HWA GeoSciences Inc.
Geotechnical Engineering • Hydrogeology • Geoenvironmental Services • Inspection and Testing

February 7, 2007
HWA Project No. 2006-172

Mike Sharar Consulting
3515 Gainsborough Ct. SE
Olympia, WA 98501-7020

Attention: Mike Sharar

Subject: **MASON COUNTY**
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER
MASON COUNTY, WASHINGTON

Dear Mr. Sharar:

HWA GeoSciences Inc. (HWA) is pleased to submit this soils and hydrogeologic evaluation of the Hoodsport Rural Activity Center (RAC), Mason County, Washington, in support of the Mason County Water Quality Project Planning.

INTRODUCTION

HWA GeoSciences Inc. was contracted by Mason County to evaluate areas within the Hoodsport RAC for potential of septic-related contamination impacting Hood Canal, based on geologic, soils, and physiographic criteria.

SOILS

Soils in the Hoodsport RAC area consist of mainly Hoodsport series soils in the upland areas, with isolated pockets of Grove series soils in some drainages, and smaller areas of fine grained (e.g., Cloquallum and Tanwax) and alluvial (e.g., Juno) soils (Ness, 1960). Figure 1 shows the mapped soil units in the Hoodsport RAC planning area.

Hoodsport soils (Hd, He, Hf) consist of well-drained, reddish soils on uplands, formed over granitic till that is highly stained by iron and contains considerable metamorphosed and basic igneous gravel and stone. The soil survey report lists Hd soils as having a “very limited” rating for septic tank absorption fields, due to slow water movement and shallow depth to saturated zone. He and Hf soils are also listed as having a “very limited” rating for septic tank absorption fields, due to slow water movement, shallow depth to saturated zone, and slope (Ness, 1960).

19730 – 64th Avenue W.
Suite 200
Lynnwood, WA 98036-5957
Tel: 425.774.0106
Fax: 425.774.2714
www.hwageosciences.com

Grove series (Gh, Gk) soils consist of somewhat excessively drained, reddish-brown gravelly soils, that formed on large glacial outwash plains over Vashon glacial drift, modified considerably by inclusions of local basaltic rock and mixed material from the Olympic Mountain glaciers. The soil survey report lists Gh and Gk soils as having a "very limited" rating for septic tank absorption fields, due to "bottom layer seepage" (i.e., soils are too permeable) (Ness, 1960).

Cloquallum silt loam (Cc) is a moderately well drained, brown upland soil, developed over silty glacial-lacustrine (lake) sediments. The soil survey report lists Cc soils as having a "very limited" rating for septic tank absorption fields, due to slow water movement and shallow depth to saturated zone (Ness, 1960).

Tanwax peat (Tb) consists of brown peat formed in wet areas and bogs. The soil survey report lists Tb soils as having a "very limited" rating for septic tank absorption fields, due to shallow depth to saturated zone, subsidence, slow water movement, and ponding (Ness, 1960).

Juno Sandy Loam (Jb) consists of coarse textured, brown to reddish-brown alluvial soils, formed over glacial alluvium in small streams. The soil survey report lists Jb soils as having a "very limited" rating for septic tank absorption fields, due to flooding, bottom layer seepage, and filtering capacity (Ness, 1960).

Although the soil survey lists all soil types present in the RAC area as having "very limited" suitability for septic drainfields, HWA's opinion is that of the soils present, the Hd Hoodsport soils (5 to 15 percent slopes) have the best septic treatment potential and least off site septic contaminant transport risk. These soils are generally found on the till uplands, on relatively flat land. Steeper Hoodsport soils (He and Hf) have a higher potential to transport contaminants, due to increased slopes. Soils with the highest potential for septic contaminant transport include Grove and Juno soils, which are found in the drainages. The Grove soils pose an increased risk due to excessive permeability. Cloquallum and Tanwax soils have a low potential for transport, but also a low potential for treatment.

