from the immediate surrounding area. This has been calculated based upon the surrounding area's topography and drainage characteristics. Throughout the drainage study the storm water system has been designed not to change the hydrology of the wetland and maintain hydrologic flows through the site as close to existing conditions as possible. This is a routine and common method of releasing storm water to a wetland to maintain hydrology and is utilized on almost all sites that have wetlands or streams and require storm water release to these water bodies. I have seen hundreds of systems such as this installed in the last 16 years in Washington along wetlands with no noticeable change to wetland hydrology, vegetation, water quality or wildlife.

To summarize, the appropriate studies have been completed to analyze hydrology impacts and contributions to the wetland. The proposed storm water system has a proven design in releasing the appropriate amount of treated water to the wetland buffer to maintain the hydrology of the wetland as close to natural as is possible. It is my professional opinion with 18 years of experience in working everyday with wetlands and development, that this system will adequately protect the character of this wetland.

Sincerely,
Sewall Wetland Consulting, Inc.

Edgar K. Sewall III
Electronic signature

Ed Sewall
President/Senior Biologist

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April 25, 2007
ES-0067

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Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

Phoenix Development, Inc.
16108 Ash Way, Suite 201
Lynnwood, Washington 98087

Attention: Mr. Bob Vick

Subject: Response to CNW Comments
Woodtrails Hearing - Exhibit 161
Geologic Hazards and Faulting

Reference: Earth Solutions NW
Addendum Report
Geologic Hazards
ES-0067, dated April 5, 2007

CNW Comments
Geologic Hazards and Faulting
Section 3, Exhibit 161
Section 6, Exhibit 161

Earth Solutions NW, LLC
Addendum Geotechnical Report
ES-0067, dated August 1, 2005

Earth Consultants, Inc.
Addendum Geotechnical Engineering Report
E-10683, dated February 14, 2005

Earth Consultants, Inc.
Geotechnical Engineering Study
E-10683, dated June 9, 2004

Dear Mr. Vick:

Earth Solutions NW, LLC (ESNW) has prepared this letter responding to comments recently submitted as part of the Woodtrails rezone public hearing. Comments presented by the Concerned Neighbors of Wellington (CNW) in Sections 3 and 6 of Exhibit 161 addressing geologic hazards and faulting are addressed in this letter.

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Subsurface Characterization

The CNW response to the referenced Addendum Report prepared by ESNW concludes that the subsurface data collected at the site is insufficient for evaluating landslide hazards at the site. The absence of deep explorations is one reason cited by the author of the CNW comments. However, the comments prepared by CNW fail to acknowledge the deep boring data collected at the site. The deepest boring was drilled to a depth of approximately 49 feet, well below the level of any proposed excavation. The standard penetration blow count data collected at the boring sites was extremely valuable in the overall assessment of soil strength characteristics and landslide hazards. In essence the deep boring data confirm the presence of highly competent, very dense and stable glacial deposits (conditions revealed throughout the site at the test pit locations).

The CNW comments also do not recognize that four deep test excavations were completed at the base of the steep slope areas. From a geotechnical standpoint, characterization of soil conditions at the base of a slope is extremely important in evaluating deep seated landslide potential. These test sites were excavated to depths of approximately 20 to 22 feet. Consistent with soil conditions encountered throughout the entire site, very dense and competent soil conditions highly resistant to landslide activity were also encountered at the deep excavation sites.

There will always be some debate within the geotechnical and geological community over what level of subsurface exploration is sufficient for reasonable characterization of a property. The unique (or not so unique) characteristics of the proposal and the level of certainty or understanding of geologic conditions and geotechnical properties possessed by the designer will largely dictate the level of exploration. With respect to the extremely competent glacial deposits that exist throughout the Woodtrails site, the soil strength characteristics and inherent stability are generally well understood. Subtle (or not so subtle) variation of soil types within the glacial deposits as a whole are generally inconsequential to the designer if it is determined that such variations will have no bearing on the stability of the site. Undoubtedly, given the complex nature of the subsurface, variation and boundaries between soil types throughout the glacial deposit could be evaluated with a high degree of accuracy through an extensive program of subsurface explorations. Such an endeavor would be an inefficient use of resources for a development such as Woodtrails, where more than sufficient data suitable for a reasonable characterization of subsurface conditions has been acquired.

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Landslide Hazards

The landslide hazard at the Woodtrails site has been thoroughly evaluated through the subsurface explorations, site reconnaissance work, geologic map and aerial photograph review and evaluation of soil characteristics on adjacent sites. The city of Woodinville geology expert and the authors of the FEIS took no exception to the level subsurface exploration and overall conclusions of the geotechnical studies that development of the site as proposed is feasible from a geotechnical standpoint. Contrary to the conclusions of the CNW comments, the Woodtrails site is not located within an identified or mapped landslide hazard area. As previously concluded by the undersigned, the upland areas of the Woodtrails site where development is proposed do not meet the definition of a landslide hazard area as defined in WMC 21.24.290 (2) (b) (ii). As supported by the sieve analysis data, the surface soil deposits possess a sufficient amount of fines (silt content) such that the WMC 21.24.290 (2) (b) (ii) definition is not satisfied.

It is acknowledged that the residential building lots should maintain an appropriate setback distance from the 40 percent slopes, and as stated in the initial geotechnical engineering study (Earth Consultants, Inc. E-10683, dated June 9, 2004) a minimum ten foot buffer should be maintained between the building lot line and the top of the 40 percent slopes. This reduced buffer distance is justified given the high degree of stability and soil strength characteristics exhibited throughout the site. Woodinville Municipal Code WMC 21.24.310 (1) (a) (ii) provides a provision for a reduced buffer distance when a qualified professional demonstrates to the satisfaction of the Planning Director that the reduction will adequately protect the proposed development, adjacent developments and uses and the subject critical area.

Erosion Hazards

The CNW comments challenge the conclusion of the referenced Addendum Report that the absence of observable widespread erosion is sufficient for supporting a conclusion that the erosion hazard throughout the upland areas of the site is moderate. In fact, the presence of highly compact soils throughout the upland areas of the site would also support the conclusion that the erosion hazard is moderate. Realistically, any exposed earth surface, whether it be flat or sloping has some susceptibility to erosion. The fact remains, however, that erosion can be managed. Properly engineered erosion control measures are very effective, and when appropriately implemented will reduce the hazard to an acceptable level. It is the experience of the undersigned that the conscientious and responsible developer committed to temporary and permanent erosion control measures will be successful in mitigating the hazard, in any setting. In any case, the Department of Ecology requires weekly monitoring of erosion control measures during construction by an erosion control specialist. For the Woodtrails project, weekly monitoring in accordance with the Department of Ecology standards would be a requirement.

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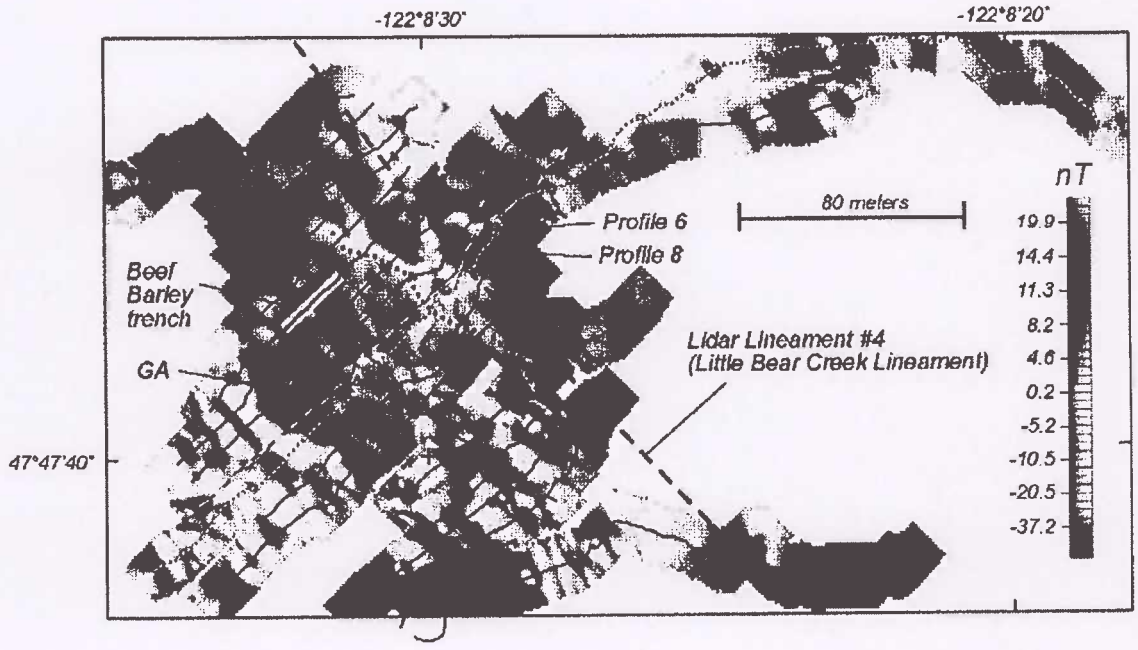
HOLOCENE FAULT SCARPS AND SHALLOW MAGNETIC ANOMALIES ALONG THE SOUTHERN WHIDBEY ISLAND FAULT ZONE NEAR WOODINVILLE, WASHINGTON

By Brian L. Sherrod, Richard J. Blakely, Craig Weaver, Harvey Kelsey, Elizabeth Barnett, and Ray Wells



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HOLOCENE FAULT SCARPS AND SHALLOW MAGNETIC ANOMALIES ALONG THE SOUTHERN WHIDBEY ISLAND FAULT ZONE NEAR WOODINVILLE, WASHINGTON

By Brian L. Sherrod[1], Richard J. Blakely[2], Craig Weaver[1], Harvey Kelsey[3], Elizabeth Barnett[1], and Ray Wells[4]

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Open-File Report 2005-1136

March 2005

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ABSTRACT

The southern Whidbey Island fault zone (SWIFZ), as previously mapped using borehole data, potential-field anomalies, and marine seismic-reflection surveys, consists of four sub-parallel, northwest-trending fault strands, extending ~100 km from near Vancouver Island to the Washington mainland. The vertical component of displacement changes both across and along the fault, and strike slip motion may be important as well. Abrupt uplift at a coastal marsh on south-central Whidbey Island suggests that the SWIFZ experienced a M_W 6.5 - 7.0 earthquake between 3200 and 2800 years B.P. The SWIFZ has been hypothesized to extend southeastward beneath the mainland, making landfall between the cities of Seattle and Everett. Linear, low-amplitude aeromagnetic anomalies in this mainland region are on strike with the SWIFZ and may facilitate mapping the SWIFZ onshore. The most prominent of the residual aeromagnetic anomalies, the Cottage Lake aeromagnetic lineament, extends at least 16 km, lies approximately on strike with the SWIFZ on Whidbey Island, and passes within about 27 km of downtown Everett. Glacial deposits are slightly magnetic in this region, as indicated by magnetic susceptibility measurements and a ground-magnetic survey, and, in places, the Cottage Lake aeromagnetic lineament is associated with topographic lineaments. Spectral analysis and modeling experiments indicate that the source of the Cottage Lake aeromagnetic lineament extends to depths greater than 2 km and into Eocene sedimentary strata.

Subtle scarps on Pleistocene surfaces are visible on high-resolution lidar topography at a number of locations in the mainland region, often closely associated with aeromagnetic lineaments. In the field, scarps exhibit northeast-side-up vertical relief of 1 to 5 m. One group of scarps extends a total distance of 18 km along the Cottage Lake aeromagnetic lineament, where they defines two strands: One strand lies east of Crystal Lake and is referred to here as the Crystal Lake lidar lineament, another strand follows the Little Bear Creek drainage and is called here the Little Bear Creek lidar lineament. Four excavations across these two lidar lineaments show evidence for multiple folding and faulting events since deglaciation, most likely above buried reverse/oblique faults. One trench exposed a normal fault, although it was not possible to determine whether slip was caused by glacial or tectonic processes. In this same trench, evidence for younger folding suggests that surface deformation during an earthquake formed the scarp seen on lidar maps near Crystal Lake. Subsequent scarp degradation buried a forest soil, from which charcoal samples indicated that the folding event occurred after 11,670 years B.P. Two trenches were also excavated along the Little Bear Creak lineament near Grace, Washington. One of these trenches showed evidence for multiple events, including both folding and faulting, with the youngest event disturbing late Holocene wetland soils. In total, paleoseismological evidence suggests that the SWIFZ produced at four events since deglaciation about 16,400 years ago, the most recent after 2.7 ka. Liquefaction features near Everett indicate that strong shaking has occurred there at least three times in the last 1100 years, although evidence that those earthquakes occurred on the SWIFZ has not yet been found.

INTRODUCTION

The southern Whidbey Island fault zone is imaged by a variety of geophysical methods as a broad, complex, northwest-striking structure extending from southern Whidbey Island to Vancouver Island (Figures 1 and 2). The SWIFZ appears in gravity and seismic tomography inversions as a structural contact between low-velocity, low-density sediments of the Everett basin and high-velocity, high-density Crescent Formation that underlies the Kingston arch

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(Brocher and others, 2001; Gower and others, 1985; Johnson and others, 1996; Ramachandran and others, 2005). The SWIFZ was originally mapped on the basis of regional gravity and magnetic anomalies as a single strand extending northwest from about Murphys Corner on the Washington mainland to Admiralty Inlet west of Whidbey Island (Gower and others, 1985; Yount and Gower, 1991). Johnson and others (1996) showed evidence in seismic-reflection data, exposures in sea cliffs, and nearby boreholes for Quaternary displacement on three separate strands of the SWIFZ and extended the zone northwestward nearly to Vancouver Island. Kelsey and others (2004) interpreted differences in relative sea-level histories at two coastal marshes on opposite sides of one strand of the SWIFZ as evidence for 1-2 m of vertical, north-side-up displacement during a M_W 6.5 to 7.0 earthquake about 3000 years ago.

While other shallow faults in the Puget Lowland show distinct aeromagnetic patterns associated with hanging-wall geology (Blakely and others, 2002), the aeromagnetic expression of the SWIFZ is broad, complex, and diffuse, possibly because strongly magnetic lithologies, like the Crescent Formation, lie at significant depths. The SWIFZ is expressed in aeromagnetic anomalies across Admiralty Inlet, but the southeastward extension of the SWIFZ from southern Whidbey Island onto the Washington mainland is subdued in unprocessed aeromagnetic data. Aeromagnetic anomalies do display a subtle northwest-striking pattern of magnetic lineaments in the Maltby-Woodinville area, particularly evident after application of data enhancement methodologies (Blakely and others, 2004). This pattern is on strike with the SWIFZ offshore and is spatially associated with a narrow, 18-km-long zone of topographic scarps and lineaments identified in a GIS analysis of lidar data. The scarps are typically 1 to 5 m high, have northeast-side up, and lie on Pleistocene and younger surfaces. On the basis of their spatial association with topographic scarps and lineaments, we earlier interpreted some of the northwest-striking aeromagnetic lineaments as onshore splays of the SWIFZ, thereby extending the zone of past deformation approximately 30 km beyond the mainland coast (Blakely and others, 2004).

A detailed description of the aeromagnetic survey and evidence for onshore extension of the SWIFZ were provided by Blakely and others (2004). In their report, Blakely and others (2004) used a numbering scheme to designate lidar features. In particular, they referred to lineament 4 as a set of topographic features that follows the Little Bear Creek drainage and crosses the site of a proposed sewage treatment facility in southern Snohomish County, and they referred to features 10 and 11 as two scarps east of Crystal Lake. In this report, we designate lineament 4 as the Little Bear Creek lineament and the scarps east of Crystal Lake as the Crystal Lake lineament. Both of these topographic features lie along the larger Cottage Lake aeromagnetic lineament. In the following section, we summarize the results of Blakely and others (2004) and their implications for more recent paleoseismic field investigations.

AEROMAGNETIC ANOMALIES

In 1997 the U.S. Geological Survey conducted a high-resolution aeromagnetic survey of the Puget Sound and adjacent areas (Blakely and others, 1999). Flight altitude was targeted at 250 m above ground or as low as permitted by safety considerations; over the Maltby-Woodinville area, flight altitude was nominally 262 m above terrain. North-directed flight lines were spaced 400 m apart over the Puget Lowland; east-directed tie lines were spaced at 8 km intervals. Two base magnetometers operated continuously during the survey in order to subsequently correct for time-varying fields. Subtraction of the International Geomagnetic Reference Field provided total-field aeromagnetic anomalies. Taking all sources of error into account, we estimate the overall precision of individual measurements to be 0.5 nT or better.

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(Blakely and others, 2004). [nT is an abbreviation for nanotesla, a unit of measure for magnetic flux density, or the "strength" of the magnetic field.. 1 nT = 10^{-9} Tesla. See Blakely (1995) for additional information.]

Figure 3A shows unprocessed aeromagnetic anomalies over the study area. Most anomalies in Figure 3A, especially those of regional extent, are caused by variations in magnetization of subsurface lithologies, and the evidence for and implications of these anomalies are discussed below. A "dimpled" pattern is also evident in some parts of Figure 3A, especially along the mainland coast. This short-wavelength pattern originates from large buildings and other manmade structures. For example, the anomaly southeast of Mukilteo (label C, Figure 3A) is situated over a Boeing facility and probably is caused by associated buildings and other infrastructure.

Magnetic anomalies and possible source lithologies

The onshore portion of the study area is dominated by two broad, high-amplitude anomalies (anomalies A and B, Figure 3A). Anomaly A south of Snohomish extends over Bald Hill and Devils Butte, which are underlain by Tertiary volcanic rocks of Mount Persis (Johnson and others, 1996; Minard, 1985; Tabor and others, 1993; Yount and Gower, 1991). These locally exposed Tertiary volcanic rocks probably extend in the subsurface throughout the region beneath anomaly A.

A second broad, high-amplitude magnetic anomaly (anomaly B, Figure 3A) is situated over the Maltby-Woodinville area. The high amplitude of anomaly B requires highly magnetic rocks, and its broad gradients indicate that the source lies at depths of several kilometers. Potential sources include Tertiary volcanic rocks of Mount Persis and basaltic rocks of the Eocene Crescent Formation.

