Appendix K
Preliminary Scopes and Budgets

Parametrix ENGINEERING • PLANNING • ENVIRONMENTAL SCIENCES

411 108th AVENUE NE, SUITE 1800
BELLEVUE, WA 98004-5571
T. 425 • 458 • 6200 F. 425 • 458 • 6363
www.parametrix.com

TRANSMITTAL FORM

To: **Jenny Gaus, P.E.**
City of Kirkland Public Works
Surface Water Utility
123 Fifth Avenue
Kirkland, WA

Date: **August 4, 2005**
Project Number: **558-1802-035**
Project Name: **Surface Water Master Plan Update**

We are transmitting the following materials:

Preliminary Scopes and Budgets for Surface Water Master Plan Program Elements:

Evaluation of Totem Lake Drainage
Routine Outreach to Kirkland Businesses
Low Impact Development Study
"Green" Landscaper Certification Program
Evaluation and Ranking of Pollutant Sources
Adoption of King County Stormwater Pollution Control Manual
Water Quality Evaluation of City Practices and Property

Comments:

These are:
- ☒ PER YOUR REQUEST
- ☒ FOR YOUR INFORMATION
- ☐ FOR YOUR REVIEW AND APPROVAL
- ☐ FOR YOUR FILES
- ☐ FOR YOUR ACTION

Sent Via:
- ☒ U.S. MAIL
- ☐ GROUND SERVICE
- ☐ EXPRESS OVERNIGHT
- ☐ COURIER
- ☐ HAND DELIVERY/PICK UP

Sincerely,

Erin Nelson

Erin Nelson

cc: File

(Rev. 06/04)

EVALUATION OF TOTEM LAKE DRAINAGE

Preliminary Scope of Work

Juanita creek, between Totem Lake and the wetlands west of 116th Ave NE, floods occasionally during large storm events and the system is constantly under water between storms. This preliminary scope of work is to evaluate the hydraulic conditions between the west end of the wetlands and Totem Lake outlet to identify the causes of flooding and potential solutions. A HEC-RAS (Hydraulic Engineering Center- River Analysis System) model will be used to evaluate the hydraulic conditions in the creek, and will be used in conjunction with another appropriate hydraulic model, such as PC-SWMM to evaluate the piped flow. Flow rates determined during the HSPF modeling effort conducted as part of the 2005 Surface Water Master Plan Update will be input into the model to evaluate conditions under different flow regimes. The reach of Juanita creek to be evaluated is approximately 3/4 mile in length. Much of the creek is in piped through this section and there are three road crossings in the reach. To accurately depict the open channel conditions, including roughness, configuration, floodplain widths, and other physical parameters, channel cross-sections will need to be surveyed at approximately 200-foot intervals through the open channel section. Cross-section spacing may be more frequent in some areas, where there are many changes in physical characteristics, and less frequent in reaches that have little variation.

Assumptions: The following are assumptions for this preliminary scope of work.

1. Approximately 10 cross-sections will be surveyed throughout the open-channel portion of the reach. This includes additional cross-sections on the up- and downstream ends of culverts, pipes and other flow constrictions. The cross-sections will extend from the left bank to right bank and include the channel overbank area and active channel area. Notes will be made about the substrate and vegetative conditions within the channel and in the overbank area, so that Manning's n values for roughness can be determined. Depending on access issues and degree of brushing that will be required to survey the cross-sections, we estimate that 2 – 6 cross sections can be surveyed in one day.

2. The City of Kirkland will obtain access for private property where surveying will need to occur.

3. Information regarding condition of existing stormwater infrastructure, including culverts, pipes, and catch basins will be provided by City staff. The Consultant will provide a list of inspection and video needs to the City.

4. HSPF flows from the 2004 hydrologic modeling analysis will be input into the HEC-RAS model to evaluate hydraulic conditions under different flow regimes.

5. Once physical data representing current conditions is input into the HEC-RAS model, the model results will be compared to available field observations to characterize model accuracy. If model results do not appear reasonable, further refinement including additional cross-sections will be input to the model until model results are acceptable, per mutual agreement between the City and the Consultant.

6. Alternative improvements to Juanita creek or infrastructure conveying Juanita creek flows will be evaluated in the model to determine a range of improvements and related flooding reduction. We estimate that 5 alternatives will be evaluated.

7. This preliminary scope and budget are for planning level efforts. A more detailed scope and budget should be generated prior to implementation.

Deliverable: The following deliverable is associated with this preliminary scope.

1. Draft and final Technical Memorandum documenting results of the modeling with possible alternatives for reducing flooding on Juanita creek between Totem Lake and the 116th Ave NE wetlands.

2. Electronic copies of the hydraulic models.

Preliminary Budget Estimate

The preliminary estimate to complete this modeling effort is approximately $37, 000, including surveying needs, model development and solution analysis.

ROUTINE OUTREACH TO KIRKLAND BUSINESSES

Preliminary Scope of Work

Purpose

Technical resources, including informational documents on the City website are available for Kirkland businesses that want help regarding stormwater and pollution prevention. Routine outreach to these businesses would increase the level of interaction between City staff and community businesses to help them make informed decisions about how to reduce pollutant discharges to surface water. Additionally, increased education about surface water codes and possible enforcement actions, would provide an incentive for businesses to modify their pollution-generating activities or install BMPs to minimize impacts. A corollary program that could be worked into the business outreach program is adoption of the King County Stormwater Pollution Control Manual by the City. Adoption of this manual prior to initiating site visits would allow staff to refer business owners to the manual for guidance and get the word out that the manual represents the current requirements for BMPs. This preliminary scope of work includes time for City surface water staff to conduct the following activities related to outreach to businesses and increased technical assistance.

Outreach to Local Businesses

Local businesses that discharge stormwater to the City's stormwater sewer system should be visited to evaluate their potential to add contaminants to this system. These include the commercial, light manufacturing and industrial businesses operating in Kirkland. Each facility, including office buildings, should be visited by City of Kirkland surface water staff to educate businesses about surface water codes and assess compliance. Staff visits will (1) assess current pollution prevention practices, (2) discuss issues regarding stormwater, (3) inform business owners about educational information and technical resources that are available through the City, and (4) assess compliance with surface water codes. The visit will also include a brief assessment of the business practices that could affect surface water as well as an explanation of what constitutes an illicit discharge.

Assumptions:

1. A checklist in the King County Surface Water Design Manual will be used to evaluate surface water practices at the local businesses. The completed checklists will be maintained as documentation for the City's Phase II NPDES permit.

2. There are approximately 1,480 business locations (commercial, industrial, and office buildings) that will need to be visited, based on the following assumptions

of number of businesses per commercial, industrial, and office buildings that will have responsibilities for stormwater management.

Business Category	Tax Paying Units as recorded by Washington Department of Revenues	Estimated Number of Stormwater Management Units
Commercial	4,025	858[a]
Manufacturing	344	344
Office Buildings	1,273	279[a]
Total	**5,642**	**1,481**

[a]Assuming that there are, on average, 5 businesses at each commercial property and office building.

3. Surface water staff will spend an average of 1 hour at each business, with the length of time varying depending on the size of the facility and the types of activities conducted. Approximately 2 hours of coordination time will be required each week that outreach is conducted to arrange scheduling and make appointments, if necessary.

4. Businesses that will require more regular or routine follow-up visits will be identified during this first round of outreach, so that they can be put on a regular schedule.

5. The goal of the follow-up visits will be to assist businesses that require more guidance and to encourage good housekeeping measures. If necessary, citations will be issued for repeated code violations. For estimating purposes, it is assumed that approximately half of the businesses will require follow-up visits and that the visits will each take an average of 1 hour. Coordination time is estimated at 2 hours for each week of outreach visits.

6. A GIS coverage will be developed following the initial completion of business outreach, to identify those businesses that could contribute pollutants to surface water and to help identify areas where the City should install water quality treatment facilities to address on-going problems from multiple sources.

7. For estimating purposes, it is assumed that approximately one quarter of all businesses visited will require some type of follow up activity. It is assumed that each follow-up action will take 5 hours of City staff time.

8. Time will be allocated for coordination with the State Department of Ecology NPDES Industrial Permit program and King County Local Hazardous Waste program.