GENERAL GEOLOGIC CONDITIONS

Figure 2 shows the mapped geology in the Hoodsport RAC planning area. According to the Logan (2003) unconsolidated sediments mapped in the Hoodsport RAC planning area include the following:

Qgt - Till, late Wisconsinan (Pleistocene). Glacial till deposits generally consist of a compact unsorted mixture of clay, silt, sand, gravel, and boulders, deposited at the base of the Puget lobe of the Cordilleran ice sheet during the latest glaciation. Occasional sand and gravel lenses may be present. Till is

commonly referred to as “hardpan” due to its cement-like texture. Till does not provide a favorable infiltration medium, but may be suitable for septic drainfields if sufficient depth of soils and weathered till are present. Till acts as an aquitard that inhibits the flow of ground water, perches water on top of it where overlain by recessional outwash, and also confines water below it in the advance outwash. In general, the permeability of till ranges from low in weathered surficial deposits to relatively impermeable in very dense non-weathered materials (Logan, 2003).

Qga - Advance outwash, late Wisconsinan (Pleistocene). Advance outwash consists mostly of glaciofluvial sand and gravel, with some and lacustrine clay, silt, and sand deposited during the advance of glaciers. Sandy units are commonly thick, well sorted, and fine grained, with interlayered coarser sand, gravel, cobbles and silt (Logan, 2003). Advance outwash is typically permeable, often water-bearing, and denser than recessional outwash, having been overridden by glacial ice. Advance outwash is commonly overlain by till.

Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene). Recessional outwash typically includes poorly to moderately sorted, rounded gravel and sand with localized coarser- and finer-grained constituents. Some fine sand, silt, and clay form local overbank sediments may also occur. Recessional outwash thickness varies and is not well known. It most commonly occupies outwash channels scoured into or through till (Logan, 2003). Recessional outwash was not glacially overridden, and is generally poorly consolidated to loose. Typically outwash deposits exhibit moderate to high permeabilities and infiltration rates depending on silt content.

Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene). Alpine outwash consists of stratified sand, gravel, and cobbles, may include peat, silt, and clay, and may be capped by weathered loess. Clasts are generally more rounded than those in till and lack facets and striations.

Qa - Alluvium (Holocene). Alluvium may consist of silt, sand, and gravel deposited in streams and alluvial fans, locally may contain Alpine drift, peat, or landslide deposits.

The soils and geologic maps reviewed are not entirely consistent with regard to correlation of mapped glacial deposits with mapped overlying soils. For example, most of the areas mapped as outwash on the geologic maps are mapped as Hoodsport series on the soils maps. The only areas mapped as Grove soils correspond with areas mapped as alluvium on the geologic maps.

Some differences in geologic mapping based on different references also occurs, which is not uncommon. Field verification of soils and geology is therefore recommended prior to design or siting of any facility. Figure 3 shows the

mapped geology per Carson (1976), which is similar to the Logan map. The main till/outwash boundary (Qgt to Qga on the Logan map) is interpreted similarly in both maps.

RISK CLASSIFICATION

Our scope of work includes using available soils and septic system information to assess which areas in the Hoodsport RAC currently served by conventional septic systems have the highest, moderate and least likely probability of causing Hood Canal contamination.

Criteria contributing to relative risk of transmitting septic contamination to Hood Canal include:

- Soils and geology (soil treatment capacity and permeability)
- Slopes
- Distance to surface water
- Depth to ground water

Several of the criteria are overlapping, for example slopes, distance to surface water, and permeable outwash soils all coincide with the coastal areas and east-west drainages in the planning area.

Soils and geology are described above. Soils with increased risk of contaminant transport and reduced treatment capacity include those that are excessively drained, such as Grove soils. These soil types would provide less treatment than slower draining soils due to less organic content and decreased residence times. Grove soils on steep slopes in and near drainages (e.g., Gk) have an added element of risk due to thinner soil profiles, and steeper hydraulic gradients. Distance to surface water relates directly to potential for septic contaminants to reach Hood Canal. For reference, Chapter 246-272A WAC, On-Site Sewage Systems specifies a setback of 100 feet for drainfields from surface water, and 30 feet from any downgradient site feature that may allow effluent to surface.

Based on these criteria, areas ranked by relative risk of transmitting septic contamination to Hood Canal include:

- Low risk – Upland areas underlain by glacial till and Hoodsport soils, not near surface water drainages.
- Moderate risk – Areas mapped as having outwash soils, but not in or near surface water drainages.

- High risk – Areas within or adjacent to surface water drainages, including the Hood Canal coastline. Most of the areas in and near drainages also contain permeable soils which are more likely to transmit water and contaminants with minimum treatment.