A subtle pattern of aeromagnetic anomalies is superimposed on anomaly B and adjacent areas. The pattern is characterized by northwest-striking lineaments, each extending more or less continuously for distances of 2 to 16 km. The narrow gradient across each lineament indicates that they originate from the shallow subsurface, and we can highlight their expression by computationally emphasizing anomalies caused by shallow sources in Figure 3A. Figure 3B shows one such method, known as "residual magnetic anomalies". Residual anomalies are calculated by transforming observed anomalies into those anomalies that would be observed at a slightly higher elevation (50 m higher in this case), a process known as upward continuation, then subtracting that result from the observed anomalies (Blakely and others, 2004).

The northwest-striking pattern of residual magnetic anomalies appears throughout the onshore portion of the study area but is best represented in the Maltby-Woodinville area. The pattern is bounded to the northeast by a pronounced northwest-striking lineament (lineament E, Figure 3B) that also forms the northeastern margin of anomaly B. South of magnetic lineament E, the lineaments each separate positive regions to the northeast from less positive regions to the southwest. The lineaments are not associated with manmade structures and must be caused by subsurface lithologies. The longest and most pronounced of these lineaments (lineament D, Figure 3B), referred to as the Cottage Lake aeromagnetic lineament in Blakely and others (2004), is spatially associated with scarps identified in lidar terrain mapping. Without exception, the sense of offset on these topographic scarps when observed in the field is northeast-side-up. Similarly, the sense of each magnetic gradient (northeast-side more positive than the southwest side) is consistent with northeast-side-up offset on a normally magnetized body. Blakely and others (2004) concluded that lineament D (the Cottage Lake aeromagnetic lineament) and other linear aeromagnetic anomalies in the Maltby-Woodinville area are caused by strands of the

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SWIFZ.

The lithologic source of the magnetic lineaments is of considerable interest. The sharp gradients of the lineaments indicate that they originate in part from relatively shallow depths, within the upper 1 to 2 km, and thus linear magnetic sources extend structurally higher than the source of anomaly B. Two nearby exploratory wells provide insights into possible magnetic lithologies at these depths. The Standard Oil Company of California Alderwood #1 well (label SA, Figure 3A) encountered unconsolidated Pleistocene glacial and interglacial deposits to a depth of 110 m; penetrated mudstone, siltstone, and sandstone of the upper Eocene to lower Oligocene Blakeley Formation to a depth of 1591 m; and bottomed in sedimentary and volcanic rocks interpreted by Rau and Johnson (1999) as Eocene sandstone of Scow Bay. The Standard Oil Company of California Socal-Schroeder #1 well (label SS, Figure 3A) passed through 207 m of unconsolidated Pleistocene glacial and interglacial deposits; penetrated Blakeley Formation and Renton Formation to a depth of 2438 m; then encountered Tertiary volcanic rocks interpreted by Rau and Johnson (1999) as volcanic rocks of Mount Persis. The volcanic-derived lithologies encountered near the bottom of each of these wells are clearly potential sources for the aeromagnetic lineaments, if those lithologies lie at shallow enough depths. Magnetic susceptibility measurements in the Maltby-Snohomish area (Blakely and others, 2004) found that even Pleistocene glacial deposits and coarse-grained units within the Blakeley Formation are sometimes weakly magnetic.

GROUND-MAGNETIC SURVEY

An open field traversed by the Little Bear Creek lidar lineament (lineament 4 on Fig. 4) afforded an excellent opportunity to conduct a ground-magnetic survey in a region of linear aeromagnetic anomalies. The motivation for this investigation was to help determine the lithologic source of aeromagnetic lineaments throughout the Maltby-Woodinville area. The open field was also the site of the "Beef Barley" trench excavation (Fig. 4), discussed subsequently, and the ground-magnetic survey provided an opportunity to characterize surrounding and underlying lithologies. The open field was ideal for this type of investigation: First, it contained no significant metallic objects (buildings, metal fences, pipes, culverts, etc.) to contaminate the magnetic field. A small amount of wire was uncovered during the trench excavation (see following), but its volume was too small to significantly affect the magnetic measurements. Second, the lack of tree cover facilitated accurate GPS determinations.

Survey Specifications

The survey was conducted prior to the Beef Barley trench excavation. Profiles were conducted on foot while carrying a Geometrics 858 magnetometer system. The 858 system includes a cesium-vapor magnetic sensor, real-time GPS navigational equipment, and a small breast-pack computer. Seventeen profiles were directed northeast and spaced nominally 9 m apart; a single profile was directed northwestward through the future trench site. Measurements were made at 1-second intervals while walking at a normal pace. According to the manufacturer, the Geometrics 858 magnetometer has a sensitivity of 0.01 nT when operated at 1.0-second intervals. A stationary base station was established within the open field and operated simultaneously with the ground-magnetic survey in order to subsequently correct for diurnal variations of the earth's magnetic field and external field fluctuations. The base-station sensor was a Geometrics 856 proton-precession magnetometer. According to the manufacturer, this magnetometer has a resolution of 0.1 nT and an accuracy of 0.5 nT.

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Ground Magnetic Anomalies

Figure 4 shows the ground-magnetic survey. Magnetic field values measured along each profile were corrected for time-varying magnetic fields as recorded at the base station, and then interpolated to a projected rectangular grid using a standard minimum-curvature algorithm. No other processing was applied to the data shown in Figure 4. Individual anomalies typically range between -40 and +20 nT and have gradient widths on the order of a few tens of meters. Individual anomalies measured at ground level with these characteristics would not appear at aeromagnetic altitudes (262 m).

The ground-magnetic anomalies are small in amplitude, considering that they were measured 2 m above ground, but we are struck by the linear nature of the anomalies and their dominantly northwest-strike parallel to the Little Bear Creek topographic lineament (lidar lineament 4 of Blakely and others (2004)) and on strike with the SWIFZ. Several pronounced northwest-striking lineaments are evident, shown by the hand-drawn dotted lines on Figure 4; one passes through the Beef Barley trench site, three lie near lidar lineament 4 (Blakely and others, 2004), and a fifth (ground-magnetic lineament GA, Figure 4) lies southwest of the trench. The trench could not be extended to this southwestern-most lineament because of environmental restrictions.

Depth and lithology of likely sources

The sharp gradients of these linear anomalies indicate that their sources lie at shallow depth. To confirm that assertion, we applied a graphical approach to estimate the depth to the magnetic sources of ground-magnetic lineament GA (Figure 4) beneath profiles 6 and 8. The technique, known as "Peters' method" (Blakely, 1995; Peters, 1949), is based on an important property of magnetic anomalies: The horizontal gradient at the margins of a magnetic anomaly depends on the depth to source; i.e., a shallow magnetic body produces a sharper magnetic anomaly relative to an anomaly caused by the same body at deeper depth. Peters' method is graphical in nature: Draw two parallel lines (dotted lines in Figure 5) with slope equal to one half of the maximum gradient of the anomaly (dashed lines in Figure 5), one line tangent to the peak of the anomaly and the other line tangent to the minimum part of the anomaly. The horizontal separation of the two lines is proportional to the depth to the top of the body. The proportionality constant is 1.2 for very thin bodies and 2.0 for very thick bodies. We chose a value of 1.2, assuming that glacial strata are relatively thin in this region. Peters' method assumes that the magnetic anomaly is caused by a two-dimensional body with vertical sides and uniform and nearly vertical magnetization. Although the magnetic sources under investigation here are two-dimensional in nature, the other underlying assumptions are less likely to be realized. Therefore, our estimates should be treated as only approximate.

Based on Peters' method, we estimate that the top of the magnetic source of lineament GA lies in the upper 8 to 20 m (Figure 5). Geo-technical boreholes indicate that Pleistocene glacial deposits extend to depths of about 100 m in this area (AspectConsulting, 2005). Thus, Pleistocene glacial deposits are apparently the lithologic source of the linear anomalies seen in ground-magnetic profiles. In the area of the Beef Barley trench specifically, boreholes encountered glacial till, overlain by outwash, at depths increasing west-southwestward across the trench site (Aspect Consulting, 2005). Extrapolating from these boreholes, we estimate the glacial till to lie approximately 10 m below ground level at ground-magnetic anomaly GA, roughly equivalent to the magnetic source depth (8.6 m) estimated from Peter's method. Several explanations for the ground-magnetic anomalies are possible. (1) The anomalies may originate from lateral variations in magnetic properties caused by contrasting depositional

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processes within the Pleistocene section, such as contacts between outwash and channel deposits. (2) The anomalies may be caused by concentrations of secondary magnetic minerals, possibly related to persistent elevated ground-water levels. (3) The anomalies may be caused by faulted offsets of Pleistocene strata. We favor the third interpretation because of the linear nature of the anomalies and their orientation relative to the Little Bear Creek lidar lineament, linear aeromagnetic anomalies, and the onshore extension of the SWIFZ.

Magnetic susceptibility measurements of deposits exposed in the trench wall ranged from $0.62x10^{-3}$ to $10.30x10^{-3}$ SIU, with an average of $2.25x10^{-3}$ SIU. [SIU is an abbreviation for Système Internationale unit. Magnetic susceptibility is proportional to induced magnetization; it is a dimensionless quantity, but its numerical value depends on the units of measure. See Blakely (1995) for additional information.] This average susceptibility would produce an induced magnetization of about 0.10 A/m. [A/m, or ampere per meter, is the unit of magnetization. See Blakely (1995) for additional information.] Susceptibility measurements of glacial till recovered from geo-technical boreholes in the area had similar magnetic susceptibilities (average 2.75x10-3 SIU).

The range of magnetic susceptibilities observed in the Beef Barley trench is marginally sufficient to explain the ground-magnetic anomalies. We verified this assertion with a simple forward model (Blakely, 1995): a horizontal layer with magnetic susceptibility of $7x10^{-3}$ SIU relative to overlying strata, a value near the high end of the measured range, and with a northwest-striking, 5-m vertical offset of its upper surface located directly beneath ground-magnetic anomaly GA. If the depth to the layer is 13 m on the southwest side of the vertical offset and 8 m on the northeast side, the calculated anomaly has approximately the same amplitude and wavelength as observed in ground-magnetic anomaly GA.

Relationship between ground-magnetic and aeromagnetic anomalies

We suggest that the linear anomalies in Figure 4 are caused by linear offsets in magnetic glacial deposits in the upper 8 to 20 m. It is important to recognize, however, that glacial deposits alone cannot also account for the aeromagnetic lineaments. Individual ground-level anomalies with characteristics described here would not be detectable at aeromagnetic altitudes (approximately 262 m), yet the ground-magnetic anomalies do lie near and parallel to the Little Bear Creak aeromagnetic lineament (Figure 3B). As suggested by Blakely and others (2004), the aeromagnetic anomalies may be caused by faults that intersect both the Pleistocene section and deeper, more magnetic lithologies.

PALEOSEISMOLOGY OF THE SWIFZ

Geophysical studies of the SWIFZ suggest that several offshore splays project onto the mainland between Edmonds and Mukilteo (Figure 6). Lidar images reveal several post-glacial scarps that sit astride magnetic anomalies and topographic lineaments. Although scarps may be formed by a variety of surficial processes, the correlation of scarps with deeper geophysical structure suggests that the scarps may be related to faulting on strands of the SWIFZ. To test this hypothesis, we excavated trenches across scarps at four sites to look for earthquake-related deformation of surficial deposits. The potential for recent earthquakes in this area is also suggested by evidence for a recent earthquake along the SWIFZ on Whidbey Island (Kelsey and others, 2004).

Summary of Whidbey Island paleoseismology

Relative sea level (RSL) histories at two coastal marshes straddling the SWIFZ on Whidbey Island show evidence for abrupt uplift between 3200 and 2800 cal yr B.P. (Figures 2

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and 7). Sea level curves for Crockett and Hancock marshes, developed using radiocarbon ages from sand/peat contacts beneath each marsh, should be nearly identical if the sites experienced no past deformation. However, combined RSL curves show that the Crockett marsh curve is displaced about 2 m relative to the Hancock marsh curve (Figure 7). Kelsey et al. (2004) inferred that an earthquake caused the changes they observed in the RSL histories from the two marshes. The earthquake, caused by reverse offset on a fault tip concealed beneath a fold on central Whidbey Island, occurred between 3200 and 2800 cal yr B.P. (Kelsey and others, 2004). The fold and fault, imaged on high-resolution seismic reflection profiles in Admiralty Inlet and Holmes Harbor, lies hidden beneath a mantle of deformed late Quaternary glacial deposits. The seismic data show an asymmetrical syncline, with a steeper limb on the north side, developed in Quaternary glacial deposits. Kelsey et al. (2004) inferred that the syncline is cut by a steep reverse fault, possibly dipping 60°.

Prehistoric liquefaction at the Snohomish River delta

Bourgeois and Johnson (2001) found evidence for several events at the Snohomish River delta near Everett, Washington. Outcrops along tidal channels, exposed at low tide, revealed evidence for several episodes of strong shaking. This evidence consists mainly of upward terminating sand dikes and sand-filled cracks, some up to 1 meter wide. The dikes and cracks cut layers containing organic materials usable for radiocarbon dating. The radiocarbon ages and stratigraphic relationships show that strong shaking events occurred 1205-1025 years B.P., 1095-1015 years B.P., and 575-365 years B.P. Because the evidence for these events consists of liquefaction features, Bourgeois and Johnson (2001) could not attribute the strong shaking to a specific source. Shaking may have been caused by a Cascadia subduction zone earthquake, intraslab earthquake, or shallow earthquake in the Puget Lowland.

Evidence for past surface rupture from lidar and historical aerial photographs

Lidar mapping and historical aerial photographs of northern King County and southern Snohomish County reveal several features along the mainland trace of the SWIFZ (Figures 6, 8 and 9). The extent of lidar coverage from King County is shown on Figure 6 and only covers part of the area traversed by the mainland projection of the SWIFZ. Poor quality and artifacts in the King County lidar data limited the resolution of our lidar analysis (Blakely and others, 2004). We identified several lidar scarps in the area near Crystal Lake and Cottage Lake (Figure 9). These features consist mainly of short (<1 km), north-side-up scarps and longer topographic lineaments (~0.5 - ~4 km long). No lidar data exists for most of Snohomish County. Therefore, we relied on historical aerial photographs to search for features possibly related to past surface rupture in southern Snohomish County. Features mapped from historical aerial photographs near Devil's Butte in Snohomish County (Figure 8) appear on both the 1933 and 1938 Army Corps of Engineers photographs (Collins and others, 2005). These features consist of short scarps and longer topographic lineaments paralleling the Snohomish River near Devil's Butte.

The lidar and aerial photograph features fall close to, or directly on, previously identified low-amplitude magnetic anomalies (Figure 6). Some of these anomalies are thought to represent strands of the SWIFZ in the shallow subsurface. The largest and most continuous aeromagnetic anomaly is the Cottage Lake aeromagnetic lineament. Two topographic lineaments that lie on top of and southwest of the larger Cottage Lake aeromagnetic lineament – the 'Crystal Lake lineament' and the 'Little Bear Creek lineament' – were selected for field study in the summer of 2004. To test the hypothesis that the topographic lineaments coincided with active faults, we mapped excavations placed across scarps at four sites.

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SELECTION OF STUDY SITES AND FIELD METHODS

Between June and October, 2004, the USGS opened and mapped four excavations across scarps lying along the onshore extension of the SWIFZ. The excavation sites lay along discrete topographic lineaments, found using lidar maps, within the larger Cottage Lake aeromagnetic lineament. Specifically, two of the excavations cross scarps along a 3-km-long topographic feature known as the Little Bear Creek lineament, and two lie along a 3-km-long scarp near Crystal Lake (Figures 6 and 9). The excavations were placed perpendicular to the scarps to depths between 1.2 and 2.4 m. Excavation walls higher than 1.2 m were sloped at about 1:1 for safety. After establishing a 1-m by 1-m grid system in each excavation, field teams flagged stratigraphic contacts and structural features using colored surveyor's tape and nails, and mapped selected excavation walls on rectified digital photomosaics.

EXCAVATIONS ACROSS THE CRYSTAL LAKE LINEAMENT

A north-side-up scarp lying along the Cottage Lake aeromagnetic lineament is the most prominent scarp observed in the lidar data (Figure 9). The scarp, previously identified as Feature 10 and Lineament 11 in Blakely et al. (2004) and herein called the Crystal Lake lineament, is about 3 km long, and is sub-parallel to the eastern shoreline of Crystal Lake. Profiles across the scarp using the lidar data show a broad, north-side-up scarp between 2.5 and 4 m in height. Field observations confirm the scarp location and approximate height. The scarp is not clear on the lidar map at its southeast end due to poor lidar returns in dense vegetation.

Two sites along the Crystal Lake lineament were selected for excavation on the basis of lidar data and field reconnaissance (Figure 9). The two excavation sites, named Mountain Beaver and Flying Squirrel, lie 100 to 200 m east of Crystal Lake in a mature Douglas-fir forest.

Mountain Beaver site

The Mountain Beaver site consists of a 16-m long excavation with sloping walls (about a 1:1 slope). This excavation exposed deposits from the last glacial advance into the Puget Lowland (Figure 10). This glacial advance, regionally called Vashon, culminated around 16,400 cal yr B.P. when the glacier disintegrated, leaving behind outwash deposits and glacial drift (Porter and Swanson, 1998). Glacial drift exposed in the excavation consisted of dense gray sandy silt with faceted pebbles and cobbles (Qvt). Overlying the drift is a thin layer of dense silt that is laminated in places (Qste). The silt is in turn overlain by a pebbly drift consisting of dense sandy silt with abundant faceted pebbles and cobbles, and discontinuous stratified sand layers (Qd).