Budget Estimate

The estimated time requirement for City staff to complete this scope of work is outlined below. There are no capital costs associated with this scope of work, and it is assumed that City staff perform the tasks. The budget is estimated in time for an FTE surface water engineer to complete the tasks. There will be a one-time set-up cost to get the program started, including development of a GIS coverage of businesses to be visited, document management and tracking. The remaining costs will be annual costs to complete the routine outreach visits, conduct code enforcement and manage the program. Although the costs below assume staff time of 0.8 FTE engineer, this program is flexible and can be implemented at a slower rate with less FTE time required. Additionally, the number of businesses to be visited will be refined based on SIC codes prior to implementation, possibly resulting in fewer visits than what is assumed above.

One-time Costs

Time to develop checklist and manage documentation:	80 hours (0.04 FTE)
Time to develop GIS coverage:	120 hours (0.06 FTE)
Initial business outreach visits plus coordination:	1481 hours (0.7 FTE)
Total FTE	0.8 FTE equivalent

Yearly Costs

Yearly follow-up outreach visits plus coordination:	740 hours (0.36 FTE)
Code Enforcement:	500 hours (0.24 FTE)
Total FTE	0.6 FTE equivalent

LOW IMPACT DEVELOPMENT STUDY

Preliminary Scope of Work

The purpose of this study is to evaluate the possible application of Low Impact Development (LID) techniques for stormwater management in the City of Kirkland. The study will include (1) a review and inventory of existing City codes to determine if there are any conflicts or restrictions that would preclude the use of LID technologies, (2) identification of LID technologies that would be appropriate for Kirkland, based on its topography and soil conditions, and development of tools to facilitate their use, (3) evaluation of incentive programs used by other Puget Sound cities or proposed by the Puget Sound Action Team (PSAT) that could be adopted to encourage LID use by private developers or other City departments, and (4) identification of potential pilot project opportunities. The following are specific task items associated with this preliminary scope of work:

Review of Existing City Codes

Existing City codes, ordinances and standards that could affect use of LID techniques include the following:

- street and sidewalk widths;
- parking lot ratios for office buildings;
- parking lot standards;
- open space design requirements;
- residential lot standards including driveway widths, lot setbacks and frontages;
- standards for roofs including parapet requirements for office buildings and aesthetic fencing for rooftop utilities
- stormwater system plumbing;
- tree conservation; and
- stormwater flow control and water quality treatment design.

A review of City codes and standards should evaluate whether any of the requirements for transportation improvements, parks and open space, and/or residential and commercial development would not allow LID. An excellent starting point for review of Kirkland's codes would be to use the Code and Ordinances Worksheet developed by the Center for Watershed Protection (http://www.cwp.org/COW_worksheet.htm) to rate the City's Codes and Ordinances according to how protective they are of streams, lakes and estuaries. Many of the questions asked on the worksheet are directly related to LID techniques.

Following review of City codes and ordinances, a list of specific codes or requirements that might preclude LID should be developed. Opportunities for code revision, or exceptions for LID should be developed for discussion with representative City departments.

Assumption:

1. Specific Titles in the Kirkland Municipal Code to be reviewed may include but are not limited to the following:

    - Title 15 – Surface Water Management
    - Title 18- Local Improvements and Public Works
    - Title 19- Streets and Sidewalks
    - Title 21- Building and Construction
    - Title 22- Subdivisions
    - Title 23- Zoning Code

Identification of Appropriate LID Techniques

A literature review of LID techniques, constraints and opportunities should be conducted to identify those techniques that would be appropriate for use in Kirkland. Successful examples of LID-implemented projects in other municipalities/communities will be reviewed, as well as the recently published Low Impact Development Technical Guidance Manual for Puget Sound (PSAT January 2005 [Revised May 2005]). A list of LID techniques will be developed under this task. The list will include (1) physical site constraints, (2) existing regulatory constraints (Local and State), (3) relative expense, and (4) opportunity for successful implementation in Kirkland.

Assumptions:

1. A literature review will be conducted of the latest LID techniques being used and/or developed by stormwater managers and researchers.

2. Up to 20 different LID techniques will be identified and further evaluated for potential use in Kirkland.

3. The LID techniques identified will be based on soils, topography and urban land use patterns.

4. A map will be produced showing neighborhoods or areas of particular land uses where LID techniques might work in Kirkland.

Identification of Incentive Programs to Encourage Use of LID

In order for Kirkland to be successful at implementing a program for City personnel and developers to utilize LID practices, an incentive program will need to be developed. Currently, LID techniques (particularly those that treat, rather than prevent runoff) are more expensive that traditional stormwater management approaches. When expense is the bottom line, traditional approaches will be chosen over LID. There are many possible alternatives for the City to provide incentives to those that could utilize LID on their projects including (1) reduced surface water utility fees, (2) expedited permitting and project approvals, and (3) others. This task will identify incentive programs for the City to evaluate with regards to its surface water program.

Assumptions:

1. Research incentive programs used by other municipalities to encourage use of LID. Up to 5 municipalities will be contacted to identify incentive programs.

2. List possible incentive programs, including relative implementation costs for the City.

Identification of Pilot Project Opportunities

One of the best ways to encourage use of LID by private developers is for the City to showcase techniques on City projects. This task will identify City projects that could incorporate LID technologies in a pilot project. Up to 3 alternative pilot projects will be identified in cooperation with Surface Water Utility staff and/or City staff from other departments.

Summary Report of Findings

A technical memorandum will be prepared summarizing the results of the Kirkland code review, LID techniques that could be used in Kirkland, possible incentive programs, and potential LID pilot projects.

Assumptions:

1. A draft and final technical memorandum will be prepared, not to exceed 15 pages.

2. Up to 5 summary tables will be included in the technical memorandum.

Budget Estimate

The estimated cost to complete this study is $48,000. It is assumed that the study would be completed by a Consultant to the City, since this represents a one-time cost. The following is a breakdown of the budget for the above-referenced work.

Review Existing Codes		$9,000
Identification of LID techniques		$12,600
Incentive Programs		$7,400
Identification of Pilot Programs		$10,400
Technical Memo		$8,600
	Total	$48,000

"GREEN" LANDSCAPER CERTIFICATION PROGRAM

Preliminary Scope of Work

A large percentage of Kirkland's residential areas are maintained by private landscapers hired by individual homeowners or the owners/managers of multi-family complexes. Landscapers that use minimal chemicals and fertilizers and generally practice "green" landscaping techniques should be encouraged to do business in Kirkland, and should be advertised by the City through a certification program. The program would be beneficial to the City in that its receiving waters would have reduced fertilizers and chemicals in runoff from landscaped areas. Landscaping businesses would benefit from the free advertising and cost-savings from using fewer chemicals. A program similar to King County's Envirostars program, where landscapers develop programs such as reducing or eliminating chemical use, practicing "natural lawn care" techniques, and selecting appropriate plants to reduce water and/or chemical usage, would be an appropriate approach to support this City goal. Currently, there are only 6 landscaping businesses or nurseries participating in King County's Envirostars program, and none of them are located in Kirkland. It is likely to take a big effort by City staff to encourage landscapers to participate in such a program, given the minimal participation in King County's program.

Development of a certification program could involve several steps, including the following:

1. Identify landscapers doing business in Kirkland from the business license list, State tax records, and discussions with property managers and owners.

2. Develop criteria for what constitutes "green" landscaping techniques. A rating system would be established to identify the degree to which the participating landscapers utilize natural yard care techniques.

3. Develop an application for businesses to apply for "green" certification.

4. Develop and conduct a 1/2-day free natural-yard care workshop specifically for landscaping businesses. Coordinate with King County Envirostars program and invite businesses that participate in that program to provide success stories and practical information on how to convert to "green" techniques. The workshop should be conducted in the winter, during the typical slow season for landscaping businesses. All landscapers in Kirkland would be invited to attend the workshop and would be provided with information about the certification program.

5. Advertise those businesses that participate in the program on the City website, and in inserts to monthly utility bills.

6. Develop an awards program to recognize those landscaping businesses that are successfully applying natural yard care techniques in Kirkland.