Figure 4 shows mapped geology (Logan, 2003) topography, and land parcels. Figure 5 shows the major geologic contacts, topography, land parcels, and an aerial photograph, to provide some indication of land development status. Figure 5 includes the three risk areas delineated in the Hoodsport RAC.

Wastewater treatment/disposal options for future development include:

- Conventional on site sewage treatment/disposal systems
- Enhanced on site sewage treatment/disposal systems (single residence or combined)
- Conveyance to a centralized waste water treatment facility (including a variety of treatment processes, effluent qualities, and effluent disposal options)

Delineation of areas for varying types or levels of treatment in the planning process may be made qualitatively, based on relative risks as outlined above, or semi-quantitatively, by establishing maximum pollutant (e.g., nitrogen) loading or downgradient concentrations, then performing analytical modeling to predict estimated concentrations for various scenarios, including effluent quality, development density, etc.

REFERENCES

Carson, R. J., 1976. OFR 76-2. *Geologic Map of North Central Mason County, Washington,* 1 sheet, scale 1:62,500, Washington Division of Geology and Earth Resources, Open File Report 76-2.

Ecology, Washington State Department of, 2005, *Stormwater Management Manual for Western Washington*, Publications Numbers 05-10-029 through 05-10-033, Water Quality Program, Washington State Department of Ecology

HWA GeoSciences, Inc., September 19, 1994. *Preliminary Hydrogeologic Evaluation, Skokomish Wastewater Facility Report*, prepared for KCM Portland.

Logan, R. L., 2003. *Geologic Map of the Shelton 1:100,000 Quadrangle,*

Washington. 45 x 36 in. color sheet, scale 1:100,000, Washington Division of Geology and Earth Resources, Open File Report 2003-15 http://www.dnr.wa.gov/geology/pdf/ofr03-15.pdf

Ness, A. 0., and Fowler, R. H., 1960. *Soil Survey Of Mason County, Washington,* Soil Conservation Service, United States Department of Agriculture, Washington Agricultural Experiment Stations. http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html

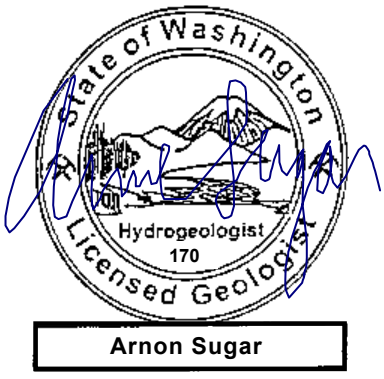
LIMITATIONS

The conclusions expressed by HWA are based solely on material referenced in this report. Observations were made under the conditions stated. Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the area at the time the report was prepared. No warranty, express or implied, is made. HWA's findings and conclusions must not be considered as scientific or engineering certainties, but rather as our professional opinion concerning the significance of the limited data gathered and interpreted during the course of the assessment.