A fault separates the pebbly drift (Qd) from overlying sand and pebbly silty sands (Qrs) that contain large intact blocks of Qd (Figure 10 and 11). The fault truncates and deforms sand and silt layers in the pebbly drift (Qd) such that a normal sense of movement on the fault is clearly observed. Photographs of the fault show truncated and deformed beds, and show a shear fabric parallel to the fault (Figure 11). Overlying the fault is a sequence of massive to interbedded sand and pebbly silty sands that pinch out towards the middle of the trench wall (Qrs). A clast of charcoal from a silty fine sand layer (sample MB001 from Qrs) yielded an AMS radiocarbon age of 31,330±340 C14 yr B.P. Overlying Qrs is a buried A-horizon (Hab). A charcoal clast collected from the stratigraphic middle of Hab in the west wall (not shown in Figure 10) of the excavation yielded an AMS radiocarbon age of 10,190±40 C14 yr B.P. (12,090 – 11,670 cal yr B.P.). Gravel lenses (not shown in Figure 10) and a silty colluvial deposit (Hc and Hcs) bury the former A-horizon and underlying deposits. The loose character of unit Hc

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makes it an ideal habitat for mountain beaver (*Aplodontia ruppia*). Several filled and open *Aplodontia* burrows were noted during field work, and several live *Aplodontia* were observed in the excavations. The tops of the excavation walls are mantled with surface accumulations of modern forest litter (Ha), with thicker accumulations near the base of the scarp.

Flying Squirrel site

The Flying Squirrel site is a 20-m long excavation across a 3.5--m high, north-side-up scarp (Figure 12). Eight lithologic units mapped in the excavation provide a stratigraphic section spanning from the Vashon advance to the present. Vashon till is exposed at the base of the stratigraphic section and consists of a gray sandy loam with faceted pebbles and cobbles of mainly felsic and intermediate rocks (unit Qvt on Figure 12). An erosional unconformity separates the till from overlying Vashon recessional outwash deposits.

The Vashon recessional outwash deposits consist of four mappable units. The oldest unit is a gray, gravelly, fine to coarse sand to sandy gravel (Qrg). Interbedded with unit Qrg are two similar units - a gray, pebbly, fine to coarse sand with crossbedding (Qrgs), and a gray, fine to coarse, crossbedded sand (Qrs). A thin silt layer with laminations (Qste) caps the recessional outwash deposits. Unit Qste is assumed to be a good indicator of paleohorizontal; however, dips of Qste range from an average of about 10° to almost 40° below the foot of the scarp (between 6 and 10 m).

Unit Qste is overlain by a gray, pebbly sandy loam (unit Qd) with planar and cross stratification observed in several places. A thick, reddish-brown sandy loam to loam, with weak sub-blocky pedogenic structures and scattered pebbles and cobbles (Hc) overlies the entire section. Tree roots and burrows of *Aplodontia ruppia* extend downward from ground surface into Hc. Former burrows and filled cavities from rotted tree roots occur in several unmapped sections of the excavation. A thin layer of organic detritus (unit Ha) overlies unit Hc and mantles the ground surface.

EXCAVATIONS ACROSS THE LITTLE BEAR CREEK LINEAMENT

The Little Bear Creek lineament follows the Little Bear Creek drainage and lies parallel to and along an aeromagnetic anomaly about 1.5 km southwest of the Cottage Lake aeromagnetic lineament (Figures 6 and 9). The southeastern part of the lineament is aligned along a deep ravine and several scarps. To investigate whether the lineament is a strand of an active fault, we selected two sites with degraded scarps for further study based on field reconnaissance. Detailed logs of the sites, named French Onion and Beef Barley after the pervasive aroma of soups produced in a nearby facility, are shown in Sherrod and others (2005).

French Onion site

The French Onion site is an excavation across a small scarp on the south side of a narrow ridge (Figure 13). The ridge is oriented northeast-southwest and bordered on the southeast and northwest by deep ravines eroded into late Quaternary glacial deposits. A small scarp lying along the Little Bear Creek lineament crosses the southwest end of the ridge. A shallow excavation across the scarp revealed eight stratigraphic units composed of glacial lake deposits, till, and Holocene soils.

The oldest units found in the French Onion excavation are glacial lake deposits, presumably of Late Pleistocene age (Figure 13). A brown to gray, laminated claystone (Qscl) and a brown mudstone (Qmud) lie at the base of the exposed section. Overlying Qscl is a massive to laminated, gray claystone (Qmcl). A small lens of glacial drift, probably a till (Qt), is located between 12 and 15 m and is nearly surrounded by Qmud. All of these units were slightly

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indurated, possibly as a result of overconsolidation below the bed of a thick glacier. No materials for radiometric dating were observed in the glacial deposits, but the overconsolidation is consistent with these units being deposits from an earlier glacial advance that were subsequently overridden by glacial ice during the Vashon advance.

Overlying the glacial deposits in the French Onion trench is a series of Holocene soils and colluvial deposits. A thick layer of buried organic-rich sandy loam to loam lies directly on the Qmud unit (unit Hab between 6 and 9 m on Figure 13). Immediately overlying Hab are two colluvial units – Hcol and Hpcol on Figure 11. Hcol is a brown sandy loam to loam and contains scattered charcoal clasts. Hpcol is similar to Hcol but has abundant pebble-sized clasts of mudstone. The mudstone pebbles were likely derived upslope from weathering of units Qscl, Qmud, and Qmcl. Hpcol overlies Hcol between 4 and 6 meters on Figure 11. A dark brown organic detritus layer (Ha) caps the stratigraphic section.

Beef Barley site

The Beef Barley site consists of an excavation ~30 meters long and ~2.4 meters deep, oriented N55°E (Figures 14 and 15). Approximately the upper meter of exposed soil consisted of fill containing shards of colored glass, a small amount of fence wire, and machine-cut lumber. The soils below the fill appeared undisturbed and likely span the time interval from Vashon recessional outwash to development of the Little Bear Creek drainage and historic settlement.

The oldest stratigraphic units found in the Beef Barley excavation were two discrete sequences of recessional outwash deposits (Figure 14). Neither sequence is overconsolidated, indicating that neither was overridden by glacial ice. The lack of overconsolidation suggests that the sequences are Vashon recessional outwash deposits. The first sequence (sequence Q1; units Q1a to Q1g on Figure 14) consists of yellowish brown to olive brown pebbly sand, loamy sand, and sandy loam. Locally, gravel beds within sequence Q1 dip ~36° to the SSW while thin silts and clay layers in sequence Q1 dip as much as 22° to the SSW. An angular unconformity (Q1-Q2 unconformity; yellow line on Figure 14) separates sequence Q1 from an overlying sequence of recessional outwash deposits (sequence Q2). Sequence Q2 consists of yellow brown to olive gray gravelly sandy loam, sandy loam, sandy clay, and clay (Figure 14). All of sequence Q2 is essentially flat-lying to very gently south-dipping.

A second unconformity separates sequence Q2 from an overlying gravelly deposit (Q2-H/Q3 unconformity; green line on Figure 14). This unconformity is flat-lying between 8 and 16 meters (see Figure 14) and rises slightly between 2 and 6 m. This slight rise could result either from a tectonic origin for the unconformity or from normal erosional processes that created the unconformity. Three conformable units lie above the Q2-H/Q3 unconformity.

Unit H/Q3 is an olive brown sandy loam that lies directly over the Q2-H/Q3 unconformity. This unit extends the length of the excavation but thins considerably in the northeastern part of the excavation. Dark brown organic-rich sandy loams (unit H4 and H4.1) overlie unit H/Q3 and most likely represent prehistoric and historic surface soils developed at the site. Charcoal samples collected at the base of unit H4 yielded AMS ages of 2450±40 C14 yr B.P. (BETA-200523; 2730 to 2350 cal yr B.P.) and 2660±50 C14 yr B.P. (BETA- 200524; 2850 to 2740 cal yr B.P.). Unit H4.1 is slightly disturbed in places, most likely by equipment used to place fill over the site in the early part of the 20th century.

EVIDENCE FOR PREHISTORIC DEFORMATION

Stratigraphic and structural observations collected from the four excavations yield insights into past earthquakes along the SWIFZ (Figure 16). We mapped each excavation in

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detail, looking for evidence of surface deformation from folding and faulting and establishing criteria to distinguish tectonic from glacial deformation. Evidence for strong shaking at each site, in the form of liquefaction features, was also mapped. At sites along the Crystal Lake lineament, we observed evidence for past folding and faulting, and at sites along the Little Bear Creek lineament we observed evidence for past folding, faulting, and liquefaction. These past folding, faulting, and liquefaction events were each assigned a unique identifier and are discussed below.

Crystal Lake lineament

The clearest indication of prehistoric deformation along the Crystal Lake lineament is post-glacial folding (Event C) and a normal fault that offsets glacial deposits (Event B). Event B is interpreted from deformed drift and outwash cut by a low-angle normal fault (Figure 11). A low-angle fault observed in the Mountain Beaver excavation (dip is ~20° on Figures 9 and 11) separates Vashon drift/ablation till (Qd) from Vashon recessional outwash deposits (Qrs channel fill). The fault truncates interbeds within Qd. Drag folds in Qd and Qrs suggest a normal sense of movement on the fault (Figure 11). Stratigraphic observations suggest that the last episode of movement on the fault could be as old as late Pleistocene, and was possibly caused by syn- or post-depositional slumping or tectonic movement. The sediments cut by the normal fault are strongly deformed and are associated with features of soft-sediment deformation. Therefore, it is likely that Event B and the normal fault are the result of slumping or landsliding in a saturated, recessional-outwash environment rather than tectonic deformation. However, a tectonic origin for the normal fault cannot be ruled out completely.

After Event B, the entire section, including the fault, was warped by several meters of north-side-up folding. If the normal fault was created by landsliding during Event B, then the original dip of the fault plane may have been quite low or even flat, accounting for the ~20° post-folding dip of the fault plane. Post-glacial folding (Event C) along the Crystal lake lineament is indicated by dipping laminated silt layers, deformed recessional outwash deposits, and a buried soil. Laminated silts observed in the Flying Squirrel and Mountain Beaver excavations had dips averaging about 10° in both excavations, but higher dips in parts of both excavations suggest post-depositional warping. Below the scarps at both excavations, dips of the silt layer increase, reaching a maximum of almost 40° in the Flying Squirrel excavation and ~30° in the Mountain Beaver excavation (Figures 10 and 11). While 10° dips may be common in glacial deposits, dips of laminated silts exceeding 30° are not common; suggesting that the higher dips resulted from post-depositional deformation. Folding in the Mountain Beaver excavation is mirrored by dips of units Qvt, Qste, Qd, and Qrs, and the normal fault described above – suggesting that the entire section was warped during a single event. Geometry of stratigraphic sections in the Mountain Beaver excavation indicates that warping was greater than 2 m during Event 2. Thus, the original scarp at the Mountain Beaver site likely was at least 2 m high. It is possible that the Mountains Beaver excavation records only Event C. Lidar profiles across the scarp show that the present-day scarp height is between 2.5 to 4 m, suggesting that folding during Event C could have been 4 m high. Over time, the original scarp at the Mountain Beaver site degraded and colluvium buried the former soil at the base of the scarp (unit Hab on Figure 10).

Unit Hab at the Mountain Beaver site is a buried A-horizon. Filled root cavities extend from the bottom of the former soil horizon into the underlying units. The surface of the buried soil rises slightly towards the scarp, suggesting that parts of the former soil were eroded over time. Colluvium from the scarp (units Hc and Hcs) buried the remaining soil after the event. Thus, radiocarbon ages from charcoal in the buried soil horizon provide a maximum age for the

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timing of the folding event described above. A single radiocarbon age from a sample collected near the middle of unit Hab yielded an age of 12,090 – 11,670 cal yr B.P. This single age indicates that Event C occurred after 11,670 cal yr B.P.

Little Bear Creek lineament

Observations of fractures, faults, and shear zones in the French Onion excavation suggest a complex deformation history. We observed at least three structural fabrics in the excavation, one dipping to the south, one to the north, and a subhorizontal fabric. When viewed in outcrop, these fabrics give the older glacial units (Qscl, Qmud, Qmcl) a shattered appearance. We observed each fabric in the older glacial units and traced only a few faults into the overlying Holocene units. However, it was not possible to determine if the faults actually offset the Holocene units or if the Holocene units were simply weathering into one of the older faulted units. With few exceptions, we could not determine the sense of motion of any of the faults. We infer that the south and north-dipping fabrics are older than the subhorizontal fabric (discussed below). We did not assign any events to these fabrics because it is likely that none of the faults observed in the French Onion excavation moved after Vashon deglaciation. It is possible that fault-line erosion created the scarp at the French Onion site rather than movement on a fault.

The south-dipping fabric in the French Onion excavation is concentrated in the southern part of the excavation (Figure 13). We observed reverse motion on at least three of the south-dipping faults. One of the south-dipping reverse faults cuts a late Quaternary till (Qt between 13 and 14.5 m on Figure 13). Several south-dipping faults appear to push Qscl against Qmud (between 7 and 10 m on Figure 13), suggesting a reverse sense of motion on this set of faults. These south-dipping reverse faults are difficult to explain with movement of glacial ice across the region. Glacial flutes indicate that ice flowed approximately north to south across the region in the last glacial advance, and we assume that previous glaciers flowed in similar directions. If these faults are glaciotectonic, then the hanging wall was thrust upwards into the bed of the glacier – an unlikely scenario. More likely, the south-dipping faults are tectonic and were later cut by north-dipping and subhorizontal faults produced by movement of glacial ice.

The north-dipping fabric is concentrated in the northern part of the excavation. The largest of the faults observed in this set of features appear to merge between grid points 9 and 10 m on Figure 13. Bedding truncations and displacements on the largest of the north-dipping faults were not observed so it is not possible to indicate a sense of slip for this set of features.

A subhorizontal shear fabric cuts across the north-dipping and south-dipping faults in the French Onion excavation. Microfaults observed in the subhorizontal fabric had both reverse and normal displacements, but were dominated by normal displacement. In general, the sense of net tectonic transport was to the south. A south-directed tectonic transport is consistent with the subhorizontal fabric resulting from simple shear at the base of a glacier. Nelson at al. (2003) observed similar shear fabrics developed in weathered bedrock immediately below Vashon till and attributed the shears to movement of glacial ice across the weathered bedrock surface.

The Beef Barley excavation has a rich history of deformation and strong ground shaking. One or possibly two angular unconformities and reverse faulting suggest multiple episodes of surface deformation. Liquefaction features observed throughout the excavation disturb recent soils and indicate strong ground shaking in the late Holocene.

The oldest period of deformation (Event D) in the Beef Barley excavation is marked by the angular unconformity between sequences Q1 and Q2 (Figures 14 and 15). Although no material was found to provide ages for either sequence, lithologic comparisons to other exposures and the lack of overconsolidation suggest that the unconformity separates two

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sequences of Vashon recessional outwash. We speculate that the unconformity was created when an earthquake on the Little Bear Creek lineament caused folding of sequence Q1 (Event D). Following Event D, the folded units were beveled off by flowing water and sequence Q2 was deposited. Thus, Event D likely occurred between deglaciation and establishment of non-glacial environments, or roughly between 16,400 and ~12,000 cal yr B.P. A limiting minimum age of 12,000 years B.P. was selected because non-glacial environments were established in many areas of the Puget Lowland by ~12,000 years B.P. (Nelson and others, 2003; Sherrod, 2002). Non-glacial environments inferred at the Mountain Beaver site at the time of Event C suggest that Event C postdates Event D by hundreds to thousands of years (Figure 16).

A possible earthquake (Event E) occurred in either the latest Pleistocene or early Holocene, marked in the Beef Barley excavation by the unconformity between sequence Q2 and unit H/Q3. This unconformity could be the result of folding on the Little Bear Creek lineament, or, alternatively, the unconformity could be the result of normal fluvial processes acting at the site at the time unit H/Q3 was deposited. Neither alternative can be dismissed based on the data collected in the excavation. If the unconformity is the result of folding on the Little Bear Creek lineament, no age data exist to constrain the age of the event beyond being younger than ~12,000 yr B.P and older than ~2850 cal yr B.P., the maximum age of unit H4.

The youngest event (Event F) recorded in the Beef Barley excavation included folding, reverse faulting, and liquefaction. Evidence for folding is best seen between 14 and 20 m on the excavation logs (Sherrod et al. (2005), and Figure 15). Reverse faulting is best seen between 13.5 and 15 m on the excavation logs. Good piercing points to measure displacement during this youngest event are lacking but the folding probably did not exceed 1 meter and the faulting is likely limited to only a few decimeters (less than 30 cm). However, none of these estimates account for out-of-plane movement (lateral displacement), and actual slip could have been quite a bit larger.

Liquefaction accompanied the folding and faulting of the youngest event, evidenced by numerous liquefaction features observed throughout the excavation (Figures 14 and 15). These features include sand-filled dikes injected upwards through fine-grained facies of sequences Q1 and Q2. Pieces of Q1 and Q2 were entrained by the flow of sand, including blocks of silt in a large liquefaction feature between 13.5 and 16 meters on the log (Figure 15). The liquefaction is associated with and may have taken advantage of the reverse faults observed between 14 and 15 meters, suggesting that the faulting and liquefaction occurred during the same event. Alternatively, it is possible that the faults created during an older event were places of weakness followed by younger liquefaction features. That the liquefaction is young is also evidenced by the degree to which unit H4 is disturbed by the liquefaction. Units H/Q3 and H4 were deformed into hummocks and swales above the liquefaction features, and one sand dike was observed cutting through units H4 and H4.1 to the former land surface. Since the liquefaction disturbs unit H4, the events that caused the shaking had to postdate the youngest charcoal collected from H4, or about 2730 cal yr B.P. It is possible that multiple events in the late Holocene caused strong ground shaking at the Beef Barley site. Bourgeois and Johnson (2001) documented at least three episodes of liquefaction in the late Holocene at the Snohomish River delta, about 26 km N/NW of the site. Any of these events could also have shaken the ground hard enough at the Beef Barley site to generate the liquefaction features observed in the excavation.

In this study, liquefaction is unique to the Beef Barley site. Site conditions explain why the Beef Barley site liquefied while the other sites did not. Saturated soils and groundwater are located near the ground surface at the Beef Barley site. Near surface soils at the Beef Barley site

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include fine-grained sediments likely to act as a barrier to upwards flow of liquefied materials. None of the other excavation sites contained the unique set of conditions conducive to liquefaction that are found at the Beef Barley site.

