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SUPPORT DOCUMENT FOR SOLE SOURCE AQUIFER DESIGNATION OF THE BAINBRIDGE ISLAND AQUIFER SYSTEM

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FOR SOLE SOURCE AQUIFER DESIGNATION
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Prepared by

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FINAL SUPPORT DOCUMENT FOR SOLE SOURCE AQUIFER DESIGNATION OF THE BAINBRIDGE ISLAND AQUIFER SYSTEM

INTRODUCTION

Purpose

This document summarizes readily available information and describes the technical and legal basis for the proposed U.S. Environmental Protection Agency (EPA) designation of the Bainbridge Island aquifer system as a sole source aquifer. All technical information presented in the document is referenced from the petition submitted to EPA.

Sole Source Aquifer Program

The Sole Source Aquifer Program is authorized by the Safe Drinking Water Act of 1974 (Safe Drinking Water Act, Public Law 93-523 42 U.S.C. 300 et.seq). Section 1424(e) of the Safe Drinking Water Act states:

"If the Administrator determines, on his own initiative or upon petition that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer."

EPA defines a sole or principal source aquifer as an aquifer or aquifer system which supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer, and for which there is no alternative source or combination of alternative drinking water sources which could physically, legally and economically supply those dependent upon the aquifer (U. S. EPA, 1987). For convenience, all EPA designated

sole or principal source aquifers or aquifer systems are often referred to simply as “sole source aquifers”.

Although EPA has authority to initiate sole source aquifer designations, the agency has a longstanding history of only responding to petitions. Until 1987, EPA accepted sole or principal source aquifer petitions which contained a minimum amount of information. This practice changed when EPA released the Sole Source Aquifer Petitioner Guidance document in February of 1987. The guidance clarifies the definition and acceptable delineation of a sole or principal source aquifer, and describes how to petition EPA.

Petition

The EPA Region 10 Drinking Water Unit in the Office of Water and Watersheds received a draft sole source aquifer petition dated August 5, 2009 from Melanie Keenan and Malcolm Gander, individuals and residents of Bainbridge Island.

Additional information was requested by EPA from the petitioners and was submitted to EPA postdated July 9, 2010. On August 12, 2010 the petitioners were informed by EPA that their submittal was complete and the technical review could begin. In January 2012 comments by the petitioners were incorporated into this draft technical support document and received by R10 Drinking Water Unit in the Office of Water and Watersheds.

Community Involvement

In February 2012, EPA began developing the community outreach plan for this potential designation. The Agency designed a communication strategy. This guided our efforts to ensure that the community and interested stakeholders were informed of EPA’s actions and had the opportunity to be meaningfully involved.

A public comment period of forty-five days from April 20 through June 4, 2012 was announced in the Bainbridge Islander local newspaper and announced via mailings and email. The mailings and emails also included a Fact Sheet that discussed the project and where to review the project documents. On April 20 the Draft Technical Support Document and the original petition were posted on a dedicated web site (http://go.usa.gov/PzJ). Hard copies of the above referenced project documents were also available for public review at the Bainbridge Island Library Reference desk and at the Bainbridge Island City Hall.

EPA received a total of seven comments. Two of the comments were from the petitioners. Of the five remaining comments four were in support of the designation and one had questions.

GEOGRAPHY

The petitioned area is Bainbridge Island (Figure 1). The Island's hydrogeologic characteristics are similar to the following Puget Sound islands whose aquifers have already been designated as sole source aquifers by EPA: Camano, Whidbey, Marrowstone, Guemes, and Vashon-Maury. The island has a total of 53 miles of seawater shoreline. Interior plateaus reach maximum elevations of 300 to 400 feet above mean sea level. The island can be divided into 12 drainage basins and is primarily a mixture of developed land and variably forested areas. The Olympic Mountains are located 40 miles northwest and the Cascade Mountains are 50 miles to the east (Keenan and Gander, 2009).

Climate

Bainbridge Island has a mid-latitude, wet-coast marine climate with relatively cool, dry summers and mild, rainy winters. Summer temperatures average in the 70s during the day and 50s at night, winter temperatures are generally in the 40s during the day and 30s at night. Rainfall ranges from 34 to 36 inches per year (Keenan and Gander, 2009).

HYDROGEOLOGY

Geology

The following information was extracted from the petition (Keenan and Gander, 2009).