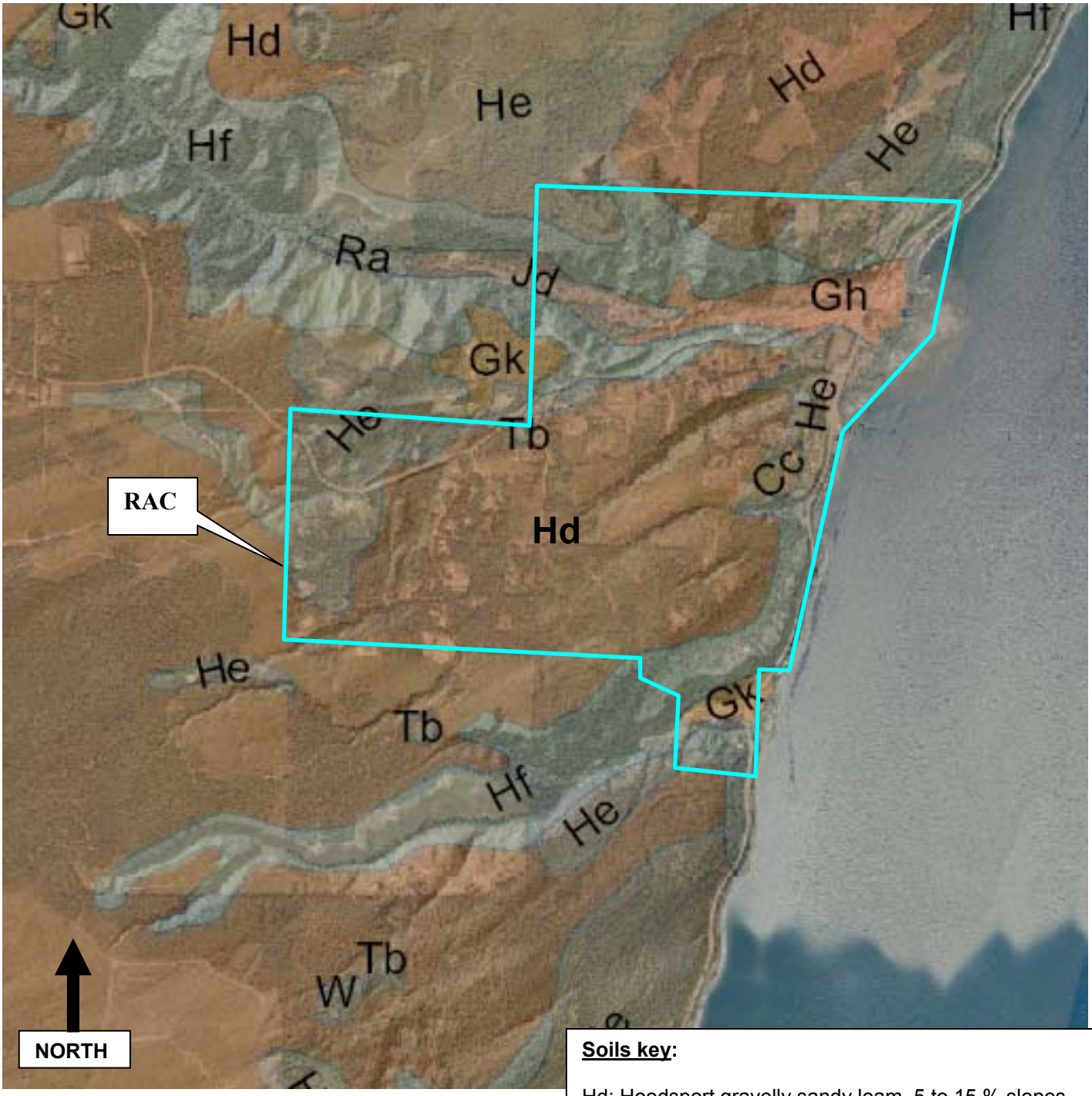
This study and report have been prepared on behalf of Mason County for the specific application to the subject property. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

We appreciate the opportunity to provide our services. Please feel free to call us if you have any questions or need more information.

Sincerely,
HWA GEOSCIENCES INC.



Arnie Sugar, LG, LHG
Vice President



Soils key:

Hd: Hoodsport gravelly sandy loam, 5 to 15 % slopes
He: Hoodsport gravelly sandy loam, 15 to 30 % slopes
Hf: Hoodsport gravelly sandy loam, 30 to 45 % slopes
Gh: Grove gravelly sandy loam, 0 to 5 % slopes
Gk: Grove gravelly sandy loam, 5 to 15 % slopes
Cc: Cloquallum silt loam, 5 to 15 % slopes
Tb: Tanwax peat, 0 to 2 % slopes
Jd: Juno sandy loam, 0 to 3 % slopes

From: Ness, A. 0., and Fowler, R. H., 1960. *Soil Survey Of Mason County, Washington,* Soil Conservation Service, United States Department of Agriculture, Washington Agricultural Experiment Stations.
http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html