Budget Estimate:

There is a one-time cost for setting up the "Green" Landscaper Certification program, in addition to an annual cost for maintaining the program. It is expected that the initial program would be set up by a Consultant to the City, and that subsequent management of the program would be conducted by City staff. The estimated cost to develop the certification program is $23,000. The costs are broken down as follows:

Identify Landscaping Businesses in Kirkland	$1,000
Develop Criteria for Certification	$3,200
Develop Application	$1,400
Develop Workshop with King County	$12,500
Advertise Participants in Program	$1,300
Develop Awards Program	$3,600
Total	$23,000

EVALUATION AND RANKING OF POLLUTANT SOURCES

Preliminary Scope of Work

This study seeks to identify locations in Kirkland that are acting as major sources of pollutants to receiving waters, based on (1) position in the watershed/drainage basin, (2) types of land activities, (3) degree of possible attenuation, and (4) the presence of operational or structural source control BMPs or water quality treatment BMPs. The study will rely on literature documenting how certain types of land uses and combinations of activities tend to cause water quality problems for receiving waters, if left untreated. Three of the City's receiving waters, Juanita, Forbes and Yarrow creeks, are on the State 303(d) list for impaired water quality. The parameters of concern all of these streams are (1) elevated fecal coliforms, (2) elevated temperatures, and (3) decreased dissolved oxygen. Although some water quality monitoring data available for receiving waters in Kirkland, there is insufficient data to accurately determine contributing sources. Additionally, not all possible stormwater constituents have been sampled at Kirkland's water quality monitoring locations.

This study will largely be a map-based exercise, using existing and newly developed GIS coverages to perform the analysis. The goal of the study is to assist the City to focus resources on the reduction of water quality impacts to surface water in these identified areas. Rather than focus many resources on monitoring water quality and trying to identify where problems are based on sampling results, this approach relies on the literature to identify where problems *should* be occurring based on types of urban activities that generate pollution in other urban environments. This study does not replace the need for water quality monitoring, but it does allow focused decisions to occur in the absence of sufficient long-term water quality data in the City's receiving waters.

GIS Data Coverages

This project will rely on existing GIS coverages maintained by City GIS staff, including:

1. Drainage basin boundaries;
2. Land-use categories;
3. Street network and right-of-way, including information about high-use intersections (this will need to be added to the street network layer);
4. Locations of commercial businesses that potentially contribute to degraded water quality (developed in the routine business outreach program element);
5. Surface water drainage infrastructure;

6. Impervious surfaces;
7. Locations of natural areas and extensive vegetation that may attenuate pollutant loading to receiving waters;
8. Locations of contaminated soils;
9. Locations of residential septic systems; and
10. Locations of site specific maintenance practices such as road sanding during the winter, herbicide use along rights-of-way, or fertilizer use at certain City facilities (developed in the City water quality evaluation program element).

Additional coverages will need to be developed during the study, including toxics information such as locations of Underground Storage Tanks (USTs), State Superfund Sites, and other toxic site information available through the Washington State Department of Ecology.

Assumptions:

1. Existing GIS coverages will be supplied by the City to the Consultant.

2. Locations of commercial businesses that conduct pollution-generating activities will be mapped on a GIS coverage in a different study (Routine Outreach to Kirkland Businesses) proposed in the Surface Water Master Plan.

3. Locations of City practices, including site specific maintenance practices such as herbicide use, and road sanding will be mapped in a different study (Water Quality Evaluation of City Practices and Property).

4. All existing GIS coverages will be vertically integrated so that analyses can be computed in a seamless manner.

Deliverables:

1. GIS data coverage showing readily available information from the Department of Ecology, such as locations of sites with (1) USTs, (2) voluntary and mandated cleanup actions, and (3) hazardous water generation or storage.
2. GIS coverage of potential pollutant sources in each basin or subbasin.

Analysis of Pollutant "Hot-Spots"

Using the GIS coverages described above, an analysis will be conducted in GIS, evaluating what areas have what sources of pollutants based on land use, commercial activity, road network and/or maintenance practices. The types of pollutant loadings that one might expect for the particular land uses will be identified, as well as any BMPs that are in place to remove such pollutants or prevent pollutants from reaching receiving waters. "Hot spots" will be identified where there are multiple pollution-generating

activities, particularly those areas where the pollution-generating activities occur on impervious surfaces and have a greater chance of entering receiving waters. Pollution-generating areas, including opportunities for treatment will be summarized in a table at the drainage basin or subbasin level. Juanita and Forbes creek drainage basins have been further divided into subbasins and opportunities for treatment for these basins will be summarized at the subbasin level.

Assumptions:

1. The GIS data coverages will be vertically integrated so that analysis can easily be performed using the data coverages described above.

2. The analysis will represent a first-cut look at the City of Kirkland and potential water quality "Hot-Spots," based on the available information and data coverages, without ground-truthing existing conditions. Potential locations for water quality treatment facilities or focused investigation of water quality problems will require field verification.

Deliverables:

1. Table listing categories of pollution-generating activities and associated water quality constituents.

2. Map showing locations of pollutant "hot-spots."

Technical Memorandum of Study Results and Recommendations for Implementation of Water Quality Treatment Facilities

A technical memorandum will be prepared summarizing the results of the above-described analyses. Based on the results, recommendations will be made for where pollution prevention should be focused and/or areas that might benefit from installation of water quality treatment facilities.

Deliverable:

1. A draft and final technical memorandum will be prepared, not to exceed 15 pages.

Budget Estimate

The estimated budget for a Consultant to the City to complete this study is $38,400. This study represents a one-time cost to the City. It is assumed that the GIS data coverages developed during this or other work efforts will be maintained and updated as necessary by City GIS staff. The breakdown of costs is as follows:

Create New GIS Coverages		$16,500
Analysis of Pollutant Hot-Spots		$13,700
Technical Memorandum		$8,200
	Total	$38,400

ADOPTION OF KING COUNTY STORMWATER POLLUTION CONTROL MANUAL

Preliminary Scope of Work

King County has recently updated and renamed their 1995 BMP Manual, intended for use by businesses in unincorporated areas of the County. The City of Kirkland is considering adopting the revised manual, now termed the King County Stormwater Pollution Control Manual, as part of its ongoing stormwater program. Manual adoption would require a one-time cost to the City to review the manual with the purpose of reconciling any differences with existing City codes and standards, and promoting the manual to local businesses. It would be most efficient if this program element were completed prior to the Routine Outreach to Kirkland Businesses, another program element outlined in the Updated Surface Water Master Plan. As part of the routine outreach to Kirkland businesses, City surface water staff could encourage use of the manual for selection of industry-specific BMPs to address individual water quality issues.

Specific Task Items:

1. Review 2005 King County Stormwater Pollution Control Manual (once the County has completed all revisions) and compare its requirements with current City of Kirkland standards to identify any inconsistencies. (Assume 40 hours of time to review manual and compare to other adopted City standards and codes).

2. Conduct informal meetings with Kirkland businesses, including organizations such as the Kirkland Chamber of Commerce, Kirkland Downtown on the Lake, and others, to get input regarding adoption of the King County Stormwater Pollution Control Manual.

3. Conduct a public meeting and public hearing to inform local residents and businesses about adoption of the manual and solicit their input prior to manual adoption.

4. Prepare documentation for City Council adoption of the King County Stormwater Pollution Control Manual as part of Kirkland's Surface Water Program requirements. (Assume 60 hours of time to provide documentation necessary for Council to adopt the manual).

5. Participate in presentations to Kirkland City Council in support of City staff presenting the adoption documentation. (Assume 12 hours to prepare and rehearse presentation material and to attend City Council meetings).

6. Prepare a fact sheet for distribution to businesses describing the adoption of the manual and associated benefits/implications for City residents and businesses. Distribution of the fact sheet would be through the routine business outreach, and renewal of business licenses. (Assume 40 hours for preparation of the fact sheet).

Budget Estimate

Adoption of the King County Stormwater Control Manual represents a one-time cost to the City. It is assumed that follow-up questions or technical guidance for implementation of BMPs in the manual would fall under the regular technical assistance duties of City surface water staff. The estimated budget for a Consultant to complete this work is $14,410. The equivalent time for a City FTE to conduct this work would be 0.06 FTE.