At least six advances and retreats of Pleistocene continental glaciers over the last 300,000 years has shaped the present-day landscape and underlying hydrostratigraphy of the Island (Easterbrook 1994). This resulted in the deposition of large volumes of unconsolidated glacial and interglacial material (mixtures of sand, silt, clay and gravels), which are host to the aquifers of the Island. Other geologic units are present on the Island and have less importance from a hydrologic standpoint. These units include surficial Quaternary alluvial deposits, and Tertiary sedimentary rocks, which are exposed at the southern end of the Island on the up-thrown side of a major east-west

trending fault that transects the Island. Figure 2 presents a surficial geologic map of the Island.

The Quaternary alluvium unit includes recent stream, lake, floodplain, beach, and peat deposits. These are generally thin and discontinuous surficial deposits that cover less than one percent of the study area.

The Vashon deposits are the youngest glacial deposits on the Island (Easterbrook 1968; Easterbrook 1994). They consist of poorly sorted sand and gravel of the Vashon recessional outwash (Qvr). Below the Qvr is the much more extensive Vashon till (Qvt), which comprises the majority of the Island's surficial exposures. The Qvt is a mixture of unstratified clay through boulder size detritus. Below the Qvt is the Vashon advance outwash (Qva), composed of sand and silty sand with lesser amounts of gravel and occasional lenses of silt. Locally, the Lawton Clay (Qvl) lies below the Qva and consists of clay and silt deposited in lakes that formed ahead of the advancing Vashon glacier.

Below the Vashon deposits are alternating groups of nonglacial and glacial unconsolidated sedimentary deposits, which have been variably named by several earlier workers. This early glacial period's deposits are not as evident as the Vashon, but are present above sea level. Delineation of the glacial units is further complicated by yet another earlier interglacial and then glacial episode that are present in some outcrops above sea level. Older glacial/interglacial episodes are evident in well logs and do not outcrop.

The aforementioned east-west fault at the south end of the Island juxtaposes unconsolidated Pleistocene sediments to the north with Tertiary sedimentary bedrock in the south. The Tertiary bedrock, which is mantled by Vashon glacial deposits, is the oldest material on the Island. The bedrock consists of shale, sandstone, and conglomerate deposited in a marine environment, and have been assigned to either the Blakely Formation or the Blakely Harbor Formation.

Aquifer System

The following information was extracted from the petition (Keenan and Gander, 2009).

Large volumes of unconsolidated glacial and interglacial materials are host to the aquifers on Bainbridge Island. Six principal aquifers have been identified on the Island:

1) Perched Aquifer System (PA) – This aquifer occurs in Vashon advance glacial outwash, which consists of fine to medium-grained silty sand with interspersed gravelly units. About 4 percent of the wells on the island are reportedly completed in this unit, and the producing zone is generally > 200 feet (ft) above mean sea level MSL.

2) Semi-Perched Aquifer (SPA) – This aquifer occurs in a mixture of non-glacial and glacially-derived sands and gravels. About 25 percent of the wells on the island are completed in this unit, and the producing zone is generally between 100 and -20 ft MSL.

3) Sea Level Aquifer (SLA) – This aquifer has been tentatively assigned to glacial deposits referred to as the Salmon Springs Drift. It is the most widely used aquifer with 53 percent of the wells completed in this unit, and the producing zone is 40 to -230 ft MSL.

4) Glaciomarine Aquifer System (GMA) – This aquifer ranges in composition from clay, silt, and silt-rich sand, to sand and gravel. It also contains interspersed zones of organic material, which indicates a non-glacial origin for this unit. About 2 percent of the island wells are completed in this unit. Several of the island's deep production wells are screened in the top of this aquifer, and the producing zone is typically -400 to -76- ft MSL.

5) Fletcher Bay Aquifer System (FBA) – This is the deepest of the six main aquifers encountered on the island. It is composed of sand and gravel with subordinate amounts of silt and silty sand. Wells in this unit are typically screened between -690 to -1,010 ft MSL. Although less than 1 percent of the island's wells are completed in this unit, the metered Kitsap Public Utility District (KPUD) and City of Bainbridge Island Fletcher Bay Aquifer (COBI FBA) wells provide approximately 30 percent of the estimated total water production on the island.

6) Bedrock Aquifer System (BAS) – This aquifer is a minor source of groundwater on the island. Less than one percent of the wells are completed in this unit. The wells are screened in sedimentary rocks of the Blakely Harbor and Blakely Formations, and are located on the south end of the island.