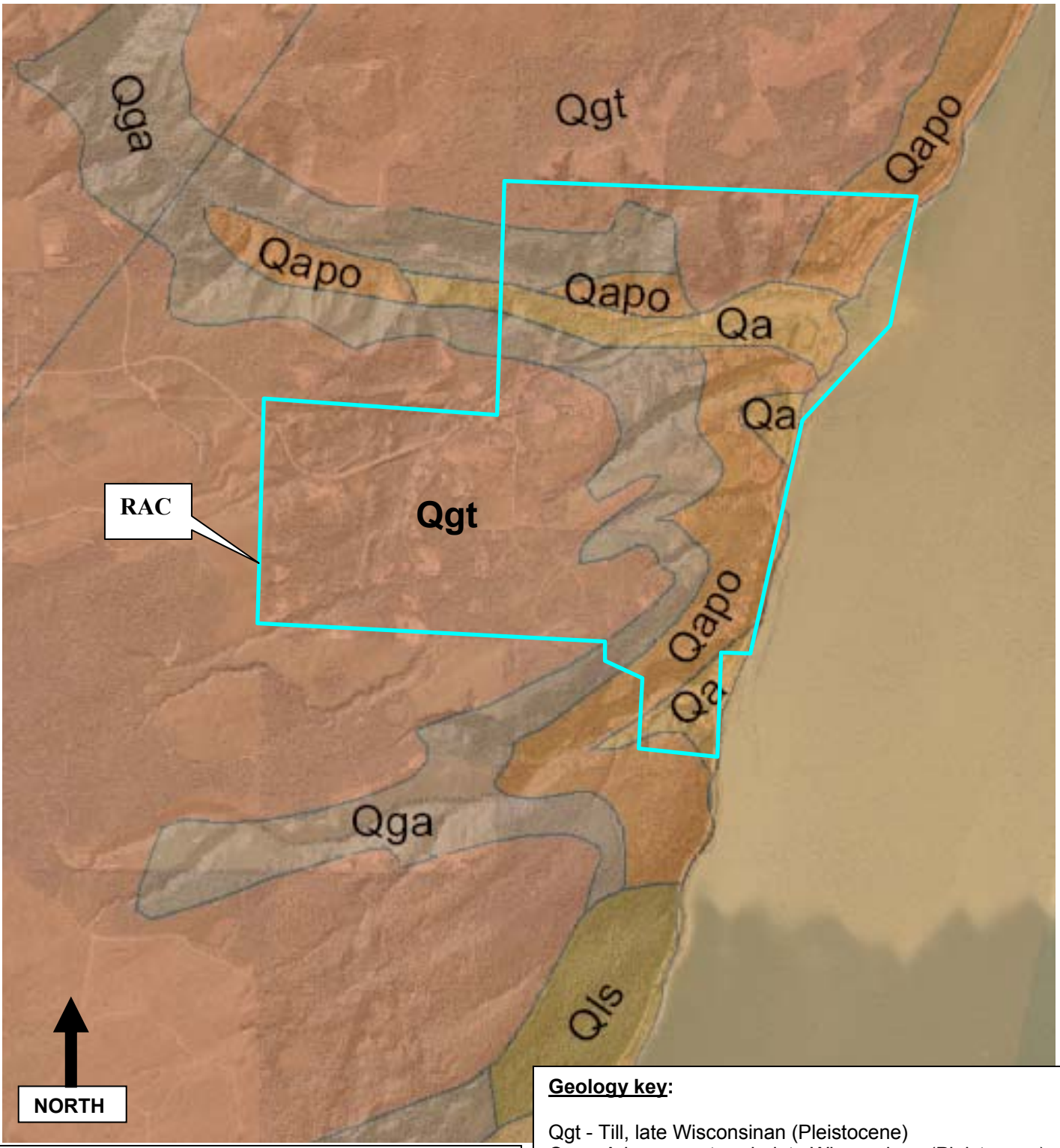
HWA GeoSciences Inc.

SOILS MAP

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
1

PROJECT NO.
2006-172



From: Logan, R. L., 2003. *Geologic Map of the Shelton 1:100,000 Quadrangle, Washington.* 45 x 36 in. color sheet, scale 1:100,000, Washington Division of Geology and Earth Resources, Open File Report 2003-15
http://www.dnr.wa.gov/geology/pdf/ofr03-15.pdf

Geology key:

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)
Qa - Alluvium (Holocene)