STRUCTURE AND PREHISTORIC EARTHQUAKES ON THE SWIFZ

Offshore marine seismic surveys indicate that several strands of the SWIFZ traverse Admiralty Inlet and Whidbey Island before making landfall between the cities of Edmonds and Mukilteo (Figure 17). The magnetic survey data presented in Blakely et al. (2004) and in this report show that after making landfall, strands of the SWIFZ continue to the southeast and cross through southern Snohomish County and northern King County near Maltby and Woodinville. Lidar mapping shows that scarps on the ground surface lie on or near several magnetic anomalies, suggesting that the shallow subsurface anomalies are strands of an active fault zone. Excavations across two scarps confirm that the Crystal Lake and Little Bear Creek lineaments are active strands of the SWIFZ.

We envision one model of the SWIFZ as a set of anastomosing faults, two of which are the Crystal Lake and the Little Bear Creek lineaments. These strands have lidar scarps and paleoseismological evidence that suggests earthquakes have ruptured the ground surface at least once in the Holocene. Other strands may be active as well, including Lineament "X" (Figure 9), the "GA anomaly" (Figure 4), and possible strands associated with scarp-like features identified on historical aerial photographs. However, poor quality of existing lidar coverage in King County and lack of lidar in southern Snohomish County preclude making any statements as to surface ruptures associated with these features. Based on the aeromagnetic mapping in southern Snohomish and King Counties, the SWIFZ could exceed 12 km in width, but at present, active strands are only known between Woodinville and Maltby (Figures 6 and 17).

Prehistoric earthquake activity on at least two strands of the SWIFZ is based on excavations across scarps identified on lidar maps. These excavations, combined with published data from Whidbey Island (Kelsey and others, 2004), indicate that at least four earthquakes struck the SWIFZ in the last 16,400 years (labeled as events C, D, W, and F on Figure 16). An additional earthquake and at least three ground shaking events have occurred along the SWIFZ when additional excavation information and events from the Snohomish River delta are considered (Bourgeois and Johnson, 2001). The liquefaction events could have sources other than the SWIFZ, such as a large Seattle fault event about 1100 years ago and intraslab events (Bucknam and others, 1992). However, if we included the liquefaction events and other evidence as indicators of possible SWIFZ events, then the number of events in the last 16,400 years increases to nine (Figure 16).

FUTURE RESAERCH DIRECTIONS

We now have strong evidence that two fault strands in the Maltby-Woodinville area, presumably part of the SWIFZ, slipped multiple times in the Holocene, yet questions remain regarding the overall hazards posed by the SWIFZ. The focus of our present study and that of a previous report (Blakely and others, 2004) was controlled partly by available lidar coverage. As shown in Figure 6, that lidar survey did not include mainland regions along the Puget Sound, nor areas northeast of Maltby. Thus, we do not have a clear view of the length and width of the active deformation zone. This uncertainty could be addressed with new, high-quality lidar surveys and follow-on trench excavations. The region between Maltby and Snohomish is of particular interest because of lineaments noted in airborne photography, many of which

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correspond to aeromagnetic anomalies.

The region between the Little Bear Creek lineament and Lake Washington is also an important concern. Numerous northwest-striking aeromagnetic lineaments have been interpreted in this region, but corresponding scarps have not been identified. Several explanations are possible: (1) The aeromagnetic lineaments may reflect sub-surface faults that have no topographic expression, either because slip surfaces did not intersect the ground or because the ground surface has been altered by human development or by geologic processes occurring subsequent to latest slip. (2) The lidar data may have been of insufficient quality to detect small scarps. (3) The aeromagnetic lineaments may be caused by geologic processes other than faulting and thus pose no hazard. An experimental trench across a well-defined aeromagnetic lineament, one without topographic expression, might determine which explanation is most plausible.

Questions also remain regarding the vertical extent and three-dimensional aspects of individual fault strands. High-resolution seismic-reflection profiles conducted across selected lineaments might define the configuration of deformed strata and the amounts of vertical offset on faults at depth. Additional ground-magnetic surveys, analyzed jointly with existing aeromagnetic anomalies, might help determine the vertical extent of identified faults. Ground magnetic surveys are impractical throughout much of the study region, however, because of the proximity of manmade structures. A helicopter-borne magnetic survey, flown as low as safely possible and along closely spaced flight lines, would serve as an excellent alternative.

ACKNOWLEDGEMENTS

The U.S. Geological Survey National Earthquake Hazards Reduuction Program and an Inter-Agency Agreement between the U.S. Geological Survey and King County, Washington provided funding for this project.

REFERENCES CITED

Aspect Consulting, 2005, North Mitigation Area Trench Boring Investigation Summary - Brightwater Treatment Plant Seismicity Investigation: Consultant report prepared for CH2M Hill.

Blakely, R.J., 1995, Potential theory in gravity and magnetic applications, Cambridge University Press, 441 p.

Blakely, R.J., Sherrod, B.L., Wells, R.E., Weaver, C.S., McCormack, D.H., Troost, K.G., and Haugerud, R.A., 2004, The Cottage Lake aeromagnetic lineament: a possible onshore extension of the southern Whidbey Island fault, Washington, *in* U.S.G.S., ed., p. 60.

Blakely, R.J., Wells, R.E., and Weaver, C.S., 1999, Puget Sound Aeromagnetic Maps and Data: U.S. Geological Survey Open-File Report 99-514, 4 p.

Blakely, R.J., Wells, R.E., Weaver, C.S., and Johnson, S.Y., 2002, Location, Structure, and Seismicity of the Seattle Fault Zone, Washington: Bulletin of the Geological Society of America, v. 114, p. 169-177.

Bourgeois, J., and Johnson, S.Y., 2001, Geologic evidence of earthquakes at the Snohomish delta, Washingotn, in the past 1200 yr: Geological Society of America Bulletin, v. 113, no. 4, p. 482-494.

Brocher, T.M., Parsons, T., Blakely, R.A., Christensen, N.I., Fisher, M.A., Wells, R.E., and Group, S.W., 2001, Upper crustal structure in Puget Lowland, Washington: Results from 1998 Seismic Hazards Investigation in Puget Sound: Journal of Geophyisical Research,

RECEIVED
APR 26 2007
CITY OF WOODINVILLE
DEVELOPMENT SERVICES

EXHIBIT 165
PAGE 42 OF 72

v. 106, p. 13,541-513,564.
Bucknam, R.C., Hemphill-Haley, E., and Leopold, E.B., 1992, Abrupt uplift within the past 1700 years at southern Puget Sound, Washington: Science, v. 258, p. 1611-1614.
Collins, B., Sheikh, A., Montgomery, D., Kiblinger, C., Greenberg, H., and Biggs, D., 2005, Puget Sound River History Project, http://riverhistory.ess.washington.edu/index.html, University of Washington.
Gower, H.D., Yount, J.C., and Crosson, R.S., 1985, Seismotectonic map of the Puget Sound region, Washington: U.S. Geological Survey Miscellaneous Investigations Series Map I-1613, 15 p.; 250,000.
Johnson, S.Y., Potter, C.J., Armentrout, J.M., Miller, J.J., Finn, C.A., and Weaver, C.S., 1996, The southern Whidbey Island Fault; an active structure in the Puget Lowland, Washington: Geological Society of America Bulletin, v. 108, no. 3, p. 334-354.
Kelsey, H.M., Sherrod, B., Johnson, S.Y., and Dadisman, S.V., 2004, Land-level changes from a late Holocene earthquake in the northern Puget Lowland, Washington: Geology, v. 32, no. 6, p. 469-472.
Kelsey, H.M., Sherrod, B.L., Johnson, S.Y., and Dadisman, S.V., 2004, Land-level changes from a late Hoocene earthquake in the northern Puget Lowland, Washington: Geology, v. 32, no. 6, p. 469-472.
Minard, J.P., 1985, Geologic map of the Maltby quadrangle, Snohomish and King Counties, Washington: U. S. Geological Survey Miscellaneous Field Studies MF-1746, 1:24,000.
Nelson, A.R., Johnson, S.Y., Kelsey, H.M., Sherrod, B.L., Wells, R.E., Okumura, K., Bradley, L.-A., Bogar, R., and Personius, S.F., 2003, Field and laboratory data from an earthquake history study of the Waterman Point fault, Kitsap County, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-2423.
Nelson, A.R., Johnson, S.Y., Kelsey, H.M., Wells, R.E., Sherrod, B.L., Pezzopane, S.K., Bradley, L.-A., Koehler, R.D., III, and Bucknam, R.C., 2003, Late Holocene earthquakes on the Toe Jam Hill fault, Seattle fault zone, Bainbridge Island, Washington: Geological Society of America Bulletin, v. 115, no. 11, p. 1388-1403.
Peters, L.J., 1949, The direct approach to magnetic interpretation and its practical application: Geophysics, v. 14, p. 290-320.
Porter, S.C., and Swanson, T.W., 1998, Radiocarbon age constraints on rates of advance and retreat of the Puget lobe of the Cordilleran ice sheet during the last glaciation: Quaternary Research, v. 50, p. 205-213.
Ramachandran, K., Hyndman, R.D., and Brocher, T.M., 2005, Northern Cascadia subduction zone: tomographic 3D P-wave velocity structure: Geophysical Journal International, v. in press.
Rau, W.W., and Johnson, S.Y., 1999, Well stratigraphy and correlations, western Washington and northwestern Oregon: U.S. Geological Survey Geologic Investigations Series Map I-2621, 31 p.
Sherrod, B.L., 2002, Late Quaternary Surface Rupture Along the Seattle Fault Zone Near Bellevue, Washington: Eos Trans. AGU, Fall Meet. Suppl., v. 83, no. 47, p. Abstract S21C-12.
Sherrod, B.L., Barnett, E., and Kelsey, H.M., 2005, Excavation Logs of Two Trenches Across a Strand of the Southern Whidbey Island Fault Zone Near Grace, Washington: U.S. Geological Survey Open-File Report 2005-1013, p. 36x48 oversized sheet.
Tabor, R.W., Frizzell, V.A., Jr., Booth, D.B., Waitt, R.B., Jr., Whetten, J.T., and Zartman, R.E.,

RECEIVED
APR 26 2007
CITY OF WOODINVILLE
DEVELOPMENT SERVICES

EXHIBIT 165
PAGE 43 OF 72

1993, Geologic map of the Skykomish River 30-minute by 60-minter quadrangle, Washington: U. S. Geological Survey Map I-1963.

Wells, R.E., and Simpson, R.W., 2001, Northward migration of the Cascadia forearc in the northwestern U.S. and implications for subduction deformation: Earth, Planets, and Space, v. 53, p. 275-283.

Wells, R.E., Weaver, C.S., and Blakely, R.J., 1998, Fore-arc migration in Cascadia and its neotectonic significance: Geology, v. 26, no. 8, p. 759-762.

Yount, J.C., and Gower, H.D., 1991, Bedrock geologic map of the Seattle 30x60 quadrangle, Washington: U. S. Geological Survey Open File Report 91-147.

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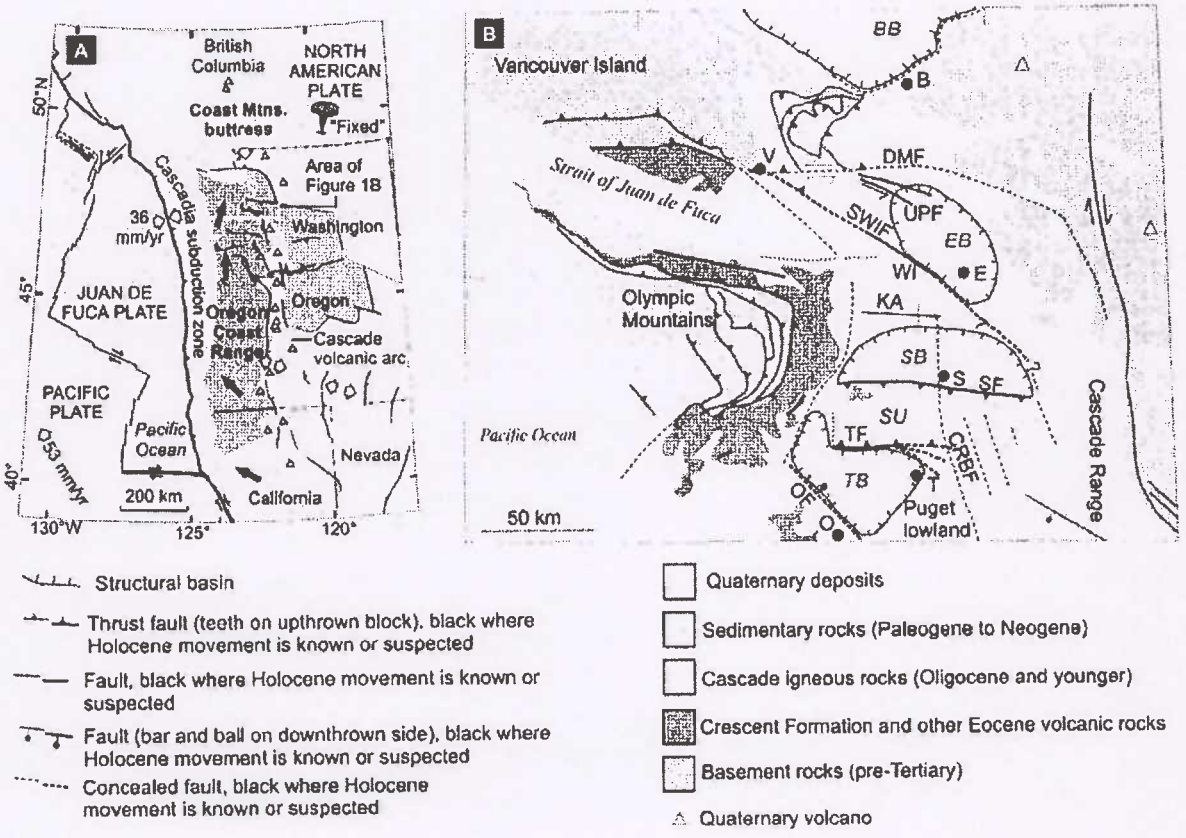

Figure 1—(A) Kinematic model of Cascadia forearc, simplified from Wells and others (Wells and others, 1998) and Wells and Simpson (2001). Northward migration of the Oregon Coast Range squeezes western Washington against North America, producing faults and earthquakes in the Puget Lowland. (B) Generallized map of the Puget Lowland and surrounding regions. BB, Bellingham basin; EB, Everett basin; SB, Seattle basin; TB, Tacoma basin; DMF, Devils Mountain fault; UPF, Utsalady Point fault; SWIF, southern Whidbey Island fault; SF, Seattle fault; TF, Tacoma fault; OF, Olympia fault; V, Vancouver; B, Bellingham; E, Everett; S, Seattle; T, Tacoma; O, Olympia; WI, Whidbey Island; KA, Kingston arch; SU, Seattle uplift. Redrawn from Brocher and others (2001).

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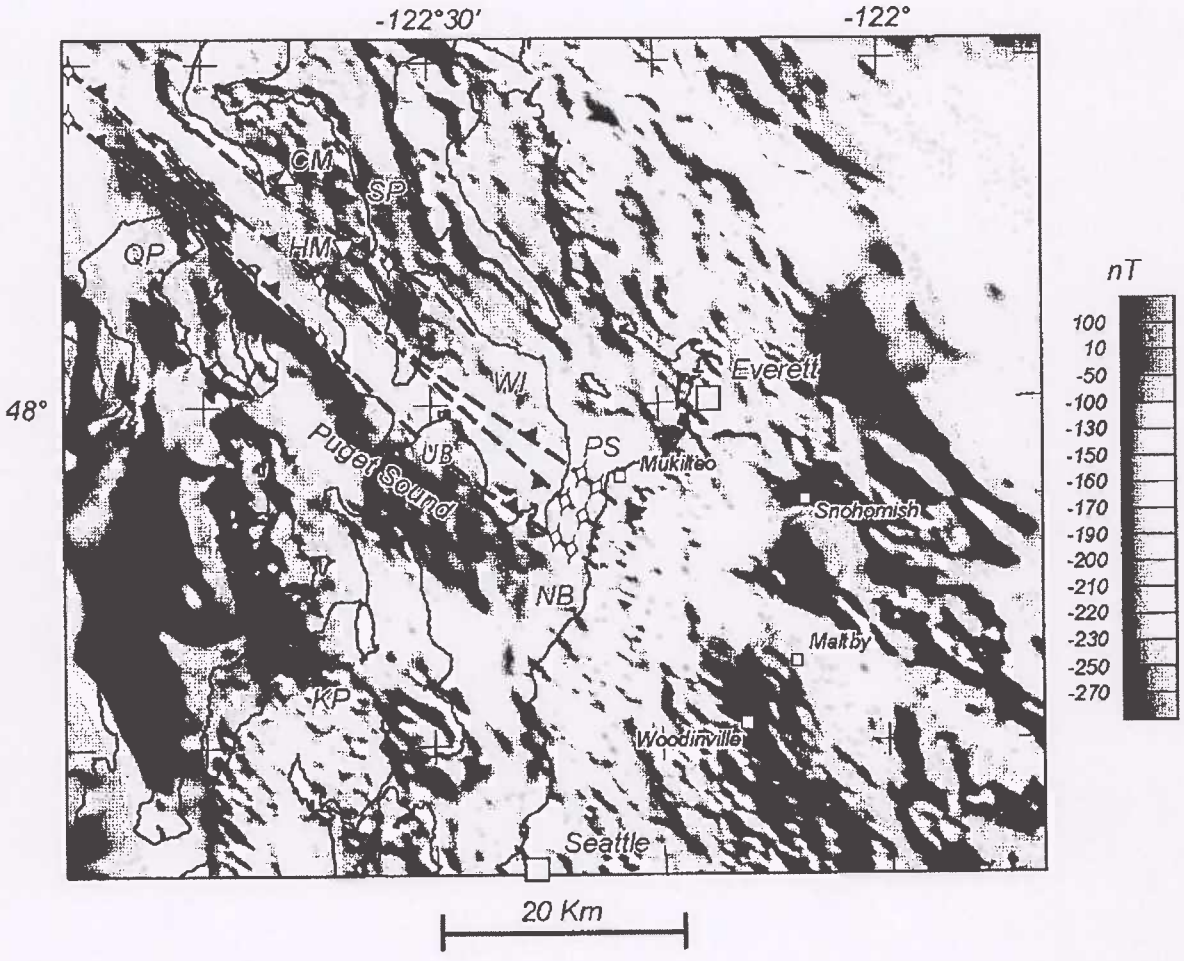

Figure 2—Evidence for the SWIFZ. Color-shaded relief map indicates intensity of the magnetic field observed in a high-resolution aeromagnetic survey (Blakely and others, 1999). Dashed lines show faults from published reports: black lines from Johnson and others (1996) and blue lines from Kelsey and others (2004). White diamonds show approximate location of faults identified using marine seismic-reflection surveys. Yellow triangles indicate relative sea-level study sites (Kelsey and others, 2004); northern triangle (Crockett marsh) is up relative to the southern triangle (Hancock marsh). CM, Crockett marsh; HM, Hancock marsh; WI, Whidbey Island; SP, Saratoga Passage; PS, Possession Sound; QP, Quimper Peninsula; KP, Kitsap Peninsula; NB, Nora Beach, UB – Useless Bay.