WATER QUALITY EVALUATION OF CITY PRACTICES AND PROPERTIES

Preliminary Scope of Work

Improving surface water quality in City receiving environments is an important goal of the City of Kirkland's stormwater utility, particularly in local streams and Lake Washington. Non-point and point source pollution in Kirkland surface water runoff can contribute to the poor water quality typical of urban areas. Kirkland's Surface Water Utility is incorporating programs into the 2005 Surface Water Master Plan to help reach this goal of improving water quality. An equally important part of this process is to recognize and reduce any contributions of City properties, infrastructure, and practices to surface water runoff contamination. This preliminary scope of work involves evaluating existing City properties, infrastructure, and practices to see if there are areas where a change in City activities or use of materials could reduce the pollutants reaching the City's receiving waters. The City will also use this evaluation to prepare a Stormwater Pollution Prevention Plan (SWPPP) as required by the new NPDES Phase II permit. The following facilities, departments, and programs are recommended for inclusion in this evaluation:

Review of City Facilities and Infrastructure

The City owns and operates a variety of facilities, including:

- City Hall;
- 6 Fire Stations;
- City Cemetery;
- Kirkland Swimming pool;
- Water Towers;
- South Rose Hill Offices;
- Ball Fields;
- 38 Parks;
- Boat Launches;
- Kirkland Performance Center;
- City Maintenance and Fueling Yard;
- Municipal Courthouse; and
- 8 Sewage Pump Stations.

The City also owns and maintains infrastructure that support citizens and businesses, including

- Streets;
- Bridges;
- Sidewalks;
- Water lines, pumps and reservoirs;
- City Events and Festivals;
- Unopened Right-of-way;
- Stormwater Sewer System;
- Catch basins;
- Landscaped traffic islands;
- General landscaping;
- City street lights; and
- Garbage and Recycling Contracting

The evaluation should include a review of materials used or stored at these facilities and for maintaining infrastructure elements that have the potential to pollute surface water. Examples of common pollution-generating materials that may be present at these facilities include galvanized pipes and gutters (contributing zinc), unpainted metal rooftops (also a zinc contributor), materials composed of copper possibly including public art or other facility features, un-landscaped areas that have exposed soil, and fueling and maintenance facilities for fleet vehicles. Another aspect of the City Facility review should be an evaluation of the types of activities that take place at the facilities and whether there are activities have the potential to generate pollution that could reach receiving waters. Additionally, the use of pollution prevention practices by City personnel should be evaluated.

Assumptions:

1. Develop a checklist for conducting the City water quality evaluation. Examples of checklist items include physical facility materials (rooftop materials, downspouts, etc.), activities conducted at the facility, materials stored at the facility, and operational or structural water quality BMPs in place to treat or prevent water quality degradation. (Assume 40 hours to develop checklist).

2. Conduct a GIS- or map-based search of City facilities to identify City-owned and/or operated facilities that should be included in the evaluation. (Assume 40 hours to develop list of facilities to evaluate).

3. The review of City facilities will involve a site visit to each facility to evaluate materials that are exposed to rainwater, thus having the potential to contribute pollutants to stormwater runoff. Additionally, any operational or structural BMPs in place will be noted. Each site visit would take no more than 3 hours.

4. It is estimated that there are 70 facilities that would need to be visited, for a total of 26 days of site visits at 3 hours/visit.

Review of Practices in City Departments

There are several City Departments that are responsible for maintenance and operations of City Facilities and/or infrastructure. The primary maintenance and operations responsibilities lie with the Parks and Recreation and Public Works Department. Parks and Recreation is responsible for maintaining 38 parks totaling over 500 acres. This department also maintains the grounds at the City Cemetery, Heritage Hall, Kirkland Performance Center, Senior Center, Teen Union Building and Library as well as public art. The Public Works Department has the responsibility for maintaining road rights-of-way, sidewalks, paths and trails, streets, surface water infrastructure, and water and sewer

lines. Additionally, the Fire Department also maintains the City's fire stations. These departments have the potential to contribute pollutants to surface water through their maintenance practices, including fertilizer and herbicide application at City Parks and public facilities, right-of-way spraying, road sanding, and vehicle maintenance, fueling and washing. The evaluation of City practices should include interviews with representative maintenance staff on the use and application of chemicals, timing of activities, and volume of materials used.

Assumptions:

1. Develop a questionnaire to be used when interviewing maintenance staff about common practices used on City property. (Assume 20 hours of preparation time to develop questionnaire).

2. Two 2-hour interviews with maintenance representatives from each of the following City Departments or Divisions: (1) Parks and Recreation, (2) fire station or fleet maintenance personnel, (3) Storm and Surface Water, (4) Sewer, and (5) Streets. The overall 4-hour interview time includes identification and coordination with appropriate staff to participate in the interview.

Summary of Evaluation Findings

Following the completion of the Evaluation of City property and practices, a report will be written summarizing the results. The report will identify alternatives for modification of City property or materials used by City personnel that could result in a reduction of pollutants from City-owned property entering receiving waters. The alternatives will be ranked according to their estimated effectiveness, cost and feasibility.

Assumptions:

1. Prepare one draft and final technical memorandum summarizing the findings of the evaluation. The technical memorandum will include a map of the facilities evaluated, a table of potential water quality concerns at each facility, and a table of specific pollution-generating maintenance practices. The report will also provide and analysis of alternatives for modifying City practices and/or materials used to reduce water quality pollutants. (Assume 60 hours for the draft and final technical memorandum).

2. Develop a GIS-coverage that lists water quality concerns at each City owned or operated facility. The GIS coverage will later be used along with other data to identify and prioritize installation of water quality treatment facilities in Kirkland. (Assume 40 hours for development of the GIS coverage).

Estimated Budget

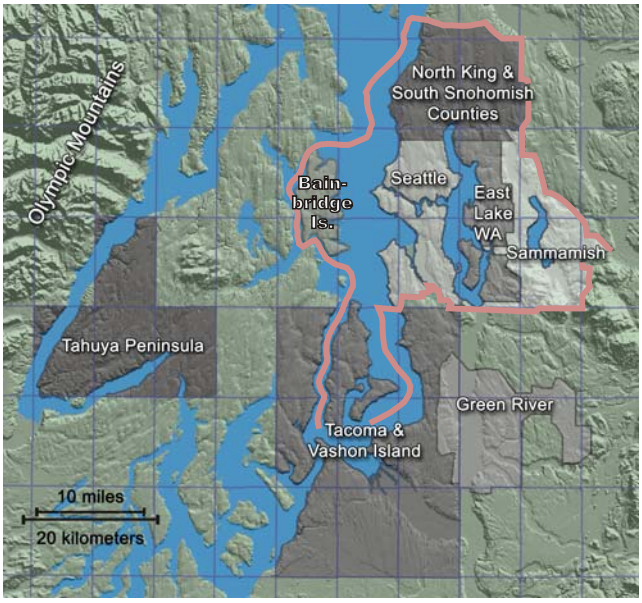
The estimated budget to complete this evaluation is $47,285. It is assumed that this work will be conducted by a Consultant to the City, as this is a one-time study. If the City should choose to do the work through one of their FTEs, we estimate that the equivalent time for an FTE to complete the work would be approximately 0.2 FTEs. The following is a breakdown of the costs.

Review City Facilities	$30,773
Review City Practices	$4,686
Prepare Report Summarizing Findings and GIS Coverage	$11, 826
Total	$47, 285

The Pacific Northwest Center for Geologic Mapping Studies

Scope and Mission

The Seattle-Area Geologic Mapping Project, begun in 1998 and originally scoped to produce detailed digital surficial and subsurface geologic maps of Seattle, has now become the Pacific Northwest Center for Geologic Mapping Studies ("GeoMapNW"), a grant-funded, collaborative research center hosted by the Earth and Space Sciences Department at the University of Washington. The mission of the Center is to provide geologic data and expertise, to conduct geologic mapping and research, and to support the geologic research efforts of others throughout the Pacific Northwest and beyond.