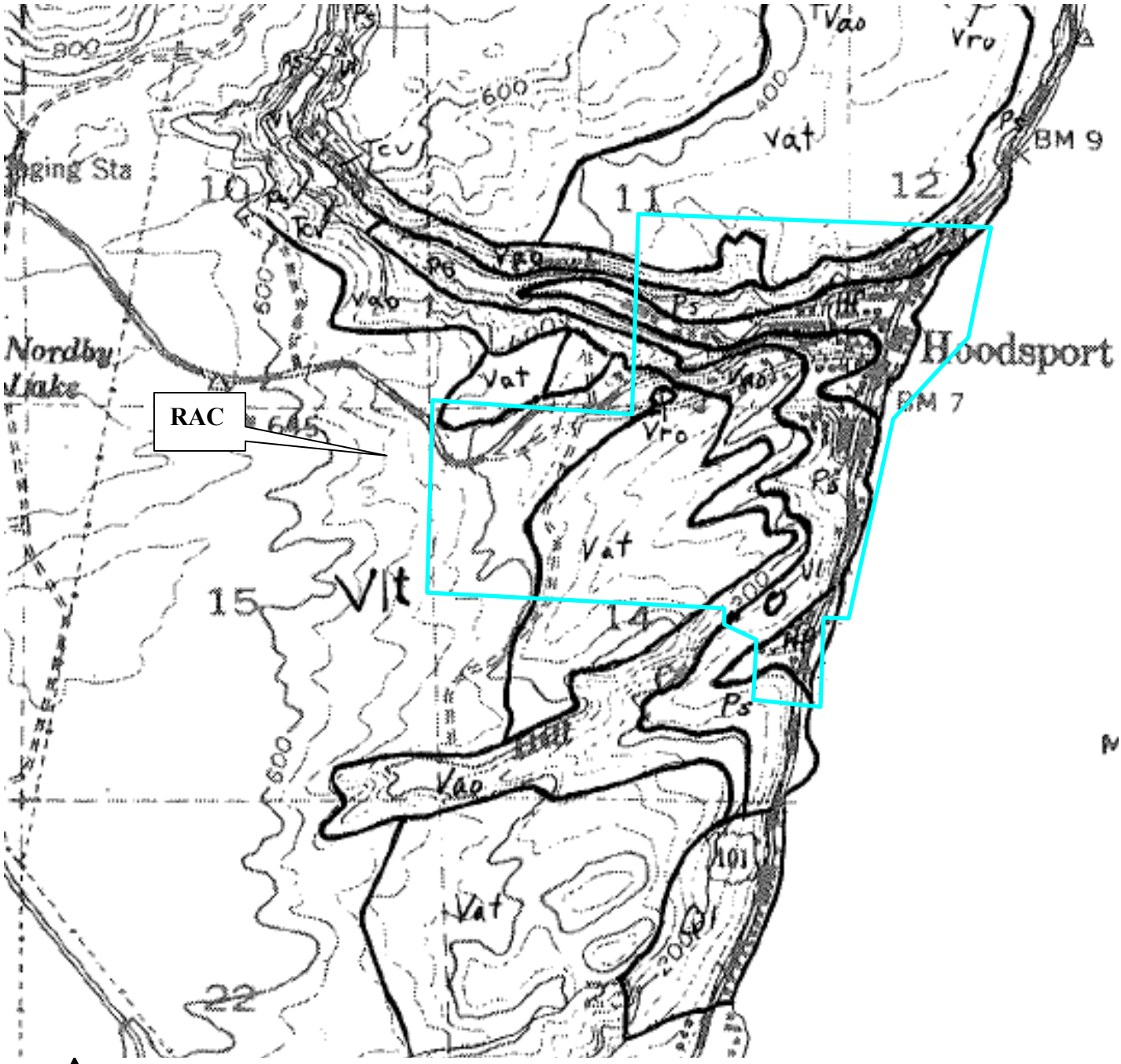
HWA GeoSciences Inc.

GEOLOGIC MAP (Logan, 2003)

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
2

PROJECT NO.
2006-172



From: Carson, R. J., OFR 76-2. Geologic Map of North Central Mason County, Washington, 1 sheet, scale 1:62,500, Washington Division of Geology and Earth Resources, Open File Report 76-2.