Figure 3 (on following page)—(A) Aeromagnetic anomalies of the study area. Major roads indicated by brown lines. Labels A, B, C, D, and E refer to anomalies and lineaments discussed in text. GMS shows location of ground-magnetic survey. SA, Standard Oil Company of California Alderwood #1 well; SS, Standard Oil Company of California Socal-Schroeder #1 well. (B) Residual magnetic anomalies of study area. Upward-continuation distance 50 m. White dots show the location of magnetic contacts determined automatically with the method of Blakely and Simpson (1986). Black dashed lines indicate lineaments associated with specific magnetic contacts; black dotted lines are lineaments identified with lower confidence. Color interval for both maps determined by an equal histogram algorithm.

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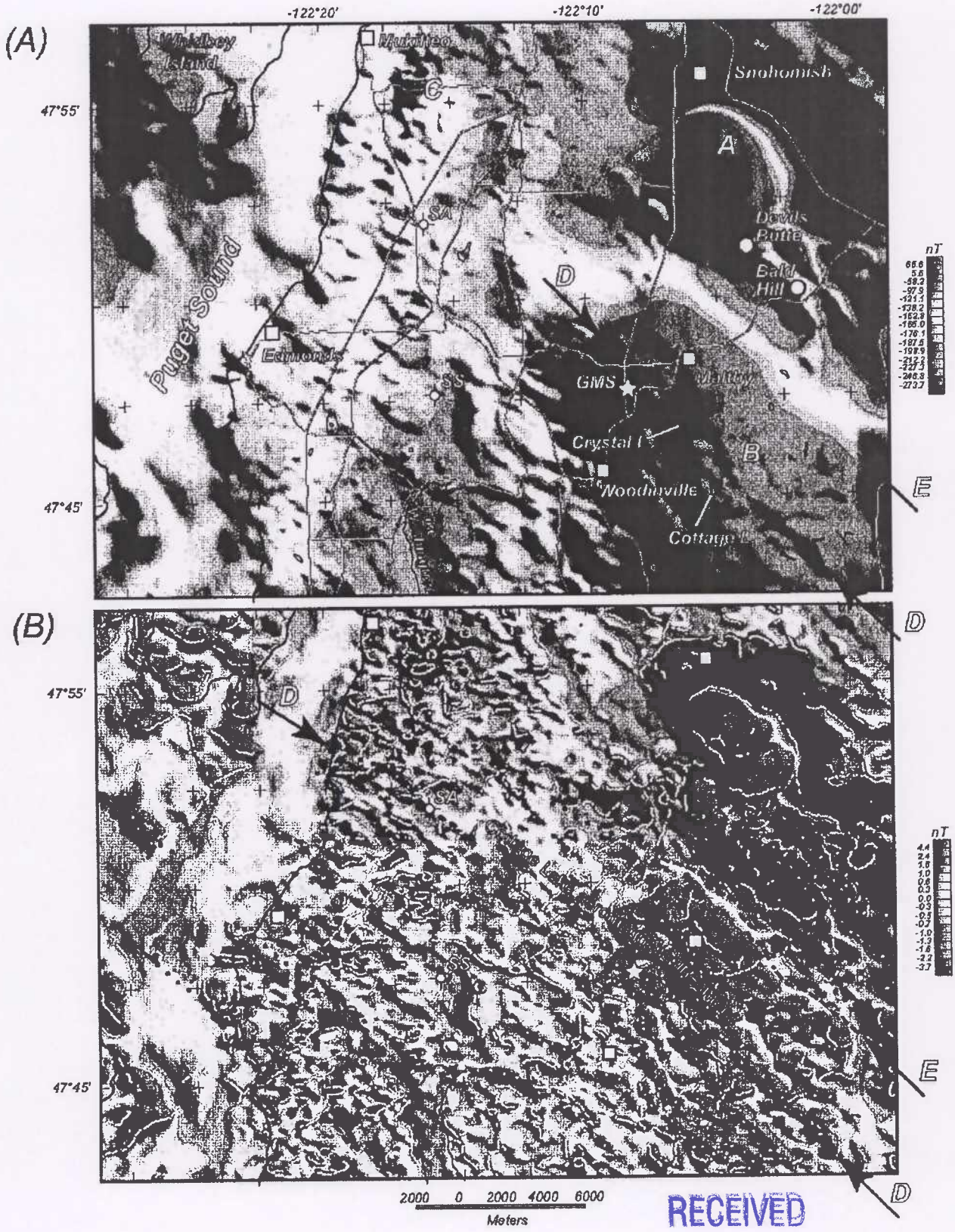

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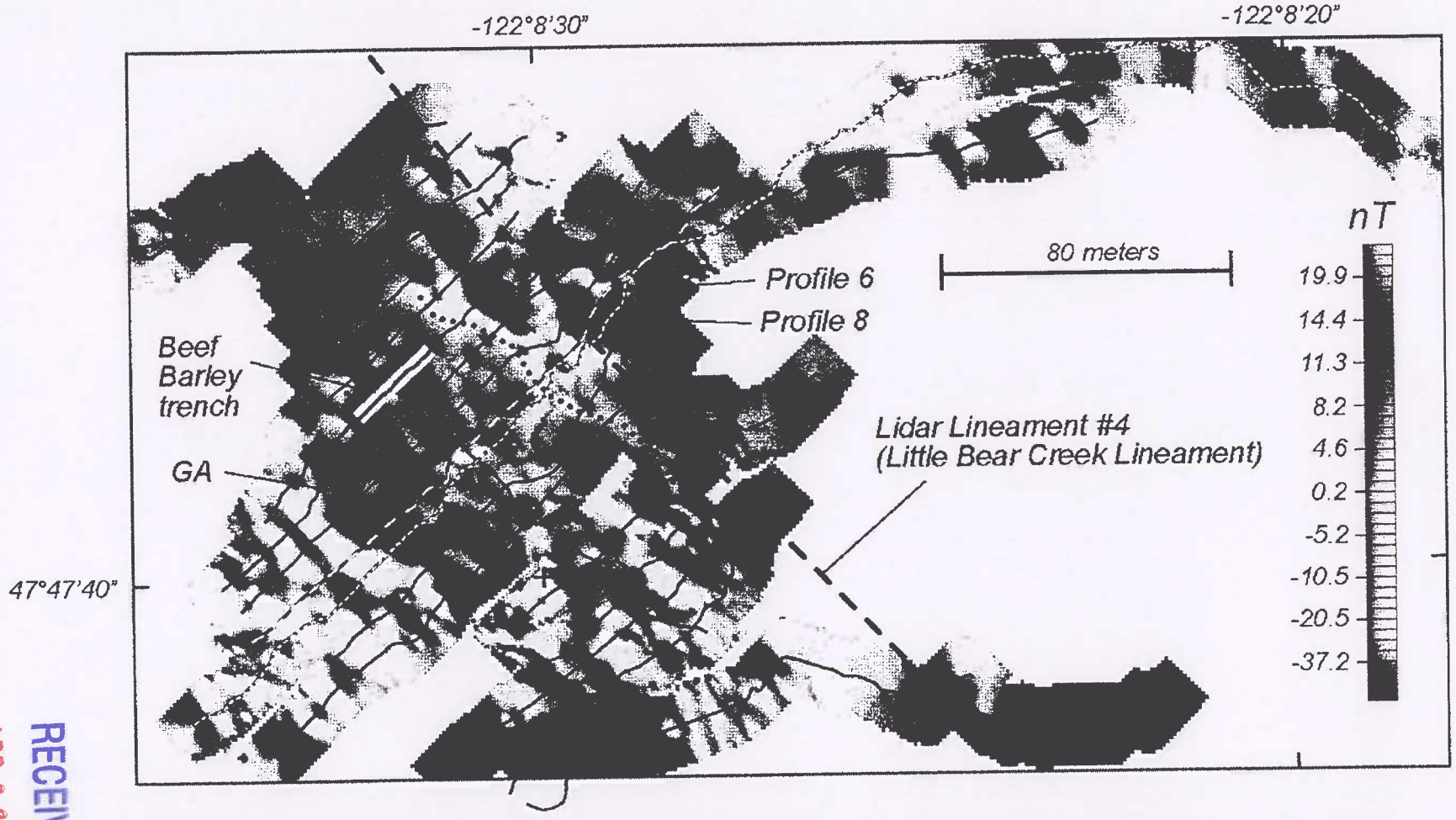

Figure 4—Ground-magnetic survey of the Beef Barley trench site. Thin black lines show location of profiles; profiles 6 and 8 (shown in Figure 5) highlighted with white dashes. Bold blue line is location of Beef Barley trench, and black dashed line is lidar lineament 4 from Blakely and others (2004). Black dotted lines indicate northwest-striking lineaments discussed in text; label GA is lineament referred to in text and identified in Figure 5.

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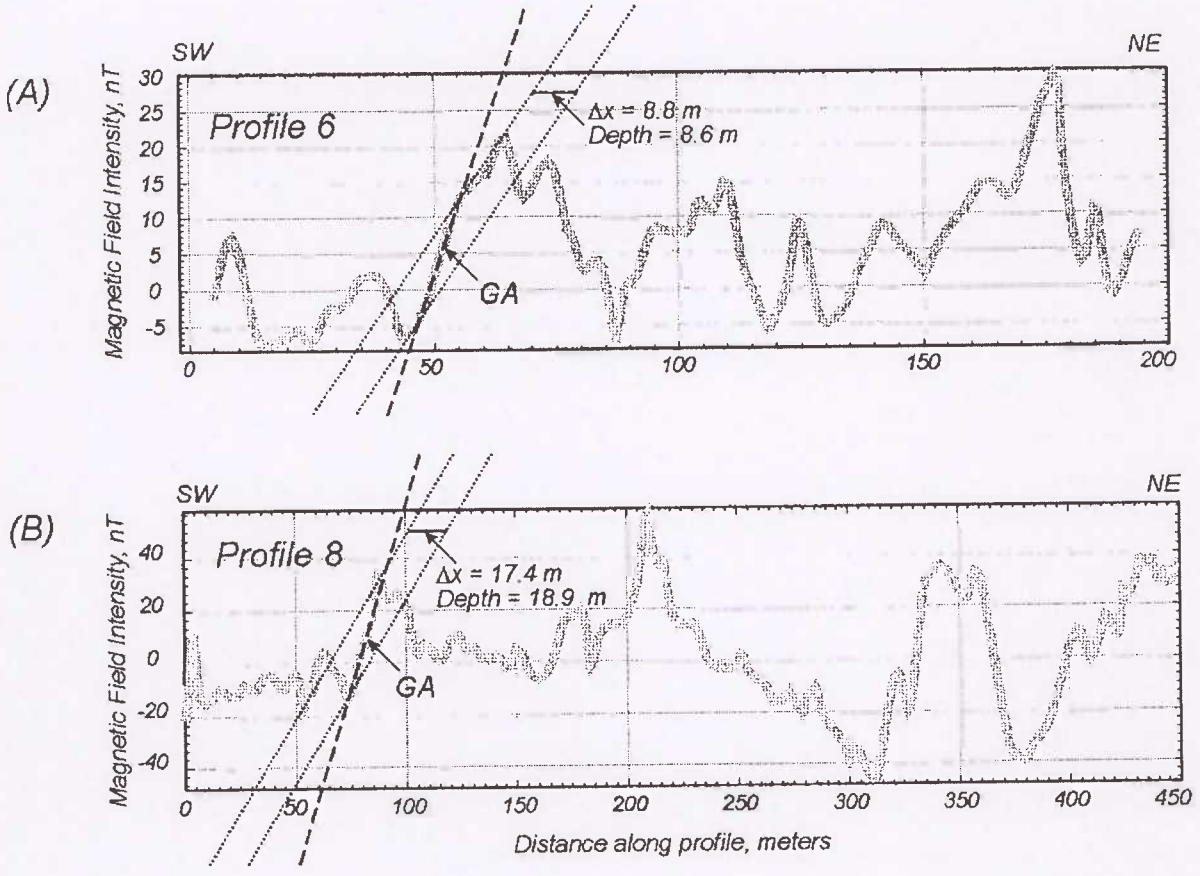

Figure 5—Profiles 6 and 8 of ground-magnetic survey (shown in Figure 4). See Figure 2 for location. Dotted and dashed lines show gradient analyzed using Peters' method (Peters, 1949; Blakely, 1995, p. 238), as discussed in text. Depth is relative to ground level.

Figure 6 (on following page)—Summary diagram showing locations of aeromagnetic anomalies, faults from marine seismic reflections data, lidar scarps, and lidar lineaments. SA, Standard Oil Alderwood#1 well; SS; Standard Oil Socal-Schroeder #1 well.

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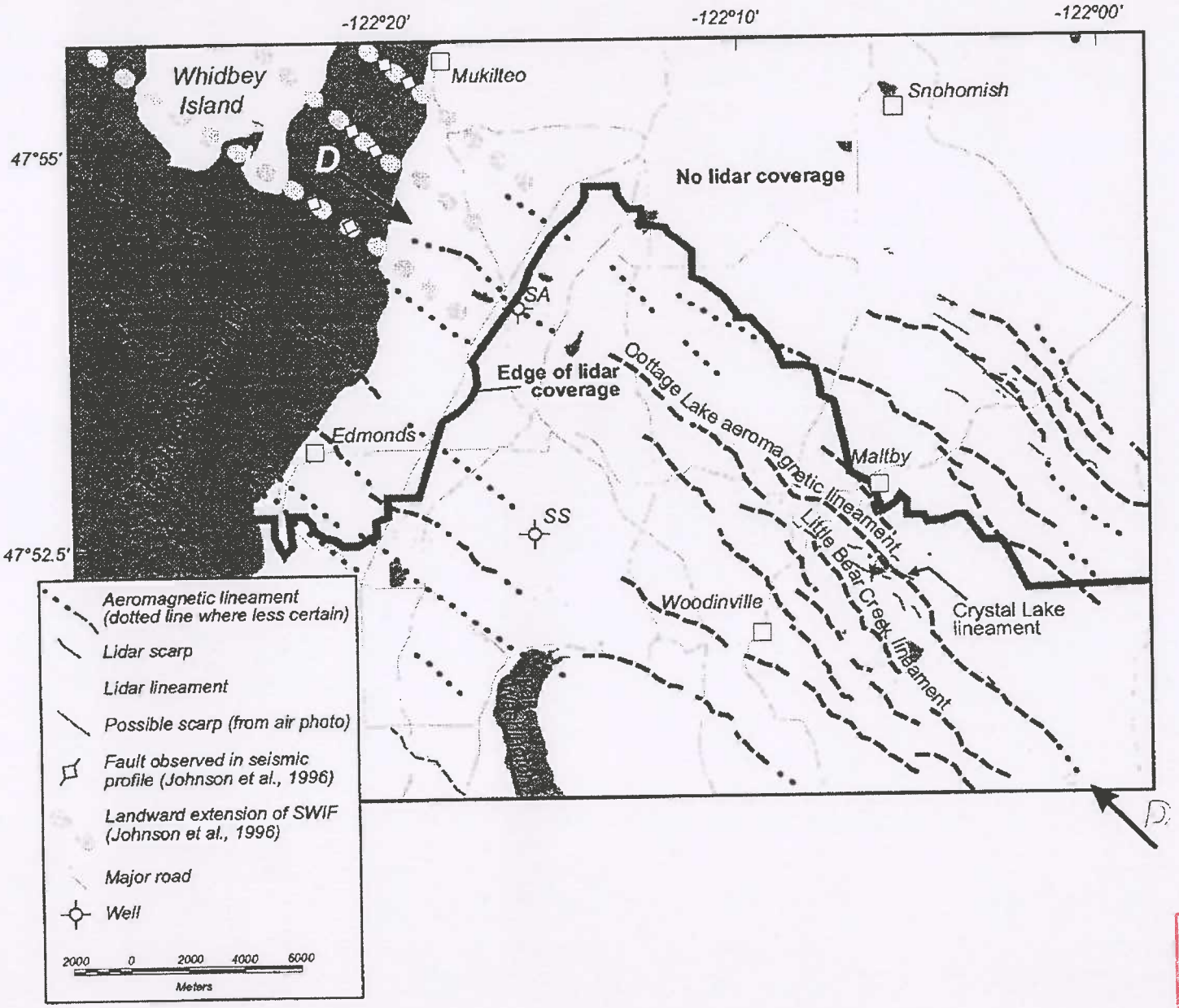

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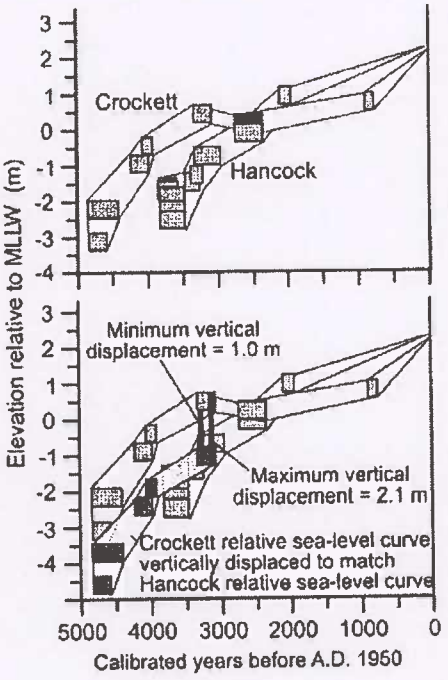

Figure 7—Relative sea-level histories from Crockett and Hancock marshes, Whidbey Island (Kelsey and others, 2004). The upper plot shows the actual sea level data, composed or radiocarbon ages from samples collected from the interface between marine and freshwater deposits beneath each marsh. The lower plot shows how much vertical displacement on the SWIFZ is required to offset the curves.