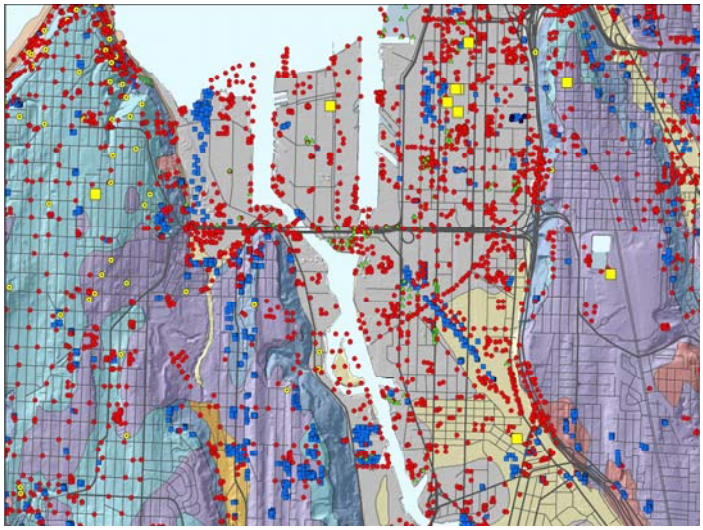
Current Research

- Chronology and stratigraphy of Quaternary deposits in the Puget Lowland
- Quaternary deformation in the Puget Lowland
- Geomorphological studies of landform development and landscape evolution
- Little Ice Age studies and lichenometry in the Pacific Northwest

Center Services

Geologic Maps—Current mapping areas include a broad swath of the central Puget Lowland, primarily at scales from 1:12,000–1:24,000 (map at right). Visit the website for current versions of published, in-press, and unpublished geologic mapping for viewing, downloading, or printing.

Geodatabase—The Center is actively compiling a database of subsurface geologic information, acquired from public and private sources throughout the region, that currently includes more than 67,000 logs of individual test pits, borings, and water wells. The current region is outlined in red above. The database is GIS-linked and accessible via the Internet; the original log copies can be viewed and copied at the Center office (contact *wisher@u.washington.edu* for appointments M-Th, 9AM-3PM). As an example, the map below of the SoDo district of Seattle and the West Seattle bridge displays the distribution of subsurface data (red dots) over the new geologic map for this area.



Derivative Maps—Using the new geologic mapping and geodatabase, the center is now producing many derivative maps to meet specialized needs: for example, aquifer susceptibility, distribution of peat, fill thickness, depth to glacially-overridden material, and depth to bedrock.

Publications—Both citations and downloads of a variety of formal and informal publications on the geology of the greater Puget Sound region are available from our website.

University of Washington, Department of Earth and Space Sciences, Box 351310, Seattle, WA 98195-1310
(206)-616-9769 http://geomapnw.ess.washington.edu
Kathy G. Troost (206-616-9769, *ktroost@u.washington.edu*); Derek B. Booth (206-543-7923, *dbooth@u.washington.edu*)
Scott A. Shimel (206-616-9361, *shimel@u.washington.edu*); Aaron P. Wisher (206-685-2821, *wisher@u.washington.edu*)
Michael A. O'Neal (206-685-2653, maoneal@u.washington.edu)

DRAFT SCOPE OF WORK

Geologic Mapping and Database for Kirkland
June 2005

This document outlines a draft scope for **new detailed geologic mapping and a subsurface database for the City of Kirkland** (City). The Pacific Northwest Center for Geologic Mapping Studies (GeoMapNW) with the U.S. Geological Survey has been remapping much of the Puget Sound urban corridor with this new integrated surface/subsurface geologic mapping approach (figure 1). The improvements in the new geologic mapping compared to the old geologic mapping include: 3 to 4 times more geologic units mapped (figure 2), 15 to 25 % more sandy material mapped at the surface and the sandy material is widely distributed across the landscape (figure 3), 25% less till or fine-grained material at the surface (figure 3), 10% more land surface mapped, 3 to 4 times the level of the detail, better delineation of weak ground (figure 4), data points are shown, and the data are accessible on a web site (image below, next page).

The new digital map and database will provide the most current compilation of geologic data available for use by City of Kirkland personnel, its consultants, and the public for planned and future projects thereby potentially improving the quality and efficiency of surface water, geotechnical, utility, transportation, and groundwater work. City employees will have access to downhole data, geologic data, and maps at their desktops to facilitate their projects.

The work described by this scope is divided into 5 tasks: building a subsurface database, preparing a new geologic map, training, meetings, web maintenance and updates.

Task 1. Subsurface Geologic Database

GeoMapNW will populate a geologic database of subsurface information from geological and geotechnical investigations. The database will be a part of our master database for the region. We will acquire, enter, and distribute existing geological data (subsurface explorations and field-mapped data) compiled from local, state, and federal agencies via a GIS-based database for Kirkland. Subsurface data will be acquired from reasonably available sources including: the City, WSDOT, King County, WA Department of Ecology, other public agencies, and selected consulting firms. Quarterly updates of ArcView shapefile-formatted themes will be provided that include geotechnical report areas (polygons) and attributes, exploration locations (points) and attributes, and a related table (.dbf file) of subsurface layer data for Kirkland.

Task 2. Geologic Maps

This task consists of the production and delivery of new digital geologic map coverage for Kirkland. Existing geologic mapping (U.S. Geological Survey, dated 1962) is at a scale of 1:24,000. The new map will be produced at 1:12,000 scale (1” = 500’) using the regional terminology and stratigraphic framework developed jointly by us and the U. S. Geological Survey. The geologic map will be based on new field mapping and the surficial geologic information in the newly populated database. We will take advantage of as many excavations as possible to gain further insights into the geology of the area.

University of Washington, Department of Earth and Space Sciences, Box 351310, Seattle, WA 98195-1310
(206)-616-9769 http://geomapnw.ess.washington.edu
Kathy G. Troost (206-616-9769, *ktroost@u.washington.edu*); Derek B. Booth (206-543-7923, *dbooth@u.washington.edu*)
Scott A. Shimel (206-616-9361, *shimel@u.washington.edu*); Aaron P. Wisher (206-685-2821, *wisher@u.washington.edu*)
Michael A. O’Neal (206-685-2653, maoneal@u.washington.edu)

Task 3. Training

Task 3 will cover a workshop on the use of the database, geology, and nomenclature. Requests for interaction with the database and assistance with the use of our data deliverables will be provided as will training of City staff and its consultants in the use of customized tools for viewing exploration log data and drawing of geologic cross sections based on the data included in the deliverables.

Task 4. Meetings

We will meet with the City on a regular basis to address scope, schedule, and budget.

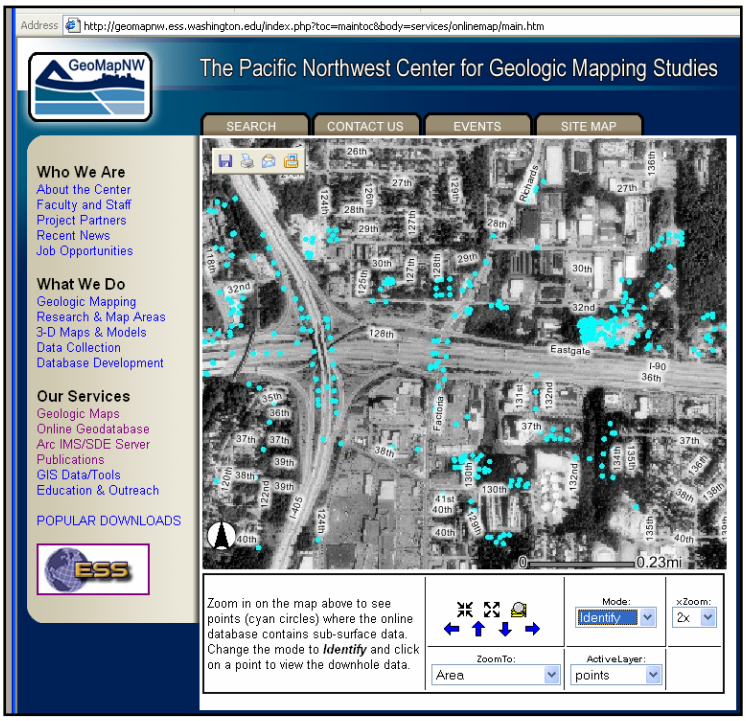
Task 5. Long-Term Maintenance and Web Access

GeoMapNW will maintain the database and provide web access to the geologic data, along with data from our other projects for as many years as support is available. Our goal is to keep the database, access, and geologic map updating available for the next several decades. Following the term of this Agreement, we expect that the City will want to maintain its contractual link to the School's database, because it will be continuing to grow with boring log data, field mapping data, and geologic research efforts.