On-Island precipitation is the only source of aquifer recharge in the SSA. Approximately thirty-four to thirty-eight inches of rain falls annually on Bainbridge Island, with the majority of that occurring in the winter

months. All of the water from the aquifers, as well as lakes, ponds, and streams, originates from precipitation on the island.

The ability of the Island to meet water demands in the future depends largely on production from the Fletcher Bay Aquifer System, which currently produces the most for the City of Bainbridge Island. The Fletcher Bay Aquifer System has been correlated with deep aquifers on Kitsap Peninsula; however, there is no evidence that the two are hydraulically connected. The Fletcher Bay Aquifer System is not an unlimited source, and its recharge area and recharge rates are poorly understood.

Another important source of groundwater resources on the Island is the Sea Level Aquifer System. Future increases in production have been recommended to be taken from this System, particularly in the north and central portions of the Island. The Sea Level Aquifer system is not an unlimited source, and its recharge area and recharge rates are unknown.

BOUNDARIES

The petitioned aquifer is presented in Fig. 1. The Bainbridge Island Sole Source Aquifer boundaries are representative of an aquifer system that encompasses the entire Bainbridge Island area. The aquifer area is bounded on all sides by Puget Sound. The vertical extent of the aquifer system at depth includes all potable water-bearing geologic units underlying the island.

The Bainbridge Island Sole Source Aquifer boundaries were determined by following aquifer definitions from EPA Guidance (EPA, 1987). The Guidance states that petitioners may request designation for part of an aquifer, an entire aquifer, or an aquifer system. A petitioner can request designation for part of an aquifer if that portion is hydrogeologically separated from the rest of the aquifer. A petitioner can also request designation for an aquifer system to the extent that all aquifers in the system are hydrogeologically connected.

GROUND WATER QUALITY

A comprehensive study of the drinking water quality on Bainbridge Island has never been completed due to lack of funding. In general, groundwater quality on the Island is good. Iron and manganese are the most common analytes found to exceed the Federal Maximum Contaminant Level (MCL). High iron and manganese can cause a

somewhat objectionable odor, taste, or color, but generally are not considered a health problem.

POTENTIAL FOR CONTAMINATION

The aquifer system is vulnerable to contamination due to potential seawater intrusion, accidental spills, petroleum products, small hazardous waste generators, household hazardous waste disposal, leachate from the closed Island landfill, leachate from the incompletely remediated Wyckoff Superfund site in Eagle Harbor, or leachate from Washington Department of Ecology listed Hazardous Sites such as the former Unocal Station on Winslow Way (WDOE 2011a), the Strawberry Plant site on Weaver Road (WDOE 2011b), and the Winslow Way West & Madison Avenue North site (WDOE 2011b), failing septic systems, fertilizers, pesticides and herbicides, improperly abandoned wells, and the impact of population growth. The aquifer system is also vulnerable to contamination from open ground water situations such as sand and gravel mining operations.

POPULATION AND DRINKING WATER CONSUMPTION

The population of Bainbridge Island is approximately 23,290. It is estimated the population will increase to 25,474 by 2020, and 28,195 by 2030. One hundred percent of the current population on the island obtain their drinking water from the petitioned aquifer. The sole source aquifer system on the Island underlies the entire Island. Actual usage was calculated by multiplying population by an estimated per capita consumption rate, which includes municipal, domestic, commercial, irrigation, fish propagation, and stock watering uses, and also includes an estimate of water use from claims and users of wells that are exempt from water rights. The 1990 population number of 15,736 was multiplied by an average use of per capita value of 132 gallons per day which yielded an annual continuous consumption total of 1,442 gpm. The projected 2014 annual continuous consumption total was calculated to be 2,067 gpm. This may represent approximately 18 percent of the estimated total groundwater resource; however, the actual groundwater resource is unknown based on a lack of data (Keenan and Gander, 2009).

ALTERNATIVE DRINKING WATER SOURCES

EPA guidance requires that petitioners demonstrate not only that an aquifer supply 50 percent or more of the drinking water for the area, but also that there are no alternative sources or combination of sources which could physically, legally, and economically supply all those who depend upon the aquifer system for drinking water (EPA, 1987). The petitioners for the Bainbridge Island Aquifer System have adequately demonstrated that there are no additional sources of drinking water that are economically available.