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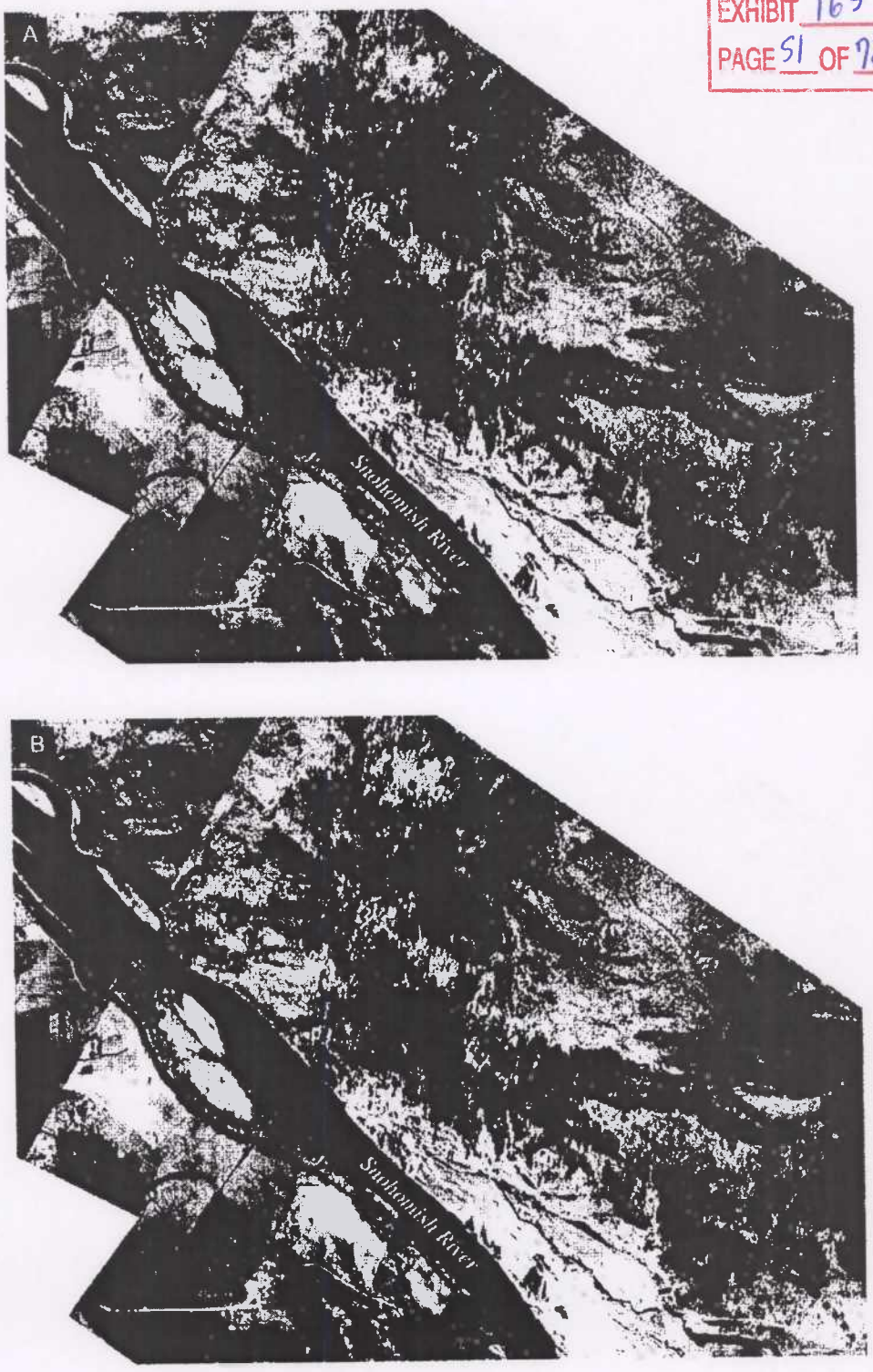

Figure 8—Historical aerial photographs along the Snohomish River near Devil's Butte. (A) Uninterpreted aerial photograph. (B) Interpreted aerial photograph. These photographs illustrate the types of features observed on the aerial photographs. In general, the scarps and lineaments have the same approximate trend as the SWIFZ and the aeromagnetic anomalies located nearby.

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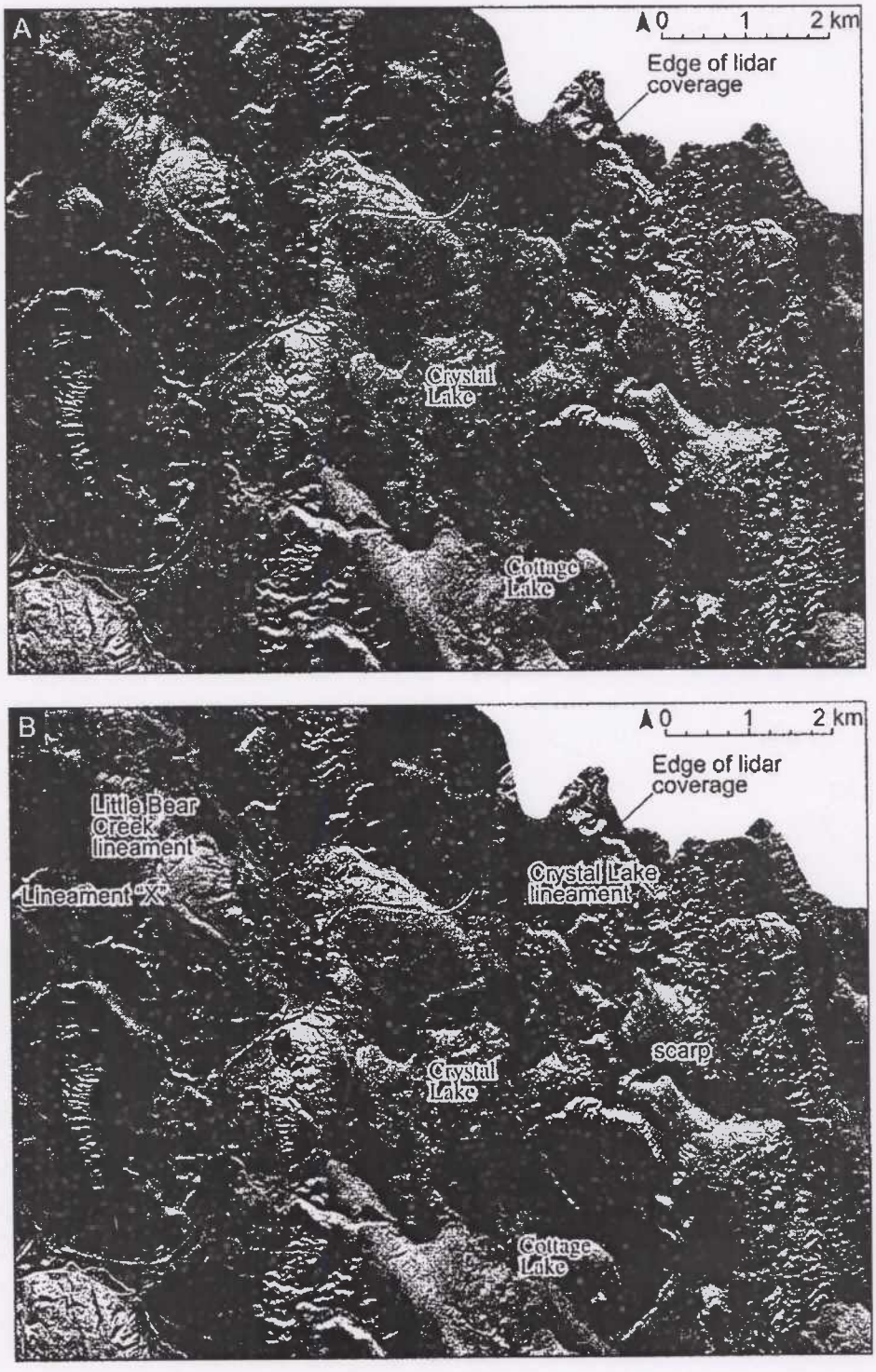

Figure 9—(A) Uninterpreted lidar image of the Crystal Lake and Little Bear Creek lineaments. (B) Interpreted lidar image of the Crystal Lake and Little Bear Creek lineaments. Thick green lines are lidar lineaments and thin red lines are lidar scarps. The scarp east of Crystal Lake is marked as 'scarp'.

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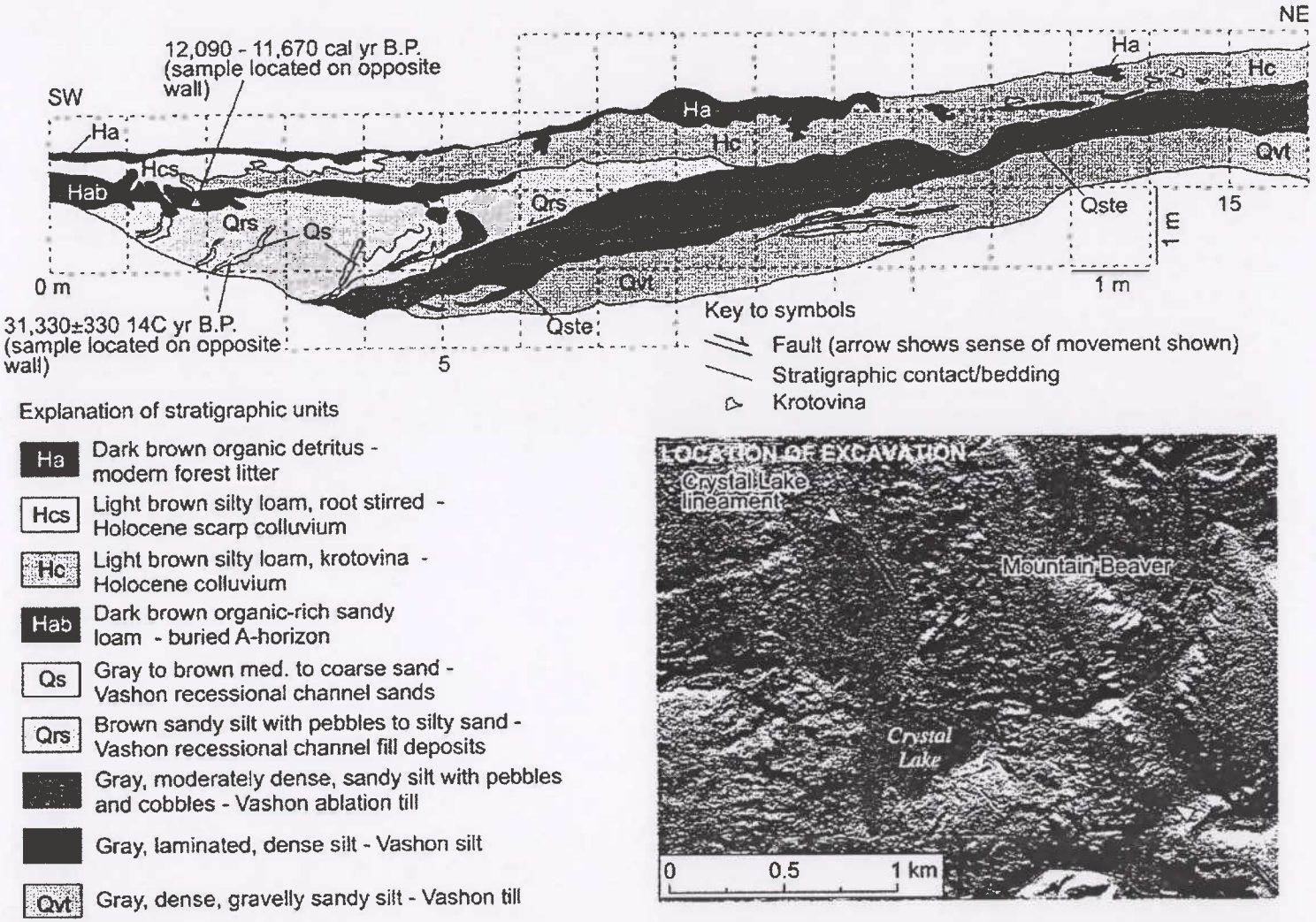

Figure 10—Simplified excavation log of the Mountain Beaver trench (east wall). (Inset) Lidar image showing the excavation site. Log is flipped relative to actual mapped log to aid intercomparison of excavation logs in this report.

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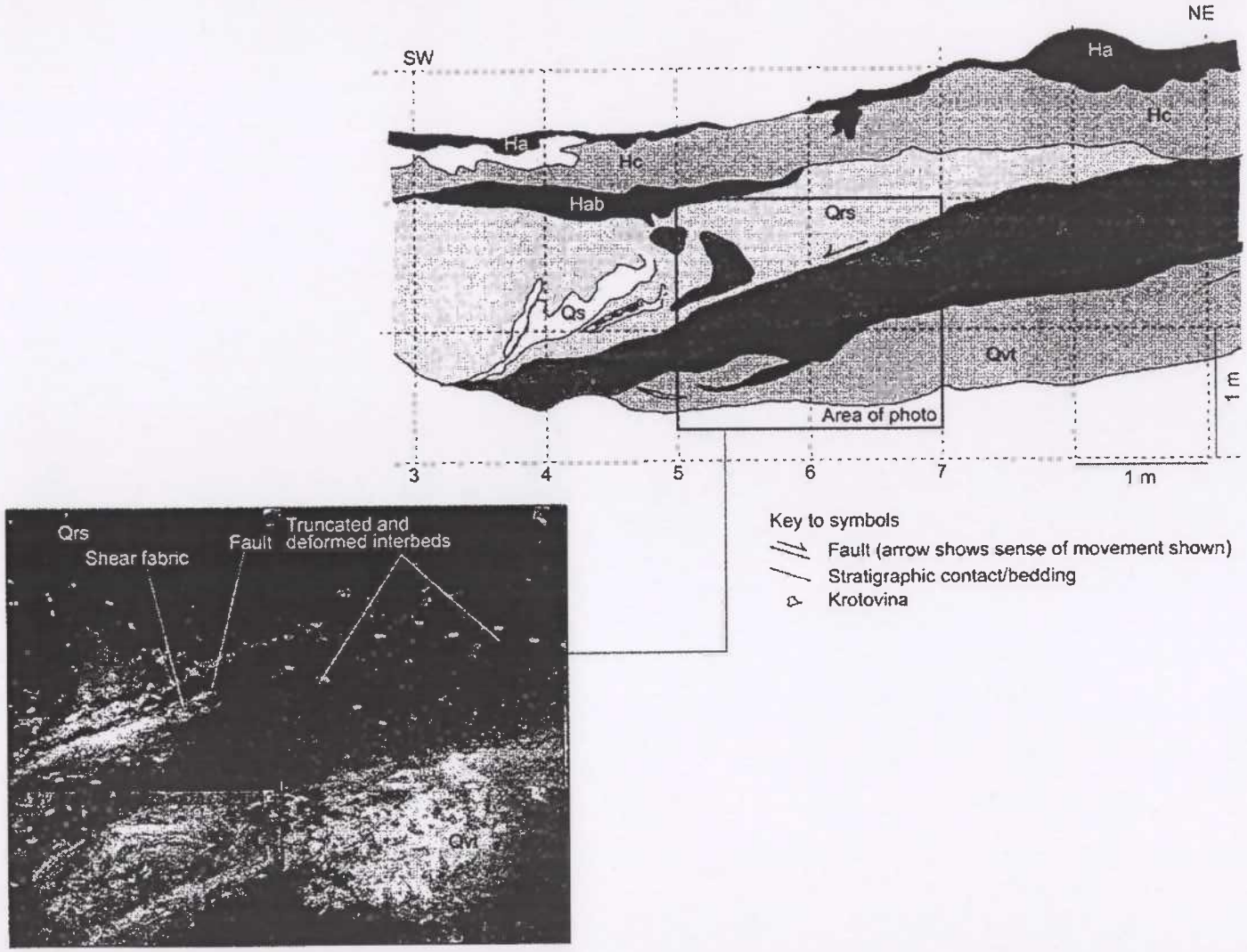

Figure 11—Enlarged excavation diagram showing the normal fault in the Mountain Beaver excavation. The photomosaic at the lower right shows an enlargement of the fault and truncated beds (photomosaic shows an area 2 meters wide). Log and photo are flipped relative to actual mapped log to aid intercomparison of excavation logs in this report.