Estimated Cost and Schedule

Without knowing more about the data available or the City's specific needs, we estimate that the cost would be between $125,000 and $150,000 to provide the geologic map, database, and training. This assumes that the City has GIS layers and geotechnical data available for our use. This also assumes that the work would be completed in 12 months time within the next 2 years. It is possible to complete this work by expending a set amount of money per year over a set amount of years, say $25,000 over 6 years. In any event a more detailed scope and more accurate cost estimate should be developed for consideration when the City is ready to begin the project. For example, the City may want to add permit numbers to the database and geotechnical files and add customized layers, such as groundwater data.

Feel free to contact us, Kathy Troost or Derek Booth, for more information or when the City is ready to develop a more detailed scope, schedule, and budget. We understand that the City is in a planning stage at this time. Our phone numbers are listed on the bottom of the previous page.



Web interface for accessing downhole data.

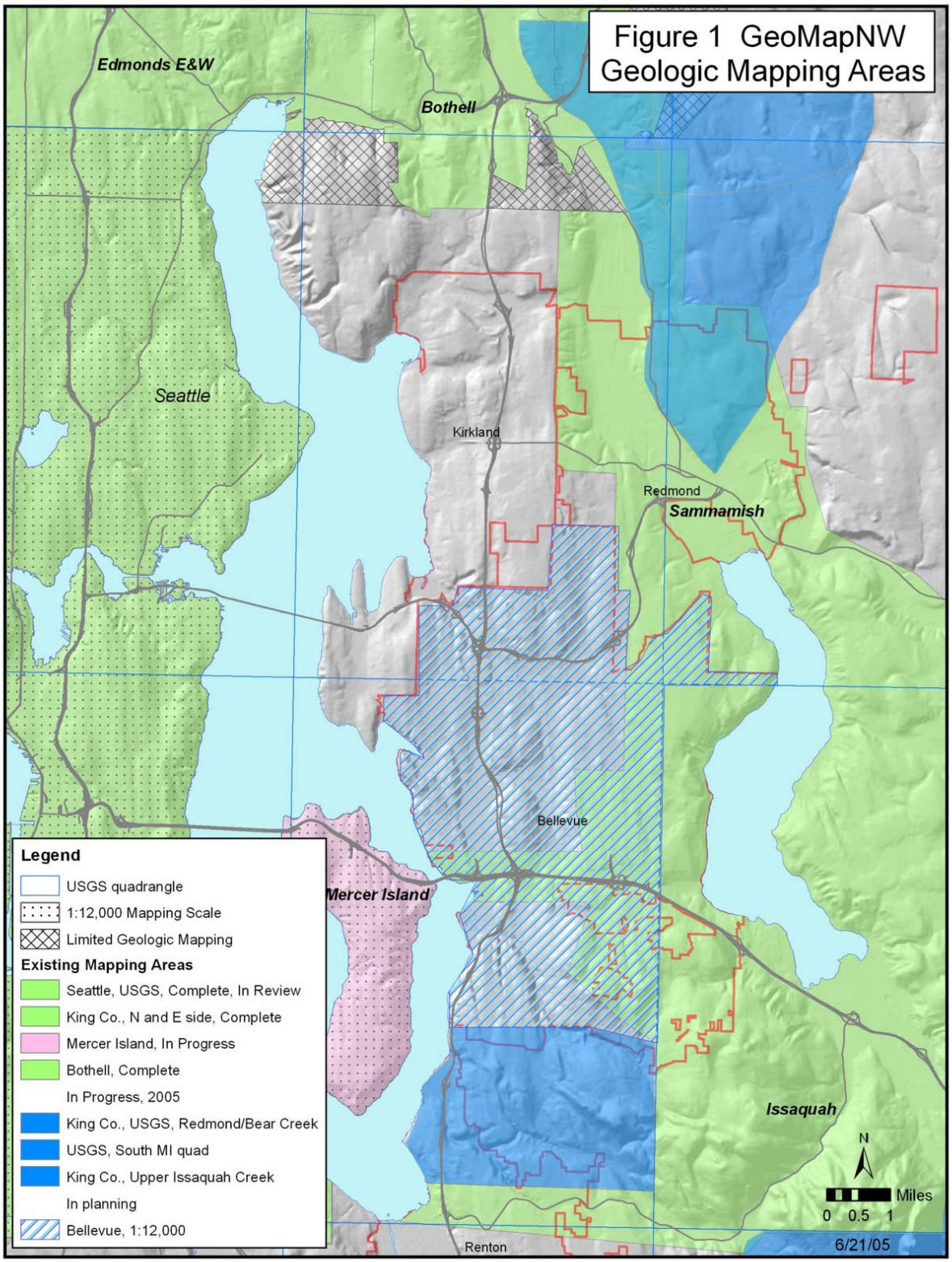
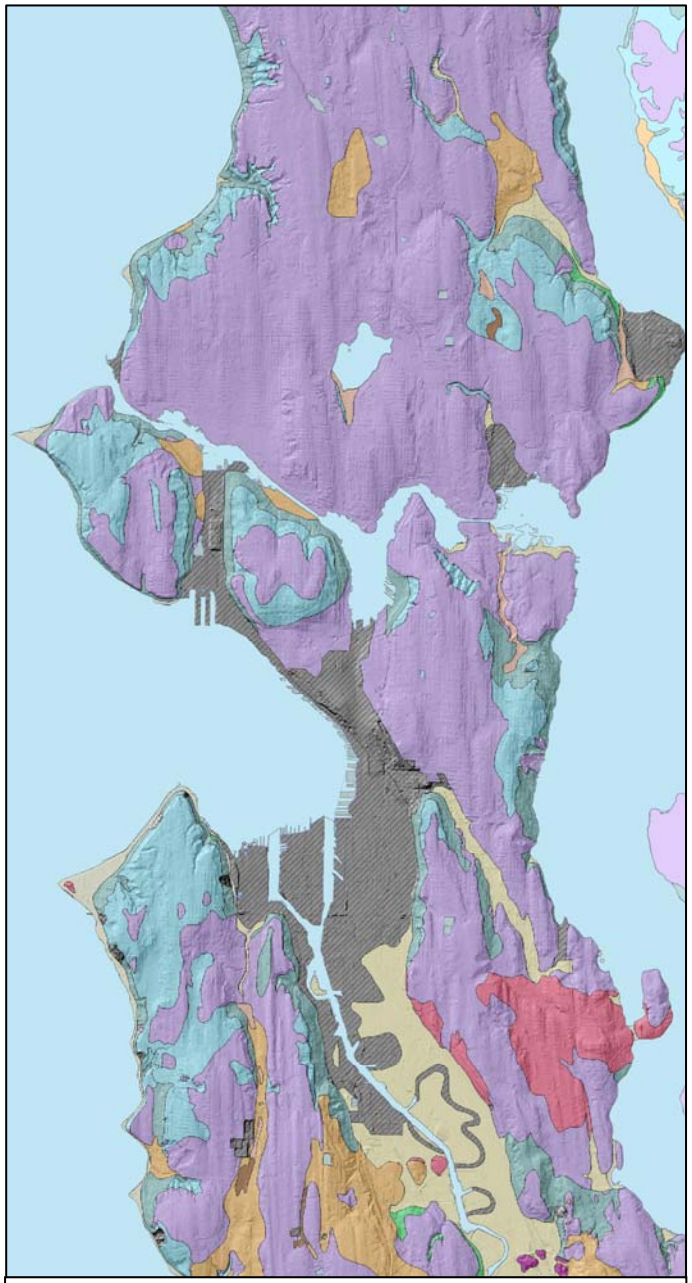


Figure 1 GeoMapNW
Geologic Mapping Areas
Edmonds E&W
Bothell
Seattle
Kirkland
Redmond
Sammamish
Bellevue
Mercer Island
Issaquah
Renton
Legend
USGS quadrangle
1:12,000 Mapping Scale
Limited Geologic Mapping
Existing Mapping Areas
Seattle, USGS, Complete, In Review
King Co., N and E side, Complete
Mercer Island, In Progress
Bothell, Complete
In Progress, 2005
King Co., USGS, Redmond/Bear Creek
USGS, South MI quad
King Co., Upper Issaquah Creek
In planning
Bellevue, 1:12,000
N
Miles
0 0.5 1
6/21/05