Geology key:

Vat - Ablation Till
Vro - Recessional outwash
Vrd - Recessional outwash - deltas/alluvial fans
Vl - Lacustrine sediments
Ps - Salmon Springs Drift
Hf - Flood plain alluvium

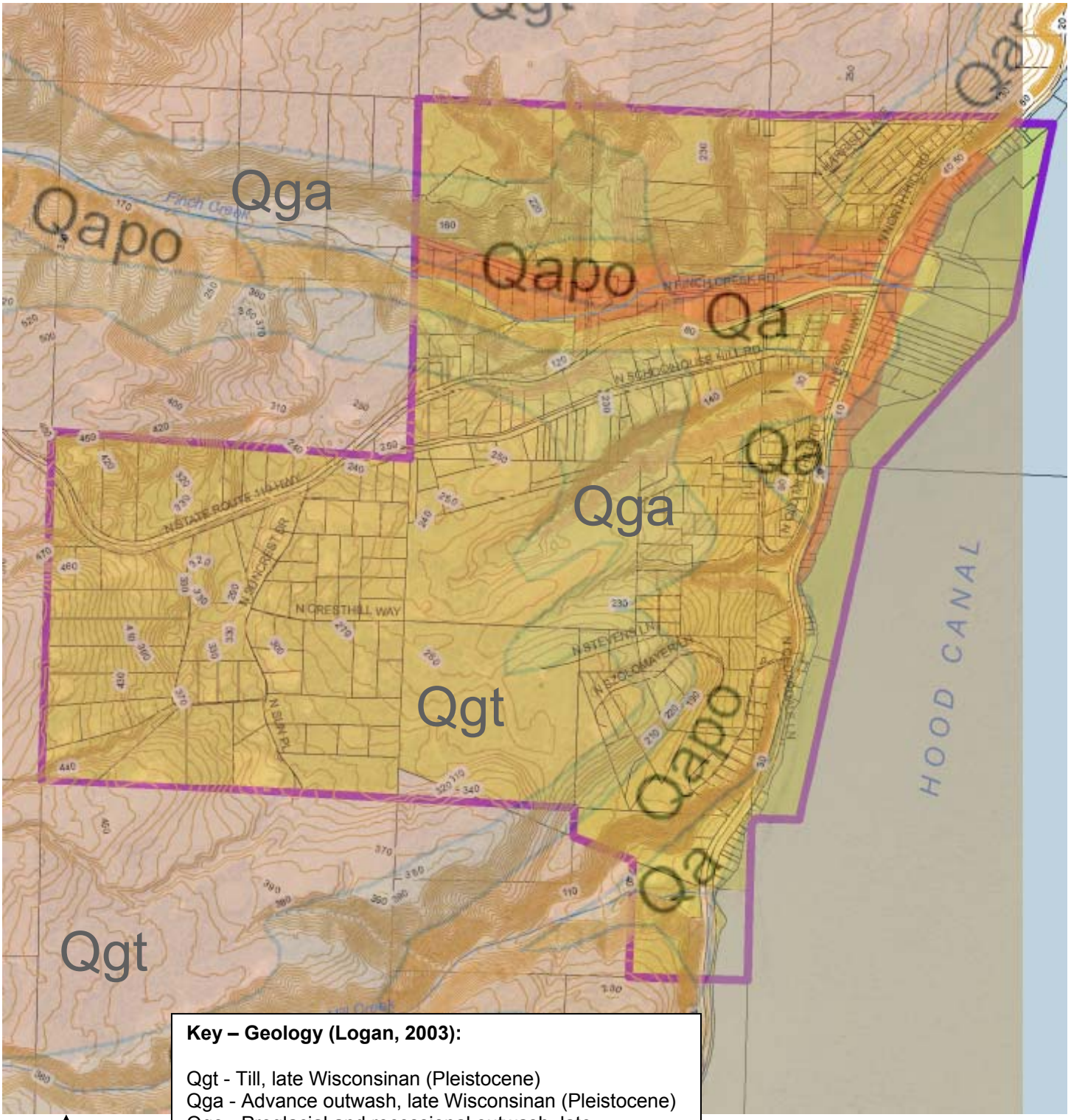
HWA GeoSciences Inc.