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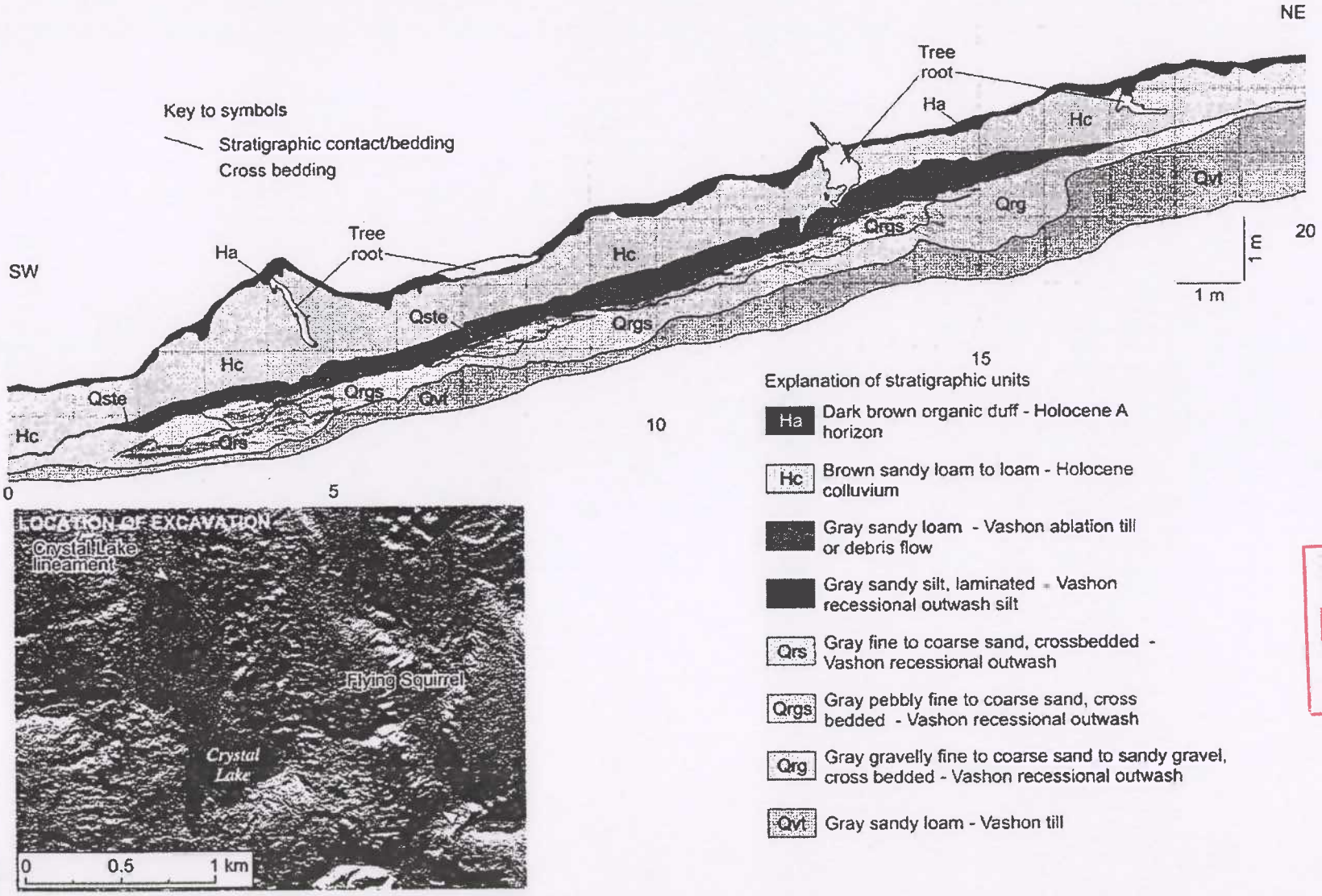

Figure 12— Simplified excavation log of the Flying Squirrel trench (west wall). (Inset) Lidar image showing the excavation site.

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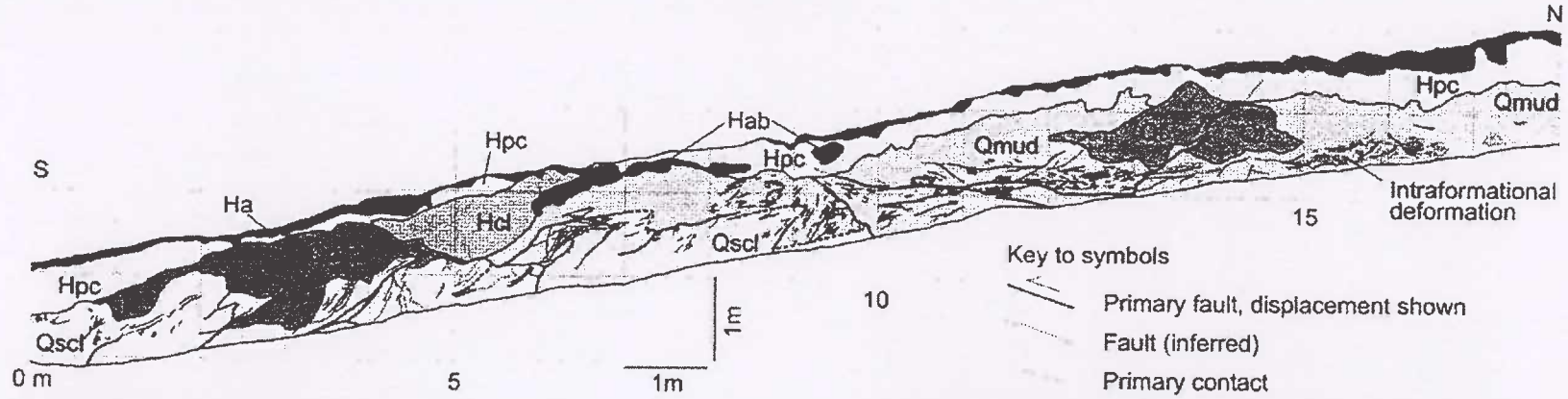

Key to symbols

- Primary fault, displacement shown
- Fault (inferred)
- Primary contact

Explanation of stratigraphic units

- Ha — Dark brown organic duff - Holocene A horizon
- Brown organic-rich, sandy loam to loam - buried Holocene A horizon
- Hpc — Brown pebbly sandy loam to loam - Holocene pebbly colluvium
- Hc — Brown sandy loam to loam - Holocene colluvium
- Brownish gray sandy loam to loam - Quaternary till
- Gray massive to laminated claystone - Quaternary glacial lake depositl
- Qmud — Brown shattered mudstone - Quaternary glacial lake deposits
- Qscl — Brown to gray shattered, laminated claystone - Quaternary glacial lake deposits

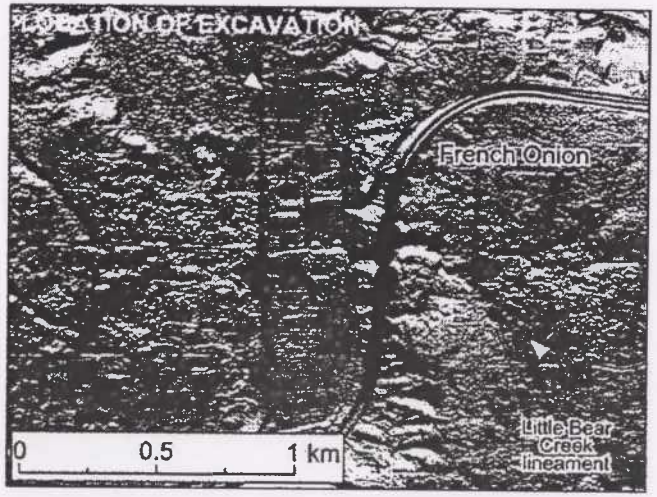

Figure 13— Simplified excavation log of the French Onion trench (east wall). (Inset) Lidar image showing the excavation site. Log is flipped relative to actual mapped log to aid intercomparison of excavation logs in this report.

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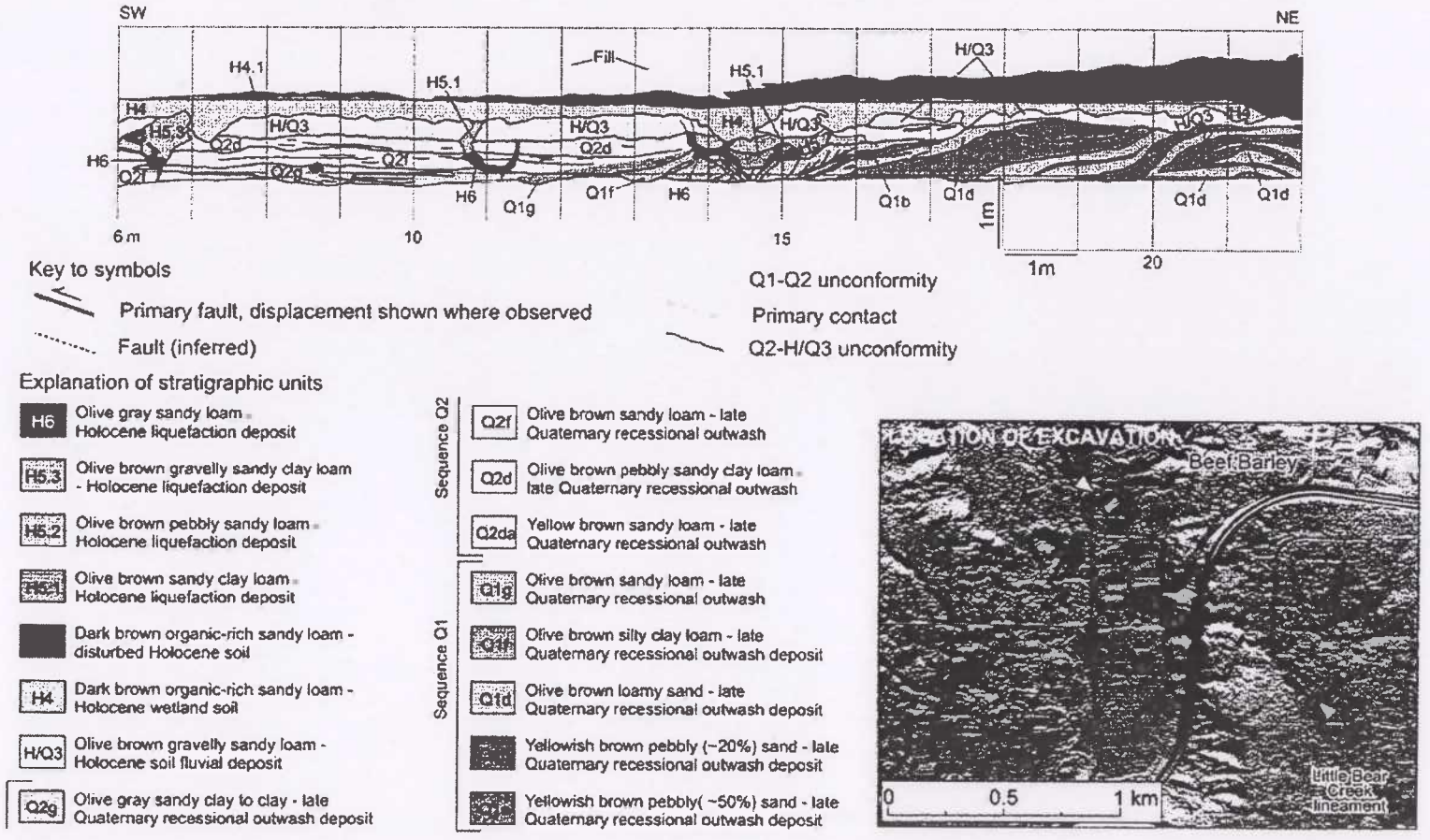

Figure 14— Simplified excavation log of the Beef Barley trench (west wall). (Inset) Lidar image showing the excavation site.

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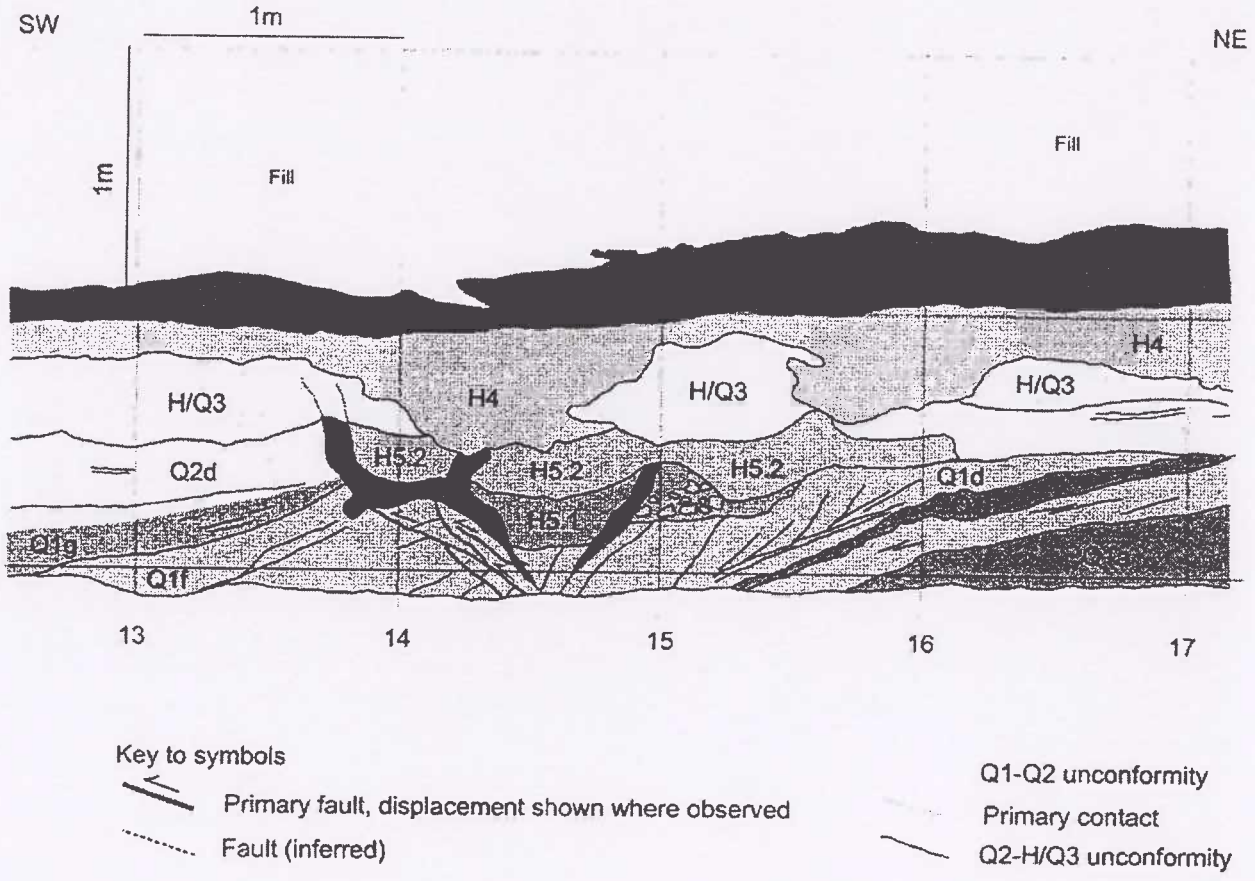

Figure 15— Enlarged excavation diagram showing the area where several small reverse faults, the unconformities, and a large liquefaction feature were observed in the Beef Barley excavation.

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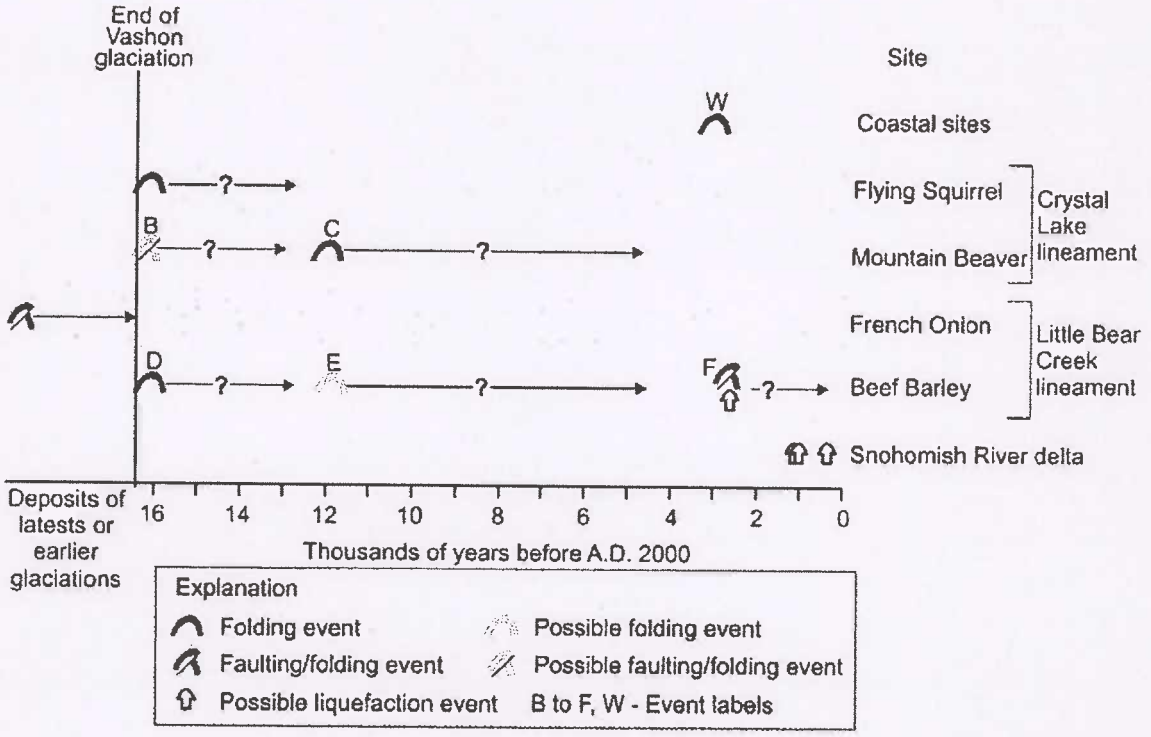

LIST OF EVENTS

Event	Age (yr B.P.)	Strand/Location
Pre-Vashon faulting	pre-16,400	Little Bear Creek
Normal faulting (B)	16,400 to ~12,000	Crystal Lake
Folding (D)	16,400 to ~12,000	Little Bear Creek
Folding (C)	post-11,670 to ~mid-Holocene	Crystal Lake
Folding/coastal uplift (W)	3200 to 2800	Whidbey Island
Faulting/folding (F)	post-2730	Little Bear Creek
Liquefaction	1150 to 1020	Bourgeois and Johnson (2001)
Liquefaction	1090 to 1010	Bourgeois and Johnson (2001)
Liquefaction	570 to 360	Bourgeois and Johnson (2001)

Figure 16—Summary diagram of paleoseismological evidence along the SWIFZ. The text below the plot lists each the approximate age and strand of each event. Event labels are the same as those mentioned in the text.