Each of the potential alternative sources that the petitioner evaluated has limitations on quantity or quality of an economically feasible alternative water source and/or the feasibility of development. There are no potential surface water bodies as a source for drinking water and the two alternatives scenarios of piping water across Agate Pass Bridge to the Island or installation of a desalination plant are both considered cost-prohibitive at this time, and as such are not considered alternative sources of drinking water. Therefore none of the potential alternative sources qualify as Alternative Drinking Water Sources as defined in the EPA Petitioners Guidance.

CONCLUSION

A sole source aquifer system must supply at least 50 percent of the drinking water consumed within the natural boundaries of the aquifer system, and there can be no economically or legally available alternative source that could supply the entire population living in the area. The Bainbridge Island Aquifer System supplies all of the drinking water to people living in the petitioned area, and there are no economical and legally available alternative sources of water. Given these conditions, the Bainbridge Island Aquifer System meets the criteria of EPA designation as a sole or principle source aquifer under Section 1424(e) of the Safe Drinking Water Act.

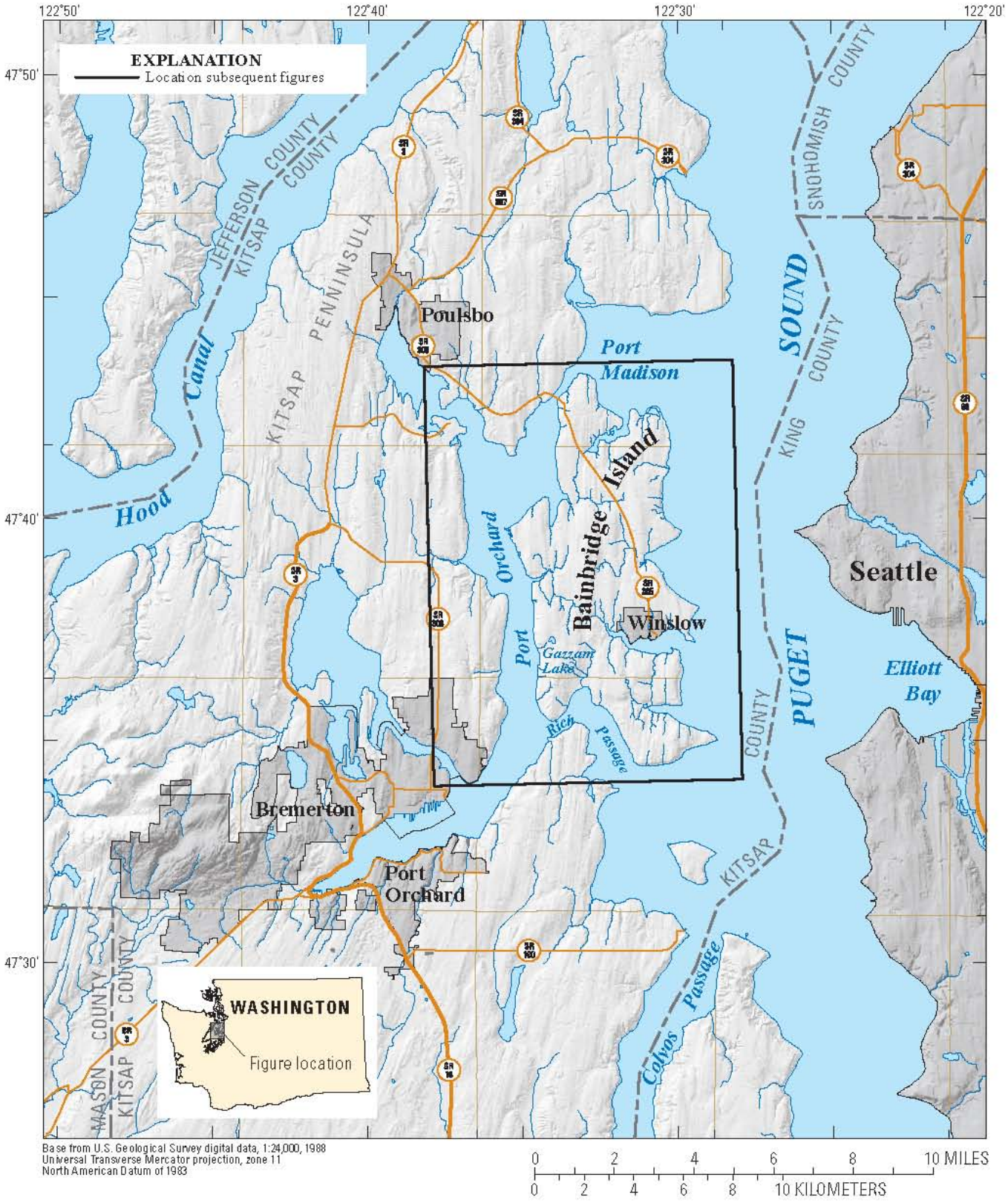

Figure 1. Map of the proposed Bainbridge Island sole source aquifer, USGS

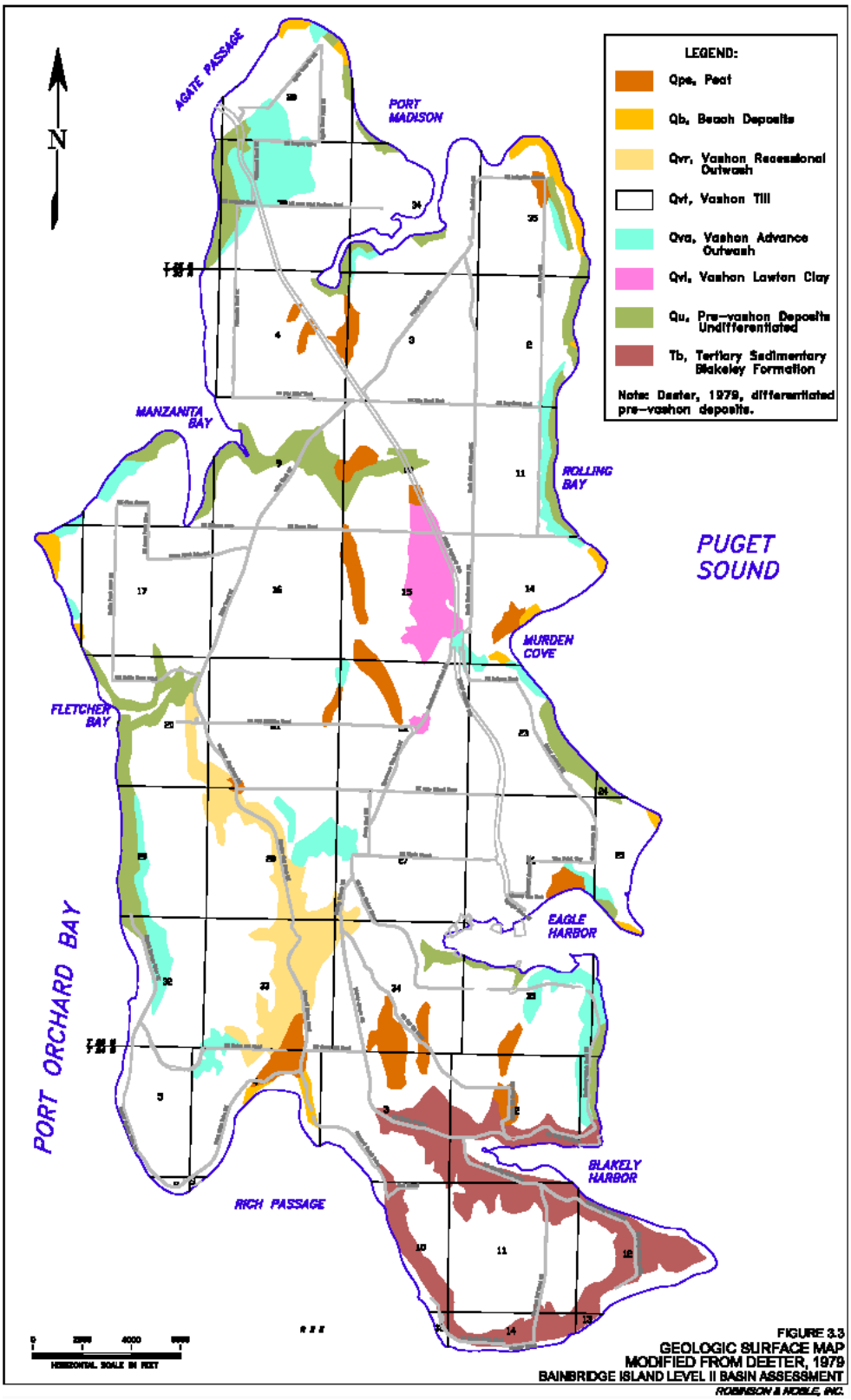

Figure 2. Geology of Bainbridge Island, City of Bainbridge Island, 2000.

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