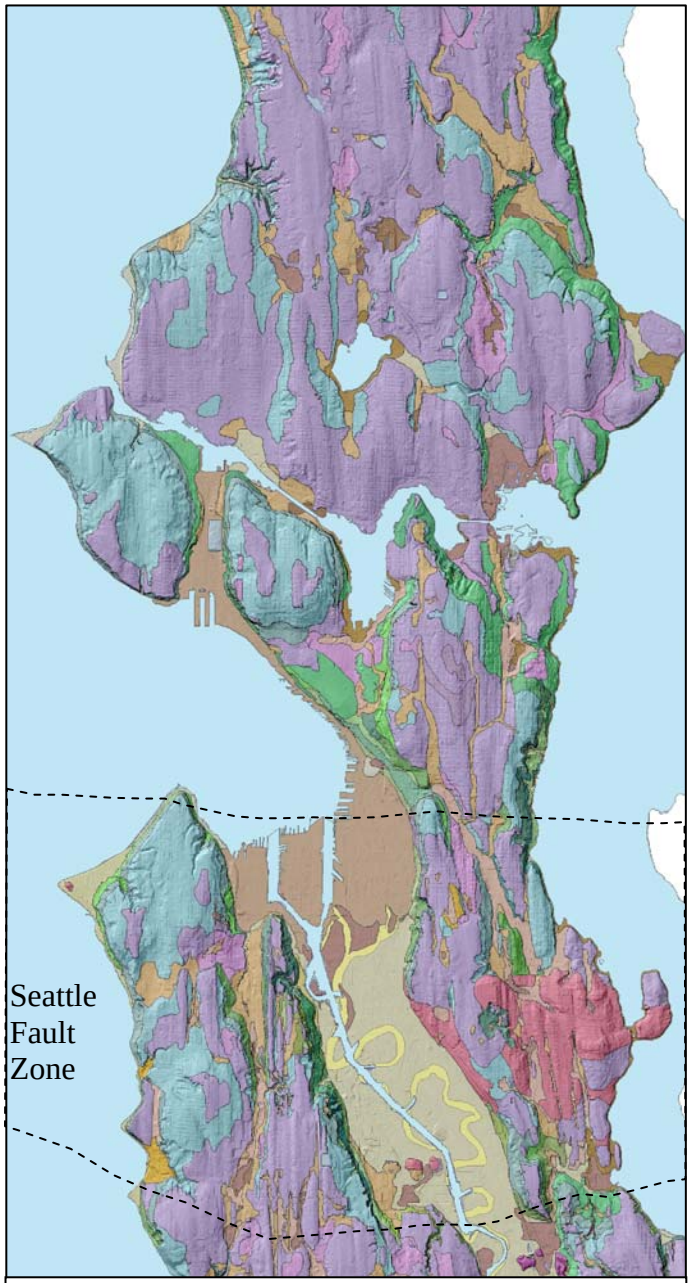
Figure 2 Comparison of Old and New Geologic Maps of Seattle

Prior to this mapping/ database project, we relied on the 1962 Preliminary Geologic Map of Seattle, by Waldron and others. It was a black and white paper map made decades before we knew about the Seattle fault and the Cascadia Subduction zone. To compare it with the new geologic map, we colorized a digitized version of the original map and then draped it over a digital elevation model of the City (map on left).

After reviewing more than 30,000 boreholes, conducting field mapping, and re-mapping old units, we have produced the new Geologic Map of Seattle (map on right). It shows more detail, contains more geologic units, and has better age/stratigraphic control. It also shows the Seattle Fault zone and maps beneath filled and graded land. Note that the till (purple) is less extensive in the new map and that more upland valleys are mapped (tans and browns) than were mapped in 1962.



Preliminary Geologic Map of Seattle, 1962



Geologic Map of Seattle, 2004

GeoMapNW 02/09/2005

Figure 3 Comparison of Preliminary Infiltration Potential

One of the significant findings of the new geologic mapping is that the Vashon till is less extensive than previously believed.

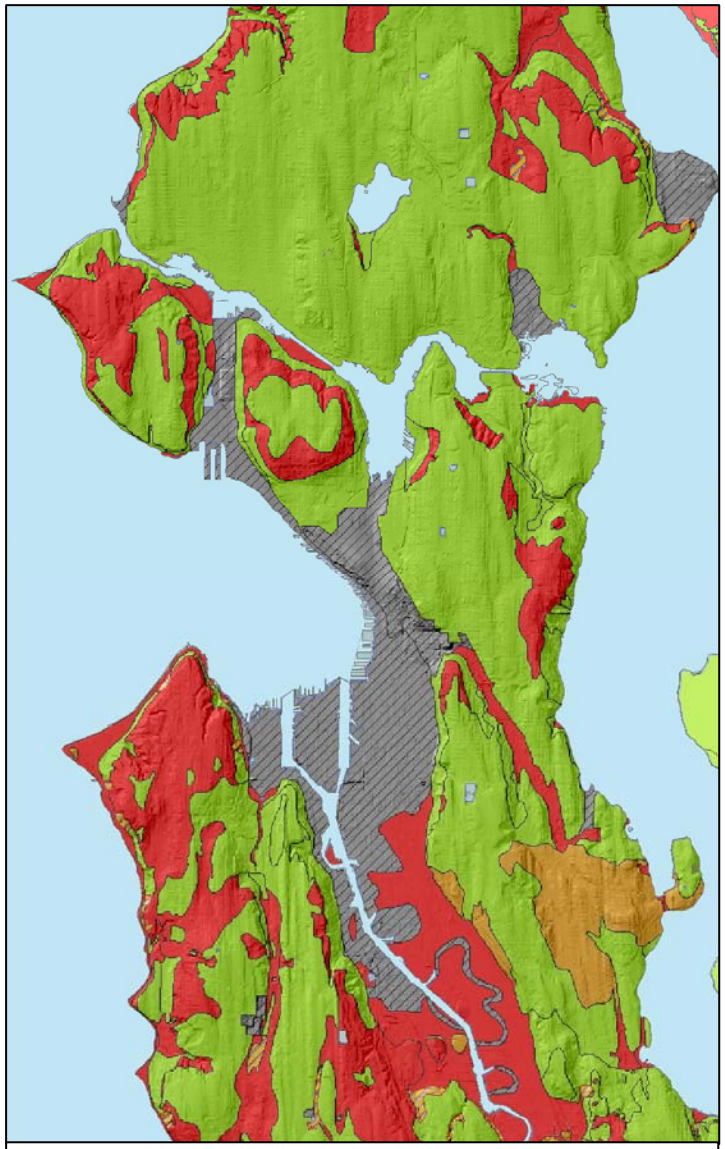
If we color the sandy units red, the silty units green, and the mixed units orange, we see just how discontinuous the till (in green) is based on the new geologic map (map on right).

The 1962 map did not provide enough geologic information to determine an infiltration potential in the areas that are shown as unmapped (map on left). This was improved with the new mapping.