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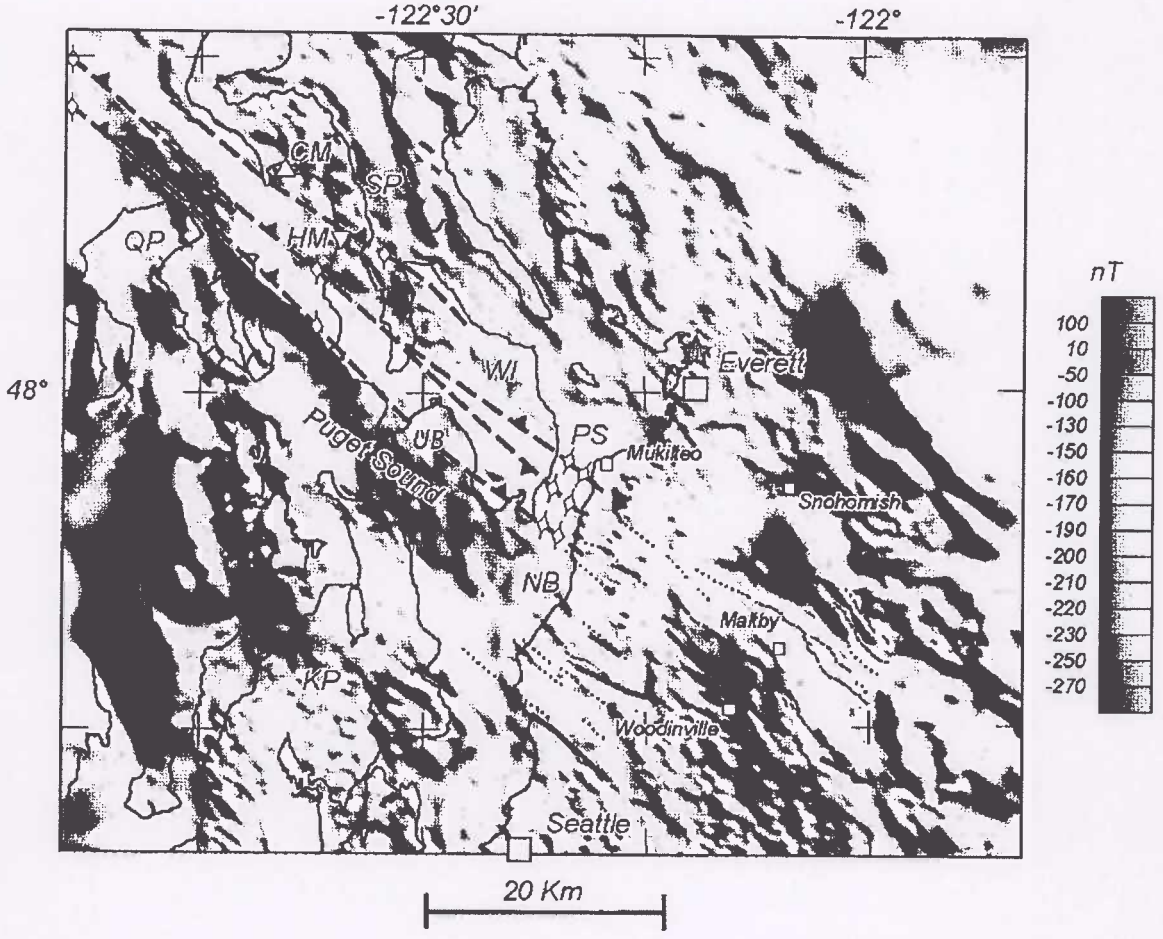

Figure 17—Map showing newly identified geologic features on the mainland with previously published evidence for the SWIFZ west of the mainland shore. Color-shaded relief map shows intensity of the magnetic field. Bold dashed lines west of the mainland shore are faults reported by Johnson and others (1996) and Kelsey and others (2004). White diamonds show locations of faulted Quaternary strata identified in marine seismic-reflection data (Johnson and others, 1996). Yellow triangles are sites of relative differences in Holocene sea-level changes (Kelsey and others, 2004). Red star is location of liquefaction evidence for multiple Holocene ground-shaking (Bourgeois and Johnson, 2001). Various dotted and dashed lines between Everett and Seattle are aeromagnetic, lidar, and airphoto lineaments. See Figures 2 and 6 for description of lines and labels.

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PHOENIX DEVELOPMENT INCORPORATED

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April 24, 2007

Mr. Greg Smith, Hearing Examiner
808 W. Spokane Falls Blvd.
Spokane, WA 99201

Re: Rebuttal to CNW Narrative – Exhibit 161, page(s) 11 to 21

Dear Mr. Smith:

The CNW arguments fail because their data is reliant upon existing R-1 housing stock for supply comparisons. They simply leave out the fact that the cost of a new home built on an acre lot is out of reach for the large majority of people.

The CNW group asserts a strong market demand for R-1 type housing. Exhibit 161 page 12, CNW states; "The analysis clearly shows that there is a high need for more R-1 houses as demonstrated by their shorter time on the market and higher sale price per square foot. Remember that the R-1 houses are resale units that historically fetch lower prices per square foot than new houses."

We agree with CNW that homes on acreage have a "higher sales price per square foot", and that existing resale houses "fetch lower prices per square foot than new houses". That is precisely the point! A high percentage of the existing housing stock in the Wellington neighborhood, and other R-1 / Low Density zoned neighborhoods consists of older homes which do not command anywhere near the same price of a new home built on an acre lot today.

CNW's analysis does not provide any meaningful discussion of new housing stock. As we have already demonstrated in our earlier reports and testimony, the actual supply of new homes is woefully inadequate.

Moreover, CNW's analysis is based on comparisons reliant on maintaining predominantly a status quo on over half of the residentially zoned land of the city, which is inconsistent with GMA urban densities. According to the City of Woodinville's "Final Sustainable Development Study dated February 21, 2007; "The R-1 Zone area represents approximately 30% of the total acres of the City, and approximately 50% of the residentially zoned land." It is growth / demand that will require adding new dwelling units within the City R-1 Low Density zoned areas CNW would set aside, given that these areas comprise 50% of the City's residentially zoned land. R-4 is a "Low Density" use, which uses up the available land.

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supply at a rate four times lower than R-1. R-4 density will result in a more affordable /diverse opportunity for future new home owners to own a new home, and will help to create an actual viable housing supply into the future.

CNW asserts in its "Executive Summary" that; "In a ten mile radius of the proposed developments there are over 6000 new or pending houses that are very similar. The applicant's developments will decrease diversity." (Exhibit 161 –Page(s) 11 -12) This statement is very telling, as it amplifies the notion that the CNW group recognizes the need / demand for the "applicants developments". Simply put, they just do not want these developments "in their back yard." We have already substantiated that there has been only a trickle of new home development in the City of Woodinville as a whole. So, it would require that CNW survey of data be pushed out to "a ten mile radius" to find the actual new home supply being provided by other municipalities. CNW admits in their analysis that others within a 10 mile radius are taking the density, while they are seeking to preserve their current inefficient one lot per acreage status as the standard for their area.

The CNW argument extends its arm out over the larger remaining parcels of land in the R-1 low density zone to constrict the larger parcels to conform to an R-1 density, when R-4 is an allowed low density zone when services are available. The CNW argument would use up the remaining larger tracts of land in the area in R-1 development, over even R-4 low density development. This is based on a perception that these low density neighborhoods will not be consistent with their view of what a neighborhood should look like. These larger remaining blocks of property are vital to City of Woodinville to provide for the future housing needs, and cannot be squandered away to meet the agenda of the CNW group.

The R-4 low density developments proposed, Wood Trails and Montevallo, are New Home developments using larger tracts of land to a higher level than what CNW would like to see. The R-4 zoning as proposed for these developments is consistent with the Comprehensive Plan, the City's land use code, and sound public policy at the time of our application(s). The plat applications before the Examiner are based on the City codes applicable to the project(s) at the time of the application.

CNW has deluged the Examiner with mountains of paper in an effort to bulk up their incorrect and inequitable position that everything around them should remain unchanged forever We hope and expect that the Examiner will rely on the factual evidence provided throughout these hours of public hearings, multiple consultant reports, and the full EIS prepared and published by the City of Woodinville to conclude that R-4 is appropriate for these developments and that the proposed plat applications meet the City's requirements for approval.

Sincerely,

Bob Vick
Senior Vice-President
Phoenix Development, Inc.

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TRIAD ASSOCIATES

EXHIBIT 165
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MEMORANDUM

Date: April 24, 2007

To: City of Woodinville Hearing Examiner

From: Erika Jensen, AICP

Re: Response to comments on City Capacity Analysis for the Woodtrails/Montevallo Hearings

Triad Job No.: 03-208/03-248

Copies To: G. Richard Hill, McCullough Hill, PS; Phoenix Development

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1. The City of Woodinville's capacity analysis (on page 4 of the Montevallo staff report, page 6 of the Woodtrails staff report, and page 38 and 39 of the Neighborhood Character section of the Sustainable Development Report) is inaccurate and incorrect.
   - The calculation is not based on an updated inventory of vacant or redevelopable land as required by the City's Comprehensive Plan (Reference attached 2001 Buildable Lands Inventory (Figure A3-3)). An updated inventory map has not been created as part of the analysis and is not included in the record.
   - Land developed between 2002 and 2007 has not been removed from the inventory, and actual observed densities on the lands developed between 2002 and 2007 have not been used to determine capacity on remaining land. Reference attached zoning map showing vacant and redevelopable R-4 land as of 2001, and also showing development that has occurred between 2002 and 2007.
   - Remaining vacant and redevelopable lands have not been adjusted to reflect new critical area buffers and stormwater detention requirements adopted after 2002. This is very important in the R-4 zone since most of the land has critical areas, and the new critical area buffers are typically larger (and thus use up more land) than the previously required buffers (Reference attached critical area map showing buildable lands as of 2001).
2. There is very little R-4 zoning in the City available for development.
   - Based on the 2001 buildable lands inventory, there were approximately 50.94 acres of vacant and 44.99 acres redevelopable lands available. Since that time, there have been at least two sizeable developments that have removed land from the inventory (reference attached zoning map showing vacant and redevelopable R-4 land as of 2001, and also showing development that has occurred between 2002 and 2007).
   - The available land with R-4 zoning as of the 2001 buildable lands report was 2.7% of the land area of the entire City. It is less than that today if the updated critical area buffers and areas that developed between 2002 and 2007 are considered (reference attached critical area map showing vacant and redevelopable R-4 zoned land as of 2001).

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Exhibit 165

Pages 64, 65, 66 and 67 are color pages and are too large to scan in color

Available for review at City of Woodinville's Development Services's counter

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TRIAD ASSOCIATES

MEMORANDUM

Date: April 26, 2007
To: Rich Hill
From: Mark Keller, P.E.
Re: CNW Volume 4 Comments on Drainage
Triad Job No.: 03-208 and 03-248
Copies To: Bob Vick, Loree Quade

Response to:
Exhibit 161, Page 167 of 196

Bullet 1 - Lake Leota Basin
The statements in the previous memo (Exhibit 134 dated April 4, 2007) regarding the Montevallo drainage within the Lake Leota basin are based on the actual field topography of the Montevallo site. As is typical through the development process, the regional maps are used as a starting point and through the development of the preliminary and final design process, the level of detail continually increases. The determination of the drainage patterns from the Montevallo site are based on field topography (2' contours are typical, however, this site has been mapped to a higher level of detail at 1' contours). This takes the information found in exhibits such as provided (Exhibit 161, Page 173 of 196) to a higher level of detail. In fact, one can not determine the accuracy of the map included in Exhibit 161, Page 173 of 196 due to the lack of topographic information.

Bullet 2 Downstream Capacity Analysis
Exhibit 161, Page 167 of 196

As stated in the previous memo (Exhibit 134 dated April 4, 2007) the level of analysis completed at this stage of the process is appropriate and typical. The CNW have completed no capacity studies on the downstream systems yet claim that all three options are over capacity. Our preliminary analysis has identified that there may be some sections of the system that will need to be upgraded (increased pipe size or increased pipe slope) and that there is adequate space to make these changes. A preliminary route has been identified and is supported by the City.
CNW has submitted photos (Exhibit 161, pages 171 and 172 of 196) of one of the three downstream systems that was considered as a drainage route. This route has not been selected as the preferred option as is indicated in the drainage deviation that has been supported by the City. CNW also claims that the swale in System A can not

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accommodate additional storage. Storage is provided in the on-site detention pond and has never been proposed in the downstream system.

Bullet 3 – Water Quality
Exhibit 161, Page 168 of 196

CNW claims that referencing KCSWDM 6.2.1 (see below) is incorrect in that "it ignores the fact that most of the pollution is discharged during the heavy storm events". This is incorrect. The majority of the pollution is generated from the smaller, more frequent storm events with each initial flush of the pollution from the impervious surfaces. That is why the water quality treatment facility designs are based on the WQ design flow (the full 2-year release rate from the detention facility) which yields the treatment of 95% of the annual average runoff volume.

> Per KCSWDM 6.2.1 "*Flow Volume to be Treated – When water quality treatment is required pursuant to the core and special requirements of this manual, it is intended that a minimum of* ***95% of the annual average runoff volume*** *in the time series, as determined with the KCRTS model, be treated. Designs using the WQ design flow (as described above) will treat this minimum volume.*" The designs will use the WQ design flows to determine the size of the water quality treatment facilites.

CNW also claims that the existing discharge rates are "zero for the portions of the site proposed for development, and indicated in site photographs during rain storms" This is incorrect as flows have been observed in the catch basins immediately below the site that collect flows from the wall and rockery drains. This information is included in the downstream analysis for Wood Trails. Also, as can be seen in the referenced photographs, there are visible moisture patterns on the wall indicating water flow from the site.

Bullet 4 – Dispersion Trenches
Exhibit 161, Page 168 of 196

As stated in the Wood Trails Staff Report to the Hearing Examiner (Page 10 of 41), the City will not allow infiltration of dispersion of roof or footing drains within 50' of the top of slope. This condition can be complied with through the methods stated in the Triad Drainage Memo (Exhibit 134, date April 4, 2007). The three alternatives offered have been through a preliminary analysis and any/all are viable options for handling the relatively small volumes of storm water generated by individual roof and footing drains.

Bullet 5 – Snohomish County Permits
Exhibit 161, Page 169 of 196

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For the reasons stated previously in the Triad Drainage Memo (Exhibit 134, dated April 4, 2007), permits from Snohomish County are not required. Per Montevallo Exhibit 50, Agency Distribution List, the project information was transmitted to Snohomish County for review and comment. No comments have been received by Triad and to our knowledge, no comments have been received by the City.

CNW states also in Exhibit 161 (page 169 of 196) that "*there is no mention made by the proponent that the discharge from the wetland in Montevallo connects to the stream that flows within Tract A of the Wood Trails development. This hydrologic connection was established and depicted by Bob Harmon after multiple field visits.*" This is incorrect as the full drainage route from the Montevallo site to Little Bear Creek is shown in the Montevallo Preliminary Technical Information Report (Section VI, Downstream Exhibit) submitted with the Preliminary Plat Application.

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TRIAD ASSOCIATES

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Kirkland, WA 98034-6929

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425.821.3481 fax
800.488.0756 toll free

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April 26, 2007

Hearing Examiner
City of Woodinville
17301 133rd Avenue NE
Woodinville, WA 98072

RE: Montevello
City File No. PPA 2004-093
Triad Job No. 03-248

Dear Sir:

In my professional opinion, no road was dedicated to the public when the plat of Summers Addition recorded on July 7, 1976 in Volume 100 of Plats, Pages 33 and 34, under Recording Number 7607070463, records of King County, Washington. Without a public road dedication, there cannot be any vacation.

Facts:

A. There is a line labeled NE 204th Street and NE 205th Street which has the following note with an arrow pointed at the line: *"Centerline of Future Public Road Alignment Subject To Revision with Subdivision of Lot 1."*

B. There are also three notes appearing on that sheet (Page 34, Volume 100 of Plats):

- *Subdividing of Lots 2, 3, 4 and 5 shall require access from a public street other than 156th Avenue NE*
- *Future structures prohibited within 50 feet of future road centerline.*
- *Subdivision of Lot No. 1 may require the construction of a public street between NE 204th Street and 156th Avenue NE.*

C. The King County Assessor does not indicate that there is a public road of a specific width. In addition, the Assessor does not assign the route a separate tax parcel or label it as a private road. He shows the line in his assessment map with the note: *"Centerline of Future Public Road Alignment Subject To Revision with Subdivision of Lot 1".* If the route is a public road, then Lot 1 has been paying taxes on a public road of unknown specified width for over 30 years.

D. Lot 1 of Summers Addition straddles both sides of the route. Generally, lot ownership is on only one side of a public road dedicated as part of the platting process.

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E. When public roads are dedicated, there are dimensions between the centerline and rights-of-way and along the rights-of-way to indicate the size of both the road and the abutting lots. Only the *"Centerline of the Future Public Road Alignment Subject To Revision with Subdivision of Lot 1"* is dimensioned.

F. The offset lines of the *"Centerline"* are labeled as *Building Setback Lines,* not right-of-way.

G. Lots 1 and 2 are dimensioned without accommodating for a dedicated public road. If the route is a public right-of-way, it has no width.

If the route between the building setback lines was a public road, then a large portion of it is 100 feet wide, which is much wider than is normally needed to connect to two 60-foot rights-of-way. In addition, if the building setback lines were the right-of-way of a public road, there would be no setback from the right-of-way, which is contrary to both the King County and the city of Woodinville urban planning codes for this zone.

Phoenix Development has submitted an application for preliminary subdivision approval effectively replatting Lots 1 through 5 of Summers Addition. The application has been made to the city of Woodinville (City), the successor jurisdiction of King County since the city's incorporation.

City has determined that the future road alignment shown on Summers Addition with connectivity to the east and west is not necessary for traffic circulation, thereby advocating for the revision of the future public road alignment to be as shown on the preliminary plat of Montevallo.

Sincerely,

TRIAD ASSOCIATES

Mark S. Harrison, PLS
Project Surveyor

MSH/shk

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