GEOLOGIC MAP (Carson, 1976)

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO. **3**

PROJECT NO. **2006-172**



Key – Geology (Logan, 2003):

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)

NORTH

Base mapping by: Mason County (topo & parcels) Geology by Logan, 2003

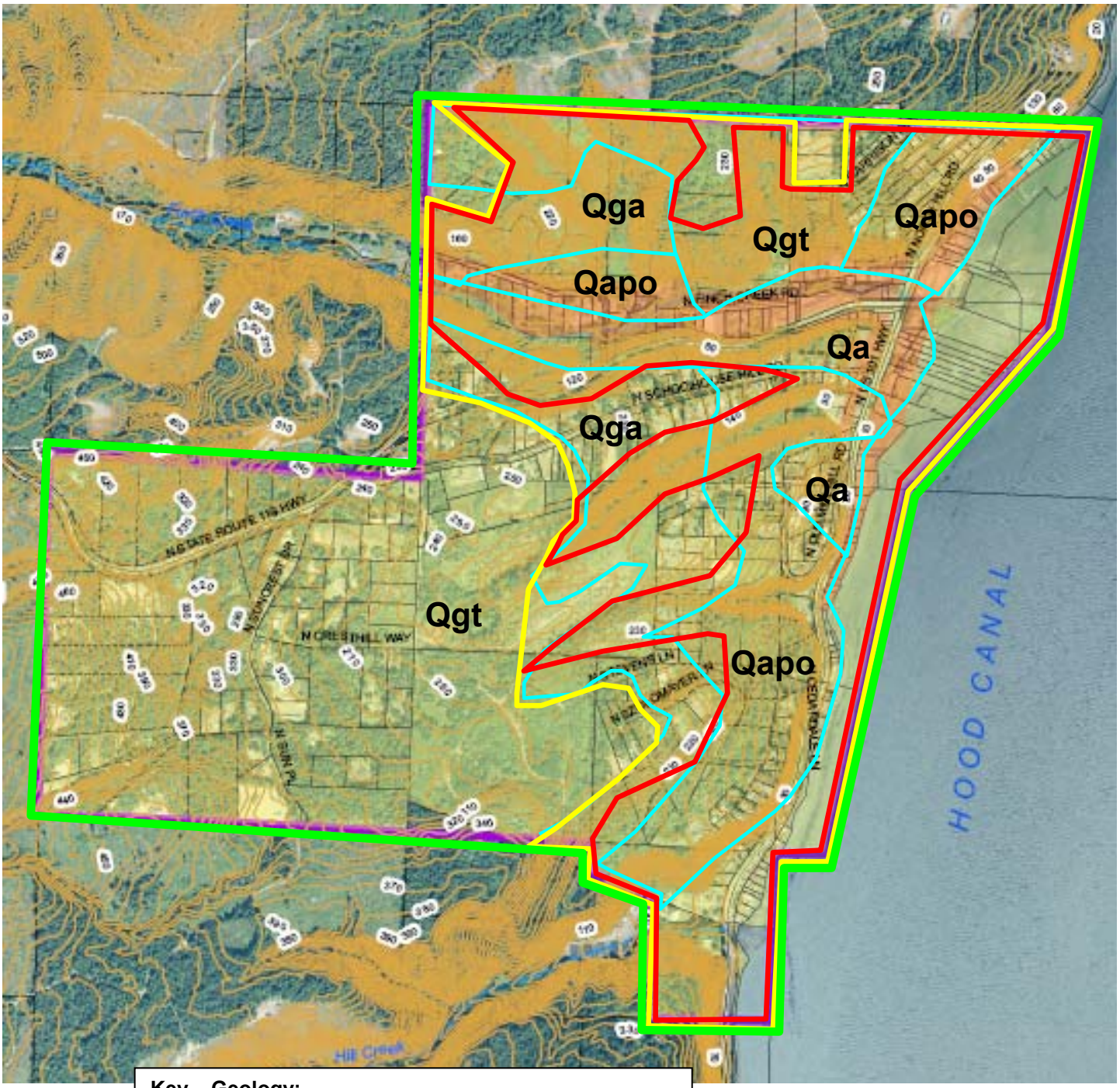
HWA GeoSciences Inc.

TOPO, GEOLOGY, & PARCELS

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
4

PROJECT NO.
2006-172



Key – Geology:

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)
Qa - Alluvium (Holocene)

Key - Relative contaminant transport risk:

- Low
- Medium
- High

NORTH

Base mapping by: Mason County (aerial, topo & parcels), Geology by Logan, 2003

HWA GeoSciences Inc.

RELATIVE CONTAMINANT TRANSPORT RISK

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO. **5**

PROJECT NO. **2006-172**