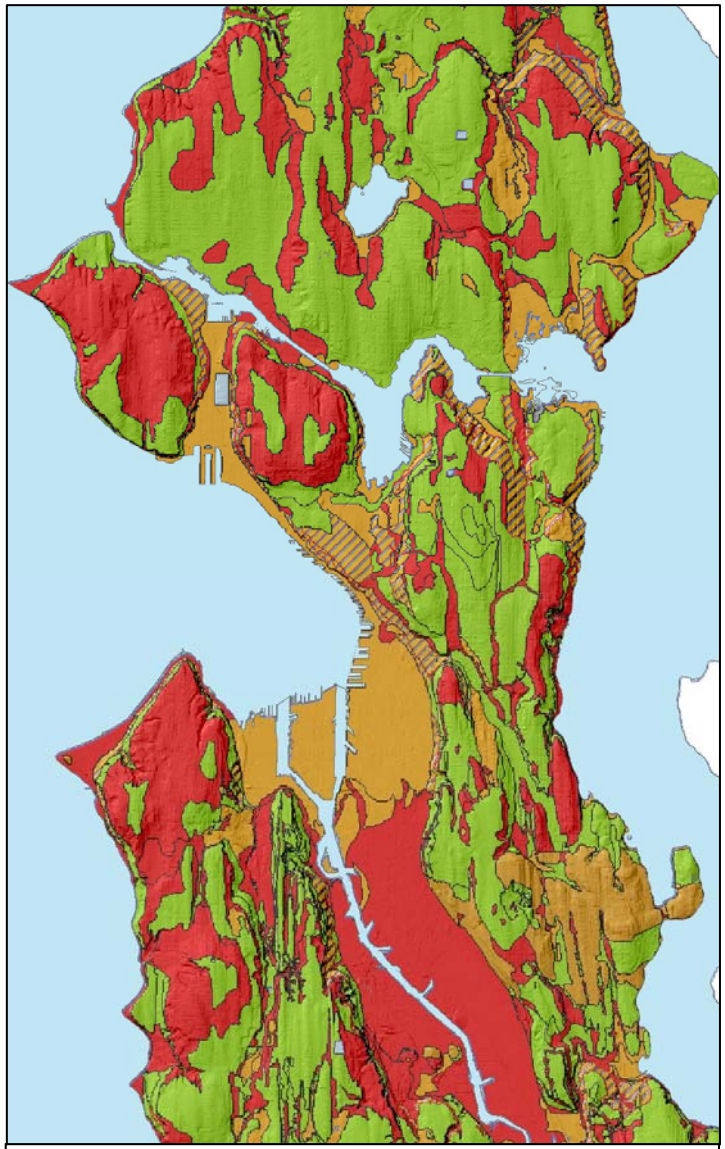
Map Units

Estimated Infiltration Potential

- **High (sandy soils)**
- **Medium**
- **Mixed**
- **Low (silty, clayey**
- **Unmapped**



Infiltration Potential, based on 1962 geologic map
This map shows 25% of the total map area as having high infiltration potential (assuming no buildings or pavement). Assessment based on qualitative estimation of permeability.



Infiltration Potential, based on 2004 geologic map
This map shows 43% of the total map area as having high infiltrative potential; nearly double that of the 1962 map.

GeoMapNW 02/09/2005

Figure 4 Preliminary Seismic Shaking Assessment

The two maps below show the most significant materials for seismic shaking assessments in the Seattle area. The map on the left, using the 1962 geology, contains loose to normally consolidated deposits over 15% of its area (9% of the map is shown as modified-containing both overridden and loose deposits). The new map, lower right, shows 28% of its total map area as loose to normally consolidated, double that of the 1962 map.

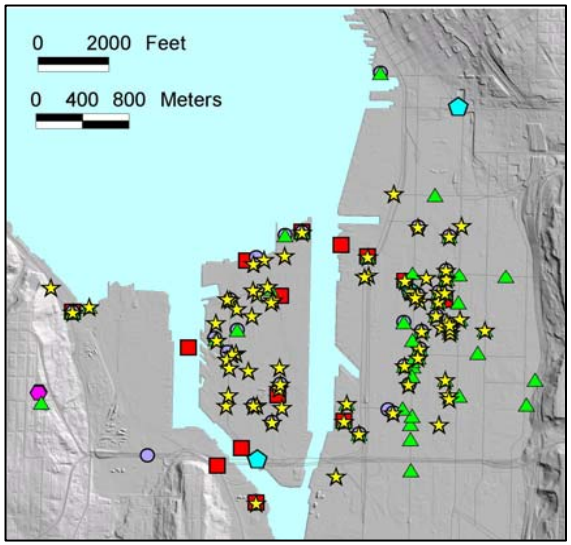
Map Units

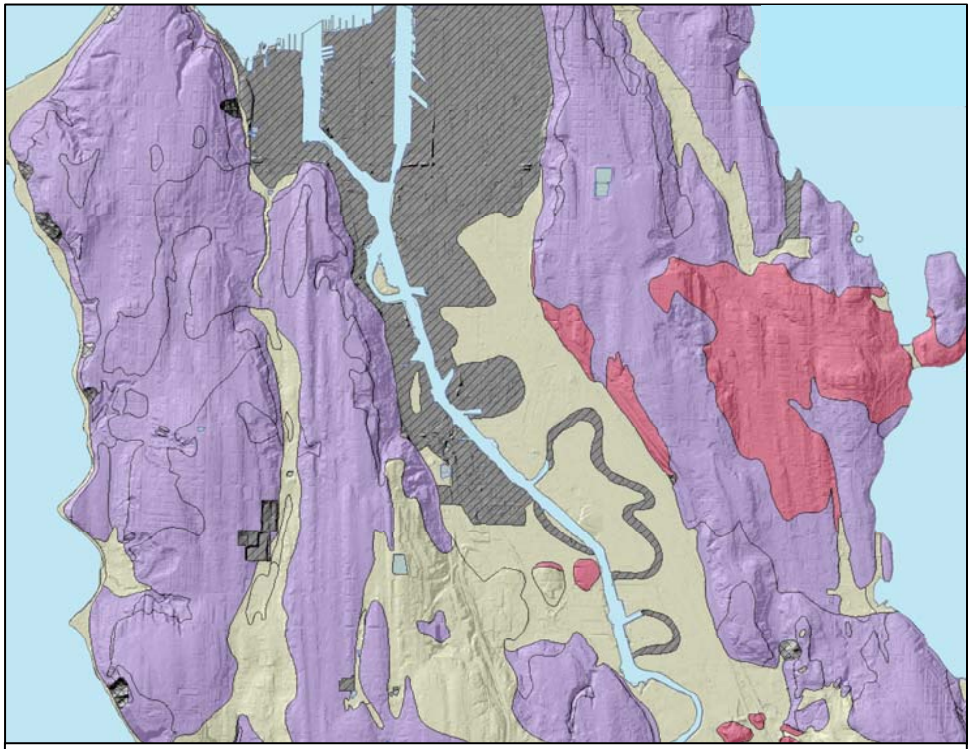
Degree of Consolidation

- Bedrock
- Glacially Overconsolidated
- Loose and Normally Consolidated
- Unmapped

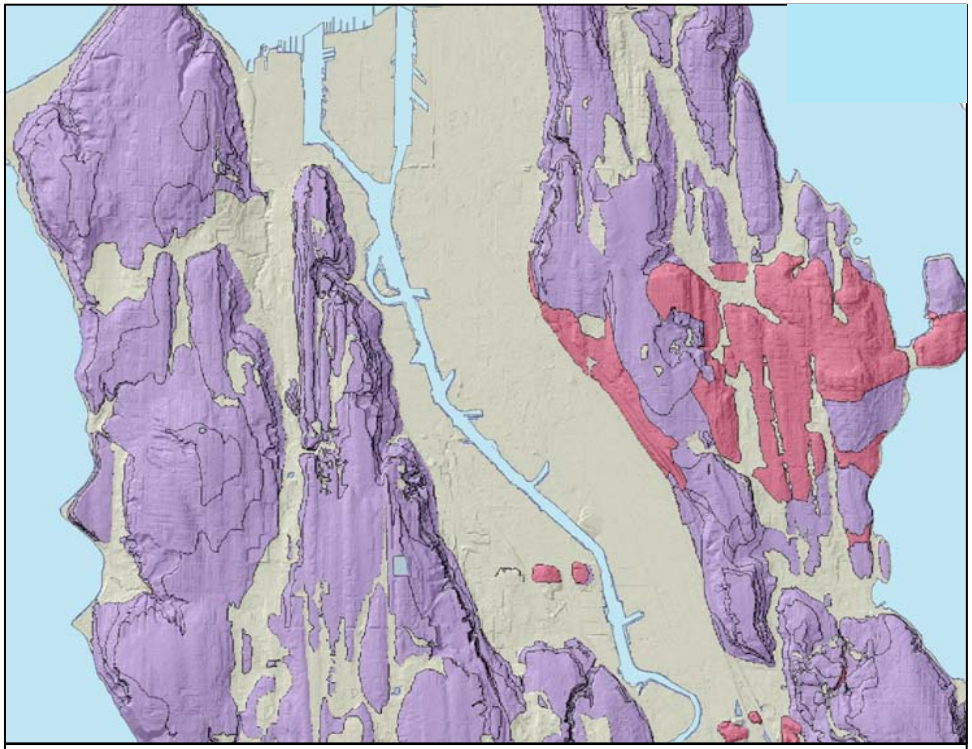
Ground Failures from the Nisqually Earthquake

After the 2001 Nisqually earthquake, ground failure observations were made in the field based on mapped areas of loose materials. Given what we know today, we will look for evidence of liquefaction in more areas during future seismic events.





Distribution of Potentially Weak Soil, based on 1962 geologic map



Distribution of Potentially Weak Soil, based on 2004 geologic map

GeoMapNW 02/09/2005